

C24_CURRICULUM

DIPLOMA IN MECHANICAL ENGINEERING



OFFERED BY

**STATE BOARD OF
TECHNICAL EDUCATION & TRAINING,
TELANGANA: HYDERABAD**

I SEMESTER

Sl N o	Course Code	Course Name	Teaching Scheme				Credit s	Examination Scheme						
			Instruction periods per week			Total Periods per semester		Continuous internal evaluation			Semester end examination			
			L	T	P			Mid Sem1	Mid Sem2	Internal evaluation	Max Marks	Min Marks	Total Marks	Min marks for Passing including internal
1	HU-101	Basic English	4	1	0	75	2.5	20	20	20	40	14	100	End Marks shall be ≥35% of Topper Marks and Subject Total Shall be ≥ D- Hybrid Grade Minimum
2	SC-102	Basic Engineering Mathematics	4	1	0	75	2.5	20	20	20	40	14	100	
3	SC-103	Basic Physics	4	1	0	75	2.5	20	20	20	40	14	100	
4	SC-104	General Engineering Chemistry	4	1	0	75	2.5	20	20	20	40	14	100	
5	ME-105	Workshop Technology	4	1	0	75	2.5	20	20	20	40	14	100	
6	ME-106	Engineering Mechanics	4	1	0	75	2.5	20	20	20	40	14	100	End Marks shall be ≥50% of Topper Marks and Subject Total Shall be ≥ D- Hybrid Grade Minimum
7	ME-107	Engineering Drawing-I	1	0	2	45	1.25	20	20	20	40	20	100	
8	ME-108	Workshop Practice	1	0	2	45	1.25	20	20	20	40	20	100	
9	SC-109	Basic Science Lab	1	0	2	45	1.25	20	20	20	40	20	100	
10	CS-110	Computer Fundamentals Lab	1	0	2	45	1.25	20	20	20	40	20	100	
			28	6	8	630	20	200	200	200	400	164	1000	

HU-101-BASIC ENGLISH

Course Title	Basic English	Course Code	HU-101
Semester	I	Course Group	Foundation
Teaching Scheme in Minutes (L:T)	3: 2	Credits	2.5
Methodology	Communicative Language Teaching + Assignments	Total Contact Hours	75
CIE	60 Marks	SEE	40 Marks

Prerequisites: Basic knowledge of English Language

COURSE CONTENTS

MODULE 1: VOCABULARY THROUGH READING - I

Duration: 15 Periods (L 9 P 6)

1. How to Learn a New Word
 - a. Spelling, pronunciation, syllabification, word class, inflections and the other forms of the word
 - b. Meanings, usage, derivatives, phrasal verbs, idiomatic expressions and context for using the word
 - c. Compound words, etymology, synonyms, antonyms and collocations.
2. Synonyms, Antonyms and One-Word Substitutes
3. Reading – I
 - a. Purpose of Reading
 - b. Types of Reading
 - c. Types of Paragraphs and Questions (Factual, Inferential, Vocabulary-based and Experiential)
4. Reading – II

Passages on Innovation, Science and Technology, History, Biography, Travel Writing, Nature Writing, Journal, Story, Process, Cause and Effect, Problem Solution, Evaluation of ideas, Reasons and Conclusion, etc.

MODULE 2: SPEAKING - 1

Duration: 10 Periods (L 6 P 4)

1. Need for English
2. Classroom English
3. Expressing Likes and Dislikes
4. Expressing Feelings

MODULE 3: GRAMMAR - I

Duration: 15 Periods (L 9 P 6)

1. Basic Sentence Structures
2. Tenses-I
3. Tenses-II
4. Voice

MODULE 4: SPEAKING – II

Duration: 10 Periods (L 6 P 4)

1. Introducing Oneself
2. Talking about daily routine
3. Fixing, Cancelling and Rescheduling Appointments
4. Extending, Accepting and Declining Invitations

MODULE 5: GRAMMAR - II

Duration: 15 Periods (L 9 P 6)

1. Adjectives
2. Prepositions
3. Asking Questions –I
4. Asking Questions - II

MODULE 6: WRITING - I

Duration: 10 Periods (L 6 P 4)

1. Paragraph Writing – I
2. Paragraph Writing – II
3. Letter Writing – I
4. Letter Writing – II

COURSE OUTCOMES

COs	At the end of the course, the students will have the ability to:
CO 1	Apply newly acquired vocabulary in contextually relevant scenarios, analyze provided passages for comprehension and formulate responses accordingly.
CO 2	Recall the uses of English, construct the frequently used sentences in classroom and express their likes, dislikes and feelings in different contexts.
CO 3	Construct various forms of sentence structures correctly and use different forms of tenses and suitable voice in various contexts.
CO 4	Introduce oneself, discuss one's daily routine, fix appointments and extend invitations.
CO 5	Describe objects using suitable adjectives, select the appropriate prepositions for different contexts and ask dichotomous and informative questions.
CO 6	Convey ideas in the form of paragraphs and compose formal and informal letters.

CO-PO Matrix

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	Mapping POs
CO 1	-	-	-	-	2	2	2	5, 6 and 7
CO 2	-	-	-	-	2	2	2	5, 6 and 7
CO 3	-	-	-	-	1	3	2	5, 6 and 7
CO 4	-	-	-	-	2	2	3	5, 6 and 7
CO 5	-	-	-	-	1	2	3	5, 6 and 7
CO 6	-	-	-	-	2	2	3	5, 6 and 7

CONTINUOUS INTERNAL EVALUATION (CIE)

Test	Modules	Marks	Pattern
Mid - I	1. Vocabulary Through Reading - I 2. Speaking- I	20	Part A: 4 short answer questions Part B: 2 short essay questions with internal choice Part C: 2 essay questions with internal choice
Mid - II	1. Grammar – I 2. Speaking- II	20	Part A: 4 short answer questions Part B: 2 short essay questions with internal choice Part C: 2 essay questions with internal choice
Slip Test - I	1. Vocabulary Through Reading - I 2. Speaking- I	5	2 questions out of 3 questions
Slip Test - II	1. Grammar – I 2. Speaking- II	5	2 questions out of 3 questions
Assignment	One assignment per one semester	5	Different assignments of higher order questions that develop problem solving skills and critical thinking should be given
Seminars	One seminar per one semester	5	Oral presentations using audio–visual equipment, charts, etc.
	Total	60	

SEMESTER END EXAMINATION

SEMESTER END EXAM							
Sl. NO.	Module	Question to be set for SEE				Remarks	
		R		U	A		
1	I	4	1		9 (a)	13 (a)	
2	II						
3	III		2		10 (a)	14 (a)	
4	IV						
5	V		3	5, 6	9 (b)	13 (b)	
					11 (a)	15 (a)	
					11 (b)	15 (b)	
6	VI			7, 8	10 (b)	14 (b)	
					12 (a)	16 (a)	
					12 (b)	16 (b)	
Total Questions		8		8	8		

Legend:

Remembering:	One mark
Understanding:	Three marks
Application:	Five marks

Suggested Student Activities:

- Practice conversation / dialogue / speech and answer the questions.
- Seminars.
- Review a movie.
- Narrate a story.
- Prepare chain stories.
- Vocabulary building games.
- Speak about incidents /events /memories /dreams/role model.
- Interviews of famous personalities.
- Collect the biographies of unsung heroes.
- Reading for main ideas and specific details.
- Describe pictures.
- Collect the letters written by famous persons and analyze them.
- Describing a process.
- Give directions using maps.

REFERENCES:

1. High School English Grammar & Composition by Wren & Martin
2. Practical English Grammar by A.J Thomson and A.V. Martinet
3. A Course in Phonetics and Spoken English by J. Sethi and P.V Dhamija
4. Word Power Made Easy by Norman Lewis.
5. Essential English Grammar by Raymond Murphy.
6. Spoken English-A Self Learning Guide to Conversation Practice by V. Sasi Kumar.

BOARD DIPLOMA EXAMINATION (C-24)
MID SEMESTER EXAMINATION -I
HU-101 BASIC ENGLISH

Time: One Hour

Total Marks: 20

PART - A

1 X 4 = 4 Marks

Instructions: a) Answer all the questions. b) Each question carries one mark.

1. Write a sentence each using the following words.
 - a. Report
 - b. Illustrate
2. Find one-word substitute for the following one.

A person who always looks at the brighter side of life.
3. Describe two qualities you dislike in your neighbour.
4. Write how you feel if you get selected for your college cricket team.

PART – B

2 X 3 = 6 Marks

Instructions: a) Answer the following questions. b) Each question carries three marks.

5. a) Read the following passage and answer the questions given below:
A dictionary serves as an efficient tool and forms the important reference material as a part of language learning. It provides spelling, pronunciation, stress and different connotations of the words in different contexts. Some dictionaries give etymology and word formation. A dictionary can be general or specialized, translating or giving lexical meanings within a single language. Dictionaries can assist the learning of vocabulary and is especially of great help to students who are learning a language.

- a) What do dictionaries generally provide?
- b) Find a synonym for 'origin of a word' from the passage.
- c) How do dictionaries assist in learning a language?

(OR)

b) Discuss any six ways of learning new vocabulary.

6. a) Explain any three problems one might face while learning English and suggest solutions to each of them.

(OR)

- b) Express any three features you like and three features you dislike in your hostel.

PART – C

2 X 5 = 10 Marks

Instructions: a) Answer the following questions. b) Each question carries five marks.

7. a) Read the following passage and answer the questions given below it.

Dreams have always held a universal fascination. Some primitive societies believe that the soul leaves the body and visits the scene of the dream. Generally, dreams are accepted to be illusions, having much in common with day-dreams, the fantasies of our waking life. When dreaming, one tends to believe fully in the reality of the dream world, however inconsistent, illogical, and odd it may be. Although most dreams apparently happen spontaneously, dream activity may be provoked by external influences.

‘Suffocation’ dreams are connected with the breathing difficulties of a heavy cold, for instance. Internal disorders such as indigestion can cause vivid dreams, and dreams of racing fire-engines may be caused by the ringing of an alarm bell. Experiments have been carried out to investigate the connection between deliberately inflicted pain and dreaming. For example, a sleeper pricked with a pin perhaps dreams of fighting a battle and receiving a severe sword wound. Although the dream is stimulated by physical discomfort, the actual events of the dream depend on the associations of the discomfort in the mind of the sleeper.

- a). What may be the cause for the dream of racing fire-engines?
- b). What was the belief of primitive societies about the dreams?
- c). What happens when one is dreaming?
- d). Find a suitable word in the passage for the following phrases. “inability to breathe or feeling uncomfortable due to less air”
- e). What could be the actual reasons for getting dreams?

(OR)

- b) Explain any five features of a new word that you wish to learn with the help of a dictionary. Give an example of each of those features.

8. a) Identify any ten problems that you face while learning English.

(OR)

- b) Express any ten common sentences used by the teacher in the classroom.

BOARD DIPLOMA EXAMINATION (C-24)
MID SEMESTER EXAMINATION -II
HU-101 BASIC ENGLISH

Time: One Hour

Total Marks: 20

PART - A

1 X 4 = 4 Marks

Instructions: *a) Answer all the questions.*

b) Each question carries one mark.

1. Write a sentence for the following sentence structure.
a) S + V
2. Change the following sentence into passive voice.
a) Pranav ate a mango.
3. Write a sentence for fixing an appointment with a general physician.
4. How do you invite your friend to play cricket with your team.

PART-B

2 X 3 = 6 Marks

Instructions: *a) Answer all the questions.*

b) Each question carries three marks.

5. a) Fill in the blanks with the suitable verb forms:
i) My father _____(watch) TV when I entered house.
ii) Jahnavi _____ (go) to railway station before I went home.
iii) My brother _____(be) a good cricket player.
(OR)
5. b) Change the following sentences into passive voice.
a) He plays cricket
b) Ramya has bought vegetables.
c) Balu is singing songs.
6. a) You have recently joined the cricket academy. Introduce yourself to your new friends.
(OR)
6. b) You have an appointment with a general surgeon. Cancel the appointment with the doctor as you are suffering from fever.

PART-C

2 X 3 = 6 Marks

Instructions: a) *Answer all the questions.*

b) *Each question carries five marks.*

7. a) Fill in the blanks with the suitable verb forms:

- i) My father _____(go) for a walk every day.
- ii) My sister _____ (buy) a book yesterday.
- iii) My brother _____(play) cricket for three hours.
- iv) The starts _____(be) bright.
- v) I _____(finish) my homework just now.

(OR)

7. b) Write a sentence each for the following sentence structures.

- a) S + V + SC
- b) S + V + O
- c) S + V + O + O C
- d) S + V
- e) S + V + D O + I O

8. a) Write about your daily routine in 10 sentences.

(OR)

8. b) Your brother's wedding is fixed. Extend the invitation to your favorite teacher.

Write a conversation between you and your teacher.

BOARD DIPLOMA END EXAMINATION (C-24)
SEMESTER END EXAMINATION
HU-101 BASIC ENGLISH

Time: Two Hours

Total Marks: 40

PART-A

1 X 8 = 8 Marks

Instructions: a) *Answer all the questions.*

b) *Each question carries one mark.*

1. Write an antonym for the underlined word in the following sentence.
a) Ramya is a generous person who supported many charities for over 20 years.
2. Write a sentence using the following sentence structure.
a) S + V + O
3. Make 'Yes/No' question using the following statement.
a) He has come to college today.
4. A student does not know the meaning of a difficult word. How does he / she ask the teacher?
5. Fill in the blank with a suitable preposition.
a) He came to college _____ foot.
6. Identify the adjectives in the following sentences.
a) Srinivas has a costly watch.
b) Pavani sold a small bag to Radha.
7. Write any two salutations generally used in the formal letter.
8. Identify the central idea of the following paragraph.

An anecdote is a quick story about something of interest, usually with a singular theme or lesson. Anecdotes are no different than the stories told among friends, but when they're used in literature, they can accomplish more than merely passing the time.

PART-B

3 X 4 = 12 Marks

Instructions: a) Answer all the questions.

b) Each question carries three marks.

9. a) How do you feel in the following situations?

- i. India won the cricket world cup.
- ii. Your friend's grandmother passed away yesterday
- iii. Your sister did not return from college until late evening.

(OR)

b) Describe your friend using six suitable adjectives.

10. a) Change the following sentences into passive voice.

- i. Bees make honey.
- ii. Prasad stole my calculator.
- iii. I will complete my assignment tomorrow.

(OR)

b) Write a paragraph on your polytechnic in 50 words.

11. a) Change the following sentences into 'Wh' questions using the hints given in brackets

- i. I bought a camera yesterday. (Use 'what')
- ii. He was born in Sircilla on 28th December, 2002 (Use 'when')
- iii. He went to Hyderabad to buy books. (Use 'why').

(OR)

b) Fill in the blanks with suitable prepositions.

- i. He is suffering _____ fever.
- ii. His grandmother died _____ Covid-19.
- iii. He is good _____ mathematics.

12. a) Write a letter to your Principal requesting him / her to permit you to participate in the National seminar to be conducted in New Delhi.

(OR)

b) Write a paragraph in 50 words about your fresher's day party.

PART-C

4 X 5 = 20 Marks

Instructions: a) Answer all the questions. b) Each question FIVE mark.

13. a) Write any of the five aspects of learning a new word.

(OR)

b) Read the following passage and answer the questions given below.

I just returned from the greatest summer vacation. It was so fantastic. I never wanted it to end. I spent eight days in Paris. My best friends, Harish and Umesh came with me. We had a beautiful hotel room in the Latin Quarter, and it wasn't even expensive. We had a balcony with a wonderful view.

We visited many famous tourist places. My favorite was the Louvre, a well-known museum. I was always interested in art, so that was a special treat for me. The museum is so huge; you could spend weeks there. Harish got tired walking around the museum and said "Enough! I need to take a break and rest."

We took lots of breaks and sat in cafes along the river Seine. The French food we ate was delicious. The fruits were tasty too. Umesh's favorite part of the vacation was the hotel breakfast. He said he would be happy if he could eat tartines like those forever. We had so much fun that we're already talking about our next vacation!

- a) Which city did they visit for summer vacation?
- b) How long was the summer vacation?
- c) What did their hotel room have?
- d) Who got tired walking in the Louvre Museum?
- e) What did Umesh enjoy the most?

14. a) Write your mother's daily routine in 100 words.

(OR)

b) Write a letter to the newspaper editor about the problem of street dogs in your colony.

15. a) Frame two 'Yes/No' questions and three 'Wh' questions from the following passage.

For a year Gopal Krishna Gokhale studied in the Deccan College, Poona. Then he went to Elphinstone College, Bombay, for his final B.A. There he took mathematics as an optional subject and eventually became interested in it. He came under the influence of a distinguished English professor who further quickened his interest in his studies. Under this professor's guidance he made so much progress that he gained a scholarship of twenty rupees a month. It was not a small sum for him who had always been poor. The scholarship was a veritable boon to him made him very happy.

In 1884 he took his B.A. in the second division. He then joined the College of Science and Engineering at Poona. A short time after doing so, he learnt that he could study law in the Deccan College. But he did not know how to do it, because he wanted to earn his living while he was a student. Soon an opening offered itself to him. He was appointed a teacher in the New English School, Poona, on thirty-five rupees a month. He made up his mind to take the law course while working as a teacher.

(OR)

- b) Describe your mobile phone using at least ten adjectives in 100 words.

16. a) Write a paragraph on different types of pollution in 100 words.

(OR)

- b) Write a letter to your school friend sharing your experiences at your polytechnic.

SC-102-BASIC ENGINEERING MATHEMATICS

Course Title	Basic Engineering Mathematics	Course Code	SC-102
Semester	I	Course Group	Foundation
Teaching Scheme in Periods (L : T : P)	4:1:0	Credits	2.5
Methodology	Lecture + Tutorial	Total Contact Periods	75
CIE	60 Marks	SEE	40 Marks

Pre requisites:

This course requires the basic knowledge of Algebra, Trigonometry in Mathematics at Secondary school level

Course Outcomes (COs):

At the end of the course, the student will have the ability to:

CO 1	Solve the problems using concepts of Logarithms and Partial fractions.
CO 2	Determine the Inverse of a square matrix using Algebra of Matrices and Determinants.
CO 3	Solve the problems using the concept of Trigonometric ratios of Allied and Compound angles
CO 4	Solve the problems using the concepts of Multiple and sub-multiple angles; and Transform sum or difference of Trigonometric ratios into products and vice versa.
CO 5	Solve the engineering problems involving Inverse Trigonometric functions and understand the Properties of Triangles.
CO 6	Solve the triangle ABC to Apply the Properties of triangles; and solve the system of linear equations that arise in various engineering problems using the concept of Matrices and Determinant

Course Content:

Unit – I Algebra:

Duration: 10 Periods (L: 08– T: 02)

Logarithms: Definition of Logarithm and its properties - Natural and Common Logarithms - Meaning of e - Exponential functions - Logarithm as a function and its graphical representation – Solve simple Problems related to Logarithms.

Partial Fractions: Rational, Proper and Improper fractions of polynomials- Reduction of Improper fractions into Proper fractions of polynomials - Resolving Rational fractions into their Partial fractions covering the types mentioned below:

- (i) $\frac{f(x)}{(x \pm a)(x \pm b)}, a \neq b;$ (ii) $\frac{f(x)}{(x \pm a)(x \pm b)(x \pm c)}, a \neq b \neq c;$
 (iii) $\frac{f(x)}{(x \pm a)^2};$ (iv) $\frac{f(x)}{(x \pm a)^2(x \pm b)}, a \neq b;$
 (v) $\frac{f(x)}{(x \pm a)(x^2 \pm bx \pm c)},$ where $a, b,$ and $c,$ are constants and $(x^2 \pm bx \pm c)$ cannot be factorised.

Unit – II Matrices and Determinants:

Duration: 15Periods (L: 12 – T:03)

Matrices: Definition of Matrix-order Of Matrix-Type of Matrices with examples - Algebra of matrices: sum, difference, scalar multiplication and product of Matrices - Equality of two matrices- Properties of Algebra of Matrices - Transpose of a Matrix-Symmetric and Skew-Symmetric Matrices.

Determinants: Determinant of a square Matrix of order 2×2 - Determinant of a square Matrix of order 3×3 by using Laplace's expansion -Properties of Determinants -Singular and non-singular Matrices- Minor and cofactor of an element of a square matrix - Adjoint of a square matrix- Multiplicative inverse of a square matrix.

Unit-III Trigonometry – I

Duration: 12Periods (L: 10 – T: 02)

Trigonometric Ratios of Allied Angles: Angle measurement- Relation between Degree and Radian-Notational conversions- Trigonometric Ratios-Trigonometric identities (statements only)-Signs of Trigonometric Ratios in different quadrants - Trigonometric Ratios of standard Allied angles- Related problems.

Compound Angles: Definition of Compound angles -Trigonometric Ratios of Compound angles (without proof) and identities - Related problems.

Unit-IV Trigonometry – II

Duration:13 Periods (L: 10 – T: 03)

Multiple and sub-multiple angles: Trigonometric Ratios of Multiple angles $2A$ and $3A$ - Trigonometric Ratios of Sub-multiple angle $(\frac{A}{2})$ - Related identities and problems.

Transformations: Transformation of products into sums or differences and vice versa - Trigonometric identities under the conditions $(A + B + C) = 90^\circ$ and $(A + B + C) = 180^\circ$ -Related problems only

Unit – V Trigonometry – III

Duration: 12Periods (L: 10– T: 02)

Inverse Trigonometric Functions: Basic concepts of Inverse Trigonometric functions along with their domains and ranges -Properties of inverse Trigonometric functions and identities - Related problems.

Properties of Triangles: Elements of a Triangle -Sine rule -Cosine rule - Projection rule - The law of tangents -Related problems.

Unit - VI Applications of Trigonometry and Matrices:

Duration: 13Periods (L: 10– T:03)

Solutions of Triangles: Solutions of triangles in the following cases: (i) when three sides (SSS) (ii) when two sides and an included angle (SAS) and (iii) when one side and two angles (SAA) are given..-Simple problems

Solutions of system of Simultaneous Linear Equations using Matrices and Determinants:

Solutions of system of simultaneous two linear equations in two unknown variables and three linear equations in three unknown variables by using Cramer's rule and Matrix Inversion Method -Elementary Row operations - Solutions of system of three simultaneous linear equations in three unknown variables by using Gauss-Jordan Method.

Reference Books:

1. Text Book of Matrices – by Shanti Narayan and Dr. P. K. Mittal.
2. Plane Trigonometry - by S.L.Loney.
3. NCERT Mathematics Text Books of Class XI, XII (Part – I).
4. Intermediate Mathematics Text Book I A (Telugu Academy).

Suggested E-Learning references:

- 1.<https://www.khanacademy.org/>
2. <https://www.wolframalpha.com/>
3. <https://onlinecourses.nptel.ac.in/>
4. <http://tutorial.math.lamar.edu/>

Suggested Learning Outcomes:

At the end of the course, the student will have the ability to:

CO1: Solve the problems using concepts of Logarithms and Partial fractions.

- 1.1 Define Logarithm.
- 1.2 Distinguish Natural Logarithms and Common Logarithms.
- 1.3 State Properties of Logarithms.
- 1.4 Explain the meaning of e and Exponential functions.
- 1.5 Define Logarithm as a function and explain its graphical representation.
- 1.6 Simplify Logarithmic expressions in engineering problems by using Properties of Logarithms.
- 1.7 Solve Logarithmic Equations by using Properties of Logarithms.
- 1.8 Define the Rational fraction of polynomials with examples.
- 1.9 Classify Rational fractions of polynomials
- 1.10 Define Proper rational fraction of polynomials with examples.
- 1.11 Define Improper rational fraction of polynomials with examples.
- 1.12 Reduce Improper rational fractions into the Proper rational fractions by using division method.
- 1.13 Resolve Rational fractions of the type: $\frac{f(x)}{(x \pm a)(x \pm b)}$ into Partial fractions, where a and b are Constants with $a \neq b$.
- 1.14 Resolve Rational fractions of the type: $\frac{f(x)}{(x \pm a)(x \pm b)(x \pm c)}$ into Partial fractions, where a , b and c are constants with $a \neq b \neq c$.
- 1.15 Resolve Rational fractions of the type: $\frac{f(x)}{(x \pm a)^2}$ into Partial fractions, where a is constant
- 1.16 Resolve Rational fractions of the type: $\frac{f(x)}{(x - a)^2(x - b)}$ into Partial fractions, where a and b are constants with $a \neq b$.
- 1.17 Resolve Rational fractions of the type: $\frac{f(x)}{(x \pm a)(x^2 \pm bx \pm c)}$ into Partial fractions, where a , b and c are constants and $(x^2 \pm bx \pm c)$ cannot be factorised further.

CO2: Determine the Inverse of a square matrix using Algebra of Matrices and Determinants.

- 2.1 Define Matrix.
- 2.2 Classify the types of Matrices with examples.
- 2.3 Define Equality of two Matrices
- 2.4 Compute the sum of two Matrices.
- 2.5 Compute the difference of two Matrices.
- 2.6 Compute the scalar multiplication of a Matrix.
- 2.7 Compute the product of two Matrices.
- 2.8 State the properties of Algebra of Matrices such as Commutative, Associative, Identity and Distributive properties with examples and counter examples.
- 2.9 Define Transpose of a Matrix and write its properties.
- 2.10 Define Symmetric and Skew-symmetric Matrices with examples.
- 2.11 Resolve a Square Matrix into a sum of Symmetric and Skew-symmetric Matrices with examples.
- 2.12 Expand the Determinant of a square of order 2×2 .
- 2.13 Expand the Determinant of a square of order 3×3 using Laplace's expansion.
- 2.14 State the Properties of Determinants.
- 2.15 Apply the Properties of Determinants to solve the problems.
- 2.16 Distinguish Singular and Non-singular Matrices.
- 2.17 Define minor and co-factor of an element of square Matrices of orders 2×2 and 3×3 with examples.
- 2.18 Compute Adjoint of a square Matrices of orders 2×2 and 3×3 .
- 2.19 Compute multiplicative inverse of non-singular square matrices of orders 2×2 and 3×3 .

CO3: Solve the problems using the concept of Trigonometric ratios of Allied and Compound angles

- 3.1 Define Trigonometric ratios.
- 3.2 State Trigonometric identities.
- 3.3 Define Degree measure and Radian measure.
- 3.4 State the relation between Degree and Radian.
- 3.5 Convert Degree into Radian and vice-versa and related problems.
- 3.6 State signs of the Trigonometric ratios in different quadrants.

3.7 Formulate Trigonometric ratios of standard Allied angles i.e. ($90^\circ \pm \theta$), ($180^\circ \pm \theta$), ($270^\circ \pm \theta$), ($360^\circ \pm \theta$) and ($-\theta$).

3.8 Solve the problems on Trigonometric ratios of Allied angles.

3.9 State the Trigonometric ratios of compound angles i.e. $\sin(A \pm B)$, $\cos(A \pm B)$, $\tan(A \pm B)$ And $\cot(A \pm B)$.

3.10 Derive the identities i.e., $\sin(A+B) \cdot \sin(A-B) = \sin^2 A - \sin^2 B$, etc.,).

3.11 Calculate the values of $\sin 15^\circ$, $\cos 15^\circ$, $\tan 15^\circ$, $\sin 75^\circ$, $\cos 75^\circ$, $\tan 75^\circ$ etc., by using 3.9

3.12 Solve the problems by applying 3.9 and 3.10.

CO4: Solve the problems using the concepts of Multiple and sub-multiple angles; and Transform sum or difference of Trigonometric ratios into products and vice versa.

4.1 Derive the formulae for Trigonometric ratios of multiple angles $2A$ and $3A$.

4.2 Derive the formulae for Trigonometric ratios of sub multiple angle $\frac{A}{2}$.

4.3 Derive useful identities i.e. $\sin^2 A = \left(\frac{1-\cos 2A}{2}\right)$, $\cos^2 A = \left(\frac{1+\cos 2A}{2}\right)$ etc.,.

4.4 Solve the problems by using 4.1, 4.2 and 4.3

4.5 Derive the formulae on transforming sum or difference of two Trigonometric ratios into a product and vice versa.

4.6 Solve the problems by applying 4.5.

4.7 Prove the Trigonometric identities under the conditions

$$(A + B + C) = 90^\circ \text{ and } (A + B + C) = 180^\circ \text{ only}$$

CO5: Solve the engineering problems involving Inverse Trigonometric functions and understand the Properties of Triangles.

5.1 Explain the concept of the inverse Trigonometric function by selecting their domains and ranges

5.2 List the Inverse Trigonometric functions along with domain and range.

5.3 State the properties of Inverse Trigonometric functions.

5.4 Derive the Inverse Trigonometric identities i.e. $\sin^{-1}x + \cos^{-1}x = \frac{\pi}{2}$ etc

5.6 Derive formulae like $\tan^{-1}(x) + \tan^{-1}(y) = \tan^{-1}\left(\frac{x+y}{1-xy}\right)$ where $x \geq 0$, $y \geq 0$, $xy < 1$ etc.,

5.5 Solve the simple problems

- 5.6 List the elements of a triangle.
- 5.7 Explain the Sine rule, Cosine rule, Projection rule and the law of tangents.
- 5.8 Solve the problems using 5.7

CO6: Solve the triangle ABC to Apply the Properties of triangles; and solve the system of linear equations that arise in various engineering problems using the concept of Matrices and Determinant.

- 6.1 Solve the Triangle ABC, when three sides are given.
- 6.2 Solve the Triangle ABC, when two sides and an included angles are given.
- 6.3 Solve the Triangle ABC, when one side and two angles are given.
- 6.4 Solve the system of two linear equations in two unknown variables using Cramer's rule.
- 6.5 Solve the system of three linear equations in three unknown variables using Cramer's rule.
- 6.6 Solve the system of two linear equations in two unknown variables using Matrix Inversion Method
- 6.7 Solve the system of three linear equations in three unknown variables using Matrix Inversion Method.
- 6.8 State elementary row operations.
- 6.9 Solve the system of three linear equations in three unknowns by Gauss- Jordan Method.

Suggested Student Activities:

- 1. Student visits Library to refer Standard Books on Mathematics and collect related material.
- 2. Quiz
- 3. Group discussion
- 4. Group Tests
- 5. Formulae Tests
- 6. Surprise tests
- 7. Seminars
- 8. Home Assignments.
- 9. Mathematics- for preparing competitive exams and solve some arithmetical ability exam questions

CO / PO - MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	Mapped POs
CO1	3	2					3	1, 2 ,7
CO2	3	2					3	1, 2 ,7
CO3	3	2					3	1, 2 ,7
CO4	3	2					3	1, 2 ,7
CO5	3	2	2				3	1, 2 ,3,7
CO6	3	2	2				3	1, 2, 3, 7

Semester End Examination

Unit No	Questions to be set for SEE				
	R			U	A
I	4	1		9(a)	13(a)
II					
III		2		10(a)	14(a)
IV					
V		3	5,6	9(b), 11(a), 11(b)	13(b), 15(a), 15(b)
VI			7,8	10(b), 12(a), 12(b)	14(b), 16(a), 16(b)
Total Questions	8			8	8

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TELANGANA
DIPLOMA EXAMINATIONS (C - 24)

SC-102

SEMESTER I, MID – I EXAM, MODEL PAPER
BASIC ENGINEERING MATHEMATICS

Duration: 1: 00 Hour

Max. Marks: 20

PART-A

04 × 01 = 04

- Instructions:
1. Answer **ALL** questions.
 - 2 Each question carries **ONE** mark.

1. Write $\log 21 + \log 5$ as a single Logarithm.
2. Define Proper fraction.
3. If $I = \begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix}$ then find I^2 .
4. If $A = \begin{pmatrix} \sin \theta & \cos \theta \\ -\cos \theta & \sin \theta \end{pmatrix}$, then find the value of $|A|$.

PART-B

02 × 03 = 06

- Instructions:
1. Answer All questions.
 2. Each question carries **THREE** marks.

5(a) Find the value of $\log_{\frac{1}{3}} \left(\frac{1}{9} \right)$.

OR

5(b) If $\frac{3x-1}{(x-2)(x-3)} = \frac{-5}{(x-2)} + \frac{A}{(x-3)}$, then find the value of A.

6(a) If $A = \begin{pmatrix} 2 & 3 \\ 4 & 1 \end{pmatrix}$, then find AA^T .

OR

6(b) If $\begin{vmatrix} 4 & 3 & P \\ 5 & 3 & 1 \\ 2 & 1 & 6 \end{vmatrix} = 0$, then find the value of “P”.

PART C

- Instructions: 1. Answer All questions
 2. Each question carries **FIVE** marks

$$02 \times 05 = 10$$

7(a) Resolve $\frac{2x}{(x+1)(x^2+1)}$ into Partial fractions.

OR

7(b) Find the value of x , if $\log_4(x) + \log_4(x - 12) = 3$.

8(a) If $A = \begin{pmatrix} 1 & 2 & -1 \\ 3 & 0 & 2 \\ 4 & 5 & 0 \end{pmatrix}$ and $B = \begin{pmatrix} 1 & 0 & 0 \\ 2 & 1 & 0 \\ 0 & 1 & 3 \end{pmatrix}$, then verify that $(AB)^T = B^T A^T$.

OR

8(b) Find the inverse matrix of $A = \begin{pmatrix} 1 & 3 & 3 \\ 1 & 4 & 3 \\ 1 & 3 & 4 \end{pmatrix}$.

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TELANGANA
DIPLOMA EXAMINATIONS (C - 24)

SC-102

SEMESTER I, MID – II EXAM, MODEL PAPER
BASIC ENGINEERING MATHEMATICS

Duration: 1: 00 Hour

Max. Marks: 20

PART-A

04 × 01 = 04

- Instructions: 1. Answer **ALL** questions.
 2 Each question carries **ONE** mark.

1. Find the value of $\sin\left(\frac{3\pi}{2}\right)$.
2. If $\tan \theta = \frac{-3}{4}$, θ lies in the second quadrant then find the value of $\cos 2\theta$.
3. Write the formula for $\sin 3A$.
4. Express $2 \sin 7\theta \sin 3\theta$ as a sum/difference.

PART-B

02 × 03 = 06

- Instructions: 1. Answer All questions.
 2. Each question carries **THREE** marks.

- 5(a) If $\tan A = \frac{1}{2}$ and $\tan B = \frac{1}{3}$, then find $\tan (A - B)$.

OR

- 5(b) Show that $\frac{\cos 19^\circ - \sin 19^\circ}{\cos 19^\circ + \sin 19^\circ} = \tan 26^\circ$.

- 6(a) Prove that $\frac{\sin 5x + \sin 3x}{\cos 5x + \cos 3x} = \tan 4x$.

OR

- 6(b) Prove that $\frac{1 + \cos 2\theta}{\sin 2\theta} = \cot \theta$.

PART C

02 × 05 = 10

- Instructions: 1. Answer All questions.
 2. Each question carries **FIVE** marks.

- 7(a) Prove that $\cos A + \cos(120^\circ + A) + \cos(120^\circ - A) = 0$.

OR

- 7(b) Evaluate $\sum \frac{\sin(A+B) \sin(A-B)}{\cos^2 A \cos^2 B}$.

- 8(a) If $A + B + C = \frac{\pi}{2}$, then prove that $\cot A + \cot B + \cot C = \cot A \cot B \cot C$.

OR

- 8(b) Prove that $\cos 10^\circ \cos 30^\circ \cos 50^\circ \cos 70^\circ = \frac{3}{16}$.

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TELANGANA
DIPLOMA EXAMINATIONS (C - 24)

SC-102

SEMESTER I, END SEMESTER EXAM, MODEL PAPER

BASIC ENGINEERING MATHEMATICS

Duration: 2:00 Hours

Max. Marks: 40

PART-A

Instructions: 1. Answer **ALL** questions.

08 × 01 = 08

2. Each question carries **ONE** mark.

1. Define Natural Logarithm.
2. Find the value of $\cos(-510^\circ)$.
3. Write the value of $\sin^{-1}(\theta) + \cos^{-1}(\theta)$.
4. List the elements of a triangle.
5. State the law of tangents.
6. Find the value of $\cos(\cos^{-1}(30^\circ))$.
7. Write the augmented matrix of the system of equations $3x + 2y - z = 4, 2x - 3y + 5z = 7$ and $x - y + z = 3$.
7. What is the formula for the solution of triangle ABC when two sides and an included angle are given?

PART-B

Instructions: 1. Answer All question.

04 × 03 = 12

2. Each question carries **THREE** marks.

9(a) Resolve $\frac{1}{(x+9)(x+7)}$ into partial fractions.

OR

9(b) Prove that $\tan^{-1}\left(\frac{1}{3}\right) + \tan^{-1}\left(\frac{1}{7}\right) = \tan^{-1}\left(\frac{1}{2}\right)$.

10 (a) Prove that $\frac{\cos(A-B)}{\cos A \sin B} = \tan A + \cot B$.

OR

10(b) Find the angle C in any triangle ABC if $b = \sqrt{2}, c = \sqrt{3}, B = 45^\circ$.

11(a) In any triangle ABC, show that $\sin A + \sin B + \sin C = \frac{s}{R}$.

OR

11(b) Prove that $\sin^{-1}\left(\frac{1}{\sqrt{5}}\right) + \tan^{-1}\left(\frac{1}{3}\right) = \frac{\pi}{4}$.

12(a) Using the method of determinants find the value of x from $x + y + z = 2, x + 2y + 3z = 1$ and $3x + y - 5z = 4$.

OR

12(b) In any triangle ABC find the side c , if $a = 2, A = 30^\circ$ and $C = 60^\circ$.

PART C

Instructions: 1. Answer All questions

04 × 05 = 20

2. Each question carries **FIVE** marks

13(a) Resolve $\frac{2x}{x^2 + 2x + 1}$ into partial fractions.

OR

13(b) If $\tan^{-1} x + \tan^{-1} y + \tan^{-1} z = \pi$, then prove that $x + y + z = xyz$.

14(a) If $\cos x + \cos y = \frac{1}{3}$ and $\sin x + \sin y = \frac{1}{4}$, then find $\tan\left(\frac{x+y}{2}\right)$.

OR

14(b) Solve the triangle ABC, with $a = 2, b = \sqrt{2}, c = \sqrt{3} + 1$.

15(a) If $\cos^{-1} \frac{x}{a} + \cos^{-1} \frac{y}{b} = \theta$, then show that $\frac{x^2}{a^2} - \frac{2xy}{ab} \cos \theta + \frac{y^2}{b^2} = \sin^2 \theta$.

OR

15(b) Show that $\sum a \sin(B - C) = 0$.

16(a) Solve the system of simultaneous equations $x + 2y - z = -3$, $3x + y + z = 4$ and $x - y + 2z = 6$ by using Gauss-Jordan method.

OR

16(b) Using Matrix inversion method, solve the system of simultaneous equations $x + y + z = 6$, $x - y + z = 2$ and $2x + y - z = 1$.

SC-103-BASIC PHYSICS

Course Title:	Basic Physics	Course Code :	SC-103
Semester:	I Semester	Course Group :	Foundation
Teaching Scheme in Periods(L:T:P):	4:1:0	Credits :	2.5
Type of Course :	Lecture+ Tutorials	Total Contact Periods:	75 Periods
CIE :	60 Marks	SEE :	40 Marks

Pre requisites

This course requires the basic knowledge of Science and Mathematics

Course Outcomes

Upon completion of the course, the student shall be able to

CO1	Identify the need of dimensional analysis and error measurements of physical quantities.
CO2	Apply vector concepts viz addition, multiplication to explain resultant of vectors, work done by force, power, torque and areas of triangle and parallelogram.
CO3	Analyze the kinematic equations for projectiles and objects moving on horizontal and inclined frictional surfaces.
CO4	Make use of the fundamental properties elasticity, surface tension and viscosity of solids and fluids to solve problems in mechanics.
CO5	Develop the knowledge associated with laws of conservation of energy and Renewable Energy sources such as Solar energy and Wind energy for sustainable environment.
CO6	Utilize the principles of thermal expansion to explain thermostat and identify the significance of laws of thermodynamics.

	Basic and Discipline Specific Knowledge	Problem Analysis	Design/Development of Solutions	Engineering Tools, Experimentation and Testing	Engineering Practices for Society, Sustainability and Environment	Project Management	Lifelong Learning	Linked PO
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	
CO1	3	1	-	-	-	-	2	1,2,7
CO2	3	1	-	-	-	-	2	1,2,7
CO3	3	-	-	-	1	-	2	1,5,7
CO4	3	1	-	-	1	-	2	1,2,5,7
CO5	3	-	-	-	1	-	2	1,5,7
CO6	3	-	-	1	-	-	2	1,4,7

Course contents:

Unit 1 Units, Dimensions and Measurements

Duration: 12 periods (L:10 – T:2)

Physical quantity, Fundamental and derived quantities, unit-definitions- SI units -Advantages of S.I. units, Dimensions and dimensional formula - units and dimensional formulae for physical quantities - Dimensionless quantities - Principle of homogeneity –numerical problems, Applications of dimensional analysis -problems- Limitations of dimensional analysis –accuracy, precision of instruments, Errors in measurement.

Unit 2 Vectors

Duration: 13 periods (L:10 – T:3)

Scalar and Vector quantities – definition and examples, Graphical representation of a vector, Classification of vectors - numerical problems. Triangle law of vectors, Parallelogram law of vectors – statement- expression for magnitude and direction of resultant vector –derivation-illustrations (working of sling and flying bird), Representation of a vector in terms of unit vectors $\hat{i}$, $\hat{j}$ and $\hat{k}$ – numerical problems. Scalar product of vectors- application to work done by a force and power – properties of scalar product – Numerical problems. Vector product of vectors– application to torque –areas of triangle and parallelogram -properties of vector product - numerical problems.

Unit 3 Mechanics

Duration: 13 periods (L:10 – T:3)

Equations of motion in a straight line, acceleration due to gravity, equations of motion in vertical motion, Projectile motion of a body- examples, Oblique projection-expression for path of a projectile-derivation-Maximum height, Time of ascent, Time of descent, Time of flight, Horizontal range and maximum horizontal range of a projectile in oblique projection - related numerical problems

Friction – causes-types- Normal reaction, angle of repose and coefficient of friction-laws of static friction, expression for acceleration, displacement and time taken to come to rest by a body on a rough horizontal surface –derivation-numerical problems, expressions for acceleration of a body on a rough inclined surface - advantages and disadvantages of friction, methods of minimizing friction.

Unit 4 Properties of Matter

Duration: 12 periods ((L:10 – T:2)

Elasticity and elastic bodies-definition- examples, Stress and Strain-expressions-numerical problems, types of stress and strain, Elastic limit-definition, Hooke's law, stress and strain curve, Young's modulus of a wire – derivation-numerical problems, Cohesive and Adhesive forces, Surface tension- explanation and illustrations, capillarity and angle of contact-definitions, formula for determination of surface tension of a liquid based on capillary rise method – outline and related numerical problems, effect of temperature and impurity on surface tension of a liquid, Viscosity-explanation- Newton's formula for viscous force-derivation- coefficient of viscosity-numerical problems- Poiseuille's equation for coefficient of viscosity- related numerical problems, effect of temperature on viscosity of liquids and gases, importance of viscosity in lubricants.

Unit 5 Work and Energy

Duration: 12 periods (L:10 – T:2)

Work, Power and Energy-explanation-numerical problems, Potential energy and Kinetic energy-explanation- examples, expressions for Potential energy and Kinetic energy and related numerical problems, Work-Energy theorem – statement-proof-related numerical problems, law of conservation of energy-statement-examples-proof in case of a freely falling body - solve related numerical problems, law of conservation of energy in the case of simple pendulum, Non-renewable and Renewable energy sources-explanation- sources, Solar water heater and Wind mill.

Unit 6 Thermal Physics

Duration: 13 periods (L:10 – T:3)

Transmission of heat -Thermal expansion of solids and three coefficients of expansion of solids – applications, thermal conductivity of a solid – expression, principle of bimetallic strip, bimetallic thermostat, Boyle’s law in gases –explanation- its limitations-related numerical problems, concept of Absolute Zero, Absolute scale of temperature, Charles’ laws in gases in terms of absolute temperature – related numerical problems, Ideal gas equation-derivation- related numerical problems, gas equation in terms of density- solve related numerical problems, Isothermal and Adiabatic processes, internal energy and external work done – explanation, expression for work done by the gas –derivation- related numerical problems, 1st law of thermodynamics-explanation-list of applications, first law of thermodynamics to isothermal and adiabatic processes, 2nd law of thermodynamics –explanation- list of applications

Reference Books

1. Principles of Physics by N. Subrahmanyam and Brijlal, S. Chand & Co, New Delhi, edition, 1982
2. Engineering Physics by R.K. Gaur, S.L. Gupta, Dhanpatrai Publications, New Delhi.
3. Intermediate Physics, Telugu Academy, TS, Hyderabad.
4. Fundamentals of Physics by Halliday and Resnick.
5. Physics Part-I & II, NCERT

E-learning resources:

Hyper Physics website:

<http://hyperphysics.phy-astr.gsu.edu/>

Learning Outcome:

Upon completion of this course the student will be able to

CO1: Identify the need of dimensional analysis and error measurements of physical quantities.

- 1.1 Define Physical quantity, Fundamental quantity, derived physical quantity and Unit.
- 1.2 List SI units of fundamental physical quantities with their symbols (Base and Supplementary quantities).
- 1.3 Outline advantages of S.I. units.
- 1.4 Define Dimensions and Dimensional formula of a physical quantity.
- 1.5 List SI units and dimensional formulae of physical quantities (Area, Volume, Density, Velocity, Acceleration, Momentum, Impulse, Force, Work, Energy, Power, Pressure, Stress, Modulus of Elasticity, Angular velocity, Torque, Frequency, Surface Tension, Coefficient of viscosity, Universal Gravitational constant, Wavelength, Planck's constant)
- 1.6 List dimensionless quantities.
- 1.7 Explain principle of homogeneity of dimensions and solve related numerical problems (finding dimensions of terms in an equation).
- 1.8 List applications of dimensional analysis and solve problems
 - (1) Correctness of physical equations
 - (i) Displacement $S = ut + \frac{1}{2}at^2$
 - (ii) Velocity of sound in elastic medium $v = \sqrt{\frac{E}{d}}$ and
 - (iii) Work done by a gas $W = P(V_2 - V_1)$
 - (2) Conversion of a unit from SI to CGS (density, force and energy).
 - (3) Construct a relation between physical quantities. (Time period of simple pendulum $T = 2\pi\sqrt{\frac{l}{g}}$)
- 1.9 List the limitations of dimensional analysis.
- 1.10 Explain error, absolute error and percentage error of a physical quantity. Solve numerical problems on percentage error.

CO2: Apply vector concepts viz addition, multiplication to explain resultant of vectors, work done by force, power, torque and areas of triangle and parallelogram.

- 2.1 Define Scalar and Vector quantities with examples.
- 2.2 Represent a vector graphically and label vector characteristics.
- 2.3 Classify Vectors (Proper vector, Equal vectors, Parallel vectors, Negative vector, Unit vector, Null vector, Collinear vectors, Coplanar vectors and Position vector).
- 2.4 Explain resolution of a Vector into two orthogonal components and solve related numerical problems.
- 2.5 Explain Triangle law of vectors.
- 2.6 Explain Parallelogram law of vectors and develop expressions for magnitude and direction of resultant of two vectors and solve related numerical problems.
- 2.7 Illustrate parallelogram law of vectors (working of sling and flying bird).
- 2.8 Explain a vector in terms of unit vectors ($\hat{i}, \hat{j}, \hat{k}$) and solve related numerical problems on finding magnitude and unit vector.
- 2.9 Explain Scalar product of two vectors and solve numerical problems.
- 2.10 Construct expressions for work done ($W = \vec{F} \cdot \vec{S}$) and power ($P = \vec{F} \cdot \vec{v}$) in vector notation starting from force and solve related numerical problems.
- 2.11 Identify the properties of scalar product.
- 2.12 Explain vector product of two vectors and solve related numerical problems.
- 2.13 Construct an expression for torque in vector notation ($\vec{\tau} = \vec{r} \times \vec{F}$) starting from force and position vector and solve numerical problems.
- 2.14 Outline the expressions for areas of triangle and parallelogram in vector notation and solve numerical problems.
- 2.15 Identify the properties of vector product.

CO3: Analyze the kinematic equations for projectiles and objects moving on horizontal and inclined frictional surfaces.

- 3.1 Outline the equations of motion in a straight line.
- 3.2 Explain acceleration due to gravity and extend the equations of motion to freely falling body and body projected vertically upward.
- 3.3 Explain projectile motion of a body with examples.
- 3.4 Develop the expression for path of a projectile in oblique projection.
- 3.5 Develop formulae for Maximum height, Time of ascent, Time of descent, Time of flight, Horizontal range and maximum horizontal range of a projectile in oblique projection and solve related numerical problems.
- 3.6 Explain friction and causes of friction.
- 3.7 Classify types of friction.

- 3.8 Explain the concept of Normal reaction, Angle of repose and Coefficient of friction.
- 3.9 Outline the laws of Static friction.
- 3.10 Develop the expression for acceleration of a body on a rough horizontal surface and solve simple numerical problems on $a = -\mu g$ and $F = \mu R$
- 3.11 Develop the expressions for displacement and time taken to come to rest by a body over a rough horizontal surface and solve simple numerical problems on $s = \frac{u^2}{2\mu g}$ and $t = \frac{u}{\mu g}$
- 3.12 Develop the expressions for acceleration of a body on a rough inclined surface (moving upward and sliding downward)
- 3.13 Outline the advantages and disadvantages of friction.
- 3.14 Identify the methods of minimizing friction.

CO4: Make use of the fundamental properties elasticity, surface tension and viscosity of solids and fluids to solve problems in mechanics.

- 4.1 Define Elasticity and elastic bodies with examples.
- 4.2 Explain Stress and Strain with their expressions and solve related numerical problems.
- 4.3 Explain types of stress and strain (longitudinal, shear and bulk).
- 4.4 Define Elastic limit and explain Hooke's law.
- 4.5 Explain stress and strain curve of a metallic wire.
- 4.6 Develop a formula for Young's modulus of a wire having circular cross-sectional area and solve related numerical problems.
- 4.7 Compare Cohesive and Adhesive forces.
- 4.8 Explain Surface tension and illustrate Surface tension with examples.
- 4.9 Explain capillarity and angle of contact.
- 4.10 Outline the formula for determination of surface tension of a liquid based on capillary rise method with legible diagram (no derivation $T = \frac{hr \rho g}{2 \cos \theta}$) and solve related numerical problems.
- 4.11 Explain the effect of temperature and impurity on surface tension of a liquid.
- 4.12 Explain Viscosity.
- 4.13 Develop Newton's formula for viscous force and explain coefficient of viscosity and solve related numerical problems.
- 4.14 Outline Poiseuille's equation for coefficient of viscosity and solve related numerical problems.
- 4.15 Explain the effect of temperature on viscosity of liquids and gases.
- 4.16 Identify the importance of viscosity in lubricants.

CO5: Develop the knowledge associated with laws of conservation of energy and Renewable Energy sources such as Solar energy and Wind energy for sustainable environment.

- 5.1 Explain the concept of Work, Power and Energy and solve related numerical problems.
- 5.2 Explain Potential energy and Kinetic energy with examples.
- 5.3 Develop expressions for Potential energy and Kinetic energy and solve related numerical problems.
- 5.4 Develop Work-Energy theorem and solve related numerical problems.
- 5.5 Explain law of conservation of energy with examples.
- 5.6 Prove law of conservation of energy in the case of a freely falling body and solve related numerical problems.
- 5.7 Illustrate law of conservation of energy in the case of simple pendulum.
- 5.8 Explain Non-renewable and Renewable energy sources and list the sources.
- 5.9 Explain construction and working of Solar water heater and Wind mill with legible diagrams.

CO6: Utilize the principles of thermal expansion to explain thermostat and identify the significance of laws of thermodynamics.

- 6.1 Explain modes of transmission of heat.
- 6.2 Explain thermal expansion of solids and develop three coefficients of expansion of solids and identify the applications.
- 6.3 Explain thermal conductivity of a solid and develop the expression for it [$Q = KA(\theta_1 - \theta_2)t$].
- 6.4 Explain principle of bimetallic strip.
- 6.5 Explain construction and working of bimetallic thermostat as an automatic temperature control device in electrical gadgets.
- 6.6 Explain Boyle's law in gases and its limitations and solve related numerical problems.
- 6.7 Explain concept of Absolute Zero using volume and pressure coefficients of a gas [$V_t = V_0(1 + \frac{t}{273})$ and $P_t = P_0(1 + \frac{t}{273})$] and develop Absolute temperature scale.
- 6.8 Explain Charles' laws in gases in terms of absolute temperature and solve related numerical problems.
- 6.9 Develop Ideal gas equation and calculate universal gas constant and solve related numerical problems.
- 6.10 Translate gas equation in terms of density and solve related numerical problems.
- 6.11 Explain Isothermal and Adiabatic processes and identify differences between them.
- 6.12 Explain the terms internal energy and external work done by a gas.
- 6.13 Develop the expression for work done by the gas [$W = P(V_2 - V_1)$] and solve related numerical problems.
- 6.14 Explain first law of thermodynamics and list applications of it and solve related numerical problems.
- 6.15 Solve first law of thermodynamics to isothermal and adiabatic processes.
- 6.16 Explain second law of thermodynamics and list applications of it.

Course Content and Blue Print of Marks for SEE

Semester End Examination

Sl No	Unit No.	Questions to be set for SEE				Remarks	
		R		U	A		
1	I	4	1		9(a)	13(a)	
2	II						
3	III		2		10(a)	14(a)	
4	IV						
5	V		3	5, 6	9(b)	13(b)	
					11(a)	15(a)	
				11(b)	15(b)		
6	VI		7,8	10(b)	14(b)		
				12(a)	16(a)		
				12(b)	16(b)		
Total Questions		8		8	8		

Legend:	Remembering (R)	1 Mark
	Understanding (U)	3 Marks
	Application (A)	5 Marks

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TELANGANA
DIPLOMA EXAMINATION (C 24)
SEMESTER I
MID-I EXAM
SC 103 Basic Physics
Model Question paper

Duration: 1hour

Max. Marks: 20

PART-A

Instructions: 1. Answer **ALL** questions.

2. Each question carries **ONE** mark.

4X1 =4

1. Define fundamental physical quantity.
2. Name the dimensional formula of Power.
3. How does vector is different from scalar?
4. Define unit vector.

PART-B

Instructions: 1. Answer **ALL** questions.

2. Each question carries **THREE** marks.

2X3 =6

5(a) Outline advantages of S.I. units.

(OR)

- (b) The displacement of a particle moving along x-axis with respect to time is $x=at+bt^2-ct^3$.
Find the dimensional formulae of a, b and c.

6(a) Explain triangle law of vectors.

(OR)

- (b) At an airport, a horizontal wind is blowing at 15 ms^{-1} at an angle of 60° north of east.
Calculate the components of the wind velocity in the north and east directions.

PART-C

Instructions: 1. Answer **ALL** questions.

2. Each question carries **FIVE** marks.

2X5 =10

7(a) Apply dimensional analysis to convert unit of energy from SI to CGS.

(OR)

(b) Construct an expression for time period of simple pendulum using dimensional analysis starting from length of pendulum (l), mass of the bob (m) and acceleration due to gravity (g). Take proportionality constant as 2π .

8(a) Develop expressions for magnitude and direction of resultant of two vectors using parallelogram law of vectors.

(OR)

(b) Apply vector properties to find the angle between $\vec{P} = 2\hat{i} - 2\hat{j} + \hat{k}$ and $\vec{Q} = \hat{i} - 2\hat{j} + \hat{k}$

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TELANGANA

DIPLOMA EXAMINATION (C 24)

SEMESTER I

MID-II EXAM

SC 103 Basic Physics

Model Question paper

Duration: 1 hour

Max. Marks: 20

PART-A

- Instructions: 1. Answer **ALL** questions.
2. Each question carries **ONE** mark.

4X1 =4

1. What is a projectile?
2. Define Normal reaction
3. Define Elastic limit.
4. Define angle of contact.

PART-B

- Instructions: 1. Answer **ALL** questions.
2. Each question carries **THREE** marks.

2X3 =6

- 5(a) A ball is kicked into air with a velocity of 20 ms^{-1} at an angle 30° to the Earth's surface. Find maximum height reached by the ball. (Take $g = 10 \text{ ms}^{-2}$)
(OR)

- (b) Outline the laws of Static friction.

- 6(a) An object of weight 20 N suspended vertically from a crane on a steel cable 4 m long and 2 mm in diameter produces an elongation of 0.24 mm. Calculate the stress and strain in the cable.

(OR)

- (b) Draw a neat diagram for the rise and fall of a liquid in a capillary tube showing meniscus and angle of contact.

PART-C

Instructions: 1. Answer **ALL** questions.

2. Each question carries **FIVE** marks.

2X5 =10

7(a) Develop the expression for path of a projectile in oblique projection.

(OR)

(b) Develop the expression for acceleration of a body moving up on a rough inclined surface

8(a) Develop a formula for Young's modulus of a wire having circular cross-sectional area.

(OR)

(b) Develop Newton's formula for viscous force and explain coefficient of viscosity.

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TELANGANA

DIPLOMA EXAMINATION (C 24)

SEMESTER I

SEMESTER END EXAM

SC 103 Basic Physics

Model Question paper

Duration: 2 hours

Max. Marks: 40

PART – A

- Instructions: 1. Answer **ALL** questions.
2. Each question carries **ONE** mark.

8X1=8

1. Name the dimensional formula of universal gravitational constant.
2. Define angle of repose.
3. What is kinetic energy?
4. Name one example of surface tension.
5. Define renewable energy source.
6. What is the principle of working of wind mill?
7. Define convection..
8. Define internal energy.

PART – B

- Instructions: 1. Answer **ALL** questions.
2. Each question carries **THREE** marks.

4X3=12

- 9(a). Explain vector product of two vectors.

(OR)

- (b). A gun fires 120 bullets per minute. Find the power of the gun if the mass of each bullet is 3 g and velocity is 500 ms^{-1} .

- 10(a). Draw a neat diagram to show various forces acting on a body which is (a) sliding downward and (b) moving upward on a rough inclined surface.

(OR)

- (b). Explain principle of bimetallic strip.

- 11(a). Calculate the work done by a ball of mass 2 kg when its velocity increases from 5 m/s to 10 ms^{-1} due to applied force.

(OR)

(b). The work done by a person in carrying a box of mass 20 kg through a vertical height of 5 m is 4900 J. Find the mass of the person.

12(a). The volume of a gas at 30°C is 200 cc. What is the volume of the gas if temperature of the gas is raised to 100°C at constant pressure?

(OR)

(b). Explain Boyle's law and its limitations.

PART – C

Instructions: 1. Answer **ALL** questions.

2. Each question carries **FIVE** marks.

4X5 = 20

13(a). Develop expressions for magnitude and direction of resultant of two vectors using parallelogram law of vectors.

(OR)

(b). Develop Work-Energy theorem.

14(a). Draw a schematic graph of the applied force versus resulting elongation of a metallic wire. Identify the important features in it.

(OR)

(b). Develop the relation between Pressure, Volume and Temperature of an ideal gas.

15(a). Prove law of conservation of energy in the case of a freely falling body.

(OR)

(b). Explain working of wind mill with legible diagram.

16(a). Develop the relation between Pressure, Volume and Temperature of an ideal gas.

(OR)

(b). Explain thermal conductivity of a solid and develop the expression for it.

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SC-104-GENERAL ENGINEERING CHEMISTRY

Course Title	General Engineering Chemistry	Course Code	SC-104
Semester	I	Course Group	Foundation
Teaching Scheme in Periods(L:T:P)	4:1:0	Credits	2.5
Methodology	Lecture + Tutorial	Total Contact Periods	75
CIE	60 Marks	SEE	40 Marks

Prerequisite: Basic knowledge of chemistry in secondary education and appreciate the role of Chemistry and environmental science in different spheres of industries.

Course Outcome: On successful completion of the course, the students will have ability to attain below

Course Outcomes (CO):

CO1	Explain the concept of atomic structure, chemical bonding, oxidation, reduction and oxidation number and apply the knowledge in the selection of engineering materials.
CO2	Explain concept of mole, molarity, normality and colloids and utilize the knowledge in various industrial processes.
CO3	Make use of the different theories of acids and bases, concept of pH, buffer action and apply the knowledge in selection of solutions in industrial areas.
CO4	Extend the knowledge of Ecosystem, Biodiversity, Green Chemistry and Management of e-waste in maintaining the sustainable development of society.
CO5	Identify the hardness and degree of hardness of water and apply there Levant water treatment methods to solve domestic and industrial problems.
CO6	Explain the concept of electrolysis, applications of electrolysis, Faraday's Laws of Electrolysis and apply the knowledge in extraction and purification of metals used for domestic and industrial purposes.

CO-PO-Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	-	-	-	-	-	1
CO2	3	1	-	-	1	-	2
CO3	3	1	-	-	-	-	2
CO4	3	-	-	-	3	-	3
CO5	3	1	-	-	3	-	-
CO6	3	1	-	-	-	-	-

COURSE CONTENTS:

UNIT-I: Fundamentals of Chemistry

L10 + T3 Periods

Atomic Structure: Introduction – Atomic number – Mass number - Isotopes and Isobars -Bohr's Atomic Theory- Quantum numbers - Orbitals - Shapes of s, p and d orbitals – Aufbau principle - Hund's rule - Pauli's exclusion principle-Electronic configuration of elements Chemical Bonding: Introduction – Electronic theory of valency - Types of chemical bonds Ionic, Covalent, Co-ordinate covalent and Metallic bond- properties of Ionic and Covalent compounds.
Oxidation - Reduction: Electronic concept of Oxidation, Reduction and Redox reaction. Oxidation number - Calculations.

UNIT-II: Solutions and Colloids

L10+ T2Periods

Introduction - Solution – Solubility - Classification of solutions based on solubility and physical state-Atomic weight-Molecular weight, Equivalent weight-Mole concept –Molarity–Normality Numerical problems on mole, molarity and normality –Colloids- Types of colloids-Lyophilic and Lyophobic colloids -Properties of Colloids -Industrial applications of colloids

UNIT-III: Acids and Bases

L10+ T2 Periods

Introduction - Theories of acids and bases and limitations - Arrhenius theory - Brownsted Lowry theory - Lewis acid base theory - Ionic product of water - pH and related numerical problems- Buffer solutions- buffer action-Applications of buffer solution-Ostwald's theory of indicators.

UNIT-IV: Environmental Science

L10+ T3 periods

Introduction-Environment –Scope and importance of environmental studies- Important terms-Concept of ecosystem - Producers, consumers and decomposers - Biodiversity, definition and threats to Biodiversity- Green Chemistry– e-waste –Management of e-waste.

UNIT-V: Water Technology

L10+ T3 periods

Introduction-Soft and hard water-Causes of hardness–Types of hardness-Disadvantages of hard water using in industries-Degree of hardness-Softening methods-Permutit process, Ion exchange process-Drinking water-Municipal treatment of water for drinking purpose–Osmosis-Reverse Osmosis-Advantages of Reverse osmosis–Desalination by Electro dialysis.

UNIT-VI: Electrochemistry

L10+ T2Periods

Conductors, insulators, electrolytes–Types of electrolytes-Arrhenius theory of electrolytic dissociation-Electrolysis–Electrolysis of fused NaCl and aqueous NaCl-Applications of electrolysis-Faraday's laws of electrolysis-Numerical problems.

COURSE OBJECTIVES

CO1: Explain the concept of atomic structure, chemical bonding, oxidation, reduction and oxidation number and apply the knowledge in the selection of engineering materials.

- 1.1 Compare the mass and charge of proton, electron and neutron
- 1.2 Define and explain atomic number, mass number, isotopes and isobars
- 1.3 State the postulates of Bohr's atomic theory and its limitations
- 1.4 Explain Quantum numbers and their Significances
- 1.5 Define an Orbital explain the shapes of s, p and d orbitals.
- 1.6 Outline the differences between Orbit and Orbital
- 1.7 Define electronic configuration and apply Aufbau principle, Hund's rule, and Pauli's exclusion principle in writing electronic configuration of elements up to atomic number 30
- 1.8 Explain the postulates of Electronic theory of valency
- 1.9 Define chemical bond and list the types of chemical bond
- 1.10 Define ionic bond and explain the Ionic bond formation in NaCl and MgO molecules
- 1.11 Define and explain the types of covalent bonds
- 1.12 Explain the covalent bond formation in homo atomic molecules (non-polar molecules):
H₂, O₂, N₂
- 1.13 Explain the covalent bond formation in hetero atomic molecules(polar molecules): HF and H₂O
- 1.14 Explain the properties of ionic compounds and covalent compounds
- 1.15 Compare the properties of ionic compounds and covalent compounds
- 1.16 Define Co-ordinate covalent bond and explain the bond formation in ammonia boron Trifluoride and Hydronium ion
- 1.17 Define metallic bond and explain with free electron theory/ electron sea model
- 1.18 Define and explain the electronic concept of oxidation, reduction and redox reaction
- 1.19 Define oxidation number and list the rules for calculation of oxidation number
- 1.20 Find the oxidation number of C, N, S, P, Cr and Mn in their compounds

CO2: Explain concept of mole, molarity, normality and colloids and utilize the knowledge in various industrial processes.

- 2.1 Define the terms: solution, solute, solvent, aqueous solution and alcoholic solution with examples
- 2.2 Define solubility and classify the solutions based on solubility
- 2.3 Classify the solutions based on the physical state of solution, solute and solvent
- 2.4 Define atomic weight, molecular weight and equivalent weight
- 2.5 Find the molecular weight and the equivalent weights of acids, bases and salts
- 2.6 Explain mole concept and solve the numerical problems on mole
- 2.7 Define and explain molarity and normality
- 2.8 Find the relationship between molarity and normality
- 2.9 Solve numerical problems on molarity and normality of solutions
- 2.10 Define the terms: true solution, colloids and suspensions with examples
- 2.11 Classify the colloids and explain their properties
- 2.12 Compare the properties of Lyophilic Colloid and Lyophobic Colloid
- 2.13 Explain the general properties of colloids such as a) Tyndall effect b) Brownian movement and c) Coagulation
- 2.14 Explain in brief any five industrial applications of colloids

CO3: Make use of the different theories of acids and bases, concept of pH, buffer action and apply the knowledge in selection of solutions in industrial areas.

- 3.1 Explain the postulates and limitations of Arrhenius theory of acids and bases
- 3.2 Explain the postulates and limitations of Brownsted - Lowry theory of acids and bases
- 3.3 Explain the postulates and limitations of Lewis theory of acids and bases
- 3.4 Define and explain the ionic product of water and solve numerical problems
- 3.5 Define pH and solve numerical problems on pH
- 3.6. Explain Ostwald's theory of indicators with phenolphthalein and methyl orange indicators as examples
- 3.7 Define buffer solution and explain the acidic and basic buffers with examples
- 3.8 Explain buffer action of Acetate buffer and Ammonium buffer
- 3.9 Explain general applications of buffer solutions

CO4: Extend the knowledge of Ecosystem, Biodiversity, Green Chemistry and Management of e-waste in maintaining the sustainable development of society.

- 4.1 Define and explain different segments of environment: i) Atmosphere, ii) Hydrosphere, iii) Lithosphere and iv) Biosphere
- 4.2 Define the terms: i) Pollutant, ii) Contaminant iii) Pollution, iv) Receptor, v) Sink, vi) Particulates, vii) Threshold limit value (TLV), viii) Dissolved oxygen (DO), ix) BOD and x) COD
- 4.3 Define Ecosystem. Explain the biotic and abiotic components of ecosystem.
- 4.4 Define and explain the following biotic components with examples:
 - 1) Producers, 2) Consumers and 3) Decomposers
- 4.5 Define biodiversity and explain the threats to biodiversity
- 4.6 Explain the methods of conservation of biodiversity
- 4.7 Define and explain the principles of Green chemistry
- 4.8 Define e-waste and explain the sources of e-Waste
- 4.9 Explain the effect of e-waste on environment and human beings
- 4.10 Explain the management of e-waste-Land filling, incineration and recycling.

CO5: Identify the hardness and degree of hardness of water and apply there Levant water treatment methods to solve domestic and industrial problems.

- 5.1 List the various sources of water.
- 5.2 Define the terms soft water and hard water
- 5.3 Define hardness of water and name the compounds responsible for hardness
- 5.4 Define and explain the types of hardness
- 5.5 Identify the disadvantages of using hard water in industries: i) Boilers ii) Laundry, iii) Textile industry, iv) Paper industry, v) Sugar Industry and vi) Pharmaceutical industry
- 5.6 Define degree of hardness and explain different units of hardness - ppm and mg/L solve numerical problems on degree of hardness
- 5.7 Utilize and explain a) Permutit process and b) Ion-Exchange process in softening of hard water:
- 5.8 Define desalination of water
- 5.9 Define Osmosis and Reverse Osmosis (RO)
- 5.10 Explain the process of conversion of sea water into drinking water by reverse osmosis
- 5.11 List the applications and advantages of RO.
- 5.12 Explain the desalination of sea water by Electro dialysis.
- 5.13 List the essential qualities of drinking water.
- 5.14 Explain the Municipal treatment of water for drinking purpose with flow chart-
 - a) Sedimentation b) Coagulation c) Filtration, d) Sterilization by Aeration and Chlorination

CO6: Explain the concept of electrolysis, applications of electrolysis, Faraday's Laws of Electrolysis and apply the knowledge in extraction and purification of metals used for domestic and industrial purposes.

- 6.1 Define the terms, conductor, insulator, electrolyte and non-electrolyte
- 6.2 Classify the electrolytes - strong and weak electrolytes with examples.
- 6.3 Compare and contrast the metallic conductors and electrolytic conductors.
- 6.4 Explain the Arrhenius theory of electrolytic dissociation.
- 6.5 Define electrolysis.
- 6.6 State and explain Faraday's laws of electrolysis
- 6.7 Define chemical equivalent and electrochemical equivalent and their relation
- 6.8 Numerical problems based on Faraday's I-law and II- law
- 6.9 Construct the suitable electrolytic cell to explain the electrolysis of fused NaCl and aqueous NaCl (Nelson Cell).
- 6.10 Apply the principle of electrolysis in Electrolytic refining of copper metal and Electroplating.

BOARD DIPLOMA EXAMINATIONS (C24)
FIRST SEMESTER EXAMINATION
MIDSEM -I
SC-104-GENERAL ENGINEERING CHEMISTRY

Time: 1 Hour

Max.Marks:20

PART-A

Instructions: Answer all questions. Each question carries one mark

4 x 1 = 4 Marks

1. State Hund's rule.
2. What is the electronic configuration of Cr.
3. Define mole.
4. What are colloids?

PART-B

2 x 3 = 6 Marks

Instructions: Answer the following questions.

Each question carries three marks

5. a) Outline the shapes of s and d orbitals.

(OR)

5. b) Explain the covalent bond formation in Nitrogen molecule by Lewis dot method.

6. a) Classify solutions based on their physical state.

(OR)

6. b) Compare any three properties of lyophilic and lyophobic colloids.

PART - C

Instructions: Answer the following questions.

Each question carries five marks

2 x 5 = 10 Marks

7. a) Identify and explain the nature of bonding in the following molecule 1.MgO, 2.HCl

(OR)

- b) Find the oxidation number of 'S' in H_2SO_4 , 'Mn' in KMnO_4 and Cr' in $\text{K}_2\text{Cr}_2\text{O}_7$

8. a) Find the weight of H_2SO_4 required to prepare 400 ml of 0.5M solution.

(OR)

- b) Find the normality of 500 ml solution containing 0.53grams of Na_2CO_3 .

BOARD DIPLOMA EXAMINATIONS (C24)
FIRST SEMESTER EXAMINATION
MIDSEM -II
SC-104-GENERAL ENGINEERING CHEMISTRY

Time: 1 Hour

Max. Marks: 20

PART-A

Instructions: Answer all questions. Each question carries one mark $4 \times 1 = 4$ Marks

1. What is conjugate acid base pair?
2. Define ionic product of water.
3. Define an ecosystem.
4. What is threshold limit value?

PART-B

Instructions: Answer the following questions.

$2 \times 3 = 6$ Marks

Each question carries three marks

5. a) .Outline the limitations of Arrhenius theory of acid and bases?

(OR)

- b) Explain neutralization according to Lewis theory of acids and bases with an example.

6. a) Explain the terms producers, consumers and decomposers with example.

(OR)

- b) Explain the effect of e-waste on environment.

PART – C

Instructions: Answer the following questions.

$2 \times 5 = 10$ Marks

Each question carries five marks

7. a) Define pH. Find the pH of 0.5M NaOH solution.

(OR)

8. b) What are buffer solutions? Explain any four applications of buffer solutions.

9. a) What is Biodiversity? Explain the methods of Conservation of Biodiversity.

(OR)

- b) What is Green chemistry? Explain any four principles of Green Chemistry.

BOARD DIPLOMA EXAMINATIONS (C24)
FIRST SEMESTER EXAMINATION
SEMESTER END EXAMINATION
SC-104-GENERAL ENGINEERING CHEMISTRY

Time: 2 Hours

Max. Marks: 40

PART-A

Instructions: Answer all questions. Each question carries one mark. 8 X 1 = 8 marks

1. Define atomic mass number.
2. What is biodiversity?
3. Define degree of hardness of water.
4. What are buffer solutions?
5. Define soft water and hard water.
6. Name the salts responsible for temporary hardness of water.
7. Define the terms conductor and insulator.
8. What is an electrolyte?

PART- B

Instructions: Answer the following questions.

4x3=12 Marks

Each question carries three marks

9. a) State and explain Hund's rule.

(OR)

- b) Interpret any six essential qualities of drinking water.

10. a) Explain the terms producers, consumers and decomposers with examples.

(OR)

- b) Explain strong and weak electrolytes? Give examples.

11. a) Define reverse osmosis and predict its advantages.

(OR)

- b) Compare temporary and permanent hardness of water.

12. a) Identify the differences between metallic and electrolytic conductors.

(OR)

- b) Explain Faraday's Laws of electrolysis.

PART– C

Instructions: Answer the following questions.

4 x5 =20 Marks

Each question carries five marks.

13. a) Find the Molarity and Normality of the two liters of solution containing 10.6 grams of Na_2CO_3 .

(OR)

- b) Find the temporary and permanent hardness of water containing the following salts per liter

i. $\text{Ca}(\text{HCO}_3)_2$ =32.4 mg ii. $\text{Mg}(\text{HCO}_3)_2$ =29.2mg iii. CaSO_4 =13.6mg iv. MgCl_2 =19 mg

14. a) Explain Lewis theory of acids and bases.

(OR)

- b) Explain the process of electrolysis of fused NaCl .

15. a) Explain the Permutit process of softening of hard water with a neat labeled diagram.

(OR)

- b) Identify and explain the disadvantages of using hard water in the following industries?

i).Boilers ii) Laundry iii) Paper industry iv) Textile industry v) Pharmaceuticals

16. a).Explain the process of electrolytic refining of copper.

(OR)

- b) Find the weight of Al deposited on the cathode if 0.5 amperes of electric current is passed through AlCl_3 solution for 1 hour.

ME-105 - WORKSHOP TECHNOLOGY

Course title:	Workshop Technology	Course code:	ME-105
Semester:	I	Course group:	Core
Teaching scheme in periods:	4:1:0	Credits:	2.5
Methodology:	Lecture+ Tutorial	Total Contact periods:	75
CE:	60 Marks	SEE:	40 Marks

Prerequisites

Enthusiasm to learn the course and requires the basic knowledge of Applied Science and Mathematics at Secondary school level.

CORSE OUTCOMES

On successful completion of the course, the students will be able to:

COURSE OUTCOMES	
CO1	Identify the hand tools used in carpentry, fitting, sheet metal and forging works and know the purpose.
CO2	Acquaint with various operations of carpentry, fitting, sheet metal and forging operations.
CO3	Gain knowledge of measuring and checking tools used in fitting.
CO4	Attain the knowledge of mechanical working of metals and differentiate Hot working and cold working processes.
CO5	Acquaint with foundry tools, patterns and moulding sands
CO6	Explain various casting methods

BLUE PRINT OF MARKS FOR SEE

Unit No	Unit Name	Periods	Questions to beset for SEE				
			R		U	A	
1	Carpentry and Forging tools	12	Q4	Q1		Q9(a)	Q13(a)
2	Fitting and Sheet metal tools	13					
3	Measuring and Checking Tools used in Fitting	12		Q2		Q10(a)	Q14(a)
4	Mechanical Working Of Metals	13					
5	Foundry	13		Q3	Q5,Q6	Q9(b), Q11(a), Q11(b)	Q13(b), Q15(a), Q15(b)
6	Casting Methods	12					
Total		75	08		08	08	

CO-PO Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	Mapping POs
CO1	3	1	2	3	-	-	1	1, 2,3,4,7
CO2	3	1	2	3	-	-	1	1, 2,3,4,7
CO3	3	1	2	3	-	-	1	1, 2,3,4,7
CO4	3	1	2	3	1	-	1	1,2,3, 4,5,7
CO5	3	1	2	3	1	-	1	1,2,3,4,5,7
CO6	3	1	2	3	1	-	1	1,2,3,4,5,7

COURSECONTENT**UNIT-I****CARPENTRY AND FORGINGTOOLS****PERIODS:12****Carpentry Tools:**

Marking & Measuring Tools - Scales, Rules, Straight Edge, Try Square, Marking gauge, Mortise gauge, Cutting gauge; Striking Tools - Hammers - Claw hammer and Mallet.

Cutting Tools - Saws - Ripsaw, Cross cut saw (Hand saw), Tenon saw. Chisels - Firmer chisel, Beveled edge firmer chisel, Parting chisel, Mortise chisel, Inside and Outside gauges. Metal jack plane(only).

Forging Tools: Anvil, Swage block, Hand hammers - types; Sledge hammer - specifications and uses. Tongs – types and uses, Chisels - hot & cold chisels - uses. Swages - types, Fullers, Flatters, Set hammer, Punch and Drift - uses. Advantages and disadvantages of forging- forging operations

UNIT-II FITTING AND SHEET METAL TOOLS**PERIODS:13****Fitting Tools:****Holding Devices:**

Vices- Bench vice, Leg-vice, Hand vice, Pin vice, Tool makers vice, Pipe vice.

Cutting tools: Hand hacksaws, Files-Chisels-Scrapers-Drill Bits-Reamers-Taps & Dies – specifications and uses.

Marking Tools: Surface plate, V-block, Angle plate, Try square, Scriber, Punch, Prick punch, Centre punch, Number punch, and Letter punch.

Sheet Metal Tools:

Cutting and Striking Tools –Snips, Straight snip, Bent or curved snip, Double shears, Bench Shear, Riveting hammer, Setting hammer, Raising hammer, Mallet.

Stakes- Double seaming stake, Break horn stake, Bevel edged square stake, Funnel Stack, Half moon stack, Hatches stake, Needle stake, Blow Horn stake, Hollow mandrel stake.

Hems: Single hem, double hem, wired edge hem, Seam and types of seams.

UNIT –III CHECKING AND MEASURING INSTRUMENTS USED IN FITTING

PERIODS:12

Checking instruments: Calipers: Outside & Inside calipers, Hermaphrodite (odd leg) caliper with firm joint, Spring calipers, Transfer caliper, Dividers - vernier calipers, vernier height gauge, vernier depth gauge, micrometer.

Measuring instruments: Combination set, bevel protractor, universal bevel protractor, sine bar, scribing block, universal scribing block, engineer's parallels, slip gauges, feeler gauge, plug gauge, ring gauge, taper gauge, snap gauges, thread gauges, screw pitch gauge, wire gauge, plate gauge, radius and fillet gauges, template gauge, telescopic gauge, - outside & inside, depth micrometer, screw thread micrometer.

UNIT IV MECHANICAL WORKING OF METALS

PERIODS: 13

Introduction: Hot working and cold working,

Hot Working Processes: Rolling - types of rolling, two high mill, three high mills, four high mills, piercing or seamless tubing, reeling, drawing or cupping, spinning, Extrusion - direct or forward extrusion, indirect or backward extrusion, tube extrusion, Impact extrusion. Effects of hot working of metals, advantages & limitations of hot working of metals.

Cold Working Processes: Rolling, drawing- wire drawing, tube drawing, Stretch forming, Cold extrusion, **Squeezing Operations**-Cold Heading, Cold reeling, Cold swaging, Stamping, Cold hobbing, Shot peening, Thread rolling, **Shearing Operations**- Blanking, Piercing, Notching, **Bending**-Roll bending, Angle bending, Cold spinning, Effects of cold working of metals, advantages & limitations of cold working.

UNIT V FOUNDRY

PERIODS: 13

Introduction to foundry

Foundry Equipment: Hand moulding tools: shovel, riddle, rammers, trowels, slick, lifter, strike off bar, sprue pin, bellow, swab, gate cutter, mallet, vent rod, draw spike, rapping plate or lifting plate, pouring weight, gagger, clamps, spirit level, moulding boxes and types of moulding Boxes.

Pattern – Making: Materials for pattern such as wood, cast iron, aluminium, brass, plastics, their uses and relative advantages, Sequence in pattern making, pattern allowances, classification of patterns such as solid (one piece), two piece and three pieces, split patterns, gate patterns, shell patterns, etc.

Types of Moulding Sand : Green sand, dry sand, loam sand, facing sand, backing sand, parting sand, core sand, system sand, binders and sand additives.

Sand Properties: Properties of moulding sand - porosity, flow ability, collapsibility, adhesiveness, cohesiveness and refractoriness.

UNIT VI CASTING METHODS

PERIODS: 13

Advantages and limitations of casting over other manufacturing processes.

Moldings: Moulding Procedure, Moulding Processes, Green sand, Dry sand moulding, Skin dry sand moulding, Loam moulding, Cement bonded moulding, Shell moulding, Ceramic moulding, Moulding a split pattern, Moulding with three parts flask.- elements of gating system – gates –runner -riser

Cores: Definition of core, Need of cores

Special casting methods: Die casting- hot chamber and cold Chamber die casting, Vacuum die casting, permanent mould (Gravity die) casting, centrifugal casting, CO₂ process, Investment casting.- casting defects causes and remedies

SUGGESTED LEARNING OUTCOMES:

Up on completion of the course the students shall be able to;

CO1: Identify the hand tools used in carpentry, fitting, sheet metal and forging works and know the purpose.

- 1.1. List various marking tools used in carpentry and find the purpose of each
- 1.2. List various measuring tools used in carpentry and find the purpose of each
- 1.3. Able to use of measuring tools in carpentry
- 1.4. State various cutting tools use in carpentry.
- 1.5. Explain the construction of Rip saw and illustrate tpi, saw setting
- 1.6. Explain the construction of Cross cut saw.
- 1.7. Explain the construction of Mortise chisel and firmer chisel and find the purpose of each.
- 1.8. Outline the usage of inside and outside gouges
- 1.9. Describe the construction and working of metal jack Plane.
- 1.10. Illustrate advantages and disadvantages of forging
- 1.11. Explain forgeability
- 1.12. List forging metals
- 1.13. Mention the forging temperatures of different metals
- 1.14. Describe black smith forge
- 1.15. State the purpose of tong
- 1.16. identify different types of tongs
- 1.17. List and explain forging operations
- 1.18. Describe construction and usage of anvil
- 1.19. Illustrate the various parts of anvil and identify the purpose of each
- 1.20. Classify and choose various hammers of forging and their specifications
- 1.21. Explain the purpose and usage of swage block, fullers, flatters and set hammers, chisels, and swages with simple sketches
- 1.22. Explain about, punches and drift

CO2: Acquaint with various operations of carpentry, fitting, sheet metal and forging operations.

- 2.1. Demonstrate the need of work holding deices
- 2.2. List various work holding devices used in fitting and outline its purpose
- 2.3. Illustrate construction and working of Bench vice.
- 2.4. What is an hack saw
- 2.5. Describe the construction of Hacksaw and show the parts
- 2.6. What is the need of a file
- 2.7. Explain types of files and its usage
- 2.8. Describe the construction of a standard file
- 2.9. List various chisels and know the purpose of each
- 2.10. List various scrapers and know the purpose.
- 2.11. What is a drill
- 2.12. Differentiate drills, reamers, taps and dies and their purposes
- 2.13. List various marking tools in fitting and know their purposes.
- 2.14. List various tools used in sheet metal work and know the purpose
- 2.15. Explain construction and working of cutting tools snips, shears used in sheet metal
- 2.16. Explain about various stakes used in sheet metal
- 2.17. What is the need of a sheet metal joint
- 2.18. List various sheet metal joints and their uses
- 2.19. How a sheet metal joint is made leak proof

CO3: Gain knowledge of measuring and checking tools used in fitting.

- 3.1. Explore the use of calipers and list various calipers
- 3.2. Explore the use of divider
- 3.3. Illustrate about slip gauges
- 3.4. Describe bevel protractor and universal bevel protractor
- 3.5. Explain combination set and sine bar
- 3.6. Differentiate simple scribing block and universal scribing block
- 3.7. Identify engineer's parallels
- 3.8. Classify various gauges and their uses
- 3.9. Able to operate various Vernier calipers
- 3.10. Able to operate various Micrometers
- 3.11. Describe the use of combination set
- 3.12. Describe the use of bevel protractor
- 3.13. Explore the use of universal bevel protractor
- 3.14. Describe the use of the following sine bar
- 3.15. Explore the use of scribing block
- 3.16. Describe the construction and use of universal scribing block
- 3.17. Able to use the engineer's parallels, slip gauges and feeler gauge
- 3.18. Explore the use of plug gauge, ring gauge, taper gauge and snap gauges
- 3.19. Explore the use of thread gauges and screw pitch gauge
- 3.20. Explore the use of wire gauge
- 3.21. Explore the use of plate gauge
- 3.22. Explore the use of radius and fillet gauges
- 3.23. Able to use template gauge
- 3.24. Able to use telescopic gauge
- 3.25. Explore the use of outside & inside, micrometer, depth micrometer and screw thread micrometer

CO4: Attain the knowledge of mechanical working of metals and differentiate Hot working and cold working processes.

- 4.1 Introduce various manufacturing methods
- 4.2 Illustrate the need and relevance of metal forming
- 4.3 Outline the advantages and disadvantages of metal forming
- 4.4 Define and explain Hot working process
- 4.5 Define and explain Cold working process
- 4.6 Differentiate hot working and cold working
- 4.7 Illustrate the rolling process and its need
- 4.8 Describe types of rolling
- 4.9 Explain how tubes are made by rolling and its advantages
- 4.10 Introduce extrusion and explain direct and indirect extrusion
- 4.11 Differentiate Piercing, reeling, drawing or cupping, spinning operations
- 4.12 Demonstrate direct extrusion, indirect extrusion, tube extrusion, impact extrusion
- 4.13 Explain Effect of hot working of metals, advantages and limitations of hot working.
- 4.14 List cold working processes
- 4.15 Explain about cold rolling; drawing–wire drawing, tube drawing, stretch forming
- 4.16 Describe cold extrusion ;squeezing operations-cold heading, cold reeling, cold swaging, stamping, cold hobbing, Shot peening, thread rolling
- 4.17 Explainshearingoperations-blanking,piercing,notching;bendingoperations- roll forming, angle bending and cold spinning
- 4.18 Write advantages and limitations of cold working processes

CO5: Acquaint with foundry tools, patterns and moulding sands.

- 5.1 Explain the importance of foundry
- 5.2 Being able to identify, select, and use the tools needed for mould preparation
- 5.3 List foundry tools and their purposes
- 5.4 Differentiate peen and butt rammer
- 5.5 Describe usage of foundry tools used in mould preparation
- 5.6 Define a pattern
- 5.7 Explain pattern making procedure
- 5.8 Describe pattern materials, their advantages and disadvantages
- 5.9 Explain types of patterns
- 5.10 Illustrate about pattern allowance need and types.
- 5.11 Compare solid, split and three piece pattern
- 5.12 Describe various moulding sand and its constituents
- 5.13 Define a binder and show its purpose
- 5.14 List and Explain desirable properties of a moulding sand

CO6: Explain various casting methods

- 6.1 Define a mould
- 6.2 List various moulds and explain their advantages and disadvantages
- 6.3 Introduce elements of gating system
- 6.4 Explain the purpose and construction of Gate, Runner and riser.
- 6.5 Define Core and need of cores
- 6.6 Explain preparation of mould
- 6.7 Explain moulding process with split pattern
- 6.8 Illustrate Green sand moulding, dry sand moulding and skin dry sand moulding
- 6.9 Differentiate loam moulding, cement bonded moulding, shell moulding, Ceramic moulding
- 6.10 What is a casting
- 6.11 Introduce Die casting system
- 6.12 Compare sand casting and die casting
- 6.13 Differentiate Die casting methods
- 6.14 Explain and differentiate hot chamber and cold chamber casting
- 6.15 Describe vacuum die casting
- 6.16 Explain centrifugal casting
- 6.17 Able to apply CO₂ Casting process and investing casting process
- 6.18 List various casting defects
- 6.19 Identify causes and remedies of casting defects

REFERENCE BOOKS

- 1. Production Technology by Jain & Gupta (Khanna Publishers)
- 2. Elementary Workshop Technology (Vol. I & II) by Hazra Chowdary
- 3. Manufacturing Technology (Vol. I) by P. N. Rao (McGraw Hill)
- 4. Workshop Technology (Vol. I & II) by Raghuvamshi
- 5. Production Technology by P. C. Sharma

Suggested E-Learning references

- 1. <http://www.asme.org>
- 2. www.ocw.mit.edu/courses/mechanical-engineering
- 3. www.nptel.ac.in

SEMESTER END EXAMINATION (SEE) BLUEPRINT PATTERN

S No	Unit No.	Questions to beset for SEE			
		R		U	A
1	I	4	1		9(a)
2	II				13(a)
3	III		2		10(a)
4	IV				14(a)
5	V		3	5, 6	9(b) 11(a) 11(b)
6	VI			7,8	13(b) 15(a) 15(b)
				10(b) 12(a) 12(b)	14(b) 16(a) 16(b)
Total Questions		8		8	8

BOARD DIPLOMA EXAMINATION,(C-24)
DME- I SEMESTER- EXAMINATION
MID SEM-I
WORKSHOP TECHNOLOGY

Time: 1Hour

Total Marks:20

PART-A

04X01=04

- Instructions :**
1. Answer **ALL** questions.
 2. Each question carries **ONE** mark.
1. State the use of try square
 2. Define forging.
 3. List any two vices used in fitting.
 4. Why stakes are used in sheet metal work?

PART-B

02X03=06

- Instructions :**
1. Answer any **TWO** questions.
 2. Each question carries **THREE** marks.
5. (a) Write about Tenon Saw with a neat sketch?
(or)
 6. (b) Differentiate hot chisel and cold chisel
-
- 6.(a) Draw a neat sketch of twist drill and label the parts
(or)
 - 6.(b) Differentiate single hem and double hem.

PART-C

- Instructions :**
1. Answer any **TWO** questions.
 2. Each question carries **FIVE** marks.
- 7.(a) List various chisels used in carpentry and explain firmer chisel with neat sketch (or)
 7. (b) Draw a neat sketch of anvil and explain.
-
- 8.(a) Explain tapping process in fitting (or)
 8. (b) List various stakes used in sheet metal, and explain about any one stake.

BOARD DIPLOMA EXAMINATION, (C-24)
MID SEM-II
DME – II SEMESTER- EXAMINATION
WORKSHOP TECHNOLOGY

Time: 1 Hour

Total Marks: 20

PART-A

04X01=04

- Instructions :**
1. Answer **ALL** questions.
 2. Each question carries **ONE** mark.

1. What is the least count of vernier caliper?
2. Why gauges are used?
3. What is rolling?
4. Define hot working?

PART-B

02X03=06

- Instructions :**
1. Answer any **TWO** questions.
 2. Each question carries **THREE** marks.
5. (a) Draw a neat sketch of vernier depth gauge and label the parts (or)
 5. (b) Explain working of a sine bar
 6. (a) Explain reeling operation with a neat sketch.
(or)
 6. (b) Explain piercing operation with a neat sketch.

PART-C

1
0

- Instructions :**
1. Answer any **TWO** questions.
 2. Each question carries **FIVE** marks.
7. (a) Draw and explain measuring dimensions with a vernier caliper.
(or)
 7. (b) Draw and explain measuring dimensions with a universal bevel protractor.
 8. (a) Explain hot extrusion with a neat sketch.
(or)
 8. (b) How wire drawing is done in cold working?

BOARD DIPLOMA EXAMINATION, (C-24)
MODEL PAPER-2024
DME-SEMESTER END EXAMINATION
WORKSHOP TECHNOLOGY

Time: 2Hours

Total Marks: 40

PART-A

08X01=08

- Instructions :**
1. Answer **ALL** questions.
 2. Each question carries **ONE** mark.
1. Name any two forging tools.
 2. Define hot working.
 3. List any two pattern materials
 4. Define 'drilling'.
 5. Write any two allowances in foundry.
 6. Why additives are used in moulding sand?
 7. Define 'moulding'.
 8. Why cores are used in casting?

PART-B

04X03=12

- Instructions :**
1. Answer any **FOUR** questions.
 2. Each question carries **THREE** marks.
9. (a) Draw a neat sketch of a file and label the parts.
(or)
 9. (b) Explain shrinkage allowance
 10. (a) Explain four high rolling with a neat sketch
(or)
 10. (b) Explain advantages and disadvantages of casting
 11. (a) List and explain various materials used for pattern making.
(or)
 11. (b) Explain any three properties of moulding sand.
 12. (a) Explain procedure for preparing a mould.
(or)
 12. (b) What are the advantages of dry sand moulding?

PART- C

Instructions :

1. Answer any **FOUR** questions.
2. Each question carries **FIVE** marks.

4X5=20

13.(a) Explain various thread cutting taps with sketches
(or)

13.(b) Explain pattern making procedure in foundry.

14.(a) Explain outside micrometer with a neat sketch
(or)

14.(b) Write about split pattern moulding procedure.

15.(a) What are the various moulding sands? Explain.
(or)

15.(b) Explain any five foundry tools with neat sketches.

16.(a) Explain hot chamber die casting with a neat sketch
(or)

16.(b) What is investing casting? Explain with neat sketch.

ME-106 - ENGINEERING MECHANICS

Course Title	Engineering Mechanics	Course Code	ME-106
SEMESTER	I	Course Group	Core
Teaching Scheme in periods (L : T : P)	4:1:0	Credits	2.5
Methodology	Lecture + Tutorial	Total Contact Periods	75
CIE	60 Marks	SEE	40 Marks

Pre-Requisites:

This course requires the basic knowledge of High School Science and Mathematics

COURSE OUTCOMES:

On successful completion of the course, the students will be able to

CO1	Understand the concept of forces, analyse the force systems and find out the resultant of the force systems
CO2	Apply knowledge of friction and force resolution to solve related numerical problems.
CO3	Locate the centre of gravity of various sections and calculate the Moment of Inertia of standards sections.
CO4	Apply the various principles like, Work-Energy principle and Impulse – Momentum principle to solve the kinetic problems of particles
CO5	Compute velocity ratio, mechanical advantage and efficiency of simple machines.
CO6	Illustrate working principles and functioning of simple mechanisms

BLUE PRINT OF MARKS FOR SEMESTER END EXAM (SEE)

Units		No of periods	Questions to be set for SEE					Remarks
			R			U	A	
Part-A	1. Statics	13	Q4	Q1		Q9(a)	Q13(a)	
	2. Friction	12						
Part-B	3. Geometric Properties of Sections	12		Q2		Q10(a)	Q14(a)	
	4. Dynamics	13						
Part-C	5.SimpleMachines	13		Q3	Q5 Q6	Q9(b) Q11(a) Q11(b)	Q13(b) Q15(a) Q15(b)	
	6. Basic Link Mechanisms	12				Q7 Q8	Q10(b) Q12(a) Q12(b)	Q14(b) Q16(a) Q16(b)
TOTAL		75	08			08	08	

COURSE CONTENT

1. Statics

Importance of engineering mechanics in engineering - Definition of force and its specifications-System of forces - Composition and Resolution of force - Equilibrium and Equilibrant, resultant -Statement of parallelogram law of forces, triangle law of forces, polygon law of forces and Lami's theorem- Numerical problems related to concurrent coplanar forces. Moment of force and moment of a couple - Condition for equilibrium of a rigid body subjected to number of coplanar forces (problems omitted)-Varignon's Principle.

2. Friction

Definition of static friction, dynamic friction - laws of solid and dynamic friction - angle of friction and angle of repose- Resolution of forces considering friction when a body moves on horizontal plane and inclined plane when force is applied (a) parallel to the plane (b) Parallel to the base (c) Inclined to the plane- Numerical examples on the above cases

3. Geometric Properties of Sections:

Definition of Centre of Gravity, Centroid; Locating centroid of geometrical plane figures (square, rectangle, triangle, circle, semi-circle, quarter circle); Centroid of composite figures composed of not more than three geometrical figures; Centre of Gravity of simple solids (Cube, Cuboid, cone, cylinder, sphere, hemisphere); Centre of Gravity of composite sections (T-Section, L-Section, I-Section Channel-Sections).

Moment of inertia (M.I.): Definition, M.I. of plane lamina, Radius of gyration, Parallel and Perpendicular axes theorems (without derivations); M.I. of rectangle, square, circle, semi-circle, quarter circle and triangle section (without derivations); M.I. of symmetrical I-section, Channel section and T-section about centroidal axes.

4. Dynamics:

Definition of Kinematics and Kinetics - Classification of motion - Definition of displacement, velocity and acceleration – Equations of motion - Newton's Laws of motion (without derivation) - Solving the problems related to the rectilinear motion of a particle - Law of conservation of energy - Law of conservation of momentum - Work-Energy principle - Impulse-momentum equation- Solving the problems using the above principles - Definition of centripetal and centrifugal force and differences between them- Numerical problems.

5. Simple Machines:

Definition of simple machine, and uses of simple machine, levers and inclined plane - Fundamental terms like mechanical advantage, velocity ratio and efficiency - Expressions (without derivation) for VR in case of three systems of pulleys, Weston Differential pulley block, Worm and Worm wheel, Rack and pinion, Winch crabs, & Screw jack -Numerical problems- Conditions for reversibility and self locking - Law of Simple Machine - Effort lost in friction, Load Equivalent of Friction Maximum Mechanical Advantage and Maximum Efficiency.

6. Basic Link Mechanisms:

Define the terms kinematic link, kinematic pair, Kinematic Chain, Mechanism, Machine, Structure and inversion - classification of kinematic pairs on different criteria – nature of contact, relative motion and type of closure Inversions-Types of Kinematic Chains-Four Bar Chain- Beam Engine-Coupling Rod of Locomotive-Single Slider Crank Chain- Pendulum Pump-Crank and Slotted Lever Quick Return Motion Mechanism-Double Slider Crank Chain-Elliptical trammel-Scotch yoke mechanism-Oldham's coupling

REFERENCE BOOKS:

1. Singer., Engineering Mechanics, B.S. Publications, New Delhi.
2. Kumar, K.L., Engineering Mechanics, TMH, New Delhi.
3. Timoshenko and Young, Engineering Mechanics, TMH, New Delhi.
4. Bhavikatti, S.S., Mechanics of Solids, New Age International Publishers.
5. Rattan, S.S., Theory of Machines, TMH, New Delhi.

ELECTRONIC RESOURCES:

1. <https://nptel.ac.in/courses/112103108>
2. <https://www.slideshare.net/>
3. https://en.wikibooks.org/wiki/Engineering_Mechanics
4. <http://ndl.ethernet.edu.et/bitstream/>
5. <https://archive.nptel.ac.in/courses/112/106/112106286/>

SUGGESTED STUDENT ACTIVITIES:

1. Record various forces applied by human beings in their daily activities.
2. Identify the applications where parallelogram law of forces, Lami's theorem etc. are used and prepare a report.
3. Use toy blocks or building bricks to create inclined planes and test how different materials slide down them, discussing the role of friction in motion.
4. Create simple crank-and-slider mechanisms using cardboard and observe how they convert rotary motion into linear motion.
5. Cut out shapes from cardboard or paper and balance them on a pencil or pen to locate their Centroids, discussing the concept of balance points.
6. Compare the ease of spinning objects of different shapes and sizes (e.g., a coin, a ring, a disk) on a tabletop and discuss how their moments of inertia differ.

SUGGESTED LEARNING OUTCOMES

Upon completion of the course the student shall be able to

CO1: Understand the concept of forces, analyse the force systems and find out the resultant of the force systems

- 1.1. Explain the meaning of mechanics in engineering.
- 1.2. State the importance of mechanics in engineering.
- 1.3. Define the force, its units and types
- 1.4. Explain various types of force systems
- 1.5. Resolve a force into horizontal and vertical components
- 1.6. Describe the concept of resultant
- 1.7. State parallelogram law and do related numerical problems
- 1.8. State triangle law and polygon law
- 1.9 Explain the concept of free body diagram.
- 1.10. State Lami's theorem and do related numerical problems
- 1.11. Describe the concept of equilibrium of forces, equilibrant and conditions for it.
- 1.12. Explain Various Force systems with neat sketches
- 1.13. Solve numerical problems on finding out the resultant of a simple coplanar, concurrent force system.
- 1.14. Explain moment of force and couple.
- 1.15.State Varignon's theorem.

CO2: Apply knowledge of friction and force resolution to solve related numerical problems.

- 2.1. Explain the concept of friction
- 2.2. State the laws of friction
- 2.3. Differentiate between static friction and dynamic friction
- 2.4. Define i) Normal Reaction ii) Co-efficient of friction
- 2.5. Define i) angle of friction ii) angle of repose
- 2.6. Interpret the significance of the angle of friction and the angle of repose in various situations.
- 2.7. Identify the machines in which friction is desirable.
- 2.8. Resolve the forces acting on bodies moving on horizontal plane.
- 2.9. Solve the related numerical problems
- 2.10. Identify factors influencing frictional forces and equilibrium on inclined planes
- 2.11. Resolve the forces acting on bodies moving upon an inclined plane. Force Applied (a) parallel to the plane (b) Parallel to the base (c) Inclined to the plane.
- 2.12. Resolve the forces acting on bodies moving down on an inclined plane. Force applied (a) Parallel to the plane (b) Parallel to the base (c) Inclined to the plane
- 2.13. Solve the related numerical problems of the above cases.

CO3: Locate the centre of gravity of various sections and calculate the Moment of Inertia of standards sections.

- 3.1. Define Centre of gravity and Centroid
- 3.2. Identify the relationship between Centroid and Centre of Gravity.
- 3.3. Locate Centroid of geometrical plane figures such as square, rectangle, triangle, circle, semi-circle, quarter circle
- 3.4. Locate Centroid of simple composite figures
- 3.5. Find out the Centre of Gravity of simple solids such as cube, cuboid, cone, cylinder, sphere, hemisphere
- 3.6. Find out the Centre of Gravity of simple composite sections T-Section, L-Section, I-Section, and Channel sections.
- 3.7. Define Moment of Inertia (M.I.) of plane lamina
- 3.8. Define the term polar moment of inertia.
- 3.9. Describe the concept of Radius of gyration
- 3.10. State and understand Parallel and Perpendicular axes theorems (without derivations)
- 3.11. State the necessity of finding Moment of Inertia for various engineering applications.
- 3.12. Find out M.I. of laminas such as rectangle, square, circle, semi-circle, quarter circle and triangle section
- 3.13. Find out M.I. of symmetrical I-section, Channel section and T-section about Centroidal axes

CO4: Apply the various principles like, Work-Energy principle and Impulse –Momentum principle to solve the kinetic problems of particles

- 4.1. Define the terms Kinematics and Kinetics.
- 4.2. Classify the motion types.
- 4.3. Define the terms displacement, velocity and acceleration and write equations of motion.
- 4.4. State the Newton's Laws of motion
- 4.5. Solve the problems related to the rectilinear motion of a particle
- 4.6. Explain the rotary motion of particle
- 4.7. Define the law of conservation of energy
- 4.8. Explain the Work-Energy principle
- 4.9. Define the law of conservation of momentum
- 4.10. Explain the Impulse–momentum equation
- 4.11. Solve the problems using the above principles.
- 4.12. Define centripetal force and centrifugal force.
- 4.13. Differentiate centripetal force from centrifugal force.
- 4.14. Solve the problems using the above principles.

CO5: Compute velocity ratio, mechanical advantage and efficiency of simple machines.

- 5.1. Define the important terms of simple machines a) Machine, b) Mechanical c) Advantage, c) Velocity Ratio, d) Efficiency
- 5.2. Define the terms with respect to simple machines a) Ideal Machine b) Ideal Effort c) Ideal Load d) Reversibility of a machine
- 5.3. Differentiate between Practical Machine and an Ideal Machine
- 5.4. Illustrate the use of three classes of simple lever.
- 5.5. Explain how an inclined plane act as a simple machine to reduce the effort in Lifting loads.

- 5.6. Explain the working of i) Wheel & axle ii) Weston Differential pulley block
iii) Pulleys iv) Worm & Worm wheel v) Winch crabs vi) Screw jack
vi) Rack & pinion
- 5.7. Find out velocity ratio for i) Wheel & axle ii) Weston Differential pulley block
iii) Pulleys iv) Worm & Worm wheel v) Winch crabs vi) Screw jack
vi) Rack & pinion
- 5.8. Calculate the efficiency of a given machine.
- 5.9. Explain the law of machine.
- 5.10. State the conditions for self-locking .
- 5.11. State the conditions for reversibility.
- 5.12. Calculate effort lost in friction and load equivalent of friction.
- 5.13. Evaluate the conditions for i) maximum mechanical advantage iii) maximum efficiency of a machine.

CO6: Illustrate working principles and functioning of simple mechanisms

- 6.1. Define the terms i) kinematic link ii) kinematic pair iii) Kinematic chain
iv) Mechanism v) Machine vi) Structure
- 6.2. Write the classification of kinematic Links of a Mechanism.
- 6.3. Differentiate between a Machine and a Mechanism.
- 6.4. Differentiate between Structure and Machine.
- 6.5. Write the classification of kinematic pairs on different criteria.
- 6.6. Identify examples of different classifications of kinematic pairs.
- 6.7. Define inversion in the context of mechanisms.
- 6.8. List out different inversions of the quadric cycle mechanism.
- 6.9. Explain with legible sketches the inversions of quadric cycle chain.
- 6.10. List out different inversions of the Slider Crank chain
- 6.11. Explain with legible sketches the inversions of Slider Crank chain.
- 6.12. List out different inversions of the Double Slider Crank chain.
- 6.13. Explain with legible sketches the inversions of Double Slider Crank chain.

COURSE OUTCOMES		CL	Linked POs	Teaching Periods
CO1	Understand the concept of forces, analyse the force systems and find out the resultant of the force systems	R, U, A	1, 2, 3, 7	13
CO2	Apply knowledge of friction and force resolution to solve related numerical problems.	R, U, A	1, 2, 3, 7	12
CO3	Locate the centre of gravity of various sections and calculate the Moment of Inertia of standards sections.	R,U, A	1, 2, 3	12
CO4	Apply the various principles like, Work-Energy principle and Impulse –Momentum principle to solve the kinetic problems of particles	R,U, A	1, 2, 3, 7	13
CO5	Compute velocity ratio, Mechanical Advantage and efficiency of simple machines.	R,U, A	1, 2, 3,5,7	13
CO6	Illustrate working principles and functioning of simple mechanisms	R, U, A	1, 2, 3, 5,7	12
			Total Periods	75

Legends: R = Remember; U= Understand; A= Apply and above levels (Bloom's revised taxonomy)

CO-PO ATTAINMENT MATRIX

COURSE OUTCOMES	Basic and Discipline Specific Knowledge	Problem Analysis	Design/Development of Solutions	Engineering Tools, Experimentation and Testing	Engineering Practices for Society, Sustainability and Environment	Project Management	Lifelong Learning
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	3				1
CO2	3	2	3				1
CO3	3	2	3				
CO4	3	3	3				1
CO5	3	2	3		2		1
CO6	3	2	3		2		1

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Lowly Addressed.

**MID SEM - I
MODEL PAPER
Engineering Mechanics (ME-106)**

Time: 1 Hours

Max. Marks: 20

PART-A

4 X 1 = 4

- Instructions:** 1. Answer **ALL** questions.
2. Each question carries **ONE** mark.
1. State triangle law of forces.
 2. What is meant by resolution of a force?
 3. State laws of dynamic friction.
 4. Define Angle of Repose.

PART-B

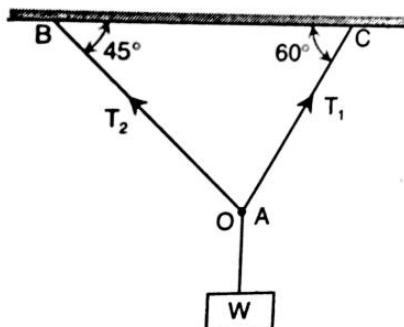
2 X 3 = 6

- Instructions:** 1. Answer **ALL** questions.
2. Each question carries **THREE** marks.
5. (a) Explain the conditions of equilibrium of a coplanar system of forces.
OR
 5. (b) Two forces of 50 N and 25 N act at a point. The angle between the lines of action of two forces is 60° . Determine the magnitude and direction of the resultant.
 6. (a) A block of mass 5 kg is placed on a horizontal surface with a coefficient of friction of 0.3. A force of 18 N is applied horizontally to the block. Calculate the frictional force acting on the block and determine if the block will move.
OR
 6. (b) A box weighing 100 N is placed on an inclined plane with an angle of 30 degrees. If the coefficient of static friction between the box and the plane is 0.4, determine whether the box will start sliding down the plane.

PART-C

2 X 5 = 10

- Instructions:** 1. Answer **ALL** questions.
2. Each question carries **FIVE** marks.
7. (a) A weight of 5kN is supported by two strings as shown in figure given below. Determine the tensions in the string.



OR

7. (b) i) State parallelogram law of forces and write the expression for magnitude and direction of resultant force. (3M)
ii) State Varignon's Principle. (2M)
8. (a) A body resting on a rough horizontal plane required a pull of 18 N inclined at 30° to the plane just to move it. It was found that a push of 22 N inclined 30° to the plane just moved the body. Determine the weight of the body and coefficient of friction.
OR
8. (b) A body of weight 1200 N is to be pulled up an inclined plane of angle 25° . The coefficient of friction between body and plane is 0.3. Draw the diagrams and find the effort required (a) when it is parallel to the plane and (b) when it is parallel to the base.

MID SEM - II
MODEL PAPER
Engineering Mechanics (ME-106)

Time: 1 Hours

Max. Marks: 20

PART-A

4 X 1 = 4

Instructions: 1. Answer **ALL** questions.

2. Each question carries **ONE** mark.

1. Define the term centroid.
2. Write the moment of inertia about their centroidal axes for a quadrant if its radius is R.
3. Define (a) centripetal force (b) centrifugal force.
4. State work- energy principle.

PART-B

2 X 3 = 6

Instructions: 1. Answer **ALL** questions.

2. Each question carries **THREE** marks.

5. (a) State parallel axis theorem. Write its equation.

OR

5. (b) A right angle triangle of base 30 mm and height 50 mm is placed in such a way that its base is parallel to horizontal. Find the moment of inertia about (a) horizontal centroidal axis (b) base.

6. (a) A 1Kg ball is thrown vertically upwards with an initial velocity of 10 m/s. Calculate the maximum height reached by the ball..

OR

6. (b) State and explain the principle of conservation of momentum..

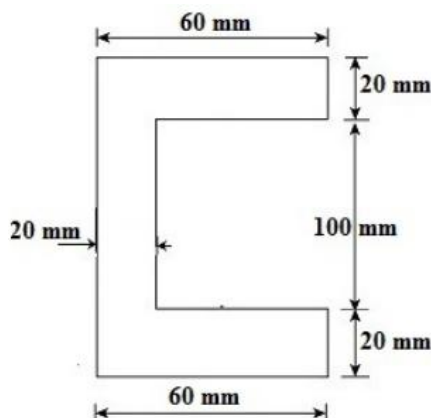
PART-C

2 X 5 = 10

Instructions: 1. Answer **ALL** questions.

2. Each question carries **FIVE** marks.

7. (a) Find the moment of inertia about centroidal X – X axis for the C-section given in the following figure.



OR

7. (b) Two rectangles of dimension 100 mm X 10 mm form a L section. Find its centroid

8. (a) A stone is projected upwards with a velocity of 110 m/s. With what initial velocity should a second stone be projected upwards 2 seconds later so that it may overtake the first stone at its maximum height?.

OR

8. (b) Find the height of tower from the top of which an object falls freely and during the last seconds of its motion, the object travels a distance equal to $\frac{2}{3}$ rd of the height of the tower. Take $g=9.8\text{m/s}^2$.

BOARD DIPLOMA EXAMINATION, (C-24)
SEE-MODEL PAPER
DME– I SEMESTER EXAMINATION
Engineering Mechanics (ME-106)

Time: 2 Hours

Max. Marks: 40

PART-A

8 X 1 = 8

- Instructions:** 1. Answer **ALL** questions.
2. Each question carries **ONE** mark.
1. State Lami's theorem.
 2. State Perpendicular axis theorem.
 3. Define Mechanical Advantage.
 4. What is a couple?.
 5. Define (a) ideal effort and (b) ideal load.
 6. Define Velocity Ratio.
 7. List out any three names of inversions of four bar chain
 8. Define (a) link and (b) kinematic pair.

PART-B

4 X 3 = 12

- Instructions:** 1. Answer **ALL** questions.
2. Each question carries **THREE** marks.
9. (a) Two forces of magnitude 30N and 40N each act on a body. The angle between the forces is 20° . Find the magnitude and direction of the resultant.
OR
 9. (b) The velocity ratio of a simple machine is 10. The effort applied is 150 N. Determine the load lifted, if 20% of the effort is lost in friction.
 10. (a) Two rectangles of dimension 100mmX10mm form a T section. Find its centroid.
OR
 10. (b) Write any three differences between machine and mechanism.
 11. (a) What is self-locking? Mention the condition for self-locking.
OR
 11. (b) Write the law of the machine with effort versus load diagram.
 12. (a) Define (a) lower pair, and (b) higher pair and give at least two examples of each.
OR
 12. (b) Differentiate between structure and machine.

PART-C

4 X 5 = 20

Instructions: 1. Answer **ALL** questions.

2. Each question carries **FIVE** marks.

13. (a) A body of weight 200 N is held vertically by means of two strings which make 30° and 60° with horizontal. Find tension in strings.

OR

13. (b) The larger and smaller diameters of differential axle are 80 mm and 70 mm respectively. The effort is applied to the wheel at the end of the lever 120 mm long. What is the velocity ratio? Find also the efficiency and frictional effort lost, when the load lifted is 8000 N and the effort applied is 320 N.

14. (a)) A bullet of mass 0.1 kg is fired into a target with a velocity of 350 m/s. The mass of the target is 10 kg and it is free to move. Find the loss of kinetic energy.

OR

14. (b) Explain Whitworth Quick Return Motion Mechanism with a neat sketch.

15. (a) In a differential wheel and axle, the difference between axle diameters is 50 mm and the diameter of the effort wheel is 750 mm. If a load of 2500 N is lifted by an effort of 175 N and a load of 3250 N is lifted by an effort of 210 N, determine : (a) law of the machine, (b) load lifted by an effort of 225 N, (c) mechanical advantage, (d) velocity ratio and (e) efficiency.

OR

15. (b) In a simple machine, whose velocity ratio is 30, a load of 2400 N is lifted by an effort of 150 N and a load of 3000 N is lifted by an effort of 180 N. Find the law of machine and calculate the load that could be lifted by a force of 200 N.

16. (a) Illustrate the working of the crank and slotted lever mechanism with a neat diagram.

OR

16. (b) Explain the slider crank mechanism with a neat line diagram.

ME-107-ENGINEERING DRAWING - I

Course Title :	Engineering Drawing – I	Course Code	ME-107
Semester	I	Course Group	Practical
Teaching Scheme in Periods (L:P)	1:0:2	Credits	1.25
Methodology	Lecture + Practice	Total Contact Periods:	45
CIE	60 Marks	SEE	40 Marks

Prerequisites: No prerequisites are required to learn this course.

Course Objectives

The Course is aimed at developing basic drawing skills so as to enable them to use these skills in the preparation of engineering drawings, their reading and interpretation.

COURSE OUTCOMES (CO)

Upon successful completion of the course, the students will be able to

Course Outcome		Cognizant Level	Linked Program Objectives (PO)
CO1	Recognize the importance of Engineering Drawing and usage of the drawing Instruments.	R	1, 4, 7
CO2	Practice free hand lettering & numbering in different styles.	R/U	1, 3, 4, 7
CO3	Use of different methods of dimensioning systems in Engineering Drawing.	R/U	1,3, 4, 7
CO4	Construct engineering curves such as parabola, hyperbola, ellipse, involute, cycloid, helix and their tangent lines.	R/U/A	1, 2, 3, 4, 7
CO5	Apply knowledge of orthographic projection principles to accurately represent the projection of points, lines, and planes onto different planes.	R/U/A	1, 2, 3, 4,6, 7
CO6	Explain the principles and conventions of orthographic projection, including the use of multiple views to fully describe an object.	R/U/A	1, 2, 3, 4, 7

BLUEPRINT FOR MARKS IN SEE

Unit No	Name of the Unit	Periods	Questions to be set for SEE		
			R	U	A
			PART-A (2M Questions)		PART-B (6M Questions)
1, 2 & 3	Importance of Engineering Drawing and Instruments, Free Hand lettering and Numbering and Dimensioning Practice	09	Q1		Q9(a)
4a.	Geometric constructions up to Construction of polygons	06	Q2		Q9(b)
4b.	Geometric constructions contd., Conical curves and Special curves	06	Q3		Q10(a)
5	Projection of points, Lines, and Planes	09	Q4		Q10(b)
6	Orthographic projections	15	Q5,Q6, Q7,Q8		Q11(a),Q11(b), Q12(a),Q12(b)
Total Periods / Total Questions		45	8		4
[R: Remembering; U: Understanding – 2 Marks; A: Application – 6 Marks] <u>Note: Question Paper consists PART– A and PART-B</u> PART–A consists of 8 questions and student as to answer ALL questions, each question Carries 2 marks. (8x2 =16) PART–B consists of 4 questions and student has to attempt ALL questions, each question carries 6 marks (4x6=24)					

COURSE CONTENTS

NOTE:

1. B.I.S Specification should in variably be followed in all the topics.
2. A-3 Size Drawing Sheets are to be used for all Drawing Practice Exercises.

1.0 The importance of Engineering Drawing and Engineering Instruments (03periods)

Explanation of the scope and objectives of the subject of Engineering Drawing – Its importance as a graphic communication – Need for preparing drawing as per standards– SP-46– 1988– Mention B.I.S-Role of drawing in Engineering education– Link between Engineering drawing and other subjects of study.

Engineering drawing Instruments

Classifications: Basic Tools, tools for drawing straight lines, tools for curved lines, tools for measuring distances and special tools like mini drafter & drafting machine – Mentioning of names under each classification and their brief description -Scales: Recommended scales reduced & enlarged -Lines: Types of lines, selection of line thickness - Selection of Pencils -Sheet Sizes: A0, A1, A2, A3, A4, A5, Layout of drawing sheets in respect of A0,A1,A3 sizes, Sizes of the Title block and its contents, Care and maintenance of Drawing Sheet, Drawing plate: Layout of sheet–as per SP-46-1988 to a suitable scale.

2.0 Free hand lettering & numbering (03periods)

Importance of lettering –Types of lettering – Guide Lines for Lettering Practicing of letters & numbers of given sizes (7mm, 10mm and 14mm) Advantages of single stroke or simple style of lettering – Use of lettering stencils

3.0 Dimensioning practice (03periods)

Purpose of Engineering Drawing, Need of B.I.S code in dimensioning –Shaped escription of an Engineering object -Definition of Dimensioning size description - Location of features, surface finish, fully dimensioned Drawing -Notations or tools of dimensioning, dimension line extension line, leaderline, arrows, symbols, number and notes, rules to be observed in the use of above tools -Placing dimensions: Aligned system and unidirectional system (SP-46-1988)-Arrangement of dimensions Chain, parallel, combined progressive, and dimensioning by co-ordinate methods-The rules for dimensioning standard, features: Circles (holes) arcs, angles, tapers, chamfers, and dimension of narrow spaces.

4.0 Geometric Construction (12periods)

Division of a line: to divide a straight line into given number of equal parts internally examples in engineering application. Construction of tangent lines: to draw tangent lines touching circles internally and externally. Construction of tangent arcs

- a) To draw tangent arc of given radius to touch two lines inclined at given angle (acute, right and obtuse angles).
- b) Tangent arc of given radius touching a circle or an arc and a given line.
- c) Tangent arcs of radius R, touching two given circles internally and externally.

Construction of polygon: construction of any regular polygon of given side length using general method.

Conical Curves: Explanation of Ellipse, Parabola, Hyperbola, as sections of a double cone and a loci of a moving point, Eccentricity of above curves – Their Engg. Application viz. Projectiles, reflectors, P-V Diagram of a hyperbolic process.

Conical Curves: Construction of any conic section of given eccentricity by general method. Construction of ellipse by concentric circles method. Construction of parabola by rectangle method. Construction of rectangular hyperbola.

Special Curves: Involute, Cycloid and Helix, explanations as locus of a moving point, their engineering application, viz, Gear tooth profile, screw threads, springs etc.- their construction

5.0 Projection of points, lines and planes (09 periods)

Projecting a point on two planes of projection - Projecting a point on three planes of projection- Projection of straight line.

- a) Parallel to both the planes.
- b) Perpendicular to one of the planes.
- c) Inclined to one plane and parallel to other planes. Projection of regular planes.
- a) Plane perpendicular to HP and parallel to VP and vice versa.
- b) Plane perpendicular to HP and inclined to VP and vice versa.

6.0 Orthographic Projections (15 periods)

Meaning of orthographic projection -Using a viewing box and a model – Number of views obtained on the six faces of the box - Legible sketches of 3 views for describing object - Concept of front view, top view, and side view for sketching these views of engineering objects- Explanation of first angle projection.– Positioning of three views in First angle projection- Projection of points as a means of locating the corners of the surfaces of an object – Use of miter line in drawing a third view when other two views are given – Method of representing hidden lines – Selection of minimum number of views to describe full object.

Reference Books

1. Engineering Drawing by N.D. Bhatt (Charotar Publishing House Pvt. Ltd.)
2. Engineering Drawing by Kapildev–(Asian Publisher)
3. Engineering Drawing by Basant Agarwal&C. M Agarwal- (McGraw-hill)
4. A Textbook on Engineering Drawing by P.Kannaiah, K.L.Narayana, K.Venkata Reddy
5. Engineering drawing + Auto CAD by Venugopal, K, New Delhi : New Age International

Online Resources

1. <https://nptel.ac.in/courses>
2. <https://nptel.ac.in/courses/124107157>
3. www.slideshare.net/shameem.mist/engineering-drawing
4. <https://www.powershow.com/viewfl/76303a->
5. OWI5M/Engineering_Drawing_powerpoint_ppt_presentation
6. <https://www.powershow.com/view0/91a2bf->
7. N2Q2N/Basic_engineering_drawing_solved_question_powerpoint_ppt_presentation

Suggested Learning Outcomes

Upon completion of the subject, the student shall be able to

CO1: Recognize the importance of Engineering Drawing and usage of the drawing instruments.

- 1.1 State the importance of drawing as an engineering communication medium
- 1.2 State the necessity of B.I.S. Code of practice for Engineering Drawing.
- 1.3 Explain the link ages between Engineering drawing and other subjects of study in diploma course.
- 1.4 Select the correct instruments and draw lines of different orientation.
- 1.5 Select the correct instruments and draw small and large Circles.
- 1.6 Select the correct instruments for measuring distances on the drawing.
- 1.7 Use correct grade of pencil for different types of lines, thickness and given function.
- 1.8 Select and use appropriate scales for a given application.
- 1.9 Identify different drawing sheet sizes as per I.S. and Standard Lay-outs.
- 1.10 Prepare Title block as per B.I.S. Specifications.

CO2: Practice free hand lettering & numbering in different styles.

- 2.1 Write titles using sloping lettering and numerals of 7mm, 10mm and 14mm height
- 2.2 Write titles using vertical lettering and numerals of 7mm, 10mm and 14mm height
- 2.3 Select suitable sizes of lettering for different layouts and applications
- 2.4 Practice the use of lettering stencils.

CO3: Use of different methods of dimensioning systems in Engineering Drawing.

- 3.1 Define “Dimensioning.
- 3.2 State the need of dimensioning of drawing according to accepted standard.
- 3.3 Identify notations of Dimensioning used in dimensioned drawing.
- 3.4 Identify the system of placement of dimensions in the given dimensioned drawing.
- 3.5 Dimension a given drawing using standard notations and desired system of dimensioning.
- 3.6 Dimensioning standard features applying necessary rules.

- 3.7 Arrange dimensions in a desired method given in a drawing.
- 3.8 Identify the departures if any made in the given dimensioned drawing with reference to SP-46-1988, and dimension the same correctly.

CO4: Construct engineering curves such as parabola, hyperbola, ellipse, involute, cycloid, helix and their tangent lines.

- 4.1 Divide a given line into desired number of equal parts internally.
- 4.2 Draw tangent lines and arcs.
- 4.3 Use General method to construct any polygon.
- 4.4 Explain the importance of conics.
- 4.5 Construct conics (ellipse, parabola and hyperbola) by general method.
- 4.6 Construct ellipse by concentric circles method.
- 4.7 Construct parabola by rectangle method.
- 4.8 Construct rectangular hyperbola from the given data.
- 4.9 Construct involute from the given data.
- 4.10 Construct cycloid and helix from the given data.
- 4.11 State the applications of the above constructions in engineering practice.

CO5: Apply knowledge of orthographic projection principles to accurately represent the projection of points, lines, and planes onto different planes.

- 5.1 Visualize the objects
- 5.2 Explain the I-angle and III-angle projections
- 5.3 Practice the I-angle projections
- 5.4 Draw the projection of a point with respect to reference planes (HP & VP)
- 5.5 Draw the projections of straight lines with respect to two reference Planes (up to lines parallel to one plane and inclined to other plane)
- 5.6 Draw the projections of planes (up to planes perpendicular to one plane and inclined to other plane)

CO6: Explain the principles and conventions of orthographic projection, including the use of multiple views to fully describe an object.

- 6.1 Explain the principles of orthographic projection with simple sketches.
- 6.2 Draw the orthographic view of an object from its pictorial drawing.
- 6.3 Draw the minimum number of views needed to represent complete engineering component.

CO-POMATRIX:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	-	-	3	-	-	3
CO2	3	1	2	2	-	-	3
CO3	3	1	2	2	-	-	2
CO4	3	1	2	2	-	-	2
CO5	3	3	2	2	-	1	1
CO6	3	1	3	3	-	-	2

BOARD DIPLOMA EXAMINATION, (C-24)
DME– I SEMESTER
ME-107, MID SEMESTER - I EXAMINATION
ENGINEERING DRAWING - I

Time:1Hour]

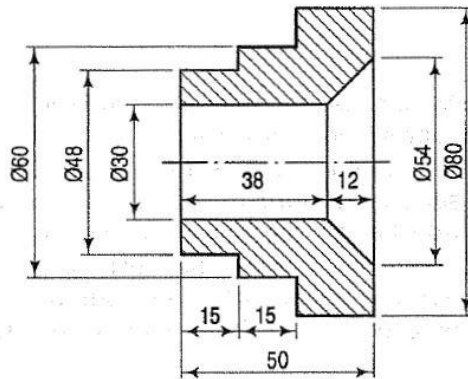
[TotalMarks:20

PART-A

04x02=08

- Instructions :**
1. Answer **ALL** questions.
 2. Each question carries **TWO** marks.

1. Write free hand the following, using single stroke vertical capital letters of height 12mm.
'NECESSITY IS THE MOTHER OF INVENTION'
2. Redraw the following figure in Uni-Directional system of dimensioning.



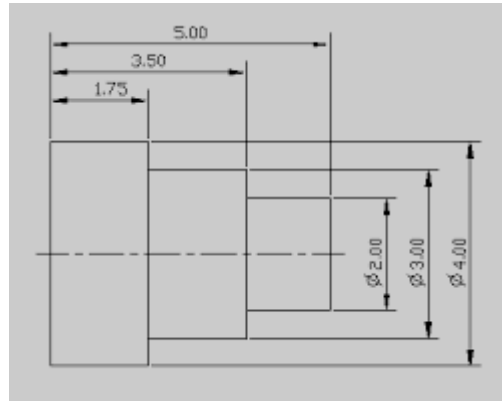
3. To divide a straight line of 70 mm into 6 equal parts.
4. Bisect a given line AB of length 75 mm.

PART-B

02x06=12

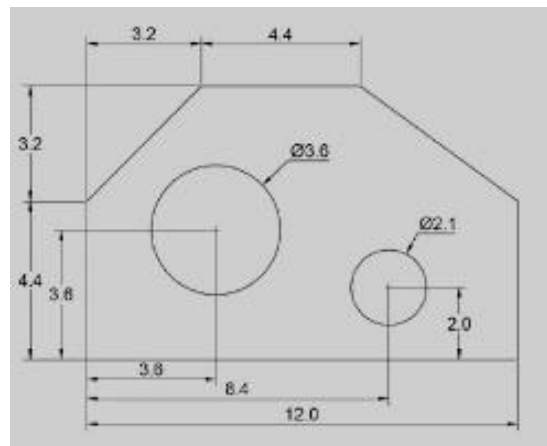
- Instructions :**
1. Answer ALL questions.
 2. Each question carries **SIX** marks.

5. (a) Redraw the following figure with chain dimensioning.



(Or)

5. (b) Redraw the following figure in aligned system of dimensioning.



6. (a) Construct a regular pentagon of base side 30 mm in general method.

(Or)

6. (b) Draw an arc of radius 30 mm touching the given straight line AB of length 70 mm and passing through a point 'P' which is 55 mm above the line AB.

BOARD DIPLOMA EXAMINATION, (C-24)
DME– I SEMESTER
MID SEMESTER - II
EXAMINATIONENGINEERING
DRAWING - I

Time:1Hour]

[TotalMarks:20

PART-A

04x02=08

- Instructions :**
1. Answer **ALL** questions.
 2. Each question carries **TWO** marks.
1. Draw an arc of radius 30mm touching the two given straight lines AB and AC making an angle 45^0 with each other.
 2. Draw an internal common tangent for the two given circles of equal radius of 30mm if the centre distance is 75 mm.
 3. Draw the projections of appoint A lying on both the planes.
 4. A line AB of length 70mm is parallel o V.P. and inclined an angle of 30^0 to H.P. Draw its projections when it send A is on the H.P. and 20 mm in front of V.P.

PART-B

02x06=12

- Instructions :**
1. Answer **ALL** questions.
 2. Each question carries **SIX** marks.
5. (a) Construct an ellipse if the distance between focus and the directrix is 50 mm by eccentricity method. Also draw the normal and tangent at any point on the curve.

(Or)
 5. (b) Construct the locus of a point 'P' which is on the circumference of circle of radius 25 mm when it is rolling on a straight line for one complete revolution without slipping. Also name the curve.
 6. (a) Draw the projections of a line AB of length 75 mm parallel to HP and inclined at an angle of 30^0 to VP. The end A is 30mm from both the reference planes.

(Or)
 6. (b) A square of base side 40mm is perpendicular to both the reference planes. Draw its projections.

MODEL PAPER SEE
BOARD DIPLOMA EXAMINATION, (C-24)
DME- I SEMESTER END EXAMINATION
ENGINEERING DRAWING - I

Time: 2 hours]

[Total Marks: 40

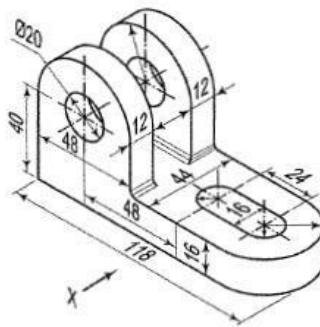
Important Note: Wherever any question has choice, marks will be allotted only to first attempted question. No marks will be allotted for extra questions answered.

PART-A

08x02=16

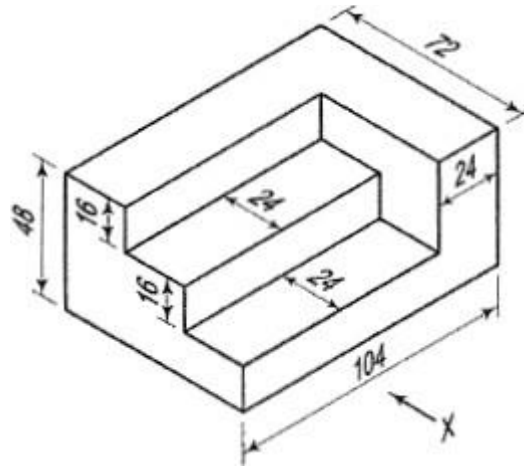
Instructions :

1. Answer **ALL** questions.
2. Each question carries **TWO** marks.
3. All the dimensions are in mm.
1. Write the following, using single stroke vertical capital letters of size 10 mm:
‘DEVELOP AN ATTITUDE OF GRATITUDE’
2. Bisect the given angle of 55° .
3. Inscribe a pentagon in a given circle of radius 35 mm.
4. Draw the projections of a point ‘P’ lying on HP and 30 mm behind VP.
5. Draw the top view of a circular plate of diameter 50 mm when its plane is perpendicular to HP.
6. Draw the projections of a cube of base side 30 mm when it is resting on one of its base on HP with one of its vertical face is parallel to VP.
7. Draw the front view of the block shown in figure



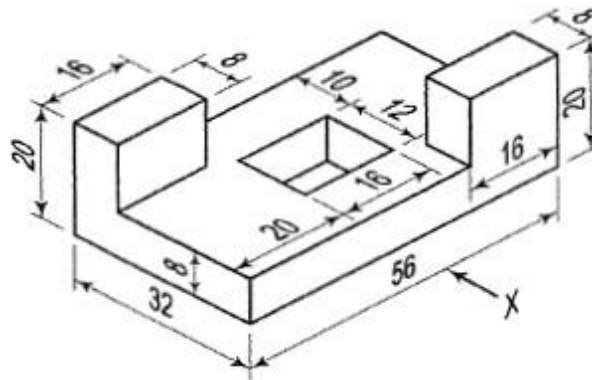
8. Draw the front view of the block shown in figure

- ## PART-B

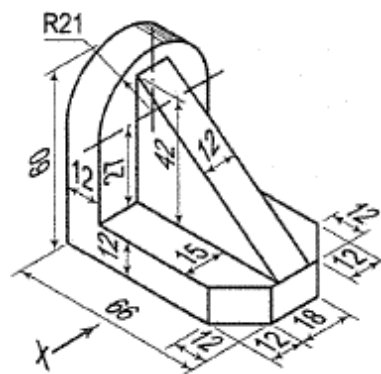


(Or)

11. (b) Draw the top view from the component as shown in figure.

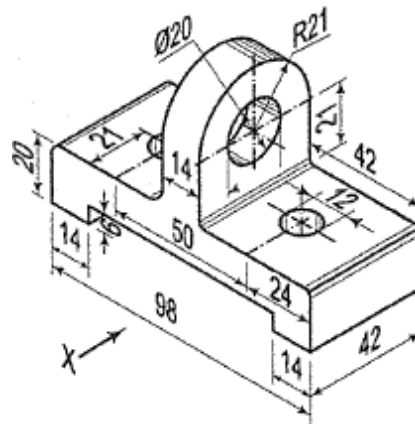


12. (a) Draw the front view of component shown in figure



(Or)

12(b) Draw the top view and front view of the component as shown in figure



ME-108 - WORKSHOP PRACTICE

Course Title	Workshop Practice	Course Code	ME-108
Semester	I	Course Group	Practical
Teaching Scheme in Periods (L: T: P)	15:00:30	Credits	1.25
Methodology	Lecture + Theory + Practice	Total Contact Periods :	45 Periods
CIE	60 Marks	SEE	40 Marks

Pre requisites

This course requires the basic skills of handling workshop tools, this course also requires the basic knowledge of applied science and mathematics at secondary school level.

BLUEPRINT FOR MARKS IN SEE

Unit No	Unit name	Periods	Questions for SEE			Marks Weightage	% Weightage
			Handling	Manipulation	Precision		
1	Fitting shop	12	10	15	15	40	100
2	Forging shop	11	10	15	15	40	100
3	Carpentry shop	11	10	15	15	40	100
4	Sheet metal shop	11	10	15	15	40	100
	Total	45					

Note:

1. Student can answer any one question out of 4 questions.
2. To pass in practical Exam student should acquire 50% marks in both CIE and SEE separately and CIE & SEE put together.
3. If the students acquire less than 50% in CIE, accordingly the students have to acquire more than 50% in SEE to get overall 50 % to pass

Course Outcomes

On completion of course the student should be able to;

CO1	Identify and use the tools and equipment in fitting Shop
CO2	Acquire skill in basic fitting operations
CO3	Identify and use the tools to perform forging operations
CO4	Identify and use the tools to perform carpentry operations
CO5	Identify and use the tools to perform operations in sheet metal shop

COURSE CONTENTS:

FITTING SHOP

1. Marking and chipping on Mild – steel flat 12 mm thick.
2. Cutting with hack saw, M.S. Flats of 6 mm thick.
3. Marking, cutting, drilling, Chamfering and tapping on a M.S. Flat 12 mm thick.
4. Assembling of two pieces, Matching by filing (L/V Shape)

FORGING SHOP

5. Conversion of round to square.
6. Conversion of round to Hexagon.
7. Preparation of chisel from round rod.
8. Preparation of ring and hook from M.S. round.
9. Preparation of a hexagonal Head using upsetting operation.

CARPENTRY SHOP

1. Cutting of wood with hand saw.
2. Planning of wood.
3. Chiselling of wood.
4. Lap joint
5. T- Joint
6. Preparation of Dovetail joint.

SHEET METAL SHOP

1. Practice on cutting of sheet
2. Formation of joints like grooved joints, locked groove joint
3. Preparation of a rectangular open type tray
4. Preparation of hollow cylinder
5. Preparation of mug.
6. Preparation of funnel

REFERENCE BOOKS:

1. Manufacturing Technology (Vol I) by P N Rao (McGraw Hill)
2. Mechanical Workshop & Laboratory Manual By K. C. John

Competencies and Key competencies to be achieved by the student.

Title of the Job	Competencies	Key Competencies
Fitting shop		
Marking and Chipping on Mild steel flat of 12 mm thick	Identify appropriate measuring tool Handle appropriate marking tool Handle appropriate chipping tool Mark the dimensions Remove the material by chipping from MS flats	Mark the dimensions Remove the material by chipping from MS flats
Cutting with hack saw of MS flats of 6mm thick	Check the raw material for size Fix the work piece in vice Mark the work as per given dimensions Perform dot punching Load and unload hack saw blade from its frame Use the hack saw to perform cutting operation	Load and unload hack saw blade from its frame cut the work as per marked dimensions using Hack saw
Drilling, chamfering and on a MS flat of 2 mm thick	Check the raw material for size Apply the chalk on the surface and on all sides of the flat Layout the dimensions and mark the lines using dot punch Chamfer the edges through filing Locate the hole centres using odd leg callipers and centre punching Identify appropriate drill bit Load and unload drill bit from the machine	Load and unload drill bit from the machine Identify appropriate taps Tap the hole

Title of the Job	Competencies	Key Competencies
Forging shop		
1. Conversion of Round to Square	- Identify the holding and striking tools - Heat the specimen to the appropriate temperature - Remove the specimen and hold it on the anvil - Hammer the specimen to the	- Heat the specimen to the appropriate temperature - Hammer the specimen to the required shape

Title of the Job	Competencies	Key Competencies
Forging shop		
	required shape	
2. Conversion of Round to Hexagon	- Identify the holding and striking tools - Heat the specimen to the appropriate temperature - Remove the specimen and hold it on the anvil - Hammer the specimen to the required shape	- Heat the specimen to the appropriate temperature - Hammer the specimen to the required shape

Title of the Job	Competencies	Key Competencies
Carpentry Shop		
1. Cutting of wood with hand saw	- Identify the orientation of grains - Select appropriate saw for cutting in each of the directions viz. across and along the grains - Select appropriate work holding device - Handle appropriate measuring and marking tools(Steel rule, Try square, Marking gauge) - Mark dimensions on work using Marking gauge - Fix the work in the vice - Perform cutting along the grains using Rip saw - Change the position of work in the vice - Perform cutting perpendicular the grains using cross cut saw	- Identify the orientation of grains - Mark dimensions on work using marking gauge - Perform cutting along and perpendicular the grains using appropriate saw
2. Planning of wood	- Identify the direction for planning wood stock - Select appropriate jack plane - Prepare the jack plane for planning - Load and unload the blade of a jack plane - Select appropriate work holding	- Identify the direction for planning wood stock - Prepare the jack plane for planning - Plane the surfaces on all four sides using jack plane

Title of the Job	Competencies	Key Competencies
Carpentry Shop		
	device ● Perform marking on work using appropriate tool ● Fix the work in the vice ● Plane the surfaces on all four sides using jack plane	
3. Chiselling of wood	● Select appropriate chisels and saw ● Select appropriate work holding device ● Select appropriate measuring and marking tools ● Fix the work in the vice ● Mark the position of grooves on work using marking gauge ● Cut sides of grooves by hand saw ● Chip the material using firmer chisel by applying pressure with mallet ● Finish the grooves with rasp file	● Select appropriate chisels and saw ● Mark the position of grooves on work using marking gauge ● Cut sides of grooves by hand saw ● Chip the material using firmer chisel by applying pressure with mallet
4. Preparation of T-Joint, Lap joint and Dove tail joint	● Select the appropriate cutting tools and work holding devices ● Plane the wooden pieces on all sides ● Mark at an angle of 75° with bevel square ● Trim the dovetail by chisel to exact size ● Cut the dovetail groove on second piece ● Finish the groove ● Assemble the two pieces to prepare dovetail halving joint by using mallet	● Trim the dovetail by chisel to exact size ● Mark at an angle of 75° with bevel square ● Cut the dovetail groove on second piece ● Assemble the two pieces to prepare dovetail halving joint by using mallet

Title of the Job	Competencies	Key Competency
Sheet metal Work		
1. Practice on cutting of sheet	● Cut the required sheet from the stock using snip ● Mark the dimensions on the sheet using scribe & steel rule ● Draw the circular shapes using divider	● Identify the marking and cutting tools ● Cut the sheet of different shapes using appropriate tools

	● Perform rough cutting of the curved shapes using chisel and finish cutting using snips ● Cut the straight edges using straight snips	
2. Formation of joints like grooved joint, locked groove joint	● Cut the sheet in to two halves ● Form the flange on the sheet by folding the sheet along scribed lines using mallet & stakes ● Perform bending edges of sheets applying moderate pressure using mallet ● Inter lock the bent edges and apply pressure with mallet to make required joint	● Identify the marking and cutting tools ● Cut the sheet ● Perform bending along the marked lines.
3. Preparation of a rectangular open type tray	● Draw the development of the object to be made ● Place the pattern on the sheet ● Mark the dimensions using scribe ● Shear the required piece from the stock using straight snips ● Mark the lines on the sheet to form bends ● Strengthen the sides of sheet by single hem using hatchet stake ● Form the sheet in to desired shape using stakes ● Seam the corners by inserting laps of the adjacent sides with single hem	● Drawing development of objects ● Cut the sheet ● Seam the corners by inserting laps of the adjacent sides with single hem
4. Preparation of hollow cylinder	● Draw the development of the object to be made ● Place the pattern on the sheet ● Mark the dimensions using scribe ● Shear the required piece from the stock using straight snips ● Mark the lines on the sheet to form bends ● Strengthen the sides of sheet by single hem on top & bottom side using hatchet stake ● Form the flat sheet into cylindrical shape by cylindrical	● Identify the marking and cutting tools ● Drawing development of objects ● Cut the sheet ● Inter lock the sides and apply pressure using mallet to make a strong joint

	stake and apply pressure using mallet • Prepare single hem on to longitudinal sides in opposite directions • Inter lock the sides and apply pressure to make a strong joint	
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Course Outcome (CO)		Cognizant Level	Linked Program Outcomes (PO)	Teaching periods
CO1	Identify and use the tools and equipment in fitting Shop	R/U/A	1,2,3,4,7	6
CO2	Acquire skill in basic fitting operations	R/U/A	1,2,3,4,7	6
CO3	Identify and use the tools to perform forging operations	R/U/A	1,2,3,4,7	11
CO4	Identify and use the tools to perform carpentry operations	R/U/A	1,2,3,4,7	11
CO5	Identify and use the tools to perform operations in sheet metal shop	R/U/A	1,2,3,4,7	11
R: Remembering, U: Understanding, A: Applying				

CO-PO MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	Mapping POs
CO1	3	2	2	3	-	-	1	1, 2,3,4,7
CO2	3	2	3	3	-	-	1	1, 2,3,4,7
CO3	3	2	3	3	-	-	1	1, 2,3,4,7
CO4	3	2	3	3	-	-	1	1,2,3,4,7
CO5	3	2	3	3	-	-	1	1,2,3,4,7

BOARD DIPLOMA EXAMINATIONS(C-24)

Model Paper

Mid Sem-I

Workshop Practice

Time: 1 Hour

Total Marks: 20 MARKS

Note: Answer any one question.

1. Plain the given wood piece and cut as per the given fig
2. Prepare a lap joint.
3. Prepare the groove joint
4. Prepare a locked groove joint
5. File the given MS plate and cut as per the drawing
6. Convert the round bar into square shape

BOARD DIPLOMA EXAMINATIONS (C-24)

Model Paper

Mid Sem-II

Workshop Practice

Time : 1 Hour

Total Marks : 20 MARKS

Note: Answer any one question.

1. Prepare a T joint.
2. Prepare a open tray
3. Prepare a hallow cylinder
4. File the given MS plate and drill a 6mm hole as per the drawing
5. Convert the round bar into hexagon shape

BOARD DIPLOMA EXAMINATIONS (C-24)

Model Paper

Semester End Examination

Workshop Practice

Time : 2 Hours

Total Marks : 40 MARKS

Note: Answer any one question.

1. Plain the given wood piece and cut as per the given fig
2. Prepare a lap joint.
3. Prepare a dovetail joint
4. Prepare the groove joint
5. Prepare a locked groove joint
6. File the given MS plate and cut as per the drawing
7. Convert the round bar into square shape
8. Prepare a T joint.
9. Prepare a open tray
10. Prepare a hallow cylinder
11. File the given MS plate and drill a 6mm hole as per the drawing
12. Convert the round bar into hexagon shape.

SC-109-BASIC SCIENCE LAB

Course Title	Basic Science Lab	Course Code	SC-109
Semester	I Semester	Course Group	Practical
Teaching Scheme in Periods (L:T:P)	15:0:30	Credits	1.25
Type of course	Lecture + Practical	Total Contact Periods	45 Periods
CIE	60 Marks	SEE	40 Marks

SC-109A - PHYSICS LAB

Pre requisites:

This course requires the basic knowledge of Science and Mathematics.

Course Outcomes

On completion of the course, the student shall be able to

CO1	Demonstrate the principle of Screw Gauge and calculate accurate measurement of thickness of glass plate and area of cross section of a wire.
CO2	Make use of laws of vector addition to verify Parallelogram law of forces and Triangle law of forces.
CO3	Determine the coefficient of friction between wood and wood and wood and glass surfaces on horizontal plane.
CO4	Calculate coefficient of viscosity of a liquid by capillary method.
CO5	Make use of Quill tube to verify Boyle's law.
CO6	Calculate the surface tension of water using capillary rise method. (Demonstration only)

	Basic and Discipline Specific Knowledge	Problem Analysis	Design/Development of Solutions	Engineering Tools, Experimentation and Testing	Practices Engineering Practices for Society, Sustainability and Environment	Project Management	Lifelong Learning	Linked PO
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	
CO1	3					1	1	1,6,7
CO2	3					1	1	1,6,7
CO3	3					1	3	1,6,7
CO4	3					1	3	1,6,7
CO5	3					1	3	1,6,7

Learning outcomes

On successful completion of the course, the student will have ability to:

1. Demonstrate the principle of Screw Gauge and calculate accurate measurement of thickness of glass plate and area of cross section of a wire.
2. Make use of laws of vector addition to verify Parallelogram law of forces and Triangle law of forces.
3. Determine the coefficient of friction between wood and wood and wood and glass on horizontal plane.
4. Calculate coefficient of viscosity of a liquid by capillary method.
5. Make use of Quill tube to verify Boyle's law.

Demonstration Experiment:

1. Calculate the surface tension of water using capillary rise method.

Course Delivery:

The course will be delivered through lectures, class room interaction, group discussions, graded exercises, demonstration and practice.

Tutorial: 1Period /Experiment:

1. Introduction to Physics practical and its importance, safety precautions in maintenance of equipment in the laboratory.
2. Maintenance of apparatus and equipment.
3. Follow of Do's and Don'ts.
4. Maintenance of data in manual and record book.
5. Write the procedure of the experiment before the commencement of each experiment.
6. Strictly following of instructions given from time to time by the lecturer-in-charge.
7. Demonstration of each experiment by the lecturer in charge.

Conduction of experiments: 2 periods/Experiment.

Student must perform experiment individually under the supervision of the lecturer-in charge.

Scheme of Valuation of SEE		
S.No	Particulars	Marks
1.	Objective/Aim	01
2.	Apparatus/Equipment	02
3.	Observations	02
4.	Principle including formula	02
5.	Experiment (Tabular form, readings, etc)	05
6.	Calculation and Result	05
7.	Viva Voce	03
	Total	20

References:

1. Intermediate Physics lab manual – Telugu Academy
2. Laboratory manual for class XI and XII – NCERT

SC-109B - CHEMISTRY LAB

Prerequisite: Knowledge of basic concepts of Chemistry of secondary education

Course Objectives: To provide practical knowledge about the basics of preparation of chemical solutions and volumetric analysis of chemical compounds.

Course Outcomes: On successful completion of the course, the student will have ability to attain

CO:

Course Outcome	
CO1	Prepare the primary standard solution to find out the concentrations of unknown solution.
CO2	Estimate the amount of the HCl in the given sample of solutions by volumetric analysis.
CO3	Estimate the amount of the NaOH in the given sample of solutions by volumetric analysis.
CO4	Find the pH of the unknown solutions collected from different industrial areas and recommend a remedial action.
CO5	Determine the hardness of water sample and recommend a solution for identified hardness

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	-	-	1	-	1	1
CO2	3	-	-	-	-	1	1
CO3	3	-	-	-	-	1	1
CO4	3	-	-	2	2	1	1
CO5	3	-	-	-	2	1	1

Course Delivery:

The course will be delivered through lectures, classroom interactions, group discussions, demonstrations and practicals.

Conduction of experiments: Lecture 1 period + Experiment 2 periods.

Student must conduct experiment individually under the supervision of the staff -in-charge.

Lecture and Demonstration: 1 Period

1. Introduction of chemistry practical and its importance, safety precautions in maintenance of cleanliness and orderliness of chemicals in the laboratory.
2. Maintenance of apparatus and equipment.
3. Follow of Do's and Don'ts.
4. Maintenance of data in record book.
5. Write the procedure of the experiment before the commencement of each experiment.
6. Strict following of instructions given from time to time by the staff-in-charge.
7. Demonstration of each experiment by the staff in charge.

Course Content

Volumetric Analysis: (22.5 Periods)

Volumetric Analysis by Titrimetric Method:

Volumetric Analysis -Titration – Standard Solutions - Concentration of solutions -Indicators
- Acid base indicators - Selection of indicators – Endpoint of titration- Neutralization-
Harness of water

List of experiments:

1. Preparation of primary standard solution.
2. Estimation of hydrochloric acid by using standard basic solution
3. Estimation of sodium hydroxide by using standard acidic solution.
4. Standardisation of disodium salt of EDTA using standard magnesium sulphate solution.
5. Determination of total hardness of water sample by EDTA method.

Specific Learning Outcomes

Upon completion of the course, the student will have ability to

1. Prepare standard sodium carbonate solution and dilute to desired concentration.
2. Estimate hydrochloric acid present given volume of solution by using standard sodium carbonate solution.
3. Estimate sodium hydroxide present in the given volume of solution by using standard hydrochloric acid solution.
4. Standardisation of disodium salt of EDTA using standard magnesium sulphate solution.
5. Determine the total hardness of water sample by using 0.02N disodium salt of EDTA solution.

Reference Books:

1. Vogel's Inorganic Qualitative and Quantitative Analysis.
2. Practical chemistry by O.P. Pande & others.
3. Intermediate Chemistry Lab manual- Telugu academy (Telangana state)

Scheme of Valuation for SEE		
Sl. No.	Particulars	MARKS
1	Identification of apparatus/equipment/chemical compounds/tools/etc.	2
2	Writing Principle and Procedure	5
3	Experiment and Observations	6
4	Calculation and Results	4
5	Viva-voice	3
Total		20

BOARD DIPLOMA EXAMINATION, (C-24)
MIDSEM – I
FIRST SEMESTER EXAMINATION
SC-109 - BASIC SCIENCE LAB

TIME: 1 Hour

TOTAL MARKS: 20

Instructions: (1) Answer both PART-A AND PART-B on separate answer sheets.

(2) Each question carries **TEN** marks.

PART-A (PHYSICS LAB)

Perform ONE experiment allotted by the examiner.

1 x 10 = 10

1. Determine the thickness of given glass plate using Screw gauge.
2. Find the cross sectional area of given wire using Screw gauge.
3. Verify parallelogram law of forces.
4. Verify triangle law of forces.

PART-B (CHEMISTRY LAB)

Perform ONE experiment allotted by the examiner.

1 x 10 = 10

1. Prepare 250ml of 0.05M sodium carbonate solution.
2. Estimate the amount of hydrochloric acid present in 500ml of the given solution using 0.02M sodium carbonate solution.
3. Estimate the amount of hydrochloric acid present in 250ml of the given solution using 0.05M sodium carbonate solution.

BOARD DIPLOMA EXAMINATION, (C-24)

MIDSEM – II

FIRST SEMESTER EXAMINATION

SC-109 - BASIC SCIENCE LAB

TIME: 1 Hour

TOTAL MARKS: 20

Instructions: (1) Answer both PART-A AND PART-B on separate answer sheets.

(2) Each question carries **TEN** marks.

PART-A (PHYSICS LAB)

Perform ONE experiment allotted by the examiner.

1 x 10 = 10

1. Determine the coefficient of friction between wooden surface and wooden block.
2. Determine the coefficient of friction between glass surfaces and wooden block.
3. Determine coefficient of viscosity of water using capillary method.

PART-B (CHEMISTRY LAB)

Perform ONE experiment allotted by the examiner.

1 x 10 = 10

1. Estimate the amount of NaOH present in 500 ml solution using 0.02M HCl solution
2. Estimate the amount of NaOH present in 750ml solution using 0.02M HCl solution
3. Find out the Normality of EDTA solution using 0.02N MgSO₄ solution

BOARD DIPLOMA EXAMINATION, (C-24)
SEMESTER END EXAMINATION
FIRST SEMESTER EXAMINATION
SC-109 - BASIC SCIENCE LAB

Time: 2 Hours]

[Total Marks: 40

Instructions: (1) Answer both PART-A AND PART-B on separate answer sheets.
(2) Each question carries **TWENTY** marks.

PART-A (PHYSICS LAB)

Perform ONE experiment allotted by the examiner.

1 x 20 = 20

1. Determine the thickness of given glass plate using Screw gauge.
2. Find the cross sectional area of given wire using Screw gauge.
3. Verify parallelogram law of forces.
4. Verify triangle law of forces.
5. Determine the coefficient of friction between wooden surface and wooden block.
6. Determine the coefficient of friction between glass surfaces and wooden block.
7. Determine coefficient of viscosity of water using capillary method.
8. Verify Boyle's law using Quill tube.

PART-B (CHEMISTRY LAB)

Perform ONE experiment allotted by the examiner.

1 x 20 = 20

1. Prepare 250ml of 0.05M sodium carbonate solution.
2. Estimate the amount of hydrochloric acid present in 500ml of the given solution using 0.02M sodium carbonate solution.
3. Find the Molarity and estimate the amount of NaOH present in 100ml of the given solution using 0.01M HCl solution.
4. Find out the Normality of EDTA solution using 0.02N MgSO_4 solution
5. Determine the total hardness of the given water sample using 0.02N EDTA solution.

CS-110-COMPUTER FUNDAMENTALS LAB

Course Title:	Computer Fundamentals Lab	Course Code	CS-110
Semester	I Semester	Course Group	Practical
Teaching Scheme in Periods (L:T:P)	1:0:2	Credits	1.25
Methodology	Lecture + Tutorials	Total Contact Periods	45
CIE	60 Marks	SEE	40 Marks

Pre-requisite: The students should have basic knowledge of English

Pre-requisite: The students should have basic knowledge of using computer

COURSE OUTCOME

CO1	Creating and saving a document, Formatting of text in MS-WORD
CO2	Spell checking, Mail merging and Printing of Documents in MS-WORD
CO3	Creating and Saving a presentation, inserting text and pictures & Formatting the text and pictures, Slide transition and Animation effects in MS-POWER POINT
C04	Building Worksheet & Charts In Ms-Excel and Printing Of Worksheet
C05	Creating Database, Tables, Forms, Queries, Reports In Ms-Access

Course Contents

Unit-I: Creating, Saving a document, Formatting of text in MS-WORD Duration: 5 hrs

MS_WORD - Creating and saving a document, Formatting of text

Unit-II: Spell checking, Mail merging and Printing of Documents in MS-WORD MS Word Duration: 10 hrs

MS-WORD - Spell Checking - Mail merging – Printing of Documents

Unit-III: Creating and saving a presentation in MS Powerpoint and Slide transition and Animation effects Duration: 10 hrs

MS-POWER POINT - Creating and saving a presentation - Inserting text and pictures - Formatting the text and pictures- MS-POWER POINT - Effects of slide transition - Animation effects - Slide show & views of slides

Unit-IV Building & Charts in MS-Excel and Printing Of Worksheet

Duration: 10 hrs

Building Worksheets – Building Charts, Printing EXCEL Worksheet

Unit-V Creating Database, Tables, Queries, Forms, Reports & Printing

Duration: 10 hrs

Creating Table, Viewing (ACCESS) – Creating Forms – Creating Queries and Viewing Database
Creating of ACCESS Reports – Printing of ACCESS Tables, Forms, Reports

Specific Learning Outcomes:

CO1: Creating and saving a document, Formatting of text in MS-WORD

- 1.1 Demonstrate starting MS word.
- 1.2 Identify the word screen elements.
- 1.3 Identify the tool bars on the screen.
- 1.4 Demonstrate loading different tool bars for their functionality.
- 1.5 Identify the drop down menus of the main menu and their functionality.
- 1.6 Demonstrate creating a sample text.
- 1.7 Demonstrate text formatting.
- 1.8 Demonstrate page formatting.
- 1.9 Demonstrate selecting, deselecting the text from menu and Copying.
- 1.10 Demonstrate importing text from other packages.

CO2: Spell checking, Mail merging and Printing of Documents in MS-WORD

- 2.1 Demonstrate search and replace of text.
- 2.2 Demonstrate spell checking.
- 2.3 Demonstrate creating tables.
- 2.4 Demonstrate mail merging of documents.
- 2.5 Demonstrate printing documents, merge printing of documents.
- 2.6 Demonstrate word procedure for importing figures, charts from other installed software.

CO2: Creating and Saving a presentation, inserting text and pictures & Formatting the text and pictures, Slide transition and Animation effects in MS-POWER POINT

- 3.1 Demonstrate starting MS Power Point.
- 3.2 Identify the opening screen elements.
- 3.3 Identify the tool bars in the opening screen.
- 3.4 Demonstrate the selection of the methods of creating a new presentation.
- 3.5 Identify the different Auto Layouts of a slide.
- 3.6 Demonstrate creating a new slide
- 3.7 Demonstrate inserting a new slide.
- 3.8 Demonstrate slide transition effects.
- 3.9 Demonstrate a slide show.
- 3.10 Demonstrate animation effects.
- 3.11 Demonstrate creating an organization chart.
- 3.12 Identify the different slide views.

CO4: Building Worksheet & Charts In Ms-Excel and Printing Of Worksheet

- 4.1 Start EXCEL from the start
- 4.2 Identify the various parts of the window.
- 4.3 Identify the tabs and groups in ribbon layout
- 4.4 Identify and customizing the quick access toolbar
- 4.5 Identify the office button and commands of the drop down menu.
- 4.6 Practice loading of the existing worksheet or create a new worksheet.
- 4.7 Practice entering into the worksheet.
- 4.8 Practice formatting the cells.
- 4.9 Practice formatting the texts in the cells.
- 4.10 Practice changing the height and width of the cells.
- 4.11 Practice freezing the rows, columns.
- 4.12 Practice splitting the screens.
- 4.13 Enter formulas into the cells.
- 4.14 Enter formulas with built in functions.
- 4.15 Create a range name for the cells for group operations.
- 4.16 Create graph for the data in the worksheet.

CO5: Creating Database, Tables, Forms, Queries, Reports In Ms-Access

- 5.1 Practice loading Ms Access from the start menu.
- 5.2 Create a database table using Database Wizard.
- 5.3 Enter data into the table.
- 5.4 Edit data in the table.
- 5.5 View data from the database.
- 5.6 Design a query.
- 5.7 View data using the query.
- 5.8 Demonstrate creating Forms.
- 5.9 View the database through Forms.
- 5.10 Practice navigating through the database through Forms.
- 5.11 Practice creating Custom Form using Forms Wizard.
- 5.12 Practice creating Reports using the Report Wizard.
- 5.13 Practice printing the tables, forms and reports.

EXERCISES

- 1. Create and save a document using MS WORD.
- 2. Format the Text document.
- 3. Change the page set-up and Insert Header/Footer.
- 4. Spell checking in the document.
- 5. Print the document.
- 6. Create main document and data file for mail merging.
- 7. Print the document with mail merging.
- 8. Create a table in the document.
- 9. Add row, column to a table.
- 10. Create and save a new presentation using MS Power Point.
- 11. Choose Auto Layout for a new slide.
- 12. Inserting text and pictures into a blank slide.
- 13. Inserting new slides into the presentation.
- 14. Applying slide transition effects.
- 15. Demonstrate a slide show.
- 16. Set animation to text and pictures in a slide.
- 17. Set the sounds, order and timing for animation.
- 18. Create and save a new work book in Excel
- 19. Operating Mouse to selecting tabs, groups, cells, group of cells
- 20. Entering and editing Data into Worksheet
- 21. Formatting the text in the cells
- 22. Formatting the numbers in the cells.
- 23. Changing the height and width of cells.
- 24. Freezing Titles, splitting screen
- 25. Enter formulae for calculation in the cells.
- 26. Copying the formula over a range of cells.
- 27. Inserting built-in functions in to the cells.
- 28. Create graphs for the data using Chart Wizard.
- 29. Practice Data Forms in Excel.
- 30. Printing of worksheet
- 31. Creating Tables using wizard in Access
- 32. Creating Tables using Design View in Access.
- 33. Entering Data into tables
- 34. Viewing the data in table.
- 35. Creating a new query using wizard.
- 36. Creating a new query using design view.
- 37. Viewing the data using a Select Query.

38. Updating the data in table using Update Query.
39. Linking two Tables on Relational Aspect.
40. Create forms using Form Wizard.
41. Create reports using Report Wizard.
42. Printing the tables, forms and reports

Suggested Student Activities

1. Student visits Library to refer to Manual for the specifications
2. Student inspects the available equipment in the Lab to identify the components
3. Visit nearby Industry to familiarize with fabrication techniques
4. Analyze the connections in the UPS available in the Institution facility
5. Quiz , Group discussion, Surprise test

RECOMMENDED BOOKS:

1. Teach yourself Office 2007 for Windows – Coray Sandler, Tom Badgett, Jan Weingarten, BPB Publications.
2. The ABC s of MS Office 2007– Guy Hard-Davis, BPB Publications.
3. Working in MS Office - Ran Mansfield, Tata McGraw Hill Publications.

Student E-Learning reference

1. <https://www.tutorialspoint.com/word/index.htm>
2. <https://www.tutorialspoint.com/powerpoint/index.htm>

CO-PO Mapping Matrix

	Basic and Discipline Specific Knowledge	Problem Analysis	Design/Development of Solutions	Engineering Tools, Experimentation and Testing	Engineering Practices for Society, Sustainability and Environment	Project Management	Lifelong Learning	Linked PO
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	PO
CO1	3	1						1,2
CO2	3	2	1					1,2,3
CO3	3	1						1,2
CO4	3	1	2	2				1,2,3,4
CO5	3	1	2	1				1,2,3,4

MODEL QUESTION PAPERS
STATE BOARD OF TECHNICAL EDUCATION & TRAINING:TS, HYDERABD
CS-110 Computer Fundamentals Lab
I-SEMESTER, MID -I MODEL PAPER

TIME: 1 hr

MARKS: 20

ANSWER ANY ONE QUESTION.

EACH QUESTION CARRIES TWENTY MARKS. 20 x 1 = 20

1. Demonstrate Starting MS word and identify the word screen elements.
2. Draw and explain the groups and commands in Home tab under ribbon in Ms word.
3. Demonstrate text formatting in Ms word.
4. Demonstrate procedure for checking of spelling and grammar using dictionaries.
5. Demonstrate paragraph formatting in Ms word.
6. Draw and explain the groups and commands in page layout tab under ribbon in Ms word.
7. Demonstrate page formatting in Ms word.
8. Demonstrate procedure for creating Mail merging process in Ms word.
9. Demonstrate creating of table and adding rows and columns to the existing table in Ms word.
10. Demonstrate finding and replacing of text & searching for a bookmark.
11. Demonstrate starting of MS Power Point and identify the opening screen elements.
12. Draw and explain the groups and commands in Home tab under ribbon in MS Power Point.
13. Demonstrate different Auto Layouts of a Slide in MS Power Point.
14. Demonstrate Slide Transition effects in Ms Power Point.
15. Demonstrate different Animation effects in Ms Power Point.
16. Draw and explain the groups and commands in Animations tab under ribbon in MS Power Point.
17. Demonstrate different Slide views in MS Power Point.
18. Draw and explain the groups and commands in Review tab under ribbon in MS Power Point.
19. Demonstrate inserting and formatting of text and pictures in MS Power Point.

MODEL QUESTION PAPERS
STATE BOARD OF TECHNICAL EDUCATION & TRAINING:TS, HYDERABD
CS-110 Computer Fundamentals Lab
I -SEMESTER, MID -II MODEL PAPER

TIME: 1 hr MARKS: 20

ANSWER ANY ONE QUESTION.

EACH QUESTION CARRIES TWENTY MARKS. 20 x 1 = 20

1. Write procedure to open Excel window and Draw and label the parts in Excel window.
2. Draw and Write about groups and commands under Formulas tab under the ribbon in MS- Excel.
3. Write procedure to format the text in the cells.
4. Write procedure to enter formulas with built in functions.
5. Write procedure for creating chart in MS-excel.
6. Write Procedure for formatting numbers in MS-Excel.
7. Write procedure for writing criteria and extract the data.
8. Write procedure for printing of a worksheet.
9. Write procedure for formatting of chart in Ms-excel.
10. Write procedure to jump to different workbooks &import worksheet from different workbook.
11. Write procedure to create a database.
12. Write procedure to create a table using design view.
13. Write procedure to create form using forms wizard.
14. Write procedure for creating reports using report wizard.
15. Write procedure for creating a Custom Form.
16. Write the procedure to create custom reports.
17. Write the procedure to print active sheet.
18. Write the procedure for Printing of reports.
19. Draw and explain the groups and commands in create tab under ribbon in Ms access.
20. Write the procedure for creating Filter by form.

MODEL QUESTION PAPERS
STATE BOARD OF TECHNICAL EDUCATION & TRAINING:TS, HYDERABD
CS-110 Computer Fundamentals Lab
I-SEMESTER, END SEMESTER MODEL PAPER

TIME: 2hr

MARKS: 40

ANSWER ANY ONE QUESTION.

EACH QUESTION CARRIES TWENTY MARKS.

20 x 1 = 20

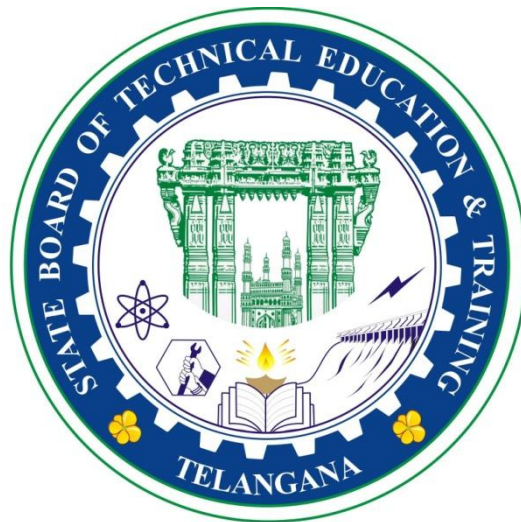
1. Write procedure for Creating and saving a document and draw and label the different parts of opening screen elements in Ms word.
2. Draw and explain the groups and commands in Home tab under ribbon in MS Power Point.
3. Write procedure for applying sounds, order, timing and effects of animation in a presentation.
4. Write procedure for character formatting in Ms word.
5. Draw and explain the groups and commands in Home tab under ribbon in Ms word.
6. Write procedure for creating main document and data file for mail merging.
7. Write procedure for page formatting in Ms word.
8. Write procedure for checking spelling and grammar using dictionary in Ms word.
9. Write procedure for printing of document in Ms word.
10. Draw and explain the groups and commands in Animations tab under ribbon in MS Power Point.
11. Write procedure to open Excel window and Draw and label the parts in Excel window.
12. Draw and Write about groups and commands under Formulas tab under the ribbon in MS- Excel.
13. Write procedure to format the text in the cells.
14. Write procedure to enter formulas with built in functions.
15. Write procedure for creating chart in MS-excel.
16. Write Procedure for formatting numbers in MS-Excel.
17. Write procedure for writing criteria and extract the data.
18. Write procedure for printing of a worksheet.
19. Write procedure for formatting of chart in Ms-excel.
20. Write procedure to jump to different workbooks & import worksheet from different workbook.
21. Write procedure to create a database.
22. Write procedure to create a table using design view.
23. Write procedure to create form using forms wizard.
24. Write procedure for creating reports using report wizard.
25. Write procedure for creating a Custom Form.
26. Write the procedure to create custom reports.
27. Write the procedure to print active sheet.
28. Write the procedure for Printing of reports.
29. Draw and explain the groups and commands in create tab under ribbon in Ms Access.
30. Write the procedure for creating Filter by form.

Record book: 10 marks

Viva-voce: 10 marks

C24_CURRICULUM

**DIPLOMA IN
MECHANICAL ENGINEERING**



Offered By

**STATE BOARD OF
TECHNICAL EDUCATION AND TRAINING
TELANGANA HYDERABAD**

TEACHING AND EXAMINATION SCHEME

Sl. No.	Course Code	Course Name	Teaching Scheme					Examination Scheme						
			Instruction periods per week			Total Periods per semester	Credits	Continuous internal evaluation			Semester end examination			
			L	T	P			Mid sem. I	Mid sem. II	Internal evaluation	Max. Marks	Min. Marks	Total marks	Min. marks for passing including internal
1	HU-201	Advanced English	4	1	0	75	2.5	20	20	20	40	14	100	End Marks shall be $\geq 35\%$ of Topper Marks and Subject Total Shall be $\geq$ D-Hybrid Grade Minimum
2	SC-202	Engineering Mathematics	4	1	0	75	2.5	20	20	20	40	14	100	
3	SC-203	Applied Physics	4	1	0	75	2.5	20	20	20	40	14	100	
4	SC-204	Applied Engineering Chemistry	4	1	0	75	2.5	20	20	20	40	14	100	
5	CS-205	Programming In C	4	1	0	75	2.5	20	20	20	40	14	100	
6	ME-206	Manufacturing Technology	4	1	0	75	2.5	20	20	20	40	14	100	
7	ME-207	Engineering Drawing - II	1	0	2	45	1.25	20	20	20	40	20	100	End Marks shall be $\geq 50\%$ of Topper Marks and Subject Total Shall be $\geq$ D-Hybrid Grade Minimum
8	ME-208	CAD Lab	1	0	2	45	1.25	20	20	20	40	20	100	
9	SC-209	Applied Science Lab	1	0	2	45	1.25	20	20	20	40	20	100	
10	CS-210	Programming In C Lab	1	0	2	45	1.25	20	20	20	40	20	100	
Total			28	6	8	630	20	200	200	200	400	164	1000	

HU – 201- ADVANCED ENGLISH

Course Title	Advanced English	Course Code	HU-201
Semester	II	Course Group	Foundation
Teaching Scheme in Minutes (L:T)	3:2	Credits	2.5
Methodology	Communicative Language Teaching + Assignments	Total Contact Hours	75
CIE	60 Marks	SEE	40 Marks

Prerequisites: Basic knowledge of English Language

COURSE CONTENTS

MODULE 1: VOCABULARY THROUGH READING - II

Duration: 15 Periods (L 9 P 6)

- a. Homonyms, Homophones and Homographs
- b. Root-words and Affixes
- c. Reading – III
Passages on Innovation, Science and Technology, History, Biography, Travel Writing, Nature Writing, Journal, Story, Process, Cause and Effect, Problem Solution, Evaluation of ideas, Reasons and Conclusion, etc.
- d. Reading – IV
Passages on Innovation, Science and Technology, History, Biography, Travel Writing, Nature Writing, Journal, Story, Process, Cause and Effect, Problem Solution, Evaluation of ideas, Reasons and Conclusion, etc.

MODULE 2: SPEAKING- III

Duration: 10 Periods (L 6 P 4)

- a. Making Requests
- b. Offering Help and Suggestions
- c. Expressing Obligations
- d. Seeking and Giving Permissions

MODULE 3: GRAMMAR-III

Duration: 15 Periods (L 9 P 6)

- a. Reported Speech
Conversion from Direct to Indirect Speech but not vice versa
- b. Error Analysis - I
On nouns, articles, pronouns and verbs
- c. Error Analysis - II
Adjectives, adverbs and Prepositions
- d. Error Analysis - III
Questions, concord, redundancy and other kinds of errors

MODULE 4: SPEAKING – IV

Duration: 10 Periods (L 6 P 4)

- a. Giving Directions
- b. Giving Instructions
- c. Talking about the Past
- d. Describing Objects

MODULE 5: WRITING - II

Duration: 15 Periods (L 9 P 6)

- a. Mechanics of Writing
 - i. Spelling, punctuation marks, capitalization and special symbols
 - ii. Different types of fonts, font size, bold, italics, underline, superscript, subscript, alignment, margins, etc.
- b. Data Interpretation -I
 - i. Understand the information and analyze the flow charts and stating the main idea.
 - ii. Describe the process (events or chronological order) interpret flow chart.
 - iii. Use connectives and sequence markers and write a meaningful paragraph.
- c. Data Interpretation -II
 - i. Understand the information in a tree diagram and analyze the data.
 - ii. State the main idea and describe the process from key word.
 - iii. Explain one branch completely and move to the branches down words and write horizontal direction.
 - iv. Use linkers and sequence markers.
- d. Data Interpretation –III
 - i. Understand the data given in tables and pie charts.
 - ii. Analyze and state the main idea of the tables and pie charts.
 - iii. Identify the similarities, differences and mention figures.
 - iv. Use linkers.

MODULE6: WRITING-III

Duration: 10 Periods – (L 6 P 4)

- a. Writing a Resume
 - i. Different formats of a resume
 - ii. Analyze strengths and weaknesses.
- b. Writing a Cover Letter
 - i. Importance of cover letter
 - ii. Format of cover letter
 - iii. Sample cover letter
- c. Note Making
 - i. Understand the Benefits of Note Making.
 - ii. Cue Method
 - iii. Mind Mapping
- d. Writing a Report
 - i. Understand the concept of report writing and formats of various reports.
 - ii. Report on an incident.
 - iii. Report on an industrial visit.
 - iv. Report on events.

COURSE OUTCOMES

CO	At the end of the course the students will be able to
CO 1	Learn vocabulary and use them in professional & social interactions and comprehend the passages.
CO 2	Make requests, offer help and suggestions, express obligations, seek and giving permissions.
CO 3	Learn English grammar to speak and write flawlessly.
CO 4	Give directions and instructions, talk about the past and describe objects.
CO 5	Learn the mechanics of writing to make the technical writing practical and meaningful and interpret the data given.
CO 6	Prepare resumes, prepare cover letters, make notes and draft reports.

CO-PO Matrix

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	Mapping POs
CO 1	-	-	-	-	2	2	2	5, 6 and 7
CO 2	-	-	-	-	2	2	2	5, 6 and 7
CO 3	-	-	-	-	1	3	2	5, 6 and 7
CO 4	-	-	-	-	2	2	3	5, 6 and 7
CO 5	-	-	-	-	1	2	3	5, 6 and 7
CO 6	-	-	-	-	2	2	3	5, 6 and 7

CONTINUOUS INTERNAL EVALUATION (CIE)

Test	Modules	Marks	Pattern
Mid - I	1. Vocabulary Through Reading- II 2. Speaking - III	20	Part A: 4 short answer questions Part B: 2 short essay questions with internal choice Part C: 2 essay questions with internal Choice
Mid - II	1. Grammar - III 2. Speaking - IV	20	Part A: 4 short answer questions Part B: 2 short essay questions with internal choice Part C: 2 essay questions with internal Choice
Slip Test 1	1. Vocabulary Through Reading - II 2. Speaking - III	5	2 questions out of 3 questions
Slip Test 2	1. Grammar - III 2. Speaking - IV	5	2 questions out of 3 questions
Assignment	One assignment per one semester	5	Different group assignments of higher order questions that develop problem solving skills and critical thinking should be given
Seminars	One seminar per one semester	5	Oral presentations using audio –visual equipment, charts, etc.
	Total	60	

Legend:

Remembering: 1 mark Understanding: 3 marks Application: Five marks

Suggested Student Activities:

- Practice conversation / dialogue / speech and answer the questions.
- Seminars.
- Collect the resumes of the successful people.
- Narrate a story.
- Prepare chain stories.
- Vocabulary building games.
- Speak about incidents / events / memories / dreams / role model.
- Interviews of famous personalities.
- Collect the biographies of unsung heroes.
- Read for main ideas and specific details.
- Picture description.
- Collect the letters written by famous persons and analyze them.
- Describe a process.
- Give directions using maps.
- Collect user manuals and analyze the sets of instructions given.
- Collect the various types of reports and analyze the information.
- Collect the official information given in the forms of tables, tree diagrams and pie charts.

REFERENCES:

1. High School English Grammar & Composition by Wren & Martin
2. Practical English Grammar by A.J Thomson and A.V. Martinet
3. A Course in Phonetics and Spoken English by J. Sethi and P.V Dhamija
4. Word Power Made Easy by Norman Lewis.
5. Essential English Grammar by Raymond Murphy.
6. Spoken English-A Self Learning Guide to Conversation Practice by V. Sasi Kumar.

BOARD DIPLOMA EXAMINATION (C-24)

MID SEMESTER EXAMINATION -I

HU-201 ADVANCED ENGLISH

Time: One Hour

Total Marks: 20

PART - A

1 X 4 = 4 Marks

Instructions: a) Answer all the questions. b) Each question carries one mark.

1. Write the antonym of words using the root word, 'Micro'.
2. Read the following paragraph and answer the question that follows.

Nature is the best gift of God to all living beings on earth. Human beings depend on nature to survive, whereas trees and other living beings balance eco system in nature. Trees, flowers, animals, mountains, rivers, oceans, valleys, sky, forest etc., are parts of nature. Nature provides us air, water, food, light, health and many more to live. But man is misusing all these natural resources for his greediness.

- a) What does nature provide us?
3. How do you request your teacher to repeat the lesson? Write in a sentence.
4. A pregnant lady is boarding a bus with heavy luggage. How do you offer her help?

PART – B

2 X 3 = 6 Marks

Instructions: a) Answer the following questions. b) Each question carries three marks.

5. i) Use the following homonyms in your own sentences.
 - a. Right
 - b. Ring
 - c. Rise

(OR)

- ii) Form antonyms for the given words using suitable prefixes.
 - a) Loyal
 - b) Legal
 - c) Necessary
6. a) Using the words of obligation, write any three precautions you have to take when a little baby is in your home.

(OR)

- b) How do you seek permission from your teacher for attending a training programme? Write your discussion in the form of a dialogue.

PART – C**2 X 5 = 10 Marks**

Instructions: a) Answer the following questions. b) Each question carries five marks.

7. a) Read the following passage and answer the questions given below it.

Man used to fly in hot air balloons before the airplane was invented. The first hot air balloon was invented in 1780. Hot air, being lighter than the cold air, made the balloon rise. The first hot air balloon was designed by the Montgolfier Brothers. It took flight in 1783. Hydrogen is the lightest of all gases. It is lighter than air. So it gives a greater lift to the balloon than hot air. Thus, the hydrogen balloon was an improvement on the hot air balloon. Ballooning was a popular sport until the 1930s. Today balloons are used for forecasting the weather and in scientific research most balloons contain Helium which is heavier than Hydrogen but does not burn as easily as Hydrogen.

- i. Who designed the hot air balloon?
- ii. When was the hot air balloon invented?
- iii. Why is hydrogen used in balloons?
- iv. How are the balloons used for today?
- v. What is the meaning of the word, forecast?

(OR)

b). Read the following passage and answer the questions given below it.

Malaria is one of the deadliest and most destructive of all diseases. Thousands of people die of it every year in India alone. In the middle ages, people realized that it was common in places where there was stagnant water or the places such as marshes and swamps. They thought the air was the cause of this disease and named it 'malaria' which means bad air. Not till nearly the end of the nineteenth century, the great discovery was made that it was not the stagnant water nor was it the marshy air which spread malaria. The real culprit was the mosquito.

- i. Name the disease considered to be deadly and destructive?
- ii. What is the meaning of malaria according to people of middle ages?
- iii. Where was malaria very common?
- iv. Nearly how many people die of malaria in India every year?
- v. Name the insect responsible for causing malaria?

8. a) How do you request your friend to clarify your doubts in mathematics. Write a dialogue.

(OR)

b) Your younger brother wants to apply for POLYCET. Give him any five suitable suggestions.

BOARD DIPLOMA EXAMINATION (C-24)

MID SEMESTER EXAMINATION -II

HU-201 ADVANCED ENGLISH

Time: One Hour

Total Marks: 20

PART - A

1 X 4 = 4 Marks

Instructions: a) Answer all the questions. b) Each question carries one mark.

1. She said, 'I am hungry'. (Change the sentence into reported speech)
2. Vijay along with friends go to temple. (Correct the sentence)
3. Give directions to your sister from your home to reach library in your town.
4. Describe your mobile using four adjectives.

PART-B

2 x 3 = 6 Marks

Instructions: a) Answer all the questions. b) Each question carries three marks.

5. a) Change the following into indirect speech.
 - i. She said to him, "Where are you going?"
 - ii. He said to her, "I bought books yesterday."
 - iii. Sunil said to me, "Will you bring your camera tomorrow?"(OR)
 - b) Correct the following sentences.
 - i. They discussed about politics.
 - ii. We buy a car two days ago.
 - iii. She is my older sister.

6. a) How did you celebrate your birthday recently?
(OR)
- b) Describe your laptop or desktop computer in 50 words.

PART-C

2 X 5 = 10 Marks

Instructions: a) Answer all the questions. b) Each question carries five marks.

7. a) Change the following sentences into reported speech.
 - i. She said, "I saw a cute dog in the park."
 - ii. He said, "I am going out."
 - iii. Vijay said, "It may rain now."
 - iv. Chandu said, "We will go to school tomorrow."
 - v. Madhuri said to Prasad, "When did you come?"(Or)

b) Correct the following sentences.

- i) My birth day is on January.
- ii) You must and should come here.
- iii) This is the horse who won the race.
- iv) I prefer coffee than tea.
- v) I am having a car.

8. a) Write instructions for taking a bus pass.

(Or)

- b) Give suggestions to your friend on how to score good marks in POLYCET

BOARD DIPLOMA END EXAMINATION (C-24)

SEMESTER END EXAMINATION

HU-201 ADVANCED ENGLISH

Time: Two Hours

Total Marks: 40

PART-A

1 X 8 = 8 Marks

Instructions: a) Answer all the questions. b) Each question carries one mark.

1. Write the antonyms of the following words using the suitable prefixes.
a) logical b) polite
2. Correct the following sentence.
a) This is the best of the two books I have.
3. What salutations do you use in a cover letter?
4. Rewrite the following sentence using appropriate punctuation marks and capital letters.
a) she told him that she had returned bhaskars book yesterday
5. Correct the spellings of the following words.
a) shedule b) plander
6. Rewrite the following sentence using the appropriate punctuation marks and capital letters.
vinod went to hyderabad on 2nd march 2024.
7. You are applying for the post of Assistant Engineer in BHEL. Write the educational qualifications in the resume.
8. What complimentary closure do you use in a cover letter?

PART-B

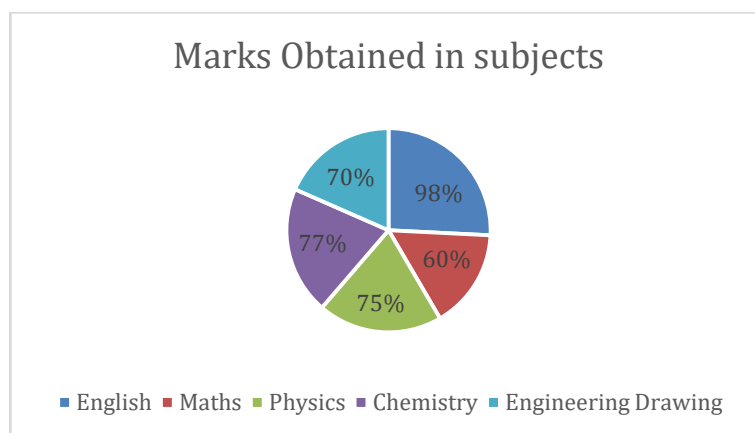
3 X 4 = 12 Marks

Instructions: a) Answer all the questions. b) Each question carries three marks.

9. a) Add affixes to the following words.
i) Value
ii) Create
iii) Sense

(OR)

- b) Write a short paragraph on the following Pie chart.



10.a) Write about your favourite past incident.

(OR)

b) Write your three strengths and three limitations.

11.a) Read the following sentence and provide proper punctuation marks.

i) drajay studied his mbbs in gandhi medical college

(OR)

b) Write a paragraph interpreting the data given in the following table.

Year	Salary	Expenditure on housing and transport	Interests on Loan	Savings
2018	70k	30k	7k	33k
2029	75k	35k	10k	30k
2020	80k	40k	13k	37k
2021	90k	45k	13k	37k
2022	1L	50k	14k	46k
2023	1.5L	52k	14k	86k

12. a) V. Vijay completed his M.Tech. He wants to apply for the post of Executive Engineer in Pragathi Engineering Company. Prepare a resume for the same.

(OR)

b) Read the following paragraph and make notes.

Yuvraj Singh is one of the most phenomenal cricketers who have redefined winning over struggle. Since the year 2000, this Punjab boy is the reason for many victories of India. His personal life and his struggle with the dreaded disease cancer is an inspiration for all of us. He is also one of the players who is honored with Arjuna award and has been declared Man of the Tournament in the 2011 ICC Cricket World Cup. Yuvraj Singh made a comeback to India national cricket team (ODI squad) after a lengthy period earlier this year, and fared average. The cricketer, also known for entrepreneurial initiatives and his charity work, says cricket will always be a priority in his life but he also tries to inspire young people with his story. He made India proud by hitting six sixes off an over in 2007, and was part of the Indian cricket team when they won World Cup 2011. But the turning point came in his life when he battled cancer in 2012. Yuvraj found a new meaning to life after the hardship. "Earlier on in my career, it was more about cricket and now it is being more about inspiring people to come out of the adversity and create examples... Since my treatment, things have changed a lot for me."

PART-C**4X 5 = 20 Marks****Instructions: a) Answer all the questions. b) Each question carries five marks. .**

13. a) Read the following paragraph and answer the questions:

Once, there lived two friends in a village. Their names were Bhaskar and Suresh. One day they set out on a journey and had to pass through a forest. As they were passing through the forest they saw a big bear coming towards them. They were frightened. Bhaskar at once climbed up a nearby tree to save his life. Suresh did not know how to climb up a tree. But he was wise and intelligent. He had heard that bears do not touch the dead. So he lay on the ground, held his breath and appeared to be dead. The bear came near him sniffed him, thinking him to be dead, it went away. When the bear had left Bhaskar came down from the tree and asked Suresh what the bear had whispered in his ear. Suresh said that the bear had advised him to beware of false friends.

1. Where were the friends going one day?
2. What is the antonym of the word, wise?
3. What did Bhaskar do when bear came towards them?
4. How can you say Suresh was wise and intelligent?
5. Did the Bear really whisper in Suresh's ear?

(OR)

b) Write a paragraph interpreting analyzing the information given in the following table.

Table Showing the Number of Students Admitted in Different Branches in Private Engineering Colleges in the Past Four Years.

Year	ECE	EEE	Mechanical	Civil	CSE
2023	54065	36255	21600	34000	13436
2022	49008	36255	20900	29000	22687
2021	45032	36255	20600	14500	32008
2020	38060	36254	20300	14500	38065

14.a) Change the following into indirect speech.

- i. He said." I have eaten a banana."
- ii. She said," I will go to Chennai tomorrow."
- iii. Hari said, "I can speak French."
- iv. Karunakar said to Vani, "I have completed my homework."
- v. Doctor said to Mani, "Are you a Professor?"

(OR)

b) Write a report on the industry you visited recently.

15. a) Rewrite the following sentences using proper punctuation marks and capital letters.

- i. when you are coming.
- ii. i love Flowers?
- iii. this is my cousins book.
- iv. "all that glittersis not gold.
- v. What a melodious song?

b)Observe the following flow chart and write a paragraph describing the steps involved in creating an e-mail.



16. a) Write a cover letter applying for the post of Work Supervisor at Bharath Electronics Private Limited.

(OR)

b) Write a report to the Principal on how you have conducted the Seminar on Robotics.

SC-202 - ENGINEERING MATHEMATICS

Course Title	Engineering Mathematics	Course Code	SC-202
Semester	II	Course Group	Foundation
Teaching Scheme in Periods (L : T : P)	4:1:0	Credits	2.5
Methodology	Lecture + Tutorial	Total Contact Periods	75
CIE	60 Marks	SEE	40 Marks

Pre requisites:

This course requires the basic knowledge of Algebra, Trigonometry in Mathematics at Secondary school level and Basic Engineering Mathematics at Diploma 1st Semester level

Course Outcomes (COs):

At the end of the course, the student will have the ability to:

CO 1	Solve simple problems in straight lines and circle using various formulae
CO 2	Solve the simple problems in conic section by using its properties
CO 3	Evaluate the Limits of Algebraic, Rational and Trigonometric functions.
CO 4	Determine the Derivatives of various Functions
CO 5	Determine the Derivatives of various functions by using various Differentiation Methods
CO 6	Solve some problems in Geometrical applications of derivatives and Maxima and Minima

Course Contents:

Unit – I Straight lines and Circles:

Duration: 12 Periods (L: 10– T:2)

Straight lines: Slope of straight line - Various forms of straight line-Horizontal and Vertical lines, Point-Slope form, Two-Point form, Slope-Intercept form, Intercept form, Normal form and General equation of a Straight line- Angle between two Straight lines- Conditions for Parallelism and Perpendicularity of the Straight lines –Equations of parallel and Perpendicular Straight lines- Distance of a point from a line -Distance between two Parallel lines - Intersection of two non-parallel lines - Related problems.

Circles: Definition of Locus of a point and Circle and its equation - Equation of the Circle, given(i) Centre and Radius, (ii) Two ends of a Diameter (iii) Centre and a point on the Circumference (iv) Centre and Tangent and (v) Three non-collinear points - Related problems.

Unit – II Conic Sections:

Duration: 13Periods (L: 10 – T:3)

Definitions of Conic Section, Focus, Eccentricity, Directrix, Axes and Latus rectum - **Parabola:** Standard equations of Parabolas have focus on one of the coordinate axes; vertex at origin and directrix is parallel to the other coordinate axis -**Ellipse:** Standard equations of Ellipses have centre at the origin and the major and minor axes are coordinate axes - **Hyperbola:** Standard equations of Hyperbola have centre at the origin and the transverse and conjugate axes are coordinate axes -Related properties and problems.

Unit-III Functions& Limits:**Duration: 12Periods (L: 10– T: 2)**

Definition of a function -Constants and Variables - Independent and Dependent Variables - Various types of functions: Constant function, Explicit and Implicit functions, Even and Odd functions, Hyperbolic functions, Modulus function and Function of a function with examples - Intervals and Neighbourhoods - Meaning of $x \rightarrow a$ - Definition of Limit of a function - Properties of Limits - Indeterminate forms- Standard Limits (without proof)- Evaluation of Limits of the form: $\lim_{x \rightarrow \infty} \frac{f(x)}{g(x)}$ using Algebraic techniques- Evaluation of limits of the form: $\lim_{x \rightarrow l} \frac{f(x)}{g(x)}$ using Direct Substitution, Factorization, Rationalization and Reduction to Standard forms.

Unit – IV Differential Calculus – I:**Duration: 13 Periods (L: 10 – T:3)**

Definition of Derivative of a function(First Principle of Derivatives) -Different notations - Derivatives of Standard Algebraic, Logarithmic, Exponential, Trigonometric, Hyperbolic and Inverse Trigonometric functions - Algebra of derivative of functions: Derivatives of Sum, Difference, Scalar Multiplication, Product, Quotient of functions-Derivative of function of a function(Chain rule)- Related problems.

Unit – V Differential Calculus – II:**Duration: 13Periods (L: 10 – T: 3)**

Logarithmic Differentiation -Derivative of Implicit functions - Differentiation of an Infinite Series - Derivative of Parametric functions- Differentiation of a function with respect to another function-Successive differentiation with emphasis on second order-Functions of several variables - Partial Differentiation - Euler's theorem for Homogeneous functions - Related problems.

Unit – VI Applications of Derivatives:**Duration: 12Periods (L: 10– T: 2)**

Geometrical Applications: Geometrical meaning of the Derivative -Slope of Tangent, Slope of Normal, Equations of Tangent and Normal to the curve at any point on the curve - Lengths of Tangent, Normal, Sub-tangent and Sub-normal to the curve at a point on the curve - Angle between two intersecting curves - Related problems.

Maxima & Minima: Increasing and decreasing functions - Extreme values and Extreme points - Conditions for Maxima and Minima of function of single variable -The maxima and minima of simple functions - Problems leading to engineering applications.

Reference Books:

1. The Elements of Co - Ordinate Geometry – by S.L. Loney.
2. Thomas Calculus, Pearson Publications.
3. NCERT Mathematics Text Books of Class XI, XII.
4. Intermediate Mathematics Text Book IB (Telugu Academy).
5. Differential Calculus -by Shanti Narayan and P. K. Mittal.

Suggested E-Learning references:

1. <https://www.khanacademy.org/>
2. <https://www.desmos.com/>
3. <https://www.wolframalpha.com/>
4. <http://tutorial.math.lamar.edu/>

Suggested Learning Outcomes:

At the end of the course, the student will have the ability to:

CO1: Solve simple problems in straight lines and circle using various formulae

- 1.1 Define slope of a straight line.
- 1.2 Classify various forms of a straight line:
 - (i) Horizontal and Vertical lines,
 - (ii) Point-slope form,
 - (iii) Two-point form,
 - (iv) Slope-intercept form,
 - (v) Intercept form,
 - (vi) Normal form and
 - (vii) General equation of a straight line.
- 1.3 Solve the problems on 1.2.
- 1.4 Find the acute angle between two straight lines.
- 1.5 Explain the conditions for parallelism and perpendicularity of straight lines.
- 1.6 Find the equation of parallel line which is passing through the given point.
- 1.7 Find the equation of perpendicular line which is passing through the given point.
- 1.8 Calculate the distance of a point from a line.
- 1.9 Evaluate the distance between two parallel lines.
- 1.10 Determine the point of intersection of two non-parallel lines.
- 1.11 Define locus of a point and circle.
- 1.12 Write the general equation of a circle with centre and radius.
- 1.13 Find the equation of a circle having its centre and radius.
- 1.14 Find the equation of a circle having two ends of a diameter.
- 1.15 Find the equation of a circle having its centre and a point on the circumference.
- 1.16 Find the equation of a circle having its centre and tangent.
- 1.17 Find the equation of a circle passing through three non-collinear points.
- 1.18 Solve the related problems from 1.12 to 1.17.

CO2: Solve the simple problems in conic section by using its properties

- 2.1 Define conic section.
- 2.2 Explain the terms focus, eccentricity, directrix, axes and latus-rectum of the conic.
- 2.3 Describe the properties of parabola in standard forms have focus on one of the coordinate axes; vertex at origin and directrix is parallel to the other coordinate axis.
- 2.4 Describe the properties of ellipses in standard forms have centre at the origin and the major and minor axes are coordinate axes.
- 2.5 Describe the properties of hyperbolas in standard forms have centre at the origin and the transverse and conjugate axes are coordinate axes.
- 2.6 Solve the problems related to 2.3, 2.4 and 2.5

CO3: Evaluate the Limits of Algebraic, Rational and Trigonometric functions.

- 3.1 Define function with example.
- 3.2. Explain constants, variables, independent and dependent variables.
- 3.3 Define various types of functions:
 - (i) Constant function,
 - (ii) Explicit and Implicit functions,
 - (iii) Even and Odd functions,
 - (iv) Hyperbolic functions,
 - (v) Modulus function and
 - (vi) Function of a function with examples.
- 3.4 Explain intervals and neighbourhoods.

- 3.5 Explain the meaning of $x \rightarrow a$.
- 3.6 Define Limit of a function.
- 3.7 Explain the Properties of Limits.
- 3.8 State indeterminate forms.
- 3.9 State the standard limits: $\lim_{x \rightarrow a} \frac{x^n - a^n}{x - a}$, $\lim_{x \rightarrow 0} \frac{\sin x}{x}$, $\lim_{x \rightarrow 0} \frac{\tan x}{x}$, $\lim_{x \rightarrow 0} \frac{a^x - 1}{x}$, $\lim_{x \rightarrow 0} \frac{e^x - 1}{x}$,
 $\lim_{x \rightarrow 0} (1+x)^{\frac{1}{x}}$, $\lim_{x \rightarrow \infty} \left(1 + \frac{1}{x}\right)^x$.
- 3.10 Evaluate the Limits of the form $\lim_{x \rightarrow \infty} \frac{f(x)}{g(x)}$ using Algebraic techniques.
- 3.11 Evaluate limits of the form $\lim_{x \rightarrow l} \frac{f(x)}{g(x)}$ using
 (i) Direct substitution,
 (ii) Factorization,
 (iii) Rationalization and
 (iv) Reduction to standard forms.

CO4: Determine the Derivatives of various Functions

- 4.1 Define the concept of derivative of a function $y = f(x)$ as $\lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ (First Principle of Derivatives) and also provide standard notations to denote the derivative of a function.
- 4.2 Find the derivatives of simple elementary functions like k (constant), x^n , $\sqrt{x}$, $\sin x$, $\cos x$ using the First Principle of Derivatives.
- 4.3 List the formulae for derivatives of standard algebraic, logarithmic, exponential, trigonometric, hyperbolic and inverse trigonometric functions.
- 4.4 Use the Algebra of derivatives of functions, i.e. derivative of sum, difference, scalar multiplication, product and quotient of functions to solve problems.
- 4.5 Find the derivatives using the method of Differentiation of a Function of a function (Chain rule).

CO5: Determine the Derivatives of various functions by using various Differentiation Methods

- 5.1 Apply the Properties of Logarithms for differentiating functions of the form: $[f(x)]^{g(x)}$.
- 5.2 Explain the procedure for finding derivatives of Implicit functions with examples.
- 5.3 Find the derivatives of Infinite series of the form: (i) $\sqrt{f(x) + \sqrt{f(x) + \sqrt{f(x)} \dots \infty}}$ and
 (ii) $f(x)^{f(x)^{f(x) \dots \infty}}$.
- 5.4 Explain the method of Parametric Differentiation with examples.
- 5.5 Explain the method of Differentiation of a function with respect to another function with examples.
- 5.6 Explain successive differentiation with examples and solve engineering problems related to second order.
- 5.7 Define functions of several variables and explain partial derivatives up to second order with examples.
- 5.8 Define homogeneous functions with examples.
- 5.9 State Euler's theorem for homogeneous functions.
- 5.10 Verify Euler's theorem for homogeneous functions.
- 5.11 Apply Euler's theorem to solve engineering problems involving partial derivatives.

CO6: Solve some problems in Geometrical applications of derivatives and Maxima and Minima

- 6.1 State the geometrical meaning of the derivative of a function as the slope of the tangent to the curve $y=f(x)$ at any point on the curve.
- 6.2 Use the concept of derivative to find the slope of normal at a point on the curve.
- 6.3 Determine the equations of tangent and normal to the curve $y=f(x)$ at any point on the curve.
- 6.4 Calculate the lengths of tangent, normal, sub-tangent and sub-normal at any point on the curve $y=f(x)$.
- 6.5 Apply the concept of derivatives for finding the angle between two intersecting curves with illustrative examples.
- 6.6 Define increasing and decreasing functions.
- 6.7 State the conditions for increasing and decreasing functions.
- 6.8 Use the conditions 6.7 to find points where the given function is increasing or decreasing.
- 6.9 Define Extreme Values (Maximum and minimum values) and Extreme points (Points of Maximum and minimum) of a function of single variable.
- 6.10 Explain conditions for maxima and minima.
- 6.11 Find the Maxima and minima of simple functions.
- 6.12 Apply maxima and minima to solve engineering problems.

Suggested Student Activities:

- 1. Student visits Library to refer Standard Books on Mathematics and collect related material.
- 2. Quiz.
- 3. Group discussion.
- 4. Group Tests.
- 5. Formulae Tests.
- 6. Surprise tests.
- 7. Seminars.
- 8. Home assignments.
- 9. Mathematics for preparing competitive exams. Solving old question papers on arithmetical ability.

CO / PO - MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	Mapped POs
CO1	3	1					3	1,2,7
CO2	3	2					3	1,2,7
CO3	3	2	1				3	1,2,3,7
CO4	3	2	1				3	1,2,3,7
CO5	3	2	1				3	1,2,3,7
CO6	3	2	3				3	1,2,3,7

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TELANGANA
DIPLOMA EXAMINATIONS (C - 24)
SC-202
SEMESTER II, MID – I EXAM, MODEL PAPER
ENGINEERING MATHEMATICS

Duration: 1: 00 Hour

Max. Marks: 20

PART-A

Instructions: 1. Answer **ALL** questions.

04 × 01 = 04

2 Each question carries **ONE** mark.

1. Write the normal form of a straight line.
2. Find the equation of the point circle whose centre is (1,2).
3. Write the standard form an ellipse whose major axis is x - axis.
4. Find the equation of directrix of the parabola $y^2 = 36x$.

PART-B

Instructions: 1. Answer any **TWO** questions.

02 × 03 = 06

2. Each question carries **THREE** marks.

- 5(a) If the equation of a line is $3x - 4y + 10 = 0$, then find i) its slope ii) x & y intercepts.

OR

- 5(b) Find the equation of the circle passing through the points (2,3) and touches the line

$$x - 3y - 11 = 0.$$

- 6(a) Find the equation of the parabola whose focus is (5, 0) and directrix is $x + 5 = 0$.

OR

- 6(b) Find the equation of an ellipse whose end points of major axis are $(\pm 3, 0)$ and end points of minor axis are $(0, \pm 2)$.

PART C

Instructions: 1. Answer any **FOUR** questions.

02 × 05 = 10

2. Each question carries **FIVE** marks.

- 7(a) Find the angle between straight lines $x + 3y - 1 = 0$ and $2x + 5y - 2 = 0$.

OR

- 7(b) Find the equation of the circle passing through the points (0, 0), (2, 0) and (0, 3).

- 8(a) Find the coordinates of foci, eccentricity and the length of latus rectum, equations of latera-recta and directrices of the ellipse $49y^2 - 16x^2 = 784$.

OR

- 8(b) Find the equation of the hyperbola whose centre is at (0,0) and passes the points (3,2) and (1,6).

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TELANGANA
DIPLOMA EXAMINATIONS (C - 24)

SC-202

SEMESTER II, MID – II EXAM, MODEL PAPER
ENGINEERING MATHEMATICS

Duration: 1: 00 Hour

Max. Marks: 20

PART-A

Instructions: 1. Answer **ALL** questions. 04 × 01 = 04
2 Each question carries **ONE** mark.

1. Find $\lim_{x \rightarrow 3} \left(\frac{x^3 - 3x^2}{x^2 - 5x + 6} \right)$.
2. Find $\lim_{\theta \rightarrow 0} \left(\frac{\sin 2\theta}{\theta} \right)$.
3. Differentiate $\tan(3x - 7)$ with respect to x .
4. If $y = x.e^x$, then find $\frac{dy}{dx}$.

PART-B

Instructions: 1. Answer any **TWO** questions. 02 × 03 = 06
2. Each question carries **THREE** marks.

5(a) Evaluate: $\lim_{x \rightarrow 5} \left(\frac{x^3 - 125}{x - 5} \right)$.

OR

5(b) Evaluate: $\lim_{x \rightarrow \infty} \left(1 + \frac{5}{x} \right)^x$.

6(a) Find the derivative of $\left(\frac{2x+3}{4x+5} \right)$ with respect to x .

OR

6(b) Differentiate $\sin^{-1}(3x - 4x^3)$ with respect to x .

PART C

Instructions: 1. Answer any **FOUR** questions. 02 × 05 = 10
2. Each question carries **FIVE** marks.

7(a) Evaluate: $\lim_{n \rightarrow \infty} \frac{1^2 + 2^2 + 3^2 + \dots + n^2}{n^3}$.

OR

7(b) Evaluate: $\lim_{\theta \rightarrow 0} \left(\frac{\cos 3\theta - \cos 5\theta}{\cos 7\theta - \cos 9\theta} \right)$.

8(a) If $y = \sqrt{e^x + \log(\log(\sin x))}$ then find $\frac{dy}{dx}$.

OR

8(b) Find the derivative of $\sin x$ with respect to x by using first principle of derivatives.

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TELANGANA
DIPLOMA EXAMINATIONS (C - 24)

SC-202

SEMESTER II, END SEMESTER EXAM, MODEL PAPER
ENGINEERING MATHEMATICS

Duration: 2:00 Hours

Max. Marks: 40

PART-A

Instructions: 1. Answer **ALL** questions.

08 × 01 = 08

2 Each question carries **ONE** mark.

1. Find the slope of a straight line passing through the points $(-2, 3)$ and $(4, 8)$.
2. Find $\lim_{x \rightarrow 0} \frac{x^2 + 3x + 2}{x^2 + 4x + 3}$.
3. Find the second order derivative of $x^3 + 4x^2 + 2$ with respect to x .
4. Write the equation of a parabola whose focus is $(a, 0)$ and the directrix is $x = -a$.
5. If $u(x, y) = x^2y$, then find $\frac{\partial y}{\partial x}$.
6. Find $(\frac{dy}{dx})$ if $xy = 2025$.
7. Find the slope of the curve $y = x^2 + 5x - 2025$ at $(1, 2)$.
8. Write the conditions for a point to be a minimum point on the curve $y = f(x)$.

PART-B

Instructions: 1. Answer any **FOUR** questions.

04 × 03 = 12

2. Each question carries **THREE** marks.

9(a) If $(1, 3)$ is an extremity of a diameter of the circle $3x^2 + 3y^2 + 6x - 12y - 2 = 0$, then find the other end point of the diameter.

OR

9(b) If $y = x^x$, then find $\frac{dy}{dx}$.

10(a) Evaluate: $\lim_{x \rightarrow 0} \frac{1 - \cos x}{x^2}$.

OR

10 (b) Find the equation of tangent to the curve $y^2 = 8x$, at $(2, 4)$.

11(a) Find $\frac{dy}{dx}$, if $x = \lambda t$ and $y = \frac{\lambda}{t}$.

OR

11(b) If $u = \tan^{-1} \left(\frac{y}{x} \right)$, then prove that $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$.

12(a) The sum of two numbers is 20. Find the numbers such that the sum of their squares is minimum.

OR

12 (b) Find the angle between the curves $y = x^2$ and $x^2 = y$.

PART C

Instructions: 1. Answer any **FOUR** questions
2. Each question carries **FIVE** marks

04 × 05 = 20

13(a) Find the centre, foci, vertices, eccentricity, length of latus-rectum and lengths of major and minor axes of the ellipse $\frac{x^2}{25} + \frac{y^2}{16} = 1$

OR

13 (b) Find $\frac{dy}{dx}$, if $\sqrt{x} + \sqrt{y} = \sqrt{a}$

14 (a) Differentiate $\log(x + \sqrt{x^2 + 1})$ with respect to x .

OR

14 (b) Show that $y^2 = 4(x + 1)$ and $y^2 = 36(9 - x)$ cut each other orthogonally.

15(a). If $y = (\sin x)^{(\sin x)^{(\sin x)^{\dots \infty}}}$, then find $\frac{dy}{dx}$.

OR

15 (b) Find the derivative of $\log \tan 2x$ with respect to $\cot 2x$

16 (a). A right circular cylinder is inscribed in a sphere of radius R , show that the volume is maximum when its height is $\frac{2R}{3}$.

OR

16 (b) Find the lengths of tangent, normal, sub-tangents and sub-normal for the curve

$$2x^2 + 3xy - 2y^2 - 8 = 0 \text{ at } (2, 3).$$

SC-203 - APPLIED PHYSICS

Course Title:	Applied Physics	Course Code :	SC-203
Semester:	II Semester	Course Group :	Foundation
Teaching Scheme in Periods(L:T:P):	4:1:0	Credits :	2.5
Type of Course :	Lecture+ Tutorials	Total Contact Periods :	75 Periods
CIE :	60 Marks	SEE :	40 Marks

Pre requisites

This course requires the basic knowledge of Science and Mathematics

Course Outcomes

Upon completion of the course, the student shall be able to

CO1	Explain the motion characteristics displacement, velocity, acceleration of Simple Harmonic Motion and apply the formulation to obtain time period of simple pendulum.
CO2	Classify wave motions and apply mathematical formulations to echo, Doppler effect and identify causes, effects and minimizing method of noise pollution.
CO3	Explain basic concepts of electricity and extend Kirchhoff's laws to construct Meter bridge to determine unknown resistance.
CO4	Identify magnetic materials and apply laws of electromagnetic induction to construct transformer.
CO5	Utilize the laws and principles of Photoelectric effect, LASER and optical fibers to build Photocell and Ruby LASER.
CO6	Apply the properties of semiconductors and volt-ampere characteristics of P-N junction diode to construct half wave and full wave rectifiers and Light Emitting Diode.

	Basic and Discipline Specific Knowledge	Problem Analysis	Design/Development of Solutions	Engineering Tools, Experimentation and Testing	Engineering Practices for Society, Sustainability and Environment	Project Management	Lifelong Learning	Linked PO
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	
CO1	3	-	-		-	-	2	1,7
CO2	3	-	-	1	-	-	2	1,4,7
CO3	3	1	-	1	-	-	2	1,2,4,7
CO4	3	1	-	1	-	-	2	1,2,4,7
CO5	3		-	1	-	-	2	1,4,7
CO6	3		-	1	1	-	2	1,4,5,7

Course content:

Unit 1 Simple Harmonic Motion

Duration: 12 periods (L: 10 – T: 2)

Periodic motion and Simple Harmonic Motion (SHM) – examples of SHM, conditions of SHM, time period, frequency, amplitude and phase of a particle in SHM-definitions, expressions for Displacement, Velocity, Acceleration, Time period and Frequency of a particle executing in SHM – derivations- numerical problems, Ideal simple pendulum-definition, expression for time period of simple pendulum-derivation- numerical problems, laws of simple pendulum, second's pendulum-length of second's pendulum.

Unit 2 Waves and Acoustics

Duration: 13 periods (L:10 – T:3)

Wave-definition-characteristics, longitudinal and transverse waves –explanation- examples –Audible range, infrasonic and ultrasonic waves, expression relating wave velocity, frequency and wavelength-derivation- numerical problems, , phenomenon of beats - applications - numerical problems, echo – explanation- time of echo from a distant obstacle-derivation- numerical problems-applications of echo, Doppler Effect in sound-formula for Doppler shift- numerical problems, applications of Doppler Effect, SONAR, Reverberation, reverberation time and Sabine's formula, acoustics of good auditorium, free and forced vibrations, and resonance – definition-examples, noise pollution- causes, effects and methods to minimize noise pollution.

Unit 3 Electricity

Duration: 12 periods (L: 10 – T: 2)

Electric current and potential difference-summarize, Ohm's law-explanation-numerical problems, specific resistance-explanation-numerical problems, conductivity and conductance-definitions, combination of resistors in electric circuit –formula for series and parallel combination-related numerical problems, Heating effect of electric current –applications- heat produced and electric power consumed in a current carrying wire -derivations, electric power- numerical problems, Kirchhoff's laws in electricity –explanation- numerical problems, Wheatstone's bridge –explanation, condition for balancing of Wheatstone's bridge –derivation-numerical problems, Meter Bridge-explanation-numerical problems.

Unit 4 Electromagnetism

Duration: 13 periods(L: 10 – T: 3)

Magnetic pole, pole strength, magnetic length of a bar magnet. Magnetic field, magnetic lines of force and magnetic induction, properties of magnetic lines of force, uniform and non uniform magnetic fields, magnetic flux, magnetization, magnetic intensity, magnetic permeability and magnetic susceptibility- simple numerical problems, types of magnetic materials. Coulomb's inverse square law of magnetism-explanation-numerical problems, expression for moment of couple on a bar magnet placed in a uniform magnetic field- derivation- numerical problems, expression for magnetic induction field strength at a point on the axial line of a bar magnet –derivation- numerical problems, Faraday's laws of electromagnetic induction, Lenz's law-explanation, self induction and mutual induction, construction of transformer-types of transformers-numerical problems.

Unit 5 Modern Physics

Duration: 13 periods (L: 10 – T: 3)

Electromagnetic spectrum-regions, Photo electric effect-explanation-Einstein's photo electric equation, work function and threshold frequency, laws of photo electric effect, working of photocell, applications of photocell, LASER-definition, concept of energy levels, Spontaneous emission, Stimulated emission, population inversion and optical pumping, characteristics of LASER, Ruby LASER, applications of LASER, critical angle and total internal reflection of light, principle and working of Optical fiber, types of optical fiber (Step index and Graded index), applications of optical fiber, Nanosclae and properties of nanomaterials - applications.

Unit 6 Semiconductor Physics

Duration: 12 periods (L: 10 – T: 2)

Valence band, Conduction band and Forbidden energy gap in solids-explanation, Conductors, Insulators and Semiconductors on the basis of energy band diagram, Fermi level, Intrinsic semiconductors-explanation-examples, concept of hole and doping in semiconductors, Extrinsic semiconductors-explanation, PN Junction Diode-explanation, Forward bias and Reverse bias of PN diode, Volt-Ampere (V-I) characteristics of PN Diode, applications of PN Diode, half wave rectifier and full wave rectifier, working principle of Light Emitting Diode (LED).

Reference Books

1. Principles of Physics by N. Subrahmanyam and Brijlal, S. Chand & Co, New Delhi, edition, 1982
2. Engineering Physics by R.K. Gaur, S.L. Gupta, Dhanpatrai Publications, New Delhi.
3. Intermediate Physics, Telugu Academy, TS, Hyderabad.
4. Fundamentals of Physics by Halliday and Resnick.
5. Physics Part-I & II, NCERT

E-learning resources:

Hyper Physics website: <http://hyperphysics.phy-astr.gsu.edu/>

Learning Outcome:

Upon completion of this course the student will be able to

CO1: Explain the motion characteristics displacement, velocity, acceleration of Simple Harmonic Motion and apply the formulation to obtain time period of simple pendulum.

- 1.1 Explain periodic motion and Simple Harmonic Motion (SHM).
- 1.2 List the examples of SHM.
- 1.3 List the conditions of Simple Harmonic Motion.
- 1.4 Define the terms time period, frequency, amplitude and phase of a particle in SHM.
- 1.5 Develop the expressions for Displacement, Velocity, Acceleration, Time period and Frequency of a particle executing in SHM and solve numerical problems.
- 1.6 Define Ideal simple pendulum and develop the expression for time period of simple pendulum and solve numerical problems.
- 1.7 Develop the laws of simple pendulum.
- 1.8 Define second's pendulum and determine its length on the Earth.

CO2: Classify wave motions and apply mathematical formulations to echo, Doppler effect and identify causes, effects and minimizing method of noise pollution.

- 2.1 Define wave and outline the characteristics of wave (frequency, wavelength, amplitude and time period).
- 2.2 Explain longitudinal and transverse waves with examples and distinguish them.
- 2.3 Explain audible range, infrasonic waves and ultrasonic waves.
- 2.4 Develop the expression relating wave velocity, frequency and wavelength ($v = n\lambda$) and solve numerical problems.
- 2.5 Explain the phenomenon of beats with legible diagram, list the applications of beats and solve numerical problems.
- 2.6 Explain echo and develop the formula for time of echo from a distant obstacle and solve numerical problems.
- 2.7 List the applications of echo.
- 2.8 Explain Doppler Effect in sound (no derivation, formulae only)- (i) source moves toward stationary observer (ii) source moves away from stationary observer (iii) observer moves

toward stationary source (iv) observer moves away from stationary source and solve simple numerical problems.

- 2.9 List the applications of Doppler Effect.
- 2.10 Explain SONAR.
- 2.11 Explain Reverberation, reverberation time and outline Sabine's formula.
- 2.12 Identify the requirements for acoustically good auditorium.
- 2.13 Explain free vibrations, forced vibrations and resonance with examples.
- 2.14 Explain noise pollution and identify the causes, effects and methods to minimize noise pollution.

CO3: Explain basic concepts of electricity and extend Kirchhoff's laws to construct Meter bridge to determine unknown resistance.

- 3.1 Summarize the concept of electric current and potential difference.
- 3.2 Explain Ohm's law and solve numerical problems.
- 3.3 Explain specific resistance ($\rho = \frac{RA}{l}$) and solve related numerical problems.
- 3.4 Define conductivity and conductance.
- 3.5 Explain combination of resistors in electric circuit and develop formulae for equivalent resistance in series and parallel connection and solve related numerical problems.
- 3.6 Explain Heating effect of electric current and list the applications of it. Develop formulae for heat produced ($H = I^2Rt$) and electric power consumed ($P=VI$) in a current carrying wire and solve numerical problems.
- 3.7 Explain Kirchhoff's laws in electricity and solve numerical problems.
- 3.8 Construct Wheatstone bridge and develop balancing condition of it starting from Kirchhoff's laws in electricity and solve numerical problems.
- 3.9 Construct Meter Bridge for determination of unknown resistance and solve numerical problems.

CO4: Identify magnetic materials and apply laws of electromagnetic induction to construct transformer.

- 4.1 Explain magnetic pole, pole strength and magnetic length of a bar magnet.
- 4.2 Explain magnetic field, magnetic lines of force and magnetic induction.
- 4.3 List the properties of magnetic lines of force.
- 4.4 Explain uniform and non uniform magnetic fields.
- 4.5 Define magnetic flux.
- 4.6 Explain magnetization, magnetic intensity, magnetic permeability and magnetic susceptibility and solve simple numerical problems.
- 4.7 Explain types of magnetic materials (dia, para and ferro magnetic materials) based on magnetic properties.
- 4.8 Explain Coulomb's inverse square law of magnetism and solve numerical problems.
- 4.9 Develop expression for moment of couple on a bar magnet placed in a uniform magnetic field ($C = MB \sin\theta$) and solve numerical problems.
- 4.10 Develop expression for magnetic induction field strength at a point on the axial line of a bar magnet [$B = \frac{\mu_0}{4\pi} \frac{2M}{d^3}$] and solve numerical problems for short bar magnet.
- 4.11 Explain Faraday's laws of electromagnetic induction.
- 4.12 Explain Lenz's law.
- 4.13 Explain Self induction and Mutual induction.
- 4.14 Explain construction and working of transformer using the principles of electromagnetic induction with legible diagram.
- 4.15 Construct a transformer to Step up and Step down input voltage with legible sketch.

CO5: Utilize the laws and principles of Photoelectric effect, LASER and optical fibers to build Photocell and Ruby LASER.

- 5.1 Outline the regions of electromagnetic spectrum.
- 5.2 Explain Photo electric effect.
- 5.3 Outline Einstein's photo electric equation; explain work function and threshold frequency and solve numerical problems.
- 5.4 Develop laws of photo electric effect.
- 5.5 Explain construction and working of photocell.
- 5.6 Identify applications of photocell.
- 5.7 Explain LASER and concept of energy levels (Ground state, excited state and Meta stable state).
- 5.8 Explain Spontaneous emission, Stimulated emission, population inversion and optical pumping.
- 5.9 List the characteristics of LASER.
- 5.10 Explain construction and working of Ruby LASER.
- 5.11 Identify applications of LASER.
- 5.12 Explain critical angle and total internal reflection of light.
- 5.13 Make use of optical properties to explain working of Optical fiber.
- 5.14 Construct Step index and Graded index optical fibers.
- 5.15 Identify applications of optical fiber.
- 5.16 Explain Nanoscale and identify properties at nano scale.
- 5.17 Classify Nanomaterials (zero, one, two and three dimensional).
- 5.18 Identify applications of nano materials.

CO6: Apply the properties of semiconductors and volt-ampere characteristics of P-N junction diode to construct half wave and full wave rectifiers and Light Emitting Diode.

- 6.1 Outline the concept of Valence band, Conduction band and Forbidden energy gap in solids.
- 6.2 Explain Conductors, Insulators and Semiconductors on the basis of energy band diagram.
- 6.3 Explain the concept of Fermi level.
- 6.4 Explain Intrinsic semiconductors with examples.
- 6.5 Explain the concept of hole and doping in semiconductors.
- 6.6 Explain Extrinsic semiconductors and identify differences between P-type and N-type semiconductors.
- 6.7 Explain PN Junction Diode.
- 6.8 Explain Forward bias and Reverse bias PN junction diode.
- 6.9 Summarize Volt-Ampere (V-I) characteristics of PN Diode.
- 6.10 Identify the applications of PN Diode.
- 6.11 Construct half wave and full wave rectifiers by making use of the characteristics of PN Diode.
- 6.12 Draw a labeled diagram and explain working of Light Emitting Diode (LED).

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TELANGANA

DIPLOMA EXAMINATION (C 24)

SEMESTER II

MID-I EXAM

SC 203 Applied Physics

Model Question paper

Duration: 1 hour

Max. Marks: 20

PART-A

4 X 1 = 4

- Instructions: 1. Answer **ALL** questions.
2. Each question carries **ONE** mark.

1. Define periodic motion.
2. Define second's pendulum.
3. Name one example each for longitudinal and transverse waves.
4. Define reverberation.

PART-B

2 X 3 = 6

- Instructions: 1. Answer **ALL** questions.
2. Each question carries **THREE** marks.

- 5 (a) List the conditions for SHM.

(OR)

- (b) The acceleration of a particle in S.H.M. is 0.09 ms^{-2} when its displacement is 0.25 m. Find the period of oscillation.

- 6 (a) The frequency of sound is 110 Hz and wavelength is 3 m. Calculate the velocity of the wave.

(OR)

- (b) Draw a neat labeled sketch of formation of beats.

PART-C

2 X 5 = 10

- Instructions: 1. Answer **ALL** questions.
2. Each question carries **FIVE** marks.

- 7 (a) Develop the formula for acceleration of a particle executing SHM and analyze for maximum and minimum accelerations.

(OR)

- (b) Develop the expression for time period of a simple pendulum.

- 8 (a) Explain echo and apply principle of echo to find the distance of an obstacle from the observer.

(OR)

- (b) List five methods to minimize noise pollution.

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TELANGANA
DIPLOMA EXAMINATION (C 24)
SEMESTER II
MID-II EXAM
SC 203 Applied Physics
Model Question paper

Duration: 1 hour

Max.Marks: 20

PART-A

4 X 1 = 4

Instructions: 1. Answer **ALL** questions.
2. Each question carries **ONE** mark.

1. Define conductance.
2. What is the principle involved in Meter Bridge?
3. Define magnetic field.
4. Define magnetic permeability.

PART-B

2 X 3 = 6

Instructions: 1. Answer **ALL** questions.
2. Each question carries **THREE** marks.

- 5 (a) An electric fan has a resistance of 100ohms. It is plugged into potential difference of 220 V.
How much current passes through the fan?

(OR)

(b) Explain specific resistance of a conductor.

- 6 (a) Two magnetic poles of strengths 40 A-m and 30 A-m are separated by a distance of 0.2 m in air. Calculate the force between them.

(OR)

(b) Draw labeled diagrams of step up and step down transformers and identify various components.

PART-C

2 X 5 = 10

Instructions: 1. Answer **ALL** questions.
2. Each question carries **FIVE** marks.

- 7 (a) Explain heating effect of current and develop the formula for heat produced in a current carrying wire.

(OR)

(b) Develop an expression for balancing condition of Wheatstone bridge with legible sketch.

- 8(a) Develop expression for moment of couple on a bar magnet placed in a uniform magnetic field.

(OR)

(b) Classify magnetic materials based on their magnetic properties.

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TELANGANA
DIPLOMA EXAMINATION (C 24)
SEMESTER II
SEMESTER END EXAM
SC –203 Applied Physics
Model Question paper

Duration: 2 hours

Max.Marks: 40

PART-A

8 X 1= 8

Instructions: 1. Answer **ALL** questions.

2. Each question carries **ONE** mark

1. What is the formula for maximum acceleration of a particle in S.H.M?
2. Define magnetic field.
3. Define critical angle.
4. What is audible range of human beings?
5. What is photo electric effect?
6. Define population inversion in LASER.
7. What is forbidden gap?
8. Define intrinsic semiconductors.

PART-B

4 X 3 = 12

Instructions: 1. Answer **ALL** questions.

2. Each question carries **THREE** marks.

9(a) The Simple Harmonic oscillations executed by a particle of mass 0.5 kg are represented by the

equation $y = 2 \sin \left(10t + \frac{\pi}{4} \right)$. Find (a) velocity when the displacement is 1 unit and (b) maximum acceleration.

(OR)

(b) List the applications of optical fibre.

10(a) Explain Coulomb's inverse square law of magnetism.

(OR)

(b) Explain the concept of Fermi level.

11(a) The work function of a photoelectric material is 3.3 eV. Calculate threshold frequency? Given Planck's constant $h = 6.6 \times 10^{-34}$ joule-sec, velocity of light $c = 3 \times 10^8 \text{ ms}^{-1}$ and $1 \text{ eV} = 1.6 \times 10^{-19}$ joule.

(OR)

(b) Draw and label the diagram showing various regions of Electromagnetic spectrum in the order of increasing wavelength.

12(a) Explain valance band, conduction band and forbidden energy gap in solids.

(OR)

(b) Explain P-type and N-type semiconductors.

PART-C

4 X 5 = 20

Instructions: 1. Answer **ALL** questions.

2. Each question carries **FIVE** marks.

13(a) Two tuning forks when sounded together give 5 beats per second. The frequency of the first fork is 480 Hz. When a piece of wax is attached to the second fork, the beats are reduced to 4. Find the frequency of the other tuning fork.

(OR)

(b) Develop laws of photoelectric effect.

14(a) Explain construction and working of transformer using the principles of electromagnetic induction with legible diagram.

(OR)

(b) Explain forward bias and reverse bias PN diode.

15(a) Identify the differences between step index and graded index optical fibers.

(OR)

(b) Identify applications of nano materials.

16(a) Construct full wave rectifier.

(OR)

(b) Draw a labeled diagram and explain working of Light Emitting Diode (LED).

SC - 204 - APPLIED ENGINEERING CHEMISTRY

Course Title	Applied Engineering Chemistry	Course Code	SC-204
Semester	II	Course Group	Foundation
Teaching Scheme in Periods (L:T:P)	4:1:0	Credits	2.5
Methodology	Lecture + Tutorial	Total Contact Periods	75
CIE	60Marks	SEE	40Marks

Prerequisite: Basic knowledge of Chemistry in Secondary Education.

Course Objective: After studying this course the student will be able to understand and appreciate the role of chemistry and environmental studies in different spheres of industries.

Course Outcome: On successful completion of the course, the students will have ability to attain below Course Outcomes (CO):

CO1	Explain the formation and functioning of Galvanic Cells, Batteries and Fuel Cells and apply the knowledge to identify and compare the materials best suited for construction of Batteries and Fuel Cells.
CO2	Explain the different metallurgical processes and apply the knowledge in the extraction of metals and in making alloys for industrial needs.
CO3	Explain the various corrosion processes, protection methods and apply the knowledge to reduce the corrosion in domestic and industrial areas.
CO4	Explain the different methods of preparation and characteristics of organic polymers and apply the knowledge to select suitable polymer for domestic and industrial use.
CO5	Identify the importance of Gaseous fuels, Lubricants, engineering materials and their uses for domestic and industrial applications.
CO6	Explain the causes, effects and controlling methods of air pollution, water pollution and soil pollution and apply relevant methods to solve domestic and industrial problems.

CO-PO Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	-	-	-	-	-	2
CO2	3	-	-	-	1	-	2
CO3	3	-	-	-	-	-	2
CO4	3	1	-	-	1	-	2
CO5	3	1	-	-	1	-	2
CO6	3	-	-	-	3	-	3

COURSE CONTENTS

UNIT – I: ELECTROCHEMICAL CELL– BATTERIES:

L10 + T3 Periods

Galvanic cell–Standard electrode potential–Reference electrodes–Electro chemical series–EMF of cell– Batteries-Types of batteries–Leclanche cell, Lead storage battery – H₂-O₂ Fuel cells.

UNIT -II: MTALLURGY:

L10 + T2 Periods

Characteristics of metals- Distinguish between metals and non metals - Mineral, Ore, Gangue, Flux, Slag - Concentration of ore, Methods of extraction of crude metal - Roasting, Calcination, Smelting, Extraction of Al, and Fe – Alloys-Purpose of making alloys – Composition and uses of Brass, Nichrome and Duralumin.

UNIT –III: CORROSION:

L10 + T2 Periods

Corrosion-Factors influencing the rate of corrosion–Dry and wet theories of corrosion–Composition cell, Stress cell and Concentration cell–Rusting of iron and its mechanism–Prevention of corrosion– Protective coatings–Cathodic protection–Paints– Constituents of paint–Functions of constituents of paint.

UNIT–IV: POLYMERS:

L10 + T3 Periods

Polymers - Polymerization - Types of polymerization – Addition polymerization, Condensation polymerization - Plastics - Types of plastics - Advantages of plastics over traditional materials - Disadvantages of using plastics- Preparation and uses of the following plastics: 1. Polythene 2.PVC 3.Urea formaldehyde 4. Bakelite - Compounding of plastics – Natural rubber – Vulcanization of natural rubber - Elastomers – Preparation and uses of Buna-s, Neoprene rubber - Biodegradable polymers-preparation and uses.

UNIT–V: INDUSTRIAL FUELS AND MATERIALS

L10 + T3 Periods

Definition and classification of fuels- Characteristics of good fuel-composition, calorific value, and uses of gaseous fuels- a) CNG b) LPG c) Bio gas – Lubricants– Classification and functions of lubricants – Engineering material -Glass-Properties- Manufacturing of glass-melting, Forming and shaping-Annealing -Finishing, Chemical components -uses of soft glass, hard glass, flint glass and laminated glass.

UNIT –VI: ENVIRONMENTAL POLLUTION AND CONTROL

L10 + T2 Periods

Air pollution-Introduction, Classification of air pollutants based on origin and states of matter, Causes, effects, and controlling methods - Water pollution – Causes, effects, controlling methods– Soil pollution – Causes, General effects,-Controlling methods –Carbon credit and carbon trading

Reference Books:

1. Engineering chemistry–Jain &Jain –Dhanpat Rai Publishing Company.
2. A Text book of Engineering Chemistry–S.S. Dara – S. Chand Publications.
3. Environmental Studies –A.K. De.
4. Environmental Studies, R. Rajagopalan,2nd Edition,2011, Oxford University Press
5. Intermediate Chemistry I and II–Telugu Academy TS
6. Engineering chemistry– Prasanta Rath, B. Ramadevi, Ch. Venkataramana Reddy & Subhendu Chakroborty–CENGAGE

E- Learning links:

<https://iupac.org/><https://www.khanacademy.org/www.nptel.ac.in>

Specific Learning Outcomes:

Upon completion of the course, the student will have ability to:

CO1: Explain the formation and functioning of Galvanic Cells, Batteries and Fuel Cells and apply the knowledge to identify and compare the materials best suited for construction of Batteries and Fuel Cells.

- 1.1. Define galvanic cell
- 1.2. Explain the construction and working of Daniel cell
- 1.3. Explain the differences between electrolytic cell and galvanic cell
- 1.4. Explain Electrode potential, Oxidation potential, reduction potential and standard electrode potential.
- 1.5. Define Reference electrode give examples.
- 1.6. Explain the construction and working of standard hydrogen electrode (SHE).
- 1.7. Explain the construction and working of calomel electrode
- 1.8. Define electrochemical series and explain its significance.
- 1.9. Define and explain EMF of cell and solve the numerical problems
- 1.10. Define battery and explain the types of batteries-Primary and secondary battery with examples
- 1.11. Explain the construction, working and applications of Dry cell (Leclanche cell) and Lead storage battery
- 1.12. Explain the construction, working and advantages of Hydrogen-Oxygen fuel cell

CO2: Explain the different metallurgical processes and apply the knowledge in the extraction of metals and in making alloys for industrial needs.

- 2.1 Identify the characteristics of metals.
- 2.2 Explain the differences between metals and non-metals
- 2.3 Define and explain the terms 1.Mineral 2.Ore 3.Gangue, 4.Flux and 5.Slag -with examples
- 2.4 Explain the minerals and ores of Iron, and Aluminium.
- 2.5 Froth floatation and Electromagnetic separation methods for the concentration of ore
- 2.6 Explain the metallurgical processes -Roasting, Calcination, Smelting.
- 2.7 Extraction of Al from Bauxite (Flow chart)
- 2.8 Extraction of Fe from Hematite (flow chart)
- 2.9 Define an alloy and explain the purpose of making of alloys
- 2.10 Explain the composition and uses of following alloys i) Brass ii) Nichrome iii) Duralumin

CO3: Explain the various corrosion processes, protection methods and apply the knowledge to reduce the corrosion in domestic and industrial areas.

- 3.1 Define corrosion
- 3.2 Explain the factors influencing the rate of corrosion based on i) Nature of metal ii) Nature of environment of metal.
- 3.3 Explain the Electrochemical theory of corrosion.
- 3.4 Explain the formation of a) Composition cell b) Stress cell c) Concentration cell
- 3.5 Define rust and explain the mechanism of rusting of iron with chemical reactions.
- 3.6 Explain the following methods of prevention of corrosion:
 - a). Protective coatings i) Metallic coatings (Anodic coating and cathodic coating) ii) Inorganic coatings iii) Organic coatings
 - b). Cathodic protection i) Sacrificial anode method ii) Impressed voltage method.
- 3.7 Define the term paint.
- 3.8 Explain the characteristics of a good paint.
- 3.9 List the constituents of paint (pigment, vehicle or drying oil, thinner, drier, filler and plasticizers) and explain the functions of constituents of paint.

CO4: Explain the different methods of preparation and characteristics of organic polymers and apply the knowledge to select suitable polymer for domestic and industrial use.

- 4.1 Define polymerization
- 4.2 Explain the types of polymerization (Addition polymerization and Condensation polymerization) with examples.
- 4.3 Define the term plastic
- 4.4 Identify the characteristics of plastics.
- 4.5 Summarize the advantages of plastics over traditional materials
- 4.6 Explain the impact of plastics on environment.
- 4.7 Explain the types of plastics with examples.
- 4.8 Identify the differences between thermo plastics and thermosetting plastics
- 4.9 Explain the methods of preparation and uses of the following plastics: 1. Polythene, 2. Polyvinylchloride, 3. Urea formaldehyde resin 4. Bakelite (Only flow chart for Bakelite i.e. without chemical equations).
- 4.10 Define the term natural rubber
- 4.11 Explain the processing of natural rubber from latex.
- 4.12 Explain the structural formula of natural rubber
- 4.13 Explain the characteristics of natural rubber
- 4.14 Explain the process of vulcanization of natural rubber with chemical reactions.
- 4.15 Interpret the characteristics of vulcanized rubber
- 4.16 Define the term elastomer
- 4.17 Explain the preparation and uses of the following synthetic rubbers a) Buna-S b) Neoprene rubber.
- 4.18 Define a biodegradable polymer and explain a method of preparation and uses of biodegradable polymer-polylactic acid and polycaprolactone.

CO5: Identify the importance of Gaseous fuels, Lubricants, engineering materials and their uses for domestic and industrial applications.

- 5.1 Define fuel.
- 5.2 Classify the fuels based on their physical state with examples.
- 5.3 Classify the fuels based on occurrence-primary and secondary fuels with examples.
- 5.4 Define calorific value
- 5.5 Calculate the oxygen required for combustion of methane and ethane gases
- 5.6 Explain the characteristics of a good fuel
- 5.7 Explain the advantages of gaseous fuels
- 5.8 Explain the chemical composition, calorific value and uses of a) CNG b) LPG c) Bio gas
- 5.9 Define lubricant.
- 5.10 Classify the lubricants based on physical state.
- 5.11 Explain the functions of lubricants.
- 5.12 Explain General characteristics of Glass.
- 5.13 Explain a method of manufacture of Glass -melting, Forming and shaping-Annealing - Finishing,
- 5.14 Explain the components and uses of the following commercial Glasses 1. Soft glass, 2. Hard glass, 3. flint glass, 4. Laminated glass.

CO6: Explain the causes, effects and controlling methods of air pollution, water pollution and soil pollution and apply relevant methods to solve domestic and industrial problems.

6.1 Define air pollution

6.2 Classify the air pollutants-based on origin and states of matter

6.3 Explain the causes of air pollution

6.4 Explain the effects of air pollution on human beings, plants and animals

6.5 Explain the Greenhouse effect- its consequences and control methods

6.6 Explain the Acid rain-its consequences and control methods

6.7 Explain the controlling methods of air pollution

6.8 Define water pollution

6.9 Explain the causes of water pollution

6.10 Explain the effects of water pollution on living and non-living things

6.11 Utilize the available methods to control water pollution.

6.12 Define soil pollution.

6.13 Explain the causes of soil pollution.

6.14 Explain the general effects of soil pollution.

6.15 Explain the methods of control of soil pollution.

6.16 Understand the concept of Carbon Credits and Carbon Trading (Elementary level only)

6.17 Understand the advantages and disadvantages of carbon trading

BOARD OF DIPLOMA EXAMINATIONS (C24)
SEMESTER EXAMINATION
MIDSEM– I

SC-204- ENGINEERING CHEMISTRY AND ENVIRONMENTAL STUDIES
Time: 1Hour

Max.Marks:20

PART–A

Instructions: Answer **all** questions. Each question carries **one** mark

4X 1=4 marks

1. Define Galvanic cell.
2. What is standard electrode potential?
3. Define an ore.
4. Define Roasting.

PART–B

Instructions: Answer the **following** questions. Each question carries **three** marks

2x 3=6 Marks

5. a. Explain any three differences between Electrolytic cell and Galvanic cell
(OR)
b. Explain the types of batteries with examples.
6. a. Explain Magnetic separation method of concentration of Ore.
(OR)
b. Explain the purpose of making alloy (any six).

PART–C

Instructions: Answer the **following** questions. Each question carries **five** marks.

2x 5=10 marks

7. a. Explain the construction and working of Leclanche cell.
(OR)
b. Define and explain EMF. Find the EMF of Cell $\text{Zn} / \text{Zn}^{2+} (1\text{M}) || \text{Cu}^{2+} (1\text{M}) | \text{Cu}$ Given E° of $\text{Zn}^{2+} | \text{Zn} = - 0.76\text{V}$ and E° of $\text{Cu}^{2+} | \text{Cu} = 0.34\text{V}$
8. a. Select a systematic process of extraction Fe from Hematite (Flow chart only).
(OR)
b. Show the Chemical composition and explain the uses of following alloys a) Brass and
b) Nichrome

BOARD OF DIPLOMA EXAMINATIONS (C24)
SEMESTER EXAMINATION
MIDSEM-II

SC-204-ENGINEERING CHEMISTRY AND ENVIRONMENTAL STUDIES

Time: 1 Hour

Max. Marks: 20

PART-A

Instructions: Answer **all** questions. Each question carries **one** mark
1=4 marks

4X

1. Define Corrosion.
2. What is a Paint?
3. Define polymerization
4. What is the chemical name of natural rubber?

PART-B

Instructions: Answer the **following** questions. Each question carries **three** marks

2x 3=6

Marks

5. a. Select any six characteristics of a good paint.
(OR)
b. Explain Sacrificial anode method of prevention of corrosion.
6. a. Write any three advantages of plastics over traditional materials.
(OR)
b. Write any three differences between thermo plastic and thermosetting plastic.

PART-C

Instructions: Answer the **following** questions. Each question carries **five** marks.

2x 5=10

marks

7. a. Explain any five factors influencing the rate of corrosion of metal.
(OR)
b. Explain any five constituents of a paint with their functions
8. a. What is vulcanization of rubber and explain with chemical equations.
(OR)
b. Explain preparation and uses of following plastics 1. Polyethene 2. PVC
(polyvinyl chloride)

BOARD OF DIPLOMA EXAMINATIONS (C24)
SEMESTER END EXAMINATION

SC-204- ENGINEERING CHEMISTRY AND ENVIRONMENTAL STUDIES

Time: 2Hour

Max. Marks: 40

PART-A

Instructions: Answer **all** questions. Each question carries **one** mark

8X 1=8 marks

1. What is electrochemical series?
2. What is the composition of Rust?
3. Define a Fuel
4. Define gangue.
5. Define a Lubricant
6. What is the composition of potash lime Glass?
7. Define air pollution.
8. Define water pollution.

PART-B

4x3=12 marks

Instructions: Answer the **following** questions. Each question carries **three** marks

9. a. Choose any six characteristics of Metals.
(OR)
b. Classify the Lubricants based on physical state. Give examples.
10. a. Identify any six advantages of plastics over traditional material.
(OR)
b. Explain any three methods of control of soil pollution.
11. a. Explain the classification of fuels based on physical state. Give examples.
(OR)
b. Explain the general characteristics of Glass (any six).
12. a. Explain the causes and effects of Greenhouse effect.
(OR)
b. Explain the effects of water pollution on Living things.

PART-C

4X5= 20 marks

Instructions: Answer the **following** questions. Each question carries **three** marks

13. a. Explain the construction and working of Hydrogen-Oxygen Fuel cell.
(OR)
b. Explain a method of manufacture of Glass with labelled diagram.
14. a. Identify any five differences between Thermoplastics and Thermosetting plastics
(OR)
b. Explain the controlling methods of water pollution.
15. a. Explain the chemical composition and uses of LPG and CNG fuels
(OR)
b. Explain the components and uses following Glasses
1. Lead glass. 2. Soda lime glass 3. Laminated Glass
16. a. Explain any five causes of Air pollution
(OR)
b. Explain any five methods of control of Water pollution

CS-205- PROGRAMMING IN ‘C’

Course Title:	Programming in C	Course Code	CS-205
Semester	II	Course Group	CORE
Teaching Scheme in Periods (L:T:P)	4:1:0	Credits	2.5
Methodology	Lecture + Tutorials	Total Contact Periods	75
CIE	60 Marks	SEE	40 Marks

Pre requisites

Basic knowledge Of Mathematics, Logical, Reasoning and IT skills

Course Outcomes

Upon completion of the course, the student shall be able to

CO1	Develop Algorithms and Draw Flowchart for given problems.
CO2	Use Data types and classify Operators.
CO3	Develop Programs Using Decision Making Branching and looping statements.
CO4	Create Arrays, know the usage of strings.
CO5	Analyze and implement Modular Programming using Functions
CO6	Develop programs Using structures and Unions

Course Content and Blue Print of Marks for SEE

Unit No	Unit Name	Periods	Questions to be set for SEE				
			R		U	A	
I	Programming Methodology and Introduction to C Language	10	Q4	Q1		Q9(a)	Q13(a)
II	Understand Constants, Variables and Data types in C and Understand Operators and Expressions in C	10					
III	Decision making and Looping statements	14		Q2		Q10(a)	Q14(a)
IV	Arrays and Strings	14					
V	User Defined functions	13		Q3	Q5,Q6	Q9(b),Q11(a), Q11(b)	Q13(b),Q15(a), Q15(b)
VI	Structures and Unions	14			Q7,Q8	Q10(b),Q12(a), Q12(b)	Q14(b),Q16(a), Q16(b)
	Total	75	8		8	8	

1. Programming Methodology and Introduction to C Language**Duration: 10 periods(L:8 – T:2)**

Steps involved in problem solving -Define Algorithm- Characteristics of algorithm- Steps involved in algorithm development - Algorithms for simple problems - Define flowchart – Symbols used in flowchart - Flowcharts for simple problems - Differentiate algorithm and flowchart – Define Program - Differentiate between algorithm and program - Define High level language and low level language- Define Compiler, Assembler, Linker and Loader - Define source code, assembly code, object code, machine code -importance of C language – structure of C program – different stages in converting the C program source code into an executable code - steps in executing the C program.

2. Understand Constants, Variables and Data Types in C and Understand Operators and Expressions in C**Duration:10 Periods(L:7 – T:3)**

Character set - C Tokens - Keywords and Identifiers- Constants and Variables - data types and Classification- declaration of a variable - Assigning values to variables - Define operator –Classify operators - List and explain various arithmetic operators with examples -Illustrate the concept of relational operators - List logical operators - various assignment operators – Increment and decrement operators - List bitwise operators - Conditional operator - various special operators - precedence and associativity of operators - Define expression - Evaluation of Arithmetic expressions - Evaluation of Logical expressions - Evaluation of Relational expressions - type conversion techniques – Know Preprocessor directives – Know Header Files - Reading and writing characters - formatted input and output.

3. Decision making and Looping statements**Duration: 14 Periods(L:12 – T:2)**

Decision making in C programming - simple if statement – if-else statement – nested if statement - else-if ladder –Switch statement - Classification of various loop statements- while loop – do-while loop - for loop - break and continue statements - nesting of loops- Comparisons of different loop statements.

4. Arrays and Strings**Duration: 14 Periods(L:11 – T:3)**

Arrays – definition, types, declaration and initialization of One Dimensional -Array - Accessing the elements in the Array - ‘accessing array out of bounds’ problem - Reordering an array in ascending order – average of elements in an array – largest element in an array - Declaration and initialization of two Dimensional Arrays - sample programs on matrix addition and matrix multiplication, transpose- Strings – Definition, Declaration and initialization of String variables - Reading of strings from terminal - writing strings to screen - String handling functions with sample programs

5. User defined functions**Duration: 13 Periods(L:10 – T:3)**

Function – Definition - Need for user defined functions - Advantages of functions - elements of function - Return values and their types - function prototype - function call - function definition – Scope, visibility and lifetime of variables in functions- storage classes- Functions with no arguments and no return values - functions with arguments with no return values - functions with arguments with return values - functions with no arguments with return values - Recursion - sample programs on recursion - passing arrays to functions

6. Structures and Unions**Duration: 14 Periods(L:12 – T:2)**

Structures and Unions Structure- Definition - Creating a structure - Declaring structure variables - Accessing the structure members - Concept of structure assignment - Find size of a structure - Nested structure - Structure as function arguments –structures vs. arrays – Array of structures - Structure containing arrays- array of structures containing arrays - Union and illustrate usage of a union – difference between Structures and Union.

Text Books

- | | | |
|--------------------------|----|----------------------------------|
| 1.LetUsC | -- | YeshwanthKanetkarBPBPublications |
| 2.Programmingin ANSIC | -- | E.Balaguruswamy TataMcGrawHill |
| 3.ProgrammingwithC | -- | GottfriedSchaum'outline |
| 4.CThecomplete Reference | -- | SchildtTataMcGraw Hill |

Reference Books

1. The C Programming Language- Brian W. Kernighan,Dennis M.Ritchie- Pre Publicationntice Hall
2. Programming in C 3rd Edition-Sams Publishing- Steven G. Kochan- Sams Publishing
3. Expert C Programming: Deep Secrets-Peter Van Der Linden- Pearson Publications
4. C Programming: A Modern Approach. K.N. King- Norton Publications
5. Learn to Program with C- Noel Kalicharan- APress Publications

Suggested e-Learning Links

1. https://www.w3schools.com/c/c_intro.php?external_link=true
2. <https://www.geeksforgeeks.org/c-programming-language/>
3. <https://www.programiz.com/c-programming>
4. <https://www.javatpoint.com/c-programming-language-tutorial>
5. <https://www.freecodecamp.org/news/the-c-programming-handbook-for-beginners/>
6. <https://www.tutorialspoint.com/cprogramming/index.htm>
7. <https://www.codecademy.com/catalog/language/c>
8. <https://www.codechef.com/learn/course/c>
9. <https://archive.nptel.ac.in/courses/106/104/106104128/>
10. <https://www.youtube.com/watch?v=3QiImIWmOM>
11. <https://www.digimat.in/nptel/courses/video/106105171/L01.html>
12. <https://www.digimat.in/nptel/courses/video/106105171/L07.html>

Suggested Learning Outcomes

For achieving the Course outcomes, the following learning outcomes must be achieved

CO1: Develop Algorithms and Draw Flowchart for given problems.

- 1.1 State different steps involved in problem solving
- 1.2 Define algorithm and know its characteristics
- 1.3 State the steps involved in algorithm development
- 1.4 Develop algorithms for simple problems.
- 1.5 Define flowchart and know symbols used in drawing flowcharts
- 1.6 Draw flowchart for simple problems.
- 1.7 Differentiate algorithm and flowchart
- 1.8 Define program and differentiate between program and algorithm
- 1.9 Define High level language and low level language
- 1.10 Define Compiler, Assembler, Linker and Loader
- 1.11 Define source code, assembly code, object code, machine code.
- 1.12 State the importance of C language
- 1.13 Explain the structure of C program
- 1.14 List and Explain different stages in converting the C program source code to executable code.
- 1.15 Explain the steps involved in executing the C program.

CO2: Use Data types and classify Operators.

- 2.1 Describe Character set, C Tokens-Keywords, Variables, Identifiers, Constants and Variables.
- 2.2 Define Data type.
- 2.3 Classify Primary data types and explain with examples
- 2.3 Write the syntax to declare and assigning values to variables.
- 2.4 Define operator.
- 2.5 Classify and explain operators with examples
- 2.6 Describe operator precedence and associativity of operators.
- 2.7 Define expression.
- 2.8 Describe evaluation of Arithmetic, Relational and logical expressions.
- 2.9 Illustrate type conversion (implicit and explicit) techniques.
- 2.10 Define and List Pre-processor directives
- 2.11 Discuss #include and #define Pre-processor directives.
- 2.12 Define Header file and discuss stdio.h, conio.h, math.h, string.h Header files.
- 2.13 Illustrate getchar(), putchar(), scanf(), printf() with programs.

CO3: Develop Programs Using Decision Making Branching and looping statements.

- 3.1 Discuss decision making in programming
- 3.2 Explain decision making statements- if, if-else, nested if-else, else-if ladder - with syntax and programs.
- 3.3 Explain decision making statement- switch statement - with syntax and programs.
- 3.4 Define looping and list loop statements.
- 3.5 Discuss the iterative statements – while, do- while, for statement- with syntax and programs.
- 3.6 Discuss break and continue statements.
- 3.7 Compare and Contrast break and continue statements.
- 3.8 Define Nested loops.
- 3.9 Develop programs using Nested loops.
- 3.10 Compare different loop statements.

CO4: Create Arrays, know the usage of strings.

- 4.1 Define an Array.
- 4.2 List different types of Arrays.
- 4.3 Declare and initialize One Dimensional Array with example program.
- 4.4 Develop a program to read, access and display the elements of a one dimensional array
- 4.5 Develop a program to sort the elements in ascending or descending order using one-dimensional Array.
- 4.6 Develop a c program to count the even and odd numbers for a given array of n elements.
- 4.7 Declare and initialize two Dimensional Arrays with example program.
- 4.8 Illustrate the concept of two dimensional arrays with the following programs
 - a. Matrix addition, subtraction
 - b. Matrix multiplication
 - c. Transpose of a matrix and check whether the given matrix is symmetric or not.
- 4.9 Define String
- 4.10 Declare and initialize a String variable.
- 4.11 Outline the different ways of reading and writing strings using scanf(), getchar(), gets(), printf(), putchar(), puts() functions.

- 4.12 Create a program to concatenate, copy, and finding out the length of a string without using string handling functions.
- 4.13 Explain about various String handling functions with sample programs.
- 4.14 Develop C programs using different string handling functions.

CO5: Analyze and implement Modular Programming using Functions

- 5.1 Define function,
- 5.2 Discuss the need of functions.
- 5.3 List out the advantages of functions.
- 5.4 Identify the elements of function.
- 5.5 Define and discuss function prototype, function call, and function definition with syntax and program.
- 5.6 Discuss the scope, visibility and lifetime of variables in functions.
- 5.7 Classify different storage classes.
- 5.8 Illustrate functions with no arguments and no return values with syntax and example programs.
- 5.9 Illustrate functions with no arguments and with return values with syntax and example programs.
- 5.10 Illustrate functions with arguments and with no return values with syntax and example programs.
- 5.11 Illustrate functions with arguments and with return values with syntax and example programs.
- 5.12 Illustrate passing arrays to functions as arguments with example programs.
- 5.13 Define recursion.
- 5.14 Develop the following programs using recursion
 - a. Factorial of a number.
 - b. compute x^n (hint : x raised to the power n).
 - c. Fibonacci series.

CO6: Develop programs Using structures and Unions

- 6.1 Define structure
- 6.2 State the uses of structures.
- 6.3 Declaration and initialization of a structure template and structure variables.
- 6.4 Explain accessing structure members using (.) dot operator.
- 6.5 Develop a C program to create, initialize a structure and access its data members.
- 6.6 Syntax to know the size of a structure.
- 6.7 Discuss nested structure concept.
- 6.8 Illustrate the concept of nested structure with a program.
- 6.9 Know the differences between Structures and Arrays.
- 6.10 Illustrate array of structures, structures containing arrays, array of structures containing arrays.
- 6.11 Illustrate array of structures using sample C program.
- 6.12 Illustrate structure as function arguments and returning of structure variables as function values.
- 6.13 Define Union.
- 6.14 State the usage of unions.
- 6.15 Declaration and initialization of a union.
- 6.16 Explain accessing of union members using (.) dot operator.
- 6.17 Know the differences between Structure and Unions.

Suggested Student Activities

Student activity like mini-project, surveys, quizzes, etc. should be done in group of 5-10 students.

1. Each group should do any one of the following type of activity or any other similar activity related to the course with prior approval from the course coordinator and programme coordinator concerned.
2. Each group should conduct different activity and no repetition should occur.
3. Explore and analyse topics to improve the level of creativity and analytical skill by taking Quiz/ tests/ assignments. Documents have to be maintained as a record.
4. Create a power point presentation on the topic relevant to course or advanced topic as an extension to the course to improve the communication skills. Documents have to be maintained as a record.
5. Visit different sites relevant to topics. Listen to the lectures and submit a handwritten report
6. Coding competitions

CO-PO Mapping Matrix

	Basic and Discipline Specific Knowledge	Problem Analysis	Design/Development of Solutions	Engineering Tools, Experimentation and Testing	Engineering Practices for Society, Sustainability and Environment	Project Management	Lifelong Learning	Linked PO
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	
CO1	2	1	1			1	1	1,2,3,6,7
CO2	2					1	2	1,6,7
CO3	2	1	2	1	1	2	2	1,2,3,4,5,6,7
CO4	2	2	2	1	1	1	2	1,2,3,4,5,6,7
CO5	2	2	2	1	3	2	2	1,2,3,4,5,6,7
CO6	2	1	1			1	2	1,2,3,6,7

State Board of Technical Education and Training, Telangana
Model Question paper
PROGRAMMING IN CII-SEMESTER
Mid Semester-I Examination

Course Code: CS-205
Course Name: Programming in C

Duration: 1 hour
Max. Marks: 20 Marks

PART-A

Answer **all** questions- Each Question carries **ONE** mark

4x1 = 4 Marks

1. List any two differences between algorithm and flowchart.
2. Define Low level language
3. List various types of constants.
4. Define an expression

PART-B

Answer **two** questions- Each Question carries **THREE** marks

2x3 = 6 Marks

- 5.a) List out any 6 symbols used in Flowchart.
(OR)
- b) Write any three differences between high level language and low level language
- 6.a) Write the syntax to declare variable in C? Give examples.
(OR)
- b) Evaluate an expression $(2+5)*(10-4)\%10$.

PART-C

Answer **two** questions- Each Question carries **FIVE** marks

2x5 = 10 Marks

- 7.a) Draw a flowchart to find factorial of given number N.
(OR)
- b) Explain the stages to execute a C-Program
- 8.a) Explain different data types in C with examples.
(OR)
- b) Elaborate any three categories of operators in C.

State Board of Technical Education and Training, Telangana
Model Question paper
PROGRAMMING IN C II-SEMESTER
Mid Semester-II Examination

Course Code: CS-205
Course Name: PROGRAMMING IN C

Duration: 1 hour
Max.Marks: 20 Marks

PART-A

Answer **all** questions- Each Question carries **ONE** mark

4x1 = 4 Marks

1. Write the syntax of if statement.
2. Give the syntax of while statement in C.
3. Define an array.
4. Give the syntax for declaring and initializing of one dimensional array.

PART-B

Answer **two** questions- Each Question carries **THREE** marks

2x3 = 6 Marks

5a) Explain switch statement with syntax.

(OR)

5b) Write any three differences between while and do-while statements.

6a) Write a C program to find largest number in array.

(OR)

6b) Explain any three String handling functions.

PART-C

Answer **two** questions- Each Question carries **FIVE** marks

2x5 = 10 Marks

7a) Explain do-while statement with syntax and sample program

(OR)

7b) Write a C program whether a given number is Armstrong or not using while loop

8. a Write a C program to multiply two matrices.

(OR)

8.b Write a C program to check whether given string is palindrome or not.

State Board of Technical Education and Training, Telangana
Model Question paper
PROGRAMMING IN C II-SEMESTER
Semester End Examination

Course Code: CS-205

Course Name: Programming in C

Duration: 2 hour

Max.Marks: 40 Marks

PART-A

Answer all questions- Each Question carries ONE mark

8x1 = 8 Marks

1. List any two differences between algorithm and program.
2. Give the syntax of simple if statement in C.
3. List any two advantages of functions.
4. Give the syntax for declaring and initializing of one dimensional array.
5. Define function.
6. Define recursion.
7. Write any two uses of structures.
8. Define Union?

PART-B

Answer Four questions- Each Question carries THREE marks

4x3 = 12 Marks

9. a) Write any three characteristics of algorithm.
(OR)
9. b) Write any three advantages of functions.
10. a) Write any three differences between break and continue statements.
(OR)
10. b) Write any three differences between structure and union statements.
11. a) Explain elements of function in C.
(OR)
11. b) Write any three differences between local variable and global variable statements.
12. a) Explain how to access structure members.
(OR)
- b. Compare structure and arrays.

PART-C

Answer Four questions- Each Question carries FIVE marks

4x5 = 20 Marks

13. a) Explain the structure of a C-Program.
(OR)
13. b) Write a C program to compute the transpose of given matrix.
14. a) Write a C program to sort the elements of a one-dimensional array.
(OR)
14. b) Write a C program to access the elements of a union.
15. a) Write a C program to illustrate functions with arguments and without return values.
(OR)
15. b) Write a C program to find the factorial of a number using recursion.
16. a) Write a C program to implement nested structures.
(OR)
- b) Write a C program to implement array of structures.

ME-206 - MANUFACTURING TECHNOLOGY

Course title:	Manufacturing Technology	Course code:	ME-206
Semester:	II	Course group:	Core
Teaching scheme in periods:	4:1:0	Credits:	2.5
Methodology:	Lecture + Tutorial	Total Contact periods:	75
CIE:	50 Marks	SEE:	40 Marks

Prerequisites

Enthusiasm to learn the course and requires the basic knowledge of Basic work shop

COURSE OUTCOMES

On successful completion of the course, the student's will be able to:

COURSE OUTCOMES	
CO1	Attain the knowledge effectively operate a lathe machine and produce high- Quality machined components in various manufacturing industries.
CO2	Grasp the fundamental principles of drilling required to effectively operate drilling machines and gain knowledge necessary to effectively utilize cutting fluids in machining operations.
CO3	Attain the concept of milling machine, types of milling machines, Milling cutters and contribute effectively to manufacturing industries.
CO4	Illustrate the Working of Grinding Process and apply for engineering applications. Understand various surface finishing processes and apply for various applications
CO5	Attain knowledge of identifying types of welding welding operations safely, efficiently, and to industry standards, thereby preparing them for careers in welding and fabrication across various sectors.
CO5	Identify the Press tools and apply it in various engineering applications & Identify Special tools for Work holding and guiding for different machining processes

BLUE PRINT OF MARKS FOR SEE

Unit No	Unit Name	Periods	Questions to be set for SEE				
			R		U	A	
1	Lathe and lathe works	12	Q4	Q1		Q9(a)	Q13(a)
2	Drilling and cutting fluids	13					
3	Milling	12		Q2		Q10(a)	Q14(a)
4	Grinding and finishing	13					
5	Welding	13		Q3	Q9(b), Q11(a), Q11(b)		Q13(b), Q15(a), Q15(b)
5	Press tool s jigs and fixtures	12			Q10(b), Q12(a), Q12(b)		Q14(b), Q15(a), Q15(b)
Total		75	08		08	08	

CO-PO Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	Mapping POs
CO1	3	3	3	2	-	1	1	1, 2,3,4,6,7
CO2	3	3	3	2	1	-	1	1, 2,3,4,5,7
CO3	3	3	3	2	-	-	2	1, 2,3,4,7
CO4	3	3	3	2	-	2	1	1,2 4,6, 7
CO5	3	3	3	2	-	1	2	1,2, 4,6,7
CO6	3	3	3	2	1	1	3	1,2,3,4,5,6,7

COURSE CONTENT

UNIT– I

LATHE & LATHEWORKS

PERIODS:12

Working Principle of Lathe, Types of Lathes - Engine lathe – construction details– specifications, geometry and nomenclature of single point cutting tool, tool signature, Cutting speed, feed, depth of cut, cutting tool materials, General and special operations – (Turning, facing, taper turning thread cutting, knurling, forming, drilling, boring, reaming, key way cutting). Explanation Lathe accessories viz., work holding devices and tool holding devices.

UNIT–II

DRILLING AND CUTTING FLUIDS

PERIODS:13

Drilling: Introduction, classification of drills, twist drills, straight flute drills, common forms of parallel shank drills, taper shank twist drills, drill size and specifications, Working principle of drilling, Type of drilling machines: sensitive drilling machine, upright drilling machine (single spindle), radial drilling machine. Operations-Drilling, reaming, boring, counterboring, counter sinking, tapping, spot facing and trepanning

Cutting Fluids and coolants : Properties and functions of fluids and coolants and their uses, Types of cutting fluids, Fluids and coolants required in turning, drilling, shaping, sawing & broaching; Selection of cutting fluids, methods of application of cutting fluid

UNIT –III

MILLING

PERIODS:12

Milling : Milling cutter - Purpose – Working principal - Classification – Applications - Column and knee type-plain universal milling machine-vertical milling machine-specification of milling machines - principles of operation-work and tool holding devices-arbor-stub arbor spring collet-adaptor- various milling operations – plain – face – straddle milling-gang milling-form milling-profile –end –saw - keyway –gear cutting –flute –cam milling

UNIT-IV

GRINDING AND FINISHING

PERIODS:13

Grinding Introduction – working Principles of Metal Removal by Grinding-Purpose of grinding – advantages –disadvantages - types of abrasives - bonding materials types – binding processes: Vitrified, silicate, shellac, rubber,-grit ,grade and structure of wheels - Standard marking systems: Meaning of letters numbers sequence of marking – Grades of letters. Grinding machines – classification: Cylindrical, Surface, Principle of centre less grinding, Advantages & limitations of centre less grinding - Dressing and trimming of grind wheels

Other Finishing processes Honing, Lapping, Super finishing, Electroplating–Basic principles–Plating metals–applications, Hot dipping: Galvanizing, Tin coating, Parkerizing, Anodizing

UNIT-V**WELDING****PERIODS:13**

Introduction & classification of welding processes. Applications, Advantages and limitations of welding, Principles of arc welding, Arc welding equipment, Choice of electrodes for different metals, Principle of gas (oxy – acetylene) welding. Equipment of gas welding. Welding procedures(arc & gas), defects in welding - testing and inspection

UNIT-VI**PRESS TOOLS JIGS AND FIXTURES****PERIODS 12**

Press tools :-Introduction - Types of Presses – hand, power, gap, inclinable, adjustable, horn, straight side, pillar presses - Constructional details of a power press-Press size. Press Tools – Punch and die-.Press working operations- blanking, piercing and forming, lancing, cutting off and parting, notching, shaving, trimming, embossing, beading and curling, bulging, twisting, coining, swaging, hole flanging or extruding –line sketches

Jigs & fixtures:- Need and Applications of jigs & fixtures - Basic principles of location - Explain the locating methods and devices. Explanation of basic principles of the clamping - Types of clamps – strap clamps, cam clamps, screw clamps, toggle clamps, hydraulic and pneumatic clamps- Types of jigs - template jig, plate jig, leaf jig, box and handle jig, Indexing jig, Universal jig, vice jigs. Types of fixtures: milling & boring fixtures.

SUGGESTED LEARNING OUTCOMES:

Upon completion of the course the student shall be able to;

CO1: Attain the knowledge effectively operate a lathe machine and produce high- Quality machined components in various manufacturing industries.

- 1.1. State the working principle of lathe
- 1.2. Identify Function of lathe
- 1.3. Categorize lathes
- 1.4. Interpret the Specification of lathe machine
- 1.5. Draw the line diagram of engine lathe and describe the functions of each part in lathe.
- 1.6. Explain the in detail about lathe bed, head stock
- 1.7. Explain the details of the tailstock, carriage
- 1.8. Explain the details about the feed rod and lead screw
- 1.9. Identify various single point Cutting tool materials and effect of alloying elements
- 1.10. Explicate the Nomenclature of single point tool with the help of legible sketch
- 1.11. Explicate the Significance of various angles like rake angle , clearance angle
- 1.12. Cognize the effect Cutting speed, feed, depth of cut on metal removal rate and surface finish
- 1.13. Record the various operations performed on lathe including special operations.
- 1.14. Explain the lathe operation centering ,facing
- 1.15. Describe the lathe operation different turning operations
- 1.16. Explain the lathe operations like drilling ,boring ,reaming ,and chamfering
- 1.17. Illustrate the lathe operations like knurling and parting off
- 1.18. Catalog and identify the purpose of different work holding devices
- 1.19. Explain the lathe centre
- 1.20. Explain the drive plate ,carriers and face plate with sketches
- 1.21. Explain the in detail about 3 jaw chuck and 4 jaw chuck with sketches
- 1.22. Differentiate between 3 jaw and 4jaw check
- 1.23. Explain the about magnetic, collet, drill chuck
- 1.24. Explain the details about angle plate and mandrels
- 1.25. Record and lineup the purpose of different tool holding devices like grinding ,milling ,taper attachment

CO2: Grasp the fundamental principles of drilling required to effectively operate drilling machines and gain knowledge necessary to effectively utilize cutting fluids in machining operations.

- 2.1. State the meaning of drilling.
- 2.2. Categorize different types of drilling machines.
- 2.3. Explain about portable drilling machine
- 2.4. Comprehend the construction and working of sensitive drilling machine
- 2.5. Grasp the construction and working of radial drilling machine.
- 2.6. Record various types of drills and their purpose
- 2.7. Interpret the construction and working of Twist drill only
- 2.8. Identify forms of drill shank such as straight and taper shank and its purpose
- 2.9. Explain the twist drill nomenclature
- 2.10. Explain the designation of drill
- 2.11. Identify various drill bit materials
- 2.12. Write the specifications of drilling machines.
- 2.13. Record the different operations on drilling machine.
- 2.14. Explain the drilling machine operations like drilling ,boring ,reaming
- 2.15. Explain the drilling machine operations like counter boring ,counter sinking ,tapping
- 2.16. Explain the drilling machine operations like spot facing ,trepanning
- 2.17. Identify different Properties and functions of cutting fluids
- 2.18. Record the uses and the Types of cutting fluids.
- 2.19. Identify Fluids and coolants required in turning, drilling, shaping, sawing & broaching;
- 2.20. Identify the Selection of cutting fluids and
- 2.21. Identify the methods of application of cutting fluid

CO3: Attain the concept of milling machine, types of milling machines, Milling cutters and contribute effectively to manufacturing industries.

- 3.1 State the purpose of the milling
- 3.2 State the working principle of the milling
- 3.3 Record the Types of milling machines
- 3.4 Record the applications of milling machines
- 3.5 Identify the types of milling machines
- 3.6 Cognize construction and working of column and knee type-plain milling machines
- 3.7 Be acquainted with the construction and working universal milling machine
- 3.8 Illustrate the construction and working vertical milling machine
- 3.9 Record the specification of milling machine
- 3.10 Identify work holding devices and their purpose
- 3.11 Explain the work holding devices like vices, clamps and T – bolts.
- 3.12 Explain the work holding devices like v blocks, angle plates.
- 3.13 Explain the work holding devices like dividing head and special milling fixture
- 3.14 Identify tool holding devices and their purpose
- 3.15 Explain the arbor and collets
- 3.16 Explain the adapter and spring collet
- 3.17 Perceive about Various Milling operations
- 3.18 Explain the plain ,face , straddle milling
- 3.19 Explain the gang-angular-form-profile-end-saw milling operations
- 3.20 Explain about keyway –gear cutting-flute milling –cam milling operation

**CO4: Illustrate the Working of Grinding Process and apply for engineering applications.
Understand various surface finishing processes and apply for various applications**

- 4.1 Comprehend the principle of metal removal by grinding.
- 4.2 Catalog the purpose of grinding
- 4.3 Record the different types abrasives like natural and artificial
- 4.4 Explain the types of natural abrasives with examples
- 4.5 Explain the artificial abrasives like Silicon Carbide and Aluminum Oxide
- 4.6 Comprehend the bonding materials used in grinding wheel
- 4.7 Elaborate the grit size in grinding wheels
- 4.8 Explain the grades associated with grinding wheel
- 4.9 Explain about vitrified, silicate bond
- 4.10 Explain about shellac ,resinoid bond
- 4.11 Perceive the designation of grinding wheel
- 4.12 State the factors for selecting the grinding wheels.
- 4.13 Record the classification of grinding machines.
- 4.14 Comprehend the working and construction of Cylindrical grinding
- 4.15 Explain about center less grinding
- 4.16 Explain about mounting in wheel maintenance
- 4.17 Differentiate between loading and glazing in grinding wheel
- 4.18 Explain about dressing in grinding wheel
- 4.19 Explain about star wheel dresser
- 4.20 Explain about star diamond wheel dresser
- 4.21 Illustrate the working and construction of surface grinding
- 4.22 Record the different finishing processes
- 4.23 Explain about honing ,lapping ,super finishing
- 4.24 Comprehend the principle of electro-plating with a legible sketch.
- 4.25 Record the different hot dipping processes
- 4.26 Explain the galvanizing
- 4.27 Explain the tin coating
- 4.28 Explain the Parkerizing and anodizing
- 4.29 List and understand the processes of various organic coatings
- 4.30 State the principles of metal spraying.
- 4.31 Select the appropriate process for surface roughness of a given application

CO5: Attain knowledge of identifying types of welding operations safely, efficiently, and to industry standards, thereby preparing them for careers in welding and fabrication across various sectors.

- 5.1 State the necessity of welding.
- 5.2 State the applications of welding
- 5.3 State the advantages and limitations of welding
- 5.4 Record the classification of welding
- 5.5 Explain the principle of arc welding
- 5.6 Explain the MMAW
- 5.7 State The Applications of MMAW
- 5.8 State and explain the equipment of arc welding.
- 5.9 State and explain the accessories of arc welding
- 5.10 State and explain DC welding methods(SP &RP)
- 5.11 State and explain the tools of arc welding
- 5.12 Explain the selection of electrodes
- 5.13 Explain the principle of gas welding.

- 5.14 Record and explain the tools of gas welding
- 5.15 Record and explain the equipment of gas welding
- 5.16 Explain types of flames in gas welding
- 5.17 Explain the different types of gas welding techniques
- 5.18 Explain The Welding Safety and practice
- 5.19 Record the welding defects
- 5.20 Explain the welding defects like undercut, lack penetration
- 5.21 Explain the welding defects like slag inclusion , porosity
- 5.22 Explain the welding defects like weld crack and spatter
- 5.23 Explain the welding defects like poor fusion and distortion
- 5.24 Record the different welding testing and inspection methods
- 5.25 Explain the visual inspection , radiography test in welding inspection
- 5.26 Explain about ultrasonic testing
- 5.27 Explain about magnetic and liquid penetrant test

CO6: Identify the Press tools and apply it in various engineering applications & Identify Special tools for Work holding and guiding for different machining processes

- 6.1 Comprehend the Importance of Press Tools
- 6.2 Record Classify presses based on power and design of frame.
- 6.3 Explain the constructional details of a power press with the help of a legible sketch
- 6.4 State the meaning of Press size.
- 6.5 Identify the Press Tools–Punch and die.
- 6.6 Describe various press working operations.
- 6.7 Explain blanking, piercing and forming,
- 6.8 Explain lancing, cutting off and parting,
- 6.9 Explain notching, shaving, trimming,
- 6.10 Explain embossing, beading and curling.
- 6.11 Explain twisting, coining, swaging, hole flanging or extruding
- 6.12 Explain hole flanging or extruding , bulging
- 6.13 State and explain various die operations
- 6.14 State punch and die materials
- 6.15 Explain the types of jigs their constructional details with the help of legible sketches
- 6.16 State general considerations in design of drill jigs
- 6.17 List different types of fixtures such as milling boring fixtures
- 6.18 Explain the milling fixture with sketch
- 6.19 Explain boring fixtures with sketch
- 6.20 Differentiate between jigs and fixtures.
- 6.21 List the advantages of Jigs and Fixtures
- 6.22 Comprehend basic principle of location.
- 6.23 Identify different locating methods and devices.
- 6.24 Explain the basic principle of clamping.
- 6.25 Identify different types of clamps

REFERENCE BOOKS

1. Production Technology by Jain & Gupta (Khanna Publishers)
2. Elementary Workshop Technology (Vol.I & II) by Hazra Chowdary
3. Manufacturing Technology (Vol.I) by P N Rao (McGraw-Hill)
4. Workshop Technology (Vol.I& II) by Raghuvamshi
5. Production Technology by P.C.Sharma
6. Production Technology (Volume I & II) – O. P. Khanna & Lal, Dhanpat Rai Publications.
7. Fundamental of metal cutting and machine tools– B. L. Juneja, New age international limited.
8. Manufacturing Technology, Metal Cutting & Machine tools– P. N. Rao, Tata McGraw-Hill Publications
9. Production Technology – R.B. Gupta, Satya Prakashan, New Delhi

Suggested E-Learning references

1. <http://www.asme.org>
2. www.ocw.mit.edu/courses/mechanical-engineering
3. www.nptel.ac.in
4. Grinding process <https://www.youtube.com/watch?v=Vcfau3bJ8hE>
5. Milling machine operation <https://www.youtube.com/watch?v=2jc3HkrHh9s>
6. Center less grinding https://www.youtube.com/watch?v=LfbNFTyGW_c
7. Truing and dressing of a Grinding wheel <https://www.youtube.com/watch?v=GOR35qroeew>
8. Manual press <https://www.youtube.com/watch?v=nTshp3STG9M>
9. Hydraulic press <https://www.youtube.com/watch?v=JxJUPD-Ajnc>
10. Die and types <https://www.youtube.com/watch?v=qTuPkrfZB00>
11. Jigs and fixtures <https://www.youtube.com/watch?v=CA3GnflmGmw>

ME-207 - ENGINEERING DRAWING – II

(This Course is Common to all programs of Diploma in Level offered by the State Board of Technical Education, Hyderabad, Telangana State)

Course Title	Engineering Drawing -II	Course Code	ME-207
Semester	II	Course Group	Practical
Teaching Scheme in Periods (L:T:P)	1:0:2	Credits	1.25
Methodology	Teaching + Practice	Total Contact Periods:	45
CIE	60 Marks	SEE	40 Marks

Pre-requisites: Knowledge of Basic Engineering Drawing pictorial intelligence to learn this course.

COURSE OUTCOMES (CO)

Upon successful completion of the course, the students will be able to

Course Outcome		Cognizant Level	Linked Program Objectives (PO)
CO1	Draw the specified projections of solids for the given 3D representation of the regular solids	R / U / A	1, 2, 3, 4, 7
CO2	Create sectional views using cutting-plane lines and appropriate section lining.	R / U / A	1, 2, 3, 4, 7
CO3	Practice drawing auxiliary views of engineering components, ensuring accuracy and alignment with other views.	R / U / A	1, 2, 3, 4, 7
CO4	Create detailed engineering drawings that include isometric views to provide a comprehensive understanding of component geometry.	R / U / A	1, 2, 3, 4, 7
CO5	Identify different types of surfaces and their corresponding development methods, such as cylindrical, conical, and spherical surfaces.	R / U / A	1, 2, 3, 4, 6, 7
CO6	Appraise the drawing principles and appreciate its applications in engineering field.	R / U / A	1, 2, 3, 4, 7

BLUEPRINT OF MARKS FOR SEE

Unit No	Name of the Unit	Periods	Questions to be set for SEE		
			R	U	A
			PART-A (2M Questions)		PART-B (6 M Questions)
1	Projection of Solids	08	Q1		Q9(a)
2	Sectional Views	08	Q2		Q9(b)
3	Auxiliary views	06	Q3		Q10(a)
4	Pictorial drawing	09	Q4		Q10(b)
5	Development of surfaces	14	Q5, Q6, Q7, Q8		Q11(a), Q11(b), Q12(a), Q12(b)
Total Periods / Total Questions		45	8		4
[R: Remembering, U: Understanding – 2 Marks] [A: Application – 6 Marks] <u>Note:</u> Question Paper consists PART – A and PART-B, Total Marks: 40, Time: 2 Hours PART – A consists of 8 and student have to answer ALL questions, each question carries 2 marks ($8 \times 2 = 16$) PART – B consists of 4 questions and student have to answer ALL questions, each question carries 6 marks ($4 \times 6 = 24$)					

COURSE CONTENT

1.0 Projection of solids

(08 periods)

Projection of regular solids

- a) Axis perpendicular to one of the planes
- b) Axis parallel to VP and inclined to HP and vice versa.

2.0 Sectional views

(08 periods)

Need for drawing sectional views – what is a sectional view - Location of cutting plane – Purpose of cutting plane line – Selection of cutting plane to give maximum information (vertical and offset planes) - Hatching – Section of regular solids inclined to one plane and parallel to other plane

3.0 Auxiliary views

(06 periods)

Need for drawing auxiliary views -Explanation of the basic principles of drawing an auxiliary views - explanation of reference plane and auxiliary plane -Partial auxiliary view.

4.0 Pictorial Drawings

(09 periods)

Brief description of different types of pictorial drawing viz., Isometric, oblique, and perspective and their use - Isometric drawings: Isoaxis, angle between them, meaning of visual distortion in dimensions - Need for an isometric scale, difference between Isometric scale and ordinary scale difference between Isometric view and Isometric projection - Isometric and non-Isometric lines -Isometric drawing of common features like rectangles, circular shapes, non-isometric lines - Use of box and offset methods.

5.0 Development of Surfaces

(14 periods)

Need for preparing development of surface with reference to sheet metal work - Concept of true length of a line with reference to its orthographic projection when the line is (i) parallel to the plane of projection (ii) inclined to one principal and parallel to the other -Development of simple solids like cubes, prisms, cylinders, cones, pyramid (sketches only) -Types of development: Parallel line and radial line development -Procedure of drawing development, drawings of trays, funnels, elbow pipes and rectangular ducts.

REFERENCE BOOKS

1. Engineering Drawing by Kapil dev – (Asian Publisher)
2. Engineering Drawing by Basant Agarwal & C.M Agarwal - (McGraw-hill)
3. Engineering Drawing by N.D.Bhatt. (Charotar Publishing House Pvt. Ltd.)
4. A Textbook on Engineering Drawing by P. Kannaiah, K. L. Narayana, K. Venkata Reddy
5. Engineering drawing + AutoCAD by Venugopal, K, New Delhi : New Age International

ONLINE RESOURCES

1. <https://nptel.ac.in/courses>
2. <https://nptel.ac.in/courses/124107159>
3. www.slideshare.net/shameem.mist/engineering-drawing
4. https://www.powershow.com/viewfl/76303aOWI5M/Engineering_Drawing_powerpoint_ppt_presentation
5. https://www.powershow.com/view0/91a2bfN2Q2N/Basic_engineering_drawing_solved_question_powerpoint_ppt_presentation

SPECIFIC LEARNING OUTCOMES

CO1: Draw the specified projections of solids for the given 3D representation of the regular solids

- 1.1. Draw the projections of solids to axis of solids parallel to one plane.
- 1.2. Draw the projections of solids to axis of solid inclined to other plane.

CO2: Create sectional views using cutting-plane lines and appropriate section lining.

- 2.1 Explain the need to draw sectional views.
- 2.2 Select the section plane for a given component to reveal maximum information.
- 2.3 Explain the positions of section plane with reference planes
- 2.4 Differentiate between true shape and apparent shape of section
- 2.5 Draw sectional views and true sections of regular solids discussed in 6.0
- 2.6 Apply principles of hatching.

CO3: Practice drawing auxiliary views of engineering components, ensuring accuracy and alignment with other views.

- 3.1 State the need of Auxiliary views for a given engineering drawing.
- 3.2 Draw the auxiliary views of a given engineering component
- 3.3 Differentiate between auxiliary view and apparent view

CO4: Create detailed engineering drawings that include isometric views to provide a comprehensive understanding of component geometry.

- 4.1 State the need of pictorial drawings.
- 4.2 Differentiate between isometric scale and true scale.
- 4.3 Prepare Isometric views for the given orthographic drawings.

CO5: Identify different types of surfaces and their corresponding development methods, such as cylindrical, conical, and spherical surfaces.

- 5.1 State the need for preparing development drawing.
- 5.2 Prepare development of simple engineering objects (cubes, prisms, cylinders, cones, pyramid) using parallel line and radial line method.
- 5.3 Prepare development of surface of engineering components like trays, funnel, 90° elbow & rectangular duct.

COURSE-PO ATTAINMENT MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	2	2	-	-	3
CO2	3	3	3	2	-	-	3
CO3	3	3	3	2	-	-	3
CO4	3	2	3	3	-	-	3
CO5	3	2	2	2	-	-	3
CO6	3	2	2	2	-	-	3

**BOARD DIPLOMA EXAMINATION, (C-24)DME – II SEMESTER
MID SEM - I EXAMINATION
ENGINEERING DRAWING - II**

Time: 1 Hours]

[Total Marks: 20

PART-A

4x2=8

Instructions :

1. Answer **ALL** questions.
2. Each question carries **TWO** marks.

1. Draw the projections of a triangular prism of base side 35 mm, resting on H.P. on its base such that one of its base side is perpendicular to V.P.
2. Draw the projections of a cone of base diameter 40 mm and height 60 mm resting on H.P. on its base.
3. A cube of base side 30 mm resting on its base on H.P. such that one of its base side is making an angle of 30^0 to V.P. A sectional plane parallel to H.P passes through the axis at a distance of 20 mm from the base. Draw the sectional top view of the truncated cube.
4. Draw the sectional top view of the square pyramid of base side 30 mm and height 60 mm is resting on HP on its base with one of its base side is parallel to V.P. when it is cut by a horizontal section plane at a distance of 30 mm from the apex.

PART-B

2x6=12

Instructions :

1. Answer any **ALL** questions.
2. Each question carries **SIX** marks.

5. (a). Draw the projections of a pentagonal pyramid, base 30 mm edge and axis 50 mm long, having its base on the H.P. and an edge of the base parallel to the V.P. Also draw its side view.

(Or)

5. (b). A tetrahedron of 50 mm long edges is resting on the H.P. on one of its faces, with an edge of that face parallel to the V.P. Draw its projections.

6. (a) A cube of 35 mm long edges is resting on the H.P. on one of its faces with a vertical face inclined at 30° to the V.P. It is cut by a section plane parallel to the V.P. and 9 mm away from the axis and further away from the V.P. Draw its sectional front view and the top view.

(Or)

6. b) A cylinder of 40 mm diameter, 60 mm height and having its axis vertical, is cut by a section plane, perpendicular to the V.P., inclined at 45° to the H.P. and intersecting the axis 32 mm above the base. Draw its front view, sectional top view and true shape.

BOARD DIPLOMA EXAMINATION, (C-21)
DME – II SEMESTER
MID SEM- II EXAMINATION
ENGINEERING DRAWING - II

Time: 1 Hours]

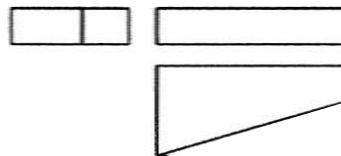
[Total Marks: 20

PART-A

4x2=8

- Instructions :**
1. Answer **ALL** questions.
 2. Each question carries **TWO** marks.

1. What is the need for an auxiliary view?
2. A cube of side 30 mm placed on HP and sectioned diagonally, draw the auxiliary view of the inclined surface.
3. Draw the isometric view of a block whose orthographic projections are given below assume proper dimensions.



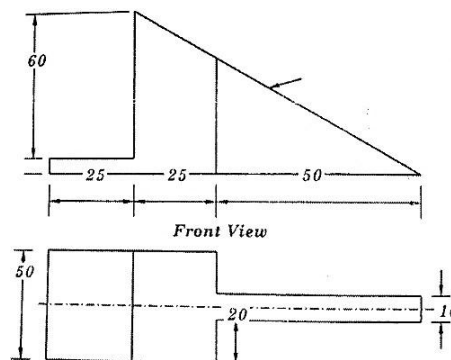
4. Draw the isometric view of a hexagonal plane of base side 30 mm when one of its side is parallel to H.P, when it is horizontal.

PART-B

2x6=12

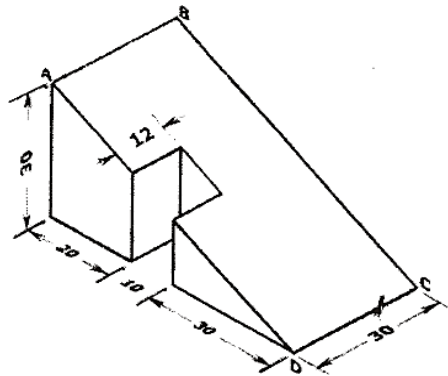
- Instructions :**
1. Answer any **ALL** questions.
 2. Each question carries **SIX** marks.

5. (a) Draw the auxiliary view of a component given below.

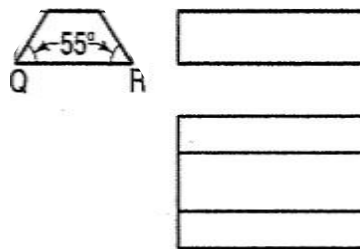


(Or)

5. (b) Draw the auxiliary view of the slopping surface of the cast iron block as shown in the figure.

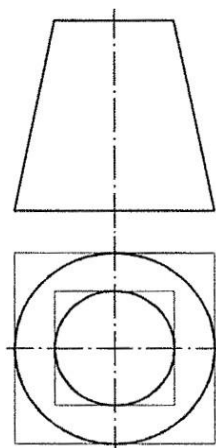


6. (a) Draw the isometric view of the block whose orthographic projections are given below by assuming proper dimensions.



(Or)

6. (b) Draw the isometric drawing of the frustum of a cone shown in figure with proper dimensions.



MODEL PAPER SEE
BOARD DIPLOMA EXAMINATION, (C-21)
DME-II SEMESTER END EXAMINATION
ENGINEERING DRAWING - II

Time: 2hours]

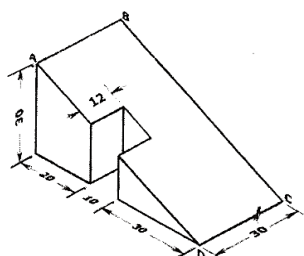
[Total Marks:40

Important Note: Wherever any question has choice, marks will be allotted only to first attempted question. **No marks will be allotted for extra questions answered.**

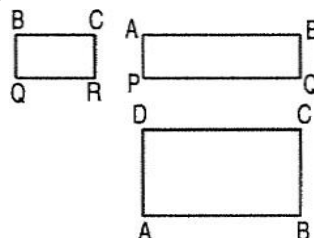
PART-A

- Instructions :**
1. Answer **ALL** questions. 8x2=16
 2. Each question carries **TWO** marks.
 3. All the dimensions are in mm.

1. Draw the projections of the cone with 30 mm height and 10 mm base circle radius, resting on H.P. on its base.
2. A cylinder with base radius 20 mm and height 60 mm resting on the ground, a 30° inclined section plane perpendicular to V.P. cuts the cylinder axis at mid-point. Draw the sectional top view of the cylinder.
3. Draw the auxiliary view of sloping surface of the object whose isometric view is given below.



4. Draw the isometric view of a block whose orthographic views are given below by assume proper dimensions.



5. Develop the lateral surface of a cube of side length 30 mm.
6. Develop the lateral surface of a triangular pyramid of base side 25 mm and height 50 mm.
7. Develop the lateral surface of a cylinder of base diameter 60 mm.
8. Develop the lateral surface of a hexagonal prism of base side 25 mm and 60 mm height.

PART-B

4x6=24

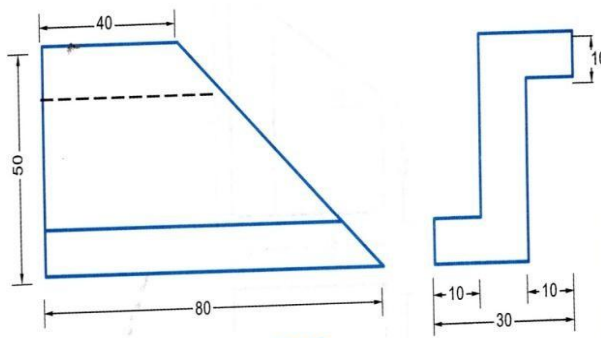
- Instructions :**
1. Answer any **ALL** questions.
 2. Each question carries **SIX** marks.
 3. All the dimensions are in mm.

9. a) Draw the projection of a cone of base diameter 50 mm and height 80 mm when its axis is making an angle of 45° to H.P and parallel to the V.P.

(Or)

9. b) A triangular prism, base 30 mm side and axis 50 mm long, is lying on the H.P. on one of its rectangular faces with its axis inclined at 30° to the V.P. It is cut by a horizontal section plane, at a distance of 12 mm above the ground. Draw its frontview and sectional top view.

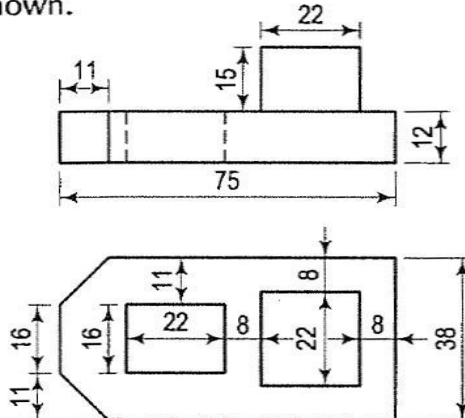
10. a) Draw the auxiliary view of sloping surface of an object shown in figure.



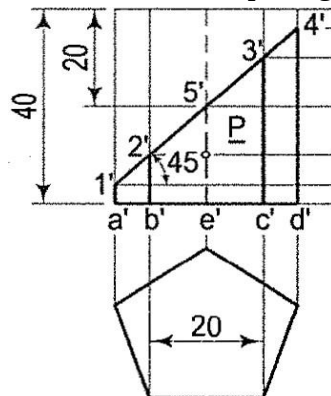
(Or)

10. b) Draw the isometric view of the block, whose orthographic views are shown in figure.

shown.

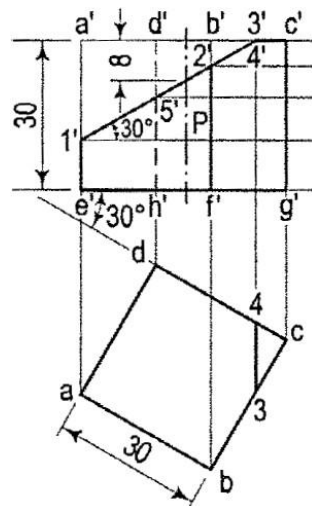


11. a) Develop the lateral surface of the truncated pentagonal prism as shown in figure.

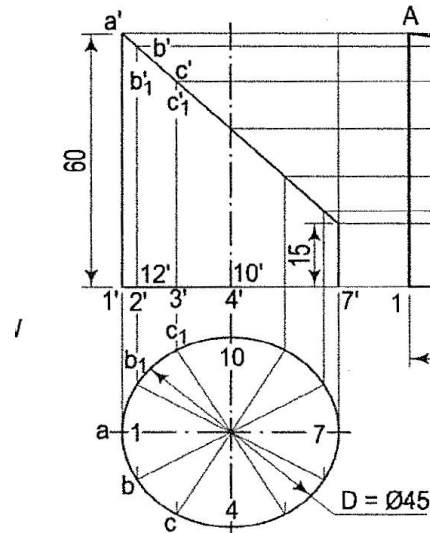


(Or)

11. b) Draw the development of a truncated cube shown in below figure.

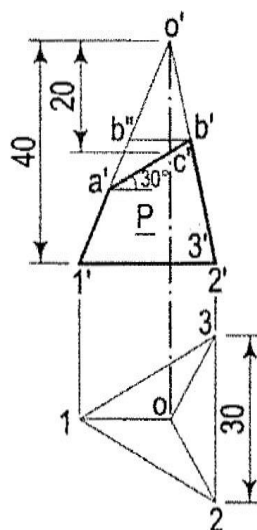


12. a) Develop of bottom portion of the truncated cylinder.



(Or)

12. b) Develop the portion 'P' in the below figure.



ME-208 - CAD LAB

Course Title :	CAD Lab	Course Code	ME-208
Semester	II	Course Group	Practical
Teaching Scheme In Periods(L:T:P)	1:0:2	Credits	1.25
Methodology	Lectures + Practice	Total Contact Periods:	45
CIE	60Marks	SEE	40Marks

Pre requisites This course requires the Basic CAD Skills and concepts of engineering drawing

COURSE OUTCOMES

At the end of the course the students will be able to:

CO	Course Outcomes (COs)
CO1	Apply basic CAD commands for entity creation, selection, and modification (lines, circles, arcs, rectangles, etc.) using absolute, relative cartesian, and polar coordinate systems.
CO2	Utilize advanced modification tools (trim, extend, stretch, fillet, chamfer) to create complex 2D shapes and leverage information retrieval tools (measure, area calculation, object properties) for accurate drawing creation.
CO3	Employ text tools for effective annotation with proper formatting and placement. Apply various dimensioning techniques (linear, angular, radial) with appropriate style control to create clear and informative drawings.
CO4	Implement layer management strategies (creation, visibility, locking, properties) to organize and control drawing elements. Utilize blocks to create reusable components and enhance drawing efficiency.
CO5	Demonstrate proficiency in basic 3D modeling techniques (extrusion, revolve, sweep, loft) to convert 2D drawings into 3D models and perform basic 3D viewing and editing tasks.
CO6	Integrate cumulative CAD skills to create a complex 2D or a simple 3D model, showcasing effective application of learned concepts in a practical scenario.

COURSE CONTENTS

UNIT 1: CAD Fundamentals (15 Periods)

Theory (3 Periods):

Introduction to CAD- Definition of Computer-Aided Drafting, Advantages of CAD, Overview of common CAD software (AutoCAD, Intelli CAD, ProG CAD, etc), Features of a CAD workstation- CAD Environment- Screen elements (drawing area, menus, toolbars), Navigating toolbars and menus- Basic Commands- Selection methods, Creating simple entities (lines, circles, arcs, rectangles, polygons), Saving and opening drawings- Coordinate Systems- Absolute coordinates, Relative cartesian coordinates, Polar coordinates.

Practice (12 Periods):

Practice with basic entity creation, Exercises using different coordinate systems, Practice with basic modification tools (move, copy, delete, mirror), Grid and snap settings configuration, Viewing tools practice (zoom, pan, scroll).

UNIT 2: Advanced Modifications & Information (10 Periods)

Theory (2 periods):

Advanced Modification Tools- Trim, Extend, Stretch, Fillet, Chamfer, Arrays- Information Retrieval Tools- Measure distance, Calculate areas, Object properties.

Practice (8 periods):

Practice creating complex shapes using advanced modification tools - Array (rectangular and polar) exercises - Practice using measure, divide, and object property tools.

UNIT 3: Text, Dimensioning, & Drawing Practice (8 Periods)

Theory (2 Periods):

Text Tools- Font styles, Text creation, Text alignment- Dimensioning- Dimensioning types (linear, angular, radial, etc), Controlling dimension styles (arrows, text format, etc).

Practice (6 Periods):

Text creation, formatting, and placement exercises - Dimensioning practice on simple 2D objects - Creating simple 2D component drawings.

UNIT 4: Layers and Blocks (5 Periods)

Theory (1 Period):

Layers- Creating layers, Layer visibility, Locking layers, Changing layer properties (color, line type, line weight), Printing on/off layers- Blocks- Concept of blocks, Creating blocks, Inserting blocks.

Practice (4 Periods):

Exercises on layer management within drawings - Practice creating and using blocks effectively.

UNIT 5: Introduction to 3D (5 Periods)

Theory (1 Period):

3D Modeling Fundamentals- Converting 2D to 3D- Extrusion, Revolve, Sweep, Loft.

Practice (4 periods):

Create basic 3D objects (boxes, cylinders, cones, spheres, wedges, tori, prisms, pyramids) - Practice viewing and basic editing in 3D.

UNIT 6: Project-Based Application(2 Periods)

Project-Based (2 Periods):

Students create a more complex 2D or simple 3D model using their cumulative skills.

RECOMMENDED BOOKS

1. Auto cad by George Omura
2. 4MCADUserGuide- Intelli CAD Technology Consortium

SPECIFIC LEARNING OUTCOMES

CO1: Apply basic CAD commands for entity creation, selection, and modification (lines, circles, arcs, rectangles, etc.) using absolute, relative cartesian, and polar coordinate systems.

1. Introduction to CAD
 - 1.1 Define Computer-Aided Drafting (CAD).
 - 1.2 Identify at least three advantages of CAD over traditional drafting methods.
 - 1.3 List three common CAD software options.
 - 1.4 Describe the basic components of a CAD workstation (monitor, input devices, etc.).
2. CAD Environment
 - 2.1 Identify the drawing area, menus, and toolbars within the CAD interface.
 - 2.2 Demonstrate how to navigate menus and toolbars.
 - 2.3 Select objects using a mouse or other input device.
3. Basic Commands
 - 3.1 Create lines, circles, arcs, rectangles, and polygons.
 - 3.2 Save a CAD drawing.
 - 3.3 Open an existing CAD drawing.
4. Coordinate Systems
 - 4.1 Define absolute, relative cartesian, and polar coordinate systems.
 - 4.2 Demonstrate how to use each coordinate system to draw basic shapes.

CO2: Utilize advanced modification tools (trim, extend, stretch, fillet, chamfer) to create complex 2D shapes and leverage information retrieval tools (measure, area calculation, object properties) for accurate drawing creation.

1. Advanced Modification Tools
 - 1.1 Use the trim tool to modify object lengths.
 - 1.2 Use the extend tool to modify object lengths.
 - 1.3 Use the stretch tool to resize objects.
 - 1.4 Use the fillet tool to create rounded corners.
 - 1.5 Use the chamfer tool to create beveled edges.
2. Information Retrieval Tools
 - 2.1 Use the distance measurement tool.
 - 2.2 Use the area calculation tool.
 - 2.3 Access the object properties window.
3. Drawing Practice
 - 3.1 Create a complex shape using a combination of basic entities and modification tools.
 - 3.2 Create a rectangular array of objects.
 - 3.3 Create a polar array of objects.

CO3: Employ text tools for effective annotation with proper formatting and placement. Apply various dimensioning techniques (linear, angular, radial) with appropriate style control to create clear and informative drawings.

1. Text Tools

- 1.1 Select a font style from available options.
- 1.2 Change the size of text elements.
- 1.3 Create a single-line text object.
- 1.4 Create a multi-line text object.
- 1.5 Position text within the drawing.
- 1.6 Align text (left, center, right, justified).

2. Dimensioning

- 2.1 Add a linear dimension.
- 2.2 Add an angular dimension.
- 2.3 Add a radial dimension.
- 2.4 Modify the appearance of dimension arrows.
- 2.5 Modify the format of dimension text.

3. Drawing Practice

- 3.1 Create a simple 2D component drawing.
- 3.2 Add appropriate text annotations to the drawing.
- 3.3 Add necessary dimensions to fully define the component.

CO4: Implement layer management strategies (creation, visibility, locking, properties) to organize and control drawing elements. Utilize blocks to create reusable components and enhance drawing efficiency.

1. Layers

- 1.1 Explain the purpose of layers in CAD drawings.
- 1.2 Create a new layer.
- 1.3 Assign a name to a layer.
- 1.4 Change the color of a layer.
- 1.5 Change the line type of a layer.
- 1.6 Change the line weight of a layer.
- 1.7 Set a layer as the current active layer.
- 1.8 Turn layer visibility on or off.
- 1.9 Freeze or thaw a layer.
- 1.10 Lock or unlock a layer.

2. Blocks

- 2.1 Define the concept of a block in CAD.
- 2.2 Explain the advantages of using blocks.
- 2.3 Create a block from existing geometry.
- 2.4 Insert a block instance into a drawing.
- 2.5 Move a block instance.
- 2.6 Rotate a block instance.
- 2.7 Scale a block instance.
- 2.8 Explode a block instance.

CO5: Demonstrate proficiency in basic 3D modeling techniques (extrusion, revolve, sweep, and loft) to convert 2D drawings into 3D models and perform basic 3D viewing and editing tasks.

1. 3D Modeling Fundamentals
 - 1.1 Explain the basic difference between 2D and 3D CAD modeling.
 - 1.2 Describe the extrusion method of creating 3D objects.
 - 1.3 Describe the revolve method of creating 3D objects.
2. 3D Creation
 - 2.1 Create a basic box shape using extrusion.
 - 2.2 Create a basic cylinder shape using revolve.
 - 2.3 Create other basic 3D shapes (cone, sphere, wedge, etc.)
3. 3D Navigation & Editing
 - 3.1 Use orbit, pan, and zoom tools to view a 3D model.
 - 3.2 Move a 3D object.
 - 3.3 Copy a 3D object.

CO6: Integrate cumulative CAD skills to create a complex 2D or a simple 3D model, showcasing effective application of learned concepts in a practical scenario.

1. Planning
 - 1.1 Choose a project that aligns with the skills learned (more complex 2D drawing or simple 3D model).
 - 1.2 Sketch or outline a basic plan for the project.
 - 1.3 Identify the CAD tools and techniques needed for the project.
2. Execution
 - 2.1 Create a new CAD drawing with appropriate settings.
 - 2.2 Apply drawing commands to build the chosen object or component.
 - 2.3 Utilize layers effectively to organize the drawing.
 - 2.4 Use blocks where appropriate to increase efficiency.
 - 2.5 Add necessary text and dimensions, ensuring clarity and accuracy.
 - 2.6 Employ 3D modeling techniques (if chosen for the project).
3. Problem-Solving
 - 3.1 Troubleshoot any issues encountered during the creation process.
 - 3.2 Reference help resources or seek assistance if needed.
 - 3.3 Adapt the approach as needed to achieve the desired outcome of the project.
4. Presentation
 - 4.1 Save the final project in an appropriate format.
 - 4.2 Prepare the project for presentation (This might include printing, creating screenshots, or preparing a 3D rendering).

Unit	Exercise	Key Components
Unit 1	Basic Shape Creation: Create drawings with lines, circles, arcs, rectangles, and polygons	Coordinate systems, selection tools, basic drawing commands
	Entity Modification: Modify existing shapes using editing tools	Move, copy, trim, extend, offset
	File Management Save, open, and close drawings	File formats, project organization
Unit 2	Advanced Modification: Create a more complex shape by combining basic entities and advanced tools	Trim, extend, stretch, fillet, chamfer, arrays
	Measuring & Analysis: Calculate the area, perimeter of shapes on a drawing	Measurement tools, object properties window
Unit 3	Component Drawing: Create a detailed 2D drawing of a mechanical part	Text tools, dimensioning, dimension styles, drawing conventions
Unit 4	Layer & Block Usage: Create a drawing with multiple components, organizing them on separate layers	Layer creation, properties, visibility, blocks (create, insert)
Unit 5	3D Fundamentals: Convert a 2D component drawing into a simple 3D model	Extrusion, revolve, sweep, loft, basic 3D navigation
Unit 6	Project Application: Design and execute a more complex 2D or simple 3D model project	Cumulative CAD skills, planning, problem-solving, presentation

CO-POMATRIX

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	1.5	3	3	3	1.5	3	3
CO2	1.5	1.5	3	3	1.5	3	3
CO3	2	1.5	3	1	2	3	1
CO4	1.5	3	3	3	1.5	3	3
CO5	3	1.5	1.5	1.5	3	3	1.5
CO6	1.5	0	3	3	1.5	1.5	3

ME-208- CAD Lab
Lab MODEL PAPER FOR
MID-I (CIE)

TIME: 2hr

Marks: 20M

PART-A

NOTE: Answer all questions

4X 2 =8marks

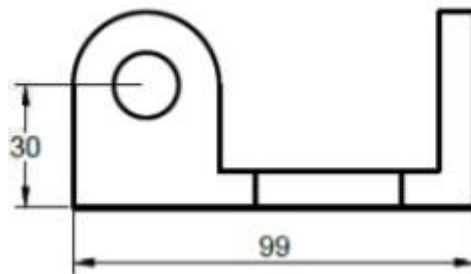
1. Draw a square of 50x50mm by using any CAD software.
2. Draw an equilateral triangle of 50mm side by using any CAD software.
3. Draw a line of 10mm and divide it into four equal parts.
4. Draw a pentagon of side 60mm and calculate its area by using any CAD software.

PART-B

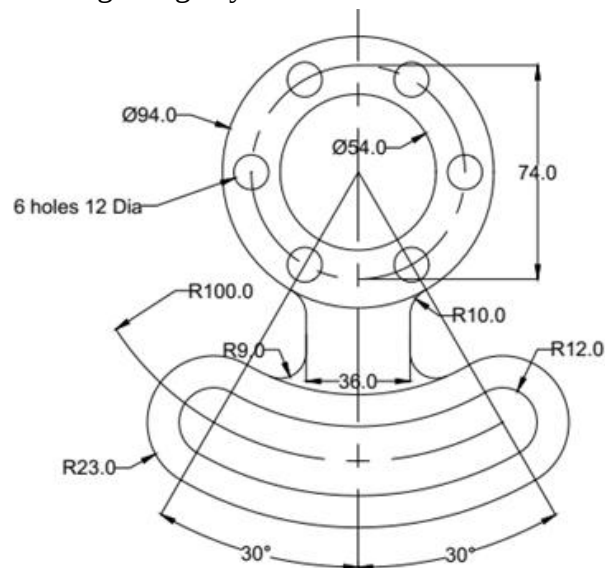
NOTE: Answer any one questions

1 X 12 =12marks

5. Draw the following using any CAD soft ware and add dimensioning.



6. Draw the following using any CAD software and add dimensioning.



ME-208- CAD Lab
MODEL PAPER FORM ID-II(CIE)

TIME: 2hr

Marks: 20M

PART-A

NOTE: Answer all questions

4X 2 = 8marks

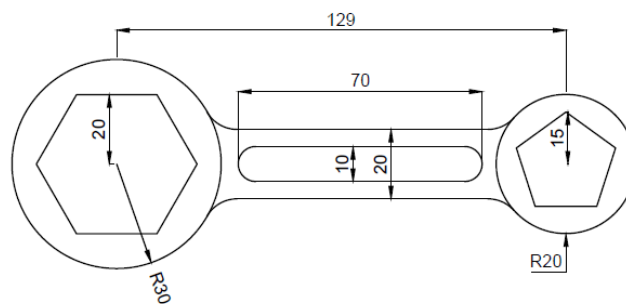
1. Write text "CAD Lab" with Calibri font style and font size 10 by using any CAD software.
2. Draw a line of 10mm, divide it into four equal parts and add continuous dimensions to the divided line.
3. Create four layers, name the layers and assign different properties like line color, line type, line weight to different layers.
4. Write the procedure to create a block.

PART-B

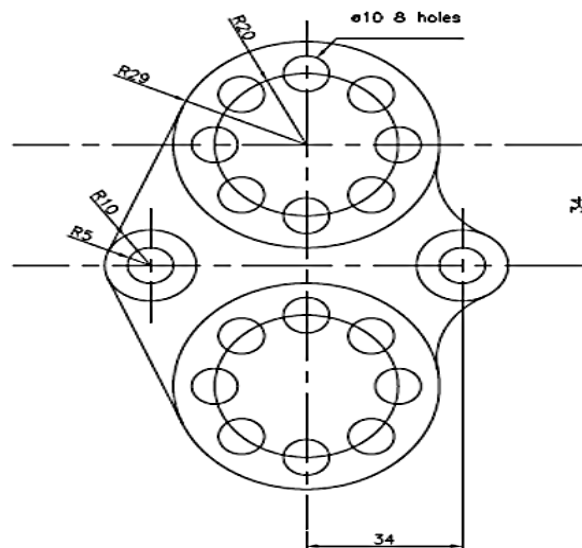
NOTE: Answer any one question

1 X 12 = 12marks

5. Draw the following using Layers. Use different layers for different line types, text, dimension and main figure.



6. Draw the following using Layers. Use different layers for different line types, text, dimension and main figure.



ME-208- CAD Lab
MODEL PAPER FORSEE

TIME:3hr

Marks:40M

PART-A

NOTE: Answer all questions

4X 4 =16marks.

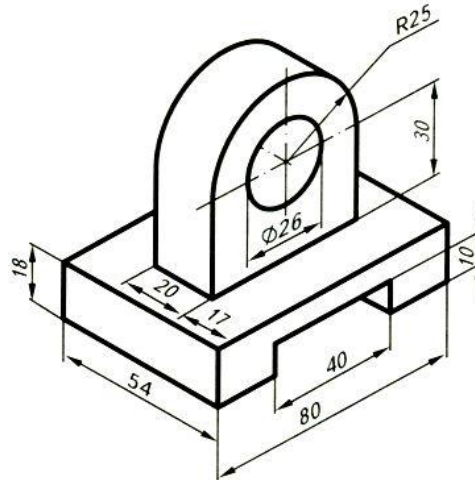
1. Draw a hexagon of 60mm side and add dimensions to it.
2. Create a rectangular array of 10mm diameter circles in 4 rows, 4 columns with 20mm space between each row and column.
3. Create four layers, name the layers and assign different properties like line color, line type, line weight to different layers.
4. Write the procedure to create and insert a block.

PART-B

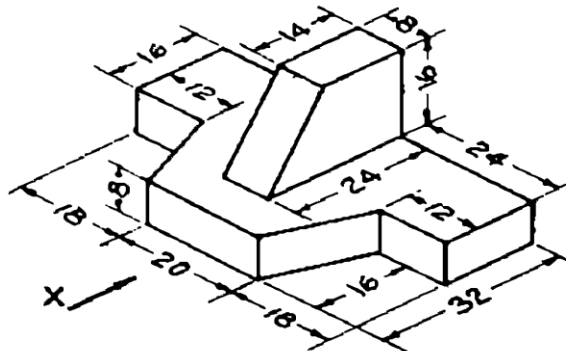
NOTE: Answer any one questions

1X 24 =24marks

5. (a) Draw the following 3D object CAD software. 20+4marks
(b) List the commands in sequence and also write the procedure



6. (a) Draw the following 3D object in CAD software. 20+4marks
(b) List the commands in sequence and also write the procedure



SC-209 - APPLIED SCIENCE LAB

Course Title	Applied Science Lab	Course Code	SC-209
Semester	II Semester	Course Group	Practical
Teaching Scheme in Periods (L:T:P)	15:0:30	Credits	1.25
Type of course	Lecture + Practical	Total Contact Periods	45
CIE	60 Marks	SEE	40 Marks

SC-209 (A) Physics Lab

Pre requisites:

This course requires the basic knowledge of Science and Mathematics.

Course Outcomes

Upon completion of the course, the student shall be able to

CO1	Determine the value of acceleration due to gravity using simple pendulum and verify with $L-T^2$ graph.
CO2	Determine the velocity of sound in air at room temperature and calculate velocity of sound at 0°C .
CO3	Draw magnetic lines of force, locate neutral points and calculate magnetic moment of a bar magnet.
CO4	Determine the specific resistance of given wire using meter bridge.
CO5	Determine the refractive index of a solid using travelling microscope
CO6	Develop V-I characteristics of Photocell (Demonstration only)

	Basic and Discipline Specific Knowledge	Problem Analysis	Design/Development of Solutions	Engineering Tools, Experimentation and Testing	Engineering Practices Engineering Practices for Society, Sustainability and Environment	Project Management	Lifelong Learning	Linked PO
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	
CO1	3					1	1	1,6,7
CO2	3					1	1	1,6,7
CO3	3					1	3	1,6,7
CO4	3					1	3	1,6,7
CO5	3					1	3	1,6,7

Learning outcomes

On successful completion of the course, the student will have ability to:

1. Determine the value of acceleration due to gravity using simple pendulum and verify with $L-T^2$ graph.
2. Determine the velocity of sound in air at room temperature and calculate velocity of sound at 00 C.
3. Draw magnetic lines of force, locate neutral points and calculate magnetic moment of a bar magnet. Determine the specific resistance of given wire using meter bridge.
4. Determine the refractive index of a solid using travelling microscope.
5. V-I characteristics of Photocell (Demonstration only)

Course Delivery:

The course will be delivered through lectures, class room interaction, group discussions, graded exercises, demonstration and practice.

Tutorial: 1 Period/Experiment:

1. Introduction to Physics practical and its importance, safety precautions in maintenance of equipment in the laboratory.
2. Maintenance of apparatus and equipment.
3. Follow of Do's and Don'ts.
4. Maintenance of data in manual and record book.
5. Write the procedure of the experiment before the commencement of each experiment.
6. Strictly following of instructions given from time to time by the lecturer-in-charge.
7. Demonstration of each experiment by the lecturer in charge.

Conduction of experiments: 2 periods/Experiment.

Student must perform experiment individually under the supervision of the lecturer-in charge.

EXAMINATION & EXPERIMENTS		
S.NO	EXAMINATION	EXPERIMENTS
1	MIDSEM-I	EXPERIMENT NO 1 & 2
2	MIDSEM-II	EXPERIMENT NO 3 & 4
3	SEMESTER END EXAMINATION	EXPERIMENT NO 1,2,3,4 and 5

Scheme of Valuation of SEE		
S. No	Particulars	Marks
1.	Objective/Aim	01
2.	Apparatus/Equipment	02
3.	Observations	02
4.	Principle including formula	02
5.	Experiment (Tabular form, readings, etc)	05
6.	Calculation and Result	05
7.	Viva Voce	03
	Total	20

References:

1. Intermediate Physics lab manual – Telugu Academy
2. Laboratory manual for class XI and XII – NCERT

SC-209 (B) Chemistry Lab

Prerequisite: Knowledge of basic concepts of Chemistry of Secondary Education

Course Objectives: To provide practical knowledge about the basics of volumetric analysis of chemical compounds

Course Outcomes: On successful completion of the course, the student will have ability to attain the following COs

Course Outcome	
CO1	Determine the molarity of potassium permanganate solution.
CO2	Estimate the amount of the Mohr's salt in the given solution.
CO3	Determine of acidic impurities present in water samples.
CO4	Determine of alkaline impurities present in water samples.
CO5	Estimate the amount of the chlorides in the water sample.

CO-PO Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	-	-	-	-	1	1
CO2	3	-	-	-	-	1	1
CO3	3	-	-	-	2	1	1
CO4	3	-	-		2	1	1
CO5	3	-	-	-	2	1	1

Course Delivery: The course will be delivered through lectures, classroom interaction, group discussion, demonstration and practical.

Conduction of experiments: Lecture 1 period + Experiment 2 periods.

Student must conduct experiment individually under the supervision of the staff-in-charge.

Lecture and Demonstration: 1 Period

1. Introduction of chemistry practical and its importance, safety precautions in maintenance of cleanliness and orderliness of chemicals in the laboratory.
2. Maintenance of apparatus and equipment.
3. Follow of Do's and Don'ts.
4. Maintenance of data in record book.
5. Write the procedure of the experiment before the commencement of each experiment.
6. Strict following of instructions given from time to time by the staff-in-charge.
7. Demonstration of each experiment by the staff in-charge.

Course content

Volumetric Analysis: (22.5 Periods) Volumetric Analysis by Titrimetric Method:-

Volumetric Analysis -Titration – Standard solutions - Concentration of solutions - Indicators– Self indicator- Acid base indicators- Selection of indicators-End point of titration - Neutralization.

List of experiments:

1. Determination of molarity of KMnO_4 by using standard oxalic acid solution
2. Estimation of Mohr's salt by using standard KMnO_4 solution.
3. Determination of acidity of water sample by using standard NaOH solution.
4. Determination of alkalinity of water sample by using standard H_2SO_4 solution.
5. Estimation of chloride content present in water sample by using standard AgNO_3 solution.

Specific Learning Outcomes

Upon completion of the course, the student will have ability to

1. Determine the molarity of KMnO_4 by using 0.1 M oxalic acid solution
2. Estimate Mohr's salt by using 0.05M potassium permanganate solution.
3. Determine the partial and total acidity of water sample by using 0.02N NaOH solution.
4. Determine the partial and total alkalinity of water sample by using 0.02N H_2SO_4 solution.
5. Estimate the chloride content present in water sample by using 0.0141N AgNO_3 solution.

Reference Books:

1. Vogel's In organic Qualitative and Quantitative Analysis.
2. Practical chemistry by O.P. Pande & others.
3. Qualitative and quantitative analysis by Alex.

EXAMINATION & EXPERIMENTS		
S.NO	EXAMINATION	EXPERIMENTS
1	MIDSEM-I	Experiment No 1 & 2
2	MIDSEM-II	Experiment No 3 & 4
3	SEMESTER END EXAMINATION	Experiment No 1, 2, 3, 4 and 5

Scheme of Valuation for SEE		
Sl.No.	Particulars	Marks
1	Identification of apparatus/equipment/chemical compounds/tools/etc.	2
2	Writing Principle and Procedure	5
3	Experiment and Observations	6
4	Calculation and Results	4
5	Viva-voce	3
Total		20

BOARD DIPLOMA EXAMINATION, (C-24)
SECOND SEMESTER EXAMINATION
MIDSEM – I
SC-209: APPLIED SCIENCE LAB

TIME: 1 Hour

TOTAL MARKS: 20

Instructions: (1) Answer both PART-A AND PART-B on separate answer sheets.
(2) Each question carries **TEN** marks.

PART-A (PHYSICS LAB)

Perform ONE experiment allotted by the examiner.

1 x 10 = 10

1. Determine the value of acceleration due to gravity using L-T² graph.
2. Determine the value of acceleration due to gravity using simple pendulum.
3. Determine the velocity of sound in air at room temperature.
4. Determine the velocity of sound in air at room temperature and calculate velocity of sound at 0° C.

PART-B (CHEMISTRY LAB)

Perform ONE experiment allotted by the examiner.

1 x 10 = 10

1. Determine the molarity of KMnO₄ solution by using 0.1M oxalic acid.
2. Estimate the amount of Mohr's salt present in the given 500 ml of solution by using 0.02M Potassium permanganate solution
3. Estimate the amount of Mohr's salt present in the given 750 ml of solution by using 0.02M Potassium permanganate solution.

BOARD DIPLOMA EXAMINATION, (C-24)
SECOND SEMESTER EXAMINATION
MIDSEM – II
SC-209: APPLIED SCIENCE LAB

TIME: 1 Hour

TOTAL MARKS: 20

Instructions: (1) Answer both PART-A AND PART-B on separate answer sheets.
(2) Each question carries **TEN** marks.

PART-A (PHYSICS LAB)

Perform ONE experiment allotted by the examiner.

1 x 10 = 10

1. Draw magnetic lines of force and calculate magnetic moment of a bar magnet.
2. Draw magnetic lines of force and locate neutral points of a bar magnet.
3. Determine the specific resistance of given wire using meter bridge.
4. Determine the resistance of given wire using meter bridge.

PART-B (CHEMISTRY LAB)

Perform ONE experiment allotted by the examiner.

1 x 10 = 10

1. Determine the partial acidity of water sample by using 0.02N NaOH solution.
2. Determine the total acidity of water sample by using 0.02N NaOH solution
3. Determine the partial alkalinity of water sample by using 0.02N H₂SO₄ solution.
4. Determine the total alkalinity of water sample by using 0.02NH₂SO₄ solution

BOARD DIPLOMA EXAMINATION, (C-24)
SECOND SEMESTER END EXAMINATION
SC-209 - APPLIED SCIENCE LAB

Time: 2 Hours]

[Total Marks: 40

Instructions: (1) Answer both PART-A AND PART-B on separate answer sheets.

(2) Each question carries **TWENTY** marks.

PART-A (PHYSICS LAB)

Perform ONE experiment allotted by the examiner.

1 x 20 = 20

1. Determine the value of acceleration due to gravity using L-T² graph.
2. Determine the value of acceleration due to gravity using simple pendulum.
3. Determine the velocity of sound in air at room temperature.
4. Determine the velocity of sound in air at room temperature and calculate velocity of sound at 0° C.
5. Draw magnetic lines of force and calculate magnetic moment of a bar magnet.
6. Draw magnetic lines of force and locate neutral points of a bar magnet.
7. Determine the specific resistance of given wire using meter bridge.
8. Determine the resistance of given wire using meter bridge.
9. Determine the refractive index of a solid using travelling microscope.

PART-B (CHEMISTRY LAB)

Perform ONE experiment allotted by the examiner.

1 x 20 = 20

1. Determine the molarity of KMnO₄ solution by using 0.1M oxalic acid.
2. Estimate the amount of Mohr's salt present in the given one litre of solution by using 0.02M KMnO₄ solution.
3. Determine the partial acidity of water sample by using 0.02N NaOH solution.
4. Determine the total acidity of water sample by using 0.02N NaOH solution
5. Determine the partial alkalinity of water sample by using 0.02N H₂SO₄ solution.
6. Determine the total alkalinity of water sample by using 0.02N H₂SO₄ solution
7. Estimate the chloride content present in water sample by using 0.0141N AgNO₃ solution

CS -210 – PROGRAMMING IN ‘C’ LAB

Course Title	Programming in C Lab	Course Code	CS-210
Semester	II Semester	Course Group	Practical
Teaching Scheme in Periods(L:T:P)	1:0:2	Credits	1.25
Methodology	Lecture + Practical	Total Contact Hours:	45
CIE	60Marks	SEE	40Marks

Prerequisites

Basic knowledge of Mathematics, Logical, Reasoning and IT skills.

Course Content and Blue Print of Marks for SEE

Unit No	Unit name	Hours/ Periods	Marks for SEE			Marks weightage	% Weightage
			Coding	Execution	Viva		
1	Programming in C Lab	45	20	10	10	40	100
	Total	45	40			40	100

Course Outcomes

On successful completion of the course, the students will be able to

CO'S	Description
CO1	Use the concepts of algorithm and flow chart for developing programs in C language.
CO2	Use variables, constants, data types, operators and Input / Output functions in programs
CO3	Apply decision making and looping concepts for developing programs in C language
CO4	Implement the concepts of arrays and structures for a given problem
CO5	Illustrate the use of functions in developing modular programming
CO6	Illustrate the usage of structures and unions.

Course Content

Unit Number	Unit Name	Periods
1	Programming Methodology and Introduction to C Language	2
2	Understand Constants, Variables and Data types in C and Understand Operators and Expressions in C	4
3	Decision making and Looping statements	9
4	Arrays and Strings	10
5	User Defined functions	10
6	Structure, union	10
	Total	45

Recommended Books

- | | | |
|-----------------------------|----|-------------------------------------|
| 1. Let Us C | -- | Yeshwanth Kanetkar BPB Publications |
| 2. Programming in ANSIC | -- | E. Balaguruswamy Tata McGrawHill |
| 3. Programming with C | -- | Gottfried Schaum's outline |
| 4. C The complete Reference | -- | Herbert Schildt Tata McGraw Hill |

Suggested E-learning references

1. https://www.w3schools.com/c/c_intro.php?external_link=true
2. <https://www.geeksforgeeks.org/c-programming-language/>
3. <https://www.programiz.com/c-programming>
4. <https://www.javatpoint.com/c-programming-language-tutorial>
5. <https://www.freecodecamp.org/news/the-c-programming-handbook-for-beginners/>
6. <https://www.tutorialspoint.com/cprogramming/index.htm>
7. <https://www.codecademy.com/catalog/language/c>
8. <https://www.codechef.com/learn/course/c>
9. <https://archive.nptel.ac.in/courses/106/104/106104128/>
10. <https://www.youtube.com/watch?v=3QiltmIWmOM>
11. <https://www.digimat.in/nptel/courses/video/106105171/L01.html>
12. <https://www.digimat.in/nptel/courses/video/106105171/L07.html>

Suggested Learning Outcomes

Upon completion of the course, the student shall be able to

List of Exercises:

1. Write an algorithm to compute whether a given number is even or odd.
2. Write an algorithm to check whether a given year is leap year.
3. Draw a flowchart to identify whether the given number is a "BUZZ" number or not.
4. Write and execute a C program to compute number of months, number of remaining weeks and number of remaining days, given number of days. (**hint : Input:** 265 days
Output: 8 months, 3 weeks, 4 days)
5. Write and execute a C program to compute Lateral surface area, Total surface area and volume of a cuboid given length, breadth and height.
6. Write and execute a C program to evaluate an expression using operator precedence and associativity rule.
(hint: $a+b/c*d - (e * (f-z)\%k)$)
7. Write and execute a C program to display the following pattern using for loop given n rows
(hint n=4).

```
1
1 2
1 2 3
1 2 3 4
```
8. Write and execute a C program to reverse a 4 digit number.
9. Write and execute a C program to print all the prime numbers from 2 to n.
10. Write and execute a C program to read two matrices to perform matrix addition.
11. Write and execute a C program to perform matrix multiplication.
12. a. Write and execute a C program to check whether the given string is palindrome or not.

- b. Write and execute a C program to read a line of text and display the vowels and consonants.
13. Write and execute a C program to compute the following series using functions
 $1 + x + (x^2/2!) + (x^3/3!) + \dots + (x^n/n!)$
14. Write and execute a C program to compute the sum of first n natural numbers using recursion.
15. Write and execute a C program on "TOWERS OF HANOI PROBLEM" using recursion.
16. Write and execute a C program to read two integers and compute sum, difference, product, quotient using "functions with arguments and with return values".
17. Consider and execute a structure with the following structure members
 a. Student name b. PIN c. subject1 marks d. subject2 marks e. subject3 marks
 Write and execute a Program to compute individual subject total, individual student marks total for n number of students.
18. Write and execute a c program to read, retrieve, and display the members of a union.

Suggested Student Activities

1. Slip test on C snippets
2. Lab Slip test to execute a random program beyond the given list of exercises

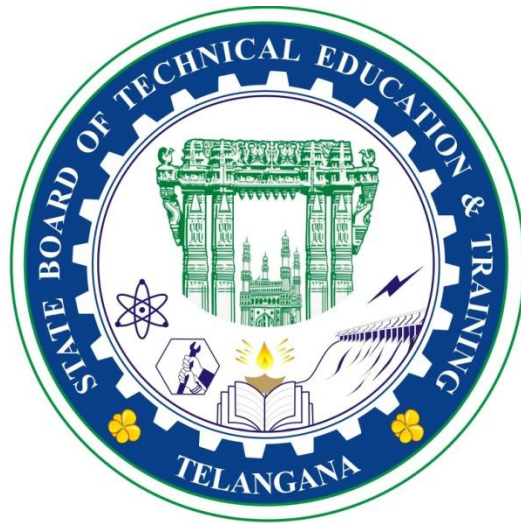
CO-PO Mapping Matrix

	Basic and Discipline Specific Knowledge	Problem Analysis	Design/Development of Solutions	Engineering Tools, Experimentation and Testing	Engineering Practices for Society, Sustainability and Environment	Project Management	Lifelong Learning	Linked PO
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	
CO1	1	1	1			2	1	1,2,3,6,7
CO2	1						1	1,7
CO3	1	2	1	2	1	2	1	1,2,3,4,5,6,7
CO4	1	1	1	1	2	1	1	1,2,3,4,5,6,7
CO5	2	2	1	3	1	2	1	1,2,3,4,5,6,7
CO6	1	1	1			1	1	1,2,3,6,7

C24_CURRICULUM

DIPLOMA IN

MECHANICAL ENGINEERING



Offered By

STATE BOARD OF

TECHNICAL EDUCATION AND TRAINING

TELANGANA HYDERABAD

TEACHING AND EXAMINATION SCHEME
III SEMESTE

S. No	Course Code	Course Name	Teaching Scheme					Examination Scheme						
			Instructional Periods per week			Total Periods per semester	Credits	Continuous Internal Evaluation			Semester End Examination			
			L	T	P			Mid Sem 1	Mid Sem 2	Internal evaluation	Max Marks	Min Marks	Total marks	Min marks for Passing including internal
1	SC-301	Applied Engineering Mathematics	4	1	0	75	2.5	20	20	20	40	14	100	End Marks shall be $\geq 35\%$ of Topper Marks and Subject Total Shall be $\geq$ D-Hybrid Grade Minimum
2	ME-302	Strength of Materials	4	1	0	75	2.5	20	20	20	40	14	100	
3	ME-303	Thermodynamics	4	1	0	75	2.5	20	20	20	40	14	100	
4	ME-304	Fluid Mechanics and Hydraulic Machinery	4	1	0	75	2.5	20	20	20	40	14	100	
5	ME-305	Engineering Materials	4	1	0	75	2.5	20	20	20	40	14	100	
6	ME-306	Additive and Advanced Manufacturing Process	4	1	0	75	2.5	20	20	20	40	14	100	End Marks shall be $\geq 50\%$ of Topper Marks and Subject Total Shall be $\geq$ D-Hybrid Grade Minimum
7	ME-307	Machine Drawing	1	0	2	45	1.25	20	20	20	40	20	100	
8	ME-308	Material Testing and Hydraulic Machines Lab	1	0	2	45	1.25	20	20	20	40	20	100	
9	ME-309	Advanced Manufacturing Lab	1	0	2	45	1.25	20	20	20	40	20	100	
10	HU-310	Communication Skills & Life Skills Lab	1	0	2	45	1.25	20	20	20	40	20	100	
TOTAL			28	6	8	630	20	200	200	200	400	164	1000	

SC-301-APPLIED ENGINEERING MATHEMATICS

Course Title	Applied Engineering Mathematics	Course Code	SC-301
Semester	III	Course Group	Foundation
Teaching Scheme in Periods (L : T : P)	4:1:0	Credits	2.5
Methodology	Lecture + Tutorial	Total Contact Periods	75
CIE	60 Marks	SEE	40 Marks

Pre requisites:

This course requires the knowledge of Basic Engineering Mathematics and Engineering Mathematics at Diploma 1st and 2nd Semester level.

Course Outcomes (COs):

At the end of the course, the student will have the ability to:

CO 1	Evaluate the Indefinite Integrals of various functions.by Using substitution method
CO 2	Integrate various continuous functions using different methods of integration
CO 3	Integrate various functions by using Partial fractions and Integration by parts method.
CO 4	Evaluate the Definite Integrals using Fundamental Theorem of Integral Calculus and its properties.
CO 5	Compute the Areas of irregular shapes and Volumes of solids of revolution using the concept of Definite Integrals.
CO 6	Find the Mean and RMS values of various functions in engineering problems and evaluate Numerical problems in engineering by using Trapezoidal and Simpson's 1/3 rd rule.

Course Content:

Unit-I Indefinite Integration – I:

Duration: 13Periods (L: 10– T:3)

Integration as an inverse process of Differentiation- Indefinite integral of standard functions- Properties of Indefinite Integral- Integration by Substitution - Integrals using Trigonometric identities of the form: $\int \sin^2 x \, dx$, $\int \cos^2 x \, dx$, $\int \sin^3 x \, dx$, $\int \cos^3 x \, dx$, $\int \sin Ax \cos Bx \, dx$, $\int \cos Ax \cos Bx \, dx$ and $\int \sin Ax \sin Bx \, dx$, where A and B are constants- Integrals of $\tan x$, $\cot x$, $\sec x$ and $\operatorname{cosec} x$ -Integrals of the form $\int \sin^m x \cdot \cos^n x \, dx$ and $\int \tan^m x \cdot \sec^n x \, dx$, where m and n are positive integers.

Unit – II Indefinite Integration – II:**Duration: 12Periods (L: 10– T:2)**

Integrals of some particular functions (Nine standard integrals) of the type: $\int \frac{1}{a^2+x^2} dx$, $\int \frac{1}{a^2-x^2} dx$, $\int \frac{1}{x^2-a^2} dx$, $\int \frac{1}{\sqrt{a^2+x^2}} dx$, $\int \frac{1}{\sqrt{a^2-x^2}} dx$, $\int \frac{1}{\sqrt{x^2-a^2}} dx$, $\int \sqrt{a^2+x^2} dx$, $\int \sqrt{a^2-x^2} dx$ and $\int \sqrt{x^2-a^2} dx$ -

Integrals of the type:

$\int \frac{1}{ax^2+bx+c} dx$, $\int \frac{1}{\sqrt{ax^2+bx+c}} dx$, $\int \sqrt{ax^2+bx+c} dx$, $\int \frac{px+q}{ax^2+bx+c} dx$, $\int \frac{px+q}{\sqrt{ax^2+bx+c}} dx$, $\int (px + q\sqrt{ax^2+bx+c}) dx$, $\int \frac{1}{a \pm b \sin x} dx$, $\int \frac{1}{a \pm b \cos x} dx$ and $\int \frac{1}{a \sin x \pm b \cos x \pm c} dx$, where a, b, c, p and q are constants.

Unit-III Indefinite Integration–III:**Duration: 12 Periods (L: 10 – T:2)**

Integration by using Partial fractions-Integration by parts - Bernoulli's rule for integration by parts - Integrals of the type: $\int e^{ax} \sin bx dx$, $\int e^{ax} \cos bx dx$ and $\int e^x [f(x) + f'(x)] dx$, where a and b are constants.

Unit – IV Definite Integral and its Properties:**Duration: 13Periods (L: 10 – T:3)**

Definite integral - Fundamental Theorem of Integral Calculus –Evaluation of definite integrals by Substitution Method- Properties of Definite Integrals -Evaluation of Definite integrals by applying their properties.

Unit – V Applications of Definite Integrals:**Duration: 13Periods (L: 10 – T:3)**

Areas under simple curves -Sign of the Area -The area of the region bounded by a curve and a line - Area between two curves -Volumes of solids of revolution about axes - Volumes of solids of revolution of the area of the region bounded by the curve and a line about axes - Volumes of solids formed by rotating a region bounded by the curves about axes.

Unit – VI Mean, RMS values and Numerical Integration:**Duration: 12Periods (L: 10 – T:2)**

Mean Values and Root Mean Square (R.M.S) values of a function in a given interval-Numerical Integration: Trapezoidal rule and Simpson's $\frac{1}{3}$ -rule to evaluate an approximate value of a definite integral in a given interval- Problems leading to engineering applications.

Reference Books:

1. Higher Engineering Mathematics, by B.S.Grewal - Khanna publishers.
2. Thomas' Calculus, Pearson Publishers.
3. NCERT Mathematics Text Book for class XII, Part II.
4. Integral Calculus by Shanti Narayan and P. K. Mittal, S. Chand Publishers.

Suggested E-Learning references:

1. <https://www.khanacademy.org/>
2. <https://www.wolframalpha.com/>
3. <https://onlinecourses.nptel.ac.in/>
4. <http://tutorial.math.lamar.edu/>

Suggested Learning Outcomes:

At the end of the course, the student will have the ability to:

CO1 : Evaluate the Indefinite Integrals of various functions by Using substitution method

- 1.1 Explain the concept of Integration as an inverse process of Differentiation with standard notations.
- 1.2 Classify the Definite and Indefinite Integrals.
- 1.3. Formulate the standard Integrals using the definition of Integration.
- 1.4. State the properties of Definite Integrals.
(i.e., $\int (u \pm v) dx$, and $\int ku dx$, where u, v are functions in x and k is a scalar).
- 1.5 Use the Indefinite integrals of standard functions and properties of Integrals in solving engineering problems.
- 1.6 Evaluate Integrals involving simple functions of the following types by the method of Substitution:
 - i) $\int f(ax + b) dx$, where $f(x)$ is in standard form,
 - ii) $\int f(g(x)) g'(x) dx$,
 - iii) $\int f(x^n) x^{n-1} dx$,
 - iv) $\int [f(x)]^n f'(x) dx$,
 - v) $\int \frac{f'(x)}{\sqrt{f(x)}} dx$
 - vi) $\int \frac{f'(x)}{f(x)} dx$
- 1.7 Find the integrals of $\tan x$, $\cot x$, $\sec x$ and $\operatorname{cosec} x$.
- 1.8 Use some trigonometric identities to find the integrals of the type: $\int \sin^2 x dx$, $\int \cos^2 x dx$, $\int \sin^3 x dx$, $\int \cos^3 x dx$, $\int \sin Ax \cos Bx dx$, $\int \cos Ax \cos Bx dx$ and $\int \sin Ax \sin Bx dx$, where A and B are constants.
- 1.9 Evaluate the integrals of the type: $\int \sin^m x \cdot \cos^n x dx$, where m and n are positive integers.
- 1.10 Evaluate the integrals of type: $\int \tan^m x \cdot \sec^n x dx$, where m and n are positive integers.

CO2: Integrate various continuous functions using different methods of integration

2.1 Evaluate the integrals of some particular functions (Nine standard integrals) of the type:

$$\int \frac{1}{a^2+x^2} dx, \int \frac{1}{a^2-x^2} dx, \int \frac{1}{x^2-a^2} dx, \int \frac{1}{\sqrt{a^2+x^2}} dx, \int \frac{1}{\sqrt{a^2-x^2}} dx, \int \frac{1}{\sqrt{x^2-a^2}} dx, \int \sqrt{a^2+x^2} dx, \int \sqrt{a^2-x^2} dx \text{ and } \int \sqrt{x^2-a^2} dx, \text{ where } a \text{ is a constant.}$$

2.2 Evaluate the integrals of the type: $\int \frac{1}{ax^2+bx+c} dx$, $\int \frac{1}{\sqrt{ax^2+bx+c}} dx$ and $\int \sqrt{ax^2+bx+c} dx$, where a , b and c are constants.

2.3 Evaluate the integrals of the type: $\int \frac{px+q}{ax^2+bx+c} dx$, $\int \frac{px+q}{\sqrt{ax^2+bx+c}} dx$ and $\int (px+q)\sqrt{ax^2+bx+c} dx$, Where a , b , c , p and q are constants.

2.4 Evaluate the integrals of the type: $\int \frac{1}{a \pm b \sin x} dx$, $\int \frac{1}{a \pm b \cos x} dx$ and $\int \frac{1}{a \sin x \pm b \cos x \pm c} dx$, where a , b and c are constants.

CO3: Integrate various functions by using Partial fractions and Integration by parts method.

3.1 Evaluate Indefinite Integrals using Partial fractions.

3.2 Evaluate Indefinite Integrals using Integration by parts.

3.3 Apply the Bernoulli's rule for evaluating the Integrals of the form $\int u \cdot v dx$, where u and v are functions in x .

3.4 Evaluate the Integrals of the form $\int e^{ax} \sin bx dx$ and $\int e^{ax} \cos bx dx$, where a and b are constants.

3.5 Evaluate the Integrals of the form $\int e^x [f(x) + f'(x)] dx$.

CO4: Evaluate the Definite Integrals using Fundamental Theorem of Integral Calculus and its properties.

4.1 State the Fundamental Theorem of Integral Calculus.

4.2 Calculate the Definite Integrals over an interval by using the Fundamental Theorem of Integral Calculus.

4.3 Evaluate the Definite Integrals by using Substitution Method.

4.4 Explain various properties of Definite Integration.

4.5 Evaluate the Definite Integrals by using its properties.

CO5: Compute the Areas of irregular shapes and Volumes of solids of revolution using the concept of Definite Integrals.

- 5.1 Define Area under simple curves.
- 5.2 Describe the sign of the Areas of simple curves.
- 5.3 Calculate the Areas under simple curves.
- 5.4 Determine the area of the region bounded by a curve and a line.
- 5.5 Find the area enclosed between two curves using methods of Definite Integration.
- 5.6 Define the volume of a solid generated by revolving a region bounded by the curves about axes.
- 5.7 Explain Volumes of solids of revolution.
- 5.8 Calculate the Volumes of a solid that is obtained by revolving a plane region about axes.
- 5.9 Compute the Volumes of solids of revolution of the area of the region bounded by the curve and
- 5.10 Evaluate the Volumes of solids formed by rotating a region bounded by the curves about axes.
a line about axes.
- 6.0 Find the Mean and RMS values of various functions in engineering problems and evaluate Numerical problems in engineering by using Trapezoidal and Simpson's $\frac{1}{3}$ rd rule.**
- 6.1 Explain Mean Value, Mean Square Value and Root Mean Square (RMS) value of the functions in any given interval.
- 6.2 Obtain the Mean Value, Mean Square Value and Root Mean Square (RMS) values of the functions in any given interval.
- 6.3 Explain Trapezoidal rule and Simpson's $\frac{1}{3}$ rules.
- 6.4 Apply the Trapezoidal rule, Simpson's $\frac{1}{3}$ rules for for approximation of definite integrals
- 6.5 Solve the problems leading to engineering applications by using above methods.

Suggested Student Activities:

- 1. Student visits Library to refer Standard Books on Mathematics and collect related material.
- 2. Quiz.
- 3. Group discussion.
- 4. Surprise tests.
- 5. Seminars.
- 6. Home Assignments.
- 7. Mathematics for preparing competitive exams and solving old question papers on arithmetical ability.

CO / PO - MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	Mapped POs
CO1	3	2					3	1, 2 ,7
CO2	3	2					3	1, 2 ,7
CO3	3	2					3	1, 2 ,7
CO4	3	2					3	1, 2 ,7
CO5	3	2	2				3	1, 2 ,3,7
CO6	3	2	2				3	1, 2, 3, 7

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TELANGANA
DIPLOMA EXAMINATIONS (C - 24)

SC-301

SEMESTER - III, MID –I EXAM, MODEL PAPER
APPLIED ENGINEERING MATHEMATICS
(Open Book System)

Duration: 1: 00 Hour

Max. Marks: 20

PART-A

Instructions: 1. Answer **ALL** questions.

04 × 01 = 04

2 Each question carries **ONE** mark.

1. Find: $\int (2x - \sqrt{x} + x^3) dx$.

2. Find: $\int \frac{dx}{3x+7}$.

3. Find: $\int \frac{dx}{\sqrt{25-x^2}}$.

4. Find: $\int \sqrt{7+x^2} dx$.

PART-B

Instructions: 1. Answer **ALL** questions.

02 × 03 = 06

2. Each question carries **THREE** marks.

5(a) Evaluate: $\int \sin^3 x dx$.

OR

5(b) Evaluate: $\int \frac{\cos \sqrt{2x}}{\sqrt{2x}} dx$.

6(a) Evaluate: $\int \frac{3x^2}{4+x^6} dx$.

OR

6(b) Evaluate: $\int \sqrt{x^2 + 2x + 5} dx$.

PART- C

Instructions: 1. Answer **ALL** questions.

02 × 05 = 10

2. Each question carries **FIVE** marks.

7(a) Evaluate: $\int \frac{dx}{4\sin^2 x + 9\cos^2 x}$.

OR

7(b) Evaluate: $\int \sin^7 x \cdot \cos^3 x dx$

8(a) Evaluate: $\int \frac{2x+5}{\sqrt{x^2-2x+2}} dx$.

OR

8(b) Evaluate: $\int \frac{1}{4\sin x + 3\cos x + 6} dx$.

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TELANGANA
DIPLOMA EXAMINATIONS (C - 24)
SC-301
SEMESTER - III, MID –II EXAM, MODEL PAPER
APPLIED ENGINEERING MATHEMATICS
(Open Book System)

Duration: 1: 00 Hour

Max. Marks: 20

PART-A

Instructions: 1. Answer **ALL** questions.

04 × 01 = 04

2 Each question carries **ONE** mark.

1. Find: $\int e^{2x} \sin 3x \, dx$.

2. Find: $\int e^x (\cot x + \log \sin x) \, dx$.

3. Find: $\int_0^1 (x^4 + 1) \, dx$

4. Find: $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} x \cos x^2 \, dx$.

PART-B

Instructions: 1. Answer **ALL** questions.

02 × 03 = 06

2. Each question carries **THREE** marks.

5(a) Evaluate: $\int \sinh 2x \cdot \sin 2x \, dx$.

OR

5(b) Evaluate: $\int x^3 \sin 2x \, dx$ by using Bernoulli's rule.

6(a) Evaluate: $\int_0^{\frac{\pi}{2}} \frac{\sin^{2025} x}{\sin^{2025} x + \cos^{2025} x} \, dx$.

OR

6(b) Evaluate: $\int_0^{2\pi} \cos^2 7x \, dx$.

PART C

Instructions: 1. Answer **ALL** questions.

02 × 05 = 10

2. Each question carries **FIVE** marks.

7(a) Evaluate: $\int \frac{x^2}{x^2 + 7x + 10} \, dx$.

OR

7(b) Evaluate: $\int \frac{x \cos^{-1} x}{\sqrt{1-x^2}} \, dx$.

8(a) Evaluate: $\int_0^{\pi} \frac{x}{25 \cos^2 x + 16 \sin^2 x} \, dx$.

OR

8(b) Evaluate: $\int_0^1 \frac{\cos^{-1} x}{x} \, dx$.

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TELANGANA
DIPLOMA EXAMINATIONS (C - 24)
SC-301
SEMESTER - III, SEMESTER END EXAM, MODEL PAPER
APPLIED ENGINEERING MATHEMATICS
(Open Book System)

Duration: 2 hours

[Total Marks: 40]

PART-A

Instructions: 1. Answer **ALL** questions. 08 × 01 = 08
2 Each question carries **ONE** mark.

1. Find $\int (a_0 + a_1x + a_2x^2 + \dots + a_nx^n)dx$.
2. Find $\int_{-1}^1 x^2 \sin x^3 dx$.
3. Find the area bounded by the curve $y = x^2$, the x – axis and the ordinates $x = 1$ and $x = 3$.
4. Find $\int \frac{1}{x \cos^2(\log x)} dx$.
5. Find the mean value of $\sin x$ over $(0, 2\pi)$.
6. Find the volume of the solid generated when the area bounded by the curve $y = x^3$, the x – axis and the lines $x = 0$ to $x = 1$.
7. Find the R.M.S value of $\sqrt{x}$ over the range $(2, 3)$.
8. Find the approximate value of $\int_0^6 f(x) dx$ from the following table:

x	0	2	4	6
$f(x)$	3	7	11	9

by Trapezoidal Rule.

PART-B

Instructions: 1. Answer **ALL** questions. 04 × 03 = 12
2. Each question carries **THREE** marks.

9(a) Evaluate: $\int \frac{1}{\sqrt{\sin^{-1}x} \sqrt{1-x^2}} dx$.

OR

9(b) Find the area bounded by the curve $y = \cos x$ in $(0, \pi)$.

10(a) Evaluate: $\int_0^5 \frac{\sqrt{x}}{\sqrt{x} + \sqrt{5-x}} dx$.

OR

10(b) A swimming pool is 100 feet wide and the depth d in meters at a distance x meters from bank is given by the following table:

x	0	20	40	60	80	100
d	0	7	9	15	8	2

Find the cross-section area of the swimming pool using Simson's $\frac{1}{3}$ -rule.

11(a) Find the area included between the parabola $x^2 = 16y$ and its latus rectum.

OR

11(b) Find the volume of the solid by rotating one arc of the curve $y = \sin 3x$ about x – axis.

12(a) Find the RMS value of $i = 3 \sin x$ over the half wave.

OR

12(b) Find the Mean value of $x^2 - 5x + 4$ between the values of x , where the expression vanishes.

PART C

Instructions:

1. Answer **ALL** questions
2. Each question carries **FIVE** marks

04 × 05 = 20

13(a) Evaluate: $\int \frac{5x+3}{\sqrt{x^2+4x+10}} dx$.

OR

13(b) Find the area enclosed between the curve $y^2 = 8x$ and the line $2y = x$.

14(a) Evaluate: $\int \frac{1}{x^4-1} dx$.

OR

14(b) The velocity of a train which starts from rest is given by the following table. The time is recorded in minutes from the start and speed in miles per hour.

Minutes	0	2	4	6	8	10	12	14	16	18	20
Miles/hour	0	10	18	25	29	32	20	11	5	2	0

Estimate approximately the total distance run in 20 meters using Simson's $\frac{1}{3}$ - rule.

15(a) Find the area between the two parabolas $y^2 = 4x$ and $x^2 = 12y$.

OR

15(b) Find the volume of the right circular cone of height h and semi vertical angle α .

16(a) Determine the Root Mean Square value of the function $y = x^2 e^{3x}$ in the range between $x = 0$ and $x = 2$.

OR

16(b) Find the Mean value of $\sin^2 \omega t$ in the interval $\left[0, \frac{2\pi}{\omega}\right]$.

ME-302-STRENGTH OF MATERIALS

Course Title:	Strength of Materials	Course Code	ME-302
Semester	III Semester	Course Group	Core
Teaching Scheme in Periods (L:T:P)	4:1:0	Credits	2.5
Methodology	Lecture+ Tutorials	Total Contact Periods	75
CIE	60 Marks	SEE	40 Marks

Pre requisites

Basic knowledge of Engineering Mechanics, Mathematics, Physics

Course Outcomes

Upon completion of the course, the student shall be able to

CO1	Compute stress and strain values and find the changes in axial, lateral and volumetric dimensions of bodies of uniform section and of composite section under the influence of normal forces.
CO2	Compute the Strain Energy under various loading conditions
CO3	Compute shear force and bending moment at any section of beam and draw the S.F. & B.M diagrams for point loads and UDL.
CO4	Compute bending stresses, safe load, dimensions ,safe span of cross section and deflections of the given beam
CO5	Compute the diameter of shaft based on strength and rigidity and finding deflection and safe load in springs
CO6	Compute the stresses developed in thin cylinders

Course Content and Blue Print of Marks for SEE

Unit No	Unit Name	Periods	Questions to be set for SEE			
			R		U	A
I	Simple Stresses and Strains		Q4	Q1	Q9(a)	Q13(a)
II	Strain Energy					
III	Shear Force and Bending Moment			Q2	Q10(a)	Q14(a)
IV	Theory of Simple Bending & Deflection of Beams					
V	Torsion in Shafts and Springs		Q3	Q5,Q6	Q9(b),Q11(a), Q11(b)	Q13(b),Q15(a), Q15(b)
VI	Thin Cylindrical Shells			Q7,Q8	Q10(b),Q12(a), Q12(b)	Q14(b),Q16(a), Q16(b)
Total		75	8		8	8

Course Contents

UNIT - 1: Simple stresses and Strains

Duration: 15 Periods (L: 12 – T: 3)

Stress, Strain and their nature, Mechanical properties of common engineering materials, Stress – Strain diagram for M.S. and C.I. specimens and Significance of various points on it; Significance of factor of safety, Hooke's Law, Relation between elastic constants (without derivations); Longitudinal and lateral strain, Poisson's ratio; Stress and strain values in bodies of uniform section and of composite section under the influence of normal forces, Related numerical problems on the above topics.

UNIT - 2: Strain Energy

Duration: 10 Periods(L: 8 – T: 2)

Strain energy or resilience, proof resilience and modulus of resilience. Derivation of strain energy for the following cases. i) Gradually applied load, ii) Suddenly applied load, iii) Impact/shock load. Related numerical problems

UNIT - 3: Shear Force and Bending Moment

Duration: 13 Periods (L: 10 – T: 3)

Types of beams and loads; Definition and explanation of shear force and bending moment, Calculation of shear force and bending moment and drawing the S.F and B.M. diagrams by the analytical method only for the following cases: Cantilever with point loads - Cantilever with uniformly distributed load - Simply supported beam with point loads - Simply supported beam with UDL - Over hanging beam with point loads, at the centre and at free ends - Over hanging beam with UDL throughout - Combination of point and UDL for the above (not more than two loads) - Related simple numerical problems; Point of contra flexure.

UNIT - 4: Theory of Simple Bending & Deflection of Beams

Duration: 12 Periods (L: 10 – T: 2)

Explanation of terms: Neutral layer, Neutral Axis, Modulus of Section, Moment of Resistance, Bending stress, Radius of curvature; Assumptions in theory of simple bending; Bending Equation $M/I = \sigma/y = E/R$ (without derivation); Problems involving calculations of bending stress, modulus of section and moment of resistance; Calculation of safe loads and safe span and dimensions of cross- section;

Definition and explanation of deflection as applied to beams; Deflection formulae without proof for cantilever and simply supported beams with point load and UDL only (Standard cases only); Related numerical problems

UNIT - 5: Torsion in Shafts and Springs**Duration: 15 Periods (L: 12 – T: 3)**

Definition and function of shaft; Define the terms polar moment of inertia, torsional rigidity and torsional stiffness; Calculation of polar M.I. for solid and hollow shafts; Assumptions in simple torsion; Torsion Equation $T/J = \tau/r = G\theta/L$ (without derivation); Problems on design of shaft based on strength and rigidity; Numerical problems related to comparison of strength and weight of solid and hollow shafts

Nomenclature of closed coil helical spring, Deflection formula for closed coil helical spring (without derivation). Explanation about stiffness of spring, Numerical problems on closed coil helical spring to find safe load, deflection, size of coil and number of coils.

UNIT - 6: Thin Cylindrical Shells**Duration: 10 Periods (L: 8 – T: 2)**

Explanation of longitudinal and hoop stresses in the case of circumferential and longitudinal failure of shell. Derivation of expressions for the longitudinal and hoop stress for seamless and seam shells. Related numerical Problems for safe thickness and safe working pressure.

Text Books

1. Timoshenko, S., Strength of Materials, Vol. I, CBS, New Delhi.
2. Timoshenko and Young, Elements of Strength of Materials by East-West Press Ltd.
3. Khurmi, R.S., Strength of Materials, S Chand and Co. Ltd. New Delhi.
4. Ramamurtham, S, Strength of Materials, Dhanpat Rai and sons, New Delhi.
5. Punmia B C, Strength of Materials, Laxmi Publications (P) Ltd. New Delhi.
6. Bansal R K, Strength of Materials, Laxmi Publications (P) Ltd. New Delhi.
7. Adarsh Swaroop, “Mechanics of Materials” 1st edition, New Age International Pvt. Ltd
8. Popov, Mechanics of Solids, 2/e, New Pearson Education,
9. S. B. Junnarkar and Dr. H. J. Shah ,Mechanics of Structures Vol.I& II , Twenty-second edition, Charotar Publishing House Pvt Ltd.
10. D. Ghosh A. K. Datta ,Strength of Materials by, New Age International Publishers
11. . F.L. Singer and Andrew Pytel ,Strength of Materials by, Harper and Row Publication.
12. Beer and Johnston ,Mechanics of Materials by, McGraw Hill Publication.

Suggested e-Learning Links

1. <https://nptel.ac.in/courses/>
2. <https://www.slideshare.net/>
3. https://en.wikipedia.org/wiki/Strength_of_materials
4. <http://ndl.ethernet.edu.et/bitstream/>
5. http://www.engineersedge.com/mechanics_material_menu.shtml/

Suggested Learning Outcomes

For achieving the Course outcomes, the following learning outcomes must be achieved

CO1: Compute stress and strain values and find the changes in axial, lateral and volumetric dimensions of bodies of uniform section and of composite section under the influence of normal forces

- 1.1. Define the mechanical properties of commonly used engineering materials
- 1.2. Classify the forces on different criteria
- 1.3. Differentiate the rigid body from the deformable body
- 1.4. Define the term stress, strain and understand various types of stresses and strains
- 1.5. State Hooke's law and define various elastic constants
- 1.6. Draw Stress – Strain diagram for M.S and C.I. specimens and identify salient points on it
- 1.7. State the significance of factor of safety
- 1.8. Define the terms longitudinal & lateral strains and Poisson's ratio
- 1.9. Write down the relation between elastic constants E , N , K , & $1/m$
- 1.10. Numerical problems related to the above cases
- 1.11. Compute stress and strain values in bodies of uniform sections
- 1.12. Compute stress and strain values in bodies of composite sections
- 1.13. Numerical problems related to the above cases
- 1.14. Define thermal stresses
- 1.15. Compute the thermal stresses in uniform and composite Bars
- 1.16. Numerical problems related to the above cases

CO2: Compute the Strain Energy under various loading conditions

- 2.1 Understand the concept of strain energy
- 2.2 Define resilience,
- 2.3 Define proof - resilience
- 2.4 Define modulus of resilience.
- 2.5 Derive an expression for the strain energy.
- 2.6 Obtain expressions for instantaneous stress developed in bodies subjected to Gradually applied load
- 2.7 Obtain expressions for instantaneous stress developed in bodies subjected to Suddenly applied load
- 2.8 Obtain expressions for instantaneous stress developed in bodies subjected to Impact/ shock load
- 2.9 Compare of proof resilience in bodies subjected to the above loads.
- 2.10 Calculate the stresses and strains in the bars using the strain energy concepts.

CO3: Compute shear force and bending moment at any section of beam and draw the S.F. & B.M diagrams for point loads and UDL

- 3.1 State the concept of beams
- 3.2 List the types of beams
- 3.3 List the types of loads
- 3.4 Define and shear force, bending moment and
- 3.5 Explain the terms shear force, bending moment and define point of contraflexure
- 3.6 Calculate the S.F. and B.M. and drawing the S.F and B.M. diagrams by the analytical method for cantilever with point loads
- 3.7 Calculate the S.F. and B.M. and drawing the S.F and B.M. diagrams by the analytical method for cantilever with UDL
- 3.8 Calculate the S.F. and B.M. and drawing the S.F and B.M. diagrams by the analytical method for cantilever with point loads & UDL
- 3.9 Calculate Support reactions for simply supported beam
- 3.10 Calculate the S.F. and B.M. and drawing the S.F and B.M. diagrams by the analytical method for simply supported beam with point loads
- 3.11 Calculate the S.F. and B.M. and drawing the S.F and B.M. diagrams by the analytical method for simply supported beam with UDL
- 3.12 Calculate the S.F. and B.M. and drawing the S.F and B.M. diagrams by the analytical method for simply supported beam with point loads & UDL
- 3.13 Calculate the S.F. and B.M. and drawing the S.F and B.M. diagrams by the analytical method for overhanging beam with point loads
- 3.14 Calculate the S.F. and B.M. and drawing the S.F and B.M. diagrams by the analytical method for overhanging beam with UDL
- 3.15 Numerical problems related to the above cases.

CO4: Calculate bending stresses, safe load, dimensions ,safe span of cross section and deflections of the given beam

- 4.1 Define the terms Neutral layer, Neutral Axis, Modulus of Section,
- 4.2 Define Moment of Resistance, Bending stress and Radius of curvature
- 4.3 Find out section modulus for various sections such as plain & hollow rectangular, square and circular sections,
- 4.4 List out the assumptions made in theory of simple bending
- 4.5 Write the Bending Equation $M/I = \sigma/y = E/R$ (without derivation) and understand the terms involved in it and their units
- 4.6 Calculate the bending stresses in beams of various cross-sections.
- 4.7 Solve the numerical problems involving calculations of bending stress, modulus of section and moment of resistance using bending equation
- 4.8 Solve the numerical problems involving calculations of safe loads and safe span and dimensions of cross- section using bending equation
- 4.9 Define and understand the concept of slope and deflection of beams

- 4.10 Write the deflection formulae without proof for cantilever beam with point load and UDL(Standard cases only)
- 4.11 Write the deflection formulae without proof for simply supported beam with point load and UDL (Standard cases only)
- 4.12 Solve numerical problems on deflection of cantilever beam subjected to point load
- 4.13 Solve numerical problems on deflection of cantilever beam subjected to UDL
- 4.14 Solve numerical problems on deflection of cantilever beam subjected to
- 4.15 Solve numerical problems on deflection of simply supported beams subjected to a combination of point load subjected to a combination of point load and UDL

CO5: Compute the diameter of shaft based on strength and rigidity and finding deflection and safe load in springs

- 5.1 Define and state the functions of a shaft
- 5.2 Define the terms polar moment of inertia, torsional rigidity and torsional stiffness
- 5.3 Calculate of polar M.I. for solid and hollow shafts
- 5.4 List out the assumptions made in theory of simple torsion
- 5.5 Write the Torsion Equation $T/J = \tau/r = G\theta/L$ (without derivation) and understand the terms involved in it and their units
- 5.6 Solve numerical problems related to Torsion Equation
- 5.7 Design of solid and hollow shafts based on strength
- 5.8 Solve related numerical problems related to above case
- 5.9 Solve numerical problems related to comparison of strength and weight of solid and hollow shafts
- 5.10 State the function of spring
- 5.11 List the types of springs
- 5.12 List all the applications of springs
- 5.13 Define the terms related to closed coil helical spring
- 5.14 State the formulae for the stress and deflection of springs closed coil helical
- 5.15 Compute the stress and deflection of the closed coil helical spring

CO6: Compute the stresses developed in thin cylinders

- 6.1 Define cylindrical shell
- 6.2 Define longitudinal stress
- 6.3 Define hoop stress
- 6.4 Derive the expression for longitudinal and hoop and seam shells and seamless shells
- 6.5 Changes in dimensions of thin cylinders due to an Internal pressure
- 6.6 Design thin cylindrical shells
- 6.7 Related numerical Problems for safe thickness
- 6.8 Related numerical Problems for working pressure

Suggested Student Activities

Student activity like mini-project, surveys, quizzes, etc. should be done in group of 3-5 students.

- Each group should do any one of the following type activity or any other similar activity related to the course and before conduction, get it approved from concerned course coordinator and programme co-coordinator.
 - Each group should conduct different activity and no repeating should occur.
1. Record various forces applied by human beings in their daily activities.
 2. Identify the applications where parallelogram law of forces, Lami's theorem etc are used and prepare a report.
 3. Using internet record various properties of commonly used materials and compare their strengths.
 4. How a corrugated roof sheet differs from plain roof sheet? Demonstrate with models.
 5. List out the applications of shafts in our daily activity as well as in industries.
 6. Collect the pictures of various types of beams which practically exist.

CO-PO Mapping Matrix

	Basic and Discipline Specific Knowledge	Problem Analysis	Design/Development of Solutions	Engineering Tools, Experimentation and Testing	Engineering Practices for Society, Sustainability and Environment	Project Management	Lifelong Learning	Linked PO
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	
CO1	3	2	2	1			2	1,2,3,4,7
CO2	3	2	3				1	1,2,3,7
CO3	3	2	3				2	1,2,3,7
CO4	3	3	3	1			2	1,2,3,4,7
CO5	3	2	3				2	1,2,3,7
CO6	3	3	3	1			2	1,2,3,4,7

State Board of Technical Education and Training, Telangana
Model Question paper, STRENGTH OF MATERIALS
Mid Semester-I Examination

Course Code: ME-302
Course Name: Strength of Materials

Duration: 1 hour
Max.Marks: 20 Marks

PART-A

Answer **all** questions- Each Question carries **ONE** mark

4x1 = 4 Marks

1. List out any two types of stresses
2. Define lateral strain.
3. Write the formula for strain energy
4. Define proof resilience

PART-B

Answer **two** questions- Each Question carries **THREE** marks

2x3 = 6 Marks

5. a) List out the three elastic constants and write down the relation between them
(OR)
b) Find the diameter of a M.S. rod, carrying a load of 560 KN. If the maximum tensile strength of the rod is 30 N/mm^2 .
6. a) A steel bar of 30 mm diameter is stressed to 175 N/mm^2 . What is the length of the bar if strain energy stored is 60 Nm. Assume $E = 2 \times 10^5 \text{ N/mm}^2$
(OR)
b) Derive an expression for strain energy in a body subjected to impact loading

PART-C

Answer **two** questions- Each Question carries **FIVE** marks

2x5 = 10 Marks

7. a) A tensile load of 15 KN is applied longitudinally on a mild steel bar having a diameter of 10 mm and 350 mm length. Calculate the extension in the bar, the change in diameter and change in volume. Take $E = 2 \times 10^5 \text{ N/mm}^2$ and the Poisson's ratio as 0.25.
(OR)
b) Draw stress-strain diagram for mild steel, show the salient points on it.
8. a) Prove that the stress induced is twice when the load applied is sudden?
(OR)
b) A load of 100N falls by gravity a vertical distance of 3000 mm when it is suddenly stopped by a collar at the end of a vertical rod of length 6m and diameter 20 mm. The top of the bar is rigidly fixed to a ceiling. Calculate the maximum stress and the strain induced in the bar

State Board of Technical Education and Training, Telangana
Model Question paper, STRENGTH OF MATERIALS
Mid Semester-II Examination

Course Code: ME-302
Course Name: Strength of Materials

Duration: 1 hour
Max. Marks: 20 Marks

PART-A

Answer **all** questions- Each Question carries **ONE** mark

4x1 = 4 Marks

1. Name any two types of loads experienced by a beam for the calculation of shear force and bending moment?
2. What is a point of contraflexure?
3. Write formula for section modulus?
4. Define neutral axis and neutral layer?

PART-B

Answer **two** questions- Each Question carries **THREE** marks

2x3 = 6 Marks

5a) Draw SF and BM diagrams for simply supported beam of length 'L' with a point load 'W' at centre.

(OR)

5. b) A cantilever beam of 3m long carries a point load of 4kN at its free end. Draw the Shear force and bending moment diagrams

6.a) State any three assumptions made in the theory of simple bending

(OR)

6. b) Write an expression for maximum slope and deflection of cantilever beam with UDL on entire span

PART-C

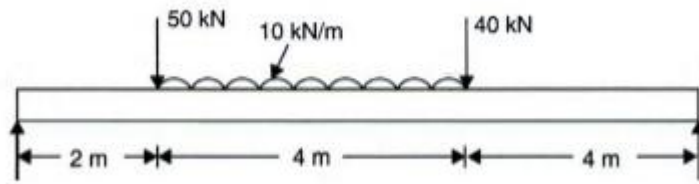
Answer **two** questions- Each Question carries **FIVE** marks

2x5 = 10 Marks

7.a) A cantilever beam of length 2 m carries a uniformly distributed load of 2 kN/m length over the entire span and a point load of 3 kN at the free end. Draw S.F. and B.M. diagrams for the beam.

(OR)

7.b) Draw the SF diagram for a simply supported beam of length 10 m carrying a uniformly distributed load and two point loads as shown in the following figure.



8 a)A square beam bends under the action of loads. The maximum stress induced is 150 N/mm^2 and bending moment is 4000 N-mm . Find the dimensions of the cross section on the beam

(OR)

8.b) A cantilever beam of span 5 m carries a UDL of 2 kN/m . Find the maximum slope and deflection .Assume $E=2 \times 10^6 \text{ N/mm}^2$ and $M.I = 300 \times 10^6 \text{ mm}^4$

State Board of Technical Education and Training, Telangana

Model Question paper
STRENGTH OF MATERIALS
Semester End Examination

Course Code: ME-302

Course Name: Strength of Materials

Duration: 2 hour

Max. Marks: 40 Marks

PART-A

Answer all questions- Each Question carries ONE mark

8x1 = 8 Marks

1. Define modulus of elasticity and bulk modulus?.
2. Define flexural rigidity
3. Write formulae for polar modulus of section
4. Write the formula of bending equation
5. State the function of shaft?
6. Define spring index
7. What is thin cylindrical shell?
8. List the type of stresses induced in thin cylindrical shell

PART-B

Answer Four questions- Each Question carries THREE marks

4x3 = 12 Marks

9. a) List the three elastic constants and write relationship between them
(OR)
b) A solid circular shaft transmits torque of 1.5 kN-m at 1440 rpm. Find the power transmitted
10. a) Write any three assumptions made in the theory of simple bending.
(OR)
b) Derive an expression for hoop stress of thin cylindrical shell
11. a) A solid shaft of 150 mm diameter is used to transmit torque. Find the maximum torque transmitted by the shaft, if the maximum shear stress induced in the shaft is 45 N/mm^2 .
(OR)
b) A closely coiled helical spring of 20 coils has wire diameter of 4 mm and mean coil diameter of 30 mm. Find stiffness of spring. Take $G = 8.4 \times 10^4 \text{ N/mm}^2$
12. a) A 900 mm diameter pipe contains fluid at pressure of 35 N/mm^2 . If the safe stress in tension is 100 N/mm^2 . Find the minimum thickness of pipe??
(OR)
b) Calculate the hoop and longitudinal stresses in material of a thin cylindrical shell of 3 m diameter and 30 mm thick subjected to internal pressure of 1 N/mm^2 .

PART-C

Answer Four questions- Each Question carries FIVE marks

4x5 = 20 Marks

13.a) A cylindrical bar of 1.25m long with 25 mm diameter, During tensile test it is found that the linear strain is 4 times the lateral strain .Calculate the shear modulus ,bulk modulus and change in volume, if the bar is elongated by 0.06 mm under an axial load of 50 kN

(OR)

13.b) A hollow circular shaft 200 mm external diameter ,thickness of metal 20 mm is to transmit 1500kW at 160 rpm .Calculate the angle of twist in a length of 5 m.Take $G=0.85 \times 10^5 \text{ N/mm}^2$

14. a) A beam of 10 m length simply supported at its ends carries a UDL of 4 kN/m over the left hand half of the span and a point load of 5 kN at the mid span. find the maximum bending moment and draw shear force and bending moment diagrams for the beam

(OR)

14. b) A thin cylindrical shell having 1.5m diameter and 5 m length is subjected to a hoop stress of 45 N/mm². Calculate the longitudinal strain. Assume Poissons ratio as 0.32 and Youngs modulus as $2.1 \times 10^5 \text{ N/mm}^2$

15. a) A square beam bends under the action of loads. The maximum stress induced is 150 N/mm² and bending moment is 4000 N-mm. Find the dimensions of the cross section on the beam

(OR)

b) A wagon weighing 30 kN moving at 7.2 kmph. How many spring each of 18 coils will be required in a buffer stop to absorb the energy of motion during a compression of 250 mm. the mean diameter of coil is 200 mm and the wire diameter is 25 mm .Take $G=0.9 \times 10^5 \text{ N/mm}^2$

16. a) A cylindrical shell 2.5 m long ,1m in diameter and metal thickness 10 mm is subjected to an internal pressure of 1.2 N/mm². Calculate the maximum intensity of shear stress induced and also the change in the dimensions of the shell

(OR)

b) A boiler shell is to be made of 10 mm thick plate having limiting tensile stress of 105 N/mm² .If the efficiencies of the longitudinal and circumferential joints are 70% and 30 % respectively. Determine the permissible intensity of internal pressure when the shell diameter is 1.3m

ME-303-THERMODYNAMICS

Course Title	Thermodynamics	Course Code	ME-303
SEMESTER	III	Course Group	Core
Teaching Scheme in periods (L : T : P)	4:1:0	Credits	2.5
Methodology	Lecture + Tutorial	Total Contact Periods	75
CIE	60 Marks	SEE	40 Marks

PRE REQUISITES: Basic knowledge of Physics

COURSE OUTCOMES: At the end of the course the students will have the ability to

CO1	Describe the fundamental concepts and principles of thermodynamics
CO2	Apply the laws of thermodynamic to process and cycle
CO3	Estimate the heat, work and entropy in different thermodynamic processes
CO4	Analyze different air standard cycles and compare them.
CO5	Illustrate working principles of IC Engines.
CO6	Explain different systems used in IC Engines and evaluate the performance of IC Engines.

BLUE PRINT OF MARKS FOR SEE:

Unit No	Unit Name	Periods	Questions to be set for SEE				Remarks
			R		U	A	
1	Fundamentals of Thermodynamics	12	4	1	9(a)	13(a)	
2	Laws of Thermodynamic	13					
3	Thermodynamic Processes	13		2	10(a)	14(a)	
4	Air Standard Cycles	12					
5	Working Principles of IC Engines	13	3	5, 6	9(b), 11(a), 11(b)	13(b), 15(a), 15(b)	
6	Systems used in IC Engines and performance of IC engines	12		7, 8	10(b), 12(a), 12(b)	14(b), 16(a), 16(b)	

Legend: R-Remembering, U-Understanding, A-Applying

COURSE CONTENT

Unit-1: Fundamentals of Thermodynamics

Duration: 12 Periods (L:10-T:2)

Introduction- macroscopic -microscopic view point- control volume -Thermodynamic systems – Property, state, path and process -Different properties – Thermodynamic Equilibrium -Quasi static process-reversible -irreversible process-Thermodynamic cycle – reversible -irreversible cycle- Zeroth law of TD – thermometric property -Heat transfer and Work transfer -path function -with sign convention – Specific heat at constant volume – constant pressure-Internal Energy -flow work.

Unit-2 : Laws of Thermodynamics

Duration: 13 Periods (L:10-T:3)

First law of TD -applied to closed system undergoing a cycle – undergoing a change of state - energy a property of the system-- internal energy- enthalpy-energy of an isolated system- PMM1- Limitations of first law of TD- first law applied to flow process -SFEE- application to various engineering systems-Second Law of Thermodynamics - energy reservoirs - Heat Engine -K-P Statement and Clausius statement of Second Law of TD -Refrigerator and Heat pump-Efficiency and Coefficient of performance -PMM2

Unit-3:Thermodynamic processes

Duration: 13 Periods (L:10-T:3)

Clausius inequality – definition of entropy --principle of entropy- entropy change in reversible and irreversible process - first and second laws combined- PMM3-Third law of Thermodynamics-Expression for work done and heat supplied (without derivation) for Isochoric, Isobaric, Isothermal, Isentropic, Polytropic processes – Relation between Pressure, Volume and Temperature in Adiabatic process and Polytropic process

Unit-4:Air Standard Cycles

Duration: 12 Periods (L:10-T:)

Calorific values (Heating value) of fuels -Air standard cycle – assumptions -compression ratio -cut off ratio-swept volume- clearance volume - Carnot's cycle - Explanation and analysis of air standard cycle- Otto cycle, Diesel cycle – Expression for efficiency of these cycles (without derivation) – Comparison of performance of Otto cycle and Diesel cycle.

Unit-5: Working Principles of IC Engines

Duration: 13 Periods (L:10-T:3)

Heat engines – Internal combustion engines and external combustion engines – classification of IC engines – Components of IC engines and their function – Principle of working and comparison of four stroke SI engine and CI engine -Value timing diagram of four stroke SI engine and 4 stroke CI engine - Principle of working of two stroke petrol engine – Comparison between four stroke engine and two stroke engine.

Unit-6: Systems used in IC Engines and performance of IC engines

Duration: 12 Periods (L:10-T:2)

Fuel systems – Battery Ignition system - Cooling systems – Lubrication systems – Firing order- Performance of IC engines – Indicated power, Brake power, Frictional power, Indicated mean effective pressure, Brake mean effective pressure, Specific fuel consumption, Mechanical efficiency - Thermal efficiency-Indicated thermal efficiency-Brake thermal efficiency- Air Fuel ratio-Volumetric efficiency

REFERENCE BOOKS

1. Engineering Thermodynamics by P.K. Nag TMH Publishers
2. Thermal Engineering by R.K Rajput
3. Thermodynamics and Heat Engines Vol 1 and Vol 2 by R Yadav
4. IC Engines by Gill and Smith

SUGGESTED LEARNING OUTCOMES:

CO1: Describe the fundamental concepts and principles of thermodynamics

- 1.1 Define Engineering Thermodynamics.
- 1.2 Explain Macroscopic approach and Microscopic approach.
- 1.3 Define Control volume.
- 1.4 Define the various terms associated with the thermodynamic system. Explain with examples Open system, closed system and isolated system.
- 1.5 Define thermodynamic property – Classify TD properties. Define properties like Temperature, Pressure, Volume, Specific volume, Density etc.
- 1.6 Define state of system, path and process traced by system – TD Cycle.
- 1.7 Explain Quasi static process.
- 1.8 Compare Reversible and Irreversible process.
- 1.9 Differentiate between Intensive and Extensive properties.
- 1.10 Explain Thermodynamic equilibrium-Thermal, Mechanical and Chemical equilibrium.
- 1.11 Illustrate Zeroth law of Thermodynamics.
- 1.12 What is Thermometric property.
- 1.13 Define Heat and Work and know sign convention of heat and work.
- 1.14 Differentiate between Point function and Path function.

- 1.15 Define Specific heats, Internal Energy, Enthalpy, Flow work.
- 1.16 Solve problems on properties of Thermodynamic systems.

CO2: Apply the laws of thermodynamic to process and cycle

- 2.1 Laws of Thermodynamics
- 2.2 State First Law of Thermodynamics.
- 2.3 Application of First Law of Thermodynamics to Closed system undergoing a cycle.
- 2.4 Application of First Law of Thermodynamics to Closed system undergoing a change of state.
- 2.5 Why Energy is a property of a system.
- 2.6 Define Internal Energy-Enthalpy of a system.
- 2.7 Show Internal Energy of an Isolated system is constant.
- 2.8 Define PMM I.
- 2.9 What are the limitations of First Law of Thermodynamics.
- 2.10 Application of First law to a Flow process and write the SFEE.
- 2.11 Application of SFEE to various Thermodynamic process-Steam turbine-Compressor-Pump-Nozzle-Condenser-Throttling process (only equation).
- 2.12 Solve problems on First law applied for a process.
- 2.13 Solve problems on First law applied to TD cycle (Non Flow Energy Equation-NFEE).
- 2.14 State Second law of Thermodynamics.
- 2.15 Define Thermal Energy reservoir (TER) – source-sink.
- 2.16 State Kelvin Planck's statement and Clausius statement.
- 2.17 Define heat engine, refrigerator and heat pump.
- 2.18 Define efficiency – Solve problems.
- 2.19 Define coefficient of performance -Solve problems.
- 2.20 Define PMM II.

CO3: Estimate the heat, work and entropy in different thermodynamic processes

- 3.1 Define Clausius inequality.
- 3.2 Define Entropy and principle of Entropy.
- 3.3 Change of Entropy for reversible and irreversible process.
- 3.4 Combine First and Second law and write two equations for Tds .
- 3.5 Define PMM III.
- 3.6 State Third law of Thermodynamics.
- 3.7 List different thermodynamic processes and write their adiabatic index.
- 3.8 What is the expression for work done and heat supplied (without derivation) for Isochoric process and solve numerical problems.
- 3.9 What is the expression for work done and heat supplied (without derivation) for Isobaric process and solve numerical problems.
- 3.10 What is the expression for work done and heat supplied (without derivation) for Isothermal process and solve numerical problems.
- 3.11 What is the expression for work done and heat supplied (without derivation) for Adiabatic process and solve numerical problems

- 3.12 What is the expression for work done and heat supplied (without derivation) for Polytropic process and solve numerical problems
- 3.13 Write the relation in terms of pressure, volume and temperature in Adiabatic process and Polytropic process.
- 3.14 Explain Throttling process and free expansion process.
- 3.15 Analyze that area under PV diagram gives work transfer and area under TS diagram gives heat transfer.
- 3.16 Draw P-v & T-s diagram for expansion and compression during isobaric, isochoric, isothermal, adiabatic, polytropic process.

CO4: Analyze different air standard cycles and compare them.

- 4.1 Define the term fuel-combustion-calorific value (HCV-LCV).
- 4.2 Define the term air standard cycle. What are the assumptions in air standard cycle.
- 4.3 Define compression ratio – cutoff ratio swept value - clearance value.
- 4.4 Draw PV diagram and TS diagram of Carnot cycle and list the process.
- 4.5 Explain working of Carnot cycle in detail.
- 4.6 List limitations of Carnot cycle.
- 4.7 Write the formula for the air standard efficiency of a Carnot cycle (without derivation)
- 4.8 Solve simple problems on analysis of Carnot cycle.
- 4.9 Draw PV diagram and TS diagram of Otto cycle and list the processes.
- 4.10 Explain working of Otto cycle in detail.
- 4.11 Write the formula for the air standard efficiency of Otto cycle (without derivation)
- 4.12 Solve simple problems on analysis of Otto cycle.
- 4.13 Draw PV diagram and TS diagram of diesel cycle and list the processes.
- 4.14 Explain working of diesel cycle in detail.
- 4.15 Write the formula for the air standard efficiency of a diesel cycle (without derivation).
- 4.16 Solve simple problems on analysis of diesel cycle.
- 4.17 Compare Otto cycle and Diesel cycle for same compression ratio.
- 4.18 Compare Otto cycle and Diesel cycle for same compression ratio and heat supplied.
- 4.19 Compare Otto cycle and Diesel cycle for same maximum pressure and heat supplied.
- 4.20 Compare Otto cycle and Diesel cycle for same maximum pressure and maximum temperature.

CO5: Illustrate working principles of IC Engines.

- 5.1 Define Heat engine- Difference between internal combustion engine and External combustion engine.
- 5.2 Classify Internal Combustion Engines.
- 5.3 Explain the various terms like TDC, BDC, stroke, and bore of an IC engine with a line diagram.
- 5.4 Explain briefly various parts of IC engine.
- 5.5 Write the four sequence of operations (strokes) of piston of an IC engine
- 5.6 What is the basic difference between 4 stroke and 2 stroke engine.

- 5.7 What is the charge in SI engine.
- 5.8 Explain the working of four stroke petrol engine (SI) with line diagram.
- 5.9 Draw theoretical indicator diagram of four stroke petrol(SI) engine.
- 5.10 Draw valve timing diagram of four stroke petrol(SI) engine and explain.
- 5.11 What is the the charge in CI engine
- 5.12 Explain the working of four stroke Diesel engine (CI) with line diagram.
- 5.13 Draw theoretical indicator diagram of four strokeDiesel (CI) engine.
- 5.14 Explain valve timing diagram of four strokeDiesel (CI) engine.
- 5.15 Explain the differences between SI engine and CI engine.
- 5.16 Differentiate between valve and ports of IC engine.
- 5.17 Explain the working of two stroke petrol engine (SI) with line diagram.
- 5.18 Draw the Indicator diagram of two stroke petrol engine.
- 5.19 Compare two stroke engine and four stroke engine.

CO6: Explain different systems used in IC Engines and evaluate the performance of IC Engines.

- 6.1 List the elements of the fuel system in a petrol engine (Fuel tank, Fuel pump, Fuel filter, Air cleaner and carburetor).
- 6.2 Explain the fuel system used in a petrol engine with a simple line diagram.
- 6.3 List the elements of the fuel systems of Diesel engine(Fuel Feed pump, Filter, Fuel Injection pump and Fuel injector).
- 6.4 Explain the fuel system used in a diesel engine with a simple line diagram.
- 6.5 List the ignition systems used in petrol engine.
- 6.6 Explain with line diagram the working of Battery Ignition system.
- 6.7 What is the necessity of cooling of an IC engine.
- 6.8 List different types of cooling system used in an IC engine.
- 6.9 Explain Air cooling system with a legible sketch.
- 6.10 Explain forced circulation water cooling system with a legible sketch.
- 6.11 Explain forced circulation liquid coolant system with a legible sketch
- 6.12 Compare Air cooling with water cooling system.
- 6.13 Why Lubrication of an IC engine is necessary.
- 6.14 What are the parts to be lubricated in an IC engine.
- 6.15 List the types of lubrication system: Mist lubrication system (petrol system) Wet sump lubrication system and Dry sump lubrication system.
- 6.16 What is the difference between wet sump and dry sump lubrication system.
- 6.17 Firing order of IC engine – Its importance – General firing order in 4 cylinder engine and 6 cylinder inline engine.
- 6.18 Define the performance parameters of IC engines like Indicated power, Brake power, frictional power and write formulae.
- 6.19 Define the performance parameters of IC engines like Indicated mean effective pressure, brake mean effective pressure, Specific fuel consumption, and write formulae.
- 6.20 Define the performance parameters of IC engines like Mechanical efficiency, Thermal

efficiency, indicated thermal efficiency, brake thermal efficiency, air fuel ratio, volumetric efficiency and write formulae.

6.21 Solve simple problems involving above parameters.

SUGGESTED STUDENT ACTIVITIES:

1. Make a list of different bikes available in market and know their capacities.
2. Make list of different cars available in market and know their capacities.
3. Visit to automobile workshops /service centers and see how an IC engine works Make a note on fuels available in market and know their calorific values.
4. Collect the data of pressure required in tyres of a two wheeler and four wheeler
5. Collect data of different engine oils used in automobiles.
6. Collect information of different liquid coolants used in automobiles.
7. Study of cutout models of IC engines.
8. Visit to an automobile workshop.
9. Working of IC Engine <https://www.youtube.com/watch?v=O9tfIfwlmz8>
10. Know fuel system <https://www.youtube.com/watch?v=DCfyUm3I4oI>
11. Know battery ignition system
<https://www.youtube.com/watch?v=OMLSNwQiiKg>
12. Know cooling system in automobile
<https://www.youtube.com/watch?v=V7inC4lOpGs>
13. Know lubrication system <https://www.youtube.com/watch?v=mmmcyj53TNic>

CO-PO MATRIX:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	Mapping POs
CO1	3	1	-	1	-	-	-	1,2,4
CO2	3	2	-	1	1	1	1	1,2,4,5,6,7
CO3	2	2	1	-	1	-	1	1,2,3,5,7
CO4	2	2	1	1	-	1	1	1,2,3,4,6,7
CO5	2	1	1	-	1	1	1	1,2,3,5,6,7
CO6	2	1	1	-	1	1	1	1,2,3,5,6,7

BOARD DIPLOMA EXAMINATION MID SEM-I MODEL PAPER

THERMODYNAMICS (ME-303)

TIME : 1 Hours

Max. Marks: 20

PART – A

8 X 1 = 8

NOTE: 1) Answer **all** questions and each question carries **one** mark.

2) Answers should be brief and straight to the point and shall not exceeding **three** simple sentences

1. Define state of a thermodynamic system.
2. Write sign convention for heat transfer.
3. Define PMM I
4. Define TER

PART – B

NOTE: Answer **all** questions . Each question carries **three** marks

4X3 =12

5. (a) what is Thermodynamic Equilibrium.

OR

5. (b) State quasi static process

6. (a) state first law of thermodynamics

OR

- 6 (b) write the relation between efficiency of heat engine COP of Refrigerator

PART – C

NOTE: Answer **all** questions. Each question carries **five** marks

4X5 = 20

- 7 (a) what is the significance of zeroth law of thermodynamics

OR

- 7 (b. why heat and work are path functions

8 (a) A thermodynamic system undergoes a cycle composed of a series of three processes for which heat transfers are $Q_1 = + 10 \text{ kJ}$, $Q_2 = + 30 \text{ kJ}$, $Q_3 = - 5 \text{ kJ}$. For the first process $\Delta E = +20 \text{ kJ}$ and for the third process $\Delta E = - 20 \text{ kJ}$. What is the work transfer in the second process and network output of cycle.

OR

- 8 (b) what are the limitations of first law of thermodynamics

**DME III SEMESTER MID SEM II EXAMINATION
THERMODYNAMICS (ME-303) MODEL PAPER**

Time : 1 hr

Total Marks : 20

PART – A

8 X1 = 8

NOTE: 1) Answer **all** questions and each question carries **one** mark.

2) Answers should be brief and straight to the point and shall not exceeding **three** simple sentences

1. Define Entropy.
2. Define PMM III.
3. What is combustion
4. State any two assumptions made in analysis of air standard cycle.

PART – B

NOTE: Answer **all** questions . Each question carries **three** marks

4X3 =12

5 (a) Define Clausius inequality

OR

5 (b) what is the change in internal energy of a system if heat is supplied at constant volume.

6 (a) State any three differences between Otto cycle and Diesel cycle.

OR

6 (b) Draw P-v and T-s diagram for Diesel cycle.

PART – C

NOTE: Answer **all** questions . Each question carries **five** marks

4X5 = 20

7 (a) A heat engine ,heat pump and a refrigerator are embedded between two heat reservoir one at 1000 K while other at 350 K determine the efficiency of heat engine and COP of heat pump and refrigerator

OR

7 (b) Heat source is available at 1000 K and it loses 20 kJ of heat to a sink 500 K find entropy change for source and sink

8 (a) Describe the processes involved in a Carnot cycle and draw P-v diagram.

OR

(b) A diesel engine has a compression ratio 14 to 1 , and the heat supply is cut-off at 0.06 stroke. Find the air standard efficiency of the cycle. Assume adiabatic ratio as 1.4

**BOARD DIPLOMA EXAMINATION SEMESTER END EXAM MODEL PAPER
THERMODYNAMICS (ME-303)**

TIME :2 Hours

Max. Marks: 40

PART – A

8 X1 = 8

NOTE: 1) Answer **all** questions and each question carries **one** mark.

2) Answers should be brief and straight to the point and shall not exceeding **three** simple sentences

1. Define thermo metric property.
2. Define Entropy.
3. State any two functions of lubricants.
4. Define compression ratio
5. Define BDC
6. What is the charge in SI engine.
7. State two functions of cooling systems in IC engine
8. Define Brake power.

PART – B

4X3 =12

NOTE: Answer **all** questions . Each question carries **three** marks

9(a) Differentiate between Point function and Path function.

OR

9(b) Write the four sequence of operations (strokes) of piston of an IC engine

10(a) List the limitations of Carnot Cycle

OR

10(b) List different types of cooling system used in an IC engine

11(a) What is the basic difference between 4 stroke and 2 stroke engine.

OR

11(b) Draw valve timing diagram of four stroke petrol(SI) engine

12(a) Draw the line diagram of petrol engine fuel system.

OR

12(b) List different types of cooling system used in an IC engine

PART – C

NOTE: Answer **all** questions . Each question carries **five** marks

4X5 = 20

13 (a) A heat engine ,heat pump and a refrigerator are embedded between two heat reservoir one at 600 K while other at 300 K determine the efficiency of heat engine and COP of heat pump and refrigerator

OR

13 (b).Explain the differences between SI engine and CI engine

14 (a) Draw P-v diagram and T-s diagram of diesel cycle and list the processes

OR

14 (b) The following results were obtained from a test on a petrol engine.

Indicated power = 30.3 kW , Brake power = 26.05 kW

Brake specific fuel consumption = 0.315 kg/kW.h , calorific value of fuel = 44100 kJ/kg

Calculate (i) Indicated thermal efficiency

(ii) Brake thermal efficiency

(iii) Mechanical efficiency.

15 (a) Explain parts of IC engine with line diagram.

OR

15 (b) Explain the working of two stroke petrol engine (SI) with line diagram.

16 (a) Explain air cooling system used in IC engine with a diagram.

OR

16 (b) Explain with line diagram the working of Battery Ignition system

ME-304-FLUID MECHANICS AND HYDRAULIC MACHINERY

Course Title	Fluid Mechanics and Hydraulic Machinery	Course Code	ME-304
Semester	III	Course Group	Core
Teaching Scheme in Periods (L: T: P)	4:1:0	Credits	2.5
Methodology	Lectures + Tutorials	Total contact periods	75
CIE	60 marks	SEE	40 marks

PREREQUISITES: Basic knowledge of physics.

COURSE OUTCOMES: At the end of the course the students will be able to

CO1	Selection of suitable fluid for various applications based on fluid properties.
CO2	Applying concept of Bernoulli's equation for flow of liquids
CO3	Estimate frictional losses and design the pipe for flow of liquids through pipes.
CO4	Analyze forces on plates or vanes due to impact of jets
CO5	Describe the working of water turbines and estimate the power developed by turbines
CO6	Describe a hydraulic pump and estimate the power required to operate hydraulic pumps.

COURSE CONTENT

UNIT-1 : Properties of fluids

Duration: Periods 12 (L: 09 – T: 03)

Definition of fluid, ideal and real fluids, compressible and incompressible fluids -Units used in fluid mechanics. Density, specific weight, specific gravity, viscosity and surface tension, compressibility and capillarity. Intensity of pressure, gauge and absolute pressures. Measurement of pressures by piezometer, U-Tube – manometer – simple problems – Bourdon tube pressure gauge.

UNIT-2

Duration: Periods 12 (L: 10 – T: 02)

Flow of Liquids

Types of Fluid flow- Steady and Unsteady flow, Uniform and Non-Uniform Flow, 1D, 2D & 3D Flow, Rotational and Irrotational flow, Laminar & Turbulent flow- Concept on Reynolds's Number, Discharge, Continuity equation for compressible and incompressible fluids- Simple problems on continuity equation- Pressure, potential and kinetic energy of liquids - Total energy, Bernoulli's equation (no derivation) – assumptions made, Simple problems on Bernoulli's equation, Working principle of Venturi meter, Simple Problems on Venturi meter, Pitot tube – principle – applications.

UNIT-3

Duration: Periods 12 (L: 09 – T: 03)

Flow through pipes

Concept of loss of head in pipes due to friction, Darcy's & Chezy's formula (without proof), Simple problems on Darcy's and Chezy's formulae, Hydraulic gradient line and Total energy line-illustration, Calculation of discharge, velocity, diameter of pipe etc., for pipes connecting two reservoirs (considering frictional losses only), Siphon – principle of working (Numerical problems omitted), Expression for power transmitted through pipes. Expression for transmission efficiency, condition for maximum efficiency (without proof.), Simple problems on power transmission

UNIT-4

Duration: Periods 13 (L: 10 – T: 03)

Impact of jets

Derivation of formulae for the force of jet on Stationary vertical flat plate, stationary inclined flat plate, Stationary curved plate and Simple problems on the above, Derivation of formulae for the force of jet on moving vertical flat plate. Derivation of formulae for the force of jet on series of moving plates fixed on the rim of a wheel, Simple problems on the above, Force of jet striking on a moving curved blade when jet strikes tangentially at one end of the tip - velocity triangles, Work done, power and efficiency in the above cases, Simple problems on the above.

UNIT-5

Duration: Periods 13 (L: 10 – T: 03)

Water turbines

Introduction to water turbines- Hydro-electric power stations line sketch showing layout of hydro-electric power plant with head race, dam, sluice gate, pen stock turbine, generator and tail race, Classification of turbines-impulse and reaction turbines, Brief sub-classification as axial, radial and tangential flow type, Working principle of Pelton wheel-velocity triangles, Simple problems, Working principle of Francis turbine - velocity triangles, Simple problems, Working principle of Kaplan turbine - velocity triangles, Simple, problems, Differences between Pelton

wheel and Francis Turbines, Differences between Francis and Kaplan turbines, Governing of methods of Water turbines

UNIT-6

Duration: Periods 13 (L: 10 – T: 03)

Pumps

Pump-Function – Classification, Principle of operation of a reciprocating pump, Constructional details of single acting, double acting pumps. Expression for theoretical power required to drive the pump (without proof)-slip- Simple problems, working principle of centrifugal pump, Installation of centrifugal pump, Priming of centrifugal pump – necessity- Cavitation in centrifugal pump -, Simple problems on work, power and efficiency of Centrifugal pumps, Difference between Reciprocating pump and Centrifugal pump.

SUGGESTED STUDENT ACTIVITIES:

1. Visit nearby Hydroelectric power station and observe dam, penstock, turbines, generators etc.
2. Visit nearby pumping station and identify the pumps used.
3. Quiz
4. Group discussion
5. Surprise test
6. Seminars

SUGGESTED LEARNING OUTCOMES:

Upon the completion of the course the student should be able to

CO1: Selection of suitable fluid for various applications based on fluid properties.

- 1.1 Define fluids.
- 1.2 Differentiate between ideal and real fluids
- 1.3 Differentiate between compressible and incompressible fluids
- 1.4 State the various units used in Hydraulics
- 1.5 Define various properties of fluids and state their units
- 1.6 Solve problems on properties of fluids
- 1.7 Define intensity of pressure and their units, differentiate between gauge pressure and absolute pressure.
- 1.8 Solve problems on pressure.
- 1.9 Explain the working principle of manometer Solve simple problems on simple U–tube manometer.
- 1.10 Borden tube pressure gauge

CO2: Applying concept of Bernoulli's equation for flow of liquids

- 2.1 Distinguish types of fluid flows and concept on Reynolds's number.
- 2.2 State the various type of energies and the total energy.
- 2.3 Know about the Discharge and velocity of a flowing liquid
- 2.4 Understand the equation of continuity and solve simple problems
- 2.5 State Bernoulli's equation and its application in hydraulics
- 2.6 Solve simple problems on Bernoulli's equation
- 2.7 Explain the working principle Venturi meter and simple problems on Venturi meter.
- 2.8 Explain the working principle pitot tube simple problems pitot tube.

CO3: Estimate frictional losses and design the pipe for flow of liquids through pipes

- 3.1 Mention the equation for loss of head due to friction in pipes
- 3.2 State Darcy's and chezy's formulae and simple problems
- 3.3 Explain the hydraulic gradient and total energy line
- 3.4 Calculate the velocity of flow, discharge and diameter of pipes connecting two reservoirs
- 3.5 Explain the function of siphon and give reason for limiting the height of the pipes
- 3.6 Explain how the power can be transmitted through pipes carrying liquid under pressure.
- 3.7 Express the condition for maximum H.P. through pipes
- 3.8 Solve simple problems on power transmission through pipes

CO4: Analyze forces on plates or vanes due to impact of jets

- 4.1 Derive expression for force of jet on stationary or fixed vertical plate and problems.
- 4.2 Derive expression for force of jet on stationary or fixed inclined flat plate and problems
- 4.3 Derive expression for force of jet on stationary or fixed curved plate and problems
- 4.4 Derive expression for force of jet on moving flat plate and problems.
- 4.5 Derive expression for the force of jet on a series of plates fixed on the rim of a wheel and problems.
- 4.6 Derive expression for the force of jet of water on a moving curved vane when jet strikes tangentially at one end of the tip.
- 4.7 Find the expressions for work done, power and efficiency
- 4.8 Solve simple problems on moving curved vane when jet strikes tangentially at one end of the tip.

CO5: Describe the working of water turbines and estimate the power developed by turbines

- 5.1 State the importance of water turbines
- 5.2 Draw the layout of a hydroelectric power station
- 5.3 Classify the water turbines based on the direction of flow of water & other criteria
- 5.4 Explain the working of Pelton wheel and simple problems.
- 5.5 Explain the working of Francis turbine and simple problems.
- 5.6 Explain the working of and Kaplan turbine and simple problems.
- 5.7 Difference between Pelton wheel and Francis Turbine
- 5.8 Difference between Francis and Kaplan turbines
- 5.9 Describe the governing of water turbines

CO6: Describe a hydraulic pump and estimate the power required to operate hydraulic pumps.

- 6.1 Explain the function of pump and Classify the pumps
- 6.2 Mention the constructional details of single acting pump and simple problems
- 6.3 Mention the constructional details of double acting pumps and simple problems
- 6.4 Expression for theoretical power required and slip and simple problems.
- 6.5 Explain the principle of operation of centrifugal pumps
- 6.6 Mention the constructional and installation of a centrifugal pump
- 6.7 Derive the expression for work done by the centrifugal pump.
- 6.8 Define the heads and efficiency of a centrifugal pump
- 6.9 Solve simple problems on centrifugal pumps
- 6.10 Appreciate the importance of priming and explain priming methods
- 6.11 Explain cavitation in centrifugal pump
- 6.12 Compare the centrifugal pump with a reciprocating pump

REFERENCE BOOKS:

- 1. Fluid Mechanics and Hydraulic Machines Dr.R.K.Bansal
- 2. Hydraulic Machines by S.AnanthaSwamy
- 3. Hydraulic Machines by R.C. Patel
- 4. Hydraulics ByMalhotra&Malhotra
- 5. Hydraulics & Hydraulic Machinery by Yeaple
- 6. Hydraulics and Pneumatics by Reya and Rao.

CO-PO Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	Mapping POs
CO1	3	1	1	-	1	-	-	1,2,3,5
CO2	3	2	2	-	-	-	-	1,2,3
CO3	3	3	3	-	-	-	-	1,2,3
CO4	3	3	1	-	-	-	-	1,2,3
CO5	3	3	3	-	2	1	-	1,2,3,5,6
CO6	3	3	2	-	-	1	-	1,2,3,6

ME-304 FLUID MECHANICS AND HYDRAULIC MACHINERY

MODEL PAPER - MID -I (CIE)

Time: 1 Hour

Max. Marks: 20 M

PART – A

4 X 1 = 4

NOTE: (i) Answer all questions and each question carries one mark.

(ii) Answers should be brief and straight to the point

1. Define ideal fluid.
2. Write the relation between specific weight and density.
3. What is a turbulent flow?
4. What is a pitot tube?

PART – B

2 X 3 = 6

NOTE: (i) Answer all questions and each question carries three marks

(ii) The answers should be comprehensive and the criteria for valuation is the content but not the length of the answer.

5. (a) Calculate the density and specific weight of 1 lt. of petrol with specific gravity 0.7?
OR
5. (b) Convert a vacuum of 90 mm of mercury into absolute pressure in meters of water?
6. (a) What is the difference between steady flow and unsteady flow?
OR
6. (b) Draw a neat sketch of a venturi meter and label its parts.

PART – C

2 X 5 = 10

NOTE: (i) Answer all questions and each question carries five marks

(ii) The answers should be comprehensive and the criteria for valuation is the content but not the length of the answer.

7. (a) Explain the working of Bourdon tube pressure gauge with a neat sketch.
OR
7. (b) A flat plate of area $1.5 \times 106 \text{ mm}^2$ is pulled with a speed of 0.4m/s relative to another plate located at a distance of 0.15mm from it. Find the force and power required to maintain this speed, if the fluid separating them is having viscosity as 1 poise.
8. (a) A pipe has a diameter 15cm at one end, 30cm at the other end. Water is flowing in this pipe with mean velocity of 20m/sec at first end. Find out A) Discharge of water through pipe, B) velocity at the other end
OR
8. (b) A pipe 300 m long has a slope of 1 in 100 and tapers from 1 m diameter at higher end to 0.5 m at the lower end. The quantity of water flowing is 900 lit/ sec. If the pressure at the higher end is 70 kPa, find the pressure at the lower end.

ME-304 FLUID MECHANICS AND HYDRAULIC MACHINERY

MODEL PAPER - MID -II (CIE)

Time: 1 Hour

Max. Marks: 20 M

PART – A

4 X 1 = 4

NOTE: (i) Answer all questions and each question carries one mark.

(ii) Answers should be brief and straight to the point

1. Define Hydraulic mean depth.
2. Define Total energy line?
3. Write an expression for force exerted on flat moving plate.
4. State the condition for maximum efficiency for a series of moving blades struck by a jet of water

PART – B

2 X 3 = 6

NOTE: (i) Answer all questions and each question carries three marks

(ii) The answers should be comprehensive and the criteria for valuation is the content

but not the length of the answer.

5. (a) Water flows through a pipe of 100mm diameter and 60m long with velocity of 2 m/sec. Find the head lost due to friction by using Darcy's formula, $f = 0.005$.

OR

5. (b) State the reason for limiting the height of the pipes for siphon system?

6. (a) A jet of diameter 40mm strikes horizontally on a plate held vertically. What force is required to hold plate for a flow of oil of specific gravity 0.8 with a velocity of 30m/s.

OR

6. (b) Draw the inlet and outlet velocity triangles for a moving curved vane, when a jet enters tangentially at one tip and leaving at the other tip.

PART – C

2 X 5 = 10

NOTE: (i) Answer all questions and each question carries five marks

(ii) The answers should be comprehensive and the criteria for valuation is the content but not the length of the answer.

7. (a) Two reservoirs are connected by a pipeline consisting of two pipes, one of 15cm dia. and 10m length and the other of 22.5cm diameter and length 20m. If the difference between water levels in the two reservoirs is 10m. Calculate the discharge, take $f = 0.02$, neglect minor losses.

OR

7. (b) Water is to be supplied from a reservoir to a turbine. The turbine is situated 150m below the reservoir level. The length of penstock is 1500m. Determine the smallest diameter of penstock to produce 500kW of power with a turbine of efficiency 95% take $f = 0.02$.

8. (a) A jet of 78.64cm² area, moving with a velocity of 12 m/sec impinges on a series of vanes moving with a velocity of 8 m/sec. Determine (i) Force on the plate(ii) Work done per sec,(iii) Efficiency.

OR

8. (b) A jet of water of diameter 15 cm, strikes a curved plate at its centre with a velocity of 25 m/sec. The curved plate is moving with a velocity of 11 m/sec in the direction of jet. The jet is deflected through an angle of 165°. Assuming the plate smooth, find (i) Force exerted on the plate in the direction of jet, (ii) Power of the jet, and (iii) Efficiency of the jet.

**BOARD DIPLOMA EXAMINATIONS
SEMESTER END EXAMINATION (SEE)
MODEL PAPER- ME-304**

FLUID MECHANICS AND HYDRAULIC MACHINERY

TIME : 2 Hours

Max. Marks: 40

PART – A

8 X 1 = 8

NOTE : 1) Answer **all** questions and each question carries **one** mark.

2) Answers should be brief and straight to the point and shall not exceeding three simple sentences

1. Write the Continuity equation for Incompressible fluids.
2. Write the Darcy Weisbach formula.
3. State the pump use.
4. Define Surface tension?
5. What is the Cross-sectional area of bucket in Pelton wheel?
6. Define overall efficiency in hydraulic turbine.
7. Define negative slip for the reciprocating pump.
8. What is positive displacement pump?

PART – B

4X 3= 12

NOTE: (i) Answer **all** questions and each question carries **three** marks

(ii) The answers should be comprehensive and the criteria for valuation is the content but not the length of the answer.

9 (a) State Bernoulli's equation and write any two assumptions made in Bernoulli's equation

OR

9 (b) Draw the layout of hydroelectric power plant and indicate the main parts.

10 (a) Write short notes on syphon system.

OR

10 (b) What are the functions of the casing of a centrifugal pump?

11(a) List any three features of Kaplan turbine.

OR

11 (b) State the need of governing in water turbines.

12 (a) What are the advantages of centrifugal pump over reciprocating pump?

OR

12 (b) Why can the suction height of a pump not exceed certain limit?

PART – C

4 X 5 = 20

NOTE: (i) Answer **all** questions and each question carries **five** marks
(ii) The answers should be comprehensive and the criteria for valuation is the content but not the length of the answer.

13 (a) Explain the working of Simple U-tube manometer with a neat sketch.

OR

13 (b) Explain governing of the reaction turbines with line diagram.

14 (a) Water supplied from a reservoir through a 300mm diameter pipe 600m long to a turbine which is situated 108m below the free surface. Discharge through the pipe is 81 lit/sec. Find the head lost and the power transmitted by the pipe? Darcy's friction factor, $f=0.01$.

OR

14 (b) Explain the working of single acting reciprocating pump with a sketch.

15 (a) A Francis turbine working under a head of 130m runs at 400rpm. The diameter of the runner at inlet is 1.5m and the flow area is 0.5m^2 . The guide blade angle is 20° and vane angle at inlet is 60° . i) Determine power developed ii) Hydraulic efficiency. The velocity of whirl at outlet is zero.

OR

15 (b) A Kaplan turbine is required to develop 7000 KW under a head of 4m, speed ratio is 2, flow ratio is 0.7 and the ratio of boss diameter to runner diameter is 0.35. Find the speed of runner assuming 90% overall efficiency.

16 (a) A double acting reciprocating pump delivers oil of specific gravity 0.82 through a height of 8 m from the pump. The suction height is 5 m and the piston speed is 4 m/sec. The diameter of the cylinder is 10 cm. taking the efficiency of the pump as 60%, find the power of the machine driving the pump.

OR

16 (b) Explain the working principle of centrifugal pump with neat sketch?

ME-305-ENGINEERING MATERIALS

Course Title	Engineering Materials	Course Code	ME-305
Semester	III	Course Group	Core
Teaching Scheme in Periods (L: T: P)	4:1:0	Credits	2.5
Methodology	Lectures + Tutorials	Total contact periods	75
CIE	60 marks	SEE	40 marks

PREREQUISITES:

Basic knowledge of Physics and Chemistry

COURSE OUTCOMES:

On successful completion of the course, the students will be able to:

CO1	Classify the properties of engineering materials and know the testing methods to analyse the mechanical properties"
CO2	Grasp the significance and basic principles underlying the structure of materials.
CO3	Comprehend the methods involved in the production of iron and steel through different processes.
CO4	Apply knowledge of the Iron-Carbon equilibrium diagram to interpret the various microstructures present in iron and steel.
CO5	Utilize knowledge of heat treatment processes to distinguish between different methods used in treating steel.
CO6	Break down the properties and characteristics of various ferrous and nonferrous metals and alloys and understand their suitability for different purposes.

COURSE CONTENT

Unit – 1

Duration:12 Periods (L: 10 – T:2)

Mechanical properties and testing of engineering materials

Engineering Materials –Importance and applications of engineering materials, mechanical properties: strength (Tensile strength, Compressive strength and shear strength), stiffness elasticity, plasticity, Ductility, Malleability, Hardness, Toughness, Brittleness, Impact

strength, Fatigue, Creep. Testing of Engineering materials: Destructive tests– Tensile and Compressive test, shear test, stress- strain curve for different materials – Brinell, Rockwell and Vickers's hardness test –Izod & Charpy impact test. Non-destructive testing: purpose – Different methods - Like Microscopy techniques (SEM, TEM): Scanning Electronic Microscope (SEM) and Transmission Electronic Microscope (Simplified overview without detailed explanation)

Unit – 2

Duration:13 Periods (L: 10 – T:3)

Structure of materials

Space lattices, Unit cells – BCC, FCC, HCP structures. Crystallization of metal: dendrite growth, grain boundary, grain size and its effect on properties–factors affecting grain size – Recrystallisation – Microstructure Enhancement Techniques: Etching solutions.

Unit – 3

Duration: 12 Periods (L:10 – T:2)

Production of Iron and Steel

Raw materials used in production of Iron and steel – Production of: Pig Iron by Blast Furnace, Wrought Iron by Puddling furnace, Cast Iron from Cupola, Steel by Bessemer Process, L.D. Process, Open Hearth Process, Electric Arc process and Electrical Induction process, Concasting (Continuous Casting Process).

Unit – 4

Duration: 13 Periods (L: 10 – T:3)

Iron-Carbon Equilibrium Diagram

Phase, equilibrium, Gibb's phase rule, alloy, solid solution: Interstitial, substitutional, chemical compound, mechanical mixture – Cooling curves of pure metals – Allotropic forms of pure iron and critical points – Micro constituents of Iron & Carbon alloy – Iron Carbon equilibrium diagram.

Unit – 5

Duration: 13 Periods (L: 10 – T:3)

Heat Treatment of Steel.

Stages in heat treatment – critical rate of cooling – martensite, bainite, sorbite and troostite- Isothermal transformation (TTT curves) - Austenite decomposition on continuous cooling transformation (CCT) diagram Heat treatment processes: Annealing – Full Annealing, Sub critical annealing, spheroidise annealing and isothermal annealing. Normalizing, Hardening,

Tempering – Austempering and Martempering, Surface hardening, Case hardening and Vacuum Furnace (only definition).

Unit – 6

Duration: 12 Periods (L: 10 – T:2)

Ferrous, Non-Ferrous metals - their alloys & Powder metallurgy

Ferrous Metals and alloys—cast iron and types – effect of carbon on properties of cast iron—composition, properties and applications of white cast iron, gray cast iron, nodular iron and malleable Iron – Plain carbon steels – effect of carbon on properties. classification of plain carbon steels – Alloy steels: Effect of adding alloying elements chromium, cobalt, manganese, molybdenum, nickel, tungsten, vanadium – composition, properties and application of chromium steel, nickel steel, manganese steel, stainless steel and HSS steel.

Non-Ferrous metals and alloys - composition, properties and application of duralumin, dural metal, Brass: cartridge brass, admiralty brass, muntz metal, and naval brass. Bronze: gun and bell metal Nickel: constantan, Monel, nichrome and invar. Babbit

Powder metallurgy: Definition and applications – Manufacturing process in powder metallurgy, methods to produce metal powders – methods to compact powders (without explanation) – Reaction sintering, Pre sintering and sintering (definition) – Advantages, limitations of powder metallurgy.

Note: At the end of every unit Tutorial classes should be held to interact with the students by various methods (slip test, seminar, quiz, virtual labs etc.) to enhance the skill and to create student centric learning.

REFERENCEBOOKS:

1. Introduction to Physical metallurgy by Avner
2. Physical metallurgy by V. Raghavan
3. Material science and engineering by V. Raghavan
4. Material science and metallurgy by Dr. O.P. KHANNA
5. Powder Metallurgy by TTTI, ECH

SUGGESTED LEARNING OUTCOMES

Upon completion of the course the student shall be able to

CO1: Classify the properties of engineering materials and know the testing methods to analyse the mechanical properties"

- 1.1 Know the importance of materials in industry.
- 1.2 Applications of engineering materials.
- 1.3 Classification of engineering materials.
- 1.4 Identify the various factors for selection of engineering materials
- 1.5 Know different mechanical properties like strength (tensile, compressive and shear strengths) stiffness, elasticity, plasticity, ductility, malleability, hardness, toughness, brittleness, impact strength, fatigue, creep.
- 1.6 Draw stress-strain curves for different materials.
- 1.7 Know the various Destructive tests and Non -destructive tests.
- 1.8 Describe tensile test and compression test on mild steel using universal testing machine (UTM)
- 1.9 Describe shear test
- 1.10 Describe Brinell hardness test.
- 1.11 Describe Rockwell hardness test
- 1.12 Describe Vickers hardness test.
- 1.13 Conduct Izod and Charpy impact tests.
- 1.14 State the purpose of different Non -destructive tests used in industry
- 1.15 Differentiate between a Scanning Electron Microscope (SEM) and a Transmission Electron Microscope (TEM) based on their fundamental principles

CO2 : Grasp the significance and basic principles underlying the structure of materials

- 2.1 Comprehend the concepts of Space lattices and Unit cells.
- 2.2 Draw the structure, calculate effective number of atoms of BCC structure and mention some materials which have the BCC structure
- 2.3 Draw the structure, calculate effective number of atoms of FCC structure mention some materials which have the FCC structure.
- 2.4 Draw the structure, calculate effective number of atoms of HCP structure mention some materials which have the HCP structure.
- 2.5 Explain the process of crystallisation of metals and discuss the process of grain formation, dendritic growth and grain boundaries
- 2.6 Explain factors effecting grain size.
- 2.7 Explain the process of recrystallisation
- 2.8 Explain the role of etching solutions in enhancing the contrast of micro structural features.

CO3: Comprehend the methods involved in the production of iron and steel through different processes.

- 3.1 Name the raw materials used in production of Iron and steel
- 3.2 Describe the production of Pig Iron by Blast Furnace.
- 3.3 Describe the production of Wrought Iron by puddling furnace.
- 3.4 Comprehend the production of Cast Iron from Cupola furnace.
- 3.5 Illustrate the production of steel by Bessemer process.
- 3.6 Describe the production of steel by L.D. Process.
- 3.7 Know the production of steel by Open Hearth process.
- 3.8 Comprehend the production of steel by Electric Arc process.
- 3.9 Describe the production of steel by Electrical Induction process.
- 3.10 Define continuous casting (concasting) and its significance in steel production
- 3.10 Iron -carbon equilibrium diagram.
- 3.10 State Gibbs phase rule and define the terms involved.
- 3.11 Know the importance of alloy and its advantages
- 3.12 Grasp the concept of solid solution
- 3.13 Discuss Interstitial and substitution solid solutions
- 3.14 Describe chemical compound, and mechanical mixture.
- 3.15 Sketch Cooling curves of pure metals
- 3.16 Discuss allotropic forms of pure iron and identify the critical points
- 3.17 Explain the following micro constituents of Iron & Carbon alloy: ferrite, austenite, cementite, ledeburite, pearlite, steel, eutectoid steel, hypo eutectoid steel and hyper eutectoid steel.
- 3.18 Sketch Iron- Carbon equilibrium diagram and understand salient points on it.
- 3.19 Describe peritectic, eutectic, eutectoid reactions.

CO4: Apply knowledge of the Iron-Carbon equilibrium diagram to interpret the various microstructures present in iron and steel.

- 4.1 Importance of heat treatment.
- 4.2 know the stages in heat treatment
- 4.3 Define critical rate of cooling, martensite, bainite, sorbite and troostite
- 4.4 Draw TTT curves (isothermal transformations) and interpret it.
- 4.5 Sketch austenite decomposition on continuous cooling transformation (CCT) diagram.
- 4.6 Explain Annealing heat treatment process
- 4.7 Compare full Annealing, Sub critical annealing, spheroidise annealing and isothermal annealing
- 4.8 Describe Normalizing process and its importance
- 4.9 Describe hardening process and its importance
- 4.10 Describe Tempering process and its importance.
- 4.11 Explain the processes Austempering and Martempering
- 4.12 Define Surface hardening and Case hardening.
- 4.13 Define the concept of a vacuum furnace and its operating principle.

CO5: Utilize knowledge of heat treatment processes to distinguish between different methods used in treating steel

- 5.1 Discuss the effect of carbon on properties of cast iron
- 5.2 List different types of cast irons
- 5.3 Compare the composition and applications of white cast iron, Gray cast iron, nodular iron and malleable Iron
- 5.4 Classify the plain carbon steels
- 5.5 Discuss the effect of carbon on properties of steel
- 5.6 Describe the effect of adding alloying elements chromium, cobalt, manganese, molybdenum, nickel, tungsten, vanadium to steel
- 5.7 Define ternary, quaternary and complex alloy steel
- 5.8 Explain the composition, properties and application of chromium steel, HSS steel, nickel steel, manganese steel and stainless steel.
- 5.9 List composition, properties and application of duralumin, dural metal
- 5.10 Give composition, properties and application of brass, cartridge brass, admiralty brass, muntz metal, and naval brass.

CO6: Break down the properties and characteristics of various ferrous and nonferrous metals and alloys and understand their suitability for different purposes.

- 6.1 Explain the importance of Bronze, gun metal and bell metal
- 6.2 Discuss the composition and application of Nickel alloys: constantan, Monel, Nichrome and invar.
- 6.3 Write composition and application of Babbitt metal
- 6.4 Define Powder metallurgy
- 6.5 Describe the manufacturing process in powder metallurgy.
- 6.6 Write the processes to produce metal powders.
- 6.7 List the methods to compact powders
- 6.8 Define Pre sintering and sintering.
- 6.9 Define reaction sintering and differentiate it from conventional sintering processes.
- 6.10 Write advantages and limitations of powder metallurgy.
- 6.11 Applications of powder metallurgy.

SUGGESTED STUDENT ACTIVITIES:

- 1. Make a list of commonly used materials in daily life like blade, knife, scissors etc and write the material used.
- 2. Examine the microstructure of the provided specimen.
- 3. Examine micro structure of given specimen after it is welded and notice the difference.
- 4. Visit to a steel plant
- 5. Compare hardness of commonly available materials and interpret.
- 6. Make a list of major parts of a two-wheeler and know the material used.
- 7. Visit a heat treatment plant.

SUGGESTED E-RESOURCES:

1. Crystal lattice and unit cell https://www.youtube.com/watch?v=BjVTdZ_hu8
2. BCC, FCC and HCP crystal structure
<https://www.youtube.com/watch?v=tq7botEnakA>
3. Production of pig iron by blast furnace
<https://www.youtube.com/watch?v=D3ejDgChEhw>
4. Production of Wrought Iron by Puddling furnace
<https://www.youtube.com/watch?v=XJ0GyofGchI>
5. Production of Cast Iron from Cupola
<https://www.youtube.com/watch?v=Cgbpbw5GRK4>
6. Production of Steel by Bessemer Process
https://www.youtube.com/watch?v=uh_RAMqRgrk
7. Production of Steel by Open Hearth Process <https://www.youtube.com/watch?v=LxH-B1efDnI>
8. Production of Steel by electric arc furnace
<https://www.youtube.com/watch?v=7oSbZgjXlFo>
9. Production of Steel by electrical induction process
<https://www.youtube.com/watch?v=5TLBdBXzMsg>

COURSE OUT COMES		CL	LINKED PO'S	TEACHING PERIODS
CO1	Classify the properties of engineering materials and know the testing methods to analyse the mechanical properties"	R, U, A	1,2,3,4	12
CO2	Grasp the significance and basic principles underlying the structure of materials.	R, U, A	1,3,4,7	13
CO3	Comprehend the methods involved in the production of iron and steel through different processes.	R, U, A	1,2,4,5	12
CO4	Apply knowledge of the Iron-Carbon equilibrium diagram to interpret the various microstructures present in iron and steel.	R, U, A	1,2,4,7	13
CO5	Utilize knowledge of heat treatment processes to distinguish between different methods used in treating steel.	R, U, A	1,2,4,7	13
CO6	Break down the properties and characteristics of various ferrous and nonferrous metals and alloys and understand their suitability for different purposes.	R, U, A	1,2,3,5	12
TOTAL PERIODS				75

Legends: R = Remember; U= Understand; A= Apply and above levels (Bloom's revised taxonomy)

CO-PO ATTAINMENT MATRIX

COURSE OUTCOMES	PO1	PO2	PO3	PO4	PO5	PO6	PO7	Mapping Pos
CO1	3	2	-	1	-	-	-	PO1, PO2, PO4
CO2	3	1	-	-	-	-	-	PO1, PO2
CO3	3	-	2	-	-	-	-	PO1, PO3
CO4	3	1	-	-	-	-	-	PO1, PO2
CO5	3	1	-	1	-	-	-	PO1, PO2, PO4
CO6	3	2	1	-	-	-	-	PO1, PO2, PO3

Level-3-highly addressed, Level-2-moderately addressed, Level-1-Lowely addressed

MODEL PAPER
MID SEM I EXAMINATION
DME III SEMESTER ENGINEERING MATERIALS

Time: 1 hr

Total Marks: 20

PART – A

Marks: 4 X 1 M = 4 M

NOTE: 1) Answer all questions and each question carries one marks.

2) Answers should be brief and straight to the point and shall not exceed three simple sentences

1. Define the term strength
2. Define the term creep
3. What is meant by unit cell?
4. Draw the shape of dendrite.

PART – B

Marks : 2 X 3 M= 6 M

NOTE: 1) Answer all questions and each question carries three marks

2) The answers should be comprehensive and the criteria for valuation are the content but not the length of the answer.

5 (a) Write the importance of engineering materials in industry.

OR

5 (b) Write any three differences between Izod and Charpy impact test . 6 (a) Describe factors affecting the grain size.

OR

6 (b) Calculate effective numbers of atoms in FCC structure.

PART – C

Marks: 2 X 05 M= 10 M

NOTE: 1) Answer all questions and each question carries five marks

2) The answers should be comprehensive and the criteria for valuation is the content but not the length of the answer.

7 (a) Explain the procedure to conduct the tensile test on mild steel by UTM

OR

7(b) Explain about Vickers hardness test

8 (a) Explain BCC structure with the help of sketch.

OR

8 (b) Explain the process of recrystallisation.

MODEL PAPER
MID SEM II EXAMINATION
DME III SEMESTER ENGINEERING MATERIALS

Time: 1 hr

Total Marks: 20

PART – A

Marks: 4 X 1 M = 4 M

NOTE: 1) Answer all questions and each question carries one marks.

2) Answers should be brief and straight to the point and shall not exceed three simple sentences

1. What are the different raw materials for production of iron?
2. Name the type of iron produced by puddling furnace.
3. Define alloy.
4. What is a solid solution?

PART – B

Marks: 2 X 3 M= 6 M

NOTE: 1) Answer all questions and each question carries three marks

2) The answers should be comprehensive and the criteria for valuation is the content but not the length of the answer.

- 5 (a) List two types of electric furnaces.

OR

- 5 (b) Write the principle of steel making.
- 6 (a) Define interstitial solid solution and substitutional solid solution.

OR

- 6 (b) Write short note on eutectoid steel.

PART – C

Marks: 2 X 05 M= 10 M

NOTE: 1) Answer all questions and each question carries five marks

2) The answers should be comprehensive and the criteria for valuation is the content but not the length of the answer.

- 7(a) Explain about steel production by L-D Process.

OR

- 7(b) Explain production of wrought iron by puddling furnace.

- 8 (a) Discuss allotropic forms of pure iron and identify the critical points.

OR

- 8(b) Explain peritectic, eutectic, and eutectoid reactions in iron carbon equilibrium.

ME-305 - SEE- MODEL PAPER
BOARD DIPLOMA EXAMINATION
DME III SEMESTER ENGINEERING MATERIALS

TIME: 2 Hours

Max. Marks: 40

PART – A

Marks: 8 X 1 M = 8M

NOTE:1) Answer all questions and each question carries one mark.

2) Answers should be brief and straight to the point and shall not exceeding three simple sentences

1. Define the term malleability.
2. What are the by-products of blast furnace?
3. What is meant by non-ferrous metal?
4. Define shear strength.
5. Define the term heat treatment.
6. Name any two annealing processes.
7. What is steel?
8. What is meant by sintering?

PART – B

Answer all questions . Each question carries three marks

4 x 3 M = 12M

- 9 (a) Write short notes on a) creep b) fatigue.

OR

- 9 (b) What are the three stages of heat treatment of steel?

- 10 (a) Write the function of coke and lime stone in production of iron.

OR

- 10 (b) Write the composition of High speed steel. And its applications. 11(a) Write about tempering process and its importance.

OR

- 11 (b) Explain sub critical annealing. 12 (a) Classify plain carbon steels.

OR

- 12 (b) what are the advantages of powder metallurgy?

PART – C

Answer all questions . Each question carries five marks 4 x 5 M = 20 M

13 (a) Explain BCC structure with sketch and name the materials which have the BCC structure.

OR

13 (b) Explain normalising process.

14 (a) Explain production of cast iron by cupola furnace.

OR

14 (b) Write short notes on below two methods of manufacture of metal powders

i) Mechanical pulverisation ii) atomisation

15 (a) Explain continuous cooling transformation (CCT) curves.

OR

15 (b) Explain hardening processes.

16 (a) Write composition, properties and application of Babbitt metal.

OR

16 (b) Explain briefly the sequence of operation in producing a part by powder metallurgy.

ME-306 ADDITIVE AND ADVANCED MANUFACTURING PROCESS

Course Title:	Additive and Advanced Manufacturing Process	Course Code	ME-306
Semester	III Semester	Course Group	Core
Teaching Scheme in Periods (L:T:P)	4:1:0	Credits	2.5
Methodology	Lecture+Tutorials	Total Contact Periods	75
CIE	60 Marks	SEE	40 Marks

Pre requisites

Basic knowledge of Manufacturing Processes and CAD software.

Course Outcomes

Upon completion of the course, the student shall be able to

CO1	Explain different working principles of additive manufacturing processes and understand the basic concept of Vat photo polymerization AM Process.
CO2	Explore the Basic principle and working of fused deposition modeling (FDM) 3D Printing process
CO3	Explain the Powder Fusion Mechanism and various processes.
CO4	Apply suitable CAD tools and CAD interface for additive manufacturing process
CO5	Appreciate the role of post-processing techniques and Explore the Applications of Additive Manufacturing in various fields
CO6	Explain Modern machining process for different applications.

Course Content and Blue Print of Marks for SEE

Unit No	Unit Name	Periods	Questions to be set for SEE				
			R		U	A	
I	Introduction to Additive Manufacturing& Vat Photo polymerization AM Processes	15	Q4	Q1		Q9(a)	Q13(a)
II	Extrusion-Based AM Processes	10					
III	Powder Bed Fusion AM Processes	15		Q2		Q10(a)	Q14(a)
IV	CAD Modelling for 3D printing	10					
V	Post processing and Applications for Additive Manufacturing	12		Q3	Q5,Q6	Q9(b),Q11(a) , Q11(b)	Q13(b),Q15(a) , Q15(b)
VI	Modern Machining Process	13			Q7,Q8	Q10(b),Q12(a), Q12(b)	Q14(b),Q16(a) , Q16(b)
	Total	75	8		8	8	

Course Contents

UNIT - 1: Introduction to Additive Manufacturing & Vat Photo polymerization AM Processes

Duration: 15 Periods (L: 13 – T: 2)

Introduction to Additive Manufacturing, Use of AM Parts, Process chain or Steps in AM, Benefits of AM, Limitations of AM, Distinction between CNC machining and AM, Types of materials for AM, and Classification of additive manufacturing processes. Concepts of additive manufacturing technologies.

Vat Photo polymerization AM Processes: Stereo lithography (SL), Materials, Process Modeling, Process Benefits and Drawbacks, Applications of Vat Photo polymerization.

UNIT - 2: Extrusion-Based AM Processes

Duration: 10 Periods (L: 8 – T: 2)

Extrusion Based AM Processes-Introduction, Principles, Materials, Plotting and path control, Fused Deposition Modeling (FDM), Bio-Extrusion, Contour Crafting, FDM of Ceramics, Advantages and Limitations of FDM, Applications of Extrusion-Based Processes.

UNIT - 3: Powder Bed Fusion AM Processes

Duration: 15 Periods (L: 12 – T: 3)

Selective laser Sintering (SLS), Materials, Powder fusion mechanism and powder handling, Process Parameters, Electron Beam melting (EBM), Process Benefits and Drawbacks, Applications of Powder Bed Fusion Processes, Case Studies.

UNIT - 4: CAD Modeling for 3D printing

Duration: 10 Periods (L: 8 – T: 2)

CAD Modeling for 3D printing-3D Scanning and digitization, data handling & reduction Methods, AM Software: data formats and standardization, Slicing algorithms: -uniform flat layer slicing, adaptive slicing, Process-path generation: Process-path algorithms, rasterisation, part Orientation and support generation.

UNIT - 5: Post processing and Applications for Additive Manufacturing

Duration: 12 Periods (L: 10 – T: 2)

Post Processing- Introduction, Support Material Removal, Surface Texture Improvement, Accuracy Improvement, Aesthetic Improvement, Preparation for use as a Pattern, Property Enhancements using Non-thermal and Thermal Techniques. Applications for Additive Manufacturing- Aerospace and Automotive application, Use of AM to support Medical Applications, Tissue Engineering, Biomedical Application, Art, Fashion, Jewelry, Toys & Other Applications.

UNIT - 6: Modern Machining Process

Duration: 13 Periods(L: 11 – T: 2)

Introduction – comparison with traditional machining; Ultrasonic Machining: principle, Description of equipment, applications - Electric Discharge Machining: Principle, Description of equipment, Dielectric fluid, tools (electrodes), Process parameters, Output characteristics, applications - Wire cut EDM: Principle, Description of equipment, Controlling parameters; applications - Abrasive Jet Machining: principle, description of equipment, application - Laser Beam Machining: principle, description of equipment, application - Electro Chemical Machining: description of equipment, application.

Text Books

1. Ian Gibson, David W Rosen, Brent Stucker., “Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing.”
2. Chua Chee Kai, Leong Kah Fai, “3D Printing and Additive Manufacturing: Principles & Applications.”
3. Additive Manufacturing, Second Edition, Amit Bandyopadhyay Susmita Bose, CRC Press Taylor & Francis Group, 2020.
4. Additive Manufacturing: Principles, Technologies and Applications, C.P Paul, A.N Junoop, McGrawHill, 2021.
5. D.T. Pham, S.S. Dimov, Rapid Manufacturing: The Technologies and Applications of Rapid Prototyping and Rapid Tooling.
6. Patri K. Venuvinod and Weiyin Ma, “Rapid Prototyping: Laser-based and Other Technologies.”
7. Rafiq Noorani, Rapid Prototyping: Principles and Applications in Manufacturing, John Wiley & Sons.
8. Manufacturing Technology - P N Rao
9. Production Technology - R.C.Patel
10. Production Technology - Jain & Gupta

Suggested e-Learning Links

1. <https://www.nist.gov/additive-manufacturing>
2. <https://www.metal-am.com/>
3. <http://additivemanufacturing.com/basics/>
4. <https://www.3dprintingindustry.com/>
5. <https://www.thingiverse.com/>
6. <https://reprap.org/wiki/RepRap>

Suggested Learning Outcomes

For achieving the Course outcomes, the following learning outcomes must be achieved

CO1: Explain different working principles of additive manufacturing processes and understand the basic concept of Vat photo polymerization AM Process.

- 1.1 Understand the fundamental concepts and principles of additive manufacturing (AM).
- 1.2 Explain the process chain or steps involved in additive manufacturing, from design to final part production.
- 1.3 Identify the benefits of additive manufacturing compared to traditional manufacturing methods.
- 1.4 Recognize the limitations and challenges associated with additive manufacturing processes.
- 1.5 Understand the distinction between AM and CNC Machining.
- 1.6 Describe the types of materials used in additive manufacturing.
- 1.7 Classify additive manufacturing processes based on their working principles and techniques.
- 1.8 Explain the working principle of Vat photo polymerization AM processes, with a focus on Stereo lithography (SL).
- 1.9 Identify the materials commonly used in Vat photo polymerization AM processes.
- 1.10 Understand the process modeling techniques used in Vat photo polymerization AM processes.
- 1.11 Evaluate the benefits and drawbacks of Vat photo polymerization AM processes.
- 1.12 Explore the applications of Vat photo polymerization AM processes in various industries, such as prototyping, healthcare, and aerospace.

CO-2: Explore the Basic principle and working of fused deposition modeling (FDM) 3D Printing process

- 2.1 Appreciate the impact of extrusion-based AM on manufacturing and product development, Understand the fundamental principles of extrusion-based additive manufacturing (AM) processes.
- 2.2 Explain the basic principles underlying extrusion-based AM, including layer-by-layer deposition and controlled material extrusion.
- 2.3 Understand the role of support structures and their significance in achieving successful prints.
- 2.4 Describe the different types of materials used in extrusion-based AM, including thermoplastics, biomaterials, and ceramics.
- 2.5 Understand the principles of plotting and path control in extrusion-based AM systems.
- 2.6 Describe the Fused Deposition Modeling (FDM) process, including the equipment setup, material extrusion, and layer-by-layer deposition.
- 2.7 Identify the advantages, limitations, and considerations specific to FDM technology in additive manufacturing applications.
- 2.8 Define bio-extrusion or bioprinting and its application in tissue engineering, regenerative medicine.
- 2.9 Explain the principles and advantages of contour crafting in construction and large-scale manufacturing.
- 2.10 Describe the process of FDM of ceramics
- 2.11 Identify and describe common limitations and challenges associated with FDM technology
- 2.12 Explore a range of applications for extrusion-based AM processes across industries, including prototyping, custom manufacturing, and education.

CO3: Explain the Powder Fusion Mechanism and various processes.

- 3.1 Understand the working principles and operation of Selective Laser Sintering (SLS) technology in additive manufacturing.
- 3.2 Explore the range of materials suitable for SLS, including polymers, metals, and ceramics.
- 3.3 Explain the powder fusion mechanism in SLS processes and the importance of proper powder handling techniques.
- 3.4 Describe the key process parameters in SLS, such as laser power, scanning speed, and layer thickness.
- 3.5 Describe the principles of electron beam melting (EBM)
- 3.6 Understand the working principles and differences between Selective Laser Sintering (SLS) and Electron Beam Melting (EBM) technologies.
- 3.7 Identify the unique advantages and limitations of EBM compared to other powder bed fusion processes.
- 3.8 Analyze the benefits and drawbacks of powder bed fusion processes
- 3.9 Explore a wide range of applications for powder bed fusion processes in industries such as aerospace, healthcare, and consumer goods.
- 3.10 Analyze case studies and examples of successful applications, including prototyping, tooling, and end-use production.

CO4: Apply suitable CAD tools and CAD interface for additive manufacturing process

- 4.1 Learn various methods for capturing and converting physical objects into digital 3D models.
- 4.2 Understand the principles and techniques of 3D scanning and digitization.
- 4.3 Identify common data formats used in additive manufacturing (AM) software and understand their characteristics and compatibility.
- 4.4 Understand the principles behind slicing algorithms used in additive manufacturing.
- 4.5 Explore different slicing techniques, including uniform flat layer slicing, adaptive slicing, and rasterization.
- 4.6 Understand the principles of process-path generation and its importance in additive manufacturing.
- 4.7 Implement process-path algorithms to generate tool paths for additive manufacturing machines.
- 4.8 Analyze rasterization techniques and their impact on print quality and efficiency..
- 4.9 Evaluate the importance of part orientation in achieving optimal print results.
- 4.10 Utilize software tools to determine the best orientation for printing based on factors such as support requirements and surface finish.

CO5: Appreciate the role of post-processing techniques and Explore the Applications of Additive Manufacturing in various fields

- 5.1 Identify the different types of post-processing techniques and their applications in enhancing AM parts.
- 5.2 Understand the importance of proper support removal in achieving desired surface finish and dimensional accuracy.
- 5.3 Implement techniques to improve the surface finish of 3D printed parts.
- 5.4 Identify common sources of dimensional inaccuracies in 3D printed parts and implement post-processing techniques to improve dimensional accuracy, such as machining.
- 5.5 Enhance the visual appearance of 3D printed parts through painting, coloring, or surface treatments to meet aesthetic requirements.
- 5.6 Recognize the requirements for using 3D printed parts as patterns for casting and molding processes.
- 5.7 Explore non-thermal techniques, and thermal techniques to enhance part strength, durability, or thermal stability.
- 5.8 Identify specific applications of additive manufacturing in the aerospace and automotive industries, such as rapid prototyping, tooling, and lightweight component production.
- 5.9 Explore the use of additive manufacturing to support medical applications, including surgical and diagnostic aids, prosthetics development, and manufacturing of medically related products.
- 5.10 Describe the role of additive manufacturing in tissue engineering and regenerative medicine, including the fabrication of scaffolds, and bio-printed tissues.
- 5.11 Explore the creative applications of AM in art, fashion, jewelry, and toy industries.

CO6: Explain Modern machining process for different applications.

- 6.1 Compare modern machining process with traditional machining.
- 6.2 Understand the principle, construction of Ultrasonic Machine and its applications.
- 6.3 Understand the principle of Electric Discharge Machining, Description of equipment
- 6.4 State the necessity of Dielectric fluid.
- 6.5 Identify the function of electrodes and its materials.
- 6.6 Give Process parameters, Output characteristics, of electrodes.
- 6.7 Understand the principle of Wire cut EDM, Description of equipment, controlling parameters and give applications.
- 6.8 Understand the principle of Abrasive Jet Machining description of equipment, and give application.
- 6.9 Understand the principle of Laser Beam Machining, description of equipment, and give application.
- 6.10 Understand the principle of Electro Chemical Machining, description of equipment, and give application

Suggested Student Activities

- 1) Provide students with case studies of real-world additive manufacturing projects in different industries (e.g., aerospace, medical, consumer goods).
- 2) Allow students to operate 3D printers and familiarize themselves with the printing process. Have them load filaments, set printing parameters, and monitor the printing progress. This hands-on experience will deepen their understanding of additive manufacturing technology.
- 3) Organize CAD modeling challenges where students are given specific design requirements (e.g., weight reduction, assembly constraints) and must create 3D models that meet those criteria. This activity will enhance their CAD modeling skills and creativity.
- 4) Have students research and compare different materials commonly used in additive manufacturing (e.g., thermoplastics, metals, ceramics). Then, ask them to select the most suitable material for specific applications based on material properties, cost, and performance requirements.
- 5) Assign group projects where students collaborate to solve a complex problem using additive manufacturing. Examples could include creating a functional tool or gadget, or developing a custom medical device. This activity promotes teamwork, problem-solving, and project management skills.
- 6) Invite professionals from additive manufacturing companies or experts in specific application areas (e.g., aerospace engineers, biomedical researchers) to give guest lectures or organize field trips to additive manufacturing facilities. This exposes students to real-world applications and industry practices.
- 7) Assign research topics related to additive manufacturing advancements, emerging technologies, or challenges facing the industry.
- 8) Use additive manufacturing simulation software to simulate different printing scenarios and evaluate their outcomes. Students can adjust printing parameters, analyze results, and optimize the printing process to achieve desired outcomes. This activity reinforces theoretical concepts and problem-solving skills.

CO-PO Mapping Matrix

	Basic and Discipline Specific Knowledge	Problem Analysis	Design/Development of Solutions	Engineering Tools, Experimentation and Testing	Engineering Practices for Society, Sustainability and Environment	Project Management	Lifelong Learning	Linked PO
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	
CO1	3	1	-	-	1	-	-	1,2,5
CO2	2	1	-	-	1	-	-	1,2,5
CO3	2	-	2	2	-	-	-	1,3,4
CO4	3	2	-	-	-	2	-	1,2,6
CO5	3	-	-	-	2	-	2	1,5,7
CO6	2	3	-	2	1	1	2	1,2,4,5,6,7

State Board of Technical Education and Training, Telangana
Model Question paper
Additive and Advanced Manufacturing Process IV-SEMESTER
Mid Semester-I Examination

Course Code: ME-306

Duration: 1 hour

Course Name: Additive and Advanced Manufacturing Process Max. Marks: 20 Marks

PART-A

Answer **all** questions- Each Question carries **ONE**-mark

4x1 = 4 Marks

1. Define additive manufacturing (AM).
2. What is one limitation of additive manufacturing?
3. Name one common material used in extrusion-based additive manufacturing.
4. Which material is commonly used in FDM of ceramics?

PART-B

Answer **two** questions- Each Question carries **THREE** marks

2x3 = 6 Marks

5. a) List three benefits of using additive manufacturing over traditional manufacturing methods.
(OR)
b) Name three types of materials commonly used in additive manufacturing processes and give an example of each.
6. a) Write three advantages and three limitations of FDM in additive manufacturing.
(OR)
b) What is Bio-Extrusion process?

PART-C

Answer **two** questions- Each Question carries **FIVE** marks

2x5 = 10 Marks

7. a) Explain stereo lithography process with a neat diagram.
(OR)
b) List and explain process chain (stages) of additive manufacturing.
8. a) Describe the FDM process, including the heating, extrusion, and deposition stages?
(OR)
b) What is plotting and path control in the context of Extrusion Based AM?

State Board of Technical Education and Training, Telangana
Model Question paper
Additive and Advanced Manufacturing Process IV-SEMESTER
Mid Semester-II Examination

Course Code: ME-306

Duration: 1 hour

Course Name: Additive and Advanced Manufacturing Process Max.Marks: 20 Marks

PART-A

Answer **all** questions- Each Question carries **ONE** mark

4x1 = 4 Marks

1. What does SLS stand for in the context of additive manufacturing?
2. Which energy source is typically used in Electron Beam Melting (EBM)?
3. Name one common data format used for storing 3D model information.
4. Define rasterization.

PART-B

Answer **two** questions- Each Question carries **THREE** marks

2x3 = 6 Marks

5. a) What are three essential process parameters that influence the quality of parts fabricated through powder bed fusion processes?
(OR)
b) List three benefits and three drawbacks of using powder bed fusion processes in additive manufacturing.
6. a) Explain the difference between uniform flat layer slicing and adaptive slicing techniques in additive manufacturing.
(OR)
b) What is the importance of part orientation in additive manufacturing?

PART-C

Answer **two** questions- Each Question carries **FIVE** marks

2x5 = 10 Marks

7. a) Define powder bed fusion processes. Discuss the solid-state sintering mechanism.
(OR)
b) Write the differences between Selective Laser Sintering (SLS) and Electron Beam Melting (EBM).
8. a) Describe the process of capturing and converting physical objects into digital 3D models, mentioning various methods involved.
(OR)
b) Explain the process-path generation in additive manufacturing, highlighting the role of rasterization.

State Board of Technical Education and Training, Telangana
Model Question paper
Additive and Advanced Manufacturing Process IV-SEMESTER
Semester End Examination

Course Code: ME-306

Duration: 2 hour

Course Name: Additive and Advanced Manufacturing Process

Max. Marks: 40 Marks

PART-A

Answer **all** questions- Each Question carries **ONE** mark

8x1 = 8 Marks

1. Briefly define contour crafting.
2. What does EBM stand for in additive manufacturing?
3. What is the primary principle of Abrasive Jet Machining?
4. Name one application of bio-extrusion in additive manufacturing.
5. Name one method to enhance the visual appearance of 3D printed parts for aesthetic requirements.
6. Identify one common source of dimensional inaccuracies in 3D printed parts.
7. What is a dielectric fluid.
8. Name the material used for electrode in EDM

PART-B

Answer **Four** questions- Each Question carries **THREE** marks

4x3 = 12 Marks

9. a) Discuss the materials commonly used in extrusion-based AM processes
(OR)
b) Explain the difference between non-thermal and thermal techniques.
10. a) Identify and describe common data formats used in additive manufacturing (AM) software
(OR)
b) Write the advantages of Modern machining process.
11. a) Why is post-processing important?
(OR)
b) Discuss the role of additive manufacturing in supporting medical applications.
12. a) List the functions of an electrode in modern machining process.
(OR)
b) List various electrode materials.

PART-C

Answer Four questions- Each Question carries FIVE marks

4x5 = 20 Marks

13. a) Define additive manufacturing process. List out the advantages of AM process in detail.

(OR)

b) Explain in brief the applications of AM systems in various industries with examples.

14. a) Explain with a neat sketch the working principle of Selective Laser Sintering process.

(OR)

b) Explain AJM.

15. a) List out the post processing technique of additive manufacturing parts. Explain any three techniques?

(OR)

b) Discuss the importance of aesthetic enhancements in additive manufacturing and provide examples of techniques used to achieve them.

16. a) Explain Electro Chemical Machining.

(OR)

b) Explain Ultrasonic machining.

ME-307 MACHINE DRAWING

Course title	Machine Drawing	Course Code	ME-307
Semester	III	Course group	Practical
Teaching scheme in periods (L:T:P)	1:0:2	Credits	1.25
Methodology	Lecturer + Practice	Total contact periods	45
CIE	60 Marks	SEE	40 Marks

PRE REQUISITES: This course requires the knowledge of Engineering Drawing

COURSE OUTCOMES: On successful completion of the course, the students will be able to

CO1	Outline the machine drawing.
CO2	Select the need and application of different types of fasteners and draw according to specifications, keys and cotter joints welded joints, piping layout and riveted joints as per IS standards.
CO3	Illustrate and draw various Welding symbols
CO4	Show and draw various pipe fittings and layouts
CO5	Proficiency In reading and interpret various drawings of a component and understand the concepts of Assembly drawings

BLUE PRINT OF MARKS FOR SEMESTER END EXAM

Unit No.	Unit Name	Periods	Questions for SEE			Remarks
			R	U	A	
1	Introduction and fastening devices	8		Q.No.1,2		
2	Pipe Layouts and Welding symbols	7		Q.No.3,4		
3	ASSEMBLY-I Assembly drawings of cotter joint, Gib and Cotter joint, Knuckle Joint, Muff coupling, universal coupling, Flange couplings, Screw Jack, Stuffing Box	15			Q.No.5	
4	ASSEMBLY –II Assembly Drawings of Bearings (Foot step Bearing, Plummer block), cross Head, connecting rod, Eccentric, lathe tail stock	15			Q.No.6	
TOTAL		45		4	2	

COURSE CONTENT

1.0 Introduction

Importance of Machine Drawing - Brief revision of 1st and 3rd angle projections - Understand the concepts of Orthographic projections and Sectional views.

Fastening Devices

Temporary and Permanent fastenings and their areas of application-thread nomenclature, forms of screw thread profiles, metric, B.A., Acme, Knuckle, etc. *Bolts and Nuts*: Specification of bolts and nuts, different types of bolted joints (through bolts, studs, screws etc.) in different applications. Purpose of lock nuts and their types *Keys and cotters*: Types of keys and cotters: Difference between key and cotter uses. *Rivets and Riveted joints*: Types and proportions and specification of rivets: Different types of riveted joints: Lap, butt-single row, double row etc., chain and zigzag riveting – calculation of diameter of rivet: Pitch and arrangement of rivets in row – use – of standard proportions.

Welded joints and types. Pipe Joints

Exercises: 1

1. Thread Nomenclature and forms of screw thread profiles.
2. Exercises in drawing – bolted connections using standard proportions.
3. Drawing of various types of lock nuts & types of keys indicating their proportionate dimensions.
4. Exercise in drawing riveted joints using standard proportions: Single row, double row (chain and zigzag) in lap and butt joints (single & double strap).

2.0 Piping layouts

Classification of pipes and tubes- Components of pipes lay-out.-Screw fitting bend, elbow, tee, lateral Cross-nipple, reducing socket and plug - Unions: Screwed ground and flanged - Valves: Gate valve: angle valve, check valve - Various conventional symbol used for the above components.

Exercise: 2

1. Single line diagram of pipe layout one exercises.
2. Double line diagram of pipe layout one exercise.

Welded fabrication drawings

Different types of weld and their basic symbols including sectional representation as per table of I.S. standards, fillet, square butt, single V-Butt, double V-Butt, single bevel

butt, double bevel butt, stud, bead (edge or seal) spot, seam. - Elements of welding symbol and their standard location the symbol as per IS standards reference code arrow head, weld symbol supplementary symbol dimensions of welds, method of welding process, special reference - Significance of arrow & position of arrow head significance of reference line as per I.S. standards with reference to fillet, V-Butt and stud welds. Supplementary symbols and special instructions: surface of reference line; as per I.S. standards with reference to fillet, V-Butt and stud welds.- Dimensions of welds: length, location and spacing of welds as per I.S., B.I.S., standards with showing dimensions required on a welding - Need of special reference.

Exercise: 3

1. Drawing tables and figs. Referred in the contents above taking from I.S. standards.
2. Dimensioning a given welding drawings as per I.S., SP-46-1988.
3. Preparing working drawing of welding fabrication from given data.

3.0 Assembly Drawings-I

Need and functions of assembly and detailed drawings - Steps in preparing assembly drawings -. - Exercises in preparing assembly drawings of commonly available engineering components.

Exercise: 4

Draw the views / sectional views of

1. Cotter joint
2. Jib and cotter joint assembly
3. Knuckle joint assembly
4. Assembly of muff coupling (solid & split) coupling, Flange couplings
5. Screw jack assembly
6. Stuffing box.

4.0 Assembly Drawings-II

With the knowledge gained by the above exercises the students shall be able to draw exercises on bearings,

1. Protective type flanged coupling
2. Piston of petrol engine

3. Cross head
4. Connecting rod
5. Eccentric
6. flexible coupling
7. Lathe tool post
8. Foot step bearing
9. Plummer block
10. Lathe tail stock

REFERENCE BOOKS:

1. T.S.M & S.S.M in respect of Technical Drawing by TTTI, Madras
2. Machine Drawing by A.C. Parkinson.
3. Machine Drawing by Jones & Jones.
4. Machine Drawing by N.D. Bhatt.

SUGGESTED LEARNING OUTCOMES:

On the completion of the course the student should be able to

CO1: Outline the machine drawing.

- 1.1 Know and draw Conventional representation of materials and parts such as screws, nuts, bolts, keys, gears, webs, ribs.
- 1.2 Know the standard specifications of Nuts & Bolts
- 1.3 Know the various temporary fastening devices
- 1.4 Know the various permanent fastening devices
- 1.5 Know difference between Temporary and permanent joints
- 1.6 Know the standard representation of Internal and external threads of Bolts & Nuts
- 1.7 Understand the Standard proportions of various threads like V, ACME, Square, Metric , Knuckle etc.,
- 1.8 Know the standard designation and purpose of Locknut, washer, set screws.
- 1.9 Know the Applications of Keys, riveted joints
- 1.10 Understand the Standard proportions of various keys and cotters
- 1.11 Know the difference between Key & Cotter
- 1.12 Know different types of riveted joints and draw according to standard specifications

CO2: Select the need and application of different types of fasteners and draw according to specifications, keys and cotter joints welded joints, piping layout and riveted joints as per IS standards.

- 2.1 Know the conventional symbols of various welded joints
- 2.2 Know the conventional symbols of various pipe joints.
- 2.3 Draw the Single line diagram of pipe layout
- 2.4 Know and draw Double line diagram of pipe layout

CO3: Illustrate and draw various Welding symbols

- 3.1 Know the need of assembly drawing
- 3.2 Know the functions of assembly drawing like manufacturing and functional requirements
- 3.3 Know the various steps in making assembly drawing like
 - Geometrical mapping
 - Dimensional mapping and
 - Functional matching
- 3.4 Study functional requirements of each component and their inter relationship
- 3.5 Study carefully the views of each component in the detail drawing and decide the relative location of each part for the proper functioning of the machine.
- 3.6 Decide the mating dimensions between two components which are required to be assembled
- 3.7 Know the use of bill of material and its designation

Course Outcomes		CL	Linked PO	Teaching Periods
CO1	Understand the machine drawing.	U/A	1,4,7	3
CO2	Understand need and application of different types of fasteners and draw according to specifications, keys and cotter joints welded joints, piping layout and riveted joints as per IS standards.	U/A	1,2,3,4,5,7	6
CO3	Understanding and draw various Welding symbols	U/A	1,4,7	3
CO4	Understand various pipe fittings and layouts	A	1,3,4,5,7	3
CO5	Proficiency In reading and interpret various drawings of a component and understand the concepts of Assembly drawings	U/A	1,2,3,4,7	30

CO-PO MAPPING MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	-	-	1	-	-	2
CO2	3	1	1	2	1	-	3
CO3	3	-	-	2	-	-	2
CO4	3	-	1	2	1	-	2
CO5	3	1	1	2	-	-	2

BOARD DIPLOMA EXAMINATIONS, (C-24)

CIE- MID SEM-I MODEL PAPER

MID –I MODEL PAPER

ME-307 MACHINE DRAWING

Time: 1 hr

Max.Marks:20

Instructions: Answer any **four** questions. Each question carries five marks 4 x 5=20

1. Draw the square thread profiles with proportions.
2. Draw the views of a square headed bolt.
3. Draw a hexagonal headed bolt with nut of 25 mm diameter.
4. Draw a double riveted lap joint connecting two plates of 6mm Thick.
5. Draw the symbols of the following welded joints.
 - a. Concave fillet weld
 - b. Single v-butt weld
 - c. Spot weld
 - d. Seam weld
 - e. Square butt weld
6. Draw the following piping joint symbols(single line)
 - a. T
 - b. Elbow
 - c. Gate valve
 - d. Lateral
 - e. Union

BOARD DIPLOMA EXAMINATIONS, (C-24)

CIE- MID SEM-I MODEL PAPER

MID –II MODEL PAPER

ME-307 MACHINE DRAWING

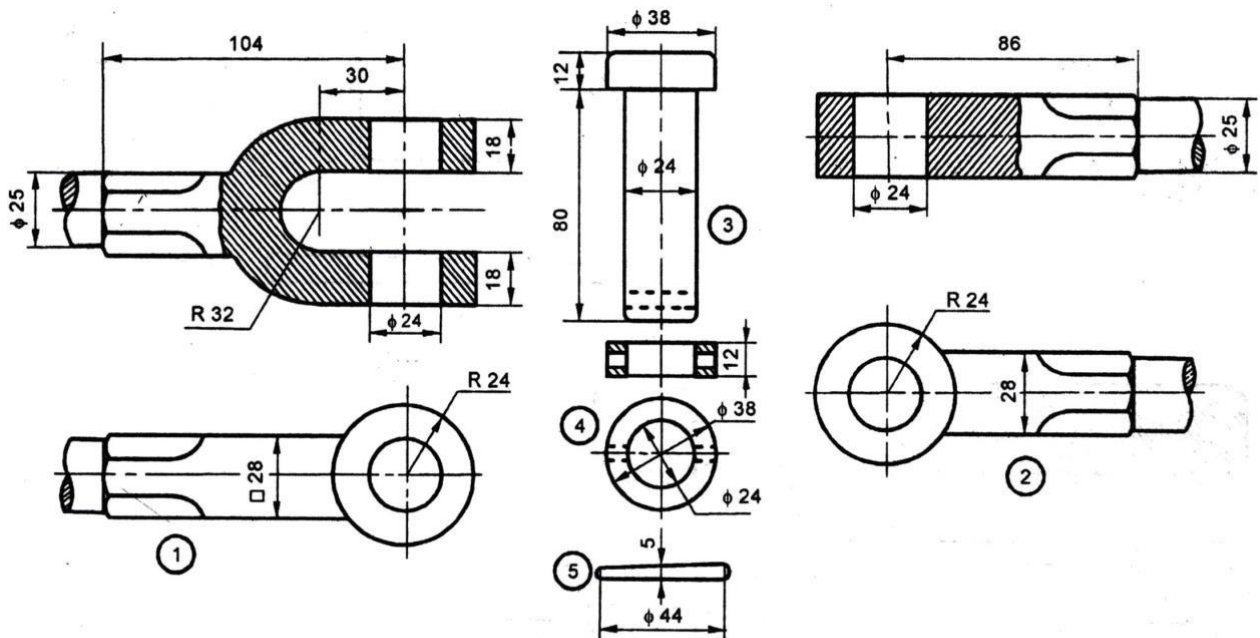
Time: 1 hr

Max.Marks:20

Instructions: Answer any **one** question. Each question carries twenty marks

1 x 20=20

1. Assemble all the parts of the knuckle joint and draw the sectional front view.

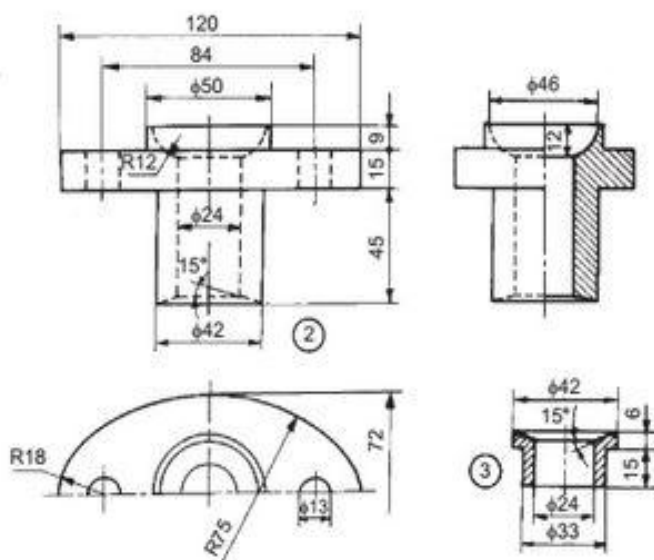
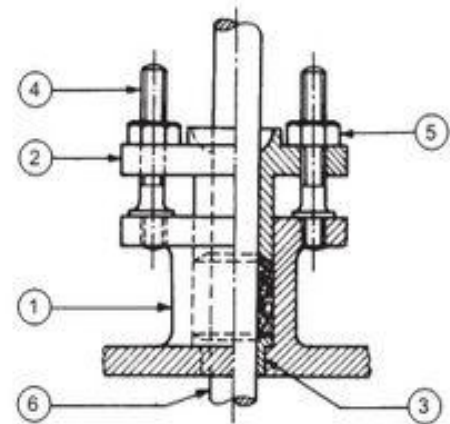
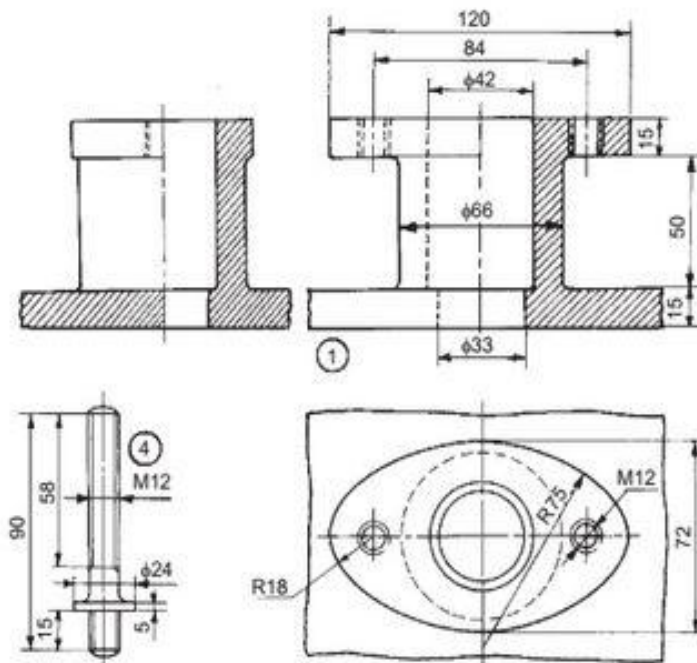


Parts list

No.	Name	Matl	Qty
1	Fork end	FS	1
2	Eye end	FS	1
3	Pin	MS	1
4	Collar	MS	1
5	Taper pin	MS	1

KNUCKLE JOINT

2. Study given part drawing of stuffing box and draw half sectional front view .



Parts list

Part No.	Name	Matl	Qty
1	Body	CI	1
2	Gland	Brass	1
3	Bush	Brass	1
4	Stud	MS	2
5	Nut, M12	MS	2

SEMESTER END EXAMINATION MODEL QUESTION PAPER
DME III ME-307 MACHINE DRAWING

Time: 2 hr

Max. Marks: 40

PART-A

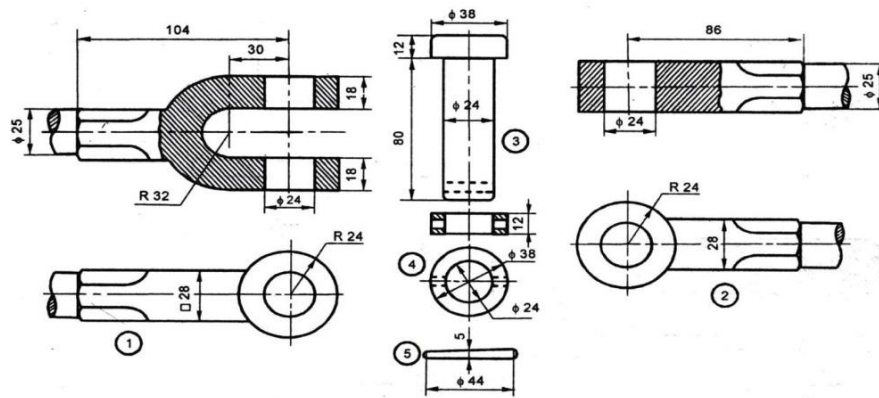
3 X 4 = 12

- INSTRUCTIONS:** (1) Answer **ALL** questions
- (2) Each question carries three marks.
- (3) Answer should be neat & clear with all the necessary dimensions.
- (4) All dimensions are in 'mm'. Choose suitable scale
-
1. Draw the following thread profiles with proportions.
(a) V threads (b) Square thread
 2. Draw the views of a hexagonal headed bolt.
 3. Draw a single riveted lap joint connecting two plates of 6mm Thick.
 4. Draw the symbols of the following welded joints.
(a) Concave fillet weld (b) Double v-butt weld (c) Spot weld
(d) Seam Weld (e) Square Butt Weld

PART-B

1 X 28 = 28

- INSTRUCTIONS:** (1) Answer any **ONE** question
- (2) Each question carries three marks.
- (3) Answer should be neat & clear with all the necessary dimensions.
- (4) All dimensions are in 'mm'. Choose suitable scale
-
5. Assemble all the parts of the **knuckle joint** and draw
 - a. Sectional front view
 - b. Top view

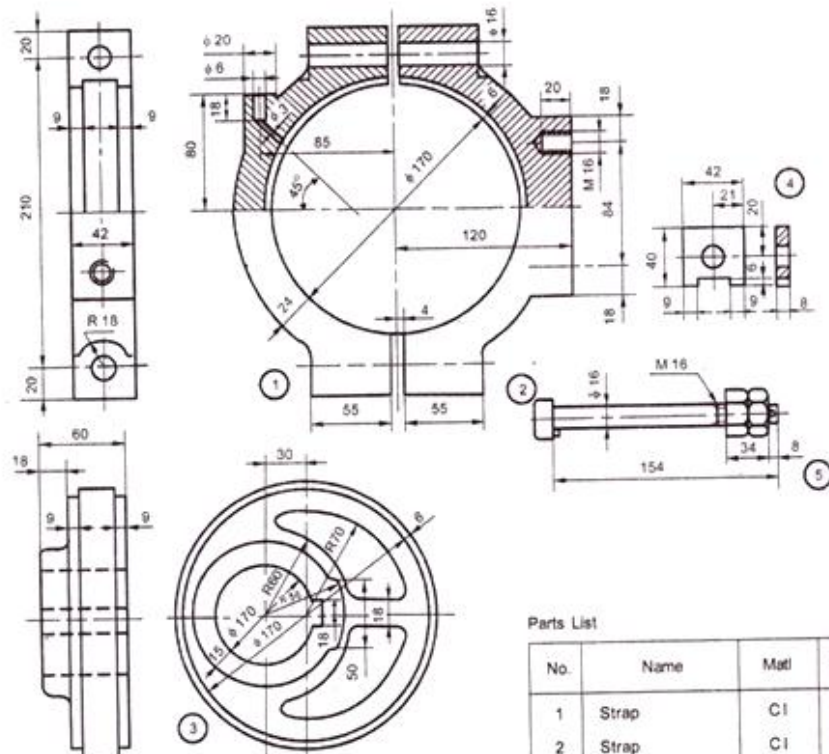


Parts list

No.	Name	Matl	Qty
1	Fork end	FS	1
2	Eye end	FS	1
3	Pin	MS	1
4	Collar	MS	1
5	Taper pin	MS	1

KNUCKLE JOINT

6. Assemble all the parts of the **eccentric** and draw the
- Half sectional front view (18 marks)
 - Right side View (10 marks)



Parts List

No.	Name	Matl	Qty
1	Strap	CI	1
2	Strap	CI	1
3	Sheave	CI	1
4	Shim	BRASS	2
5	Bolts with nuts	MS	2

ME-308-MATERIAL TESTING AND HYDRAULIC MACHINES LAB

Course Title	Material Testing and Hydraulic Machines Lab	Course Code	ME-308
Semester	III	Course Group	Practical
Teaching Scheme in Periods (L:T:P)	1:0:2	Credits	1.25
Methodology	Lecture + Practical	Total Contact Periods	45
CIE	60	SEE	40

A. MATERIAL TESTING

PRE REQUISITES: This course requires the basic knowledge of Strength of materials.

COURSE OUTCOMES:

On successful completion of the course, the students will be able to

Course Outcomes		Linked POs	Teaching Periods
CO1	Analyze the various parameters in tensile testing	1,2,3,4,5	03
CO2	Determine the ultimate strength of wood	1,2,3,4,5	03
CO3	Determine the impact strength	1,2,3,4,5	03
CO4	Calculate the hardness number of the given material	1,2,3,4,5	03
CO5	Conduct torsion test on solid shaft and hollow shaft	1,2,3,4,5	03
CO6	Analyze the micro structure of the metals and alloys	1,2,3,4,5	7.5

BLUE PRINT OF MARKS FOR SEE

Unit No	Unit name	Periods	Marks for SEE			Marks weight age	% Weightage
			Hand ling	Manip ulation	Prec ision		
1.	Tensile test	4	10	10	20	40	100
2.	Compression test	4	10	10	20	40	100
3.	Impact test	4	10	10	20	40	100
4.	Hardness test	4	10	10	20	40	100

5.	Torsion test	3	10	10	20	40	100
6.	Investigation of metal and alloy microstructure	3.5	15	15	10	40	100

COURSE CONTENT:

1. Analyze the various parameters in UTM machine.
2. Determine the ultimate crushing strength of wood. When the load applied perpendicular to grains and load applied along the grains of the wooden block.
3. Determine the impact strength or toughness of material by conducting an impact test on Izod testing machine.
4. Calculate the hardness number of the specimen on Brinell's hardness testing machine.
5. Calculate modulus of rigidity by conducting torsion test on solid shaft and hollow shaft
6. Analyze the micro structure of the metals and alloys

SUGGESTED LEARNING OUTCOMES:

Up on the completion of the course the student shall able to gain the following competencies

Title of the Experiment	Competencies	Key competency
1. Tensile test	A. Fix specimen in the jaws of the machine B. Fit strain gauge to the specimen C. Apply load gradually on the specimen D. Record load, elongation, diameter without error E. Plot graph stress vs strain F. Locate points of elastic limit, yield stress, ultimate stress on the graph	- Record load, elongation, diameter without error - Plot graph stress vs strain - Locate points of elastic limit, yield stress, ultimate stress on the graph
2. Compression test	A. Place the specimen in the machine properly B. Apply load on the specimen C. Record load	- Apply load on the specimen - Record load
3. Impact test	A. Prepare specimen by making V notch at the required height B. Fix specimen on the machine C. Release load to hit the specimen precautions D. Record load	- Release load to hit the specimen precautions - Record load
4. Hardness test	A. Place the specimen on the machine at correct location B. Identify suitable indenter for the specimen C. Make indent on the specimen properly D. Measure diameter of indentation E. Calculate hardness number	- Make indent on the specimen properly - Measure diameter of indentation

5. Torsion test on mild steel bar	A. Measure diameter and length of mild steel bar. B. Take down the value of torque from the indicating dial for particular value of angle of twist. C. Calculate maximum shear stress and shear modulus.	- Measure the diameter of the MS bar with vernier callipers.
6. Investigation of metal and alloy microstructure	A. Prepare specimen B. Handling microscope to observe micro structure C. Plot microstructure	- Handling microscope to observe micro structure - Plot microstructure

CO-PO MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	Mapping Pos
CO1	3	2	-	2	-	-	-	1,2,4
CO2	2	2	-	2	-	-	-	1,2,4
CO3	2	2	-	2	-	-	-	1,2,4
CO4	2	2	-	2	-	-	-	1,2,4
CO5	2	2	-	2	-	-	-	1,2,4
CO6	2	2	-	3	-	-	-	1,2,4

BOARD DIPLOMA EXANIMATIONS

MID-I Model Question Paper ME-308-MATERIAL TESTING LAB

Duration: 1 hour

Max.Marks:10

Instructions to the Candidate:

- (i) Answer any One of the following Questions.
 - (ii) Record the results on a graph sheet if required and conclude your observation of the experiment
 - (iii) Draw the diagram for illustration & choose appropriate values when not mentioned in the question
-
- 1. Determine the tensile strength of the given material using UTM.
 - 2. Determine the ultimate strength of the given material using UTM.
 - 3. Determine the impact strength or toughness of material by conducting an impact test on izod testing machine.
 - 4. Determine the Brinell's hardness number of a given material using BHM.
 - 5. Determine the Rockwell hardness number of a given material.
 - 6. Draw the micro structures of a) Mild Steel b) Pure iron c) Grey cast iron d) Brass e) Aluminum

Note: Mid Exam should be conducted from the experiments in which student undergoes training only, as classes are conducted on rotation basis

BOARD DIPLOMA EXANIMATIONS

MID-II Model Question Paper ME-308-MATERIAL TESTING LAB

Duration: 1 hour

Max.Marks:10

Instructions to the Candidate:

- (i) Answer any One of the following Questions.
 - (ii) Record the results on a graph sheet if required and conclude your observation of the experiment
 - (iii) Draw the diagram for illustration & choose appropriate values when not mentioned in the question
-
- 1. Determine the tensile strength of the given material using UTM.
 - 2. Determine the ultimate strength of the given material using UTM.
 - 3. Determine the impact strength or toughness of material by conducting an impact test on izod testing machine.
 - 4. Determine the Brinell's hardness number of a given material using BHM.
 - 5. Determine the Rockwell hardness number of a given material.
 - 6. Draw the micro structures of a) Mild Steel b) Pure iron c) Grey cast iron d) Brass e) Aluminum

Note: Mid Exam should be conducted from the experiments in which student undergoes training only, as classes are conducted on rotation basis

BOARD DIPLOMA EXANIMATIONS

SEE Model Question Paper

ME-308-MATERIAL TESTING LAB

Duration: 1 hour

Max.Marks:20

Instructions to the Candidate:

- (i) Answer any One of the following Questions.
 - (ii) Record the results on a graph sheet if required and conclude your observation of the experiment
 - (iii) Draw the diagram for illustration & choose appropriate values when not mentioned in the question
-
- 1. Determine the tensile strength of the given material using UTM.
 - 2. Determine the ultimate strength of the given material using UTM.
 - 3. Determine the impact strength or toughness of material by conducting an impact test on izod testing machine.
 - 4. Determine the Brinell's hardness number of a given material using BHM.
 - 5. Determine the Rockwell hardness number of a given material.
 - 6. Draw the micro structures of a) Mild Steel b) Pure iron c) Grey cast iron d) Brass e) Aluminum

Note: 15 marks for the experiment and 5 marks for viva-voce

B. HYDRAULIC MACHINES LAB

PRE-REQUISITES: This course requires the basic knowledge of Strength of materials.

COURSE OUTCOMES:

On successful completion of the course, the students will be able to

CO1	Calibrate the venturi meter
CO2	Calculate the brake power and efficiency of Pelton turbine
CO3	Calculate the brake power and efficiency of Kaplan turbine.
CO4	Calculate the brake power and efficiency of Francis turbine
CO5	Calculate the efficiency of reciprocating Pump
CO6	Calculate the efficiency of Centrifugal pump

BLUE PRINT OF MARKS FOR SEE

Unit No	Unit name	Hours/ Periods	Marks for SEE			Marks weight age	% Weightage
			Handling	Manipulation	Precision		
1	Venturi meter	4	5	7.5	7.5	20	100
2	Pelton wheel	4	5	7.5	7.5	20	100
3	Kaplan turbine	4	5	7.5	7.5	20	100
4	Francis turbine	4	5	7.5	7.5	20	100
5	Reciprocating pump	3	5	7.5	7.5	20	100
6	Centrifugal pump	3.5	5	7.5	7.5	20	100
Total	22.5						

COURSE CONTENT:

1. Determination of Coefficient of discharge of Venturi meter.
2. Determination of B.P. and efficiency of Pelton wheel.
3. Determination of B.P. and efficiency of Kaplan turbine.
4. Determination of B.P. and efficiency of Francis turbine.
5. Determination of overall efficiency of a reciprocating pump
6. Determination of overall efficiency of the Centrifugal pump

SUGGESTED LEARNING OUTCOMES:

Up on Completion of the Lab the student shall be able to

1.0 Venturi meter

- 1.1 State the practical applications of venturi meter.
- 1.2 Record the manometric head readings from U-tube manometer
- 1.3 Record the time taken for collecting discharge by varying the discharge
- 1.3 Calculate the areas of the pipe and throat of the given venturi meter
- 1.4 Calculate coefficient of discharge of venturi meter.

2.0 Pelton Wheel

- 2.1 Identify the components of Pelton wheel
- 2.2 Start turbine by switching on jet of water slowly
- 2.3 Apply load steadily
- 2.4 Record load, speed
- 2.5 Calculate power and efficiency of turbine

3.0 Kaplan Turbine

- 3.1 Identify the components of Kaplan Turbine
- 3.2 Start turbine by giving input water supply
- 3.3 Apply load steadily
- 3.4 Record load, speed
- 3.5 Calculate power and efficiency of turbine

4.0 Francis Turbine

- 4.1 Identify the components of Francis Turbine
- 4.2 Start turbine by switching on jet of water slowly
- 4.3 Apply load steadily
- 4.4 Record load, speed
- 4.5 Calculate power and efficiency of turbine

5.0 Reciprocating Pump

- 5.1 Identify the components of reciprocating pump
- 5.2 Record the suction and delivery pressures from pressure gauges
- 5.3 Record the time taken for collecting the discharge
- 5.4 Record the energy meter readings and calculate input power
- 5.5 Calculate the output power
- 5.6 Calculate the efficiency

6.0 Centrifugal Pump

- 6.1 Identify the components of centrifugal pump
- 6.2 Record the suction and delivery pressures from pressure gauges
- 6.3 Record the time taken for collecting the discharge
- 6.4 Record the energy meter readings and calculate input power
- 6.5 Calculate the output power
- 6.6 Calculate the efficiency

Key competencies to be acquired by students

Exercise	Key competency expected
Calculation of coefficient of discharge of Venturi meter	A. Maintain constant head B. Record readings of U- tube manometer without parallax error C. Record time taken for collection of specific quantity of water D. Calculate discharge and coefficient of discharge of venturi meter E. Repeat experiment for different heads (discharge)
Pelton wheel	A. Start turbine by switching on jet of water slowly B. Apply load steadily C. Record load, speed D. Calculate power and efficiency of turbine A. Plot performance curves
Kaplan Turbine	A. Start turbine by switching on water supply B. Apply load steadily C. Record load, speed D. Calculate power and efficiency of turbine E. Repeat experiment by Varying load/speed; Plot performance curves
Francis Turbine	A. Start turbine by switching on water supply B. Apply load steadily C. Record load, speed D. Calculate power and efficiency of turbine E. Repeat experiment by Varying load/speed; Plot performance curves
Reciprocating Pump	F. Maintain steady flow in suction and delivery pipes G. Record suction and delivery pressure gauge readings H. Record time for collection of specific quantity of water, electrical meter reading (input power) I. Calculate indicated power and efficiency E. Vary the head (flow) and repeat experiment
Centrifugal Pump	A. Maintain steady flow in suction and delivery pipes B. Record suction and delivery pressure gauge readings C. Record time for collection of specific quantity of water, electrical meter reading D. Calculate indicated power and efficiency J. Vary the head (flow) and repeat experiment

CO-PO MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	Mapping Pos
CO1	3	2	-	2	-	-	-	1,2,4
CO2	2	2	2	2	-	-	-	1,2,3,4
CO3	2	2	2	2	-	-	-	1,2,3,4
CO4	2	2	2	2	-	-	-	1,2,3,4
CO5	2	2	2	2	-	-	-	1,2,3,4
CO6	3	2	-	2	-	-	-	1,2,4

BOARD DIPLOMA EXANIMATIONS

MID-I Model Question Paper

ME-308-Fluid Mechanics & Hydraulic Machines Lab

Duration: 1 hour

Max.Marks:10

Instructions to the Candidate:

- (i) Answer any One of the following Questions.
- (ii) Record the results on a graph sheet if required and conclude your observation of the experiment
- (iii) Draw the diagram for illustration & choose appropriate values when not mentioned in the question

- 1. Determine the coefficient of Discharge of Venturi meter.
- 2. Determine Brake Power and Efficiency of Pelton Turbine
- 3. Determine Brake Power and Efficiency of Francis Turbine
- 4. Determine Brake Power and Efficiency of Kaplan Turbine.
- 5. Calculate the efficiency of Reciprocating Pump.
- 6. Calculate the efficiency of Centrifugal Pump.

Note: Mid Exam should be conducted from the experiments in which student undergo training only, as classes are conducted on rotation basis

BOARD DIPLOMA EXANIMATIONS
MID-II Model Question Paper
ME-308-Fluid Mechanics & Hydraulic Machines Lab

Duration: 1 hour

Max.Marks:10

Instructions to the Candidate:

- (i) Answer any One of the following Questions.
- (ii) Record the results on a graph sheet if required and conclude your observation of the experiment
- (iii) Draw the diagram for illustration & choose appropriate values when not mentioned in the question

- 1. Determine the coefficient of Discharge of Venturi meter.
- 2. Determine Brake Power and Efficiency of Pelton Turbine
- 3. Determine Brake Power and Efficiency of Francis Turbine
- 4. Determine Brake Power and Efficiency of Kaplan Turbine.
- 5. Calculate the efficiency of Reciprocating Pump.
- 6. Calculate the efficiency of Centrifugal Pump.

Note: Mid Exam should be conducted from the experiments in which student undergoes training only, as classes are conducted on rotation basis

BOARD DIPLOMA EXANIMATIONS
SEE Model Question Paper
ME-308-Fluid Mechanics & Hydraulic Machines Lab

Duration: 1 hour

Max.Marks:20

Instructions to the Candidate:

- (i) Answer any One of the following Questions.
 - (ii) Record the results on a graph sheet if required and conclude your observation of the experiment
 - (iii) Draw the diagram for illustration & choose appropriate values when not mentioned in the question
-
- 1. Determine the coefficient of Discharge of Venturi meter.
 - 2. Determine Brake Power and Efficiency of Pelton Turbine
 - 3. Determine Brake Power and Efficiency of Francis Turbine
 - 4. Determine Brake Power and Efficiency of Kaplan Turbine.
 - 5. Calculate the efficiency of Reciprocating Pump.
 - 6. Calculate the efficiency of Centrifugal Pump.

Note: 1) 15 marks for the experiment and 5 marks for viva-voice.
2) Student must attend both labs, and if the student fails one of the labs, it is presumed that he fails the lab.

ME-309 ADVANCED MANUFACTURING LAB

Course Title	Advanced Manufacturing Lab	Course Code	ME-309
Semester	III	Course Group	Practical
Teaching Scheme in Periods (L: T: P)	15:00:30	Credits	1.25
Methodology	Lecture+Theory + Practice	Total Contact Periods :	45 Periods
CIE	60 Marks	SEE	40 Marks

Pre requisites

This course requires the basic skills of handling workshop tools; this course also requires the basic knowledge of applied science and mathematics at secondary school level.

Unit No	Unit name	Periods	Questions for SEE			Marks Weightage	% Weightage
			Handling	Manipulation	Precision		
1	Foundry	10	10	15	15	40	100
2	Machine Shop	15	10	15	15	40	100
3	Welding	10	10	15	15	40	100
4	Machine Shop	10	10	15	15	40	100
	Total	45					

Note:

1. Student can answer any one question out of 4 questions.
2. To pass in practical Exam student should acquire 50% marks in both CIE and SEE separately and CIE & SEE put together.
3. If the students acquire less than 50% in CIE, accordingly the students have to acquire more than 50% in SEE to get overall 50 % to pass

On completion of course the student should be able to;

CO1	Ability to prepare sand for moulds and making the moulds ready for casting operation.
CO2	Able to perform certain lathe operations like Plain Turning, Step Turning, Knurling, Facing, Taper Turning
CO3	Understand different equipments, tools and accessories used in welding.
CO4	Basic knowledge in operating welding equipment and performing some welding operations.
CO5	Ability to demonstrate and perform some operations on slotting, shaping machine

COURSE CONTENTS:

FOUNDRY SHOP

Preparation of sand Mould and cutting of Gate, Runner and Riser

- 1.1 With single piece pattern
- 1.2 With Split pattern
- 1.3 With Connecting rod

Lathe shop

- 2.1 Facing, Plain Turning and knurling
- 2.2 Facing ,Step Turning

Welding

- 3.1 Layout of Beads
- 3.2 Butt joints.

Machine shop

- 4.1 Produce V-Block on shaping machine
- 4.2 Key way cutting Slotting Machines

REFERENCE BOOKS:

1. Manufacturing Technology (Vol I) by P N Rao (McGraw Hill)
2. Mechanical Workshop & Laboratory Manual By K. C. John

Competencies and Key competencies to be achieved by the student.

Title of the Job	Key Competencies
Moulding and Casting of solid bearing	- Select the suitable sand and its mix for the mould - Place the pattern in correct position - Ram the sand properly - Provide vent holes - Remove the pattern slowly - Cut gates and runners - Pour sufficient quantity of molten metal into the mould cavity
Moulding and Casting of split bearing	- Select the suitable sand and its mix for the mould - Place the pattern in correct position - Ram the sand properly - Provide vent holes - Remove the pattern slowly - Cut gates and runners - Pour sufficient quantity of molten metal into the mould cavity

Title of the Job	Key Competencies
Plain turning	- Check the centering of the work piece using dial gauge - Fix the cutting tool at proper inclination - Select the suitable speed, feed and depth of cut for rough and finishing operations - Check the dimensions
Knurling	- Check the centering of the work piece using dial gauge - Fix the cutting tool at proper inclination to turn the work piece - Select the suitable speed, feed and depth of cut for rough and finishing operations - Check the dimensions - Fix the knurling tool and selecting the suitable speed and feed
Taper turning	- Just an introduction of 4 methods. Student is expected to show how they work on machine. - Hands on exposure to swiveling compound rest method
Welding Layout of beads	- Perform Edge preparation - Hold the electrode at suitable angle and distance with respect to the work piece to maintain the arc - Check the bead
Butt joint	- Perform Edge preparation - Hold the electrode at suitable angle and distance with respect to the work piece to maintain the arc - Check the bead
Lap joint	- Perform Edge preparation - Hold the electrode at suitable angle and distance with respect to the work piece to maintain the arc - Check the bead

V-block on shaping machine.	a. Fix the job on shaping machine table b. Set the tool and give the table feed c. Set the stroke of the ram
Key way cutting by slotting machine	d. Fix the job on slotting machine table e. Set the tool and give the table feed f. Set the stroke of the ram

Course Outcome (CO)		Cognizant Level	Linked Program Outcomes (PO)	Teaching periods
CO1	Identify and use the tools and equipment in foundry Shop	R/U/A	1,2,3,4,7	6
CO2	Acquire skill in basic foundry operations	R/U/A	1,2,3,4,7	6
CO3	Identify and use the tools to perform machining (turning) operations	R/U/A	1,2,3,4,7	11
CO4	Identify and use the tools to perform welding operations	R/U/A	1,2,3,4,7	11
CO5	Identify and use the tools to perform operations in machining (shaping /slotting) operations	R/U/A	1,2,3,4,7	11
R: Remembering, U: Understanding, A: Applying				

CO-PO MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	Mapping POs
CO1	3	2	2	3	-	-	1	1, 2,3,4,7
CO2	3	3	3	-	-	-	2	1, 2,3,7
CO3	3	3	3	-	-	-	2	1, 2,3,7
CO4	3	3	3	-	-	-	2	1, 2,3,7
CO5	3	2	3	-	-	-	2	1, 2,3,7

BOARD DIPLOMA EXAMINATIONS (C-24)
Model Paper MID SEM – I, Advanced Manufacturing Lab

Time : 2 Hours

Total Marks : 40 MARKS

Note: Answer any one question.

1. Prepare V Block on shaper.
2. Prepare Key way in a metal block on slotting machine.
3. Prepare mould for given pattern solid bearing.
4. Prepare mould for given pattern split bearing.
5. Prepare mould for given pattern connecting rod
6. Prepare the plain turning as per the given figure.
7. Prepare the step turning as per the given figure.
8. Prepare the taper turning as per the given figure.
9. Prepare Lap joint as per the given figure.
10. Prepare Butt joint as per the given figure.

BOARD DIPLOMA EXAMINATIONS (C-24)
Model Paper, MID SEM –II, Advanced Manufacturing Lab

Time : 2 Hours

Total Marks : 40 MARKS

Note: Answer any one question.

1. Prepare V Block on shaper.
2. Prepare Key way in a metal block on slotting machine.
3. Prepare mould for given pattern solid bearing.
4. Prepare mould for given pattern split bearing.
5. Prepare mould for given pattern connecting rod
6. Prepare the plain turning as per the given figure.
7. Prepare the step turning as per the given figure.
8. Prepare the taper turning as per the given figure.
9. Prepare Lap joint as per the given figure.
10. Prepare Butt joint as per the given figure.

BOARD DIPLOMA EXAMINATIONS (C-24)
Model Paper, Semester End Examination, Advanced Manufacturing Lab

Time : 2 Hours

Total Marks : 40 MARKS

Note: Answer any one question.

1. Prepare V Block on shaper.
2. Prepare Key way in a metal block on slotting machine.
3. Prepare mould for given pattern solid bearing.
4. Prepare mould for given pattern split bearing.
5. Prepare mould for given pattern connecting rod
6. Prepare the plain turning as per the given figure.
7. Prepare the step turning as per the given figure.
8. Prepare the taper turning as per the given figure.
9. Prepare Lap joint as per the given figure.
10. Prepare Butt joint as per the given figure.

HU – 310 COMMUNICATION SKILLS AND LIFE SKILLS LAB

Course Title	Communication Skills and Life Skills Lab	Course Code	HU - 310
Semester	III	Course Group	Practical
Teaching Scheme in Periods -L:T:P	1 : 0 : 2	Credits	1.25
Methodology	Lecture + Practical	Total Contact Hours	45 Periods (3 Periods per Week)
CIE	60 Marks	SEE	40 Marks

Rationale:

The course is designed to impart listening skills and life skills to the students of diploma which will help them a great deal in personal and professional fronts.

Prerequisites:

The course requires the basic knowledge of vocabulary, grammar, and four language learning skills, viz. Listening, Speaking, Reading and Writing.

Course Contents

- | | | |
|----|---|-------------------------------|
| 1. | Listening Skills - I | Duration: 6 (L 2 P 4)- |
| | <ul style="list-style-type: none"> • A paragraph • A song • A recipe • A dialogue | |
| 2. | Life Skills - I | Duration: 9 (L 3 P 6) |
| 1. | Attitude <ul style="list-style-type: none"> • Features of attitude • Attitude and behaviour • Attitude formation • Positive attitude • Negative attitude • Overcoming negative attitude • Attitude at workplace | |
| 2. | Adaptability <ul style="list-style-type: none"> • Need for adaptability • Willingness to experiment • Fear of failure • Think ahead • Stay positive | |

- Curiosity
- Being in present

3. **Listening Skills- II**

Duration: 6 (L 2 P 4)

- Biography
- Interview
- A Report
- Telephone Conversation

4. **Life Skills-II**

Duration: 9 (L 3 P 6)

3. Goal setting
- Importance of setting goals
 - What is goal setting
 - Short term goals
 - Long term goals
 - Achieve goals using SMART

4. Creativity
- Flexibility
 - Curiosity
 - Determination
 - Innovative ideas

5. **Life Skills – III**

Duration: 6 (L 2 P 4)

5. Time Management
- Features of time
 - Secrets of time management
 - Time wasters
 - Prioritization
 - Productive time
 - Time Quadrant

6. Human Values
- Honesty and integrity
 - Work Ethics
 - Ego and Respect
 - Trust and Truthfulness
 - Social Responsibility
 - Character formation
 - Designing Destiny

6. **Life Skills- IV**

Duration: 9 (L 3 P 6)

7. Problem Solving and Decision Making

- Define the problem
- Generate Options
- Evaluate and choose an option
- Implement solution
- Monitoring and Seeking Feedback

8. Leadership Qualities and Team Work

- Significance of Leadership
- Factors of leadership
- Leadership styles
- Leadership Skills
- Importance of Team work
- Characteristics of a good team
- Benefits of team work
- Problems of team work
- Qualities of team player

Course Outcomes

CO	At the end of the course the students will have the ability to:
CO 1	Comprehend factual information and infer the required details after listening to auditory input and respond to the given context.
CO 2	Comprehend factual information and infer the required details after listening to auditory input and respond to the given context.
CO 3	Develop positive attitude to adapt oneself to all the situations to succeed in professional and personal life.
CO 4	Set goals using SMART features for life and get inspired to get success in professional and personal life. Create innovative things and think out of the box.
CO 5	Apply various time management techniques and prioritize tasks effectively, and learn to be creative and innovative in thinking and maintain core human values in personal life and professional life.
CO 6	Develop problem-solving skills, make timely decisions, develop trust, confidence, leadership skills and team qualities.

CO-PO Matrix

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	Mapping POs
CO 1	-	-	-	-	3	2	3	5,6 and 7
CO 2	-	-	-	-	3	2	3	5,6 and 7
CO 3	-	-	-	-	3	3	3	5,6 and 7
CO 4		-		-	2	2	3	5,6 and 7
CO 5					2	2	3	5,6 and 7
CO 6					2	2	3	5,6 and 7

References:

- a. Flint, Chris and Jamie Flockhart *is ending: A2 (Collins English for Life: Skills)* Collins.2013
- b. Brown, Stephen E. *English in Everyday Life.* McGraw-Hill Education.2008
- c. Mohanraj, Jayashree. *Let Us Hear Them Speak: Developing Speaking-Listening Skills in English.* Sage. 2015
- d. Susan Earle—Carlin. *Q Skills for Success: Listening and Speaking 5: Student Book with Online Practice.* Oxford University Press. 2013
- e. Kumar, Sanjay and Pushpa Latha. *Communication Skills: A Work Book.* Oxford University Press. 2018
- f. Carnegie, Dale. *The Leader in You.* Simon & Schuster:1995
- g. Carnegie, Dale. *The Art of Public Speaking.* Prabhat Prakashan. New Delhi. 2013
- h. Kaye, Martin. *Goal Setting (Work book Included): Goals & Motivation: Introduction to A Complete & Proven Step – By – Step Blue print For Reaching You Goals (Goal Setting Master Plan 1).* Kindle Edition. MK Coaching. 2016.
- i. West, Steven. *Critical Thinking Skills: Practical Strategies for Better Decision making,*
- j. Tracy, Brain. *Goals.* Berret – Koehler Publishers Inc. San Francisco. 2017
- k. Tracy, Brain. *Master your Time Master your Life.* Penguin Random House Inc. New York.2017
1. Sean Covey. *The 7 Habits of Highly Effective Teens.* Simon andSchuster,2011

E-Learning Resources:

- a. <http://www.bbc.co.uk/worldservice/learningenglish/youmeus/learnit/learnitv39.shtml>
- b. https://www.examenglish.com/leveltest/listenin_leveltest.htm
- c. <https://www.oxfordonlineenglish.com/listening?utmreferrer=https%3A%2F%2Fwww.google.co.in%2F>
- d. <https://takeielts.britishcouncil.org/prepare-test/free-ielts-practice-tests/listening-practice-test-1>
- e. <https://learnenglish.britishcouncil.org/en/listening>
- f. <https://www.cambridgeenglish.org/learning-english/activities-for-learners/?skill=1listening>
- g. <https://www.businessenglishsite.com/business-english-listening.html>

BOARD DIPLOMA EXAMINATION (C-24)
MID SEMESTER EXAMINATION - I
HU-310 COMMUNICATION SKILLS AND LIFE SKILLS

Time: One Hour

Total Marks: 20

Part – A

10 Marks

1. Listening Comprehension (5 X 2 = 10)

Instruction: Questions shall be given before reading the passage.

Emperor Ashoka was an emperor in ancient India. He was also called Ashoka the Great. He lived a long time ago, around 304 BCE. When he was young, he became the king of a big part of India after a fight for power.

At first, Ashoka wanted to win more land and power. He fought many wars and won many battles. But one day, during a battle in a place called Kalinga, Ashoka saw a lot of people suffering and dying. This made him feel very sad and sorry for what he had done. He decided he didn't want to fight anymore.

After this, Ashoka became a follower of Buddhism, a peaceful religion. He started to teach people about being kind and not hurting others. He wrote down his ideas on big stone pillars and put them all over his kingdom. These were called the "Edicts of Ashoka."

Ashoka did many good things for his people. He built hospitals for sick people and shelters for travelers. He also helped spread Buddhism to other countries.

Ashoka's time as king was a peaceful and happy time for India. He is remembered as a great leader who wanted everyone to be happy and peaceful.

Questions:

- a. Who was Ashoka?
- b. Why did Ashoka stop fighting wars?
- c. What religion did Ashoka follow after he stopped fighting?
- d. What were the "Edicts of Ashoka"?
- e. Name one good thing Ashoka did for his people.

Part – B

10 Marks

2. How can maintaining a positive attitude in the face of challenges contribute to personal and professional growth?
3. Give an example of a situation where you had to adapt to unexpected changes or circumstances. How did your adaptability skills help you navigate through the situation effectively?

BOARD DIPLOMA EXAMINATION (C-24)

MID SEMESTER EXAMINATION - II

HU -310 COMMUNICATION SKILLS AND LIFE SKILLS

Time: One Hour

Total Marks: 20

Part – A

10 Marks

1. Listening Comprehension (5 X 2 = 10)

Instruction: Questions shall be given before reading the passage

Prithviraj Chauhan was a courageous emperor who ruled parts of northern India during the 12th century. He was born into the Chauhan dynasty, a family known for its valor and leadership. Prithviraj ascended to the throne at a young age after the death of his father, Someshwar Chauhan.

Prithviraj's reign was marked by numerous military conquests and battles to defend his kingdom against rival Rajput clans and foreign invaders. He was renowned for his exceptional skill in warfare, especially archery and horse riding. His bravery and strategic prowess earned him the admiration of his allies and the fear of his enemies.

One of the most famous events in Prithviraj's life was his legendary rivalry with the Afghan ruler, Muhammad Ghori. The two clashed in a series of battles for supremacy in northern India. The most notable of these battles was the Battle of Tarain, fought in 1191 CE. Despite being outnumbered, Prithviraj displayed remarkable leadership and tactical brilliance, leading his forces to victory and capturing Muhammad Ghori. However, the tide turned in the subsequent battle at Tarain in 1192 CE. Due to a betrayal by one of his allies and underestimating Ghori's tactics, Prithviraj faced defeat and was captured. He was taken as a prisoner to Ghori's capital, where he met his tragic end.

Prithviraj Chauhan's legacy remains etched in the annals of Indian history as a symbol of bravery, resilience, and honor. His valorous deeds continue to inspire generations, and his name is remembered with reverence as one of India's greatest warriors and emperors.

Questions:

1. Who was Prithviraj Chauhan?
2. What dynasty did Prithviraj Chauhan belong to?
3. What were Prithviraj Chauhan's notable skills in warfare?
4. Describe the rivalry between Prithviraj Chauhan and Muhammad Ghori.
5. What happened to Prithviraj Chauhan after the Battle of Tarain in 1192 CE?

PART-B

10 Marks

Instruction: Answer any one of the following questions in 150 words.

1. Why is it important to set clear and achievable goals in both personal and professional life? give an example of a goal you have set for yourself and explain how you plan to achieve it.
2. How do you use a 'pen' in ten different ways apart from using it for writing?

BOARD DIPLOMA EXAMINATION (C-24)
SEMESTER END EXAMINATION
HU-310 COMMUNICATION SKILLS AND LIFE SKILLS

Time: Three Hours

Total Marks: 40

Part – A

10 Marks

1. Listening Comprehension

(5 X 2 = 10)

Instruction: Questions shall be given before reading the passage

Gautama Buddha, also known simply as the Buddha, was a spiritual leader who lived in ancient India around the 6th century BCE. Born into a noble family in Lumbini, now located in present-day Nepal, Siddhartha Gautama, as he was originally named, led a life of luxury and privilege.

However, Siddhartha's life took a profound turn when he encountered the realities of human suffering. Despite being sheltered from the harshness of the world, he witnessed old age, sickness, and death, which deeply troubled him. Determined to find answers to the mysteries of life and alleviate human suffering, Siddhartha renounced his princely status and embarked on a spiritual quest.

For years, Siddhartha wandered the forests of India, seeking enlightenment through meditation and ascetic practices. After undergoing rigorous self-discipline and introspection, he finally attained enlightenment under a Bodhi tree in Bodh Gaya, Bihar. It was during this transformative moment that Siddhartha became the Buddha, meaning the "Enlightened One."

Following his enlightenment, the Buddha dedicated his life to teaching others the path to liberation from suffering. He expounded the Four Noble Truths and the Eightfold Path, which form the core teachings of Buddhism. The Four Noble Truths explain the nature of suffering, its causes, its cessation, and the path to its cessation, while the Eightfold Path outlines the ethical and spiritual practices necessary to achieve liberation.

The Buddha's teachings emphasized compassion, mindfulness, and inner peace. He encouraged his followers to cultivate wisdom and lead a virtuous life guided by right understanding, intention, speech, action, livelihood, effort, mindfulness, and concentration.

Throughout his lifetime, the Buddha traveled extensively across northern India, preaching his message of enlightenment and compassion to people from all walks of life. His teachings transcended social barriers and cultural boundaries, attracting followers from diverse backgrounds.

Gautama Buddha's legacy endures as one of the most influential spiritual figures in human history. His teachings continue to guide millions of people around the world on the path to inner peace, compassion, and liberation from suffering.

Comprehension Questions:

1. Who was Gautama Buddha, and when did he live?
2. What prompted Siddhartha Gautama to leave his life of luxury?
3. Where did Gautama Buddha attain enlightenment?
4. What are the Four Noble Truths and the Eightfold Path?
5. How did Gautama Buddha's teachings impact society?

PART-B

15Marks

Instruction: Answer any one of the following questions in 150 words.

2. Seminar on Life Skills Topics

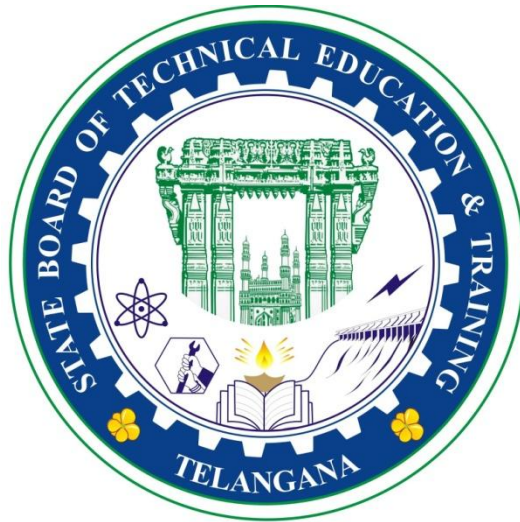
PART- C

15Marks

3. Viva Voce

C24_CURRICULUM

**DIPLOMA IN MECHANICAL
ENGINEERING**



Offered By

**STATE BOARD OF
TECHNICAL EDUCATION AND TRAINING
TELANGANA HYDERABAD**

IV SEMESTER

S. N O	Course		Teaching Scheme					Examination Scheme						
	Code	Course Name	Instruction Periods per week			Total Periods per semester	Credit s	Continuous Internal Evaluation (CIE)			Semester End Examination (SEE)			
			L	T	P			Mi d Se m 1	Mi d Se m 2	Internal Evaluatio n	Max mark s	Min mark s	Total Mark s	Min marks for passing includin g internal
1	SC-401	Advanced Engineering Mathematics	4	1	0	75	2.5	20	20	20	40	14	100	End Marks shall be $\geq 35\%$ of Topper Marks and Subject Total Shall be $\geq$ D-Hybrid Grade Minimum
2	ME-402	Design of Machine Elements	4	1	0	75	2.5	20	20	20	40	14	100	
3	ME-403	Thermal Engineering	4	1	0	75	2.5	20	20	20	40	14	100	
4	ME-404	Industrial Engineering, Estimation & Costing (IEE & C)	4	1	0	75	2.5	20	20	20	40	14	100	
5	ME-405	Green Energy Sources	4	1	0	75	2.5	20	20	20	40	14	100	
6	EE-416	Basic Electrical & Electronics Engineering	4	1	0	75	2.5	20	20	20	40	14	100	End Marks shall be $\geq 50\%$ of Topper Marks and Subject Total Shall be $\geq$ D-Hybrid Grade Minimum
7	EE-417	Basic Electrical & Electronics Engineering Lab	1	0	2	45	1.25	20	20	20	40	20	100	
8	ME-408	Computer Assisted Production	1	0	2	45	1.25	20	20	20	40	20	100	
9	ME-409	Thermal Engineering Lab	1	0	2	45	1.25	20	20	20	40	20	100	
10	HU-410	Employability Skills Lab	1	0	2	45	1.25	20	20	20	40	20	100	
			28	6	8	630	20	200	200	200	400	164	1000	

SC-401 - ADVANCED ENGINEERING MATHEMATICS

Course Title	Advanced Engineering Mathematics	Course Code	SC-401
Semester	IV	Course Group	Foundation
Teaching Scheme in Periods (L : T : P)	4:1:0	Credits	2.5
Methodology	Lecture + Tutorial	Total Contact Periods	75
CIE	60 Marks	SEE	40 Marks

Pre requisites:

This course requires the knowledge of Engineering Mathematics at Diploma first year level and Applied Engineering Mathematics at Diploma 3rd Semester level.

Course Outcomes (Cos):

CO 1	Solve Differential Equations of first order and first degree with appropriate method
CO 2	Solve the higher order Homogeneous Linear Differential Equations with constant coefficients.
CO 3	Solve the Higher order Non-Homogeneous Linear Differential Equations with constant coefficients.
CO 4	Expand given functions as a Fourier Series in the given intervals.
CO 5	Find the Laplace Transforms of simple functions using its properties.
CO 6	Solve Linear Differential Equations with constant coefficient by using Laplace and inverse Laplace Transformations.

At the end of the course, the student will have the ability to:

Course Contents:

Unit – I

Duration: 15 Periods (L:12 – T:3)

Differential Equations of First Order and First Degree: Definition of a Differential Equation - Order and Degree of a Differential Equations-Formation of Differential Equations - Solutions of Ordinary Differential Equations of first order and first degree: Variable Separable Method, Homogeneous Differential Equations, Exact Differential Equations,

Linear Differential Equations and Bernoulli's Equation-Problems leading to engineering applications by using above methods.

Unit – II

Duration: 10 Periods (L: 8– T:2)

Higher order Homogeneous Linear Differential Equations with constant coefficients:

Homogenous Linear Differential Equations with constant coefficients of second and higher order-Problems leading to engineering applications.

Unit-III

Duration: 12 Periods (L: 10 – T: 2)

Higher order Non-Homogeneous Linear Differential Equations with constant coefficients:

Complimentary Function (C.F), Particular Integral (P.I) and General Solution (G.S) of Non- Homogeneous Linear Differential Equations with constant coefficients-Second and Higher order Non- Homogenous Linear Differential Equations with constant coefficients of the form $f(D)y = X$, where $f(D)$ is a polynomial in D and X is in the form $k(a \text{ constant}), e^{ax}, \sin(ax), \cos ax, x^n$ ($n= 1,2,3$)- Related engineering problems with emphasis on second order Non-Homogeneous Linear Differential Equations.

Unit – IV

Duration: 13 Periods (L:10 – T:3)

Fourier Series: Periodic functions - Orthogonality Property of Trigonometric functions - Representation of a function as Fourier series over the interval $(c, c + 2\pi)$ - Euler's formulae - Sufficient conditions for existence of Fourier series for a function $f(x)$ - Fourier series of functions over the interval $(0, 2\pi)$ and $(-\pi, \pi)$ - Fourier series of odd and even functions in the interval $(-\pi, \pi)$.

Unit – V

Duration: 12 Periods (L: 10 – T: 2)

Laplace Transformations: Definition of Laplace Transform -Sufficient conditions for Existence of Laplace Transform, Laplace Transform of some elementary functions -Linearity Property -First Shifting Theorem - Laplace Transforms of Derivatives - Laplace Transforms of Integrals - Multiplication t^n -Division by t - Related problems.

Unit – VI

Duration: 13 Periods (L: 10 – T:3)

Inverse Laplace transforms and Applications of Laplace Transformations: Definition of Inverse Laplace Transform- Inverse Laplace Transform of elementary functions – Linearity Property – First Shifting Theorem - Inverse Laplace Transforms by using Partial fractions - Inverse Laplace Transform of Derivatives - Inverse Laplace Transform of Integrals - Multiplication by s^n Division by s -Definition of Convolution of two functions –Convolution Theorem (without proof) and its Applications -Applications of Laplace Transforms in solving Second order Linear Differential Equations with constant coefficients under the Initial conditions-Problems leading to engineering applications.

Reference Books:

1. Advanced Engineering Mathematics-Erwin Kreyszig, John Wiley Publications.

2. Advanced Engineering Mathematics- R.K. Jain and S.R.K. Iyengar, Narosa Publications.
3. Higher Engineering Mathematics-B.S.Grewal, Khanna Publications.
4. Laplace Transforms - Murray R. Spiegel, Schaum's Outline Series, McGRAW-HILL.
5. Integral Transforms – A.R. Vasishtha and R. K. Gupta, Krishnan Prakashan Publications.

Suggested E-Learning references:

1. <https://www.khanacademy.org/>
2. <https://www.wolframalpha.com/>
3. <https://onlinecourses.swayam2.ac.in/>
4. <http://tutorial.math.lamar.edu/>

Suggested Learning Outcomes:

At the end of the course, the student will have the ability to:

CO1: Solve Differential Equations of first order and first degree with appropriate method

- 1.1 Explain the concept of Differential Equations.
- 1.2 Classify the Differential Equations.
- 1.3 Find the order and degree of Differential Equations.
- 1.4 Form a Differential Equation by eliminating arbitrary constants.
- 1.5 Solve the first order first degree Differential Equations by using Variables Separable Method.
- 1.6 Solve the first order first degree Homogeneous Differential Equations.
- 1.7 Solve the first order first degree Exact Differential Equations.
- 1.8 Solve the first order Linear Differential Equation of the form $\frac{dy}{dx} + Py = Q$, where P and Q are functions in x alone or constants.
- 1.9 Solve the first order Bernoulli's equations of the form $\frac{dy}{dx} + Py = Qy^n$, where P and Q are Functions of x alone or constants.
- 1.10 Solve the problems leading to engineering applications by using above methods.

CO2: Solve the Higher order Homogeneous Linear Differential Equations with constant coefficients.

- 2.1 Solve Differential Equations of the type: $a\frac{d^2y}{dx^2} + b\frac{dy}{dx} + c = 0$, where a, b and c are constants, when the roots of the Auxiliary Equation are real & distinct.
- 2.2 Solve Differential Equations of the type: $a\frac{d^2y}{dx^2} + b\frac{dy}{dx} + c = 0$, where a, b and c are constants, when the roots of the Auxiliary Equation are real & equal.
- 2.3 Solve Differential Equations of the type: $a\frac{d^2y}{dx^2} + b\frac{dy}{dx} + c = 0$, where a, b and c are constants, when the roots of the Auxiliary Equation are complex conjugate pair.
- 2.4 Solve the Higher order Homogeneous Linear Differential Equations with constant coefficients.

CO3 Solve the Higher order Non-Homogeneous Linear Differential Equations with constant coefficients.

- 3.1 Explain the concept of Complementary Function and Particular Integral to get General Solution of Non-Homogeneous Linear Differential Equation with constant coefficients.
- 3.2 Solve the Higher order Non-Homogeneous Linear Differential Equations of the type $f(D)y = X$, where $f(D)$ is a polynomial in D and X is a function of the form: k (constant) and e^{ax} .
- 3.3 Solve the Higher order Non-Homogeneous Linear Differential Equations of the type $f(D)y = X$, where $f(D)$ is a polynomial in D and X is a function of the form: $\sin ax$ and $\cos ax$.
- 3.4 Solve the Higher order Non-Homogeneous Linear Differential Equations of the type $f(D)y = X$, where $f(D)$ is a polynomial in D and X is a function of the form x^n ($n = 1, 2, 3$).
- 3.5 Solve engineering problems with emphasis on second order Non-Homogeneous Linear Differential Equations by using above methods.

CO4 Expand given functions as a Fourier Series in the given intervals.

- 4.1 Define Periodic function with examples
- 4.2 Explain the Orthogonality Property of functions in an interval.
- 4.3 Define the Fourier series of a function in the interval $(c, c+2\pi)$ and state Euler's Formulae for determining the Fourier coefficients.
- 4.4 Write the sufficient conditions for the existence of Fourier series for a function.
- 4.5 Expand Fourier series of functions in the range $(0, 2\pi)$ and $(-\pi, \pi)$.
- 4.6 Expand Fourier series for even and odd functions in the interval $(-\pi, \pi)$.

CO5 Find the Laplace Transforms of simple functions using its properties

- 5.1 Define Laplace Transform.
- 5.2 Explain sufficient conditions for existence of Laplace Transform.
- 5.3 Obtain Laplace Transforms of some elementary functions.
- 5.4 State the Linearity Property of Laplace transforms.
- 5.5 State the First Shifting Theorem on Laplace Transforms.
- 5.6 Explain the Laplace transform of $f'(t)$ and $f^{(n)}(t)$ in terms of Laplace transform of $f(t)$.
- 5.7 Explain the Laplace transform of $\int_0^t f(u)du$ in terms of Laplace transform $f(t)$.
- 5.8 Explain the Laplace transform of $t^n f(t)$ in terms of Laplace transform of $f(t)$.
- 5.9 Explain the Laplace transform of $\frac{f(t)}{t}$ in terms of Laplace transform of $f(t)$.
- 5.10 Solve problems on above methods.

CO6 Solve Linear Differential Equations with constant coefficient by using Laplace and inverse Laplace Transformations

- 6.1 Define Inverse Laplace Transform and write Inverse Laplace Transforms of standard functions.

- 6.2 State the Linearity Property of Inverse Laplace transforms.
- 6.3 State the First Shifting Theorem on Inverse Laplace Transforms.
- 6.4 Solve problems on Inverse Laplace transforms using Partial fractions.
- 6.5 Explain Inverse Laplace transforms of the functions: $s^n f(s)$, $\frac{f(s)}{s}$, $f^{(n)}(s)$, $\int_s^\infty f(u)du$.
- 6.6 Solve the problems on 6.2, 6.3, 6.4 and 6.5.
- 6.7 Acquire the knowledge of convolution of two functions and state the convolution theorem.
- 6.8 Evaluate Inverse Laplace transforms of simple functions using Convolution Theorem.
- 6.9 Use Laplace and Inverse Laplace Transforms to solve second order Linear Differential Equations with constant coefficients under the initial conditions.
- 6.10 Solve the problems leading to engineering applications.

Suggested Student Activities:

1. Student visits Library to refer Standard Books on Mathematics and collect related material.
2. Quiz.
3. Group discussion.
4. Group Tests.
5. Surprise tests.
6. Seminars.
7. Home Assignments.
8. Mathematics for preparing competitive exams and solving old question papers on Arithmetical ability.

CO-PO Mapping Matrix

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	Mapped POs
CO1	3	2	1				3	1,2,3, 7
CO2	3	2					3	1,2, 7
CO3	3	2					3	1,2, 7
CO4	3	2	1				3	1,2, 3,7
CO5	3	2	1				3	1,2, 3,7
CO6	3	2	1				3	1,2,3,7

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TELANGANA

DIPLOMA EXAMINATIONS (C - 24)

SC-401 SEMESTER IV, MID –I EXAM, MODEL PAPER

ADVANCED ENGINEERING MATHEMATICS

(Open Book System)

Duration : 1: 00 Hour

Max. Marks: 20

PART-A

Instructions: 1. Answer **ALL** questions.

04 × 01 = 04

2 Each question carries **ONE** mark.

1. Find the order and degree of the differential Equation $\left(\frac{d^3y}{dx^3}\right)^4 + 3\left(\frac{d^2y}{dx^2}\right)^3 - 5\frac{dy}{dx} + y = 0$.

2. Find the Integrating Factor of $(1 + x^2)\frac{dy}{dx} + 2xy = \frac{1}{1+x^2}$.

3. Find the roots of auxiliary equation of the differential equation $(2D^2 + 5D - 3)y = 0$.

4. Write the auxiliary equation of the differential equation $a_3\frac{d^3y}{dx^3} + a_2\frac{d^2y}{dx^2} + a_1\frac{dy}{dx} + a_0y = 0$.

PART-B

Instructions: 1. Answer **ALL** questions.

02 × 03 = 06

2. Each question carries **THREE** marks.

5(a) Form the differential equation by eliminating arbitrary constants A and B in the family of curves $y = A\cos mx + B\sin mx$, where m is a constant.

OR

5(b) Solve $\frac{dy}{dx} - y\tan x = 0$.

6(a) Solve $6\frac{d^2x}{dt^2} - \frac{dx}{dt} - 2x = 0$.

OR

6(b) Solve $(D^2 - 4)^2y = 0$.

PART- C

Instructions: 1. Answer **ALL** questions

02 × 05 = 10

2. Each question carries **FIVE** marks

7(a) Solve $xy^3dy = (x^4 + y^4)dx$.

OR

7(b) Solve $(x^4 - 2xy^2 + y^4)dx - (2x^2y - 4xy^3 + \sin y)dy = 0$.

8(a) Solve $(D^3 + 3D^2 - 4)y = 0$.

OR

8 b) Solve $(D^3 - 8)y = 0$.

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TELANGANA
DIPLOMA EXAMINATIONS (C - 24) SC-401
SEMESTER IV, MID –II EXAM, MODEL PAPER
ADVANCED ENGINEERING MATHEMATICS
(Open Book System)

Duration: 1: 00 Hour

Max. Marks: 20

PART-A

Instructions: 1. Answer **ALL** questions.

04 × 01 = 04

2. Each question carries **ONE** mark.

1. Find the Particular Integral of $(D^2 - 5D + 6)y = e^{-x}$.
2. Find the Complementary Function of $2\frac{d^2y}{dx^2} + 3\frac{dy}{dx} - 5y = 6 \sin 2x$.
3. Find a_0 for $f(x) = x \cos x$ in $-\pi < x < \pi$.
4. Find b_1 for $f(x) = x$ in $0 < x < 2\pi$.

PART-B

Instructions: 1. Answer **ALL** questions.

02 × 03 = 06

2. Each question carries **THREE** marks.

5(a) Find Particular Integral of $(D^2 - D - 6)y = e^x \cosh 3x$.

OR

5(b) Solve $(D^2 + 2025)y = \sin 45x$.

6(a) Calculate a_1 in the Fourier series expansion of $f(x) = x \sin x$ in the interval $(-\pi, \pi)$.

OR

6(b) Find the value of b_n in the expansion of Fourier series for the function $f(x) = e^{3x}$, where $0 < x < 2\pi$.

PART- C

Instructions: 1. Answer **ALL** questions

02 × 05 = 10

2. Each question carries **FIVE** marks

7(a) Solve $(D^2 - 3D + 2)y = e^x$ if $y = 3$ and $\frac{dy}{dx} = 3$, when $x = 0$.

OR

7 (b) Solve $y'' + y = x, y(0) = y'(0) = 1$.

8(a) Obtain Fourier series expansion of $|x^3|$ in the interval $(-\pi, \pi)$.

OR

8(b) Obtain Fourier series expansion of $f(x) = \begin{cases} x & \text{if } 0 < x < \pi \\ 2 & \text{if } \pi < x < 2\pi \end{cases}$.

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TELANGANA
DIPLOMA EXAMINATIONS (C - 24)
SC-401 SEMESTER IV, SEMESTER END EXAM, MODEL PAPER
ADVANCED ENGINEERING MATHEMATICS

(Open Book System)

Duration: 2: 00 Hours

Max. Marks: 40

PART-A

Instructions: 1. Answer **ALL** questions.

08 × 01 = 08

2 Each question carries **ONE** mark.

1. Find the order and degree of the Differential Equation $2y''' - 3y' = y$.
2. Find the Particular Integral of $(D^2 + 1)y = e^{\frac{x}{2}}$
3. Find $L(e^{-5t} + 7)$.
4. Verify the differential equation $(x + 2y - 2025)dy - (2x - y + 2024)dx = 0$ is homogeneous or not.
5. Find $L(5 \cos 3t + 7 \sinh 2t)$.
6. Find $L(te^{\omega t})$.
7. Find $L^{-1}\left(\frac{s}{s^2+81}\right)$.
8. Find $L^{-1}\left(\frac{3}{(s-3)^2}\right)$.

PART-B

Instructions: 1. Answer **ALL** questions.

04 × 03 = 12

2. Each question carries **THREE** marks.

9(a) Solve $(9D^2 - 24D + 16)y = 0$.

OR

9(b) Evaluate $L(2 \cos^2 3t)$.

10(a) Solve $(D^2 + D - 2)y = 16$.

OR

10(b) Evaluate $L^{-1}\left(\frac{6}{s^2-4s+7}\right)$.

11(a) Evaluate $L(2 \cos^2 3t)$.

OR

11(b) Evaluate $L(5e^{3t} \cosh 2t)$.

12(a) Evaluate $L^{-1}\left(\log\left(\frac{s-2}{s+3}\right)\right)$.

OR

12(b) Evaluate $L^{-1}\left(\frac{1}{s^2(16+s^2)}\right)$.

PART- C

Instructions: 1. Answer **ALL** questions.

04 × 05 = 20

2. Each question carries **FIVE** marks.

13(a) Solve: $x \log x \frac{dy}{dx} + y = \frac{\log x}{x}$.

OR

13(b) Evaluate $L\left[e^{2t} \left(\frac{1-\cos 3t}{t}\right)\right]$.

14(a) Obtain the Fourier series expansion of the function $f(x) = |\sin x|$ in $(-\pi, \pi)$.

OR

14(b) Evaluate $L^{-1}\left(\frac{s}{(s+1)^2(s^2+1)}\right)$.

15(a) Evaluate $L(f(t))$, where $f(t) = \begin{cases} t & \text{if } 0 \leq t < 2 \\ 3 & \text{if } t \geq 2 \end{cases}$.

OR

15(b) Evaluate $L((t^2 + 2t + 3) \sin 2t)$.

16(a) Evaluate $L^{-1}\left(\frac{1}{(s+1)(s+3)}\right)$ using Convolution Theorem.

OR

16(b) Solve the Differential Equation $\frac{d^2x}{dt^2} + 4x = 0$, when $y(0) = y'(0) = 1$ by using Laplace

Transform method.

ME-402-DESIGN OF MACHINE ELEMENTS

Course Title	Design of Machine Elements	Course Code	ME-402
SEMESTER	IV	Course Group	Core
Teaching Scheme in periods (L : T : P)	4:1:0	Credits	2.5
Methodology	Lecture + Tutorial	Total Contact Periods	75
CIE	60 Marks	SEE	40 Marks

Prerequisites: Knowledge of solid mechanics

COURSE OUTCOMES

	At the end of the course the student should be able to
CO1	Illustrate the concept of design procedure and Estimate the size of screwed fastener for given application.
CO2	Design of Solid and Hollow shafts to transmit the desired power based on strength and rigidity.
CO3	Design keys and couplings based on different modes of failure.
CO4	Design the size of belt for a given power transmission and a suitable gear train to transmit the desired velocity ratio.
CO5	Design Sliding Contact Bearings and Rolling Contact Bearing.
CO6	Design Profile of Cams based on different Follower Motion requirements and latest developments in design of machine elements

COURSE CONTENT

Blue Print of Marks for SEE:

Unit No	Unit Name	Periods	Questions to be set for SEE (QNo)			
			R		U	A
1	Introduction to Design and Design of Bolts Nuts, Screws	12	4	1	9(a)	13(a)
2	Design of Shafts	12				
3	Design of Keys and Couplings	12		2	10(a)	14(a)
4	Design of Belts and Gear Drives	14				
5	Design of Bearings	13	3	5,6	9(b),11(a), 11(b)	13(b),15(a), 15(b)
6	Design of Cams & Latest developments in design of machine elements.	12		7,8	10(b),12(a), 12(b)	14(b),16(a), 16(b)
Total		75	8		8	8

Legend: R; Remembering, U: Understanding A: Applying

Unit-I. Introduction to Design

Duration: 12 Periods (L: 10.0 – T: 2.0)

Design philosophy, Factors governing the design of machine element

Design procedure: General sequence of steps in designing a machine element.

Need of standard data for design purpose, use of machine design data, hand books and other data manuals.

Design of Bolts, Nuts & Screws

Thread nomenclature, specifications. Types of screw fasteners, Strength of screwed fasteners and failure due to different reasons, Stresses due to initial tightening and external forces, Stress due to combination of forces

Design of a Nut – Hexagonal and square nuts only.

Design and draw an Eye bolt for a given load and using empirical proportions, Applications of eye-bolt and Numerical problems

Self-locking mechanism-some smart fasteners

Unit-II. Design of Shafts**Duration: 12 Periods (L: 10.0 – T: 2.0)**

Functions, Materials, Types of shafts, Standard sizes of shafts as per I.S

Design of diameters for solid and hollow shafts to transmit a given power at given rpm.

a) Based on strength

b) Based on rigidity.

Comparison of solid and hollow shafts, Design of axle, Numerical problems.

Illustrate Hybrid shaft design.

Unit- III. Design of Keys and Couplings**Duration: 12 Periods (L: 10.0 – T: 2.0)****➤ Design of Keys**

Keys-Function of keys, types of keys, Splines, Specification of splines. Materials of keys and splines. Key failure, Effect of key way on the shaft strength. Design of a rectangular sunk key considering its failure against shear and crushing and using empirical proportions for given diameter of the shaft. Proportions of a spline for a given application using tables.

➤ Design of Couplings

Function, types of couplings. Design and draw a muff coupling (solid) and rigid flange coupling for a given torque using empirical formulae.

Unit- IV. Design of Belts and Gear Drives**Duration: 14 Periods (L: 12.0 – T: 2.0)**

Factors to be considered while selecting the type of drive -Belt drive, types of belt drives; belt materials, belt joints- length of open and crossed belts (without proof). Slip and Creep-Expression for the ratio of belt tensions (without proof), Concept of centrifugal tension – Relation between centrifugal tension and the tension on tight side for transmitting maximum power (derivation omitted) - Permissible stress in the belt per unit width, per unit cross Section-Calculation of belt thickness and width for given permissible stress for open and crossed belts.

Gear tooth terminology–Involute and Cycloidal profiles- advantages of involute Profile- Gear Material-Simple, compound, reverted & Epi-cyclic gear trains-simple problems on gear terminology- number of teeth for simple, compound and reverted gear trains for a given speed ratio.

Unit-V. Design of Bearings.**Duration: 13 Periods (L: 11.0 – T: 2.0)**

Functions, types of bearings, lubrication types, difference between hydro dynamic lubrication and hydrostatic lubrication- Journal bearing – terminology, performance - McKee's Equation, Bearing Modulus, power lost in friction and heat generated.

Thrust bearing- Torque equations for flat pivot and flat collar bearings under conditions of uniform pressure and uniform wear (without proof), Power lost in friction.

Rolling contact bearings – advantages and Disadvantages-Components of rolling contact bearing, ball and roller bearings-types, Applications-Rating life of antifriction bearing.

Unit-VI. Design of Cams & Latest developments in Design of machine elements

Duration: 12 Periods (L: 10.0 – T: 2.0)

Functions of cam - Classification of cams –Classifications of followers – uses. Working principle of plate and cylindrical cams - Nomenclature of cam profile, base-circle, cam angles, trace point - Motion of follower – Uniform velocity, uniform acceleration and retardation and simple harmonic motion – displacement diagrams for above motion - Construction of cam profile of a plate cam with knife edged, flat & roller follower for all three types of motions stated above - Problems on drawing of cam profiles as stated above for the follower axis passes through the axis of the cam shaft (offset followers not included)

List latest developments in design of machine elements-Identify various optimization techniques in design of machine elements.

REFERENCES

1. **Machine design Dr N, .C PandyaDr.C. S shah**
2. Machine Design - Joseph Edward Shingly.
3. Machine Design - R.S.Khurmi & J.K. Gupta
4. Design of Machine Elements - Pandya and Shah.
5. Design of Machine Elements – V B Bhandari
6. Machine Design Data Handbook by H A Patil

ONLINE RESOURCES

1. <https://nptel.ac.in/courses/>
2. [An Online Mechanical Engineering Resource | The Engineer's Reference](#)
3. <https://www.slideshare.net/>
4. [Machine element - Wikipedia](#)
5. Course: Machine Design (iasri.res.in)

SUGGESTED LEARNING OUTCOMES

Upon Successful completion of the course the student shall be able to

Unit- I. Introduction to Design and Design of Bolts, Nuts & Screws

- 1.1. Define the term Design
- 1.2. Describe the basic requirements of Design.
- 1.3. Describe the phases of Design process
- 1.4. List the factors governing the Design.
- 1.5. Use of relevant Indian Standard Codes for Design
- 1.6. Define screw thread
- 1.7. Explain screw thread nomenclature
- 1.8. specifications of screw threads
- 1.9. List the different threaded fasteners with legible sketches.
- 1.10. Explain the strength of screwed fasteners
- 1.11. List the stresses in bolts
- 1.12. Design the size of bolt for a given load
- 1.13. Design a Hexagonal and a Square Nut
- 1.14. Design the size of eye bolt for a given load.
- 1.15. Draw an eye bolt showing the proportions.
- 1.16. Describe about self-locking mechanism
- 1.17. List out some smart fasteners

2. Design of Shafts

- 2.1. Define the terms shaft and axle
- 2.2. State the functions of shaft
- 2.3. List out materials used for shafts
- 2.4. List the types of shafts
- 2.5. List the standard sizes of shafts as per I.S
- 2.6. Write the formula for power transmitted by the shaft
- 2.7. Design the shaft subjected to only torsion
- 2.8. Design the shaft subjected to only bending load (Design of axle)
- 2.9. Design the shaft subjected to bending and torsion based on Rankine and Guest theories
- 2.10. Design the shaft against the rigidity.
- 2.11. Compare the strength and rigidity of solid and hollow shafts.
- 2.12. Illustrate about hybrid shaft design

3. Design of Keys and Couplings

- 3.1. Define key
- 3.2. List different types of keys
- 3.3. Write the function of key.
- 3.4. Define spline
- 3.5. Name the recommended materials used for keys and splines.
- 3.6. Design the keys based on different modes of failure and also based on empirical relations
- 3.7. Write all the proportions of a spline for a given application referring tables.
- 3.8. Write the specifications of parallel, Gib-head and taper sunk keys as per B.I.S.
- 3.9. Define coupling
- 3.10. Write the functions of a coupling
- 3.11. Classify the couplings
- 3.12. Design the muff coupling for a shaft of given Torque and using empirical relations.
- 3.13. Design the cast iron flange-coupling (rigid type) for a given torque
- 3.14. Draw the above couplings according to the standard specifications

4. Design of Belts and Gear Drives

- 4.1. List the different power drives.
- 4.2. Compare the flexible drives with the rigid drives
- 4.3. Classify the belt drives
- 4.4. List the belt materials
- 4.5. Define the slip and creep in belts.
- 4.6. Explain the effect of slip and creep on power transmission
- 4.7. Write the expression for the length of open and cross belts
- 4.8. Write the expression for ratio of belt tensions
- 4.9. Write the expression for centrifugal tension in the belt
- 4.10. Explain the effect of centrifugal tension on power transmission
- 4.11. Design the belt cross-sectional dimensions (V-belts are excluded)
- 4.12. Solve the numerical problems related to the above cases.

- 4.13. Explain the nomenclature of spur gear tooth.
- 4.14. Identify various tooth profiles of gear.
- 4.15. Advantages of involute profile
- 4.16. Explain the terminology related to gear drive
- 4.17. List the gear materials
- 4.18. List different types of gear trains
- 4.19. Write the advantages and disadvantages of gear drives.
- 4.20. Explain different types of gear trains
- 4.21. Solve the simple problems related to gear terminology and gear trains.

5. Design of Bearings

- 5.1. State the function of bearing.
- 5.2. Classify the bearings—sliding and rolling contact.
- 5.3. State the advantages and disadvantages of sliding contact bearings
- 5.4. List the types of lubrication.
- 5.5. Difference between hydrodynamic lubrication and hydrostatic lubrication
- 5.6. Explain the construction and working principle of journal bearing
- 5.7. Explain friction in journal bearing.
- 5.8. Write McKee's equation Explain the terms in McKee's equation.
- 5.9. Design a simple journal bearing.
- 5.10. Calculate heat generated and dissipated in journal bearing
- 5.11. Write the expressions for the load and torque carried by thrust and collar bearings under uniform pressure and wear conditions (without proof)
- 5.12. Calculate heat generated and dissipated in collar bearing based on uniform pressure and uniform wear conditions
- 5.13. Solve the numerical problems.
- 5.14. Explain the nomenclature of rolling contact bearing.
- 5.15. Explain the types of ball and roller bearings
- 5.16. List the Advantages and disadvantages of anti-friction bearings
- 5.17. List all the differences between sliding contact and roller bearings
- 5.18. Properties of the bearing material
- 5.19. Define the term- Rating life of bearing**

6. Design of Cams& Latest Developments in Design of Machine Elements

- 6.1. Define Cam
- 6.2. State the function of cam
- 6.3. Classify the cams.
- 6.4. List different followers
- 6.5. Explain the cam profile.
- 6.6. Define terminology related to cam profile.
- 6.7. list different follower motions.
- 6.8. Draw angular - displacement diagram for lift motion for:
 - a) Uniform velocity.
 - b) S.H.M.
 - c) Uniform acceleration & retardation.
- 6.9. Draw simple cam profiles in above three cases for knife edged, flat and roller followers. (Offset followers are omitted).
- 6.10. List latest software technologies for design of machine elements.
- 6.11. Identify various optimization techniques in design of machine elements.

SUGGESTED STUDENT ACTIVITIES

1. Student has to identify the machines and inspects the available equipment in the workshops/lab to identify different machine elements.
2. Identify the purpose of Gear trains used in automobiles, machine tools etc.
3. Draw the Involute and Cycloidal Gear tooth profile.
4. Recognize the need of cams and Draw the cam profiles
5. Collect the pictures and record videos of various types of machine elements which practically exist in machinery and automobiles.
6. Quiz & Group discussion, Surprise test.
7. Any Case studies- Example- Identifying any new ideas adopted for existing design.

COURSE OUTCOMES		CL	Linked POs	Teaching Periods
CO1	Illustrate the concept of design procedure and Estimate the size of screwed fastener for given application.	R, U, A	1,2,3,5,7	12
CO2	Design of Solid and Hollow shafts to transmit the desired power based on strength and rigidity	R, U, A	1,2,3,7	12
CO3	Design keys and couplings based on different modes of failure	U, A	1,2,3,7	12
CO4	Design the size of belt for a given power transmission and a suitable gear train to transmit the desired velocity ratio.	R, U, A	1,2,3,7	14
CO5	Design Sliding Contact Bearings and Rolling Contact Bearing.	R, U, A	1,2,3,7	13
CO6	Design Profile of Cams based on different Follower Motion requirements and latest developments in design of machine elements	U, A	1,2,3,7	12
			Total Periods	75

Legends: R = Remember; U= Understand; A= Apply and above levels (Bloom's revised taxonomy)

CO-PO Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	Mapping Pos
CO1	3	2	2	-	1	-	1	1,2,3,5,7
CO2	2	3	3	-	-	-	1	1,2,3,7
CO3	2	3	3	-	-	-	1	1,2,3,7
CO4	2	3	2	-	-	-	1	1,2,3,7
CO5	2	3	2	-	-	-	1	1,2,3,7
CO6	1	2	2	-	-	-	1	1,2,3,7

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Lowly Addressed.

C24-MID-I Examination
Model Paper
ME-402 DESIGN OF MACHINE ELEMENTS

TIME : 1 Hour

Max. Marks: 20

PART – A

Marks: 04 X 1 M = 4M

NOTE: 1) Answer **All questions** and each question carries one mark.

2) Answers should be brief and straight to the point

1. Define Machine design.
2. How do you specify screw thread.
3. List different types of shafts.
4. Write any two functions of shaft.

PART – B

Answer all questions

2 x 3 M = 6M

5(a). What are the factors to be considered for design of machine element?

OR

5(b) Compute the safe tensile load for a bolt of M36 if the permissible tensile stress is 90 N/mm^2

6(a) what are the advantages of Hollow shaft over solid shaft

(OR)

6(b). A hollow steel shaft has 200mm external diameter and 125 mm internal diameter. Shear stress at outer surface is 64 N/mm^2 . Calculate the shear stress at inner surface.

PART – C

Answer all questions

2 x 05 = 10M

7(a). An eye bolt is to be used for lifting a load of 100KN. Design the bolt, If the tensile stress is not to exceed 100 N/mm^2 .

(OR)

7(b). The cylinder head of steam engine is subjected to a pressure of 1 N/mm^2 . It is held in a position by means of 12 bolts. The effective diameter of cylinder is 300mm. A soft copper gasket ($k=0.5$) is used to make the joint leak proof. Determine the size of bolt so that the stress in bolt does not exceed 100MPa.

8(a) A solid circular shaft is used to transmit a torque of 9.6N-m.. The angle of twist over a length of 2m is 2° . Estimate the required diameter of the shaft and shear stress induced in the material. Take $G = 0.8 \times 10^5 \text{ N/mm}^2$.

(OR)

8(b) A hollow shaft has 200mm external diameter and 125 mm internal diameter. Shear stress at outer surface is 64 N/mm^2 . Calculate the shear stress at inner surface.

C24-MID –II Examination
Model Paper
ME-402 DESIGN OF MACHINE ELEMENTS

TIME: 1 Hour

Max. Marks: 20

PART – A

Marks: 04 X1 M = 04M

NOTE: 1) Answer **All questions** and each question carries one mark.

2) Answers should be brief and straight to the point

1. State the effect of keyway on the strength of a shaft.
2. What is flexible coupling?
3. Define creep of belt.
4. Write any two applications of Epicyclic gear train

PART – B

Answer all questions

2 x 3 M = 06M

5(a) Draw the neat sketch of Gib Head Key with Proportions.

(OR)

5(b) Calculate the size of sleeve of muff coupling to connect two shafts of diameter 50 mm.

6(a) A gear has 50 teeth and pitch circle diameter is 300 mm. find the module

(OR)

6(b) Explain the following terms (a) Circular pitch (b) Pitch circle.

PART – C

Answer all questions

2 x 5 = 10M

7 (a) Design a rectangular sunk key for a shaft of 60mm diameter. The permissible shear stress is 35 N/mm² and compression stress is 75 N/mm².

(OR)

7(b) Design a shaft and bolts for cast iron flange coupling to connect two shafts in order to transmit 9 kW at 800 rpm. The permissible shear and crushing stress for shaft and bolt material are 35 N/mm² and 60 N/mm².

8 (a) A belt is required to transmit 15 KW from a pulley of 1000mm diameter at 420 rpm. The angle of lap is 160° and coefficient of friction is 0.3. If the safe working stress of belt material is 1.2 N/mm², find the width of belt. Thickness of belt is 10mm.

(OR)

8 (b) Explain about simple gear train with a neat sketch

BOARD DIPLOMA EXAMINATION

C24-End Semester Examination

Model Paper

ME-402 DESIGN OF MACHINE ELEMENTS

TIME: 2 Hrs.

Max. Marks: 40

PART – A

Marks: 08 X1 M = 08M

*NOTE:1) Answer **All questions** and each question carries one marks.*

*2)Answers should be brief and straight to the point and shall not exceed **three** simple sentences*

1. What is stud?
2. List different belt materials.
3. What is displacement diagram?
- 4.What is the need for joining of shafts with couplings.
- 5.Write two functions of lubricants used in bearings.
- 6.Write the applications of bearings.
7. State three main parts of a cam mechanism.
8. List out the different followers.

PART – B

Answer all questions

4 x 3 M = 12M

9(a) What are the steps involved in design of a machine element.

(OR)

9(b) What is bearing. How are they classified.

10(a) A gear of 48 teeth has pitch circle diameter of 384mm. What is its module and circular pitch?

(OR)

10(b) What is a cam. List out types of cams.

11(a) what are equivalent static load and equivalent dynamic load.

(OR)

11(b) Write the advantages and disadvantages of sliding contact bearings.

12(a) Define the following

(i) Base circle (ii) dwell

12(b) Write the information required to draw cam profile

PART-C

Answer all questions 4X5=20M

13(a) A solid shaft is subjected simultaneously to a torque of 28 KNm and bending moment of 22KNm. Find the diameter of shaft if the maximum shear stress is 30 N/mm^2 and normal stress is 50 N/mm^2 .

(OR)

13(b) A Flat collar bearing has internal and external diameter of 60 mm and 100 mm respectively and coefficient of friction is 0.05. Assuming the pressure is uniform at 0.14 N/mm^2 . Calculate the power lost in friction at a speed of 5rev/sec.

14(a) The diameter of the pulley on the driving shaft running at 150 rpm is 0.6 m. A counter shaft is to be driven at 375rpm by an open belt drive, having a coefficient of friction 0.3. The distance between the shafts is 2.4m. Determine the width of the belt to transmit 3 KW, If the safe permissible tension is 15N/mm width of belt.

(OR)

14(b)What is displacement diagram. Explain the construction of displacement diagram for a follower moving with SHM.

15(a) A journal bearing 60mm in diameter and 90mm long runs at 450rpm. The oil used for hydrodynamic lubrication has absolute viscosity of 0.016 kg/m.s . If the diametral clearance is 0.1mm, find the safe load on bearing.

(OR)

15(b)A foot step bearing supports a shaft of 120mm diameter, running at 100rpm. The shaft is bored with a shallow hole of 40mm at the end. If the bearing pressure is 0.75 N/mm^2 . Find (a) load to be supported and (b) power lost in friction if coefficient of friction is 0.015. (c) Heat generated.

16(a) A cam is to be designed for a knife edge follower with the following data:

1. Cam lift = 40 mm during 90° of cam rotation with simple harmonic motion.
2. Dwell for the next 30° .
3. During the next 60° of cam rotation, the follower returns to its original position with simple harmonic motion.
4. Dwell during the remaining 180° .

Draw the displacement diagram and profile of the cam when the line of stroke of the follower passes through the axis of the cam shaft.

The radius of the base circle of the cam is 40 mm.

(OR)

16 (b) Draw the profile of a cam to give the following motion to a reciprocating follower with a flat contact of face.

1. Out stroke during 120° of cam rotation
2. Dwell for the next 30° of cam rotation
3. Return stroke during 120° of cam rotation
4. Dwell for the remaining 90° of the cam rotation

The stroke of the follower is 30mm and the minimum radius of the cam is 25 mm. The follower moves with uniform velocity during both out stroke and return stroke. The axis of the follower passes through the axis of the cam shaft.

ME-403– THERMAL ENGINEERING

Course Title	Thermal Engineering	Course Code	ME-403
SEMESTER	IV	Course Group	Core
Teaching Scheme in periods (L : T : P)	4:1:0	Credits	2.5
Methodology	Lecture + Tutorial	Total Contact Periods	75
CIE	60 Marks	SEE	40 Marks

Prerequisites

Basic knowledge of Thermodynamics.

Course outcomes

On Successful completion of the course, the student will be able to

CO1 :	Explain construction and working of Air compressors.
CO2 :	Explain construction and working of Gas turbines . Describe the working of Jet and Rocket Engines.
CO3 :	Interpret various properties of steam and compute them using steam tables and Mollier diagram. Describe the construction and working of different types of boilers, their mountings and accessories.
CO4 :	Interpret different thermodynamic vapour processes & compute change in internal energy, work transfer and heat transfer for the given vapour process. Compute various terms associated with performance of boilers for the given boiler conditions.
CO5 :	Explain working and design of steam nozzles for the given conditions. Describe working of impulse and reaction turbines. Apply different compounding and governing methods for the given conditions of turbine.
CO6:	Describe the construction and working of condensers and compute various terms associated with its performance.

Blue Print of Marks for SEE

Unit no.	Unit name	Questions to be set for SEE (Q No)					Remarks
		R		U	A		
1	Air Compressors	4	1	9(a)	13(a)		
2	Gas Turbines & Jet Propulsion						
3	Properties of Steam & Steam Boilers		2	10(a)	14(a)		
4	Vapour processes & Performance of Boilers						
5	Steam Nozzles& Turbines		3	9(b) 11(a) 11(b)	13(b) 15(a) 15(b)		
6	Steam Condensers			10(b) 12(a) 12(b)	14(b) 16(a) 16(b)		
Total questions		8		8	8		

Legend: R : Remembering U: Understanding A:Applying

COURSE CONTENT

UNIT-1

Air compressors

Duration: Periods: 13 (L: 10 – T:03)

Functions of air compressor – uses of compressed air – types of air compressors - Single stage reciprocating air compressor its construction and working (with line diagram) using P.V. diagram. Formulae for work done and power required- simple problems on calculation of work done and power required-various efficiencies of compressors - Multi stage compressors – advantages over single stage compressors. Use of inter cooler – conditions for minimum work in two stage compressor (without proof)- Formulae for work done and power required in two stage compressors – simple problems.

UNIT-2

Gas Turbines & Jet Propulsion

Duration: Periods:12 (L: 09 – T:03)

Gas turbines – comparison of gas turbine with reciprocating I.C. engines and steam turbines - Classification – open cycle gas turbines and closed cycle gas turbines– Applications, advantages and limitations of gas turbines- working of constant pressure gas turbine – working of constant volume gas turbine – general lay out- P.V. and T.S diagrams- fuels used in gas turbines - applications of gas turbine. Principle of jet propulsion- classification of jet propulsion units- Operation ,working and applications of turbo propeller, turbo jet units and Ram jet engines– rocket engines –comparison of jet engines and rocket engines- fuels used in jet propulsion.

UNIT-3

Properties of steam and Steam Boilers

Duration: Periods:13 (L: 10 – T:03)

General layout of steam power plant. Functions and use of Steam Boiler, Nozzle, Turbine, Condenser and Pumps –Rankin cycle- Formation of steam under constant pressure- dryness fraction and degree of superheat - Determination of enthalpy, entropy and specific volume of wet, dry and superheated steam at a given pressure using steam tables and Mollier chart- internal energy, internal latent heat of wet, dry and superheated steam using steam tables. Steam boilers- Classification - Comparison of water tube and fire tube boilers –Cochran, Babcock& Wilcox Boilers - modern high pressure boilers- Lamont and Benson boilers - Boiler mountings - Boiler accessories – boiler draught systems.

UNIT-4

Vapour processes & Performance of Boilers

Duration: Periods:12(L: 10 – T:02)

Vapour processes- Isochoric, isobaric, isothermal, adiabatic , polytropic and throttling processes -Representation of vapour processes on h-s and T-s diagrams- Formulae for work transfer, change in internal energy and heat transfer for above processes (without proof) - Simple problems . Performance of boilers - Actual evaporation - Equivalent of evaporation - Factor of evaporation - Boiler horse power – Boiler thermal efficiency - Formulae for the above terms without proof - Simple direct problems.

UNIT-5

Steam Nozzles and Turbines

Duration: Periods :13 (L: 10 – T: 03)

Steam Nozzles-Functions and types - Flow of steam through nozzle - Velocity of steam at the exit of nozzle- Effect of friction in nozzles- Discharge of steam through nozzles - Critical pressure ratio -simple problems. Steam turbines- Classification - impulse & reaction turbines -

working of a simple De-laval turbine - Velocity diagrams of impulse turbines - Expression for tangential force , work done and axial thrust - blade or diagram efficiency, stage efficiency, nozzle efficiency –Compounding of turbines- velocity, pressure and combined pressure and velocity - Simple problems on single stage impulse turbines- analytical and graphical methods. Working of Parson's Reaction turbine -Bleeding, re-heating – regenerative heating and reheat factor (Problems omitted) - Governing of steam turbines.

UNIT-6

Steam Condensers

Duration: Periods: 12 (L: 10 – T: 02)

Steam condensers -Advantages of incorporating steam condenser in a power plant -Elements of a condensing unit -Classification – Jet condenser -types of jet condensers -surface condenser - types of surface condensers-Mixture of air and steam (Dalton's law of partial pressure), Measurement of vacuum in a condenser , Vacuum efficiency ,Condenser efficiency, - Simple problems on Steam condensers - sources of Air leakage into condenser, effects of Air leakage, Wet-air extraction using Edwards Air pump.-Cooling towers- types of cooling towers.

REFERENCE BOOKS

1. Thermodynamics byYunus Cengel
2. Thermal Engineering by Arora& S. Domkundwar
3. Thermodynamics and Heat Engines by R Yadav
4. Thermal Engineering by R.K Rajput
5. Thermal Engineering by R.SKhurmi

Suggested student activity

1. Students are advised to visit a nearby industry involving use of boiler and conduct energy auditing.
2. Analyze the data by using spread sheet, identify the areas of wastage of energy and suggest suitable methods for improvement of performance.
3. Velocity triangles of turbine may be solved using any CAD software.
4. Visit nearest thermal power station and prepare a report consisting of layout – construction and working of various elements.

SUGGESTED LEARNING OUTCOMES

Up on completion of the course the student shall be able to

1 Air compressors

- 1.1 List the functions of air compressors.

- 1.2 Outline the uses of compressed air.
- 1.3 Name the different types of compressors.
- 1.4 Explain the working of a single stage reciprocating air compressor using p-v diagram.
- 1.5 Write the formulae for work done and power required to drive single stage compressor.
- 1.6 Solve simple problems on single acting reciprocating air compressors.
- 1.7 Define various efficiencies of compressors.
- 1.8 List the advantages of multi- stage compression over single stage compression.
- 1.9 Explain the use of intercooler.
- 1.10 Write the conditions for minimum work done in two stage compression.
- 1.11 Write the formulae for work done and power required to drive two stage compressors.
- 1.12 Solve simple problems on two stage air compressors.

2 Gas Turbines & Jet Propulsion

- 2.1 Classify gas turbines.
- 2.2 Compare Gas turbines with Steam turbines.
- 2.3 Compare Gas turbines with IC engines.
- 2.4 Mention the applications and limitations of gas turbines.
- 2.5 Explain with line diagrams the working of an open and closed cycle gas turbines.
- 2.6 Explain the working of constant pressure and constant volume gas turbines.
- 2.7 Represent cycle of operations for the above turbines on P-V and T-s diagrams.
- 2.8 Identify the fuels used in gas turbines.
- 2.9 Classify jet propulsion units.
- 2.10 Explain with line diagram the principle of operation of Turbo jet, Turbo propeller units.
- 2.11 Compare Turbo jet engines with Turbo propeller engines.
- 2.12 Explain with line diagram the principle of operation of Ramjet engines.
- 2.13 Explain the working of Rocket engine.
- 2.14 Compare Jet engines with Rocket engines.
- 2.15 Identify the fuels used in jet propulsion.

3 Properties of steam and Steam Boilers

- 3.1 Draw the layout of steam power plant.
- 3.2 State the function of each element in a steam power plant.
- 3.3 Draw Rankin cycle used for steam power plant on T-s diagram.
- 3.4 Explain different stages of steam formation.

- 3.5 Define sensible heat, Latent heat of vapourisation.
- 3.6 Explain different types of steam.
- 3.7 Define dryness fraction, wetness fraction and degree of super heat.
- 3.8 Draw T-S and H-S diagrams for steam.
- 3.9 Compute the enthalpy, specific volume and entropy for wet, dry and superheated steam using steam tables.
- 3.10 Compute internal energy, internal latent heat of wet, dry and superheated steam using steam tables
- 3.11 Find properties of steam using Mollier chart.
- 3.12 Classify steam boilers.
- 3.13 Distinguish between water tube and fire tube boilers.
- 3.14 Explain the working of Cochran Boiler with a legible sketch.
- 3.15 Explain the working of Babcock Wilcox Boiler with a legible sketch.
- 3.16 Interpret the need of modern high-pressure boilers.
- 3.17 Explain the working of Lamont and Benson boilers with legible sketches.
- 3.18 List all the boiler mountings.
- 3.19 State the function of all the mountings.
- 3.20 Explain the working of Bourdon Tube Pressure gauge with a legible sketch.
- 3.21 Explain the working of water level indicator with a neat sketch.
- 3.22 Explain the fusible plug with a legible sketch.
- 3.23 List common types of safety valves
- 3.24 Explain the working of lever safety valve with a neat sketch.
- 3.25 List all the boiler accessories and write their functions.
- 3.26 Explain the working of Economizer, Super heater and Air pre heater with line Diagrams.
- 3.27 Explain steam trap and steam separator with neat sketches.
- 3.28 State the function of boiler draught.
- 3.29 Classify boiler draught.
- 3.30 Explain different boiler draught systems.

4 Vapour processes & Performance of Boilers

- 4.1 Identify the various thermodynamic vapour processes - isochoric,
- 4.2 Isobaric, isothermal, adiabatic, polytropic and throttling processes.
- 4.2 Represent different vapour processes on p-v, T-s and h-s diagrams.
- 4.3 Write Formulae for work transfer, change in internal energy and heat Transfer for all vapour processes.
- 4.4 Compute the work done, change in internal energy, heat transfer and

- change in entropy in isochoric process.
- 4.5 Compute the work done, change in internal energy, and change in entropy and heat transfer in isobaric process.
- 4.6 Compute the work done, change in internal energy, change in entropy and heat transfer in hyperbolic process.
- 4.7 Compute the work done, change in internal energy, change in entropy and heat transfer in adiabatic process.
- 4.8 Compute the work done, change in internal energy, change in entropy and heat transfer in polytropic process.
- 4.9 Compute the final condition of steam in throttling process.
- 4.10 Explain the terms actual/equivalent evaporation and factor of evaporation.
- 4.11 Define Boiler HP.
- 4.12 Define Thermal efficiency of boiler.
- 4.13 Write the formulae for different terms associated with performance of boilers
- 4.14 Compute the equivalent and actual evaporation from given data.
- 4.15 Solve problems on Boiler HP& Thermal efficiency.

5. Steam Nozzles and Turbines

- 5.1 Explain the Flow of steam through nozzle.
- 5.2 List the types of nozzles.
- 5.3 Derive the expression for Velocity of steam at the exit of nozzle in terms of enthalpy drop.
- 5.4 Calculate Velocity of steam at the exit of nozzle by using steam tables or Mollier chart.
- 5.5 Write the expression for Discharge of steam through nozzles.
- 5.6 Write the formula for Critical pressure ratio (without proof)
- 5.7 Explain the Effect of friction in nozzles
- 5.8 Solve problems on nozzles based on discharge (calculations on cross section area of throat and exit are omitted)
- 5.9 Explain the working principle of a steam turbine.
- 5.10 Classify the steam turbines with examples.
- 5.11 Differentiate the impulse turbines from reaction turbines.
- 5.12 Explain the Principle of working of simple De-Laval turbine.
- 5.13 Draw velocity triangles for impulse turbine.
- 5.14 List various blade angles.
- 5.15 Write formulae for tangential force, work done, axial thrust and power.
- 5.16 Define various efficiencies associated with turbines.
- 5.17 State the necessity of compounding a turbine.

- 5.18 Describe the methods of reducing rotor speeds by velocity, pressure and pressure-velocity compounding with the help of pressure, velocity variation charts.
- 5.19 Explain the working principle of Parson's Reaction Turbine with a line diagram.
- 5.20 Solve simple problems on Single Stage Impulse turbines (Velocity triangles and problems on reaction turbine are omitted)
- 5.21 Define the terms bleeding & reheating.
- 5.22 State the necessity of governing a turbine.
- 5.23 List the methods of turbine governing.
- 5.24 Explain Throttle governing.

6 Steam Condensers

- 6.1 State the functions of steam condenser.
- 6.2 Write the advantages of incorporating a condenser in power plant.
- 6.3 Classify steam condensers.
- 6.4 Explain the working principle of Low level counter flow and Parallel flow jet Condensers.
- 6.5 Explain the working principle of High level Jet condenser.
- 6.6 List the Advantages and Disadvantages of High- Level Jet condenser.
- 6.7 Explain the working principle of Shell and Tube Surface condenser.
- 6.8 Distinguish between down flow and central flow surface condensers.
- 6.9 Explain the working principle of Evaporative condenser.
- 6.10 List Advantages and Disadvantages of Surface condensers.
- 6.11 Distinguish between Jet Condenser and Surface Condensers.
- 6.12 Write the Formulae for cooling water required, Condenser efficiency, corrected Vacuum, absolute pressure and Vacuum efficiency.
- 6.13 Solve simple problems on Steam condensers to Estimate the Cooling water requirement, Condenser efficiency and Vacuum efficiency.
- 6.14 Define Air Extraction.
- 6.15 List the sources of air leakage into condenser.
- 6.16 State the effects of air leakage into condenser.
- 6.17 Explain the working principle of Edwards Air pump.
- 6.18 State the functions of cooling towers.
- 6.19 Explain the working principle of natural, forced and induced draught cooling towers.

CO-PO Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	Mapping Pos
CO1	3	2	1	-	-	-	2	1,2,3,7
CO2	3	1	-	-	-	-	2	1,2,7
CO3	3	2	1	-	1	-	2	1,2,3,5, 7
CO4	3	3	2	-	-	-	2	1,2,3,7
CO5	3	2	2	-	1	-	2	1,2,3,5,7
CO6	3	2	1	-	1	-	2	1,2,3,5, 7

State Board of Technical Education, Telangana
Model Paper
ME-403: THERMAL ENGINEERING

Mid Sem-I

Time :1 Hour

Total Marks : 20

PART-A

Marks: 4 X 1 =4

NOTE: 1) Answer ALL questions and each question carries One mark.

1. State the function of an air compressor.
2. Define the term clearance ratio.
3. Write any two applications of gas turbines.
4. Mention any two fuels used in jet propulsion.

PART- B

Marks : 2 X 3= 6

NOTE: 1) Answer ALL questions and each question carries Three marks

5.(a) State the two conditions for maximum efficiency of a two stage reciprocating compressor.
(OR)

5. (b) Draw p-v diagram for single stage reciprocating compressor with clearance for polytropic compression.

6.(a) Differentiate between Open and Closed cycle gas turbines in any three aspects.
(OR)

6.(b) Write any two differences between Turbo propeller and Turbo jet engines.

PART- C

Marks : 2 X 5 = 10

NOTE :

- 1) Answer ALL questions and each question carries Fivemarks.
- 2) The answers should be comprehensive and the criteria for valuation is the content but not the length of the answer.

7.(a) Explain the working of a Two Stage Air Compressor with the help of p-v diagram.
(OR)

7.(b) A single cylinder, single stage reciprocating compressor is required to compress 0.015 m^3 of air per cycle from 1 bar to 6 bar pressure. Calculate the power required if compressor runs at 180 rpm and compression follows the law $PV^{1.25} = \text{constant}$.

8.(a) Explain the working of Closed cycle gas turbine with a neat sketch.
(OR)

8.(b) Explain the working of Ram jet engine with the help of a neat sketch.

State Board of Technical Education, Telangana
Model Paper
ME-403 -THERMAL ENGINEERING
Mid Sem-II

Time :1 Hour

Total Marks: 20

PART- A

Marks: 4 X 1 =4

NOTE: Answer ALL questions and each question carries One mark.

1. Mention any two Boiler mountings.
2. Define the term dryness fraction.
3. Define the term Boiler HP.
4. Represent adiabatic expansion process on T-s diagram.

PART- B

Marks : 2 X 3= 6

NOTE: Answer ALL questions and each question carries Three marks

5(a). Write any three differences between fire tube and water tube boilers.

(OR)

5(b). Find the enthalpy and entropy of wet steam at 11 bar and 90% dry.

6 (a). Dry saturated steam is cooled in a closed vessel of 2 m^3 volume from 10 bar to 2 bar. Find (a) Mass of steam and (b) Final condition of steam.

(OR)

6 (b). Define the terms Equivalent of evaporation and Boiler thermal efficiency.

PART- C

Marks : 2 X 5 = 10

NOTE :

1. Answer ALL questions and each question carries Five marks.
2. The answers should be comprehensive and the criteria for valuation is the content but not the length of the answer

7 (a). Explain the working of Lamont boiler with a neat sketch.

(OR)

7(b). Define the term draught. Explain forced draught system with a line diagram.

8(a). 1 kg of steam 0.8 dry at 10 bar abs. expands during a non flow polytropic process according to the law $PV^{1.3} = \text{Constant}$ until the pressure becomes 2.8 bar. Calculate (a) Final condition of steam (b) Work done and (c) Heat transfer

(OR)

8(b). A boiler generates 18,000 kg of steam per hour at 12 bar 95% quality. Feed water temperature is 110°C . Rate of coal firing is 2000 kg/ hr. If HCV of coal is 27,500 kJ/ kg, find (a) Factor of Evaporation (b) Equivalent of evaporation and (c) Thermal efficiency.

Board of Technical Education, Telangana State
SEE -Model Paper
ME-403 -THERMAL ENGINEERING

Time :2Hours

Total Marks : 40

PART-A

08X01=08

Instructions :1. Answer ALL questions.

2. Each question carries ONE mark.

1. Write the formula for power required to drive a compressor.
2. What is the function of fusible plug in a steam boiler ?
3. Define the term stage efficiency.
4. Represent isothermal process on T-s diagram.
5. Write the expression for exit velocity of steam in a steam nozzle.
6. What is bleeding with respect to a steam turbine ?
7. Define a steam condenser .
8. Define the term vacuum efficiency with respect to a condenser.

PART-B

04X03=12

Instructions : 1. Answer ALL questions.

9(a). Write the advantages of multistage compression over single stage compression.

(OR)

9(b). Write the differences between impulse and reaction turbines.

10(a). List the classification of steam boilers.

(OR)

10(b). Differentiate surface condensers from jet condensers.

11(a). Define the terms reheating and reheat factor.

(OR)

11(b). Explain the working of De-Laval turbine with a neat sketch.

12(a). Write a short note on shell and tube surface condenser.

(OR)

12(b). The vacuum in a condenser is 672 mm of Hg. Barometer reading is 757 mm of Hg. The pressure corresponding to condensation temperature is 55.3 mm of Hg. Find the vacuum efficiency.

PART-C

04X05=20

- Instructions :1. Answer ALL questions.
2. Each question carries FIVE marks.

13(a). Explain the working of an open cycle constant pressure type gas turbine with the help of a neat sketch.

(OR)

13.(b) List different methods of governing steam turbines and explain throttle governing with a neat sketch.

14.(a) Explain the working of Benson boiler with a neat sketch.

(OR)

14.(b) Explain the working of Edward's wet air pump with a neat sketch.

15.(a) Explain pressure compounding with the help of pressure velocity variation chart.

(OR)

15.(b) Steam issues from a nozzle at 800 m/s. The velocity of moving blade is 200 m/s and the mass of steam flow is 1.5 kg/s. The nozzles are inclined at 16° to the plane of rotation of wheel, taking friction factor as 0.85 and outlet angle of blade as 30° , find

(a) Power developed (b) Blade angle at inlet (c) Blade efficiency and (d) Axial thrust.

16.(a) A surface condenser is designed to handle 1200 kg of steam per hour. The steam enters at 0.08 bar, 0.9 dry and the condensate leaves at the corresponding saturation temperature

17.e. The pressure is constant throughout the condenser. Estimate the cooling water flow rate if the inlet and outlet temperatures of cooling water are 20° and 30° respectively. Assume specific heat of water as 4.2 kJ/kg-K

(OR)

16. (b) Explain the working of High Level Jet Condenser with the help of a neat sketch.

ME-404 INDUSTRIAL ENGINEERING & ESTIMATING AND COSTING

Course Title:	Industrial Engineering & Estimation and Costing	Course Code:	ME-404
Semester:	IV	Course group:	Core
Teaching Scheme (L:T:P):	4:1:0	Credits:	2.5
Methodology:	Lecture + Assignment	Total Contact Periods:	75
CIE:	60 Marks	SEE:	40 Marks

Prerequisites: Knowledge of Basic Sciences and Industrial Management.

COURSE OUTCOMES

On successful Completion of the course, the students will be able to

Course Outcomes	
CO1	Explain the need for Method study, Time study and Ergonomics design
CO2	Explain the methods of Wage Payment, Incentives and Merit rating methods
CO3	Elaborate the importance of Inspection and Statistical Quality Control and Apply SQC tools in a given situation
CO4	Identify Constituents of Estimation and Costing & Compute Selling Price of a component and Depreciation of an asset
CO5	Estimate Weight of material in a Component and Machining time
CO6	Identify and Compute components of the Cost of Fabrication, Forging and Foundry

Blue Print of Marks for SEE:

Units		No of periods	Questions to be set for SEE				Remarks	
			R		U	A		
PART-A	1. Work Study-Method study, Time study & Ergonomics	15	Q4	Q1		Q9(a)	Q13(a)	
	2. Wage Payment & Incentives & Merit Rating	10						
PART-B	3. Inspection & Statistical Quality Control	15		Q2		Q10(a)	Q14(a)	
	4. Estimating & Costing & Depreciation	10						
PART-C	5. Estimation of Weights of Components & Manufacturing Time	10		Q3	Q5	Q9(b)	Q13(b)	
		Q6			Q11(a)	Q15(a)		
	6. Estimation of Fabrication Cost, Forging Cost& Foundry Cost	15			Q7	Q10(b)	Q14(b)	
				Q8	Q12(a)	Q16(a)		
				Q12(b)	Q16(b)			
TOTAL		75	08		08	08		

COURSE CONTENT:

1. Work Study-Method study, Time study & Ergonomics:

Work Study: - Meaning, Objectives

Productivity: Meaning, role in Work study

Method Study: Meaning, Objectives, Procedure, Symbols used ,Tools Used

Micro motion study: Therbligs, SIMO Chart

Time Study: Meaning, Purpose, Procedure, Equipment, Time allowances,

Standard time Calculation, PMTS, Work Sampling

Ergonomics: Meaning, Design at workplace

2. Wages & Incentives& Merit rating:

Wages: Definition, Types, Standard Wage Plans, Wage differentials-causes

Incentives: Meaning, Types, Financial Incentive Plans and Managerial schemes

Merit rating: Definition, objectives, Methods

3. Inspection & Statistical Quality Control:

Inspection: Objectives, Methods

Statistical Quality Control: Meaning, advantages, pattern of variations, Types of Statistical data and Techniques

Control Charts: Meaning, Types- Attributes and Variables Charts-Illustration, procedure

OC Curve: Illustration and Importance

Sampling Plans: Single sampling plan and Double sampling plan

4. Estimation & Costing& Depreciation:

Estimation: Meaning, Objectives, Functions, Constituents and Qualities of an Estimator

Costing: Meaning, Objectives, Elements, Components, Calculating Selling Price

Depreciation: Definition, Causes, Methods of Calculation.

5. Estimation of Weights of Components& Manufacturing Time:

Estimation of Weights: Formulae, Principles of Dividing drawings into components, Calculation of Volume, Weight of material for Components

Estimation of manufacturing time: Turning, drilling, Boring, Facing, Knurling, Reaming, Chamfering and Thread Cutting –Formulae and Simple problems

6. Estimation of Fabrication cost, Forging cost and Foundry cost:

Fabrication: Meaning, Types, Welding Joints, Cost calculation -Gas welding and Arc welding, Problems

Forging: Meaning, Types, losses and estimation of Cost

Foundry: Meaning, Pattern allowances and estimation of Cost

REFERENCE BOOKS:

1. Introduction to Work study by ILO
2. Work study by Ralph & Barnes
3. Fundamentals of Ergonomics by Dr UV Kiran
4. Industrial Engineering and Management by OP Khanna
5. Industrial Engineering & Management Science by TR Bhanga
6. SQC by Juran
7. SQC by M Mahajan

8. SQC by Grant & Levenworth
9. Mechanical Estimating and costing by R Bhanga, SC Sharma
10. Work study and Ergonomics by Lakhwinder Pal Singh
11. Industrial Ergonomics by M.L Khan

ELECTRONIC RESOURCES:

1. <https://nptel.ac.in/courses/>
2. <https://www.slideshare.net/>
3. <https://en.wikipedia.org/wiki>
4. <https://ndl.ethernet.edu.et/bitstream/>
5. <https://www.physio-pedia.com/Ergonomics>

SUGGESTED STUDENT ACTIVITIES:

1. Prepare a Case study on productivity improvement by using a Work study
2. Draw human ergonomics at the workplace
3. Identify various jobs in any organization and study their pay structures.
4. Identify various quality control methods for various products, processes, and services
5. Identify various administrative expenses in your institution
6. Estimate the total cost of a sheet metal tray manufactured in a workshop
7. Estimate the Forging cost of a specimen

SUGGESTED LEARNING OUTCOMES:

Upon completion of the course, the student shall be able to

- 1. Work Study-Method study, Time study & Ergonomics**
 - 1.1 Define Work study and State Objectives of Work study
 - 1.2 Define Productivity and Discuss the role of Work study in Productivity
 - 1.3 Define Method Study and State Objectives of Method Study
 - 1.4 Explain the Method Study Procedure and Process Chart Symbols
 - 1.5 Illustrate Operation Process Chart, Flow Process Chart and Two hand Process Chart
 - 1.6 Illustrate Flow diagram, String diagram, Cycle graph and Chronocycle graph
 - 1.7 Define Micro motion Study and Therblig
 - 1.8 Illustrate different Therblig symbols and SIMO Chart
 - 1.9 Define Time study and State the Purpose
 - 1.10 Explain the procedure for Time study using a Stopwatch
 - 1.11 Explain Time study equipment
 - 1.12 Discuss various Time allowances and Standard time calculation
 - 1.13 Practice simple problems on Standard time calculation
 - 1.14 Explain the procedure for PMTS and Work sampling
 - 1.15 Define Ergonomics and Illustrate Ergonomics Design at workplace

2. Wage Payments & Incentives & Merit Rating:

- 2.1 Define Wage and discuss types of Wages
- 2.2 Define Wage differentials and discuss the causes
- 2.3 Explain various types of Standard Wage plans
- 2.4 Define Incentives and discuss types of incentives
- 2.5 Explain the methods of Financial Incentive Plans
- 2.6 Practice problems on Halsey's Premium Plan and Rowan's Plan
- 2.7 Explain the Incentives schemes to managerial and Supervisory Staff
- 2.8 Define Merit rating
- 2.9 Discuss the objectives of Merit rating
- 2.10 Explain the Methods of Merit rating

3. Inspection & Statistical Quality Control :

- 3.1 Define Inspection and State the Objectives of Inspection
- 3.2 Explain methods of Inspection
- 3.3 Define Statistical Quality Control and State the advantages of SQC
- 3.4 Discuss various Patterns of Variations and types of statistical data
- 3.5 List out Statistical Quality Control techniques
- 3.6 Define Control Charts and State types of Control Charts
- 3.7 Discuss objectives of $\bar{X}$ and R charts
- 3.8 Explain the procedure of $\bar{X}$ and R charts
- 3.9 Practice problems on $\bar{X}$ and R charts
- 3.10 Discuss Control charts for attributes
- 3.11 Explain the procedure of the P Chart, nP Chart and 100P Chart
- 3.12 Practice problems on P Chart, nP Chart and 100P Chart
- 3.13 Illustrate the OC curve and discuss the terminology
- 3.14 Illustrate the Single Sampling Plan
- 3.15 Illustrate the double Sampling Plan

4. Estimation & Costing & Depreciation:

- 4.1 Define Estimation
- 4.2 Discuss objectives and functions of Estimation
- 4.3 Discuss the qualities of the Estimator and Constituents of the Estimation
- 4.4 Define Costing
- 4.5 Discuss Objectives of Costing and Differentiate Estimating and Costing
- 4.6 Explain the elements of Cost and Components of cost and types of Overheads
- 4.7 Practice problems on Calculation of the Selling price of a product manufactured
- 4.8 Define Depreciation
- 4.9 Discuss Causes of Depreciation and methods of Calculation of Depreciation
- 4.10 Practice Problems for calculation of Depreciation using Straight line method and Sinking fund method

5. Estimation of Weights of a component & Machining time:

- 5.1 Review of mensuration formulae for regular 2D figures including fillets, Segments of circle
- 5.2 Review mensuration formulae for regular 3D solids of revolution and segments
- 5.3 Principles of dividing the component drawing into simple and smaller Geometrical configurations
- 5.4 Procedure for estimation of the weight of materials for a component
- 5.5 Practice simple problems on the estimation of weights of various machine Components
- 5.6 Define Machining time, Cutting speed, Feed, and Depth of Cut
- 5.7 Discuss the purpose of calculating machining time and terms related
- 5.8 Formulae to estimate machining time for turning, Drilling, Boring and Facing Operations
- 5.9 Formulae to estimate machining time for Knurling, Reaming, Chamfering and Thread cutting
- 5.10 Practice Simple problems on Estimation of Machining time

6. Estimation of Fabrication Cost, Forging Cost & Foundry Cost:

- 6.1 Define Fabrication and Welding
- 6.2 Discuss types of Welding and Welding joints
- 6.3 Explain the Principle of Welding and techniques of Welding
- 6.4 Estimation of Gas Welding Cost and Gas Cutting Cost
- 6.5 Estimation of Arc Welding Cost
- 6.6 Practice problems on the estimation of Gas welding cost
- 6.7 Practice problems on the estimation of Arc Welding cost
- 6.8 Define Forging
- 6.9 Discuss types of Forging and Illustrate Forging Operations
- 6.10 Explain different Forging losses
- 6.11 Estimation of Forging Cost
- 6.12 Define Foundry
- 6.13 Explain the process of producing Castings in the Foundry Shop
- 6.14 Explain various Pattern allowances
- 6.15 Estimation of Foundry Cost

COURSE OUTCOMES		CL	Linked Pos	Teaching Periods
CO1	Explain the need for Method study, Time study and Ergonomics design	R,U,A	1,2,3,4,5,7	15
CO2	Explain the methods of Wage Payment, Incentives and Merit rating methods	R,U,A	1,2,3,5	10
CO3	Elaborate the importance of Inspection and Statistical Quality Control and Apply SQC tools in a given situation	R,U,A	1,2,3,4,6,7	15
CO4	Identify Constituents of Estimation and Costing & Compute Selling Price of a component and Depreciation of an asset	R,U,A	1,2,3	10
CO5	Estimate the Weight of a material in a Component and Machining time	R,U,A	1,2,3	10
CO6	Identify and Compute components of the Cost of Fabrication, Forging and Foundry	R,U,A	1,2,3,5,7	15
			Total Periods	75

Legends: R = Remember: U = Understand: A = Apply and above levels (Bloom's revised taxonomy)

CO-PO Attainment Matrix:

COURSE OUTCOMES	PROGRAM OUTCOMES						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	<u>3</u>	<u>3</u>	<u>3</u>	<u>2</u>	<u>2</u>		<u>2</u>
CO2	<u>2</u>	<u>2</u>	<u>2</u>		<u>2</u>		
CO3	<u>3</u>	<u>3</u>	<u>3</u>	<u>2</u>		<u>2</u>	<u>2</u>
CO4	<u>2</u>	<u>2</u>	<u>2</u>				
CO5	<u>3</u>	<u>2</u>	<u>2</u>				
CO6	<u>3</u>	<u>3</u>	<u>3</u>		<u>2</u>		<u>2</u>

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Lowly Addressed.

MID SEM-I EXAM
Model Paper :: ME-404
Industrial Engineering & Estimating and Costing

Time: 1 hr

Max. Marks: 20

PART-A

4x1=4 Marks

NOTE: 1) Answer all questions and each one carries one mark.

2) Answers should be brief and straight to the point and shall not exceed three simple Sentences.

1. List any two advantages of Work Study.
2. Define Ergonomics.
3. What is an Incentive?
4. Name two types of Wage payment methods.

PART-B

2x3 M= 6 Marks

NOTE: 1) Answer all questions and each one carries three marks.

2) Answers should be comprehensive and the criterion for valuation is the content but not the length of the answer.

5(a). Draw any six therblig symbols.

OR

5(b). Compare and Contrast Method study and Time study.

6(a). Explain Rowan's Plan.

OR

6(b). Write three advantages of Merit rating.

PART-C

2x5 M= 10 Marks

NOTE: 1) Answer all questions and each one carries Five marks.

2) Answers should be comprehensive and the criterion for valuation is the content but not the length of the answer.

7(a). Develop a Two-hand Process Chart for Nut and Bolt assembly.

OR

7(b). Explain Cyclegraph and Chronocyclegraph with a neat sketch.

8(a). Discuss various types of Incentives.

OR

8(b). Management sets the target of completing 72 jobs for each worker. The hourly wage rate is Rs 2/- and the standard time set for each job is 8 hours but worker completes the job in 6 hours only. Compute the daily earnings on Rowan's Plan.

MID SEM-II EXAM
Model Paper :: ME-404
Industrial Engineering & Estimating and Costing

Time: 1 hr

Max. Marks: 20

PART-A

4x1=4 Marks

NOTE: 1) Answer all questions and each one carries one mark.

2) Answers should be brief and straight to the point and shall not exceed three simple Sentences.

1. List two advantages of Inspection.
2. What is Control chart?
3. Define Estimation.
4. Write the formula used to calculate Prime cost.

PART-B

2x3 M= 6 Marks

NOTE: 1) Answer all questions and each one carries three marks.

2) Answers should be comprehensive and the criterion for valuation is the content but not the length of the answer.

5(a). List out three SQC techniques

OR

5(b). What are the objectives of $\bar{X}$ and R charts

6(a). Write three qualities of an Estimator

OR

6(b). What are the causes of Depreciation

PART-C

2x5 M= 10 Marks

NOTE: 1) Answer all questions and each one carries Five marks.

2) Answers should be comprehensive and the criterion for valuation is the content but not the length of the answer.

7(a). Explain the procedure of the P Chart(attribute control chart)

OR

7(b). Explain a Single Sampling Plan with a neat sketch.

8(a). Differentiate Estimating and Costing.

OR

8(b). A radial drilling machine was purchased for Rs 2,90,000 and its installation cost was Rs 10,000. The serviceable life of the machine was estimated as 5 years and its scrap value as Rs 1,00,000. Determine the rate of depreciation by Sinking fund method if the rate of interest is 5%.

BOARD DIPLOMA EXAMINATION, (C-24)

SEE-MODEL PAPER, ME-404

DME-IV SEMESTER EXAMINATION

Industrial Engineering & Estimating and Costing

Time: 2 hrs

Max. Marks: 40

PART-A

8x1=8 Marks

Instructions: 1) Answer all questions.

2) Each question carries ONE mark.

1. Define Time study.
2. What is Prime cost?
3. List two types of Welding.
4. Abbreviate AOQ.
5. Give a formula to calculate the volume of Cylinder.
6. Write the units for Cutting Speed.
7. Define Forging.
8. Give two examples of components made by Foundry.

PART-B

4X3 = 12 Marks

Instructions: 1) Answer all questions.

2) Each question carries THREE marks.

9(a). Draw Stopwatch used in Time study.

OR

9(b). Write the Formula used to calculate Manufacturing time for Turning Operation.

10(a). What are the Objectives of Costing?

OR

10(b). Write a short note on Shrinkage allowance.

11(a). How do you calculate the volume of a Cone and a Sphere?

OR

11(b). Differentiate between Feed and Depth of Cut.

12(a). Draw any three Welded joints.

OR

12(b). What are Drop Forging and Press Forging?

PART-C

4x5 M= 20 Marks

Instructions: 1) Answer all questions.

2) Each question carries FIVE marks.

13(a). Explain Halsey's Premium Plan.

OR

13(b). Explain the procedure for Estimation of weights of materials.

14(a). Discuss four methods of Inspection in detail.

OR

14(b). How do you estimate the Gas Welding Cost.

15(a). Explain the Procedure for the estimation of Weight of materials.

OR

15(b). Estimate the time required for Cutting threads of 3 mm Pitch on a mild steel bar of 32 mm diameter and 85 mm long. Assume Cutting Speed for threads as 15m/min.

16(a). Four plates of each 100X10X1 cm are to be welded together to form a plate of 100X40X1 cm. Neglecting the cost of preparing edged, Calculate the cost of Material required for welding, assuming:

(a) Consumption of O_2 and C_2H_2 each $1\text{ m}^3/\text{hr}$

(b) Welding Speed = 2 m/hr

(c) Diameter of Filler rod = 5mm

(d) Length of Filler rod used / m of weld = 4.5m

(e) Cost of O_2 = Rs $7/\text{m}^3$

(f) Cost of C_2H_2 = Rs $50/\text{m}^3$

(g) Cost of Filler metal = Rs 20/ kg

(h) Density of Filler metal = 8 gm/cm^3

OR

16(b). How do you estimate Forging Cost.

ME-405 GREEN ENERGY SOURCES

Course Title:	Green Energy Sources	Course Code:	ME-405
Semester:	IV	Course group:	Core
Teaching Scheme(L:T:P):	4:1:0	Credits:	2.5
Methodology:	Lecture + Assignment	Total Contact Periods:	75
CIE:	60 Marks	SEE:	40 Marks

Prerequisites:

- 1 **Basic Physics & Chemistry:** Understanding of energy principles, electro magnetism, and chemical reactions relevant to energy technologies.
- 2 **Environmental Science (Introductory):** Awareness of climate change, pollution, and the importance of sustainable energy sources.
- 3 **Data Interpretation:** Familiarity with reading charts, graphs, and units of measurement in the energy sector.

COURSEOUTCOMES

On successful Completion of the course, the students will be able to

Course Outcomes	
CO1	Analyze the global energy landscape, contrasting traditional sources with green alternatives and their environmental impacts.
CO2	Design basic solar energy systems, demonstrating components election and system integration.
CO3	Assess wind energy potential, analyze site selection factors, and compare wind turbine technologies
CO4	Analyze the potential of ocean and geothermal energy resources in India, evaluate extraction technologies, and assess their environmental considerations.
CO5	Evaluate the suitability of different green bio energy production methods in India, considering sustainability, efficiency, and local conditions.
CO6	Analyze green hydrogen production, storage, applications, and safety, and evaluate its role in India's clean energy future.

Blue Print of Marks for SEE:

Units		No of period s	Questions to be set for SEE				Remarks
			R		U	A	
PART- A	1. Green Energy and Sustainability	10	Q4	Q1	Q9(a)	Q13(a)	
	2. Solar Energy	10					
PART- B	3. Wind Energy Engineering	10		Q2	Q10(a)	Q14(a)	
	4. Ocean & Geothermal Energy	15					
PART- C	5. Green Bioenergy	15	Q3	Q5 Q6	Q9(b) Q11(a) Q11(b)	Q13(b) Q15(a) Q15(b)	
	6. Green Hydrogen for a Clean Energy Future	15					Q7 Q8
TOTAL		75	08		08	08	

Legends: R=Remember: U=Understand: A=Apply and above levels (Bloom's revised taxonomy)

COURSECONTENT:

Unit1: Green Energy and Sustainability

Duration:10periods(L:08-T:2)

Global Energy: Traditional reserves, consumption patterns, environment a limpacts (climate change, pollution).

Green Energy: Definition, technologies (solar, wind, hydro, etc.), advantages and limitations.

India's Context: Green energy policies, green technology potential.

Economics: Cost analysis, economic feasibility, subsidies, market forces, implications of a green transition.

Unit II: Solar Energy

Duration:10periods(L:08-T:2)

Solar Radiation: Nature of radiation, terminology, extra terrestrial and terrestrial radiation, measurement techniques.

Solar Collectors: Flat plate collectors, concentrating collectors, performance analysis, thermal applications.

Solar Photo voltaic: PV effect, solar cell types and characteristics, efficiency factors.

Solar PV Systems: System components, design principles, grid integration, applications (residential to utility-scale).

Unit III: Wind Energy Engineering

Duration :10 periods(L:08-T:2)

1. **Introduction:** Wind energy basics, significance in the renewable energy landscape.
2. **Wind Fundamentals:** Nature of wind formation, wind speed-power relationship, forces on turbine blades.
3. **Site Selection:** Key factors (wind resource, topography, environmental), wind data analysis.
4. **WECS:** Components (rotor, generator, etc.), horizontal and vertical axis turbines, advantages and limitations of wind energy.
5. **Wind energy in India:**
 - a. Wind energy potential in India (regional variations, resource assessment)
 - b. Status of wind energy installations in India (capacity, major projects, growth trends)

Unit IV: Ocean & Geothermal Energy

Duration :15 periods(L:12-T:3)

1. **Ocean Energy:** Tidal principles (range, currents), extraction technologies (barrages, turbines), resource mapping in India, environmental considerations. Wave energy devices, potential along Indian coasts, environmental factors. OTEC fundamentals (closed/open cycle), applications, resource potential for India.
2. **Geothermal Energy:** Resource formation (high/low temperature), power plant technologies (dry steam, flash, binary), direct use applications, geothermal mapping with a focus on India.

Unit V: Green Bio energy

Duration :15 periods(L:12-T:3)

1. **Introduction:** Defining green bio energy principles (sustainability, efficiency), comparison to conventional bio energy and fossil fuels, role in India's clean energy transition.
2. **Green Biomass:** Sustainable feed stocks (residues, energy crops, algae, waste), responsible production practices (land-use, soil health).
3. **Bio energy Production:** Biogas (anaerobic digestion, upgrading), advanced bio fuels (cellulosic, algal, conversion processes), green electric power generation
4. **Applications:** Distributed power systems, rural energy, transport fuels (bio

ethanol, biodiesel, bio-CNG), bio fertilizers, emerging uses.

5. **India-Specific Focus:** National policies promoting green bio energy, challenges and opportunities within India's energy landscape

Unit VI: Green Hydrogen for a Clean Energy Future

Duration :15 periods(L:12-T:3)

1. **Fundamentals:** Hydrogen properties, production methods (grey, blue, green),electrolysis powered by renewable resources.
2. **Green Hydrogen Benefits & Applications:** Zero-emission fuel, energy storage,sector coupling in transportation, industry (steel, fertilizer), and grid balancing.
3. **India's Green Hydrogen Landscape:** Energy transition goals, the National Hydrogen Mission.
4. **Storage, Transportation, & Safety:** Compression, liquefaction, emerging materials,pipelines, handling protocols and safety standards.
5. **Outlook:** Opportunities and challenges in Green hydrogen adaption, and India's rolein the global green hydrogen market.

REFERENCE BOOKS:

1. Non-Conventional Energy Resources by B.H. Khan
2. Renewable Energy & Green Technology by Anjan K. Sahoo & Dr. S. P. Nanda
3. Solar Energy: Renewable Energy and Sustainable Technologies by Sukhatme,
4. Wind Energy Technology by Goswami, D. Y., & Chakravarthy, K. K.
5. Bio energy and Bi ofuels: Production, Technologies, Economics and Policies by AshokKumar and Vikas Pandey
6. Ministry of New and Renewable Energy (MNRE)Publications
<https://mnre.gov.in/>)

ELECTRONIC RESOURCES:

- 2.2 NPTEL -Renewable Energy Sources
(<https://nptel.ac.in/courses/108/106/108106137/>)
- 2.3 **MNRE Knowledge Portal:** Access government reports and data on renewable energywithin India (<https://research.mnre.gov.in/home>)
- 2.4 **National Hydrogen Mission** by Ministry of New and Renewable Energy (MNRE)Link: <https://mnre.gov.in/national-green-hydrogen-mission/>

SUGGESTED STUDENT ACTIVITIES:

Site Visits: Field trips to renewable energy installations (solar parks, wind farms, bioenergyplants, etc.) for real-world exposure.

Project-Based Learning: Assignments where students:

Design small-scale solar/wind/bioenergy systems for a local need. Conduct a local energy audit and propose green solutions.

Research a specific green technology innovation and present findings.

Case Studies: Analyze the successes/failures of green energy projects or policies within India or internationally.

Guest Lectures: Invite experts from renewable energy industries or research labs for talks/Q&A sessions.

Suggested Learning Outcomes

Upon completion of the course, the student shall be able to :

UNIT 1: Green Energy and Sustainability:

Global Energy Context

- 1.1 Introduction to green energy and sustainability
- 1.2 Identify major global energy reserves and their geographical distribution.
- 1.3 Analyze trends and patterns in global energy consumption, differentiating between sectors and regions.
- 1.4 Evaluate the environmental impacts associated with traditional energy sources (e.g., climate change, pollution).

Green Energy Foundations

- 1.5 Define the concept of green energy and how it differs from conventional energy.
- 1.6 Classify various green energy technologies and explain their basic operating principles.
- 1.7 Compare and contrast the advantages, disadvantages, and suitability of different green energy sources.

India-Specific Focus

- 1.8 Analyze India's energy mix and the relative contributions of renewable and non-renewable resources.
- 1.9 Outline key government policies and initiatives driving India's green energy transition.
- 1.10 Assess the potential and suitability of various green energy technologies for India based on resource availability and other factors.

Economics of Green Energy

- 1.11 Analyze cost structures and economic factors driving the adoption of green energy technologies.
- 1.12 Evaluate the economic feasibility of green energy projects in India, considering subsidies, technological trends, and market influences.
- 1.13 Discuss the potential economic benefits and challenges of a green energy transition for India.

Unit-II: Solar Energy

Solar Radiation Fundamentals

- 2.1 Define key terms related to solar radiation (e.g., irradiance, insolation, spectral distribution).
- 2.2 Explain the factors affecting solar radiation reaching the Earth's surface (e.g., atmospheric effects, time of day, seasonality).
- 2.3 Identify various instruments used for measuring solar radiation components (e.g., pyranometer, pyrheliometer, sunshine recorder) and describe their operating principles.

Solar Energy Collection

- 2.5 Differentiate between flat plate and concentrating solar collectors, explaining their construction and principles of operation.
- 2.6 Evaluate the suitability of different collector types for various thermal applications.
- 2.7 Analyze factors influencing the performance and efficiency of solar collectors.

Solar Thermal Applications

- 2.8 Classify various direct solar thermal applications (e.g., water heating, space heating, drying) based on their function and temperature requirements.
- 2.9 Illustrate the components and working principles of typical solar thermal systems with examples.
- 2.10 Assess the suitability of solar thermal technologies for different domestic and industrial needs considering efficiency and cost-effectiveness.

Solar Photovoltaic (PV) Technology

- 2.11 Explain the fundamental principles of photovoltaic conversion (light absorption, charge generation).
- 2.12 Analyze the structure and operation of different types of solar cells.
- 2.13 Evaluate the factors affecting the efficiency of solar cells (material, design, environmental conditions).

Solar PV Systems

- 2.14 Design basic solar PV systems, including sizing, component selection, and performance estimation.
- 2.15 Illustrate the processes involved in solar PV power generation, from cell level to grid integration, using diagrams or schematics.
- 2.16 Evaluate various applications of solar PV power considering their advantages and limitations.

Unit 3: Wind Energy Engineering

Introduction and Wind Fundamentals

- 3.1 Define wind energy and explain its importance within the renewable energy sector.
- 3.2 Explain the fundamental processes governing wind formation (e.g., pressure gradients, temperature, Coriolis effect).
- 3.3 Analyze the relationship between wind speed and available power potential.
- 3.4 Illustrate the key forces (lift and drag) acting on wind turbine blades and their impact on energy conversion.

Site Selection

- 3.5 Identify the crucial factors influencing wind farm site selection (wind resources, topography, environmental impact, land use).
- 3.6 Evaluate the role of wind data collection and analysis in the site selection process.
- 3.7 Analyze potential environmental and social impacts of wind energy projects

Wind Energy Conversion Systems (WECS)

- 3.8 Classify the primary components of a WECS and explain their functions (e.g., rotor, blades, generator, gearbox, tower, control systems).
- 3.9 Compare horizontal axis and vertical axis wind turbines in terms of their design, operation, advantages, and limitations.
- 3.10 Assess the overall benefits and limitations of wind energy conversion systems for power generation.
- 3.11 Analyze the factors that influence the efficiency of a wind turbine.

Wind energy in India

- 3.12 Evaluate the current status of wind energy installations in India, including capacity, major projects, and growth trends.
- 3.13 Discuss the challenges and opportunities specific to the development of wind energy in India (e.g., grid integration, infrastructure, policy landscape)

Unit IV: Ocean & Geothermal

Energy Introduction and Ocean Energy Basics

- 4.1 Define key terminology related to ocean energy (tides, currents, thermal gradient, wave energy) and geothermal energy.
- 4.2 Classify the different types of ocean energy resources and describe how they can be harnessed.
- 4.3 Explain the basic principles underlying tidal, wave, and OTEC power generation.

Tidal Energy

- 4.4 Compare different methods for tidal energy extraction (barrages vs. tidal stream turbines) in terms of their operation, efficiency, and suitability.
- 4.5 Interpret tidal resource maps of India to identify potential locations for tidal power projects.
- 4.6 Evaluate the environmental impacts of tidal energy projects on marine ecosystems and coastal habitats.

Wave Energy

- 4.7 Illustrate the working principles of common wave energy conversion devices (oscillating water column, overtopping devices) through drawings or schematics.
- 4.8 Assess the advantages and limitations of wave energy as a renewable power source.
- 4.9 Estimate the potential for wave energy development along India's coastline based on wave patterns and coastal geography.
- 4.10 Analyze the potential environmental concerns associated with wave energy installations.

OTEC

- 4.11 Contrast closed-cycle and open-cycle OTEC systems, evaluating their advantages and disadvantages.
- 4.12 Categorize the various applications of OTEC technology, including power generation and desalination.
- 4.13 Evaluate the potential of OTEC in India by analyzing maps of suitable

temperature gradients.

4.14 Assess the technical challenges and environmental considerations associated with OTEC implementation.

Geothermal Energy

4.15 Classify different types of geothermal resources based on their temperature and geological formations.

4.16 Illustrate the components of common geothermal power plants (dry steam, flash steam, binary cycle), depicting their operation.

4.17 Explain the various direct use applications of geothermal energy.

4.18 Evaluate the geothermal potential in India, focusing on high-temperature areas within the Himalayan region.

Unit V: Green Bio energy

Introduction

5.1 Define "green bio energy" and articulate its core principles of sustainability and efficiency.

5.2 Compare green bio energy and conventional bio energy, highlighting differences in feed stocks, environmental impact, and long-term sustainability.

5.3 Contrast green bio energy and fossil fuels based on renewability, greenhouse gas emissions, and overall environmental footprint.

5.4 Explain the significance of green bio energy in India's transition to clean energy, including its potential to reduce reliance on fossil fuels and address climate change concerns.

Green Biomass

5.5 Categorize various sustainable feedstocks for green bioenergy, including:

- a. Agricultural residues (e.g., crop straw, bagasse)
- b. Dedicated energy crops (e.g., fast-growing grasses, short-rotation trees)
- c. Algae (e.g., microalgae, macroalgae)
- d. Waste streams (e.g., municipal solid waste, food processing waste)

5.6 Explain responsible biomass production practices that prioritize:

- e. Sustainable land-use (avoiding deforestation, preserving biodiversity)
- f. Soil health (maintaining fertility, preventing erosion)

5.7 Identify the potential environmental and socioeconomic benefits of using sustainable biomass for bio energy.

Bio energy Production

5.8 Diagram the process of biogas production through anaerobic digestion, including the stages involved and the types of microorganisms responsible.

5.9 Explain the purposes and techniques of biogas upgrading (e.g., removal of carbon dioxide, hydrogen sulfide) to enhance its energy content.

5.10 Differentiate first-generation biofuels (e.g., corn ethanol) from advanced biofuels, emphasizing the advantages of advanced biofuels in terms of feedstock flexibility and sustainability.

5.11 Explain key conversion processes for advanced biofuels:

- a. Thermochemical (e.g., gasification, pyrolysis)
- b. Biochemical (e.g., enzymatic hydrolysis, fermentation)

5.12 Outline different methods for green electricity generation from biomass (combustion, gasification, co-firing) and their relative efficiencies.

Applications

- 5.13 Explain how green bioenergy can power distributed energy systems, providing advantages for rural and remote areas.
- 5.14 List the different types of biofuels suitable for transportation (bioethanol, biodiesel, bio-CNG) and their potential to reduce fossil fuel dependence.
- 5.15 Explain how digestate (the byproduct of anaerobic digestion) can be used as abiofertilizer, promoting sustainable agriculture.
- 5.16 Identify emerging applications of green bioenergy beyond fuels and electricity, such as bio-based chemicals, bioplastics, and building materials.

India-Specific Focus

- 5.17 List the primary national policies in India that incentivize and support green bioenergy development (e.g., National Biofuels Policy).
- 5.18 Identify key challenges to widespread green bioenergy adoption in India, including:
 - a. Feedstock availability and competition with other uses
 - b. Technological maturity and costs
 - c. Infrastructure limitations
- 5.19 Analyze potential opportunities for green bioenergy in India, considering:
 - d. Abundant agricultural residues
 - e. Growing energy demand
 - f. Rural development and employment needs
- 5.20 Assess the overall potential of green bioenergy to contribute to India's goals for energy security, climate mitigation, and sustainable development.

Unit VI: Green Hydrogen for a Clean Energy Future

Fundamentals

- 6.1 Define hydrogen and its fundamental properties.
- 6.2 Distinguish between different hydrogen production methods using the color-coding system (grey, blue, green).
- 6.3 Explain the process of electrolysis and its role in green hydrogen production.
- 6.4 Identify renewable energy sources (solar, wind, etc.) that can power electrolysis.
- 6.5 List the advantages of green hydrogen over traditional production methods.

Green Hydrogen Benefits & Applications

- 6.6 Assess the emissions of Hydrogen combustion and advantages.
- 6.7 Explain the concept of energy storage in the context of green hydrogen.
- 6.8 Discuss how green hydrogen enables sector coupling across transportation, industry, and energy.
- 6.9 Identify specific industries (e.g., steel, fertilizer) where green hydrogen can aid decarbonization.
- 6.10 Illustrate potential use cases of fuel cell vehicles powered by green hydrogen.

India's Green Hydrogen Landscape

- 6.11 Assess India's current energy landscape and how green hydrogen aligns with the nation's goals.
- 6.12 Outline National Hydrogen mission

Storage, Transportation, & Safety:

- 6.13 Compare different green hydrogen storage methods (compression, liquefaction, hydrides).
- 6.14 Analyze the infrastructure requirements for widespread green

hydrogentransportation.

6.15 Evaluate safety considerations, protocols, and standards related to hydrogen handling.Outlook:

6.16 Compare the advantages of hydrogen-powered vehicles over electric vehicles (EVs),considering factors like range, refuelling time, and infrastructure.

6.17 Analyze the key challenges (cost, infrastructure) hindering large-scale green hydrogenadoption in India.

6.18 Assess how technological advancements and policy support could drive costreduction.

6.19 Hypothesize the potential trajectory and impact of green hydrogen on India's energysector.

COURSE OUTCOMES		CL	Linked Pos	Teaching Periods
CO1	Analyze the global energy landscape, contrasting traditional sources with green alternatives and their environmental impacts.	R,U,A	1,2,5	10
CO2	Design basic solar energy systems, demonstrating component selection and system integration.	R,U,A	1,3,4	10
CO3	Assess wind energy potential, analyze site selection factors, and compare wind turbine technologies	R,U,A	1,2,4	10
CO4	Analyze the potential of ocean and geothermal energy resources in India, evaluate extraction technologies, and assess their environmental considerations.	R,U,A	1,2,4,5	15
CO5	Evaluate the suitability of different green bioenergy production methods in India, considering sustainability, efficiency, and local conditions.	R,U,A	1,2,5	15
CO6	Analyze green hydrogen production, storage, applications, and safety, and evaluate its role in India's clean energy future.	R,U,A	1,2,4,5	15
			Total Periods	75

Legends: R = Remember: U = Understand: A = Apply and above levels (Bloom's revisedtaxonomy

CO-PO Attainment Matrix:

COURSE OUTCOMES	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2	3	1	1	3	1	1
CO2	2	1	3	2	1	1	1
CO3	2	3	1	2	1	1	1
CO4	2	3	1	2	3	1	1
CO5	2	3	1	1	3	1	1
CO6	2	3	1	2	3	1	1

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Lowly Addressed.

Model Paper ME-406
GREEN ENERGY SOURCES

Time: 1 hr

Max. Marks: 20

PART-A

4x1=4 Marks

NOTE: 1) Answer all questions and each one carries one mark.
2) Answers should be brief and straight to the point and shall not exceed three simple sentences.

1. Define "Green energy"
2. List out the greenhouse gases associated with climate change.
3. Define "solar irradiance"
4. List out light absorbing materials used in solar panels.

PART-B

2x3 M= 6 Marks

NOTE: 1) Answer all questions and each one carries three marks.
2) Answers should be comprehensive and the criterion for valuation is the content but not the length of the answer.

5. a) Outline key government policies driving India's green energy transition.
OR
b) Explain basic working principles of any two green technologies.
6. a) Explain the working principle of a solar water heater
OR
b) Explain the working principle of solar photovoltaic cell.

PART-C 2x5 M= 10 Marks

NOTE: 1) Answer all questions and each one carries Five marks.
2) Answers should be comprehensive and the criterion for valuation is the content but not the length of the answer.

7. a) Explain the primary environmental impacts associated with traditional energy resources
OR
b) Write about the economic benefits and challenges of green energy transition in India.
8. a) Explain solar photovoltaic power generation
OR
b) Differentiate between flat plate and concentric solar collectors.

MID SEM-II EXAM
Model Paper ME-406
GREEN ENERGY SOURCES

Time: 1 hr
PART-A

Max. Marks: 20
4x1=4 Marks

NOTE: 1) Answer all questions and each one carries one mark.
2) Answers should be brief and straight to the point and shall not exceed three simple sentences.

1. Define Wind energy
2. List out the components of wind energy system.
3. List out various ocean energy resources
4. Name the working fluids used in OTEC.

PART-B

2x3 M= 6 Marks

NOTE: 1) Answer all questions and each one carries three marks.
2) Answers should be comprehensive and the criterion for valuation is the content but not the length of the answer.

5. a) Explain the principle of wind energy conversion
OR
b) Explain the fundamental process of wind formation
6. a) Write the working principle of OWC wave energy convertor
OR
b) Categorize the various applications of OTEC technology.

PART-C

2x5 M= 10 Marks

NOTE: 1) Answer all questions and each one carries Five marks.
2) Answers should be comprehensive and the criterion for valuation is the content but not the length of the answer.

7. a) Explain the key factors influencing the wind farm site selection
OR
b) Compare Horizontal axis and vertical axis wind turbine
8. a) Explain the operation of binary cycle-geothermal power plant with a simple diagram
OR
b) Compare open and closed OTEC systems

BOARD DIPLOMA EXAMINATION, (C-24)
SEE-MODEL PAPER,
ME-406 DME-IV SEMESTER EXAMINATION
GREEN ENERGY SOURCES

Time: 2 hrs

Max. Marks: 40

PART-A

Instructions: 1) Answer all questions

8x1=8 Marks

2) Each question carries ONE mark.

1. Name the instrument used to measure the duration of sunshine hours.
2. List the components of a wind energy system.
3. Define green bioenergy
4. Define “solar irradiance”
5. List the sources of green biomass.
6. Write the applications of biogas.
7. Name the emission products associated with hydrogen combustion.
8. Classify hydrogen production methods.

PART-B

4X3 = 12 Marks

Instructions: 1) Answer all questions.

2) Each question carries THREE marks.

9(a). Explain the working principle of solar photovoltaic cell.

OR

9(b). Outline the basic steps involved in producing biogas

10(a). Write the working principle of OWC wave energy convertor

OR

10(b). Outline the objectives of “National Hydrogen Mission”

11(a). Write about the Pyrolysis process in green bioenergy

OR

11(b). Differentiate green bioenergy and conventional bioenergy.

12(a) Explain how green hydrogen can be used to produce “Zero emission fertilizers”

OR

12(b). Summarize the potential uses of hydrogen in transportation sector

PART-C

4x5 M= 20 Marks

Instructions: 1) Answer all questions.

2) Each question carries FIVE marks.

13(a). Write about the economic benefits and challenges of green energy transition in

OR

13(b). Explain the process of biofuel production from cellulosic ethanol

14(a) Explain the key factors influencing the wind farm site selection

OR

14(b). Explain various hydrogen storage methods

15(a). Explain the process of biogas production from biomass

OR

15(b). Explain how biofuels can be used as alternatives to fossil fuels in the transportation sector

16(a). Compare hydrogen powered vehicles with Electric powered vehicles

OR

16(b). Explain the production process of green hydrogen

EE-416-BASIC ELECTRICAL & ELECTRONICS ENGINEERING

Course Title:	Basic Electrical & Electronics Engineering	Course Code	EE-416
Semester	IV Semester	Course Group	Core
Teaching Scheme in Periods (L:T:P)	60:15:0	Credits	2.5
Methodology	Lecture + Tutorials	Total Contact Periods	75
CIE	60 Marks	SEE	40 Marks

Pre requisites

Enthusiasm to learn the course, the basic knowledge of Physics and Mathematics and particularly electrical fundamentals at secondary school level.

Course Outcomes

Upon successful completion of the course, the students will be able to

CO1	Apply the concepts of Basic electrical circuits, Electromagnetism and the Induced E.M.F.
CO2	Detail the construction and working of D.C Machines.
CO3	Apply the characteristics of AC waveforms to summarize the working of transformer
CO4	Detail the construction and working of A.C Machines.
CO5	Make use of Electrical Safety procedures and Protection for electrical wiring
CO6	Apply the concept of PN junction diode, transistor configuration and types of logic gates and ICs.

Blue Print of Marks for SEE

Unit No	Unit Name	Periods	Questions to be set for SEE				
			R		U	A	
1	Electrical Engineering Fundamentals	10	Q4	Q1	Q9(a)	Q13(a)	
2	D.C. Machines and Batteries	15					
3	A.C. Fundamentals and Transformers	10		Q2	Q10(a)	Q14(a)	
4	A.C. Machines	15					
5	Wring system, tools & Safety procedures	10		Q3	Q5, Q6	Q9(b), Q11(a), Q11(b)	Q13(b), Q15(a), Q15(b)
6	Basic Electronics	15					
Total		75	8		8	8	

Course Contents

UNIT-I **Electrical Engineering Fundamentals**

Duration:10Periods(L:8-T: 2)

Definitions: Voltage, Current, Ohm' sLaw, work, power, energy with units. Kirchhoff's Laws. Electro – magnetic induction. Lenz's Law, Fleming's right-hand rule. Dynamically and statically induced e. m. f., Self and Mutual induced e.m.f

UNIT-II **D.C. Machines and Batteries** **Duration:15 Periods(L:12-T: 3)**

D.C Generator: Principle of operation - Parts of generator - Types of generators - E.M.F equation-DC Motors: Principle of operation-Types of motors- Back e. m. f - Applications of motors. Batteries: primary cells and secondary cells, types of storage cell batteries - Definition trickle charging - indications of full charged battery.

UNIT-III A.C. Fundamentals and Transformers

Duration:12Periods(L:9-T: 3)

Definition – alternating current, voltage amplitude, time period frequency, instantaneous value, Average value, R.M.S value, form factor- Phase difference - Definition of poly-phase and 3- Ø circuits. Transformers: Transformer working principle. Single phase transformers - Voltage ratio, Current ratio, Turns ratio

UNIT-IV A.C. Machines

Duration:13Periods(L:10-T: 3)

Alternators – principle of working. Constructional features of alternators. Speed and frequency relations. 3-Phase Induction Motor-Working principle, Construction - Squirrel cage and Wound Rotor - Single phase Induction Motors - Types and applications of single-phase induction motors. Braking methods – AC motor used in EVs – Regenerative braking in EVs

UNIT-V Wring system, tools & Safety procedures

Duration:13Periods (L:10-T: 3)

Wiring Systems: Different types of wires and cables – use of standard wire gauge- types of wiring systems- Surface conduit and Concealed - types of switches – Necessity of fuse and MCB-Measuring tools used in Electrical quantities -connection diagram for measurement of voltage and current power and energy in ac circuits-multimeter- Electrical safety Procedures - Effects of shock -First aid in case of electrical shocks – Earthing Purpose - uses of Megger

UNIT-VI Basic Electronics

Duration:12Periods(L:9-T: 3)

Semi-conductors-N-type, P-type. Behavior of PN junction diode. Forward and Reverse bias- Introduction of PNP, NPN transistors. Truth tables for OR, AND, NOT, NAND and NOR gates – IC types _Clarification _ Advantages.

Reference Books

1. B.L. Theraja-Electrical Technology – Vol –I, II S.Chand& Co.
2. M.G Say –AC machines
3. P.S. Bhimbra–Electrical machines – Khanna Publishers
4. A.E. Fritzgerald, C. Kingsley and S. Umans Electrical machinery-McGraw Hill
5. MV Deshpande-Electric machines – Wheeler publishing.
6. BR Gupta and VandanaSinghal– Fundamentals of Electric machines

Suggested E-learning references

1. www.khanacademy.org
2. www.ocw.mit.edu/courses/electrical-engineering
3. www.nptel.ac.in

Suggested Learning Outcomes

Upon completion of the course the student shall be able to

CO1: Apply the concepts of Basic electrical circuits, Electromagnetism and induced emf

- 1.1 Define Voltage and Current.
- 1.2 Define Resistance.
- 1.3 Define Ohm's Law.
- 1.4 State Work, Power and Energy from electrical and mechanical aspects and understand their units.
- 1.5 State Kirchhoff's laws.
- 1.6 Define flux and flux density
- 1.7 State Faraday's laws of Electro Magnetic Induction
- 1.8 State Fleming's Right Hand rule.
- 1.9 State Lenz's Law.
- 1.10 Describe dynamically induced E.M.F.
- 1.11 Describe Statically Induced E.M.F. i) Self Induced EMF ii) Mutual Induced EMF

CO2: Detail the construction and working of D.C. Machines.

- 2.1 Explain working principle of DC Generators.
- 2.2 Know the constructional features of DC Generators and materials used.
- 2.3 List the types of DC Generators.
- 2.4 Write E.M.F equation of D C Generator
- 2.5 Solve simple substitution problems on emf equation $E_g = \frac{\phi Z N}{60} \times \frac{P}{A}$
- 2.6 List the different losses in DC generator
- 2.7 Explain working principle of DC Motor.
- 2.8 List types of DC motors.
- 2.9 Understand the Significance of back e.m.f in DC motor.
- 2.10 List the applications of DC motors.
- 2.11 Define primary cells and secondary cells
- 2.12 State types of storage cell batteries(Li-ion, Li-phosphate, Ni-Cd)
- 2.13 Define trickle charging
- 2.14 List the indications of full charge

C03: Apply the characteristics of AC waveforms to summarize the working of transformer

- 3.1 Definitions Alternating current, amplitude, time period, instantaneous value,
- 3.2 Define Average value, R.M.S value , form factor.
- 3.3 Define Phase and phase difference.
- 3.4 Define Power factor.
- 3.5 Write the formula for AC power(single-phase and three phase)
- 3.6 Write Advantages of 3-phase system over single phase system.
- 3.7 Explain the working principle of transformer.
- 3.8 List the types of Transformers
- 3.9 Define Transformation ratio,
- 3.10 Give the relation between Transformation ratio, Voltage and Current ratios.

CO4: Detail the construction and working of A.C. Machines

- 4.1 Explain working principle of alternators.
- 4.2 Constructional features of Alternators.
- 4.3 Write relation between frequency and speed and number of poles in alternators.
- 4.4 Explain the working Principle of 3-phase induction motor.
- 4.5 Constructional features of three phase Induction motor.
- 4.6 List the applications of 3-phase induction motors.
- 4.7 Describe the working principle of Single-phase induction motor by double field revolving theory.
- 4.8 List the types of 1-phase induction Motors.
- 4.9 Write the Applications of 1-phase induction .
- 4.10 Know the AC motor used in Electric Vehicles
- 4.11 List different braking methods
- 4.12 Explain about Regenerative braking used in EVs

CO5: Make use of Electrical Safety procedures and Protection for electrical wiring

- 5.1 List the different types of wires used in House wiring
- 5.2 List the different types of single phase and three phase cables
- 5.3 State the uses of standard wire gauge
- 5.4 List the different types of wiring systems
- 5.5 Explain Surface conduit wiring system
- 5.6 Explain Concealed wiring system.
- 5.7 List the various types of Main Switches
- 5.8 State necessity of fuse in a Circuit.
- 5.9 What is the main function of MCB
- 5.10 List the equipments used for measurement of electrical quantities
- 5.11 Draw the connection diagram of Ammeter and voltmeter to Measure Voltage and Current for resistive load
- 5.12 Draw the circuit diagram to measure power in Ac Circuit with Resistive load
- 5.13 Draw the Circuit diagram to measure Energy in AC Circuit with Lighting load.
- 5.14 State the uses of Multi meter
- 5.15 Detail first aid treatment for electric shock Victim and Electric burn victim
- 5.16 Know the purpose of earthing of electrical equipment and Machinery.

CO6: Apply the concept of PN junction diode, transistor configuration and types of logic gates and ICs.

- 6.1. Classify materials as conductor, semi-conductor and insulator.
- 6.2 Distinguish between intrinsic and extrinsic semiconductors.
- 6.3 Describe the formation of P type and N type materials.
- 6.4 Write the formation of P.N junction diode.
- 6. 5 Explain the working of P.N junction diode in forward bias and reverse bias.
- 6.6 Draw VI characteristics of PN junction diode.
- 6.7 Explain the formation of NPN and PNP Transistor
- 6 .8 Draw the symbols of NPN and PNP transistors.
- 6 .9 Write the truth tables for OR,AND,NOT,NAND and NOR logic gates.
- 6.10 What is an Integrated Circuit
- 6.11 Clarification of IC based on size of chips
- 6.12 List the Advantages and limitations of IC
- 6.13 List application of ICS

Note : Where ever mentioned, simple formula substitution problems only be solved and no problems in the other specific objectives.

Suggested Student Activities

- 1. Student visits Library to refer to Manual of Electrical Safety.
- 2. Student inspects the available equipment in the Lab to identify the components
- 3. Quiz
- 4. Group discussions
- 5. Surprise test

CO-PO Mapping Matrix

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	Linked POs
CO1	2	1	-	1	-	-	1	1,2,4,7
CO2	2	-	-	2	1	-	1	1,4,5,7
CO3	2	1	-	1	-	-	1	1,2,4,7
CO4	2	1	-	2	1	-	1	1,2,4,5,7
CO5	2	-	-	2	2	-	2	1,4,5,7
CO6	2	-	-	1	-	-	1	1,4,7

Level3-Highly Addressed, Level2-Moderately Addressed, Level1-Low Addressed

BOARD DIPLOMA EXAMINATIONS
Model Question Paper
DME IV semester Mid Semester-I Examination

Course Code: EE-416

Duration:1 hour

Course Name: Basic Electrical & Electronics Engineering

Max.Marks:20

PART- A

Marks:4 X1= 4

Instructions:(1)Answer all questions

(2)Each question carries **one** marks.

1. Define Ohm's Law.
2. Define Resistance.
3. Write the EMF equation of D.C Generator
4. Write the classifications of D.C Generators

PART-B

Marks:2 x3 = 6

Instructions:(1)Answer **all** questions.

(2)Each question carries **three** marks.

5.(a)Define work ,power and energy in Electrical aspects

OR

5.(b) State Fleming's Right Hand rule.

6.(a)Write the types of D.C Generator.

OR

6.(b)List storage cell batteries

PART-C

Marks:2x5= 10

Instructions:(1)Answer **all** questions.

(2)Each question carries **five** marks.

7.(a) State Faraday's laws of Electro Magnetic Induction.

OR

7.(b) Describe dynamically induced emf

8.(a)Explain working principle of D.C Motor

OR

8.(b)An 8-pole d.c. generator has 500 armature conductors, and a useful flux of 0.05 Wb per pole. What will be the e.m.f. generated if it is lap-connected and runs at 1200 rpm.

Model Question paper
DME IV Semester MidSemester- II Examination

Course Code:EE-416

Duration:1 hour

Course Name: Basic Electrical and Electronics Engineering

Max.Marks:20

PART-A

Marks:4X1=4

Instructions:(1)Answer all questions

(2)Each question carries **one** marks.

1. Define Time Period
2. Define R.M.S Value
3. Write the relation between speed,no of poles and frequency
4. Write any two applications of 1-phase induction motor

PART-B

Marks: 2x3 = 6

Instructions:(1)Answer all questions.

(2)Each question carries **three** marks.

5.(a).Define Phase and phase difference

OR

5.(b) List the types of Transformers

6.(a) list the applications of 3 phase Induction motor

OR

6.(b) List different breaking methods

PART-C

Marks:2x 5=10

Instructions:(1)Answer all questions.

(2)Each question carries five marks.

7.(a).write any 5 advantages of 3 phase system over single phase system.

OR

7.(b).Explain working principle of transformer

8.(a).Explain working principle of alternator

OR

8.(b).Explain Regenerative braking in EV Vehicles .

BOARD DIPLOMA EXAMINATIONS
DIPLOMA IN MECHANICAL ENGINEERING
SUBCODE: EE-416
Basic Electrical and Electronics Engineering
SEMESTER END EXAM MODEL PAPER

TIME: 2 HOURS

TOTAL MARKS: 40

PART- A

Marks: 8X1=8

Instructions: (1) Answer all questions

(2) Each question carries **one** mark.

1. Define Flux.
2. Define Power factor.
3. List different types of 3 phase cables
4. State necessity of fuse in a Circuit.
5. List the various types of Main Switches
6. What is the instrument used to measure Power.
7. Draw the symbol of N.P.N transistor.
8. Write the truth tables for OR gate

PART-B

Marks: 4X3 =12

Instructions: (1) Answer all questions.

(2) Each question carries **three** marks.

9.(a). State Faraday's laws of Electro Magnetic Induction.

OR

9.(b). Draw the circuit diagram to measure Energy in Ac Circuit with lighting load

10.(a). Define Transformation ratio and write the relation between Transformation ratio and current ratio.

OR

10.(b). Explain the formation of nN-type materials

11.(a). What are the advantages and disadvantages of surface conduit wiring system.

OR

11.(b). What is the main function of MCB.

12.(a). Distinguish between intrinsic and extrinsic semiconductors.

OR

12.(b). Explain formation of NPN transistor.

PART-C

Marks:4x5=20

Instructions:(1)Answer all questions.

(2)Each question carries **five** marks.

13.(a).Explain working principle of D.C Generator.

OR

13.(b).Explain about concealed wiring system.

14.(a).Explain the working principle of 1-phase induction Motors by double field revolving theory.

OR

14.(b).Write truth tables for OR ,AND, NOT,NAND and NOR gates

15.(a).Describe the procedure of Pipe earthing

OR

15.(b).Explain Surface conduit wiring system

16.(a).Explain the working of P.N junction diode in forward bias

OR

16.(b).Classify materials as conductors, semiconductors and insulators.

EE-417 BASIC ELECTRICAL & ELECTRONICS ENGINEERING LAB

Course Title:	Basic Electrical & Electronics Engineering Lab	Course Code	EE-417
Semester	IV Semester	Course Group	Practical
Teaching Scheme in Periods (L:T:P)	15:0:30	Credits	1.25
Methodology	Lecture + Practical	Total Contact Periods	45
CIE	60 Marks	SEE	40 Marks

Pre requisites

This course requires the knowledge of basic electrical quantities

Course Outcomes

CO1 :	Comply with Electrical Safety practices
CO2 :	Use Electrical Measuring Instruments to measure Electrical Quantities.
CO3 :	Make simple wiring circuits.
CO4 :	Connect Starter to a 3 Phase Induction motor and run the motor in either direction

CO1 Comply with Electrical Safety Practices

Duration: 15 periods (L:5 + P:10)

- 1.1 Read Signs related to safety.
- 1.2 Identify various symbols related to Electrical Engineering
- 1.3 Identify Various safety devices used for protection in Electric circuit
- 1.4 Identify Personal Protective Equipment (PPE) used for Protection against Electrical Hazards
- 1.5 Demonstrate the procedure of first aid and Electric Shock
- 1.6 Demonstrate Pipe Earthing
- 1.7 Demonstrate Plate Earthing

CO2 Use Measuring Instruments to measure Electrical Quantities

Duration: 15 periods (L:5 + P:10)

- 2.1 Connect a Voltmeter and an ammeter in a Single phase AC circuit through an auto transformer and measure Voltage and Current
- 2.2 Connect two Lamps in series and measure voltage and current
- 2.3 Connect two lamps in parallel and measure voltage and current
- 2.4 Connect a Single phase energy meter to a given resistive load and measure energy consumed by Load.
- 2.5 Use a Digital Multimeter(DMM) to measure Voltage
- 2.6 Use a Tong Tester to measure current in a single phase AC circuit

CO3: Make simple wiring circuits**Duration: 12 periods (L:3 + P:9)**

- 3.1 Identify various wiring tools
- 3.2 Identify and select various wiring accessories.
- 3.3 Identify the terminals of i) 2 Pin socket ii) 3 Pin socket
- 3.4 Identify wires and cables for simple house wiring applications.
- 3.5 Make a connection to control one lamp using one way switch with provision for plug socket
- 3.6 Make a connection to control Two lamps using two independent switches
- 3.7 Make a connection to control one lamp from two different locations(stair case wiring)

CO4 Connect Starter to a 3 Phase Induction motor and run the motor in either direction**Duration: 03 periods (L:1 + P:2)**

- 4.1 Connect a DOL Starter to a 3 Phase Induction motor and run the motor in either direction.

CO-PO Mapping Matrix

	Basic and Discipline Specific	Problem Analysis	Design/Development of Solutions	Engineering Tools, Experimenta	Engineering practices for society, sustainability	Project Management	Lifelong learning	Linked PO
CO\PO	PO 1	PO 2	PO 3	PO 4	PO5	PO 6	PO 7	
CO 1				2			1	4, 7
CO 2				2			1	4, 7
CO 3				2			1	4, 7
CO 4				2			1	4, 7

STATE BOARD OF TECHNICAL EDUCATION & TRAINING , TELANGANA

MID SEM - I

Course Code: EE-417

Duration: 1 hour

Course Name: Basic Electrical & Electronics Engg. Lab

Max.Marks:20

Note: Answer allotted Question.

Instructions to the Candidate:

(i) Record the results on a graph sheet if required, and conclude your observation of the experiment

(ii) Draw the circuit diagram for illustration; choose appropriate values when not mentioned in the question

1. Identify Different safety signs at work place
2. Identify the following Electrical Symbols i) AC Source ii) DC Source
3. Identify the following Protective device i) Fuse ii) MCB iii) MCCB
4. Write the procedure for rescuing a person from Electric Shock
5. Demonstrate Pipe earthing
6. Demonstrating Plate earthing.

STATE BOARD OF TECHNICAL EDUCATION & TRAINING , TELANGANA

MID SEM - II

Corse Code: EE-417

Duration: 1 hour

Course Name: Basic Electrical & Electronics Engg. Lab

Max.Marks: 20

Note: Answer allotted Question.

Instructions to the Candidate:

(i) Record the results on a graph sheet if required, and conclude your observation of the experiment

(ii) Draw the circuit diagram for illustration; choose appropriate values when not mentioned in the question

1. Connect a Voltmeter and an ammeter in a Single phase AC circuit through an auto transformer and measure Voltage and current
2. Connect two Lamps in series and measure voltage and current
3. Connect two lamps in parallel and measure voltage and current
4. Connect a Single phase energy meter to a resistive load and measure energy
5. Measure Voltage & current in a AC circuit using Appropriate instruments

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TELANGANA
SEMESTER END EXAMINATION

Corse Code: EE-417

Duration: 2 hours

Course Name: Basic Electrical & Electronics Engg. Lab

Max.Marks: 40

Note: Answer allotted Question.

Instructions to the Candidate:

(i) Choose appropriate values when not mentioned in the question

1. Connect a Voltmeter and an ammeter in a Single phase AC circuit through an auto transformer and measure Voltage and current
2. Connect two Lamps in series and measure voltage and current
3. Connect two lamps in parallel and measure voltage and current
4. Connect a Single phase energy meter to a resistive load and measure energy
5. Use a Digital Multimeter(DMM) to measure Voltage & a tong tester to measure current
6. Make a connection to control one lamp controlled from one switch with provision for plug socket
7. Make a connection to connect one lamp controlled from two different locations
8. Connect a DOL Starter to a 3 Phase Induction motor and run the motor in forward direction
9. Connect a DOL Starter to a 3 Phase Induction motor and run the motor in reverse direction

ME-408- COMPUTER ASSISTED PRODUCTION DRAWING

Course Title	Computer Assisted Production drawing	Course Code	ME-408
Semester	IV	Course Group	Practical
Teaching Scheme in Periods (L :T:P)	1:0:2	Credits	1.25
Methodology	Lecture + practice	Total Contact in Periods	45
CIE	60 Marks	SEE	40 Marks

Prerequisites: Basic knowledge of Assembly Drawing.

Course Outcomes

CO1	Differentiate machine drawing from production drawing.
CO2	Interpret the need and calculation of limits, fits and tolerances, illustrate the Geometrical Tolerances indicated on production drawing.
CO3	Explain the importance of surface roughness on life of component and its representation on part drawings.
CO4	Create and edit three-dimensional entities by applying different methods using any modelling software
CO5	Develop production drawings for the given assembly drawing using CAD software and prepare process sheet for the given part using spread sheet or document file.
CO6	Create solid models of machine parts using modelling software.

Blue Print of Marks for SEE

Unit No	Unit Name	Periods	Questions for SEE		
			R	U	A
PART-A					
1	Introduction to production drawing, Limits, fits and tolerances, Geometrical Tolerances	06		2	
2	Surface finish and standard mechanical component specifications.	06		2	
PART-B					
3	Creation of three-dimensional entities using different methods by modelling /CAD 3D software - Drawing atwo-dimensional entity in three-dimensional spaceand converting two dimensional planar entities into three dimensional entities by extruding, revolving. - Creation of three-dimensional entities such as boxes, Cylinders, Cones, Spheres, wedges, torus, Regions, extruded solids, revolved solids, Editing in three dimensions - Creating a threedimensions Array in three dimensions both Rectangular and polar. - Applying commands Mirroring, chamfer, fillet in three dimensions, Aligning in three dimensions - Applying Boolean operations Union, subtract and intersect - Sectioning and slicing of solids, hiding, shading and rendering Selection of material from library - Enable the material library, Editing materials and material library	18			1
PART-C					
4	PART DRAWING EXERCISE Using CAD 2D Creating Solid models of Gib and Cotter joint, knuckle joint, flange coupling, universal coupling, Eccentric, Plummer block,lathe tail stock,Revolving center etc. by using any CAD 2D software.	15			1
	Total	45			

Part C each question carries 28 marks and distributed for

- **Component drawing views..... 20 marks**
- **limits fits and tolerances..... 2 marks**
- **Geometrical tolerances..... 1 mark**
- **Surface finish..... 2 marks**
- **Process sheet 3 marks**

3. Standard components in part-B question need not be drawn.

COURSE CONTENT

1.1 Introduction to production Drawing

Need of preparing a production drawing-requirements for manufacturing a product like equipment, tools, measuring instruments depending upon processes- accuracy and finish data available in machine drawing – components of a production drawing - fits and tolerances, surface finish, specific processes, material of the component.

1.2 Limits, fits and tolerances

Concept of limits fits and tolerances – need of limits – concept of interchangeability- standard designation of Hole and Shaft dimensions- Calculation of limits fits by using tolerance charts- Selecting dimensions from BIS standards to obtain clearance, transition and interference fits for a given set of mating parts – computation of fit and tolerance from BIS table- Exercises on computing tolerances.

1.3 Geometrical tolerances Standard Mechanical component specification

Need of geometrical tolerances- Types of geometrical tolerances - Tolerance of profile: profile of a line, surface -Tolerance of orientation or attitude: angularity,perpendicularity,parallelism, flatness, cylindricity and circularity - Tolerance of location: position- concentricity, symmetry- Composite tolerances: radial run-out, axial run-out- Symbols for geometrical tolerances -Exercises on representation of geometrical tolerances on component drawings.

1.4 Surface finish

Profile of a surface and important characteristics of a surface- surface texture symbols- Lay direction, surface roughness achievable from different manufacturing processes, -Equivalent surface roughness symbols- surface roughness values or grade number and corresponding symbols as per BIS- Indicate surface roughness on drawings.

Exercises on specifying the surface roughness (average values) for functional surfaces of the following machine tool parts.

- -Shaft rotating in bush bearing,
- -Tailstock sleeve in tailstock body,
- -Keys and keyways
- -Mounting surfaces for antifriction bearings
- -Shaft or bush press fitted into bodies
- -Beds of machine tools, guide-ways
- -Contact surfaces:example: flanges of pipe fittings
- -Peripheral surfaces of pulleys and grooves for v-belts

- -Surfaces of control elements example: levers, hand wheels
- -Bases of machines
- -Machine tool tables

1.5 Standard Mechanical component specification.

Standard components (parts) are to be designated as per BIS like

- Specification of Bolts,
- Specification of Nuts,
- Specification of Locknuts
- Specification of Washers,
- Specification of Screws
- Specification of Studs
- Specification of Circlips
- Specification of Cylindrical and taper pins
- Specification of Keys
- Specification of Rivets
- Specification of Splines
- Specification of Oil seals-rings and
- Specification of Antifriction bearings.

2 Practising of modelling software/ CAD 3D Software

- **Creation of three-dimensional entities using different methods**
- Drawing a two-dimensional entity in three-dimensional space and converting two dimensional planar entities into three dimensional entities by extruding, revolving.
- Creation of three-dimensional entities such as boxes, Cylinders, Cones, Spheres, wedges, torus, Regions, extruded solids, revolved solids,
- **Editing in three dimensions**
- Creating a three dimensions Array in three dimensions both Rectangular and polar. Applying commands Mirroring, chamfer, fillet in three dimensions, Aligning in three dimensions
- Applying Boolean operations Union, subtract and intersect
- Sectioning and slicing of solids, hiding, shading and rendering
- **Selection of material from library**
Enable the material library, Editing materials and material library

3 Production drawing exercises using modelling software / CAD 3D Software

Using modelling software create solid models of the part(s) of a given assembly drawing. Dimension the solid models so obtained and indicate relevant notes - Compute/ identify the type of fit between mating parts from ISI tables as per the function- Indicate the geometrical tolerances on the solids-Mark the surface finish symbols with indications added.

Production drawing exercises

Gib and Cotter joint- Knuckle joint - Flange coupling - Universal coupling – Eccentric - Plummer block - Foot step bearing - Lathe Tail stock and Revolving centre.

- Using CAD 2D software prepare the relevant views of the part(s) of a given assembly drawing needed for the purpose of production -Dimension the views obtained and indicate on it with relevant notes on the specific processes- Compute/ identify the type of fit between mating parts from ISI tables as per the function of the component and indicate the limits at appropriate places on the drawings prepared- Indicate the geometrical tolerances on the component drawings- Mark the surface finish symbols with indications added- Using spread sheet / document file Prepare the process sheet indicating sequence of processes and equipment, tools and measuring instruments required for manufacturing of given part.

Student Activity

Students/staff members advised to visit nearby local industry and collect actual production drawing, study and practise as exercise.

REFERENCE BOOKS

1. IS 696 – 1972-Code of Practice for General Engg. Drawing & B.I.S Code – SP. 46. IS 696 – 1988
2. Machine Design data hand book – Vol I & II – Dr. K. Lingaiah, (Suma Publishers, Bangalore).
3. IS Code on fits and tolerances.
4. Blur print reading for Mechanical Trades by B.R.Sachdeva.
5. Machine drawing by R.B. Gupta.
6. Machine Drawing by Siddeswar.
7. Production Drawing by K.Venkat Reddy
8. Machine Drawing by Nagpal

SUGGESTED LEARNING OUTCOMES.

On the completion of the course the student should be able to

1.0 Understand the need of production drawing and Interpret dimension to obtain

- 1.11 Distinguish the machine drawing from a production drawing.
- 1.12 Identify the components of a production drawing indicated on production drawing like Limits, fits, Tolerances, surface roughness symbols and Geometrical tolerances and its importance

1.2 Limits, fit and Tolerance as per BIS standards.

- 1.21 State the need of Limits, allowance and tolerance
- 1.22 Definition of fit, allowance and tolerance.

- 1.23 Identify tolerance zones and tolerance grades
- 1.24 Classify types of fits, Material conditions, System of limits, specification tolerances
- 1.25 Selection of suitable fit for a given mating part.
- 1.26 Compute the fit from tables.
- 1.27 Indicate fits on the drawings.

1.3 Geometrical Tolerances, and standard mechanical component specifications

- 1.31 Need of geometrical tolerances, Types of geometrical tolerances
- 1.32 Guidelines for indication of feature controlled by geometrical tolerances
- 1.33 Guidelines for indication of datum features, datum planes in space, General principles for applying geometrical tolerances on a component

1.4 Surface finish

- 1.41 Indicate Profile of a surface and important characteristics of a surface on drawings
- 1.41 Identify the surface texture symbols. Identify Lay direction, surface roughness achievable from different manufacturing processes, Equivalent surface roughness symbols.
- 1.42 Indicate the roughness values or grade number and corresponding symbol as per BIS.
- 1.43 Indicate the sequence of process of production.

1.5 Standard Mechanical component specification.

- 1.51 Draw Standard components (parts) are to be designated as per BIS like - Specification of Bolts, Nuts, Locknuts, Washers, Screws, Studs, Circlips, Cylindrical and taper pins, Keys, Rivets, Splines, seals-rings and Antifriction bearings.

2.0 Practising of modelling software / CAD 3D Software

2.1 Create three-dimensional entities using different methods

- Draw two dimensional entities in three-dimensional space
- Convert two dimensional planar entities into three dimensional entities by applying elevation and thickness
- Convert two dimensional planar entities into three dimensional entities by revolving or extruding.
- Create three-dimensional faces
- Create three dimensional entities such as boxes, Cylinders, Cones, Spheres, wedges, torus, Regions,
- Create extruded solids
- Create revolved solids
- Create composite solids
- Create intersect solids

2.2 Edit in three dimensions

- Rotate in three dimensions
- Array in three dimensions (Rectangular and polar)
- Mirror in three dimensions
- Align in three dimensions

2.3 Edit three dimensional solids

- Practice Sectioning and Slicing solids

- Practice hiding, shading and rendering

2.4 Practice the selection of material from library

- Enable material library
- Edit materials and material library
- Use any of the solid modelling packages stated above and generate a solid model of a machine component for different 3D components

3.0 Production drawing practice

Draw part drawing using any CAD Software indicating (a) Limits, fits and tolerances (b) Surface roughness values (c) Geometrical tolerances and prepare process sheet using spread sheet or document file for the following components.

- Gib and Cotter joint
- Knuckle joint,
- Flange coupling
- Universal coupling,
- Eccentric,
- Plummer block,
- Foot step bearing,
- Lathe Tail stock and
- Revolving centre.

CO-PO Matrix

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO6	PO7
CO1	2	-	-	2	-	-	3
CO2	3	1	1	2	-	-	2
CO3	2	1	2	3	-	1	3
CO4	3	2	3	3	-	2	2
CO5	3	3	2	2	1	3	2
CO6	2	3	3	3	1	2	3

BOARD DIPLOMA EXANIMATIONS

CIE- MID-1Model Paper

ME-408 -COMPUTER ASSISTED PRODUCTION DRAWING

Time: 1 Hours

Max. Marks: 20

PART – A

04 X 05 M = 20M

- Instructions :**
1. Answer any **FOUR** questions.
 2. Each question carries **FIVE** marks.
 3. Answer should be neat & clear with all the necessary Dimensions.
 4. All Dimensions are in mm. Choose suitable Scale.
 5. Use of tolerance tables permitted.
1. The dimensions of a shaft and a hole are given
Hole: $35^{+0.022}_{+0.000}$ Shaft: $\phi 35^{+0.031}_{+0.056}$ find out
(a) Hole Tolerance (b) Shaft Tolerance (c) Min Allowance (d) Max allowance
(e) Type of fit
 2. The dimensions of a shaft and a hole are given 40Hg7
(a) Hole Tolerance (b) Shaft Tolerance (c) Min Allowance (d) Max allowance
(e) Type of fit
 3. The dimensions of a shaft and a hole are given 25Ng6
(a) Hole Tolerance (b) Shaft Tolerance (c) Min Allowance (d) Max allowance
(e) Type of fit
 4. Indicate the roughness values for the following surface roughness grade numbers:
(a) N 10 (b) N 8 (c) N 6 (d) N 4 (e) N 1
 5. Write the meaning of the following designations of mechanical components:
(a) Square bolt M10 $\times$ 50 N
(b) Ball bearing 308
(c) Taper key 12 X 8 X 50
(d) Fe 600 W
(e) Splines 5 X 20 X 30
 6. Draw the symbols of the following geometrical tolerances:
a) Perpendicularity b) straightness c) concentricity d) angularity e) position

BOARD DIPLOMA EXANIMATIONS

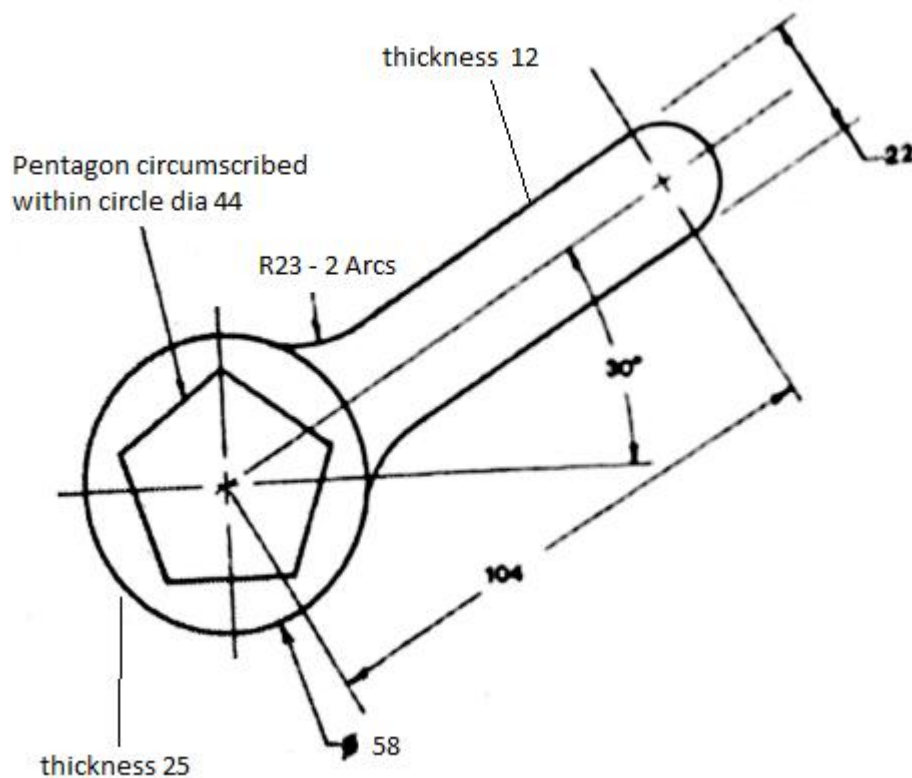
CIE- MID 2 Model Paper-

ME-408 -COMPUTER ASSISTED PRODUCTION DRAWING

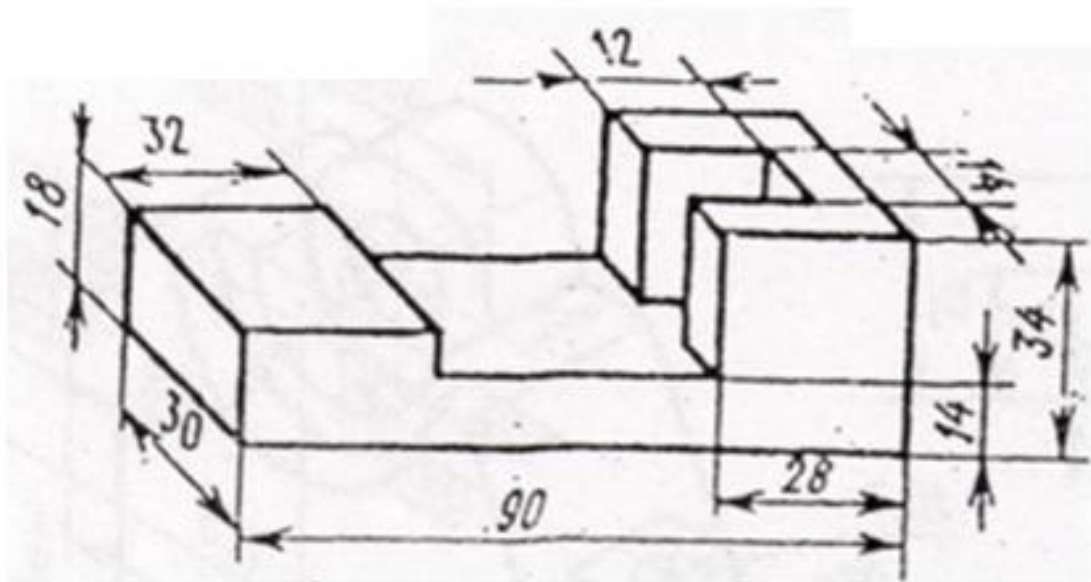
Time: 1 Hours

Max. Marks: 20

- Instructions :**
1. Answer any **ONE** questions.
 2. Each question carries **twenty** marks.
 3. Answer should be neat & clear with all the necessary Dimensions.
 4. All Dimensions are in mm. Choose suitable Scale.
 5. Assume missing data proportionately is any
1. Draw the following figure by using solid modelling/ CAD 3D software.



2. Draw the following figure by using solid modelling/ CAD 3D software.



**BOARD DIPLOMA EXAMINATION
MECHANICAL BRANCH –IV SEMESTER
END EXAMINATION (SEE)**

ME-408 -COMPUTER ASSISTED PRODUCTION DRAWING

Time: 2 Hours

[Total Marks: 40]

PART-A

Instructions: 1. Answer all Questions

4X3=12 Marks

2. Each question carries **Three marks**.

3. Answer should be neat & clear with all the necessary Dimensions

4. All Dimensions are in mm. Choose suitable Scale

1. The dimensions of a hole and shaft are given below :

+0.039

+0.062

Hole : 30 +0.000

Shaft : 30 +0.041

Find (a) maximum allowance, (b) minimum allowance and (c) type of fit.

2. The dimensions of a shaft and a hole are given 35H₇g₇

(a) Hole Tolerance (b) Shaft Tolerance (c) Min Allowance (d) Max allowance

(e) Type of fit

3. Draw the symbols of the following geometrical tolerances:

a) Perpendicularity.

b) Cylindricity

c) Angularity

4. Write the surface roughness values for the following:

(a) Hot rolling

(b) Cylindrical grinding

(c) Lapping

PART-B

Instructions:

1X28=28 Marks

1. Answer any **one** Question
2. Each question carries 28 marks.
3. Answer should be neat & clear with all the necessary Dimensions
4. All Dimensions are in mm. Choose suitable Scale.

5. Draw the assembly drawing of Lathe tail stock and draw the component drawings indicating fits, roughness values and tolerances, write the process sheet for barrel using CAD 2D software

Component drawing views..... 20 marks

- limits fits and tolerances..... 2 marks
- Geometrical tolerances..... 1 mark
- Surface finish..... 2 marks
- Process sheet 3 marks

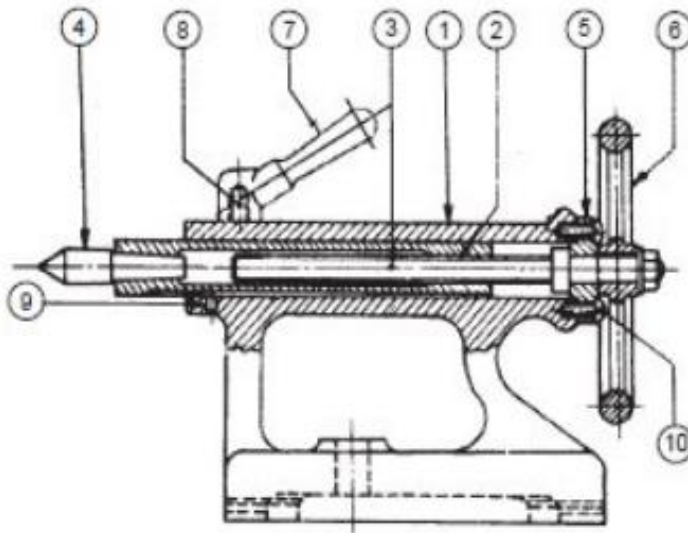


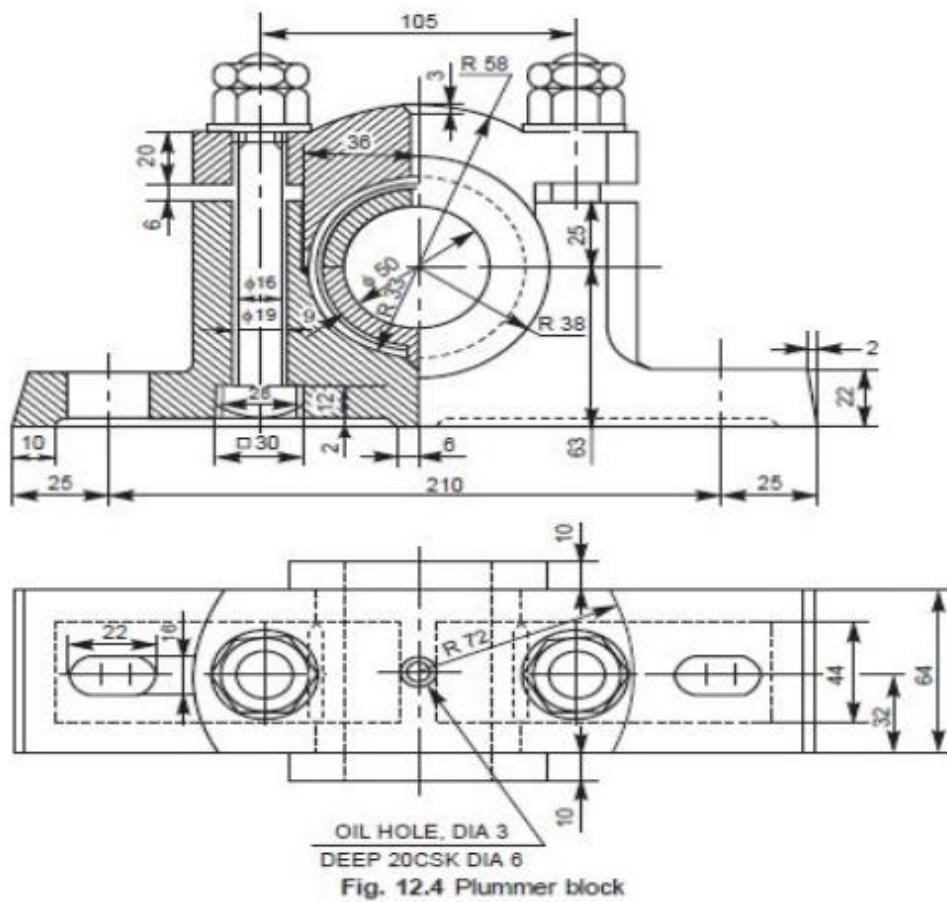
Fig. 18.18A Lathe tail-stock

Parts list

Part No.	Name	Matl	Qty
1	Body	CI	1
2	Barrel	MS	1
3	Spindle with washer & nut	MS	1
4	Centre	CS	1
5	Spindle bearing	CI	1
6	Hand wheel	CI	1
7	Clamping lever	MS	1
8	Stud	MS	1
9	Feather key	MS	1
10	Screw	MS	4

Component drawing views..... 20 marks

- limits fits and tolerances..... 2 marks
- Geometrical tolerances..... 1 mark
- Surface finish..... 2 marks
- Process sheet 3 marks



ME-409-THERMAL ENGINEERING LAB

Course Title	Thermal EngineeringLab	CourseCode	ME-409
Semester	IV	Course Group	Practical
TeachingSchemein Periods(L:T:P)	1:0:2	Credits	1.25
Methodology	Lecture+ Practical	TotalContactPeriods	45
CIE	60 Marks	SEE	40 Marks

PREREQUISITES: Basic knowledge of Thermodynamics

COURSE OUTCOMES:

On successful completion of the course, the studentwill be able to

CO1	Determine Flash and Fire point of given sample of fuels and Lubricants by using given Apparatus (Cleveland /Abel's/ Pensky Martens)
CO2	Compute the Viscosity of a given fuel or Lubricating oil using a given apparatus (Redwood/Say bolt viscometers)
CO3	MeasureCalorific value of gaseous fuels byusingJunker'scalorimeter
CO4	Calculate the power developed by multicylinder engineusingMorseTest
CO5	Understand the Performance Characteristics of given IC Engine/ Estimate Heat Balance of Given IC engine
CO6	Understand working principle of Morcet Boiler

COURSE CONTENT:

S.No	THERMALENGINEERINGLAB	Number of Periods
1	Flash and Fire point test using ClevelandApparatus(open cup test)	3
2	Flash and Fire point test using Pensky Martens Apparatus/ AbelsApparatus(closed-cup test)	3
3	Viscosity measurementtest using viscometer	3
4	Viscosity measurement test using Saybolt viscometer	3
5	Calorific value test using Junkers gas calorimeter	6
6	Morse Test on a 4-stroke multicylinder IC Engine	6

7	Estimate Heat Balance of given IC Engine	6
8	Performance test on 4 stroke IC Engine	6
9	Study of Morcet Boiler	3
Total		45

BLUE PRINT OF MARKS FOR SEE

S.N	Unit Name	Periods	Marks for SEE			Marks weightage	% Weightage
			Handling	Manipulation	Precision		
1	Flash and Fire point test using Cleveland Apparatus (open cup test)	3	10	10	20	40	100
2	Flash and Fire point test using Pensky Martens Apparatus/ Abels Apparatus (closed cup test)	3	10	10	20	40	100
3	Viscosity measurement test using Redwood viscometer	3	10	10	20	40	100
4	Viscosity measurement test using Saybolt viscometer	3	10	10	20	40	100
5	Calorific value test using Junkers gas calorimeter	6	15	15	10	40	100
6	Morse Test on a 4-stroke multicylinder I.C engine	6	15	15	10	40	100
7	Estimate Heat Balance of Given IC engine	6	15	15	10	40	100
8	Performance test on 4 stroke I.C engine	6	15	15	10	40	100
9	Study of Boiler	3	10	10	20	40	100

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	Mapped POs
CO1	1	3	-	2	1	3	3	1,2,4,5,6,7
CO2	2	3	-	2	1	3	2	1,2,4,5,6,7
CO3	2	3	-	2	1	3	2	1,2,4,5,6,7
CO4	2	2	1	2	-	-	3	1,2,3,7
CO5	3	3	2	2	-	1	3	1,2,3,4,6,7
CO6	2	-	-	1	-	-	3	1,4,7

Level 3-Highly addressed, Level 2-Moderately addressed, Level 1-Lowly addressed,

SUGGESTED LEARNING OUTCOMES

S.No	Exercise	Key competency
1	Flash and Fire point test using Clevel and Apparatus	a. Define flash and fire points b. Know the importance of flash and fire points c. Know the range of flash point measured by the meter d. Identify various parts of the apparatus
2	Flash and Fire point test using Pen sky Marten Apparatus Flash and Fire point test using Abels Apparatus	a. Differentiate flash and fire points b. Understand factors affecting the flash point c. Identify various parts of the apparatus d. Know the range of flash point measured by the meter
3	Viscosity measurement test Redwood viscometer	a. State the importance of viscosity b. Identify various factors affecting the viscosity c. Know different types of visco meters d. Differentiate between absolute viscosity and kinematic viscosity e. Know the units of viscosity f. Find various parts of the redwood viscometer
4	Viscosity measurement test Saybolt viscometer	a. State the importance of viscosity b. Identify various factors affecting the viscosity c. Know different types of visco meters d. Differentiate between absolute viscosity and kinematic viscosity e. Know the units of viscosity f. Find various parts of the Say bolt viscometer
5	Calorific value test using Junkers gas calorimeter	a. Understand the principle of operation b. Know various components of the calorimeter c. Know the applications of

		Junker's calorimeter
6	Morse Testona 4-stroke multi cylinder I.C.Engine	a. Identify various parts of an I.C.Engine b. Understand the working principles of an SI engine c. Understand the terms Friction power,engine efficiency d. Calculate friction power of the engine
7	Estimate Heat Balance of Given IC engine	a. Identify various parts of an I.C engine b. Understand the working principles of an IC engine c. Understand the terms Calorific value, specific heat Break power, S.F.C . d. Calculate heat lost to Break power, cooling water and exhaust gases. e. Tabulate heat balance sheet of given I.C engine
8	Performance test on 4 stroke I.C.Engine	a. Identify various parts of an I.C engine b. Understand the working principles of an IC engine c. Understand the terms Break power, S.F.C, Break thermal Efficiency d. Calculate Break power, S.F.C , Break thermal Efficiency e. Plot graphs B.P vs S.F.C, B.P vs Break thermal Efficiency f. Know the application and usage of Tachometer
9	Study of Morcet Boiler	a. Identify various mountings and accessories of boilers. b. Understand the working principle of fire-tube and water-tube boilers c. Understand the terms Boiler horse power, Boiler efficiency

ME-409

BOARD DIPLOMA EXAMINATIONS(C24)

Model Paper MID SEM -I

DME IV SEMESTER EXAMINATION

Thermal Engineering Lab

Time:1Hours

Max.Marks:20

Answer any **one** of the following questions

1. Determine the flash and fire point of given sample using Cleveland apparatus
2. Determine the flash and fire point of given sample using Abels apparatus/ Determine the flash and fire point of given sample using Pensky marten apparatus
3. Determine Viscosity of given sample of oil using Redwood viscometer
4. Determine Viscosity of given sample of oil using Saybolt viscometer
6. Determine Calorific value of given gaseous fuel using Junkers gas calorimeter.
5. Conduct a test on IC engine and determine BP, FP and IP and mechanical efficiency.
6. Conduct test on IC engine and prepare the Heat balance sheet
7. Conduct a test on IC engine at constant speed and draw the performance curves
8. Using a boiler evaluate relationship between pressure and temperature of saturated steam.

Note: Mid Exam should be conducted from the experiments

in which student undergoes training only as experiments are conducted on rotation basis.

ME-409

BOARD DIPLOMA EXAMINATIONS(C24)

Model Paper MIDSEM -II

DME IV SEMESTER EXAMINATION Thermal Engineering Lab

Time:1Hours

Max.Marks:20

Answer any **one** of the following questions

1. Determine the flash and fire point of given sample using Cleveland apparatus
2. Determine the flash and fire point of given sample using Abel's apparatus / Determine the flash and fire point of given sample using Pensky-Marten apparatus
3. Determine Viscosity of given sample of oil using Redwood viscometer
4. Determine Viscosity of given sample of oil using Saybolt viscometer
6. Determine Calorific value of given gaseous fuel using Junkers gas calorimeter.
5. Conduct test on IC engine and determine BP, FP and IP and mechanical efficiency.
6. Conduct test on IC Engine and prepare the Heat balance sheet
7. Conduct a test on IC Engine at constant speed and draw the performance curves
8. Using a boiler evaluate relationship between pressure and temperature of saturated steam.

Note: Mid Exam should be conducted from the experiments in which student undergone training only as experiments are conducted on rotation basis.

ME-409

BOARD DIPLOMA EXAMINATIONS(C24)

Model Paper (SEE)

DME-IV SEMESTER

Thermal Engineering Lab

Time:2Hours

Max.Marks:40

Answer any **one** of the following questions

1. Determine the flash and fire point of given sample using Cleveland apparatus
2. Determine the flash and fire point of given sample using Abels apparatus/ Determine the flash and fire point of given sample using Pensky marten apparatus
3. Determine Viscosity of given sample of oil using Redwood viscometer
4. Determine Viscosity of given sample of oil using Saybolt viscometer
6. Determine Calorific value of given gaseous fuel using Junkers gas calorimeter.
5. Conduct a test on IC engine and determine BP, FP and IP and mechanical efficiency.
6. Conduct test on IC engine and prepare the Heat balance sheet
7. Conduct a test on IC engine at constant speed and draw the performance curves
8. Using a boiler evaluate relationship between pressure and temperature of saturated steam.

HU-410 EMPLOYABILITY SKILLS LAB

Course Title	Employability Skills Lab	Course Code	HU-410
Semester	IV	Course Group	Practical
Teaching Scheme in periods (L:T:P)	15:0:30	Credits	1.25
Methodology	Lecture + Practical	Total Contact Hours	45(3 periods per week)
CIE	60 Marks	SEE	40 Marks

Rationale:

The course is designed to impart employability skills to make the students of diploma get the initial employment, maintain the employment and get better employment, if they wish.

Prerequisites:

The course requires the basic knowledge of vocabulary, grammar, four language learning skills, viz. listening, speaking, reading and writing and life skills.

Course Contents

Module 1: Presentation Skills:

Duration: 9 Periods (L3 P6)

- a) Significance of presentation
- b) What makes a good presentation?
- i. Understand, Collect, Organize, Use presentational aids and Practice
 - c) Tips for an effective presentation.
- ii. Good Beginning – Greeting, Confidence, Body Language, Opening Ideas (Funny Videos, Ridicule. Asking Questions, Quote someone/Proverb or telling a story/referring an historical event)
- iii. Unveiling – Develop systematically, usage of appropriate linkers or discourse markers. Eye contact and Effective usage of PPTs
- iv. Conclusion – Summarize - Giving time to the audience for queries and Time management
 - d) Guidelines for PPTs

Module 2: JAM**Duration: 6 Periods (L 2 P 4)**

- a) What is JAM?
- b) Significance of JAM
- c) Enhancing Speaking skills, fluency, usage, coherence, spontaneity, voice modulation, eye contact, body language, Creativity, Sense of humor, Confidence and Time management.
- d) Learn avoiding hesitation, deviation and repetition

Module 3: Group Discussion**Duration: 9 Periods (L 3 P 6)**

- a) Purpose of Group Discussion
- b) Types of Group Discussion
- c) Different expressions and phases and their effective usage
- d) Dos and Don'ts of a Group Discussion
- e) Practice.

Module 4: Interview Skills**Duration: 6 Periods (L 2 P 4)**

- i. Importance of interview skills
- ii. Types of interviews
 - a) Face to Face / One to Many,
 - b) Telephonic.
- iii. Understanding the process of interview.
 - a) Before the interview
 - b) On the day of the interview
 - c) After the interview
- iv. FAQs, Common expressions of an interviewer and interviewee
- v. Body language, Grooming and Attire.

Module 5: Workplace Awareness and Professional Ethics**Duration: 9 Periods (L 3 P 6)**

- a) Workplace etiquette
- b) Knowledge, skills and attributes useful at workplace
- c) Workplace Relationships
- d) Gender sensitization
- e) Professional Ethics

Module 6: Writing Skills at Workplace:**Duration: 6 Periods (L 2 P 4)**

- a) Various writing formats useful at workplace

- i) Emails
- ii) Notice
- iii) Agenda
- iv) Minutes of meeting
- v) Circular Memo
- vi) Press release

Course Outcomes

CO1	Make effective presentation, develop public speaking skills and learn to make visually attractive PPTs.
CO2	Converse fluently and accurately accordingly in JAM sessions.
CO3	Group Discussions will enhance the willingness to take the Initiative, accept adaptability in turn developing leadership qualities and Communication Skills
CO4	Understand purpose and process of interview in turn knowing how to prepare and succeed in interview
CO5	Build strong workplace relationships by learning workplace etiquette, professional ethics and gender sensitization.
CO6	Learn various writing formats useful at workplace and to develop an ability to apply technical information in documentation.

CO-PO Matrix

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	Mapping POs
CO1					2	2	2	5,6,7
CO2					2	2	3	5,6,7

CO3					1	3	2	5,6,7
CO4					2	2	3	5,6,7
CO5					2	2	3	5,6,7
CO6					2	3	3	5,6,7

References:

- Adair, John. *Effective Communication*. London: Pan Macmillan Ltd., 2003. Ajmani, J. C. *Good English: Getting it Right*. New Delhi: Rupa Publications, 2012.
- Amos, Julie-Ann. *Handling Tough Job Interviews*. Mumbai: Jaico Publishing, 2004. Collins, Patrick. *Speak with Power and Confidence*. New York: Sterling, 2009.
- Fensterheim, Herbert and Jean Baer. *Don't Say Yes When You Want To Say No*. New York: D Raman, Meenakshi & Sangeeta Sharma. *Technical Communication: Principles and Practice*. Second Edition. New Delhi: Oxford University Press, 2011.

E-Learning Resources :<http://www.dailywritingtips.com/>

- <http://www.englishdaily626.com/c-errors.php><http://www.owl.net.rice.edu/~cainproj/><http://www.thehumorsource.com/>
- <http://www.indiabix.com/group-discussion/topics-with-answers/><http://networketiquette.net/>
- <https://public.wsu.edu/~brians/errors><http://www.bbc.co.uk/worldservice/learningenglish/radio/specials/15>

BOARD DIPLOMA EXAMINATION (C-24)
MID SEMESTER EXAMINATION – I
HU-410 EMPLOYABILITY SKILLS LAB

Time: One Hour

Total Marks: 20

Part – A

10 marks

Instruction: Answer any one of the following questions.

1. Write the guidelines of making a PPT?
2. What are some common mistakes which should be avoided during presentation?
3. How can you use audio -visual aids effectively to enhance your presentation?

Part – B

10 marks

Instruction: Answer any one of the following questions.

1. What are the tips to be followed to start a JAM session?
2. What are the do's and don'ts of presenting JAM?
3. What is JAM? Write significance of JAM in communication skills.

BOARD DIPLOMA EXAMINATION (C-24)
MID SEMESTER EXAMINATION – II
HU-410 EMPLOYABILITY SKILLS LAB

Time: One Hour

Total Marks: 20

Part – A

10 marks

Instruction: Answer any one of the following questions.

1. List the abilities required by a person to succeed in a Group Discussion.
2. Explain how to initiate, continue and conclude a Group Discussion and mention some suitable phrases to be used in each step.
3. Mention the guidelines to be followed in a Group Discussion.

Part – B

10 marks

Instruction: Answer any one of the following questions.

1. What precautions do you take for a telephonic interview?
2. How do you prepare for an interview?
3. Explain interview process and suitable attire for an interview?

BOARD DIPLOMA EXAMINATION (C-24)
SEMESTER END EXAMINATION
HU-410 EMPLOYABILITY SKILLS LAB

Time: Three Hours

Total Marks: 40

Part – A

10 marks

Instruction: Pick any one question from the given lot.

1. Write the guidelines involved in making a good presentation?
2. Describe the steps involved in JAM.
3. Mention different types phrases used in Group Discussion.
4. List few professional ethics useful at workplace.
5. Write a notice, agenda and minutes of meeting on any occasion.

Part – B

15 marks

6. Interview / Group Discussion

Part – C

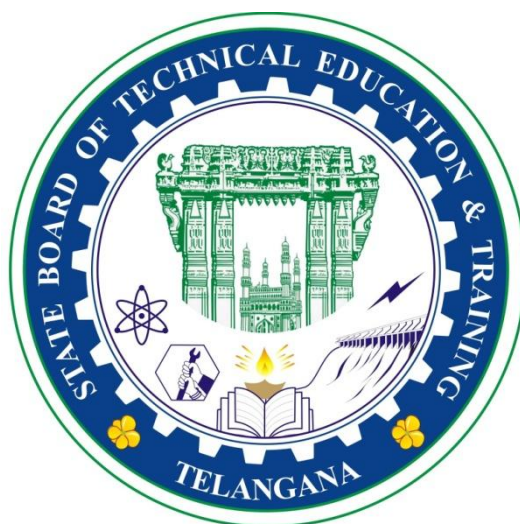
15 marks

7. Viva Voce

C24-CURRICULUM

DIPLOMA IN

MECHANICAL ENGINEERING



Offered By

STATE BOARD OF

TECHNICAL EDUCATION AND

TRAINING TELANGANA

HYDERABAD

V SEMESTER

S. NO	Course		Teaching Scheme					Examination Scheme						
	Code	Course Name	Instruction Periods per week			Total Periods per semester	Credits	Continuous Internal Evaluation (CIE)			Semester End Examination (SEE)			
			L	T	P			Mid Sem 1	Mid Sem 2	Internal Evaluation	Max marks	Min marks	Total Marks	Min marks for passing including internal
1	ME-501	IME & Start Ups	4	1	0	75	2.5	20	20	20	40	14	100	End Marks shall be ≥35% of Topper Marks and Subject Total Shall be ≥ D-Hybrid Grade Minimum
2	ME-502	Refrigeration and Air Conditioning	4	1	0	75	2.5	20	20	20	40	14	100	
3	ME-503	computer aided design and manufacturing	4	1	0	75	2.5	20	20	20	40	14	100	
4	ME-504	Fluid Power Systems	4	1	0	75	2.5	20	20	20	40	14	100	
5	AU-515A	Automobile Engineering	4	1	0	75	2.5	20	20	20	40	14	100	
	EE-505B	Electric Vehicles												
6	ME-506A	Introduction to Artificial Intelligence	4	1	0	75	2.5	20	20	20	40	14	100	
	ME-506B	Mechatronics												
7	ME-507	Manufacturing Automation Lab	1	0	2	45	1.25	20	20	20	40	20	100	End Marks shall be ≥50% of Topper Marks and Subject Total Shall be ≥ D-Hybrid Grade Minimum
8	ME-508	Metrology lab and Pneumatics Lab	1	0	2	45	1.25	20	20	20	40	20	100	
9	ME-509	Refrigeration and Air Conditioning Lab	1	0	2	45	1.25	20	20	20	40	20	100	
10	ME-510	Project work	1	0	2	45	1.25	20	20	20	40	20	100	
			28	6	8	630	20	200	200	200	400	164	1000	

ME-501 – IME & STARTUPS

Course title	IME & Startups	Course code	ME-501
Semester	V	Course group	Core
Teaching scheme in periods (L:T:P)	4:1:0	Credits	2.5
Methodology	Lecture+ Tutorial	Total Contact Periods	75
CIE	60 Marks	SEE	40 Marks

Prerequisites: Knowledge of Basic Sciences.

COURSE OUTCOMES

On successful completion of the course, the students will be able to

Course Outcomes	
CO1	Illustrate the principles and functions of management and Outline Organization structure&Organizational behaviour
CO2	Summarise the Functions of Production Management
CO3	Analyse the functions of Materials Management
CO4	Compare Marketing, sales & Feasibility study
CO5	State the use of ISO 9000 & T.Q.M and discussIndustrial legislation & safety
CO6	Illustrate Entrepreneurship and Start-ups

Blue Print of Marks for SEE:

Units		No of period s	Questions to be set for SEE				Remarks		
			R		U	A			
Part-A	I. Management, Organisation structure and behaviour	13	Q4	Q1		Q9(a)	Q13(a)		
	II. Production management	12							
Part-B	III. Materials management	12		Q2		Q10(a)	Q14(a)		
	IV. Marketing, Sales & feasibility study	13							
Part-C	V. Quality & ISO 9000 and Industrial Legislation & safety	13		Q3	Q5 Q6		Q9(b) Q11(a) Q11(b)	Q13(b) Q15(a) Q15(b)	
	VI. Entrepreneurship and start-ups	12			Q7 Q8		Q10(b) Q12(a) Q12(b)	Q14(b) Q16(a) Q16(b)	
TOTAL		75	08		08	08			

COURSE CONTENT**UNIT-I: Management, Organization Structure and Behaviour****Duration: 13 Periods (L: 11.0 – T: 2.0)**

Management-Concept, Evolution, Levels, Skills and Functions, Principles of Scientific Management, Management Information System (MIS)-Concept and Models, Organisation and Organisation Structure Meaning, Types of Ownerships-Sole Proprietorship, Partnership, Joint Stock Companies, Co-operative Societies and Public Organisations, Line and Staff and Functional Organisations, Concept of Organisation Behaviour, Job analysis, Motivation- Theories of Motivation, Leadership-Styles

UNIT-II**Production Management****Duration: 12 Periods (L: 10.0 – T: 2.0)**

Production Management, Relation of Production department with other departments, Production, Planning and Control (PPC)-Meaning, Functions of PPC – Planning, Routing, Scheduling, Dispatching and Follow up (Expediting)-Need, Procedure, PERT and CPM - Concept, Simple problems.

UNIT-III

Materials Management

Duration: 13 Periods (L: 11.0 – T: 2.0)

Role of Materials in industry, Materials Management - Objectives and Functions, Inventory Control models- ABC Analysis, Re-order level, Economic Order Quantity(EOQ) and Automated inventory management system (IMS), Stores-Layout and Equipment, Stores Records-Bincard and Cardex method, Purchasing- Procedure, Records

UNIT-IV

Marketing, Sales & Feasibility study

Duration: 12 Periods (L: 10.0 – T: 2.0)

Sellers and Buyers market, Marketing, Sales, Market conditions, Oligopoly, Perfect competition, Cost -Elements of Cost, Break-even analysis, Market Survey, Product and Production Analysis, Materials Input, Manpower, Location, Economic and Technical Evaluation, Preparation of Feasibility Study report.

UNIT-V

Quality & ISO 9000 and Industrial Legislation & Safety

Duration: 13 Periods (L: 11.0 – T: 2.0)

Concepts of Quality, Quality Control, Quality Assurance and Quality Systems-Elements, ISO 9000 series-Features, Advantages, Limitations and Beneficiaries. TQM, Concept of zero defects, 5-S Principles, Lean Management, Kaizen and Poka Yoke Concept. Employer-employee relations-rights and responsibilities, Trade Unions, Causes and Settlement of disputes methods, Indian Factories Act-Salient features, Safety at workplaces-Importance, Hazards-Types and Accidents.

UNIT-VI

Entrepreneurship and Start-ups

Duration: 12 Periods (L: 10.0 – T: 2.0)

Entrepreneur, Entrepreneurship, Intrapreneurship, Self-employment schemes, Institutional support needed, financial assistance programs. Start-ups- Features, Benefits, Schemes, Need of Start-Ups in 21st Century-Gaps to Start Start-Ups -Features and Start-Ups registration process, List of successful Start-Ups.

REFERENCE BOOKS

1. Industrial engineering and management by O.P Khanna.
2. Production management by Buffa
3. Industrial Engineering & Management Science by TR Banga
4. Engineering Economics and Management Science by Banga & Sharma
5. Personnel management by Flippo
6. Lean management tools and techniques by Sateesh Raju G
7. Entrepreneurship by NITTTR Chennai.

ELECTRONIC RESOURCES

1. <https://nptel.ac.in/courses/>
2. <https://www.slideshare.net/>
3. <https://en.wikipedia.org/wiki/>
4. <http://ndl.ethernet.edu.et/bitstream/>
5. <https://webapps.ilo.org/>

SUGGESTED STUDENT ACTIVITIES

1. Identify any 5 industries with different types of ownership.
2. Prepare an organizational structure for the institution
3. Survey Product marketing.
4. Prepare a list of ISO 9000 series as well as latest quality standards
5. Prepare sign boards representing safety measures.
6. Role-play as an entrepreneur
7. Case study on a Start-up

SUGGESTED LEARNING OUTCOMES

Upon completion of the course the student shall be able to

CO1: Illustrate principles and functions of management and Outline Organization structure & organizational behavior

- 1.1 Define Management and Administration
- 1.2 Discuss the evolution of Management
- 1.3 Discuss Levels and Skills of Management
- 1.4 Illustrate functions of Management
- 1.5 Explain the Principles of Scientific Management
- 1.6 Define Management Information System (MIS).
- 1.7 Discuss the importance of MIS
- 1.8 Illustrate the models of MIS
- 1.9 Define Organisation and Organisation Structure
- 1.10 Explain different types of Ownerships-Sole Proprietorship, Partnership, Joint Stock Company, Co-operative Societies and Public Sector Organisations
- 1.11 Explain Line, Staff and Functional Organisations
- 1.12 Understand Organisation behaviour
- 1.13 Explain Job analysis
- 1.14 List and Explain Motivation theories
- 1.15 Explain the Line, Staff and Functional organisations.
- 1.16 Explain different leadership styles.

CO2: Summarise the Functions of Production Management

- 2.1 Define Production, Planning and Control.
- 2.2 Relate the production department with other departments.
- 2.3 Discuss the functions of Production, Planning and Control.
- 2.4 State the Need for Planning
- 2.5 Explain the Routing procedure.
- 2.6 Explain Scheduling Methods.
- 2.7 Explain the Dispatching procedure
- 2.8 Explain Expediting (Follow up)
- 2.9 Draw PERT/CPM networks.
- 2.10 Identify the critical path
- 2.11 Problems on PERT & CPM.

CO3: Analyze the functions of Materials Management

- 3.1 State the role of materials in the Industry
- 3.2 Discuss the Objectives and Functions of Materials management
- 3.3 Define Inventory and Inventory Control
- 3.4 Explain ABC analysis.
- 3.5 Define Reorder level
- 3.6 Derive the expression of EOQ for inventory control.
- 3.7 Define safety stock, Buffer stock
- 3.8 Discuss Automated Inventory Management System (IMS)
- 3.9 State the Functions of the Stores department
- 3.10 Explain the Stores layout,
- 3.11 Discuss the Stores Equipment
- 3.12 Explain the Store records.
- 3.13 Discuss the Bin card and Cardex method.
- 3.14 List Objectives and functions of the Purchasing department
- 3.15 Explain Purchasing procedures.
- 3.16 List out Purchase records.

CO4: Compare Marketing, Sales & Feasibility study.

- 4.1 Define Marketing and Sales
- 4.2 Differentiate Sellers and Buyer's Market
- 4.3 Discuss Marketing and Sales functions.
- 4.4 List out Marketing conditions.
- 4.5 Differentiate Monopoly, Oligopoly and Perfect Competition.
- 4.6 Define Cost and list the Elements of Cost
- 4.7 Explain Break-even analysis
- 4.8 Steps in conducting Market and Demand surveys.
- 4.9 Differentiate Product and Production Analysis.
- 4.10 Identify the input materials, i.e. Bill of materials

- 4.11 Discuss the factors to choose Plant Location
- 4.12 Evaluate Economic and Technical factors.
- 4.13 Discuss the Preparation of the Feasibility Study.

CO5: State the use of ISO 9000 & TQM and discuss Industrial legislation & safety

- 5.1 Define Quality, Quality Control, Quality Assurance and Quality System
- 5.2 Discuss the Elements of Quality Systems.
- 5.3 Discuss ISO 9000 series of Standards.
- 5.4 State Advantages, Limitations and Beneficiaries of ISO 9000 series
- 5.5 Explain the Concept of TQM
- 5.6 Define Lean management, Kaizen and Poka-Yoke concepts
- 5.7 Define the term “ZERO DEFECT”
- 5.8 State 5-S principles.
- 5.9 Discuss the Employer and Employee relations
- 5.10 List out the rights and responsibilities of employees and employers.
- 5.11 Define Trade union and list its functions
- 5.12 Explain the Causes and settlements of Industrial disputes.
- 5.13 List the salient features of the Indian Factories Act.
- 5.14 Explain the importance of safety and its provisions at workplaces
- 5.15 Discuss types of hazards and their causes

CO6: Illustrate Entrepreneurship and Start-ups

- 6.1 Define Entrepreneur, Intrapreneur and Entrepreneurship
- 6.2 Discuss the qualities of an entrepreneur.
- 6.3 Explain the role of entrepreneurs in promoting Small Scale Industries.
- 6.4 Explain different Self-employment schemes.
- 6.5 Discuss Institutional and Financial Assistance Program Institutions
- 6.6 Define Start-ups
- 6.7 State the Need for Start-ups in the 21st Century
- 6.8 Explain the features and registration process for Start-ups
- 6.9 List various Start-up schemes and their benefits
- 6.10 Identify the gaps for initiating Start-ups.
- 6.11 List out the most successful recent start-ups in India.

COURSE OUTCOMES		CL	Linked POs	Teaching Periods
CO1	Illustrate the principles and functions of management and Outline Organization structure& organizational behavior	R, U, A	5,6,7	13
CO2	Understand the Functions of Production Management	R, U, A	2,5,6	12
CO3	Analyse the functions of Materials Management.	U, A	1,6,7	12
CO4	Compare Marketing, sales & Feasibility study.	U, A	1,6,7,	13
CO5	State the use of ISO 9000 & T.Q.M and discussIndustrial legislation & safety	U, A	1,6,7	13
CO6	Illustrate Entrepreneurship and Start-ups	R, U, A	1,6,7	12
			Total Periods	75

Legends: R = Remember; U= Understand; A= Apply and above levels (Bloom's revised taxonomy)

CO-PO Attainment Matrix:

COURSE OUTCOMES	PROGRAM OUTCOMES						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1					2	3	1
CO2		2			1	3	
CO3	1					2	3
CO4	1					3	2
CO5	2					3	1
CO6	1					2	3

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Lowly Addressed.

STATE BOARD OF TECHNICAL EDUCATION & TELANGANA
MID SEM-I Model Paper
ME-501 - IME & START UPS

Time: 1 hr

Max. Marks:20

PART-A

4x1=4Marks

NOTE: 1) Answer all questions and each carries **one** mark.

2) Answers should be brief and straight to the point and shall not be exceed three simple sentences.

1. Who makes policies of an organisation?
2. Define management information system(MIS)
3. What do you understand about routing?
4. What does CPM Stands for.?

PART-B

2X3M=6 Marks

NOTE: 1) Answer all questions and each carries **three** marks.

2) Answers should be comprehensive and the criterion for valuation is the content but not length of the answer.

- 5.(a) What type of managerial skills required by top level management

OR

- 5.(b) List out theories of motivation.

- 6.(a) Which type of projects uses PERT network technique and why?

OR

- 6.(b) Discuss about scheduling

PART-C

2X5M=10 Marks

NOTE: 1) Answer all questions and each carries **five** mark.

2) Answers should be comprehensive and the criterion for valuation is the content but not length of the answer.

- 7.(a) Explain the principles of scientific management

OR

- 7.(b) Explain about Maslow's theory of motivation

- 8.(a) Draw the project network of the given project and identify all paths through it.
Find the critical path, TL and T_E on the network.

Activity	Optimistic Time(a)	Most likely Time (m)	Pessimistic Time (b)
1-2	1	1	7
1-3	1	4	7
1-4	2	2	8
2-5	1	1	1
3-5	2	5	14
4-5	2	6	10
5-6	3	6	15

OR

- 8.(b) Which leadership style gives more freedom at work place?And discuss about it

STATE BOARD OF TECHNICAL EDUCATION & TELANGANA
MID SEM-II , Model Paper
ME-501 IME & START UPS

Time: 1 hr

Max. Marks:20

PART-A

4x1=4Marks

NOTE: 1) Answer all questions and each carries **one** mark.
2) Answers should be brief and straight to the point and shall not exceed three simple sentences.

1. Ajay purchased more material with less cost. which class material in ABC analysis?
2. When do we use buffer stock?
3. What Is a feasibility study?
4. What is Breakeven Point?

PART-B

2X3M=6 Marks

NOTE: 1) Answer all questions and each carries **three** mark.
2) Answers should be comprehensive and the criterion for valuation is the content but not length of the answer.

- 5.(a) List the advantages of ABC analysis.

OR

- 5.(b) State the functions of Material Management.

- 6.(a) List out the elements of cost ?

OR

- 6.(b) What is buyer's market and seller's market.

PART-C

2X5M=10 Marks

NOTE: 1) Answer all questions and each carries **five** mark.
2) Answers should be comprehensive and the criterion for valuation is the content but not length of the answer.

- 7.(a) Explain the functions of Purchase management.

OR

- 7.(b) Explain various records used in stores.

- 8.(a) What is Break-even analysis? Illustrate graphically the concept of Break-even point.

OR

- 8.(b) Differentiate Product and Product analysis.

STATE BOARD OF TECHNICAL EDUCATION & TELANGANA
BOARD DIPLOMA EXAMINATION, (C-24)
SEE-MODEL PAPER ME-501
DME– V SEMESTER EXAMINATION
ME-501 –IME & START UPS

Time: 2 Hours

Max. Marks: 40

PART-A

8 X 1 = 8

Instructions: 1. Answer **ALL** questions.
2. Each question carries **ONE** mark.

1. What do you say about Organisation behaviour?
2. Where you can use a bin card?
3. List two benefits of ISO 9000 certification.
4. Define PERT.
5. Define Quality control.
6. What is ISO.
7. Why trade unions formed?
8. Name any two entrepreneurs in India.

PART-B

4 X 3 = 12

Instructions: 1. Answer **ALL** questions.
2. Each question carries **THREE** marks.

9. (a) Differentiate Line Organisation and Line and Staff Organisation.
OR
9. (b) What are the 5-S principles?
10. (a) What do you understand about inventory control?
OR
10. (b) How an Entrepreneur helps in economic development
11. (a) List the beneficiaries of the ISO 9000 certificate.
OR
11. (b) Explain about quality assurance.
12. (a) What do you understand expectations of an entrepreneur
OR
12. (b) Name any six startups recently in India.

PART-C

4 X 5 = 20

- Instructions:** 1. Answer **ALL** questions.
2. Each question carries **FIVE** marks.

13. (a) Explain the principles of Scientific management stated by F.W. Taylor

OR

13(b) Explain various elements of quality systems.

14 (a) Ramesh started a company. he wants to purchase materials on cost analysis. What Type of inventory control technique select and explain about it?

OR

14(b) Explain the factors influencing the site selection for a plant location.

15 (a) What are the different ISO-9000 series. Explain about them.

OR

15(b) Explain the rights and responsibilities of the Employee and Employer.

16(a) Explain the role of an entrepreneur in the promotion of small-scale industries

OR

16(b) Explain various steps to start Start-ups.

ME 502 – REFRIGERATION AND AIR CONDITIONING

Course Title:	Refrigeration and Air Conditioning	Course Code:	ME-502
Semester:	V	Course group :	Core
Teaching Scheme(L:T:P):	4:1:0	Credits:	2.5
Methodolgy :	Lecture + Assignment	Total contact periods:	75
CIE:	60 Marks	SEE:	40 Marks

Pre-requisites: Basic knowledge of Thermodynamics.

COURSE OUTCOMES

	On Successful completion of the course, the student will be able to
CO 1	Classify and explain the methods of refrigeration and elaborate air refrigeration cycles
CO 2	Evaluate vapour compression and vapour absorption refrigeration systems, calculate parameters and compare the systems
CO 3	Adapt to eco friendly refrigerants and know the function of equipment used in refrigeration, describe and differentiate them.
CO 4	Outline and determine various psychrometric properties, Analyze psychrometric processes..
CO 5	Explain and Assess working of various air conditioning equipment and draw their layout
CO 6	Make use of recent trends in the field of refrigeration and air conditioning and correlate them with their application in industry

COURSE CONTENT AND BLUE PRINT OF MARKS FOR SEE

Unit No	Unit Name	Periods	Questions to be set for SEE (Q No)				Remarks
			R		U	A	
1	Introduction to Refrigeration & Air refrigeration systems	12	4	1	9(a)	13(a)	
2	Vapour compression and absorption refrigeration Systems	13					
3	Refrigerants and refrigeration equipment	13					
4	Psychrometry & Psychrometric processes	12		2	10 (a)	14 (a)	
5	Air distribution and Air conditioning equipment	12					
6	Applications of refrigeration and air conditioning – Recent trends in Refrigeration and air conditioning.	13		3	7, 8	10(b), 12(a), 12(b)	14(b), 16(a), 16(b)

Legend: R:Remembering, U: Understanding A: Applying

COURSE CONTENT

Refrigeration and Air conditioning

Unit – 1 Introduction to Refrigeration & Air refrigeration systems

Duration: 12 Periods (L: 10 – T:2)

Definition of refrigeration, Air conditioning – Heat engine, refrigerator and heat pump. Basic terms involved in refrigeration : Refrigeration effect, Work of compression, COP, Ton of refrigeration, Power required per TR – Natural and Artificial methods of refrigeration : Ice, Dry Ice refrigeration. — Thermodynamic analysis of Reversed Carnot refrigeration cycle – Limitations - Thermodynamic analysis of Bell Coleman refrigeration cycle .

Unit – 2 Vapour compression and absorption refrigeration Systems

Duration: 13 Periods (L: 10 – T: 3)

Vapour compression refrigeration system (VCRS):-Principle –Thermodynamic analysis of VCRS -Factors effecting performance of VCRS - Wet and dry compression –Receiver, Accumulator, strainer , drier and flash chamber.

Vapour absorption refrigeration system(VARS):-Principle – Refrigerant absorbent pairs - Working of Ammonia water vapour absorption refrigeration system – Working of Lithium Bromide Water vapor absorption refrigeration system- Expression for COP of VARS.

Unit – 3 Refrigerants and refrigeration equipment

Duration: 13 Periods (L:10 – T:3)

Refrigerants:- Definition - Primary and secondary refrigerants — properties of good refrigerants – Commonly used refrigerants – Ozone depletion, phase out of Chlorofluro carbon refrigerants – Montreal protocol – Global warming and Kyoto protocol.

Refrigeration equipment :-Hermetic compressor – Natural circulation tube and fin air cooled condenser, forced circulation tube and fin air cooled condenser, shell & tube water cooled condensers and evaporative condenser –Capillary tube and thermostatic expansion valve – Difference between direct evaporator and flooded evaporator, and Plate surface evaporator, Bare tube evaporator, finned tube forced circulation evaporator and Shell and tube evaporator , ..

Unit – 4 Psychrometry& Psychrometric processes

Duration: 12 Periods (L: 10 – T:2)

Definition of air conditioning - Classification of air conditioning systems - Human comfort conditions – Effective temperature – Factors governing effective temperature – comfort chart. Psychrometry:-Definition– Psychrometric terms – Carrier Equation - Psychrometric chart – Psychrometric processes

Unit – 5 Air distribution and Air conditioning equipment

Duration: 12 Periods (L: 10 – T:2)

General Air distribution (Air flow diagram for an ac system) – Air distribution system in a Room :- Ejection system, Downward system and Upward system. -Ducts: -Definition, Types, material used, Need for insulating a duct and Duct system - Fans and blowers – Supply air outlets – Filters – Heating and cooling coils –AHU (Air handling units). –Chiller

Unit – 6 Applications of refrigeration and air conditioning – Recent trends in Refrigeration and air conditioning.

Duration: 13 Periods (L:10 – T:3)

Applications of refrigeration :- Domestic refrigerator– Water cooler –Desert/air cooler(Evaporative cooling), - Unitary vs Central Air conditioning system - Applications of air conditioning:-Window air conditioner, Summer air conditioning system – Winter air conditioning system – Central air conditioning system

Recent trends in RAC :Ice line refrigerator, chest refrigerator - Clean rooms vs Dry rooms - Variable refrigerant flow (VRF) system - Inverter AC – Smart HVAC controls – Natural ventilation.

REFERENCE BOOKS

1. Refrigeration and Air Conditioning – by C. PArora
2. Refrigeration and Air Conditioning – byDomakundwar
3. Basic Refrigeration and Air conditioning - by P NAnanthanarayana
4. Refrigeration and Air Conditioning – byDosatt
5. Refrigeration and Air Conditioning – byStoecker

SUGGESTED LEARNING OUTCOMES

1. Introduction to refrigeration & air refrigeration systems

- 1.1 Define the terms refrigeration and air conditioning
- 1.2 Know the difference between heat engine, refrigerator and heat pump.
- 1.3 Define the terms Refrigeration effect and Work of compression
- 1.4 Define COP
- 1.5 Expression for COP of refrigerator and heat pump and relation between them.
- 1.6 Define unit of refrigeration (Ton of refrigeration- TR).
- 1.7 Evaluate power required per ton of refrigeration
- 1.8 Numerical problems on COP , unit of refrigeration and power required per TR.
- 1.9 Know different natural methods and mechanical methods of refrigeration.
- 1.10 Explain such as direct ice and indirect ice method of refrigeration
- 1.11 Explain dry ice refrigeration system refrigeration
- 1.12 Introduction to Air refrigeration and list different air refrigeration systems.

- 1.13 Explain reverse Carnot refrigeration cycle with flow diagram, PV and TS diagram.
- 1.14 Know limitations of reverse Carnot refrigeration cycle.
- 1.15 Know expression for COP of reverse Carnot refrigeration cycle (derivation omitted)
- 1.16 Solve numerical problems on COP of reverse Carnot refrigeration cycle.
- 1.17 Explain Bell Coleman air refrigeration cycle with flow diagram, PV and TS diagram
- 1.18 Know expression for COP of Bell Coleman air refrigeration cycle (derivation Omitted)
- 1.19 Solve numerical problems on COP of Bell Coleman air refrigeration cycle

2. Vapour compression and absorption refrigeration Systems

- 2.1 List major components in simple (basic) vapour compression refrigeration system.
- 2.2 Draw flow diagram of simple (basic) vapour compression refrigeration system.
- 2.3 Explain principle and working of simple (basic) vapour compression refrigeration system with the help of T-S and P-h diagrams.
- 2.4 Write the expression for COP of vapour compression system.
- 2.5 Distinguish between wet and dry compression.
- 2.6 Solve simple problems on basic vapor compression refrigeration system
- 2.7 Summarize the effects of evaporator pressure and condenser pressure on COP
- 2.8 Summarize the effects of under cooling and super heating on COP.
- 2.9 State the use of receiver, accumulator, strainer, drier and flash chamber.
- 2.10 Explain principle of simple vapor absorption systems.
- 2.11 State the desirable properties of refrigerants -absorbers
- 2.12 List commonly used refrigerant – absorber pairs.
- 2.13 Explain the construction and working of Ammonia-Water VARS
- 2.14 Explain the construction and working of Water-Lithium Bromide VARS.
- 2.15 Know expression of COP of VARS (without derivation)
- 2.16 Solve simple problems on COP of VARS.

3. Refrigerants and refrigeration equipment

- 3.1 Distinguish between primary and secondary refrigerants.
- 3.2 List the desirable properties of refrigerants and Classify refrigerants.
- 3.3 Know the difference between chlorofluoro carbon refrigerants, hydro chlorofluoro refrigerants and hydro carbon refrigerants.
- 3.4 Write chemical formula, designation name and application of the following refrigerants – R 12, R 22, R 134 a, R 290a, R 600a, R 401a, R 410 a, R 717, R 718, R 729, R 744.
- 3.5 Know the impact of refrigerants on Ozone depletion – Need to phase out of Chlorofluoro carbons and hydro Chlorofluoro carbons –
- 3.6 Understand Montreal protocol (Statement of protocol)

- 3.7 Know the effect of refrigerants on Global warming .
- 3.8 Understand Kyoto protocol. (Statement of protocol).
- 3.9 Know the application of reciprocating, scroll, screw and centrifugal compressors.
- 3.10 Explain construction and working of hermetic reciprocating compressor.
- 3.11 State the function of condenser, know difference between air cooled condenser and water cooled condenser – know difference between natural circulation and forced circulation condenser.
- 3.12 Explain the working of natural circulation tube and fin air cooled condenser used in domestic refrigerator.
- 3.12 Explain the working of forced circulation tube and fin air cooled condenser used in window air conditioner/water cooler.
- 3.13 Explain the working of shell & tube water cooled condensers used in big capacity refrigeration/air conditioning systems.
- 3.14 Explain the working of evaporative condensers used in ice making plants..
- 3.15 Explain the working of capillary tube.
- 3.16 Know the difference between direct evaporator and flooded evaporator.
- 3.17 Explain the working plate surface evaporator used in domestic refrigerator/ display panel in bakeries..
- 3.18 Explain the working of bare tube evaporator used in water cooler.
- 3.19 Explain the working of finned tube forced circulation evaporator used in window air conditioner.
- 3.20 Explain the working of shell and tube evaporator used in big capacity refrigeration/air conditioning plants.

4.Air conditioning &Psychrometry

- 4.1 Define air conditioning and classify air conditioning systems
- 4.2 Know the following terms: human comfort, effective temperature
- 4.3 Know about comfort chart.
- 4.4 Define the terms: Psychrometry, dry air and moist air, DBT, WBT, DPT and adiabatic saturation temperature
- 4.5 Define the terms humidity, absolute humidity, relative humidity, specific humidity.
- 4.6 Know carrier's equation and solve problems involving psychrometry.
- 4.7 Construction and working of different psychrometers- Laboratory, continuous recording, sling, aspirating psychrometers.
- 4.8 Explain the features of psychrometric chart, plot all psychrometric processes on the chart.
- 4.9 Simple problems on psychrometric processes using psychrometric chart only.
- 4.10 Know the concept of mixing of air streams and solve problems.

5. Air distribution and Air conditioning equipment

- 5.1 Draw the general air flow diagram for AC system and explain flow of air.
- 5.2 Explain different air distribution systems in a room like ejection system, downward system and upward system.
- 5.3 Air distribution system in a Room :- Ejection system,
- 5.4 Air distribution system in a Room :- Downward system
- 5.5 Air distribution system in a Room: Upward system.
- 5.6 Explain the need of duct- Know duct materials, shapes and classify ducts
- 5.7 Explain need of insulating a duct and material used for insulation.
- 5.8 Explain the duct system based on arrangement of supply ducts loop perimeter system
- 5.9 Explain the duct system based on arrangement of supply : radial perimeter system
- 5.10 Explain the duct system based on arrangement of supply ducts : extended plenum system.
- 5.11 Explain duct system based upon number of ducts used like: single duct system, dual duct system and dual duct with induction system.
- 5.12 Differentiate fan and blower.
- 5.13 Know the factors governing selection of fans.
- 5.14 Classify fans according to direction of airflow.
- 5.15 Know about grill outlets, slot diffusers, ceiling diffusers, perforated ceiling panels and their applications.
- 5.16 Know different types of filters (Dry, Viscous, Wet, Electronic and HEPA filters)-
- 5.17 Explain heating and cooling coils.
- 5.18 Know about air handling unit (AHU).
- 5.19 Know the function of chillers in air conditioning.

6. Applications of refrigeration and air conditioning – Recent trends in Refrigeration and air conditioning

- 6.1 Explain construction and working of domestic refrigerator.
- 6.2 Explain construction and working of storage type water cooler.
- 6.3 Know about ice line refrigerator and chest freezer.
- 6.4 Explain the working of desert type air cooler.
- 6.5 Explain difference between unitary and central ac system.
- 6.6 Explain working of window air conditioner.
- 6.7 Know the difference between unitary air conditioner, split air conditioner and cassette air conditioning system.

- 6.8 Explain summer air conditioning system for hot & humid out door conditions and hot & dry conditions.
- 6.9 Explain winter air conditioning system for cold & dry out door conditions
- 6.10 Explain central air conditioning system
- 6.11 Know the difference between clean room and dry room.
- 6.12 Know about variable refrigerant flow (VRF) system.
- 6.13 Know about inverter ac system.
- 6.14 Explain briefly smart HVAC system.
- 6.15 Explain briefly about Natural ventilation system.

CO – PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	1.50	1.50	3.00	3.00	1.50	1.50	3.00
CO2	1.50	3.00	3.00	3.00	1.50	3.00	3.00
CO3	3.00	3.00	1.50	1.50	3.00	3.00	1.50
CO4	3.00	3.00	1.50	1.50	3.00	3.00	1.50
CO5	3.00	1.50	1.50	3.00	3.00	3.00	1.50
CO6	3.00	1.50	1.50	1.50	3.00	3.00	1.50
AVERAGE	2.50	2.25	2.00	2.25	2.50	2.75	2.00

BOARD DIPLOMA EXAMINATIONS (C 24)
MID SEM I EXAMINATION
DME V SEMESTER
REFRIGERATION AND AIR CONDITIONING

Time : 1 Hour

Total Marks : 20 M

PART – A

Marks: 4 X 1M = 4 M

*NOTE: 1) Answer **all** questions and each question carries **one** mark.*

*2) Answers should be brief and straight to the point and shall not exceed **three** simple sentences*

1. Define the term Ton of refrigeration.?
2. Find COP of a heat pump working on Reverse Carnot cycle operating between -10° C and 40° C?
3. What is function of accumulator in VCRS?
4. In Water- Lithium bromide VARS which Refrigerant is used?

PART – B

Marks: 2 X 3M= 6 M

*NOTE: 1) Answer **all** questions and each question carries **three** marks*

*2) The answers should be comprehensive and the criteria for valuation is the content
but not the length of the answer.*

5.(a). Explain about ice refrigeration

OR

5. (b). Draw PV and TS diagram of refrigerator of reverse Carnot air refrigeration cycle.

6 a). Draw the layout of Ammonia – water VARS..

OR

6 (b). Why is water Lithium bromide VARS is limited to be used only for air conditioning?

PART – C

Marks : 2 X 5 M = 10 M

NOTE :

1. Answer **all** questions and each question carries **five** marks.
2. The answers should be comprehensive and the criteria for valuation is the content but not the length of the answer

7(a) Explain Bell Coleman refrigeration cycle with a layout.

OR

7(b) A refrigeration plant works between -15°C and 30°C . The refrigerant is dry and saturated at the end of compression. Calculate Refrigerating effect, Carnot COP and COP of VARS, if enthalpy values before and after compression are 1280 kJ/kg and 1470 kJ/kg, fluid enthalpy at 30°C is 320 kJ/kg.

8 (a) Explain with help of Pressure-Enthalpy (P-H) diagram the effect of increase in condenser pressure on refrigeration system performance.

OR

8 (b) Differentiate between wet compression and dry compression refrigeration system.

BOARD DIPLOMA EXAMINATIONS (C 24)
MID SEM II EXAMINATION
DME V SEMESTER
REFRIGERATION AND AIR CONDITIONING

Time : 1 Hour

Total Marks : 20 M

PART – A

Marks: 4 X 1M = 4 M

*NOTE: 1) Answer **all** questions and each question carries **one** mark.*

*2) Answers should be brief and straight to the point and shall not exceed **three** simple sentences*

1. What is a secondary refrigerant. Give an example.
2. What is chemical name of R- 290.
3. Define air conditioning ?
4. Define the term relative humidity.

PART – B

Marks : 2 X 3M= 6 M

*NOTE: 1) Answer **all** questions and each question carries **three** marks*

2) The answers should be comprehensive and the criteria for valuation is the content but not the length of the answer.

5. (a) Write short notes on KYTO protocol

OR

- 5 (b) When are forced circulation water cooled condensers used in air conditioning systems.

6. (a) How does Dry bulb temperature change in sensible cooling and sensible heating.

OR

- 6 (b) Write carrier's equation used in air conditioning and indicate the terms used in it?.

PART – C

Marks : 2 X 5 M = 10 M

NOTE :

3. Answer **all** questions and each question carries **five** marks.

4. The answers should be comprehensive and the criteria for valuation is the content but not the length of the answer

- 7(a) Explain working of Hermetic compressor.

OR

- 7(b) Explain working of capillary.

- 8 (a) A air conditioning system requires air which is at DBT 35C . Without changing its specific humidity, its temperature should change to 15 C. Indicate the process on Psychrometric chart and name the process?

OR

- 8 (b) Explain the difference between humidification and dehumidification.

BOARD DIPLOMA EXAMINATIONS (C 24)
MODEL PAPER (SEE)
DME V SEMESTER
REFRIGERATION AND AIR CONDITIONING

TIME : 2 Hours

Max. Marks: 40

PART – A

Marks: 8 X 1 M = 8 M

*NOTE : 1) Answer **all** questions and each question carries **one** marks.*

*2) Answers should be brief and straight to the point and shall not exceeding **three** simple sentences*

1. Define the term refrigeration.
2. What is the function of flash chamber in VCRS.
3. Why is an air conditioning duct need to be insulated.
4. Write equation to find humidity of air.
5. What is function of a duct in conditioning systems..
6. What is approximate value of relative humidity of Vishakapatnam?.
7. What are main components in out door unit of split air conditioner?
8. What psychrometric process does air under go in air cooler ?

PART – B

*Answer **all** questions . Each question carries **three** marks*

4x 3 M = 12M

9(a) COP of refrigerator working on reverse Carnot cycle is 5. What is the value of ratio of high temperature and low temperature of the cycle.

OR

9(b) What does HEPA stands for? Why it is used.

10(a) What are primary refrigerants give two examples.

OR

10 (b) Draw layout of components in window air conditioner?

11 (a) Differentiate slot diffuser and ceiling diffuser.

OR

11(b) Differentiate radiation and convection heat transfer

12(a) Draw the layout of summer air conditioning system.

OR

12(b) Draw the layout for domestic refrigerator.

PART – C

*Answer **all** questions. Each question carries **five** marks*

4x 5 M = 20 M

13 (a) Explain reverse Carnot air refrigeration cycle?

OR

13 (b) Explain loop perimeter duct system with a neat sketch.

14 (a) Explain working of thermostatic expansion valve.

OR

14 (b) Explain working of window air conditioner.

15 (a) Explain general air distribution system.

OR

15 (b) Explain individual duct air conditioning system.

16 (a) Explain winter air conditioning system ?

OR

16 (b) Write short notes on clean rooms and dry rooms?

ME-503-COMPUTER AIDED DESIGN AND MANUFACTURING

Course Title:	Computer Aided Design And Manufacturing	Course Code:	ME-503
Semester:	V	Course group :	Core
Teaching Scheme(L:T:P):	4:1:0	Credits:	2.5
Methodology:	Lecture+ Assignment	Total contact Periods:	75
CIE:	60 Marks	SEE:	40 Marks

Prerequisites: Basic knowledge of Computers.

COURSE OUTCOMES

At the end of the course the students will be able to :	
1	Apply computer-aided design (CAD) and manufacturing (CAM) software to create, analyze, and optimize product designs, as well as implement production planning techniques for efficient manufacturing.
2	Evaluate and implement advanced CNC machining techniques for efficiency and flexibility, including programming, cloud integration, and cobot collaboration.
3	Master machining centers and their CNC components for effective operation within Industry 4.0, including maintenance, advanced materials, and IoT integration.
4	Program CNC lathes and mills, covering coordinate systems, machine-specific structures, G/M-codes, canned cycles, subroutines, macros, and automated toolpath generation.
5	Gain expertise in applying CIMS principles, functions, and implementation strategies while evaluating advanced technologies like AI, Big Data, CAI for manufacturing process optimization.
6	Evaluate the components, classifications, and industrial applications of robotic and automation systems (AGVs, ASRS), exploring their integration within CIM and the impact of artificial intelligence on manufacturing capabilities.

COURSE CONTENT AND BLUEPRINT OF MARKS FOR SEE

Unit No	Unit Name	Periods	Questions to be set for SEE(Q No)				Remarks
			R		U	A	
1	Introduction to Computer Aided Design and Manufacturing	13	4	1	9(a)	13(a)	
2	Introduction to NC, CNC and DNC Machines	13					
3	CNC Machines and their Components	12		2	10(a)	14 (a)	
4	CNC Part Programming	13					
5	CIMS, FMS and CAI	12		3	5,6	9(b), 11(a), 11(b)	13(b), 15(a), 15(b)
6	Fundamentals of Robotics and Automation	12					
				7,8	10(b), 12(a), 12(b)	14(b), 16(a), 16(b)	

Legend: R Remembering, U:Understanding A:Applying

COURSE CONTENTS

Unit – 1

INTRODUCTION TO COMPUTER AIDED DESIGN AND MANUFACTURING

Introduction to Computer Aided Design (CAD): Introduction to CAD, Parametric Modeling & Generative Design, Benefits of CAD, Stages of CAD - Simulation Techniques: Introduction to simulation, Types of simulations, Finite Element Analysis (FEA), Digital twins, Virtual reality/augmented reality (VR/AR), applications in design and production.

Introduction to Computer Aided Manufacturing (CAM): Introduction to CAM, Functions of CAM, Benefits of CAM, Fundamentals of Computer Aided Process Planning, CAPP and Types of CAPP : Generative and Retrieval, MRP I, MRP II, ERP, SAP, Comparison of MRP I, MRP II, ERP and SAP.

Unit-2

INTRODUCTION TO NC AND CNC MACHINES

Numerical Control (NC) System: Introduction to Numerical Control (NC) System , Parts of NC System with a block diagram, Advantages and limitations of NC system.

Computer Numerical Control (CNC) Machining: Introduction to CNC, Manufacturing methodology of Modern CNC Machining, Advanced programming techniques, Cloud computing for CNC machines, Classification of CNC Machining centers, Block diagram of

CNC system, Functions of each components of CNC system, Advantages and Disadvantages of CNC over NC, Applications of CNC.

Direct Numerical Control (DNC) systems: Basic concept of DNC, Block diagram of DNC system with basic components, working principle, Concept of DNC system with and without satellite, Functions of DNC, Advantages of DNC - Collaborative robots (cobots) - Comparison between NC, CNC and DNC Machine tools.

Unit-3

CNC MACHINES AND THEIR COMPONENTS

Machining Centers (MC): Types, Construction features of machining centres specification of MC - Components of CNC: Automatic tool changer, working of Tool gripper, tool magazine, types of tool magazines, Automatic pallet changer, Care and maintenance of CNC machines, Spindle drives, feed drives, Slide ways, types with illustrations, Bearings, linear motion bearings, recirculatory ball screws - Advanced materials for reduced friction and wear - Feedback devices - integration with IoT and Industry 4.0 standards - transducers, encoders, linear transducers.

Unit-4

CNC PART PROGRAMMING

Introduction to CNC Lathe and Milling, Steps involved in CNC Lathe and Milling Programming, Types of Part Programs: Manual and Computer Assisted, CNC Part Programming languages Lathe and Milling, CNC coordinate system: NC axis system for milling, drilling and turning, Coordinates referencing methods: Absolute positioning, Incremental positioning, Concept of Fixed point zero, Floating point zero.

NC Part Programming (Lathe & Milling): Structure of NC Part Programming, Standard NC Functions/Words used in NC Part Programming language, Preparatory functions (G Codes): Interpolation and Types, Linear Interpolation, Circular Interpolation, Cutter/Tool Compensation, Miscellaneous functions (M Codes), Part programming formats, Canned cycles in Lathe & Milling, Subroutines in Lathe & Milling, Macros in Lathe & Milling, Example problems on Preparatory functions (G Codes), Miscellaneous functions (M Codes), Canned cycles, Subroutines, Macros in Lathe & Milling - Automated Tool Path Generation.

Unit-5

CIMS, FMS and CAI

Computer integrated manufacturing system: Introduction, Definition of CIM, Various process involved in CIM – CIM Cycle with integration of all functions, Importance, Necessity and features of CIMS, Flexible Manufacturing System (FMS): Definition, Application characteristics of FMS, Need of FMS, Basic Components of FMS, Features of FMS, Advantages of FMS, Limitations of FMS, Computer Aided Inspection: Introduction to CNC-CMM, features, working, advantages of CNC-CMM.

CIM Software's, Big Data, AI, Machine Learning and Edge Computing in CIM, Computer

Aided Inspection (CAI): Introduction, CAI Techniques, Integration of CAI in CIM.

Unit-6

FUNDAMENTS OF ROBOTICS AND AUTOMATION

Robotics: Definition of a robot, necessity, Degrees of freedom (DOF) of Robot, Classification of Robots: Definition of each robot under each classification, Basic Components of a Robotic System, Manipulator and Working, End Effectors: Different Grippers and Tools, Applications of Industrial Robots, Disadvantages, Role of robots in CIM, Artificial intelligence (AI) in robotics,

Automation: Automatic Guided Vehicles: Introduction, process control, Sensors and data acquisition, Simple AGV System, Components of AGV system, Types of AGVs, Automatic Storage and Retrieval System (ASRS): Introduction, Components of ASRS, Advantages of ASRS.

REFERENCE BOOKS:

- Computer Integrated Design and Manufacturing, McGrawHill –BedworthDavid.D
Computer Integrated Manufacturing, PHI – Paul G. Ranky
- Industrial Robotics, PHI–Gordon.N.Mair
- NumericalControlAndComputerAidedManufacturing,TMH–T.K.Kundra,P.N. Rao
- Computer Aided Manufacturing, TMH–T.K.Kundra, P.N.RaoCNCMachines, New Age – B.S. Pabla and M. Adithan
- CAD,CAM,CIM byRadha Krishnan.

SUGGESTED LEARNING OUTCOMES

On completion of the course the student should be able to

1. **Understand the basic concepts of Computer aided Design (CAD) and Computer Aided Manufacturing**
 - 1.1. Define CAD and its role in product design and development.
 - 1.2. Explain the key advantages of using CAD in various industries (e.g., increased precision, design iteration, collaboration).
 - 1.3. List and describe the different stages of the CAD process (conceptualization, modeling, analysis, documentation).
 - 1.4. Explain the principles of parametric modeling and how they are used to create flexible designs.
 - 1.5. Demonstrate basic proficiency in using a CAD software to create simple 3D models.
 - 1.6. Apply parametric modeling techniques to modify and refine 3D models.
 - 1.7. Describe the concept of generative design and identify software tools used for this process.
 - 1.8. Utilize generative design techniques to explore a range of design solutions based on defined constraints.
 - 1.9. Define simulation and explain its importance in the design process.
 - 1.10. Differentiate between various types of simulations (FEA, digital twin, VR/AR).
 - 1.11. Describe real-world applications of simulation techniques in design and production.
 - 1.12. Define CAM and its role in the manufacturing process.

- 1.13. List the primary functions of CAM systems.
- 1.14. Explain the advantages of CAM in manufacturing (e.g., increased efficiency, reduced waste, improved quality).
- 1.15. Describe the basic concepts of Computer-Aided Process Planning (CAPP).
- 1.16. Distinguish between generative and retrieval CAPP systems.
- 1.17. Define Material Requirements Planning (MRP I) and Manufacturing Resource Planning (MRP II).
- 1.18. Describe the key components and functions of MRP I and MRP II systems.
- 1.19. Define Enterprise Resource Planning (ERP) and outline its functions.
- 1.20. Explain SAP and outline its functions.
- 1.21. Construct a table that compares and contrasts MRP I, MRP II, ERP, and SAP.

2. Understand the Concepts of NC, CNC and DNC systems

- 2.1. Define Numerical Control (NC) and explain its basic principles.
- 2.2. Describe the key components of an NC system and illustrate their functions with a block diagram.
- 2.3. List the advantages and limitations of NC systems compared to conventional machining.
- 2.4. Explain the different types of motion control in NC systems (point-to-point, continuous, and contouring), providing examples of their applications.
- 2.5. Define Computer Numerical Control (CNC) and explain how it differs from NC.
- 2.6. Describe the evolution of CNC systems and their impact on manufacturing.
- 2.7. Explain the working principles of a CNC system, including the functions of key components (e.g., controller, machine tool, feedback devices).
- 2.8. Identify the advantages and disadvantages of CNC systems compared to NC systems.
- 2.9. List and describe various applications of CNC machining in different industries.
- 2.10. Define Direct Numerical Control (DNC) and explain its role in manufacturing networks.
- 2.11. Draw a block diagram of a DNC system and label its basic components.
- 2.12. Describe the working principles of DNC systems, including options with and without satellite computers.
- 2.13. List the advantages of using DNC systems in manufacturing environments.
- 2.14. Describe the role of cloud computing in modern CNC machining.
- 2.15. Explain the principles and applications of collaborative robots (cobots) in manufacturing.
- 2.16. Construct a table comparing and contrasting NC, CNC, and DNC systems in terms of features, capabilities, advantages, and limitations.

3. Familiar with the CNC Machines and Components and Attachments

- 3.1. Define the term "Machining Center" and describe its key functions in manufacturing.
- 3.2. Identify the different types of machining centers (e.g., horizontal, vertical, universal) and explain their applications.
- 3.3. Describe the major components of a machining center and illustrate their roles within the system.
- 3.4. Explain the principles behind automatic tool changers (ATCs), including their components and benefits.
- 3.5. Describe different tool magazine types and how they function within an ATC system.
- 3.6. Explain the concept of an automatic pallet changer (APC) and outline its advantages for production efficiency.
- 3.7. Compare and contrast stepper motors and servo motors in CNC applications, focusing on accuracy and suitability for different tasks.

- 3.8. Describe various slide way types used in CNC machines and explain their impact on machine precision.
- 3.9. Explain the function of linear motion bearings and recirculating ball screws in CNC machines.
- 3.10. Identify common feedback devices used in CNC systems and explain their role in closed-loop control.
- 3.11. Describe the different types of transducers (linear and rotary) and explain their applications in CNC position feedback
- 3.12. Outline essential maintenance procedures for CNC machines to ensure optimal performance and longevity.
- 3.13. Identify advanced materials used in CNC components to reduce friction and wear, and discuss their benefits.
- 3.14. Explain how CNC technologies integrate with IoT and Industry 4.0 standards, enabling real-time monitoring and data-driven manufacturing.

4. Familiar with the CNC Part Programming concepts

- 4.1. Understand the basics of CNC Lathe and Milling machines.
- 4.2. Identify the steps involved in programming for CNC Lathe and Milling.
- 4.3. Differentiate between Manual and Computer-Aided Part Programming methods.
- 4.4. Explore various CNC Part Programming languages for Lathe and Milling.
- 4.5. Grasp the concept of CNC Coordinate Systems for Milling, Drilling, and Turning.
- 4.6. Understand Absolute and Incremental Coordinate Referencing methods.
- 4.7. Differentiate between Fixed and Floating Zero Point in CNC machining.
- 4.8. Learn the Structure of NC Part Programs for Lathe and Milling.
- 4.9. Identify Standard NC Functions (G & M Codes) used in Part Programming.
- 4.10. Understand Preparatory Functions (G Codes) and their types (Linear & Circular Interpolation).
- 4.11. Explore the concept of Cutter/Tool Compensation in CNC machining.
- 4.12. Grasp the functionalities of Miscellaneous Functions (M Codes).
- 4.13. Analyze different Part Programming Formats.
- 4.14. Understand Canned Cycles used in Lathe and Milling Programming.
- 4.15. Learn about Subroutines and Macros in Lathe and Milling.
- 4.16. Solve example problems using G-codes, M-codes, Canned Cycles, Subroutines, and Macros.
- 4.17. Understand the concept of Automated Tool Path Generation in CNC machining.

5. Understand the concepts of CIMS, FMS and CAI

- 5.1. Define CIM and understand its role in modern manufacturing.
- 5.2. Explain the CIM cycle, highlighting the integration of various processes.
- 5.3. Analyze the importance, necessity, and key features of CIMS.
- 5.4. Define FMS, its application characteristics, and the need for its implementation.
- 5.5. Identify the basic components and features of a Flexible Manufacturing System.
- 5.6. Evaluate the advantages and limitations of Flexible Manufacturing System.
- 5.7. Explain the concept of Computer-Aided Inspection using CNC Coordinate Measuring Machines.
- 5.8. Analyze the features, working principle, and advantages of CNC-CMM technology.
- 5.9. Identify the role of CIM software, Big Data, AI, Machine Learning, and Edge Computing in a CIM system.
- 5.10. Define Computer-Aided Inspection (CAI) and explore its techniques and integration within CIM.

6. FamiliarwiththefundamentalsofRobots,AutomatedStorageandRetrieval Systems and Automated Guided Vehicles (AGVs).

- 6.1. Define a robot.
- 6.2. Understand the necessity of robots.
- 6.3. Grasp the concept of Degrees of Freedom (DOF) of a robot.
- 6.4. Classify robots and understand the definition of each type.
- 6.5. Identify basic components of a robotic system.
- 6.6. Illustrate manipulator function.
- 6.7. Explore end effectors types (grippers & tools).
- 6.8. Analyze applications of industrial robots.
- 6.9. Understand the disadvantages of industrial robots.
- 6.10. Explore the role of robots in CIM.
- 6.11. Understand Automation: Process control in AGVs.
- 6.12. Understand Automation: Sensors and data acquisition in AGVs.
- 6.13. Describe a simple AGV system and its components along with different AGV types.
- 6.14. Define Automatic Storage and Retrieval System (ASRS), its components, and advantages.

SUGGESTED E RESOURCES / STUDENT ACTIVITIES

- A Visit to a nearest Industry working on CNC Machines.
- Identify various machine tools including CNC and write the report differentiating an ordinary machine tool with CNC machine tool
- Write a part program for producing work pieces like round rods, stepper rods and screwed fasteners etc.
- www.nptel.ac.in
- www.coursera.com

Course Outcomes		CL	Linked PO	Teaching Hours
CO1	Apply computer-aided design (CAD) and manufacturing (CAM) software to create, analyze, and optimize product designs, as well as implement production planning techniques for efficient manufacturing.	U/A	1,2,3,4,5,6,7	13
CO2	Evaluate and implement advanced CNC machining techniques for efficiency and flexibility, including programming, cloud integration, and cobot collaboration.	U/A	1,2,3,4,5,6,7	13
CO3	Master machining centers and their CNC components for effective operation within Industry 4.0, including maintenance, advanced materials, and IoT integration.	U/A	1,2,3,4,5,6,7	12
CO4	Program CNC lathes and mills, covering coordinate systems, machine-specific structures, G/M-codes, canned cycles, subroutines, macros, and automated toolpath generation.	A	1,2,3,4,5,6,7	13
CO5	Gain expertise in applying CIMS principles, functions, and implementation strategies while evaluating advanced technologies like AI, Big Data, CAI for manufacturing process optimization.	U/A	1,2,3,4,5,6,7	12
CO6	Evaluate the components, classifications, and industrial applications of robotic and automation systems (AGVs, ASRS), exploring their integration within CIM and the impact of artificial intelligence on manufacturing capabilities.	A	1,2,3,4,5,6,7	12

CO – PO MATRIX

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	2	1	2	1	2
CO2	2	3	2	2	2	2	1
CO3	2	2	3	2	2	3	1
CO4	2	3	3	3	2	2	1
CO5	2	2	2	2	3	2	2
CO6	2	2	2	2	2	3	2

BOARD DIPLOMA EXAMINATIONS, (C24)

Model Paper : COMPUTER AIDED DESIGN AND MANUFACTURING

Mid Sem-I (CIE)

Time: 1 Hour

Total Marks: 20 M

PART – A

Marks: 4 X 1M = 4M

*NOTE: Answer **all** questions and each question carries **one** mark.*

1. Define CAD
2. Define MRP-II.
3. Write one limitation of the NC System
4. What is the full form of DNC?

PART – B

Marks: 2 X 3M = 6M

*NOTE: Answer **all** questions and each question carries **Three** marks*

- 5(a). Explain the principles of parametric modelling.

Or

- 5(b). List any three advantages of CAPP.

- 6(a). List three different types of motion control in NC systems.

Or

- 6(b). List any three limitations of NC over conventional machining.

PART – C

Marks: 2 X 5M = 10M

*NOTE: Answer **all** questions and each question carries **Five** marks.*

- 7(a). List any five features of CAD packages.

Or

- 7(b). Explain the concept of SAP briefly.

- 8(a). Draw the Block Diagram of the CNC Machining system and label all the components.

Or

- 8(b). List any five advantages of DNC.

BOARD DIPLOMA EXAMINATIONS, (C24)

Model Paper: COMPUTER AIDED DESIGN AND MANUFACTURING

Mid Sem-II (CIE)

Time: 1 Hour

Total Marks : 20 M

PART – A

Marks: 4 X 1M = 4M

*NOTE: Answer **all** questions and each question carries **one** mark.*

1. What is the full form of ATC related to CNC Machining?
2. Write the use of CNC Automatic Pallet Changer.
3. What is the meaning of the 'S2000' CNC word?
4. Mention the functions of G-Codes G00 and G01.

PART – B

Marks: 2 X 3M = 6M

*NOTE: Answer **all** questions and each question carries **Three** marks*

- 5(a). Write any three CNC Machining center components

Or

- 5(b). Specify the function of the CNC Spindle drive

- 6(a). What is T-Word in CNC part programming?

Or

- 6(b). What is circular interpolation in the CNC part program?

PART – C

Marks: 2 X 5M = 10M

*NOTE: Answer **all** questions and each question carries **Five** marks.*

- 7(a). Draw a neat sketch of Automatic Tool Changer (ATC).

Or

- 7(b). Write a short note on the following

- i) Servomotor
 - ii) Stepper motor

- 8(a). Briefly explain the Co-Ordinate Referencing Methods in CNC.

Or

- 8(b). Write the steps involved in CNC Part Programming.

BOARD DIPLOMA EXAMINATIONS, (C24)

SEMESTER END EXAMINATION (SEE)

Model Paper: COMPUTER AIDED DESIGN AND MANUFACTURING

Time: 2 Hours

Total Marks: 40

PART-A

Marks: 8X01=08

Instructions: 1. Answer **ALL** questions.

2. Each question carries **ONE** mark.

1. Mention any three advantages of CAD.
2. Define numerical control. What are the basic components of NC system?
3. What is the full form of ASRS?
4. What is the actuator of a robot?
5. FMS is best suited for?
6. Define CIM and write its role in modern manufacturing.
7. What is a robot?
8. What is the full form of AGV?

PART-B

Marks: 04X03=12

Instructions: 1. Answer any **FOUR** questions.

2. Each question carries **THREE** marks.

9(a). Explain various stages involved in design of a component using CAD.

(or)

9(b). Mention the importance of Computer Integrated Manufacturing System (CIMS).

10(a). How do you call a P2000 Subroutine repeating 6 times in CNC Lathe program?

(or)

10(b). Classify the Robots as per the Degrees of Freedom.

11(a). Mention the importance of Computer Integrated Manufacturing System (CIMS)

(or)

11(b). Define Computer-Aided Inspection (CAI) and write its techniques.

12(a). Write a short note on SCARA Robot.

(or)

12(b). Draw and name the basic components of a robotic system.

PART-C

Marks: 04X5=20

Instructions: 1. Answer any **FOUR** questions.

2. Each question carries **FIVE** marks.

13(a). What is MRP-II? Explain in detail various functions of MRP-II.

(or)

13(b). Draw a neat sketch of CNC-CMM and explain the working procedure of CNC-CMM.

14(a). Explain in detail the procedure involved in computer aided part programming.

(or)

14(b). Draw a neat sketch of a Robot showing Six Degrees of freedom in motion

15(a). Draw a Figure showing the application characteristics of FMS.

(or)

15(b). Explain the role of CIM software, Big Data, AI, Machine Learning, and Edge Computing in a CIM system.

16(a). Classify the Robots as per the Workspace Geometry.

(or)

16(b). Briefly explain the components of the AS/RS system.

ME-504-FLUID POWER SYSTEMS

Course Title:	Fluid Power Systems	Course Code:	ME-504
Semester:	V	Course group:	Core
Teaching Scheme(L:T:P):	4:1:0	Credits:	3
Methodology :	Lecture + Assignment	Total contact periods:	75
CIE:	60 Marks	SEE:	40 Marks

Prerequisites

Basic Knowledge of hydraulics, pneumatics, and control systems

Course Outcome

On successful completion of the course, the students will be able to attain below Course Outcome (CO):

Course Outcome	
CO1	Explain and Evaluate Hydraulic and Pneumatic Pump
CO2	Explain and differentiate Hydraulics motors
CO3	Describe the construction of various directional, Pressure and Flow control valves.
CO4	Hydraulic circuit design and Analysis.
CO5	Understand and explain Actuators
CO6	Design the single Actuator Circuits

Blue Print of Marks for SEE

Unit Name		Questions to be set for SEE Marks					Remarks
		periods	R		U	A	
PART-A	Introduction to hydraulics and pumps	13	Q4	Q1	9(a)	13(a)	
	Hydraulic Motors and Actuators	12					
PART-B	Directional pressure and flow control valves	13		Q2	10(a)	14(a)	
	Hydraulic circuit design and analysis	12					
PART-C	Introduction to pneumatics and actuators	13		Q3	9(b) 11(a) 11(b)	13(b) 15(a) 15(b)	
	Single Actuator circuits	12					
TOTAL		75	10	8	06	06	

COURSE CONTENT

UNIT-I

Introduction to Hydraulics and Hydraulic pumps

Definition and scope of fluid power, Advantages, and drawbacks of fluid power, Applications of fluid power, Components of Fluid power system - Comparison between Hydraulic and Pneumatic Systems, Comparison of Different Power Systems -mechanical, electrical, hydraulic and pneumatic power systems, Future of Fluid power industry - in general and related to India. – Elements of the hydraulic system - Classification of pumps based on Displacement, Delivery and Motion, Positive and Non-positive displacement pumps, Advantages and disadvantages of Non-positive displacement pumps Differences between Positive and Non positive displacement pumps, Classification of positive displacement pumps Pumping Theory, Gear pumps - External and internal gear pumps, Lobe and Screw pumps, Advantages, Disadvantages and applications of the above pumps, Vane pumps - Unbalanced and Balanced vane pumps, Advantages, Disadvantages and applications of vane pumps, Piston Pumps - Axial and Radial Piston Pumps Bent - Axis type and Swash - P Advantages, Disadvantages and applications of vane pumps, plate type piston pumps, Advantages, Disadvantages and applications of piston pumps, Volumetric and Mechanical efficiencies of pumps.

UNIT-2

Hydraulic Actuators

Introduction- Differences between hydraulic pump and motor, Classification of actuators, Types of hydraulic cylinders – Single acting - Gravity return and spring return single acting cylinders, Double-acting - Piston rod on one side and both the sides, Telescope and Tandem cylinders Applications of hydraulic motors, Comparison between hydraulic and electric motors, Classification of hydraulic motors, Gear motors, Vane motors, Piston motors, Semi rotary actuators, Rack & pinion, parallel piston and vane type Theoretical torque, power and flow rate, Volumetric, Mechanical and Overall efficiencies of hydraulic motor. Introduction-, Cylinder force, velocity and power, First, Second, and Third Class lever systems used in cylinders, Cylinder cushions and it's importance.

UNIT-3

Directional, pressure, and Flow control valves

Introduction to valves used in fluid power, Functions of direction control valves, Classification of direction control valves on different criteria, Classification of DCVs based on Fluid Path, Design Characteristics, Control Method, Construction of Internal Moving Parts, Symbols of various direction control valves, Different types of actuators - Manually operated, mechanically operated, Solenoid operated and Pilot operated actuators, Check valve – construction and operation details of Ball type, Poppet, Pilot operated, Two way and Three-way control valves and their applications. Necessity and functions of pressure control valves, Classification of pressure control valves, Pressure relief valves - construction and working of simple and compound (pilot operated) pressure relief valves, Pressure reducing valves, Unloading valves - Direct Acting and Pilot operated unloading valves - construction and operation, Counterbalance valves, Pressure sequence valves, Cartridge valves - Balanced and unbalanced poppet controlled cartridge valves, Applications of pressure control valves. Functions of flow control valves, Classification of flow control valves, Construction and operation of non-pressure compensated and Pressure compensated flow control valves.

UNIT-4

Hydraulic accessories, circuit design, and Analysis

Hydraulic accessories - tanks, coolers and heaters, filters, monitoring elements, and accumulators. Describing the operation of complete hydraulic circuits drawn using graphic symbols for all components, Control of single-acting hydraulic cylinder, Control of double-acting hydraulic cylinder, Regenerative cylinder circuit – expression for the cylinder extending speed, Load carrying capacity during extension, Pump unloading circuit, Double - pump hydraulic circuit, Counterbalance valve application, Hydraulic cylinder sequencing circuit, Cylinder synchronizing circuits - cylinders connected in parallel and series, fail-safe system with overload protection, Two-handed safety system.

UNIT-5

Introduction to Pneumatics and Actuators

Introduction to Pneumatics, Choice working medium and system, Advantages and disadvantages of compressed air, Applications of pneumatics, Basic components of pneumatic systems, Advantages and disadvantages of pneumatic systems, Comparison of

Mechanical / Electrical, Hydraulic and Pneumatic transmission systems Introduction to pneumatic actuators, Types of pneumatic actuators – Linear actuators (pneumatic cylinders), Rotary actuators (Air motors) and Limited angle actuators, Classification of Linear actuators based on, Application for which cylinders are used, cylinder's action, cylinder's movement and cylinder's design, Materials of construction for light, medium and heavy duty cylinders, Single acting cylinders - construction of Diaphragm cylinder, Rolling diaphragm cylinders, Gravity return and Spring return single acting cylinders, Construction of double - acting cylinders with piston rod on one side and both the sides, Telescopic cylinder, Tandem cylinder, Rodless cylinder, Cable cylinder, Sealing band Cylinder with slotted cylinder barrel, Cylinder with Magnetically Coupled Slide, Impact cylinders and Duplex cylinders, Graphic symbols of cylinders, Cylinder Seals - characteristics and classification, Static and Dynamic seals, Different types of cylinders used in cylinders, Working and applications of Air Motor.

UNIT-6

Single Actuator circuits.

Functions of the pneumatic circuits, Direct and indirect control of single-acting cylinders, Control of single-acting cylinder with OR, AND, NOT valves, Direct and indirect control of double-acting cylinders, Control of double-acting cylinders with Supply air - throttling, Exhaust air throttling, Time-dependent controls - Time delay valve NC-type, Time delay valve NO-type.

REFERENCE BOOKS

1. Fluid power with applications by Anthony Esposito - Prentice Hall of India
2. Fluid power control - NPTEL Web Course
3. Pneumatics by SRIHARI RAO
4. Pneumatic controls by FESTO
5. Fluid Power Pneumatics by ALAN H. JOHN
6. Pneumatics by FLIPPO
7. Pneumatics By TTI
8. Hydraulics & Pneumatics by RAY & RAOd
9. Fluid Power & Pneumatics by AUDEL Series

E resources/ suggested student activities

1. <https://www.youtube.com/watch?v=YlmRa-9zDF8> basics
2. <https://www.youtube.com/watch?v=8xd7cWvMrvE> nptel
3. <https://www.youtube.com/watch?v=p7kaKmwc09g> practical examples
4. visit nearby JCB cranes, and tippers identify pneumatic devices and circuits, and prepare a report about their working and their location.

SUGGESTED LEARNING OUTCOMES

On successful completion of the course, the student shall be able to

1. Explain and Evaluate Hydraulics, Pneumatics and Pump

- 1.1 Explain the meaning of fluid power.
- 1.2 List the various applications of fluid power.
- 1.3 Explain pascals law
- 1.4 Differentiate between fluid power and transport systems.
- 1.5 Differentiate between electrical, pneumatic, and fluid power systems
- 1.6 List the advantages and disadvantages of fluid power.
- 1.7 Explain the industrial applications of fluid power.
- 1.8 Introduce the terms hydraulics and pneumatics.
- 1.9 Compare hydraulics and pneumatics
- 1.10 Explain the meaning of Pneumatics.
- 1.11 List the elements of the hydraulic power system.
- 1.12 List types of hydraulic oils used for power transmission
- 1.13 Explain the required properties of hydraulic oil
- 1.14 Understand hydraulic filters and working lines
- 1.15 Identify the type of motors used with hydraulic systems with reasons.
- 1.16 Classify the hydraulic pumps used in the industry.
- 1.17 Differentiate between positive displacement and non-positive displacement pumps.
- 1.18 Explain the working, construction, Advantages, and applications of external gear and internal gear pump.
- 1.19 Explain the working, construction, Advantages, and applications of the balanced vane and unbalanced vane pump
- 1.20 Explain the working, construction, Advantages, and applications of bent-axis piston pumps.
- 1.21 Define the mechanical, volumetric, and overall efficiency of pumps.
- 1.22 Differentiate between internal and external gear pumps.

2 Hydraulics actuators

- 2.1 Explain an actuator
- 2.2 Classify types of actuators – linear, rotary and semi-rotary
- 2.3 List different types of linear actuators
- 2.4 Explain the construction and working of single-acting cylinders and types- gravity return and spring return
- 2.5 Explain the construction and working of double-acting cylinders and types – piston rod on one side and double side
- 2.6 Explain the construction, working, and advantages of a telescopic cylinder
- 2.7 Explain the construction, working, and advantages of tandem cylinder
- 2.8 List types of rotary actuators
- 2.9 Explain the construction and working of gear, vane, and piston motors
- 2.10 Differentiate between a hydraulic motor and a hydraulic pump.
- 2.11 List various applications of hydraulic motors in fluid power.
- 2.12 Explain various types of efficiency terms used in hydraulic motors.
- 2.13 Determine the torque and power delivered by hydraulic motors

- 2.14 Solve problems on calculation of torque and power
- 2.15 List types of semi-rotary actuators Rack & pinion, parallel piston, and vane type
- 2.16 Explain the construction and working of Rack & pinion, parallel piston, and vane-type
- 2.17 Understand various lever systems -1,2 & 3 using hydraulic cylinders and their applications
- 2.18 Explain the importance of cylinder cushioning.

3 Directional, Pressure, and Flow control valves.

- 3.1 List different types of valves used in fluid power.
- 3.2 Classifications of directional control valves based on Construction, number of ports, number of working positions, and actuating methods
- 3.3 Describe the working and construction of 3/2,4/2,5/2 & 5/3 sliding spool valves and their applications.
- 3.4 Define valve overlap
- 3.5 Identify the graphic symbols for various types of direction control valves.
- 3.6 Explain the construction and working of DCV actuating methods.
- 3.7 Explain the working principle of solenoid-actuated valves.
- 3.8 Explain various functions of pressure-control valves like
- 3.9 Explain various classifications of pressure-control valves.
- 3.10 Describe the working and construction of pressure relief and pilot-operated pressure relief valve.
- 3.11 Describe the working, construction, and applications of pressure-reducing
- 3.12 Describe the working, construction, and applications of the unloading valve
- 3.13 Describe the working, construction, and applications of sequence valve
- 3.14 Describe the working, construction, and applications of the counterbalance valve
- 3.15 Understand cartridge valve
- 3.16 Differentiate between a pressure relief valve, a pressure-reducing valve, a sequence valve, and an unloading valve.
- 3.17 Identify the graphic symbols for various types of pressure-control valves.
- 3.18 Explain various functions of flow-control valves.
- 3.19 Explain various classifications of flow-control valves.
- 3.20 Describe the working and construction of various non-compensated flow control valves.
- 3.21 Differentiate between compensated and non-compensated flow-control valves.
- 3.22 Identify the graphic symbols for various types of flow-control valves.
- 3.23 Explain different applications of flow-control valves.
- 3.24 Know the purpose of check valve
- 3.25 Explain the construction and working of spring-loaded and pilot-operated check valves only
- 3.26 Know the purpose and applications of flow dividers

4. Hydraulic accessories, circuit design, and Analysis.

- 4.1 Identify various hydraulic accessories Hydraulic tanks, coolers and heaters, filters, monitoring elements, and energy storage devices (accumulators)
- 4.2 Know the purpose of all accessories mentioned above
- 4.3 Know the types of monitoring elements

- 4.4 Classify different types of accumulator's weight loaded, spring loaded, piston type, bladder type, and membrane type
- 4.5 Explain the construction and working of the above-mentioned accumulators
- 4.6 Identify the graphic symbols for various types of hydraulic components.
- 4.7 Explain various hydraulic circuits to control single-acting and double-acting cylinders.
- 4.8 Explain a regenerative circuit and determine the load-carrying capacities.
- 4.9 Describe the working of a double-pump circuit along with its advantages.
- 4.10 Explain the working of a sequencing circuit and a counterbalancing circuit.
- 4.11 Differentiate between series and parallel synchronization circuits.
- 4.12 Explain the fail-safe circuit with overload protection
- 4.13 Explain two hand safety circuit

5. Understand and explain Actuators.

- 5.1 Explain the meaning of Pneumatics
- 5.2 Describe the various properties desired of an air medium in a pneumatic system
- 5.3 Explain the advantages and disadvantages of compressed air
- 5.4 Identify and appreciate the application of pneumatic systems in various Industries
- 5.5 List the basic components required for a pneumatic system including F-R-L
- 5.6 Explain the construction and working of the filter, regulator, and lubricator
- 5.7 Explain the meaning of Pneumatic Actuator
- 5.8 Classify the various types of Pneumatic actuators. Linear, rotary, and semi-rotary
- 5.9 Explain the construction and working of single-acting cylinders, diaphragm, rolling diaphragm, spring return, gravity return air cylinders
- 5.10 Explain the construction and working of telescopic, tandem, rodless, impact, and duplex air cylinders
- 5.11 Explain the construction and working of double-acting cylinder, single rod, and double rod types
- 5.12 Explain the construction and working of rotary actuators. gear and vane-type
- 5.13 Explain the working and application of air motors
- 5.14 Explain the construction and working of cylinder cushioning
- 5.15 Explain the need and purpose of seals used in the Pneumatic actuators
- 5.16 Types of seals static, dynamic, seals material and characteristics of seals

6. Design the single Actuator Circuits.

- 6.1 Differentiate between pneumatic circuit and pneumatic circuit diagram
- 6.2 State basic rules used in the design of pneumatic circuits
- 6.3 Explain the memory, delay, **OR**, **AND** and **NOT** functions
- 6.4 Explain the direct and indirect control of single-acting cylinder
- 6.5 Explain the direct and indirect control of the double-acting cylinder
- 6.6 Explain the speed control of a single-acting cylinder
- 6.7 Differentiate supply and exhaust air throttling

6.8 Design pressure and time-dependent circuits

Course Outcome			Linked PO	Teaching Periods
CO1	Explain And Evaluate Hydraulic and Pneumatic Pump	R, U, A	1,2,3,7	13
CO2	Explain and differentiate Hydraulics motors	R, U, A	1,2,3,7	12
CO3	Describe the construction of various directional, Pressure and Flow control valves.	U, A	1,2,3,7	13
CO4	Hydraulic circuit design and Analysis.	U, A	1,2,3,7	12
CO5	Understand and explain Actuators	U, A	1,2,3,	13
CO6	Design the single Actuator Circuits	R, U, A	1,2,3,7	12
		Total Sessions		75

○

Legends: R = Remember U= Understand; A= Apply and above levels (Bloom's revised taxonomy)

CO-PO Attainment Matrix:

COURSE OUTCOMES	PROGRAM OUTCOMES						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	2	-	-	-	1
CO2	3	2	3	-	-	-	1
CO3	3	2	3	-	-	-	
CO4	3	3	3	-	-	-	1
CO5	3	2	3	-	-	-	
CO6	3	3	3	-	-	-	1

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Lowly Addressed.

MID SEM-1 EXAM
BOARD DIPLOMA EXAMINATIONS (C21)
MID SEM I, MODEL PAPER
Fluid Power Systems

Time: 1 Hours]

[Total Marks: 20

Instructions: 1. Answer **ALL** questions.

2. Each question carries **ONE** mark.

1. What is the fluid transport system? 04x01=04 M
2. State two applications of fluid power in Automobiles.
3. Why is the actual torque output delivered by the hydraulic motor is less than the calculated theoretical torque?
4. What is the function of a Hydraulic cylinder?

PART-B

02X03=06M

Instructions: 1. Answer any **TWO** questions.

2. Each question carries **THREE** marks.

5. (a) Mention any three differences between the hydraulic system and the pneumatic system.
(or)
5. (b) Define the overall efficiency of a pump. Write an expression for overall efficiency.
6. (a) State the advantages of a Hydraulic motor over an Electric motor.
(or)
5. (b) What is meant by cylinder cushioning?

PART-C

Instructions: 1. Answer any **TWO** questions.

05X02=10M

2. Each question carries **FIVE** marks.

7. (a) Explain the Classification of hydraulic pumps in fluid power systems.
(or)
7. (b) Explain the working and construction of the Vane pump.
8. (a) Explain the third-class lever system used in hydraulic cylinders.
(or)
8. (b) State the formulae for various efficiencies of a moto.?

BOARD DIPLOMA EXAMINATIONS (C21)
MID-SEM II
MODEL PAPER
Fluid Power Systems

Time: 1 Hours]

[Total Marks: 20

- Instructions:** 1. Answer **ALL** questions.
 2. Each question carries **ONE** mark.

04x01=04 M

1. State the function of a pneumatic valve.
2. List any two applications of flow control valves.
3. Draw the graphical symbol for the cooler.
4. Draw the graphical symbol for cylinder - double acting.

PART-B

02X03=06M

- Instructions:** 1. Answer any **TWO** questions.
 2. Each question carries **THREE** marks.

5. (a) Explain various functions of pressure-control valves.
 (or)
5. (b) State the functions of the flow control valve.
6. (a) Draw the graphic symbols for the following (i) Component enclosure (ii) reservoir-vented
 (iii) Reservoir - Pressurized
 (or)
6. (b) What are the factors considered for designing hydraulic circuits?

PART-C

- Instructions:** 1. Answer any **TWO** questions.
 2. Each question carries **FIVE** marks.

05X02=10M

7. (a) Explain the ball-type check valve with a neat sketch.
 (or)
7. (b) Explain the working principle of a solenoid-actuated valve.
8. (a) Explain the protection against overload circuit
 (or)
8. (b) Describe the working of a pump-unloading circuit using a circuit diagram

BOARD DIPLOMA EXAMINATIONS (C18)
SEE-MODEL PAPER
DME– V SEMESTER EXAMINATION
Fluid Power Systems

Time: 2 Hours]

[Total Marks: 40

PART-A

08X01=08

Instructions: 1. Answer **ALL** questions.

2. Each question carries **ONE** mark.

1. Define hydraulic rotary actuator.
2. State the function of a check valve
3. List the types of pneumatic actuators
4. Write the classification of hydraulic motors.
5. State the different power transmission systems.
6. What is a dynamic seal?
7. State the basic rules used in the design of pneumatics.
8. State the function of pneumatic circuits.

PART-B

04X03=12

Instructions: 1. Answer any **FOUR** questions.

2. Each question carries **THREE** marks.

9. (a) List out the types of hydraulic cylinders.
(or)
9. (b) Write a short note on free air and standard air.

10. (a) Explain briefly the functions of the direction control valve.
(or)
10. (b) Why Exhaust air throttling is used for speed control of the double-acting cylinder?
11. (a) State the rules followed in the selection of a working medium in a fluid power system.
(or)
11. (b) Write the advantages of the pneumatic system

12. (a) State the rules used in the design of Pneumatic circuits.
(or)
12. (b) How does a 3/2-way valve work?

PART-C

04X5=20

Instructions: 1. Answer any **FOUR** questions.

2. Each question carries **FIVE** marks.

13. (a) Explain the screw pump with a neat sketch.

(or)

13. (b) What are the basic components of the Pneumatic system? Explain their function

14. (a) Describe the working of the Double-Pump hydraulic system using a circuit diagram.

(or)

14. (b) Explain the Control of a single-acting cylinder with a "NOT" valve.

15. (a) Write briefly about the advantages and disadvantages of compressed air.

(or)

15. (b) State the specific applications of pneumatic systems in various industries.

16. (a) Explain the direct control of the double-acting cylinder

(or)

16. (b) Explain Exhaust air throttling.

AU-515A-AUTOMOBILE ENGINEERING

Course Title:	Automobile Engineering	Course Code:	AU-515A
Semester:	V	Course group :	Elective
Teaching Scheme(L:T:P):	4:1:0	Credits:	2.5
Methodolgy :	Lecture + Assignment	Total contact periods:	75
CIE:	60 Marks	SEE:	40 Marks

Prerequisites: Basic knowledge of Science, Workshop technology, Thermal engineering, theory of Machines.

COURSE OUTCOMES

On successful completion of the course, the students will be able to

Course Outcomes	
CO1	Demonstrate the concept of the basic structure of an Automobile Chassis and Frame
CO2	Aware of the working principle of clutch and Apply the concept of the Transmission system to an Automobile
CO3	Describe the arrangement, and working of the Propeller Shaft and rear axle.
CO4	Explain the detailed working of the front axle and steering system
CO5	Demonstrate the working of wheels and suspension system and compare the characteristics of various tyres.
CO6	Demonstrate the classification of brakes and the working principle of the braking system

Blue Print of Marks for SEE:

Units		No of periods	Questions to be set for SEE				Remarks	
			R		U	A		
Part-A	1.Automobile Chassis and Frame	10	Q4	Q1		Q9(a)	Q13(a)	
	2. Clutch and Transmission system	13						
Part-B	3. Propeller Shaft and rear axle	12		Q2		Q10(a)	Q14(a)	
	4 Front Axle and Steering	13						
Part-C	5. Suspension, wheels and tyres	14		Q3		Q9(b) Q11(a) Q11(b)	Q13(b) Q15(a) Q15(b)	
	6.Brakes	13						
TOTAL		75	08		08	08		

COURSE CONTENT**UNIT-1****No of Periods (L-8,T-2)****Automobile Chassis and Frame**

Automobile components - Basic structure - transmission system, the auxiliaries, the controls, and the superstructure.

Chassis -various types of Chassis, It's construction. The functions of the frame- The loads on frame- frame construction, Materials for frame, Defects in frame- frameless construction.

UNIT-2**No of Periods (L-12,T-1)****Clutch and Transmission system**

Requirements of Clutch, Description of Clutch components - Types of Clutches(friction and fluid clutches only), Mechanical operation of Clutch, Principle of friction clutch - description and working of dry friction clutches, Working of Hydraulically operated single plate clutch.

Transmission system- Function of components, the concept of total resistance to the vehicle motion, Tractive effort, Necessity of transmission, Working of gear boxes-Selector mechanism with the gear lever, Lubrication of the gearbox.

UNIT-3

No of Periods: (L-11, T-1)

Propeller Shaft and rear axle

Functions of the propeller shaft, Construction of the Propeller shaft, Universal joints, The function and operation of a Differential, Arrangement of a live rear axle, Loads on the rear axle, Different methods of supporting rear axle shafts, Difference between semi-floating and full floating rear axle.

UNIT-4

No of Periods: (L-12, T-1)

Front Axle and Steering system

Axle and its Function – Stub axle, Its types, Description of Elliot, Reverse Elliot, Lamoine - Reverse Lamoine -Front wheel stub axle assembly, Steering system- Functions & Requirement of the steering system. Construction and working of steering linkage – the principle of correct steering (simple equation), Steering geometry, Ackerman steering mechanism-Power steering.

UNIT-5

No of Periods: (L-12, T-2)

Suspension, wheels, and tyres:

Suspension- Elements of suspension, Different types of suspension springs- Leaf Springs- Helical Springs and its construction, Construction and working of McPherson and wishbone suspension –Air Suspension, Construction and working of Telescopic shock absorbers. Automobile wheels, their construction and working, Requirements of wheels - Construction, working and comparison of radial, cross-ply and tubed, tubeless tyre - Tyre specifications- Factors affecting tyre life-Wheel Alignment and Balancing.

UNIT-6

No of Periods: (L-11, T-2)

Brakes

Brake- Types of Brakes, transfer of weight during braking operation, wheel skidding and techniques to prevent wheel skidding-Factors influencing braking effect, Mechanical shoe brake, Parking Brake, Hydraulically operated four wheel brake and its working, Air brake system and explain its working in detail. Internal expanding brake - Disc brake- Anti-lock braking system(ABS), Regenerative Brakes System(RBS).

REFERENCE BOOKS

1. Automobile Engineering Vol I, II, Kirpal Singh, Standard Publishers Distributors, Delhi. 2012.
2. Automobile Mechanics, A.K. Babu, S.C. Sharma, Khanna Publications, New Delhi
3. Automobile Engineering R.B.Guptha –
4. Automobile Mechanics William Crouse Tata McGraw hill
5. Automotive Mechanics Joseph Hitner
6. Automotive Engineering, Jain and Asthana, Tata McGraw Hill.
7. Automotive Engineering-G.B.S Narang

8. Automobile Engineering- Kirpalsingh
9. Automobile Engineering- Rajput
10. The motor vehicle- Newton Steeds & Garret
11. Automotive Chassis- P.M. Heldt.

SUGGESTED RESOURCES

1. Automatic Transmission System
https://www.youtube.com/watch?v=u_y1S8C0Hmc
2. Rack & Pinion Steering mechanism.
https://www.youtube.com/watch?v=_L41jg9h-S0
3. Anti-lock braking system(ABS)
<https://www.youtube.com/watch?v=ru4JIZ-x8yo>
4. McPherson & wishbone.
<https://www.youtube.com/watch?v=oZz7RD7KRI0>
5. Wheel Alignment and Balancing.
https://www.youtube.com/watch?v=7d2K_mKgsZ0
6. hydraulically operated four-wheel brake system
<https://www.youtube.com/watch?v=82qBBJ8iwcc>

SUGGESTED STUDENT ACTIVITIES

1. Prepare a list of various major automobile manufacturers of Two-wheelers and four-wheelers in India, along with their specifications.
2. Prepare a report on the Top 10 Car/MUV/2W/Heavy vehicle Manufacturers in India & their sales in last 2 Years.
3. Collect the detailed specifications on the Top 5 models of cars manufactured in India
4. Download technical specifications/ catalogs, videos, or any other suitable presentations on Automobile engines used in four-wheelers
5. Download technical specifications/ catalogs, videos, or any other suitable presentations on Automobile tyres/Power steering/Suspension system
6. Visit to a four- wheeler service station & any automobile manufacturing unit. Prepare handwritten reports on aspects they observed in a service station

SUGGESTED LEARNING OUTCOMES

Upon completion of the course, the student shall be able to

1.0 Introduction to the basic structure of an automobile

- 1.1 Explain various components of an automobile.
- 1.2 Define the basic structure, the power plant, the transmission system, the auxiliaries, the controls, and the superstructure of an automobile.
- 1.3 List types of Chassis construction.
- 1.4 Define functions of frame.

- 1.5 Define loads on the frame.
- 1.6 Explain Frame construction with a neat sketch.
- 1.7 Write various materials for frames
- 1.8 Explain Subframes and defects in frames.
- 1.9 Explain Frameless construction with a sketch.
- 1.10 Explain Engine construction with a neat sketch.
- 1.11 Explanation of stationary and moving parts of the engine

2.0 Clutch and Transmission

- 2.1 Explain the Functions of Clutches.
- 2.2 Know the Requirements of Clutch.
- 2.3 Give a Brief description of the components of the Clutch, clutch plate-clutch facing- pressure plate-springs-Bearings.
- 2.4 Know the Mechanical operation of the clutch.
- 2.5 Illustrate the Main types of clutches (Friction clutch and fluid clutch only).
- 2.6 Understand the Principle of friction clutches - Coefficient of friction, axial pressure (w), and mean radius of contact surfaces(R).
- 2.7 Give Description and working of dry friction clutches-Single plate, multi-plate.
- 2.8 Formulas for Torque transmission for uniform pressure and uniform wear criterion (without derivation)
- 2.9 Simple problems on a single plate and multi-plate friction clutches.
- 2.10 Understand the Working of hydraulically operated single plate clutch
- 2.11 Functions of the transmission system.
- 2.12 Explain the Concept of total resistance to the vehicle motion-Tractive effort-necessity of transmission.
- 2.13 State Working of sliding mesh-constant mesh-Synchromesh gearboxes.
- 2.14 State Working of selector mechanism with gear lever on top of the transmission case
- 2.15 Explain the Lubrication of the gearbox.

3.0 Propeller Shaft and rear axle

- 3.1 Explain the functions of the propeller shaft.
- 3.2 Understand the construction of the propeller shaft with a neat sketch.
- 3.3 Explain various universal joints in automobiles.
- 3.4 Analyse the function and operation of the differential in an automobile.
- 3.5 Understand the general arrangement of a live rear axle.
- 3.6 Give different loads on the rear axle.
- 3.7 Explain Different methods of supporting rear axle shafts with a sketch.
- 3.8 Give the difference between semi-floating and fully floating rear axle

4.0 Front Axle and Steering

- 4.1 Define front axle.
- 4.2 Explain Stub axle-ELLIOT-Reversed ELLIOT-LAMOINE-Reversed LAMOINE-brief description.

- 4.3 Description of front wheel stub axle assembly.
- 4.4 Explain Factors influencing the wheel alignment.
- 4.5 Understand Factors pertaining to wheels -Balance of wheels-Inflation of tyres - Brake adjustment-Concept of Steering geometry - Camber - Kingpin inclination - Combined angle - castor - Toe-in & Toe-out and their effects
- 4.6 Explain Steering linkage - the principle of correct steering angle (without mathematical analysis) simple equation.
- 4.7 Give details of the Ackerman steering mechanism.
- 4.8 Understand the concept of cornering force-self-righting torque.
- 4.9 Understand the concept of under steering & over steering.
- 4.10 Understand the concept of Rack & Pinion Steering mechanism-Power steering

5.0 Suspension systems wheels and tyres

- 5.1 Explain the Suspension system.
- 5.2 Know the Need for a good suspension system.
- 5.3 List elements of the suspension system.
- 5.4 Explain Leaf Springs.
- 5.5 Explain Helical Springs.
- 5.6 Explain the Construction & working of McPherson & wishbone.
- 5.7 Explain the Construction & working of Telescopic shock absorbers.
- 5.8 List types of Automobile wheels.
- 5.9 Explain the construction & working of different Automobile wheels.
- 5.10 Explain the essential requirements of wheels.
- 5.11 Explain the Construction, working & comparison of a radial, cross-ply, and tubed, tubeless tyre.
- 5.12 Give Tyre specifications.
- 5.13 Explain Factors affecting tyre life.
- 5.14 Explain Wheel Alignment and Balancing.

6.0 Brakes

- 6.1 Know the requirements of an automobile brake.
- 6.2 Understand the transfer of weight during braking operation.
- 6.3 Explain wheel skidding and describe techniques to prevent wheel skidding.
- 6.4 Explain various factors influencing the braking effect.
- 6.5 Give Classification of brakes.
- 6.6 Understand mechanical shoe brakes with a neat sketch.
- 6.7 Explain the layout of the hydraulically operated four-wheel brake system with a simple diagram and explain its working in detail.
- 6.8 Explain the schematic diagram showing the layout of the complete air brake system and explain the working of its main units in detail.
- 6.9 Explain the working of disc brakes
- 6.10 Explain about ABS
- 6.11 Explain the working of the Regenerative Braking System.

Legends: R = Remember; U= Understand; A= Apply and above levels (Bloom's revised taxonomy)

CO1	Demonstrate the concept of basic structure of an Automobile Chassis and Frame	R, U	1,5, 7	10
CO2	Aware the working principle of clutch and Apply the concept of Transmission system to an Automobile	R, U, A	1, 5, 7	13
CO3	Describe the arrangement and working of Propeller Shaft and rear axle.	R,U	1,5, 7	12
CO4	Explain the detail working of front axle and steering system	R,U, A	1,5, 7	13
CO5	Demonstrate the working of wheels, Suspension system and compare the characteristics of various types of tyres.	R,U, A	1, 5, 7	14
CO6	Demonstrate the classification of brakes and the details working principle of braking system	R, U, A	1,5, 7	13
			Total Periods	75

CO-PO Attainment Matrix:

COURSE OUTCOMES	PROGRAM OUTCOMES						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2	0	0	0	2	0	3
CO2	3	0	0	0	3	0	3
CO3	3	0	0	0	3	0	3
CO4	3	0	0	0	3	0	3
CO5	3	0	0	0	2	0	3
CO6	3	0	0	0	3	0	3

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Lowly Addressed.

Legend	Remembering (R)	1 Mark
	Understanding (U)	3 Marks
	Application (A)	5 Marks

MID SEM - I
MODEL PAPER
AU-515A- AUTOMOBILE ENGINEERING

Time: 1 Hour

Max. Marks: 20

PART-A

4 X 1 = 4

- Instructions:** 1. Answer **ALL** questions.
2. Each question carries **ONE** mark.
1. Define piston.
 2. List two functions of piston rings
 3. What are the requirements of Clutch
 4. What is the purpose of Clutch

PART-B

2 X 3 = 6

- Instructions:** 1. Answer **ALL** questions.
2. Each question carries **THREE** marks.
5. (a) List various components of an automobile.
OR
5 .(b) What are the different loads on the frame?
 6. (a) List different types of gearboxes.
OR
6(b) What are the functions of the transmission system?

PART-C

2 X 5 = 10

- Instructions:** 1. Answer **ALL** questions.
2. Each question carries **FIVE** marks.
- (7(a) Explain Engine construction with a neat sketch
OR
7(b) Explanation of stationary and moving parts of the engine
 - 8(a) Explain the Working of hydraulically operated single plate clutch
OR
8(b) Explain the working of the Sliding mesh Gearbox with a neat sketch

MID-SEM - II
MODEL PAPER
AU-515A- AUTOMOBILE ENGINEERING

Time: 1 Hour

Max. Marks: 20

PART-A

4 X 1 = 4

Instructions: 1. Answer **ALL** questions.
2. Each question carries **ONE** mark.

1. What is the function of a propeller shaft?
2. What is differential?
3. Define front axle.
4. Write the correct steering angle.

PART-B

2 X 3 = 6

Instructions: 1. Answer **ALL** questions.
2. Each question carries **THREE** marks.
5. (a) Give different loads on the rear axle.

OR

5(b) what are Various universal joints in automobiles

6(a) List the functions of steering mechanism

OR

6(b) What are the requirements of the steering mechanism

PART-C

2 X 5 = 10

Instructions: 1. Answer **ALL** questions.
2. Each question carries **FIVE** marks.

7. (a) Explain Different methods of supporting rear axle shafts with a sketch.

OR

7(b) Give The difference between semi-floating and fully floating rear axle

8(a) Explain the Construction and working of the Power Steering mechanism with a neat sketch.

OR

8(b) Explain the Ackerman steering mechanism.

BOARD DIPLOMA EXAMINATION, (C-21)
SEE-MODEL PAPER
DME– V SEMESTER EXAMINATION
AU-515A- AUTOMOBILE ENGINEERING

Time: 2 Hours

Max. Marks: 40

PART-A

8 X 1 = 8

- Instructions:** 1. Answer **ALL** questions.
2. Each question carries **ONE** mark.
1. List the different types of gearboxes.
 2. Define Kingpin inclination.
 3. List the elements of the suspension system.
 4. List the types of Automobile wheels.
 5. List the factors affecting the tyre life.
 6. What is the Need for a good suspension system?
 7. What are the requirements of an automobile brake?
 8. What is wheel skidding?

PART-B

4 X 3 = 12

- Instructions:** 1. Answer **ALL** questions.
2. Each question carries **THREE** marks.
- 9(a). what are the different types of Chassis construction

OR

9(b) . Explain tubed tyres.

10(a). Explain the construction of the propeller shaft with a neat sketch

OR

10(b). list the types of Excavators.

11 (a) Explain telescopic shock absorbers

OR

11 (b) Explain the elements of the suspension system.

12(a). Give Classification of brakes.

OR

12(b). Explain various factors influencing the braking effect.

.

PART-C

4 X 5 = 20

- Instructions:** 1. Answer **ALL** questions.
2. Each question carries **FIVE** marks.

13 (a). Explain various components of an automobile.

OR

13 (b). explain the wishbone suspension system.

14 (a) Explain the working of the Rack & Pinion Steering mechanism

OR

14 (b) Explain the Anti-lock braking system.

15 (a) Explain the McPherson suspension system..

OR

15 (b) Explain wheel alignment and balancing in a vehicle.

16 (a). Explain mechanical shoe brake with a neat sketch.

OR

16 (b) Explain wheel skidding and describe techniques to prevent wheel skidding.

EE-505B ELECTRIC VEHICLES

Course Title:	Electric Vehicles	Course Code	EE-505B
Semester	V Semester	Course Group	Elective
Teaching Scheme in Periods (L:T:P)	4:1:0	Credits	2.5
Methodology	Lecture + Tutorials	Total Contact Periods	75
CIE	60 Marks	SEE	40 Marks

Prerequisites:

Basic knowledge of Electrical machines, Electric circuit analysis, Power electronic converters, Battery technology, Drive trains, I.C. Engines, and Working principles of automobiles.

Course Outcomes

Upon Successful completion of the course, the student will be able to

CO1 :	Outline the layout of an automobile and the functional parts of an automobile.
CO2 :	Summarize the architecture of the Electric, Hybrid Vehicles and the function of their components.
CO3 :	Illustrate the constructional details of various power sources of electric vehicles and Battery management systems.
CO4 :	Explain the concepts of battery charging and Indian standards for E.V. charging.
CO5 :	Interpret the working of various E.V. motors, drives, and drive controls.
CO6	Summarise the concepts of Renewable energy integration of a charging station, Recycling, and disposal of an Electric vehicle battery and to trouble shoot an electric vehicle.

Course Contents:

UNIT-1: Introduction to Vehicle and its sub Systems

Periods: 10

Definition of an Automobile – General layout of an automobile – Axle and types of axles – Two-wheel drive and four-wheel drive – Frame and Chassis – Introduction to Functional systems of an automobile: Working of 4-stroke I.C.Engines, Cooling system, Lubrication System, Working principle of a friction clutch, Construction and working of single plate clutch and Diaphragm Clutch, Need of gearbox, Working of constant mesh gearbox and synchromesh gearboxes, Propeller shaft and Universal joints, Final drive, Differential, Wheels and Tyres, Steering system, Suspension system, Braking system.

UNIT-2: Introduction to Electric and Hybrid Vehicles

Periods: 10

Introduction to Electric Vehicle(EV) – Hybrid Electric vehicle (HEV) – Plug-in Hybrid Electric vehicle (PHEV) - Types of Electric vehicles based on drive train configuration – Types of HEV series, parallel, series-parallel and Complex - Fuel cell vehicles -Differences between EV and conventional vehicles - Differences between complete EV and Hybrid vehicles - Differences between series hybrid and parallel HEV - Differentiate between a mild hybrid and full hybrid - Benefits of EV including environmental impacts - Types of Transmission: Single speed transmission, Multispeed transmission and Continuously Variable Transmission (CVT) - Single and multi-motor drives in electric vehicles - Operating modes of power flow control in a Series HEV. Parallel HEV, ICE dominated power flow control modes in Series Parallel HEV - Mechanical coupling in Parallel HEV - Types of mechanical coupling – Dual Clutch transmission- Difference between 2WD, 4WD, and AWD.

Unit-3: Battery and Battery Management System

Periods: 10

Introduction to energy storage devices in EV and HEV- main types of batteries used in EVs- Definition of different battery parameters - Lead Acid Battery – Nickel based batteries – Lithium based batteries - Definition of different battery parameters - Effect of Temperature on battery performance - C-Rate parameter - Hybridization of different energy storage devices -Difference between Cell monitoring Controller and battery monitoring Controller - Protective measures for EV batteries - Fuel Cell - Types of fuel cells - Super Capacitor - Super Flywheel based energy storage and it's analysis- EV battery and battery management systems.

UNIT-4: Charging Station and Standards

Periods: 10

Definition and purpose of charging station - Understand AC and DC Charging -Difference between level 1, level 2, and level 3 Chargers - Domestic and Public charging equipment - EV acceptance rate - Onboard and Off-board charging - Power factor correction in an On-Board Charger (OBC) - Types of Level 3 Chargers – Bi-directional charging - Type-1, Type-2 and Type-3 connector - CHAdeMO connector - Combined charging system(CCS) Combo-1 and Combo-2 connectors - Charging time and Charging cost - Peak shaving - Difference between charging station (EVCS) and charging point (EVSE) - Open Charge Point Protocol (OCPP) - Electric Vehicle Supply Equipment (EVSE) - Battery swapping - Wireless charging- Indian Standards for AC and DC Charging.

UNIT-5: EV Motors, Drives, and Drive Control

Periods: 15

Various components of EV and their purpose - Introduce Electric motor as Propulsion unit - Types of Electric motors used in EV- Switching devices – MOSFET - IGBT- Advantages of DC motors over AC - construction and working of BLDC Motors - Induction motor - Permanent magnet Synchronous motor, Switched reluctance motor and their Controllers and Drives.

UNIT-6 EVs and renewable energy (RE) integration, Troubleshooting Periods: 15

Scheduling of EVs for increased RE generation uptake - RE-based EV charging stations
Correlation between EV charging and RE integration - Coordinated operation of EVs and distributed generation - Cost comparison of RE-based EV charging with other alternatives
Maintenance, repairing and services Troubleshooting faults in different EV components (Motor, drive train, battery etc.) - Repairing and rectifying faults in EV motor and components - EV charging device repairing - Battery disposal & Recycling.

Reference Books:

- 1 A Text Book on Modern EV, HEV, and Fuel cell vehicles by Mehرداد, Eshani, Yimin Gao
- 2 Handbook on EV charging Infrastructure Implementation by NITI Ayog, Govt Of India
- 3 NEPTel Notes on Introduction to EV & HEV
- 4 [Electric Vehicle trends - Electrical Installation Guide \(electrical-installation.org\)](http://electrical-installation.org/)
- 5 Electric Vehicles Integrated with Renewable Energy Sources for Sustainable Mobility <https://www.intechopen.com>
- 6 [\(PDF\) A REVIEW ON RENEWABLE ENERGY INTEGRATION FOR ELECTRIC VEHICLES \(researchgate.net\)](https://www.researchgate.net/publication/312111111)

Suggested E-learning references:

1. <https://nptel.ac.in/courses/108/106/108106170/>
2. https://en.wikipedia.org/wiki/Category:Heavy_electric_equipment
3. How does an Electric Car work? | Tesla Model S: <https://www.youtube.com/watch?v=3SAxXUIre28>
4. Tesla Model : <https://www.youtube.com/watch?v=esUb7Zy5Oio>
5. Toyota Hybrid System: <https://www.youtube.com/watch?v=jNuixuVhc5E>
6. Honda Motor Hybrid System Explained: https://www.youtube.com/watch?v=-P_VChMGK8
7. Honda Hybrid E-Drive <https://www.youtube.com/watch?v=QLUIExAnNcE>
8. Audi e-tron Motor Production: <https://www.youtube.com/watch?v=uWBEPEspbWI>
9. BMW Battery Cells Production Assembly Line: <https://www.youtube.com/watch?v=xvaQMTcckSg>
10. How Tesla Builds Cars So Fast: <https://www.youtube.com/watch?v=KqXi6EkCdpQ>

Suggested Learning Outcomes:

Upon completion of the course, the student shall be able to

CO1: Outline the layout of an automobile and the functional parts of an automobile.

- 1.0 Define an Automobile
- 1.1 Draw the general layout of an automobile
- 1.2 Define an axle
- 1.3 List the types of Axle
- 1.4 Differentiate between a live axle and a dead axle
- 1.5 Identify the difference between Two-wheel drive and four-wheel drive
- 1.6 Define a Frame
- 1.7 Define a Chassis
- 1.8 Differentiate between a frame and a chassis
- 1.9 List the Functional systems of an automobile
- 1.10 State the function of each functional component of an automobile
- 1.11 Explain the working of 4-stroke I.C Engines
- 1.12 List the types of cooling systems
- 1.13 Explain the working of the liquid cooling system.
- 1.14 List the types of lubricating systems
- 1.15 Explain the working of the wet sump lubricating system.
- 1.16 Explain the working principle of a friction clutch
- 1.17 Illustrate the construction and working of single plate clutch
- 1.18 Summarise the working of the diaphragm spring clutch
- 1.19 State the need of a gearbox
- 1.20 Interpret the working of constant mesh gearboxes and synchromesh gearboxes
- 1.21 State the function of a Propeller shaft
- 1.22 Explain the need for Universal joints
- 1.23 State the function of the Final drive
- 1.24 Interpret the need of a Differential in an automobile
- 1.25 State the role of wheels in an automobile
- 1.26 List the types of tyres used in an automobile
- 1.27 State the function of the Steering system in an automobile
- 1.28 Explain the need of a Suspension system
- 1.29 List the types of suspension systems used in automobiles
- 1.30 State the need of a brake for an automobile
- 1.31 State the working principle of the braking system.
- 1.32 Draw the layout of a hydraulic braking system.
- 1.33 Explain the construction and working of a hydraulic braking system.

C02 - Summarize the architecture of the Electric, Hybrid Vehicles and the function of their components.

- 2.0 Define an Electric Vehicle (EV)
- 2.1 Define a Hybrid Electric vehicle (HEV)
- 2.2 Define a Plug-in Hybrid Electric vehicle (PHEV)
- 2.3 List the types of Electric vehicles based on drive train configuration
- 2.4 Draw the layout of HEV series, parallel, series-parallel, and Complex
- 2.5 Define a Fuel cell vehicle

- 2.6 State the differences between EV and conventional vehicles
- 2.7 List the differences between complete EV and Hybrid vehicles
- 2.8 Enumerate the differences between series hybrid and parallel HEV
- 2.9 Differentiate between a mild hybrid and a full hybrid
- 2.10 State the benefits of EVs including environmental impacts
- 2.11 Draw the layout of single-speed transmission in Electric vehicles
- 2.12 Explain the concept of single-speed transmission in Electric vehicles
- 2.13 Draw the layout of multi-speed transmission in Electric vehicles
- 2.14 Explain the concept of multi-speed transmission in Electric vehicles
- 2.15 Draw the layout of CVT in Electric vehicles
- 2.16 Explain the concept of CVT in Electric vehicles
- 2.17 Explain the Single and multi-motor drives in electric vehicles
- 2.18 Illustrate the operating modes of power flow control in a Series HEV. Parallel HEV, ICE dominated power flow control modes in a Series-Parallel HEV
- 2.19 State the use of mechanical coupling in Parallel HEV
- 2.20 Explain the types of mechanical coupling in parallel HEV
- 2.21 Summarise the concept of dual-clutch transmission
- 2.22 State the advantages and limitations of 2WD, 4WD and AWD.

C03 - Illustrate the constructional details of various power sources of electric vehicles and Battery management systems.

- 3.1 List the various components of EVs like
 - 3.1i Traction battery pack.
 - 3.1ii DC-DC Converter.
 - 3.1iii Electric motor.
 - 3.1iv Power inverter.
 - 3.1v Charge Port.
 - 3.1vi Onboard charger.
 - 3.1vii Controller.
- 3.2 Know the purpose of each component.
- 3.3 Introduce Electric motor as Propulsion unit.
- 3.4 List various types of Electric motors both AC/DC.
- 3.5 List the advantages of DC motors over AC.
- 3.6 Explain the construction and working of the Induction motor.
- 3.7 Explain the construction and working of the Permanent magnet motor.
- 3.8 Describe the construction and working of the Switched reluctance motor.
- 3.9 List the various energy storage devices like Batteries, Fuel cells, Supercapacitors, and super fly wheels.
- 3.10 Outline the battery terminology like
 - 3.10i Depth of Discharge.
 - 3.10ii Daily Depth of Discharge.
 - 3.10iii Battery State of Charge (BSOC).

- 3.10iv Self-discharge rate.
- 3.10v Charge equalization.
- 3.10vi State of health.
- 3.10vii Calendar life.
- 3.10viii Charge cycle.
- 3.10ix Cycle life.
- 3.10x Battery capacity.
- 3.10xi Internal resistance.
- 3.11 Explain the effect of Temperature on battery performance.
- 3.12 Define the term C-Rate parameter.
- 3.13 List three main types of batteries used in EVs.
- 3.14 Name three types of cathode materials in a lithium-ion battery.
- 3.15 State the advantages/Merits of Lithium batteries as an energy source for EVs.
- 3.16 State the need and concept of Hybridization of various energy sources.
- 3.17 List five types of fuel cells.
- 3.18 Describe the main components of a battery management system.
- 3.19 Differentiate between Cell monitoring Controller and battery monitoring Controller.
- 3.20 Name five protective measures for EV batteries.

CO4 - Explain the concepts of battery charging and Indian standards for E.V. charging.

- 4.1 Definition and purpose of charging station
- 4.2 Identify the difference between AC and DC Charging
- 4.3 Differentiate between level 1, level 2, and level 3 Chargers.
- 4.4 Summarize the domestic and Public charging equipment
- 4.5 Define the term EV acceptance rate.
- 4.6 Differentiate between on-board and off-board charging.
- 4.7 Explain the purpose of power factor correction in an On-Board Charger (OBC)
- 4.8 Comprehend Indian Standards for AC and DC Charging (ex. IS17017).
- 4.9 Describe the principle of bidirectional charging.
- 4.10 List the five basic types of EV connectors.
- 4.11 Identify the types of connectors to plug the charging cable to the vehicle inlet like Type-1, type-2, and type-3 connectors.
- 4.12 Identify the CHAdeMO connector, Combined charging system (CCS) Combo-1 and combo-2 connectors
- 4.13 Calculate charging time and charging cost.
- 4.14 Define the term peak shaving.
- 4.15 Identify the difference between a charging station (EVCS) and a charging point (EVSE)
- 4.16 Explain the purpose of Open Charge Point Protocol (OCPP)
- 4.17 Identify the various parts and working of Electric Vehicle Supply Equipment (EVSE)
- 4.18 State the difference between manual and automated battery swapping.

- 4.19 List the merits and demerits of battery swapping.
- 4.20 Explain the concept of Wireless charging.

CO5 - Interpret the working of various E.V motors, drives, and drive controls.

- 5.1 List the various components of EV and state their purpose
- 5.2 State the role of the Electric motor as a Propulsion unit
- 5.3 List the types of Electric motors used in EV
- 5.4 Name the various Switching devices used in Electric vehicles
- 5.5 Explain the role of MOSFET – IGBT in the drive control of Electric vehicles
- 5.6 Advantages of DC motors over AC motors
- 5.7 Explain the construction and working of BLDC Motors, Induction motors, Permanent magnet Synchronous motors, and Switched reluctance motors.
- 5.8 Explain the working of Electronic Controllers and Drives.

C06 - Summarise the concepts of Renewable energy integration of a charging station, Recycling, and disposal of an Electric vehicle battery and to trouble shoot an electric vehicle.

- 6.1 List and understand various types of renewable energy sources.
- 6.2 Define the term smart grid.
- 6.3 State the need for EV integration with renewable energy.
- 6.4 List the advantages of EV integration with renewable energy.
- 6.5 Identify the safety aspects of EVs.
- 6.6 Summarise the service and maintenance schedules of EVs.
- 6.7 Identify the challenges in EV integration with renewable energy.
- 6.8 Explain EV integration with Wind energy.
- 6.9 Explain EV integration with solar energy.
- 6.10 State the term EV coordination.
- 6.11 Identify the battery faults like
 - a. Overcharge and Over-discharge
 - b. Overheating and undercooling
 - c. Short circuit or open circuit of the inner cell
- 6.12 State the steps to identify a dead battery
- 6.13 Explain the procedure to dispose of a dead battery disposal.
- 6.14 Illustrate the methods adopted for recycling a dead battery.
- 6.15 Identify the drive motor faults.
- 6.16 State the procedure for the identification of software problems.
- 6.17 State the method to use OBD (On-board diagnostics) and scanning tools for OBD.
- 6.18 Explain the methods available for Remote diagnostics.
- 6.19 Explain the process to identify various Power electronics faults.

CO-PO Matrix

CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1
CO 1	Outline the layout of an automobile and the functional parts of an automobile.	3	2	1	-	-	-	2	2
CO 2	Summarize the architecture of the Electric, Hybrid Vehicles and the function of their components.	2	1	-	-	-	-	2	1
CO 3	Illustrate the constructional details of various power sources of electric vehicles and battery management systems.	3	2	-	-	1	1	2	-
CO 4	Explain the concepts of battery charging and Indian standards for E.V. charging.	3	2	1	-	3	1	3	-
CO 5	Interpret the working of various E.V. motors, drives, and drive controls.	3	2	1	-	1	1	2	-
CO 6	Summarise the concepts of Renewable energy integration of a charging station, Recycling, and disposal of an Electric vehicle battery and to trouble shoot an electric vehicle.	1	1	1	-	2	-	2	3

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Lowly Addressed.

OVERVIEW OF CONTINUOUS INTERNAL EVALUATION

Mid Semester Examination-1

Max.Marks: 20

Mid Semester Examination I				Maximum Marks: 20	
S.No	Unit	R	U	A	Remarks
1	Unit-I	1, 2	5(a)	7(a)	
			5(b)	7(b)	
2	Unit-II	3, 4	6(a)	8(a)	
			6(b)	8(b)	
Total Questions		4	4	4	

Mid Semester Examination-2**Max.Marks: 20**

S.No	Unit	R	U	A	Remarks
1	Unit-III	1, 2	5(a)	7(a)	
			5(b)	7(b)	
2	Unit-IV	3, 4	6(a)	8(a)	
			6(b)	8(b)	
Total Questions		4	4	4	

Internal Assessment**Max.Marks: 20**

Type of test	Unit	Marks allotted	Remarks
Slip Test 1	1 and 2	5	2 Essay Questions out of 3 Questions
Slip Test 2	3 and 4	5	2 Essay Questions out of 3 Questions
Assignment	Anyone Unit	5	Questions will be issued to the individual or to a group at the discretion of the faculty.
Seminar		5	Any topic approved by the faculty

Blue Print of Marks for SEE:

Unit No	Unit Name	Periods	Questions to be set for SEE				
			R		U	A	
1	Introduction to Vehicle and it's sub Systems	10	Q4	Q1		Q9(a)	Q13(a)
2	Introduction to Electric and Hybrid Vehicles	15					
3	Battery and Battery Management Systems.	10		Q2		Q10(a)	Q14(a)
4	Charging Station and Standards	15					
5	E.V Motors, Drives and Drive Control	10		Q3		Q9(b), Q11(a), Q11(b)	Q13(b), Q15(a), Q15(b)
6	EV's and Renewable energy integration, Troubleshooting	15					
Total		75	8		8	8	

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TELANGANA
EE-505B, ELECTRIC VEHICLES
MID-SEM -I MODEL PAPER

TIME: 60 min

TOTAL MARKS: 20

Important Note: Wherever any question has a choice, marks will be allotted only to the first attempted question. No marks will be allotted for extra questions answered.

PART – A

Marks: 4Q X 1= 04

Instructions: (1) Answer all questions. (2) Each question carries One mark.

1. Define an Automobile.
2. Define a Chassis.
3. Define EV?
- 4 Define a Fuel Cell Vehicle.

PART – B

Marks: 2Q X 3= 06

Instructions:(1) Answer all questions.(2) Each question carries Three marks.

5(a) List the Functional systems of an automobile.

----OR----

5(b) List the Types of Cooling systems.

6(a) List the types of Electric vehicles based on drive train configuration.

----OR----

6(b) State the use of mechanical coupling in Parallel HEV.

PART – C

Marks: 2Q X 5= 10

Instructions: (1) Answer all questions. (2) Each question carries Five marks.

7(a) State the function of the Steering system in an automobile

----OR----

7(b) Draw the layout of a hydraulic braking system.

8(a) Draw the layout of HEV series, parallel, series-parallel, and Complex

----OR----

8(b) Differentiate between a mild hybrid and a full hybrid.

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TELANGANA
EE-505B, ELECTRIC VEHICLES
MID SEM -II MODEL PAPER

TIME: 60 min

TOTAL MARKS: 20

Important Note: Wherever any question has a choice, marks will be allotted only to the first attempted question. No marks will be allotted for extra questions answered.

PART – A

Marks: 4Q X 1= 04

Instructions: (1) Answer all questions
(2) Each question carries One mark.

1. State the purpose of Traction Battery Pack
2. State about Depth of Discharge.
3. Define the purpose of the Charging Station.
4. Define the term EV acceptance rate.

PART – B

Marks: 2Q X 3= 06

Instructions: (1) Answer all questions
(2) Each question carries **Three** marks.

5(a) List the types of Electric motors AC/DC

----OR----

5(b) List the advantages of DC motors over AC.

6(a) Understand AC and DC Charging

----OR----

6(b) List the five basic types of EV connectors

PART – C

Marks: 2Q X 5= 10

Instructions: (1) Answer all questions
(2) Each question carries **Five** marks.

7(a) Explain the construction and working of a Permanent magnet motor

----OR----

7(b) Differentiate between Cell monitoring Controller and battery monitoring Controller,

8(a) Explain the purpose of power factor correction in an On-Board Charger (OBC)

----OR----

8(b) Explain the purpose of Open Charge Point Protocol (OCPP)

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TELANGANA
EE-505B, ELECTRIC VEHICLES
SEE MODEL PAPER

TIME: 60 min

TOTAL MARKS: 40

Important Note: Wherever any question has a choice, marks will be allotted only to the first attempted question. No marks will be allotted for extra questions answered

PART – A

Marks: 8Q X 1= 08

Instructions: (1) Answer all questions
(2) Each question carries One mark.

1. State the need for a gearbox
2. List any two main types of batteries used in EVs
3. State any two maintenance schedules of EVs.
4. State about Charge Cycle.
- 5 List any Two components of EV.
6. List the Types of Electric motors used in EV
7. Define the Smart Grid
8. State the term EV Co-ordination

PART – B

Marks: 4Q X 3= 12

Instructions:(1) Answer Any **Four** questions
(2) Each question carries **Three** marks.

9(a) Enumerate the differences between series hybrid and parallel HEV

----OR----

9(b) Advantages of DC motors over AC motors

.

10(a) Name five protective measures for EV batteries

----OR----

10(b) State the need for EV integration with renewable energy

11(a) State the role of the Electric motor as Propulsion unit

----OR----

11(b) Explain about two components used in EV

12(a) Describe the challenges associated with integrating Electric vehicles with renewable energy sources

----OR----

12(b) How an overcharging and overheating impact the performance and safety of EV

PART – B

Marks: 4Q X 5= 20

Instructions: (1) Answer Any **Four** questions

(2) Each question carries **Five** marks.

13(a) Explain the construction and working of single plate clutch

----OR----

13(b) Explain the role of MOSFET – IGBT in the drive control of Electric vehicles

.

14(a) List any five differences between a charging station (EVCS) and a charging point (EVSE).

----OR----

14(b) Explain EV integration with Wind energy

15(a) Explain the construction and working of BLDC Motors

----OR----

15(b) Explain the construction and working of a Permanent magnet Synchronous motor,

16(a) Summarise the service and maintenance schedules of EV

----OR----

16(b) Explain the procedure to dispose of a dead battery disposal.

ME-506A INTRODUCTION TO ARTIFICIAL INTELLIGENCE

Course Title	Introduction to Artificial Intelligence	Course Code	ME-506A
Semester	V Semester	Course Group	Elective
Teaching Scheme in Hrs(L:T:P)	4:1:0	Credits	2.5
Methodology	Lecture + Tutorial	Total Contact Periods	75
CIE	60 Marks	SEE	40 Marks

Pre requisites

Knowledge of Mathematical and Logical skills.

Course Outcomes

Upon completion of the course the student shall be able to

Course Outcome	
CO1	Understand the basic concepts of Artificial Intelligence
CO2	Apply the Probability functions for solving AI Problems.
CO3	Illustrate the concept of Problem state space representation and Searching
CO4	Apply various Knowledge representation and Inference Techniques
CO5	Apply various AI techniques to Game playing
CO6	Apply Reasoning under uncertainty methods for AI problems

Course Content

1. Introduction to Artificial Intelligence

Duration: 15 Periods (Theory: 13, Tutorial: 2)

Artificial Intelligence - definition, features & limitations, types of AI, applications, challenges, Building blocks of AI, - Domains of Learning. Areas of AI - Expert Systems, Deep Learning, Computer Vision, Natural Language processing, Robotics, AI Ethics and Safety.

2. Mathematics Foundation to Artificial Intelligence

Duration: 12 Periods (Theory: 10, Tutorial: 2)

Introduction to Probability - State the Importance of Probability to AI - Conditional Probability - Multiplication rule of Probability - Probability Distribution - Random Variables - Bernoulli Trails and Binomial Distribution

3. Problems and State Space Search Methods in AI

Duration: 17 Periods (Theory: 15, Tutorial: 2)

Percept and Rationality - Agents and type of Agents - Environment and types of Environment.
Problem as a State Space Search – Problem Characteristics – production system –
Searching problems, solutions – Un-informed Searching strategy - Breadth First Search, Depth
First Search, Informed Searching strategy - Hill climbing.

4. Knowledge Representation, Logic and Inference

Duration: 10 Periods (Theory: 8, Tutorial: 2)

Knowledge representation - types of Knowledge - Knowledge representation issues - **Propositional logic, Rules of Inference**, First Order Logic, Inference in First Order Logic, Unification in First Order Logic, Horn Clause, Definite Clause, Backward and Forward chaining.

5. Games and AI

Duration: 10 Periods (Theory: 8, Tutorial: 2)

Importance of AI for Games - Game theory - Types of Games - Game Tree, Min max algorithm – Alpha_Beta Pruning Algorithm - Evaluation function - Algorithm for a Tic Tac Toe game.

6. Reasoning under Uncertainty and AI Applications

Duration: 15 Periods (Theory: 13, Tutorial: 2)

Reasoning under Uncertainty – Methods for handling uncertainty, Probabilistic Reasoning, Bayes Belief Network.

Solve basic AI problems: Water jug problem, 8-Queen problem.

Applications of AI: Robotics, Automotives, E-commerce, Education, Agriculture, Healthcare, Astronomy, Gaming, Finance, Social Media.

Recommended Books

1. Artificial Intelligence, 3rd Edn, E. Rich and K.Knight (TMH)
2. Artificial Intelligence, A Modern Approach, 3rd Edition, S. Russell, Peter Norvig, PHI.
3. Artificial Intelligence, 3rd Edn., Patrick Henry Winston, Pearson Education
4. Artificial Intelligence, Shivani Goel, Pearson Education.
5. Artificial Intelligence and Expert systems – Patterson, Pearson Education

Recommended Web Resources:

1. <https://www.javatpoint.com/artificial-intelligence-tutorial>
2. www.w3schools.com
3. <http://github.com>

Specific Learning Outcomes:

Upon completion of the course the student shall be able to

CO1: Understand the basic concepts of Artificial Intelligence

- 1.1 Define Artificial Intelligence
- 1.2 List the features of Artificial Intelligence
- 1.3 Identify the limitations of Artificial Intelligence
- 1.4 List the Types of AI
- 1.5 Define Artificial Narrow Intelligence
- 1.6 Define Artificial General Intelligence
- 1.7 Define Artificial Super Intelligence
- 1.8 List Applications of AI
- 1.9 Identify the Challenges of AI
- 1.10 Demonstrate building blocks of AI
- 1.11 Explain the Domains of Learning
- 1.12 Define Turing Test
- 1.13 Illustrate Intelligent behavior of a machine using Turing Test
- 1.14 List different areas / domains of AI
- 1.15 Define Expert System
- 1.16 List different Expert Systems
- 1.17 Define Computer Vision
- 1.18 List main features of Computer Vision
- 1.19 Define Deep Learning
- 1.20 Define Natural Language Processing
- 1.21 Demonstrate how NLP works

CO2: Apply the Probability functions for solving AI Problems

- 2.1 List the Importance of Probability
- 2.2 Define Sample Space
- 2.3 Define Event
- 2.4 Show the Importance of Probability to AI
- 2.5 Illustrate Conditional Probability with Simple Problems
- 2.6 Illustrate Multiplication theorem on probability with Simple Problems
- 2.7 Illustrate Independent Events, Total Probability with Simple Problems
- 2.8 Illustrate Bayes' Theorem with Simple Problems
- 2.9 Define Probability Distribution
- 2.10 Demonstrate Random Variables and its Probability Distribution
- 2.11 Explain Bernouli Trails and Binomial Distribution with examples
- 2.12 Define Discrete Probability Distribution
- 2.13 Define Continuous Distribution
- 2.14 Define Joint Distribution
- 2.15 Define Multivariate Distribution

CO3: Illustrate the concept of Problem state space representation and Searching

- 3.1 Define Percept and Rationality
- 3.2 Demonstrate Agents and type of Agents
- 3.3 Define Environment
- 3.4 List the types of Environment

- 3.5 Define the problems as a state space search.
- 3.6 List the Problem Characteristics.
- 3.7 Define the production system.
- 3.8 Demonstrate the Production systems.
- 3.9 List the Features of Production system.
- 3.10 Explain about Searching problems, solutions
- 3.11 Define Un-informed Searching strategy.
- 3.12 Define Informed Searching strategy
- 3.13 Define Breadth First Search
- 3.14 Illustrate the Breadth First Search with an example
- 3.15 Define Depth First Search
- 3.16 Define Hill climbing
- 3.17 Illustrate the Hill Climbing with an example
- 3.18 Compare Breadth First Search and Depth First Search
- 3.19 List the problems suitable for BFS, DFS and Hill Climbing

CO4: Apply various Knowledge representation and Inference Techniques

- 4.1 Define Knowledge Representation
- 4.2 List the types of Knowledge Representation
- 4.3 Summarize different types of Knowledge representations
- 4.4 Define Declarative Knowledge, Procedural Knowledge, Meta Knowledge, Heuristic Knowledge, Structural Knowledge
- 4.5 What is the difference between Knowledge and Intelligence
- 4.6 Identify the requirements for Knowledge representation system.
- 4.7 Identify the issues in Knowledge Representation
- 4.8 Demonstrate the AI Knowledge Cycle
- 4.9 List different approaches to Knowledge representation
- 4.10 Define a Proposition
- 4.11 List the different Logical Connective in Proposition logic
- 4.12 Illustrate converting simple facts into proposition logic
- 4.13 List and explain propositional equivalences with examples
- 4.14 Define First Order Logic / Predicate Logic
- 4.15 List and explain basic Elements of first order logic
- 4.16 List and explain different Quantifiers in first order logic
- 4.17 Demonstrate how to convert statements into First Order logic
- 4.18 Illustrate inference in First order logic
- 4.19 Define Unification in FOL
- 4.20 Define Horn Clause
- 4.21 Define Definite Clause
- 4.22 Demonstrate Forward Chaining method with an example
- 4.23 Demonstrate Backward Chaining method with an example
- 4.24 Compare Forward Chaining with Backward Chaining

CO5: Apply various AI techniques to Game playing

- 5.1 What is the Importance of AI in Gaming Industry
- 5.2 List the applications of AI in Gaming Industry
- 5.3 List out the limitations of AI in Gaming Industry

- 5.4 List different types of Games according to Game theory
- 5.5 Define Game Tree.
- 5.6 Illustrate formalization of Game as State Space representation
- 5.7 How to represent Tic-Tac-Toe Game as Game Tree.
- 5.8 Define Min-Max Algorithm.
- 5.9 Illustrate Min-Max Algorithm and its working with an example.
- 5.10 Define Alpha_Beta Pruning algorithm.
- 5.11 Illustrate Alpha_Beta Pruning Algorithm and its working with an example.

CO6: Apply Reasoning under uncertainty methods for AI problems

- 6.1 Define Reasoning under uncertainty
- 6.2 List the causes of uncertainty
- 6.3 List the method for handling uncertainty
- 6.4 Define Probabilistic Reasoning
- 6.5 Define conditional and unconditional probabilities
- 6.6 Define chain rule
- 6.7 Apply Bayes rule for Inference
- 6.8 Define Bayes Belief Network
- 6.9 Illustrate Bayes Belief Network with an example
- 6.10 Demonstrate solution of Water Jug Problem
- 6.11 Demonstrate solution of 8-Queen problem
- 6.12 Demonstrate the application of AI in the areas such as
 - a. Robotics
 - b. Automotives
 - c. E-Commerce
 - d. Education
 - e. Agriculture
 - f. Healthcare
 - g. Astronomy
 - h. Gaming
 - i. Finance
 - j. Social Media

Suggested Student Activities

Note: The following activities or similar activities for assessing 2.5 credits (Any one)

Student activity like mini-project, quizzes, etc. should be done in group of 5-10 students.

1. Each group should do any one of the following type of activity or any other similar activity related to the course with prior approval from the course coordinator and program coordinator concerned.
2. Each group should conduct different activity and no repetition should occur.
3. Explore and analyse topics to improve the level of creativity and analytical skill by taking Quiz/ tests/ assignments. Documents have to be maintained as a record.
4. Create a power point presentation on the topic relevant to course or advanced topic as an extension to the course to improve the communication skills. Documents have to be maintained as a record.
5. Visit different sites relevant to topics. Listen to the lectures and submit a handwritten report
6. Coding competitions.

CO-PO Mapping Matrix:

	Basic and Discipline Specific Knowledge	Problem Analysis	Design/Development of Solutions	Engineering Tools, Experimentation and Testing	Engineering Practices for Society, Sustainability and Environment	Project Management	Lifelong Learning	Linked PO
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	
CO1	2						1	1,7
CO2	2	1	1				1	1,2,3,7
CO3	2	2	1				1	1,2,3,7
CO4	2	2	1				2	1,2,3,7
CO5	2	2	1				2	1,2,3,7
CO6	2	2	1				2	1,2,3,7

MODEL QUESTION PAPER
DIPLOMA BOARD MID SEM-I SEMESTER EXAMINATIONS (C-24)
ME-506A Introduction to Artificial Intelligence

Duration : 1 Hour

Maximum Marks: 20

PART-A

Instructions: (1) Answer all questions.

4x1 = 4 Marks

(2) Each question carries one mark.

1. Define Artificial Intelligence
2. List any two applications of AI
3. Define Probability
4. Define Sample Space

PART-B

2×3=6 Marks

Instructions: (1) Answer one question each from 5 and 6

(2) Each Question is of internal choice type

(3) Each question carries three marks

5 (a). Explain evolution of Artificial Intelligence

OR

5 (b). Explain Different Stages of AI

6 (a). Explain Conditional Probability with an Example.

OR

6(b). Explain Independent Events with an Example

PART-C

2×5=10 Marks

Instructions: (1) Answer one question each from 7 and 8.

(2) Each Question is of internal choice type

(3) Each question carries five marks.

7(a). Explain any five challenges due to use of Artificial Intelligence

OR

7(b). Illustrate Intelligent behavior of a machine using Turing test.

8 (a). In a school, there are 1000 students, out of which 430 are girls. It is known that out of 430, 10% of the girls study in class XII. What is the probability that a student chosen randomly studies in Class XII given that the chosen student is a girl?

OR

8 (b). An urn contains 10 black and 5 white balls. Two balls are drawn from the urn one after the other without replacement. What is the probability that both drawn balls are black?

MODEL QUESTION PAPER
DIPLOMA BOARD MID SEM-II SEMESTER EXAMINATIONS
ME-506A Introduction to Artificial Intelligence

Duration : 1 Hour

Maximum Marks: 20

PART-A

Instructions: (1) Answer all questions.

4x1 = 4 Marks

(2) Each question carries one mark.

1. Define Agent
2. List any two types of Environments.
3. Define Horn Clause
4. Define Proposition

PART-B

2×3=6 Marks

Instructions: (1) Answer one question each from 5 and 6

(2) Each Question is of internal choice type

(3) Each question carries three marks

5a. Explain any two types of Environments

OR

5b. Explain BFS algorithm

6a. Demonstrate Forward Chaining method

OR

6b. How AI is utilized in Natural Language Processing.

PART-C

2×5=10 Marks

Instructions: (1) Answer one question each from 7 and 8.

(2) Each Question is of internal choice type

(3) Each question carries five marks.

7a. Explain types of Agents

OR

7b. Explain Hill Climbing Algorithm

8a. Illustrate Backward chaining with an example

OR

8b. Demonstrate how convert simple facts into propositional logic.

BOARD DIPLOMA SEMESTER END EXAMINATION

ME-506A Introduction to Artificial Intelligence

Duration : 2 Hours

Marks: 40

PART-A

Instructions: (1) Answer all questions.

8x1 = 8 Marks

(2) Each question carries one mark.

1. What is Turing Test?
2. Define discrete probability distribution.
3. Define Deep Learning
4. Define uninformed search strategy
5. Define Predicate Logic
6. Define knowledge representation.
7. List any two forms of Learning
8. Define Horn Clause

PART-B

Instructions: (1) Answer *one* question each from 9,10,11 and 12.

4 x 3 =12 Marks

(2) Each Question is of internal choice type

(3) Each question carries three marks.

9(a). How AI is utilized in Natural Language Processing.

OR

9(b). How to structure facts and representations?

10(a). List the conditions to be satisfied by Bernoulli trials.

OR

10(b). Define Clustering. Give Example for Clustering

11(a). Write about instance and ISA relationship.

OR

11(b). How to represent simple fact in logic? 12(a).

Define Classification and give examples.

OR

12(b). Define Activation function. List various activation functions.

PART-C

Instructions: (1) Answer one question each from 13,14, 15 and 16. 4×5=20 Marks

(2) Each Question is of internal choice type

(3) Each question carries five marks

13(a). Explain how to use Google teachable machine

OR

13(b). Explain Issues in Knowledge Representation.

14a. Ten eggs are drawn successively with replacement from a lot containing 10% defective eggs. Find the probability that there is at least one defective egg.

OR

14b. Demonstrate Min-Max Algorithm.

15a. Explain various approaches for knowledge representation.

OR

15b. Explain types of Knowledge.

16a. Demonstrate solution of Water jug problem.

OR

16b. Explain any Five applications of AI.

ME-506B-MECHATRONICS

Course Title:	Mechatronics	Course Code:	ME-506B
Semester:	V	Course group :	Elective
Teaching Scheme(L:T:P):	4:1:0	Credits:	2.5
Methodology :	Lecture + Assignment	Total contact periods:	75
CIE:	60 Marks	SEE:	40 Marks

Prerequisites: Knowledge of Basic Science and Engineering

COURSE OUTCOMES

On successful completion of the course, the students will be able to

CO1	Illustrate the importance of Mechatronics with control systems, mathematical models and engineering systems.
CO2	Describe the different sensors with applications
CO3	Describe different various Drives, Actuators and Controllers
CO4	Illustrate Programmable Logic Controller (PLC) Controllers with different Programming Languages
CO5	Design a Mechatronic system for a given application using sensors, actuators, drives and Controllers
CO6	Describe the Kinematics of Robot with Trajectory planning

Blue Print of Marks for SEE:

Units		No of periods	Questions to be set for SEE				Remarks	
			R		U	A		
Part-A	1. Introduction to Mechatronics	12	Q4	Q1	Q9(a)	Q13(a)		
	2. Sensors and applications	13						
Part-B	3. Drives, Actuators and Controllers	12		Q2	Q10(a)	Q14(a)		
	4. Programmable Logic Controller (PLC)	13						
Part-C	5. Design of Mechatronic systems	13		Q3	Q5 Q6	Q9(b) Q11(a) Q11(b)	Q13(b) Q15(a) Q15(b)	
	6. Robot kinematics	12						
TOTAL		75	08		08	08		

COURSE CONTENT

7. Introduction to Mechatronics:

Importance of Mechatronics – Mechatronic System - Measurement system - Control system and their types: Open and Closed-loop control.

System Model: Mechanical Systems: Rotational, Translational Systems - Hydraulic and Pneumatic Systems - Fluid Systems - Thermal Systems – Electrical Systems - Electro-Mechanical System - System Modeling methods/techniques/approaches. Introduction to Mathematical model - Mechanical System building blocks - Electrical System building blocks - Fluid System building blocks -Thermal System building blocks.

8. Sensors and Applications:

Sensors characteristics,; Principles and Applications of the following types of sensors: Position sensors (Encoders, Resolvers) - Range sensors (Triangulation Principle, Structured lighting approach) - Velocity sensors - Acceleration sensors- Torque sensors - Proximity sensing - Lighten infrared sensors -Touch and Tactile sensors - Temperature,

Pressure and Flow transducers - Resistive - Inductive and Capacitive sensors - Industrial Applications.

9. Drives, Actuators and Controllers

Actuators: Hydraulic - Pneumatic and Electrical drives - Linear actuator - Rotary drives: AC servo motor - DC servo motors and Stepper motors - Conversion between linear and rotary motion - switching devices (Relay, Metal Oxide Semiconductor Field Effect Transistor (MOSFET) and Insulated Gate Bipolar Transistor (IGBT)), Solenoids – microcontroller and interfacing.

10. Programmable Logic Controller (PLC)

Definition - Basic block diagram and structure of PLC - Input/output processing - PLC Programming: Ladder diagram - its logic functions - Latching and Sequencing - PLC mnemonics – Timers - Internal relays and Counters - Shift registers - Master and Jump Controls - Data handling - Analog input/output - Selection of PLC - types of PLC- Case studies

11. Design of Mechatronic systems

Design process stages - Traditional Vs Mechatronics designs - possible design solutions - Case studies of Mechatronics systems: pick-and-place pneumatic system - automatic car parking system - Car engine management system - Automatic Washing Machine, CNC based manufacturing systems.

12. Robot kinematics

Kinematic Pair – Classification, Types, Examples, Degrees of freedom, Differences of closed loop and open loop mechanism, Grubler's rule to find the degrees of freedom of kinematic link with examples - Degrees of freedom of robot – Definition of Forward Kinematics and Inverse Kinematics; Mathematical Expressions for Forward Kinematics and Inverse Kinematics of planar manipulator of Two Degrees of Freedom with rotary joints using geometric and algebraic approach - Simple Problems on planar manipulator with two rotary joints. Difference between Trajectory Vs. Path – Cubic polynomial trajectory – Displacement, Velocity and Acceleration of a joint with one degree of freedom.

Text Books:

1. S.K.Saha, "Introduction to Robotics", Second Edition, McGraw Hill Education (India) Private Limited, New Delhi, 2014.
2. Mikell P Groover, Nicholas G Odrey, Mitchel Weiss, Roger N Nagel, Ashish Dutta, "Industrial Robotics, Technology programming and Applications", McGraw Hill, 2012.
3. Craig. J. J. "Introduction to Robotics- mechanics and control", Addison- Wesley, 1999.
4. W.Bolton, "Mechatronics" , Pearson education, second edition, fifth Indian Reprint,

2003.

5. Smaili and F. Mrad, "Mechatronics- integrated technologies for intelligent machines", Oxford university press, 2008.

Reference Books:

1. Mechatronics – W. Bolton, Pearson Education India.
2. A Text Book on Mechatronics – R.K.Rajput, S. Chand & Co, New Delhi.
3. Exploring Programmable Logic Controllers with applications Pradeep Kumar Srivatsava, BPB Publications.
4. Michael B. Histan and David G. Alciatore, “ Introduction to Mechatronics and Measurement Systems”, McGraw-Hill International Editions, 2000. D. A. Bradley, Dawson D., Buru N.C. and. Loader A.J, “Mechatronics”, Chapman and Hall,1993.
5. Dan Necsulesu, “Mechatronics”, Pearson Education Asia, 2002 (Indian Reprint).
6. Lawrence J. Kamm, “Understanding Electro – Mechanical Engineering”, An Introduction to Mechatronics, Prentice – Hall of India Pvt., Ltd., 2000.
7. Nitaigour Premchand Mahadik, “Mechatronics”, Tata McGraw-Hill publishing Company Ltd, 2003.

ELECTRONIC RESOURCES

1. <https://nptel.ac.in/courses/>
2. <https://www.slideshare.net/>
3. <https://en.wikipedia.org/wiki/>
4. <http://ndl.ethernet.edu.et/bitstream/>

SUGGESTED LEARNING OUTCOMES

1. Introduction to Mechatronics

- 1.1. Describe the scope and importance of Mechatronics.
- 1.2. Explore the knowledge on measurement and control systems
- 1.3. Explore the different types of control systems
- 1.4. Distinguish between Open and Closed-loop control Systems with examples.
- 1.5. Illustrate the Mathematical Model of a system.
- 1.6. Describe the Mechanical and Electrical system building blocks.
- 1.7. Describe the Fluid System building blocks.
- 1.8. Describe the Thermal System building blocks
- 1.9. Illustrate what is system model and List the different Engineering System Models.
- 1.10. Describe the concept of engineering system model with simple examples
- 1.11. Explain the System Modeling methods/techniques/approaches.
- 1.12. Describe the Rotational System models
- 1.13. Describe the Translational System models

- 1.14. Illustrate the Hydraulic System Models
- 1.15. Illustrate the Electrical System Models
- 1.16. Illustrate the Thermal Engineering System Models
- 1.17. Illustrate the Electro-Mechanical Engineering System Model

2. Sensors & Applications

- 2.1. Classify different sensors used in mechatronics
- 2.2. Describe the principle of different sensors
- 2.3. Describe the functions of different sensors
- 2.4. Describe the characteristics of sensor
- 2.5. Illustrate the principle and applications of position sensors (Encoders, Resolvers, Piezo-Electric)
- 2.6. Illustrate the principle and applications of range sensors (Triangulation principle, structured lighting approach)
- 2.7. Illustrate the principle and applications of velocity sensors
- 2.8. Illustrate the principle and applications of acceleration sensors
- 2.9. Illustrate the principle and applications of Force sensors
- 2.10. Illustrate the principle and applications of Torque sensors
- 2.11. Illustrate the principle and applications of proximity sensors
- 2.12. Illustrate the principle and applications of Lighten infrared sensors
- 2.13. Illustrate the principle and applications of Touch sensors
- 2.14. Illustrate the principle and applications of Tactile sensors
- 2.15. Illustrate the principle and applications of Temperature sensor
- 2.16. Illustrate the principle and applications of Pressure sensors
- 2.17. Illustrate the principle and applications of Flow sensors.
- 2.18. Illustrate the principles and applications of Resistive sensors
- 2.19. Illustrate the principle and applications of Inductive sensors
- 2.20. Illustrate the principle and applications of capacitive sensors.

3. Drives, Actuators and Controllers:

- 3.1. Explore the different drive systems of engineering systems such as hydraulic, pneumatic and electric
- 3.2. Explore the different Actuators such as linear and rotary
- 3.3. Describe the working of AC servo motor
- 3.4. Describe the working of DC servo motor
- 3.5. Describe the working of stepper motors
- 3.6. Illustrate the conversion between linear and rotary motion with examples
- 3.7. Illustrate the concept of switching devices
- 3.8. Illustrate the concept of Relay

- 3.9. Illustrate the principle of MOSFET
- 3.10. Illustrate the principle of IGBT
- 3.11. Distinguish between IGBT and MOSFET
- 3.12. Illustrate the block diagram of IGBT
- 3.13. Describe the concept of Solenoids with simple examples in different engineering fields
- 3.14. Explore the concept of microprocessor based control system

4. Programmable Logic Controller (PLC)

- 4.1. Describe the basic definition and concept of PLC
- 4.2. Illustrate the basic block diagram and structure of PLC
- 4.3. Describe the concept of Input/output processing
- 4.4. Illustrate the basic PLC Programming and types
- 4.5. Describe the Ladder diagram and its logic functions
- 4.6. Describe the Latching and Sequencing of PLC
- 4.7. Illustrate the concept of mnemonics, Timers, Internal relays and Counters
- 4.8. Illustrate the concept of shift registers, Master and Jump Controls, Data handling & Analog input/output in PLC
- 4.9. Describe the selection of PLC

5. Design of Mechatronic systems

- 5.1. Explore the design stages in Mechatronics
- 5.2. Distinguish between Traditional vs. Mechatronics designs
- 5.3. Describe the case study of Mechatronics system: Pick-and-place pneumatic system in a robot
- 5.4. Describe the case study of Mechatronics system: Car parking system
- 5.5. Describe the case study of Mechatronics system: Car engine management system
- 5.6. Describe the case study of Mechatronics system: Automatic Camera
- 5.7. Describe the case study of Mechatronics system: Automatic Washing Machine
- 5.8. Describe the case study of Mechatronics system in CNC Machines to operate tool, table
- 5.9. Describe the case study of Mechatronics system in CNC Machines for selecting speed, feed and depth of cut.

6. Robot kinematics

- 6.1. Define kinematic pair
- 6.2. Classify kinematic pairs with examples

- 6.3. Differentiate closed loop and open loop mechanism
- 6.4. Illustrate the Grubler's rule to find the Degrees of freedom of kinematic link
- 6.5. Define Degrees of freedom of robot
- 6.6. Define Forward kinematics and Inverse kinematics of robot
- 6.7. Derive the mathematical expression for *Forward kinematics* of planar manipulator of two degrees of freedom with rotary joints using *geometric approach*.
- 6.8. Derive the mathematical expression for *Forward kinematics* of planar manipulator of two degrees of freedom with rotary joints using *algebraic approach*
- 6.9. Derive the mathematical expression for *Inverse kinematics* of planar manipulator of two degrees of freedom with rotary joints using *geometric approach*.
- 6.10. Derive the mathematical expression for *Inverse kinematics* of planar manipulator of two degrees of freedom with rotary joints using *algebraic approach*.
- 6.11. Solve the Simple Problems on planar manipulator with two rotary joints using geometric and algebraic approach.
- 6.12. Define Trajectory and Path of Robot
- 6.13. Differentiate Trajectory and Path of the Robot
- 6.14. Expressions for Displacement, Velocity and Acceleration in cubic polynomial trajectory of a joint with one degree of freedom
- 6.15. Example for cubic polynomial trajectory for Displacement, Velocity and Acceleration of a joint with one degree of freedom

COURSE OUTCOMES		CL	Linked POs	Teaching Periods
CO1	Illustrate the importance of Mechatronics with control systems, mathematical models and engineering systems.	R, U, A	1,2,4,7	10
CO2	Describe the different sensors with applications	R, U, A	1,3,4,6,7	10
CO3	Describe different various Drives, Actuators and Controllers	R, U, A	1,2,3,4,7	13
CO4	Illustrate Programmable Logic Controller (PLC) Controllers with different Programming Languages	R, U, A	1,4,7	14
CO5	Design a Mechatronic system for a given application using sensors, actuators, drives and Controllers	R, U, A	1,2,3,4,6,7	14
CO6	Describe the Kinematics of Robot with Trajectory planning	R, U, A	1,2,3,4,7	14
Total Periods				75

Legends: R = Remember; U= Understand; A= Apply and above levels (Bloom's revised taxonomy)

CO-PO Attainment Matrix:

CO'S	PROGRAM OUTCOMES						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	1	-	2			2
CO2	3	-	1	2		1	2
CO3	3	2	1	1			2
CO4	3	-	-	2			3
CO5	3	-	1	2		1	2
CO6	3	2	1	2			2

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Lowly Addressed.

MID SEM-I EXAM

Unit No	Unit Name	R	U	A	Remarks
1	Introduction to Mechatronics	1, 2	5(a) 5(b)	7(a) 7(b)	
2	Sensors and applications	3, 4	6(a) 6(b)	8(a) 8(b)	
Total Questions		4	4	4	

MID SEM-II EXAM

Unit No	Unit Name	R	U	A	Remarks
3	Drives, Actuators and Controllers	1, 2	5(a) 5(b)	7(a) 7(b)	
4	Programmable Logic Controller (PLC)	3, 4	6(a) 6(b)	8(a) 8(b)	
Total Questions		4	4	4	

MID SEM-I EXAM
Model Paper
ME-506E(B) - Mechatronics

Time: 1 hr

Max. Marks: 20

PART-A

4x1=4 Marks

NOTE: 1) Answer all questions and each one carries one mark.

1. What is Mechatronics?
2. List the control systems in Mechatronics.
3. List any two sensors used in an engineering system
4. Write the principle of proximity sensor.

PART-B

2x3 M= 6

Marks

NOTE: Answer all questions and each one carries three marks.

5(a). Distinguish between Traditional design and Mechatronics design

Or

5(b). Illustrate the Mathematical Model of a system.

6(a). List any three functions of sensors.

Or

6(b). Illustrate the principle of Torque sensors

PART-C

2x5 M= 10

Marks

NOTE: 1) Answer all questions and each one carries Five marks.

7(a). Illustrate the Electrical System Models

Or

7(b). Illustrate the Thermal Engineering System Models

8(a). Illustrate the principle and applications of tactile sensors

Or

8(b). Illustrate the principle and applications of pressure sensors

MID SEM-II EXAM
Model Paper
ME-506E (B) - Mechatronics

Time: 1 hr

Max. Marks: 20

PART-A

4x1=4 Marks

NOTE: 1) Answer all questions and each one carries one mark.

1. List any two types of drive systems in mechatronics
2. What is the purpose of Relay?
3. What is sequencing?
4. Define latching.

PART-B

2x3 M= 6

Marks

NOTE: Answer all questions and each one carries three marks.

5(a). Describe the working of DC servo motor.

Or

5(b). Illustrate the principle of IGBT.

6(a). Briefly describe the ladder diagram.

Or

6(b). Describe the concept of sequencing in PLC.

PART-C

2x5 M= 10

Marks

NOTE: 1) Answer all questions and each one carries Five marks.

7(a). Illustrate the principle of MOSFET

Or

7(b). Illustrate the principle of IGBT

8(a). List any points to be considered while selecting PLC

Or

8(b). Write a brief note on the concept of mnemonics

STATE BOARD OF TECHNICAL EDUCATION AND TRAINING - TS
SEMESTER END EXAMINATION
MODEL PAPER
ME-506E (B) - MECHATRONICS

Time: 2 hrS

Max. Marks: 40

PART-A

8x1=8 Marks

NOTE: 1) Answer all questions and each one carries one mark.

1. What is Mechatronics?
2. What is the purpose of Relay?
3. Define degrees of freedom of robot.
4. What is the principle of proximity sensor?
5. What do you understand by "synthesis" in design process?
6. What is Mechatronics approach in design?
7. Define kinematic pair.
8. Write the equation of Grublers rule for DoF of a kinematic chain.

PART-B

4x3 M= 12Marks

NOTE: Answer all questions and each one carries three marks.

9(a). Define sensor and name any two major functions of sensors in robots

Or

9(b). Write short notes on mechatronics approach in design.

10(a). Write a short note on IGBT.

Or

10(b). Write a short note on forward kinematics of a robot

11(a). What is the traditional approach for wind-screen wiper motion?

Or

11 (b). Write the working principle of bathroom scale using traditional mechanical system.

12 (a). Illustrate the Grubler's rule to find the Degrees of freedom of kinematic link

Or

12 (b). Differentiate Trajectory and Path of the Robot

PART-C

4x5 M= 20 Marks

NOTE: 1) Answer all questions and each one carries Five marks.

13(a). Explain the basic functions of a sensor.

Or

13(b). Explain the automatic car parking system using PLCs with a block diagram.

14 (a). Explain the working principle of DC servo motor.

Or

14(b). Derive the mathematical expression for *Forward kinematics* of planar manipulator of two degrees of freedom with rotary joints using *algebraic approach*.

15(a). Explain pick and place robot with possible design solution.

Or

15(b). Draw the block diagram of car engine management system.

16(a). Derive the mathematical expression for *Inverse kinematics* of planar manipulator of two degrees of freedom with rotary joints using *algebraic approach*.

Or

16(b). Expressions for Displacement, Velocity and Acceleration in cubic polynomial trajectory of a joint with one degree of freedom

ME-507 Manufacturing & Automation Lab

Course Title :	Manufacturing & Automation Lab	Course Code	ME-507
Semester	V	Course Group	Practical
Teaching Scheme in periods (L:T:P)	1:0:2	Credits	1.25
Methodology	Lecture+Practice	Total Contact periods	45 Periods
CIE	60 Marks	SEE	40 Marks

Course Outcomes:

CO1	Demonstrate a foundational understanding of robot anatomy, including manipulators, end-of-arm tooling (EOAT), sensors, and actuators. Additionally, program basic movements and tasks using robot simulation software.
CO2	Explain the functionalities of CNC lathes. Write basic CNC programs for turning operations and perform simple turning exercises under instructor supervision.
CO3	Explain the functionalities of CNC mills. Develop practical skills through programming and milling exercises under instructor guidance, enabling them to write basic CNC programs for milling operations.
CO4	Describe 3D printing technology, specifically FDM (Fused Deposition Modeling). Utilize slicing software to prepare 3D models for printing. Operate a 3D printer and print simple objects with instructor support.
CO5	Apply their understanding of the working principles of various sensors through hands-on exercises, including limit switches (mechanical and magnetic), encoders (rotary and linear), and photoelectric sensors (reflective and thru-beam).
CO6	Analyze the applications of force sensors in different scenarios through demonstrations and practical exercises. Gain a deeper understanding of sensor technology and its role in various industrial processes.

Prerequisites:

This course requires the Basic Computer Skills, basic math and understanding of basic electronics/mechanics concepts

Course Content

1. Industrial Robots

Duration: 6 periods (T:1 + P:5)

- **Theory:** Brief introduction to robot anatomy (manipulator, end-of-arm tooling (EOAT), sensors & actuators) (1 hours).
- **Practical:** Robot simulation software for basic movements and programming tasks (5 hours) (Focus on practical exploration and experimentation).

2. CNC Lathe

Duration: 9 periods (T:1 + P:8)

- **Theory:** Brief demonstration of a CNC lathe and its key functionalities (1 hours).
- **Practical:** G-Code Commands, M-Code Commands, Writing basic CNC programs for Face Turning, Straight Turning, Tapered Turning, Thread Cutting, Canned Cycles under instructor supervision (8 hours) (Focus on practical programming and turning exercises).

3. CNC Mill

Duration: 9 periods (T:1 + P:8)

- **Theory:** Brief demonstration of a CNC mill and its key functionalities (1 hours).
- **Practical:** G-Code Commands, M-Code Commands, Writing basic CNC programs for Face Milling, Drilling Single Hole, Drilling Cycle for Multiple Holes, Slot Milling, Square Pocket Milling, Circular Pocket Milling, Pocket Milling with Island under instructor supervision (8 hours) (Focus on practical programming and milling exercises).

4. 3D Printing

Duration: 9 periods (T:1 + P:8)

- **Theory:** Brief introduction to 3D printing technologies (FDM) and printer components (1 hour).
- **Practical:** Slicing software for Preparing 3D Models for Printing - 3D printer operation and printing a variety of simple objects with instructor guidance (8 hours).

5. Sensors:

Duration: 12 periods (T:0 + P:12)

5.1. Sensors & Limit Switches (3 Hours)

Practical: Working principle of limit switches (mechanical and magnetic) explored through practical exercises (Focus on practical application).

5.2. Encoders (3 Hours)

Practical: Exploring the function of encoders (rotary and linear) through practical exercises (Focus on hands-on understanding).

5.3. Photoelectric Sensors (3 Hours)

Practical: Experimenting with different photoelectric sensors (reflective and thru-beam) for object detection and control tasks (Focus on practical application).

5.4. Force Sensors (3 Hours)

- 5.5. **Practical:** Exploring the applications of force sensors through demonstrations and hands-on practice exercises.

Learning Outcomes:

1. Industrial Robots:

Knowledge and Understanding:

- 1.1 Define the basic components of an industrial robot: manipulator, end-of-arm tooling (EOAT), sensors, and actuators.
- 1.2 Explain the functions of each component in robot operation.
- 1.3 Differentiate between various types of end-of-arm tooling used for different tasks.
- 1.4 Identify common sensor types used in industrial robots and their applications (e.g., proximity sensors, vision systems).
- 1.5 Describe the role of actuators in robot movement and control.

Skills and Abilities:

- 1.6 Utilize robot simulation software to perform basic robot movements (e.g., pick and place, linear motions).
- 1.7 Apply basic programming commands to control robot motion within the simulation environment.
- 1.8 Troubleshoot basic issues encountered during robot simulation exercises.
- 1.9 Communicate effectively the capabilities and limitations of industrial robots.

2. CNC Lathe:

Knowledge and Understanding:

- 2.1 Explain the basic functionalities of a CNC lathe.
- 2.2 Differentiate between various types of CNC lathes.
- 2.3 Define G-code and M-code commands used in CNC lathe programming.

Skills and Abilities:

- 2.4 Identify and interpret common G-code and M-code commands.
- 2.5 Write basic CNC lathe programs for face turning, straight turning, tapered turning, thread cutting, and canned cycles.
- 2.6 Set up and operate a CNC lathe under instructor supervision.
- 2.7 Analyze and troubleshoot basic CNC lathe programming errors.

3. CNC Mill:

Knowledge and Understanding:

- 3.1 Explain the basic functionalities of a CNC mill.
- 3.2 Differentiate between various types of CNC mills.
- 3.3 Define G-code and M-code commands used in CNC mill programming.

Skills and Abilities:

- 3.4 Identify and interpret common G-code and M-code commands.
- 3.5 Write basic CNC mill programs for face milling, drilling single and multiple holes, slot milling, square and circular pocket milling, and pocket milling with islands.
- 3.6 Set up and operate a CNC mill under instructor supervision.
- 3.7 Analyze and troubleshoot basic CNC mill programming errors.

4. 3D Printing:

Knowledge and Understanding:

- 4.1 Explain the basic principles of 3D printing technology (e.g., FDM).
- 4.2 Identify the key components of a 3D printer.

Skills and Abilities:

- 4.3 Utilize slicing software to prepare 3D models for printing.
- 4.4 Operate a 3D printer and print a variety of simple objects under instructor guidance.
- 4.5 Troubleshoot basic 3D printing problems (e.g., filament jams, poor print quality).

5. Sensors:

Knowledge and Understanding:

- 5.1 Define sensors and their role in automation and data acquisition.
- 5.2 Classify different types of sensors based on their operating principle (e.g., mechanical, electrical, optical).
- 5.3 Describe the working principles of limit switches (mechanical and magnetic) and their applications in industrial settings.
- 5.4 Explain the function of encoders (rotary and linear) and their use for measuring position and speed.
- 5.5 Discuss the operation of photoelectric sensors (reflective and thru-beam) for object detection and control tasks.
- 5.6 Explain the applications of force sensors in measuring pressure, weight, and strain.

Skills and Abilities:

5.7 Select appropriate sensors for specific industrial applications based on their characteristics and functionalities.

5.8 Interpret sensor data and troubleshoot basic sensor malfunctions.

5.9 Wire and connect sensors to control systems following safety protocols.

Recommended Books

1. Industrial Robots:

Industrial Robots: Design, Applications And Technology by Dr. Senthilkumar Selvaraj.

2. CNC Lathe and Milling:

CNC Fundamentals and Programming by P. M. Agrawal and Dr. V. J. Patel.

3. 3D Printing:

The 3D Printing Handbook: Technologies, Design and Applications by Ben Redwood, Filemon Schöffner, and Brian Garret.

4. Sensors:

Industrial Instrumentation and Control by S. K. Singh.

Key competence to be achieved by students / Suggested Learning Outcomes:

Unit	Key Competencies	Suggested Learning Outcomes
Industrial Robots	* Understand robot anatomy and function. * Apply basic robot programming skills. * Analyze robot capabilities and limitations.	* Define the basic components of an industrial robot. * Explain the functions of robot manipulators, EOAT, sensors, and actuators. * Utilize robot simulation software for basic movements and programming tasks. * Communicate effectively the capabilities and limitations of industrial robots.
CNC Lathe	* Understand CNC lathe functionalities and programming. * Perform basic CNC lathe operations. * Analyze and troubleshoot CNC lathe programs.	* Explain the basic functionalities of a CNC lathe. * Define G-code and M-code commands used in CNC lathe programming. * Write basic CNC lathe programs for turning operations (facing, turning, tapering, threading). * Set up and operate a CNC lathe under instructor supervision (consider safety protocols in your country). * Analyze and troubleshoot basic CNC lathe programming errors.

CNC Mill	* Understand CNC mill functionalities and programming. * Perform basic CNC mill operations. * Analyze and troubleshoot CNC mill programs.	* Explain the basic functionalities of a CNC mill. * Define G-code and M-code commands used in CNC mill programming. * Write basic CNC mill programs for milling operations (facing, drilling, slotting, pocketing). * Set up and operate a CNC mill under instructor supervision (consider safety protocols in your country). * Analyze and troubleshoot basic CNC mill programming errors.
3D Printing	* Understand 3D printing technology (FDM). * Operate a 3D printer for basic tasks. * Troubleshoot common 3D printing problems.	* Explain the basic principles of FDM 3D printing. * Identify the key components of a 3D printer. * Utilize slicing software to prepare 3D models for printing. * Operate a 3D printer and print a variety of simple objects under instructor guidance. * Troubleshoot basic 3D printing problems (e.g., filament jams, poor print quality).
Sensors	* Understand different sensor types and their applications. * Select appropriate sensors for specific tasks. * Interpret sensor data and troubleshoot basic malfunctions.	* Define sensors and their role in automation and data acquisition. * Classify different types of sensors based on their operating principle (mechanical, electrical, optical). * Describe the working principles of limit switches, encoders, photoelectric sensors, and force sensors. * Explain applications of various sensors in industrial settings. * Select appropriate sensors for specific industrial applications based on their characteristics and functionalities. * Interpret sensor data and troubleshoot basic sensor malfunctions (consider safety protocols in your country when working with electrical components).

CO-PO MATRIX :

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	1.50	0.00	3.00	3.00	1.50	1.50	3.00
CO2	1.50	3.00	3.00	3.00	1.50	3.00	3.00
CO3	1.50	3.00	3.00	3.00	1.50	3.00	3.00
CO4	2.00	1.50	3.00	3.00	2.00	3.00	1.00
CO5	3.00	0.00	1.50	1.50	3.00	3.00	1.50
CO6	3.00	0.00	1.50	1.50	3.00	3.00	1.50
AVERAGE	2.08	1.25	2.50	2.50	2.08	2.75	2.17

CourseOutcomes		CL	Linke dPO	Teaching Hours
CO1	Demonstrate a foundational understanding of robot anatomy, including manipulators, end-of-arm tooling (EOAT), sensors, and actuators. Additionally, program basic movements and tasks using robot simulation software.	U/A	1,3,4,5 ,6,7	3
CO2	Explain the functionalities of CNC lathes. Write basic CNC programs for turning operations and perform simple turning exercises under instructor supervision.	U/A	1,2,3,4 ,5,6,7	12
CO3	Explain the functionalities of CNC mills. Develop practical skills through programming and milling exercises under instructor guidance, enabling them to write basic CNC programs for milling operations.	U/A	1,2,3,4 ,5,6,7	6
CO4	Describe 3D printing technology, specifically FDM (Fused Deposition Modeling). Utilize slicing software to prepare 3D models for printing. Operate a 3D printer and print simple objects with instructor support.	A	1,2,3,4 ,5,6,7	6
CO5	Apply their understanding of the working principles of various sensors through hands-on exercises, including limit switches (mechanical and magnetic), encoders (rotary and linear), and photoelectric sensors (reflective and thru-beam).	U/A	1,3,4,5 ,6,7	3
CO6	Analyze the applications of force sensors in different scenarios through demonstrations and practical exercises. Gain a deeper understanding of sensor technology and its role in various industrial processes.	A	1,3,4,5 ,6,7	15

MID SEM-I EXAM

S.No	Unit Name	R	A	Remarks
1	Unit-I	1, 2	1	
2	Unit-II	3,4	2	
Total Questions		4	2	

MID SEM –II EXAM

S.No	Unit Name	R	A	Remarks
1	Unit-III	1, 2	5	
2	Unit-IV	3,4	6	
Total Questions		4	2	

SEMESTER END EXAM

S N	Unit name	Questions to be set for SEE		Remarks
		R, U	A	
1	Unit-1,2	1,2		
2	Unit-3,4	3,4		
3	Unit-5		5, 6	
Total Questions		4	2	

ME-507, MANUFACTURING &AUTOMATION LAB
MODEL PAPER FOR MID -1 (CIE)

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TIME: 1hr

Marks: 20M

PART-A

NOTE: Answer all questions

4 X 2 =8marks

1. What are the main components of Industrial Robot.
2. Write any two basic programming commands to control robot motion.
3. Write any two G-Codes used in CNC lathe programming and mention their purpose.
4. Write any two M-Codes used in CNC lathe programming and mention their purpose.

PART-B

NOTE: Answer any one question.

1 X 12 = 12marks

5. Perform basic robot movements, by utilizing robot simulation software.
6. Write a program to machine a 30 mm diameter steel rod to 25 mm diameter for 40 mm length on a CNC lathe.

ME-507, MANUFACTURING &AUTOMATION LAB
MODEL PAPER FOR MID -2 (CIE)

.....

TIME: 1hr

Marks: 20M

PART-A

NOTE: Answer all questions

4 X 2 =8marks

1. Write any two G codes used in CNC mill and mention their purpose.
2. Write any two M codes used in CNC mill and mention their purpose.
3. What are the main components of a 3D Printer?
4. What is the purpose of Slicing software used in 3D Printing.

PART-B

NOTE: Answer any one questions.

1 X 2 =12marks

5. Write a program to Drill four 6 mm diameter holes in a square pattern on a 50 mm x 50 mm aluminum block to a depth of 4mm with each hole centered 10 mm from the edge of the block.
6. Print a cylinder of 20mm diameter and 10 mm height on 3d printer and write the procedure.

ME-507, MANUFACTURING&AUTOMATION LAB
MODEL PAPER FOR SEE

.....

TIME: 2hr

Marks: 40M

PART-A

NOTE: Answer all questions

4 X 4 =16marks

1. Write the functions of each component in robot.
2. Differentiate between various types of CNC lathes.
3. Write the functions of each component in 3D printer.
4. Write any two type of sensors used in industries and their purpose.

PART-B

NOTE: Answer any one questions.

1 X 24 = 24marks

5. Print a cube of 30mm side on 3d printer and write the procedure.
6. Use a linear encoder to measure distance and speed of an object and write the procedure.

ME-508- METROLOGY AND PNEUMATICS LAB

Course Title:	Metrology and Pneumatics Lab	Course Code:	ME-508
Semester:	V	Course group :	Core
Teaching Scheme(L:T:P):	1:0:2	Credits:	1.5
Methodolgy :	Lecture + Assignment	Total contact periods:	45
CIE:	60 Marks	SEE:	40 Marks

Prerequisites: Basic knowledge of Metrology& pneumatics systems

COURSE OUTCOMES

On successful completion of the course, the students will be able to

Course Outcomes	
CO1	Measure the angle of the machined surface using a sine bar with slip gauges
CO2	Measure the geometrical dimensions of a given thread and spur gear and alignment of a given surface
CO3	Measure the surface roughness and linear displacement
CO4	Construct the pneumatic circuit for direct and speed control of Single & double acting cylinder
CO5	Construct the pneumatic circuit for the Control of a double-acting cylinder using OR logic
CO6	Construct the pneumatic circuit for the Control of a Double-acting cylinder using AND LOGIC

LIST OF EXPERIMENTS

S.No.	Description	No of Periods
A) METROLOGY LAB		
1	Introduction to Metrology	3
2	Measure the angle of the machined surface using a sine bar with slip gauges	3
3	To measure the screw thread parameters of a given specimen and given spur gear teeth using Tool Maker's Microscope and Gear tooth vernier	6
4	Check the alignment using Autocollimator	3
5	Measurement of displacement using LVDT	3
6	Measurement of surface roughness using Talysurf tester	3
B) PNEUMATICS LAB		
1	Introduction to Pneumatic Components	3
2	Direct control of a single-acting cylinder	3
3	Direct control of a double-acting cylinder	3
4	Speed control of a double-acting cylinder	3
5	Control of a double-acting cylinder with OR logic	6
6	Control of a double-acting cylinder with AND logic	6
Total		45

REFERENCE BOOKS

1. Engineering Metrology – R. K. Jain
2. Engineering precision metrology – R. C. Gupta
3. A Handbook of Industrial Metrology – ASME
4. Measurement System (Application and Design) – Ernest O Doebelin
5. Pneumatics by SRIHARI RAO
6. Pneumatic controls by FESTO

SUGGESTED LEARNING OUTCOMES

Upon completion of the course, the student shall be able to

1. Introduction to Metrology

- 1.1. State the need and importance of Metrology
- 1.2. Define metrology
- 1.3. Identify various measuring Instruments and their purpose.

2. Measure the angle of the various machined surfaces using a sine bar with slip gauges:

- 2.1. Identify various parts of the sine bar.
- 2.2. Demonstrate the usages of slip gauges
- 2.3. Experiment with the method of finding out angel using a sine bar

- 2.4. Calculate the angle of the machined surface
- 3. To measure the screw thread parameters of a given specimen using Tool Maker's Microscope/Gear tooth vernier:**
 - 3.1. Define various screw thread parameters
 - 3.2. Identify various parts of the apparatus
 - 3.3. Analyse the experimental setup
 - 3.4. Experiment with the method of finding out various screw thread parameters
- 4. Check the alignment using Autocollimator:**
 - 4.1. Illustrate the concepts and necessity of alignment of parts/surfaces
 - 4.2. Identify various parts of the apparatus
 - 4.3. Demonstrate the experimental setup
 - 4.4. Measure the required parameters with Autocollimator
- 5. Measurement of displacement using LVDT:**
 - 5.1. State the necessity of precision measurement of displacement
 - 5.2. Identify various parts of the apparatus
 - 5.3. Demonstrate the experimental setup
 - 5.4. Measure displacement using LVDT
- 6. Measurement of surface roughness using Talysurf tester:**
 - 6.1. Understanding the concepts of surface roughness and the necessity of measuring surface roughness
 - 6.2. Identify various parts of the apparatus
 - 6.3. Demonstrate the experimental setup
 - 6.4. Measure surface roughness using a Talysurf tester
- 7. Introduction to Pneumatic Components**
 - 7.1. Demonstrate the working of Pneumatic components.
 - 7.2. Explain Pneumatics
 - 7.3. Identify & List Symbols used in Pneumatic circuits.
 - 7.4. Explain the phenomena of compressed air for transmitting power.
 - 7.5. State Pascal's law.
 - 7.6. List all the pneumatic applications.
 - 7.7. Define Pneumatic actuator.
 - 7.8. Classify the actuators.
 - 7.9. Explain Linear actuators and Rotary actuators.
 - 7.10. Define valve.
 - 7.11. List different types of valves.
 - 7.12. Explain the function of a valve.
 - 7.13. Identify the components of a valve.
 - 7.14. Identify ports and positions.
 - 7.15. List the Applications of valves.
- 8. Direct control of a single-acting cylinder**
 - 8.1. Draw the circuit diagram for actuating a single-acting cylinder.
 - 8.2. Select the suitable valve. eg: 3/2 valve.
 - 8.3. Connect the 3/2 valve to the actuator.
 - 8.4. Actuate the single-acting cylinder by operating a 3/2 valve.
- 9. Direct control of a double-acting cylinder**
 - 9.1. Draw the circuit diagram for actuating a Double-acting cylinder.

- 9.2. Select the suitable valve.eg:4/2 valve.
- 9.3. Connect the 4/2 valve to the actuator.
- 9.4. Actuate the double-acting cylinder by operating a 4/2 valve.

10. Speed control of a double-acting cylinder

- 10.1. Draw the pneumatic circuit for controlling the speed of a double-acting cylinder
- 10.2. Select a 4/2 or 5/2 valve and a throttle valve.
- 10.3. Connect the 4/2 valve and throttle valve as per the circuit.
- 10.4. Operate the 4/2 valve and adjust the throttle valve to control the speed of the double-acting cylinder

11. Control of a double-acting cylinder with OR logic

- 11.1. Draw the pneumatic circuit for controlling the speed of the double-acting cylinder using OR logic.
- 11.2. Select two 3/2 valves and a shuttle valve(OR Valve).
- 11.3. Connect 3/2 valves and OR valves to the double-acting cylinder as per the circuit.
- 11.4. Operate either one of the 3/2 valves to control the speed of the double-acting cylinder.

12. Control of a Double-acting cylinder with AND LOGIC

- 12.1. Draw the pneumatic circuit for controlling the speed of the double-acting cylinder using AND logic.
- 12.2. Select two 3/2 valves and an AND valve.
- 12.3. Connect 3/2 valves and AND valves to the double-acting cylinder as per the circuit.
- 12.4. Operate two valves simultaneously to control the speed of the double-acting cylinder.

COURSE OUTCOMES		CL	Linked POs
CO 1	Measure the angle of a machined surface using a sine bar with slip gauges	R, U, A	1,2,4,5,6,7
CO 2	Measure the geometrical dimensions of the given thread and spur gear alignment of a given surface	R, U, A	1,2,4,5,6,7
CO 3	Measure the surface roughness and linear displacement	R, U, A	1,2,4,5,6,7
CO 4	Construct the pneumatic circuit for direct and speed control of Single & double acting cylinder	U, A	1,2,3,4,5,6,7
CO 5	Construct the pneumatic circuit for the Control of a double-acting cylinder using OR logic	U, A	1,2,3,4,5,6,7
CO 6	Construct the pneumatic circuit for the Control of a Double-acting cylinder using AND LOGIC	R, U, A	1,2,3,4,5,6,7

Legends: R = Remember; U= Understand; A= Apply and above levels (Bloom's revised taxonomy)

CO-PO Attainment Matrix:

COURSE OUTCOMES	PROGRAM OUTCOMES						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	1	3	-	2	1	3	3
CO2	2	3	-	2	1	3	2
CO3	2	3	-	2	1	3	2
CO4	2	3	1	2	1	3	1
CO5	2	3	1	1	1	3	3
CO6	1	1	2	2	1	3	1

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Lowly Addressed.

State Board of Technical Education, Telangana State
Model Paper
ME-508 – METROLOGY LAB PNEUMATICS LAB
Mid Sem-I (CIE)

Time: 1 Hour

Total Marks: 20 M

Note: Answer any one question.

1. Measure the angle of the machined surface using a sine bar with slip gauges.
2. Measure the screw thread parameters such as pitch, thread angle, and depth of screw of a given specimen using Tool Maker's Microscope/Gear tooth vernier
3. Check the alignment of a given specimen using an Autocollimator.
4. Measure the displacement using LVDT.
5. Measure the surface roughness of a given surface using a Talysurf tester.
6. Connect pneumatic devices and control the direction of a Single Acting Cylinder
7. Connect pneumatic devices and control the direction of a Double Acting Cylinder
8. Connect the Pneumatic controls for Control of a double-acting cylinder with OR logic
9. Connect the Pneumatic controls for Control of a double-acting cylinder with AND logic
10. Connect pneumatic devices and control the speed of a Double Acting Cylinder

Note: Exam should be conducted from the experiments in which students undergo training only as classes are conducted on a rotation basis.

State Board of Technical Education, Telangana State
Model Paper
ME-508 – METROLOGY LAB PNEUMATICS LAB
Mid Sem-II (CIE)

Time: 1 Hour

Total Marks : 20 M

Note: Answer any one question.

1. Measure the angle of the machined surface using a sine bar with slip gauges.
2. Measure the screw thread parameters such as pitch, thread angle, and depth of screw of a given specimen using Tool Maker's Microscope/Gear tooth vernier
3. Check the alignment of a given specimen using an Autocollimator.
4. Measure the displacement using LVDT.
5. Measure the surface roughness of a given surface using a Talysurf tester.
6. Connect pneumatic devices and control the direction of a single-acting cylinder
7. Connect pneumatic devices and control the direction of a double-acting cylinder
8. Connect the Pneumatic controls for Control of a double-acting cylinder with OR logic
9. Connect the Pneumatic controls for Control of a double-acting cylinder with AND logic
10. Connect pneumatic devices and control the speed of a Double Acting Cylinder

Note: Exam should be conducted from the experiments in which students underwent training only as classes are conducted on a rotation basis.

State Board of Technical Education, Telangana State
SEE Model Paper
ME-508 – METROLOGY LAB PNEUMATICS LAB

Time: 2 Hour

Total Marks: 40 M

Note: Answer any one question.

1. Measure the angle of the machined surface using a sine bar with slip gauges.
2. Measure the screw thread parameters such as pitch, thread angle, and depth of screw of a given specimen using Tool Maker's Microscope/Gear tooth vernier
3. Check the alignment of a given specimen using an Autocollimator.
4. Measure the displacement using LVDT.
5. Measure the surface roughness of a given surface using a Talysurf tester.
6. Connect pneumatic devices and control the direction of a Single Acting Cylinder
7. Connect pneumatic devices and control the direction of a Double Acting Cylinder
8. Connect the Pneumatic controls for Control of a double-acting cylinder with OR logic
9. Connect the Pneumatic controls for Control of a double-acting cylinder with AND logic
10. Connect pneumatic devices and control the speed of a Double Acting Cylinder

ME-509-REFRIGERATION AND AIR CONDITIONING LAB

Course Title	Refrigeration and Air Conditioning Lab	Course Code:	ME-509
Semester:	V	Course group :	Practical
Teaching Scheme(L:T:P):	1:0:2	Credits	1.25
Methodolgy :	Lecture + Assignment	Total contact periods:	45
CIE:	60 Marks	SEE:	40 Marks

Prerequisites: Basic knowledge of Thermodynamics and Refrigeration & Air conditioning

COURSE OUTCOMES

CO	On Successful completion of the course, the student will be able to
1	Summarize working of refrigeration and air conditioning system tools and perform basic operations on softcopper tube
2	Identify and acquire knowledge to handle different components of Refrigeration and Air Conditioning systems.
3	Classify refrigerants and justify their application.
4	Evaluate Coefficient of Performance (COP) of Refrigeration and Air conditioning system with given data and validate the result by using p-hchart.
5	Determine Coefficient of Performance (COP) of Refrigeration and Air conditioning systems
6	Illustrate working of air cooler, water cooler, domestic refrigerator, split air Conditioner and window air conditioner and sketch the flow diagram.

Course Content and Blue Print of Marks for SEE

	Unit name	Hours/ Periods	Marks for SEE			Marks weightage	%Weightage
			Handling	Manipulation	Precision		
1.	R&AC Tools, Basic Operations on soft Coppertube	3	10	15	15	40	100
2.	Vapour Compression cycle testrig	6	10	15	15	40	100
3.	Water cooler	6	10	15	15	40	100
4	Air conditioning test rig	6	10	15	15	40	100
5	Domestic refrigerator	6	10	15	15	40	100
6	Window air conditioner	6	10	15	15	40	100
7	Split air conditioner	6	10	15	15	40	100
8	Air cooler	6	10	15	15	40	100
	TOTAL	45					

CO-PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	0.00	0.00	1.50	1.50	0.00	0.00	0.00
CO2	3.00	3.00	1.50	1.50	3.00	3.00	1.50
CO3	1.50	3.00	3.00	3.00	1.50	3.00	3.00
CO4	1.50	0.00	0.00	0.00	0.00	0.00	0.00
CO5	1.50	0.00	3.00	3.00	1.50	1.50	3.00
CO6	3.00	0.00	3.00	3.00	1.50	1.50	3.00
AVERAGE	1.75	1.00	2.00	2.00	1.25	1.50	1.75

CO-PO Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2	-	-	3	1	-	2
CO2	2	-	1	2	1	-	3
CO3	2	-	-	2	1	-	2
CO4	2	1	1	2	-	-	3
CO5	2	1	1	2	1	-	2
CO6	1	-	-	2	2	-	2

COURSE OUTCOMES		CL	Linked POs
CO1	Evaluate Refrigeration and Air conditioning system tools and basic operations on soft copper tube	R, U, A	1,4,5,7
CO2	Identify and acquire knowledge on working of different parts of Refrigeration and Air conditioning systems.	R, U, A	1,3,4,5,7
CO3	Develop knowledge on refrigerants.	R, U, A	1,4,5,7
CO4	Measure Coefficient of Performance(COP) of Refrigeration and Air conditioning system with given data and use p-h chart.	U, A	1,2,3,4,7
CO5	Determine Coefficient of Performance(COP) of Refrigeration and Air conditioning systems.	U, A	1,2,3,4,7
CO6	Distinguish working of air cooler, water cooler, domestic refrigerator, split air conditioner and window air conditioner.	R, U, A	1,4,5,7

BOARD DIPLOMA EXAMINATIONS (C24)
Model Paper MID SEM - I
DME V SEMESTER EXAMINATION
REFRIGERATION AND AIR CONDITIONING LAB

TIME :1 Hours

Max. Marks: 20

Answer any one question

1. List all basic tools used in RAC and identify them
2. Perform flaring and swaging operation on copper tube.
3. Perform brazing operation on given copper tube.
4. Determine COP of Vapour compression cycle from given data numerically
5. Determine COP of Vapour compression cycle from given data using p-h chart.
6. Identify all parts of water cooler and explain their function.
7. Determine COP of air conditioning test rig from given data numerically

BOARD DIPLOMA EXAMINATIONS (C21)
Model Paper MID SEM - II
DME V SEMESTER EXAMINATION
REFRIGERATION AND AIR CONDITIONING LAB

TIME :1 Hours

Max. Marks: 20

Answer any one question

1. Identify all parts of domestic refrigerator and explain their function.
2. Determine COP of domestic refrigerator from P-h diagram.
3. Identify all major parts of window air conditioner and explain their function.
4. Identify all major parts of split air conditioner and explain their function.
5. Identify all major parts of window air conditioner and explain their function, record the change in temperature of room for every 5 minutes.

BOARD DIPLOMA EXAMINATIONS (C24)
Model Paper (SEE)
DME V SEMESTER EXAMINATION
REFRIGERATION AND AIR
CONDITIONING LAB

TIME :2 Hours

Max. Marks: 40

Answer any one question

1. List out all basic tools used in Refrigeration and Air conditioning system. Identify the tools and perform flaring and swaging operation on copper tube
2. List out all basic tools used in Refrigeration and Air conditioning systems. Identify the tools and perform brazing and swaging operation on copper tube
3. Determine COP of Vapour compression cycle from given data numerically
4. Determine COP of Vapour compression cycle from given data using p-h chart.
5. Determine COP of Vapour compression cycle from experimental data
6. Determine COP of water cooler from experimental data.
7. Determine COP of domestic refrigerator from experimental data.
8. Determine COP of air conditioning test rig from experimental data.
9. Identify all major parts of window air conditioner and explain their function.
10. Identify all major parts of split air conditioner and explain their function.
11. Identify all major parts of window air conditioner and explain their function, record the change in temperature of room for every 5 minutes.

SEE Question paper has to be prepared by Internal and External Examiners together.

ME-510 – PROJECT WORK

Course Title	Project Work	Course Code	ME-510
Semester	V	Course Group	Practical
Teaching Scheme in Periods(L:T:P)	1:0:2	Credits	1.25
Methodology	Practical	Total Contact Periods	45
CIE	60 Marks	SEE	40 Marks

Course out comes:

The student should be able to

1. Apply principles of Mining Engineering to solve real world problems
2. Demonstrate the knowledge and skills to assess safety, legal issues and consequent responsibilities.
3. To function effectively as an individual and as a member in a team
4. To communicate and collaborate effectively with the team
5. To engage in lifelong learning in the context of technological changes

S. No	Subject	Duration	Items	Max Marks	Remarks
1	PROJECT		1.project I spell (Abstract submission)	25	
			2. project II spell (Final submission)	25	
			3.a)Maintenance of Log Book	15	
			b)Record work	15	
			4.a) Seminar	10	
			b) Viva Voce	10	
Total :				100	

The Project shall carry 100 marks and pass marks is 50% a candidate failing to secure the minimum marks should repeat the Project work.

Thrust areas identified for Project work

According to the local needs, the following major projects are suggested:

1. Open cast Mining
2. Mine Machineries
3. Mine Environmental Engg.
4. Mine Ventilation
5. Mine Disasters
6. Mining Geology
7. Mine Surveying
8. Underground Metaliferrous Mining
9. Advanced Open cast Machineries
10. Any concerned mining Projects
11. Rock Mechanics and Ground control
12. Controlled blasting techniques

Project report

The Project Report should consist of following items.

1. Introduction
2. Review of Literature
3. Study Area
4. Methodology/Design/fabrication/Tests
5. Result and Discussion
6. Conclusion and scope for future study
7. References.

Standards of the Project Report

1. Project reports should be typed neatly in Times New Roman letters with
 - (a) Font size 14 for titles
 - (b) Font size 12 for text on both sides of the paper
 - (c) 1.5 line spacing on a A4 size paper (210 x 297 mm)
 - (d) The margins should be: Left - 1.5", Right - 1", Top and Bottom - 0.75".
2. Total number of reports (Soft bound) to be prepared is:
 - (a) One copy to the department /library
 - (b) One copy to the concerned guide(s)
 - (c) One copy to the candidate.
 - (d) One copy to the Industrial training Officer

3. Before taking the final printout, the approval of the concerned guide(s) is mandatory and suggested corrections, if any, must be incorporated.
4. Every copy of the report must contain
 - a. Inner title page (White)
 - b. Outer title page with a plastic cover
 - c. Candidate declaration and Certificate in the format enclosed both from the institution and the organization where the project is carried out.
5. An abstract (synopsis) not exceeding 100 words, indicating salient features of the work.
6. Chapters(to be numbered in Arabic) containing

Introduction which usually specifies the scope of work and its importance and relation to previous work and the present developments.

Main body of the report divided appropriately into chapters, sections and subsections.

The chapters, sections and subsections may be numbered in the decimal form for e.g. Chapter 2, sections as 2.1, 2.2 etc., and subsections as 2.2.3, 2.5.1 etc. The chapter must be left or right justified (font size 16). Followed by the title of chapter centered (font size 18), section/subsection numbers along with their headings must be left justified with section number and its heading in font size 16 and subsection and its heading in font size 14.

The body or the text of the report should have font size 12. The figures and tables must be numbered chapter wise

The last chapter should contain the summary of the work carried, contributions if any, their utility along with the scope for further work.

Reference or Bibliography: The references should be numbered serially in the order of their occurrence in the text and their numbers should be indicated within square brackets for e.g. [3]. The section on references should list them in serial order.

C24_ Curriculum

DIPLOMA IN MECHANICAL ENGINEERING



OFFERED BY

**STATE BOARD OF TECHNICAL EDUCATION
& TRAINING**

TELANGANA: HYDERABAD

ME-601-INDUSTRIAL TRAINING

Course Title:	Industrial Training	Course Code	ME-601
Semester	VI Semester	Course Group	Practical
Teaching Scheme in Periods (L:T:P)	0:0:0	Credits	20
Methodology	Training	Total Duration	6 months
CIE	900 Marks	SEE	100 Marks

This course requires the skills of handling electrical tools, accessories and performing wiring connections

Rationale: Industrial training is introduced in the VI semester for the students as a part of the program to make the passed out students industry ready thus saving the training and apprenticeship needs in the industry and also help in capacity building of the Telangana state and the country.

Course Objective:

To enable the students to

1. Acquaint with Industry environment and culture.
2. Develop professional skills
3. Enhance the usage skills of modern tools
4. Develop Communication and leadership skills.
5. Encourage entrepreneurship

Course Outcomes:

CO1	Appreciate the organizational setup and hierarchy
CO2	Practice the use of Resource optimization techniques
CO3	Develop core engineering skills
CO4	Develop an understanding of solutions for Environmental issues in the industry
CO5	Get acquainted to industry culture and professionalism

Evaluation:

1. The student should submit a report describing the profile of the company, Nature of the job assigned to him /her and other details in a standard format duly attested and approved by the

head of the industry after two weeks and before Four weeks from the date of joining through e mail. Hard copy of the report may be submitted in person or by post.

2. A candidate shall be assessed twice in the spell of industrial training i.e. at the end of third month and finally before he/she completed the industrial training
3. The assessment shall be carried out by a committee comprising of a representative of the Industry where the candidate is undergoing training and a faculty member from the respective program from the Polytechnic.

For Institution level evaluation of industrial training, a committee consisting following faculty members (1) Head of Dept. concerned.(2) Faculty member who assessed the student in the industry (3) any other staff member of departmentconcerned may be formed.

Institution Level Evaluation Scheme			
Sl No	Criteria	Marks	Time
1	1 st Report Submission	50	within 4 Weeks
2	Seminar-I	50	9th to 10 th week
3	2 nd Report Submission	50	Within 12 weeks
4	Log book	100	--
5	Seminar-II	50	Before Viva-Voce
	Institute Evaluation Total	300	
Semester End Examination			
1	Viva-Voce	50	After 15 weeks
2	Demonstration of skills	50	
	Total	100	

Note: For obtaining Provisional certificate the student has to submit training completion certificate from the industry after six months of training.

Assessment parameters and Blue Print of Marks for Industry Evaluation

Sl No	Learning Parameter	Marks
1	Attendance and punctuality	40
2	Familiarity of tools and material	60
3	Engineering skills	100
4	Application of knowledge & Problem solving skills	100
5	Comprehension and observation	20
6	Professionalism/Professional ethics	40
7	Safety and environmental consciousness	20
8	Communication skills	40
9	Supervisory skills	100
10	General conduct during the period	80
Total marks for Industry Evaluation		600
Institute Evaluation		300
Semester End Examination/Viva-Voce		100
TOTAL		1000

Learning Outcomes

1.0 Observe Safety Precautions and rules of the industry

- 1.1. Know the importance of safety in industries
- 1.2. Understand the safety about personnel protection, equipment protection
- 1.3. Know the usage of various safety devices
- 1.4. Precautionary measures to be taken.

2.0 Appreciate organizational set up from top executive to workmen level

- 2.1. Acquaint with the function of each department/section
- 2.2. Comprehend the inter relationship among various department/sections.

3.0. Observe the end product ,variousComponents/ materials used in the production and identify their source.

- 3.1. Identify the various stages involved in the assembly and production of end product.
- 3.2. List the final products, their composition and its commercial importance, uses and Applications.

4.0. Develop an Understanding of various stages involved in processing, sequential arrangement of different equipment.

- 4.1. Represent the whole process and each sub processes with a flow diagram
- 4.2. Observe and appreciate the resource optimization of space (the arrangement of various equipment and machinery in systematic manner in a less possible area of site), Electricity, Men machinery, money and Time.

5.0. Explain various analytical methods used in the quality control department

- 5.1. Practice the Testing methods for quality assurance and bench mark standards
- 5.2. Practice use of various tools, instruments used for quality checking.

6.0. Observe trouble shooting /servicing /maintenance techniques used during the production

- 6.1. Observe preventive precautions and maintenance of each equipment in the unit
- 6.2. Follow Starting andshutting down procedures for the equipment in the unit.

7.0. Identify the various pollutants emitted from the plant/Industry.

- 7.1. State effects of pollutants.
- 7.2. Explain handling methods of E waste and pollutants disposal