C24_CURRICULUM

DIPLOMA IN MECHANICAL ENGINEERING

Offered By

STATE BOARD OF

TECHNICAL EDUCATION AND TRAINING TELANGANA HYDERABAD

IV SEMESTER

S. NO	Course		Teaching Scheme					Examination Scheme						
			Instruction Periods per week			Total Periods per semester	Credits	Continuous Internal Evaluation (CIE)			Semester End Examination (SEE)			
	Code	Course Name	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-401	Advanced Engineering Mathematics	**4**	**1**	**0**	**75**	**2.5**	**20**	**20**	**20**	**40**	**14**	**100**	**35**
2	ME-402	Design of Machine Elements	**4**	**1**	**0**	**75**	**2.5**	**20**	**20**	**20**	**40**	**14**	**100**	**35**
3	ME-403	Thermal Engineering	**4**	**1**	**0**	**75**	**2.5**	**20**	**20**	**20**	**40**	**14**	**100**	**35**
4	ME-404	Industrial Engineering, Estimation & Costing (IEE & C)	**4**	**1**	**0**	**75**	**2.5**	**20**	**20**	**20**	**40**	**14**	**100**	**35**
5	ME-405	Green Energy Sources	**4**	**1**	**0**	**75**	**2.5**	**20**	**20**	**20**	**40**	**14**	**100**	**35**
6	EE-416	Basic Electrical & Electronics Engineering	**4**	**1**	**0**	**75**	**2.5**	**20**	**20**	**20**	**40**	**14**	**100**	**35**
7	EE-417	Basic Electrical & Electronics Engineering Lab	**1**	**0**	**2**	**45**	**1.25**	**20**	**20**	**20**	**40**	**20**	**100**	**50**
8	ME-408	Computer Assisted Production	**1**	**0**	**2**	**45**	**1.25**	**20**	**20**	**20**	**40**	**20**	**100**	**50**
9	ME-409	Thermal Engineering Lab	**1**	**0**	**2**	**45**	**1.25**	**20**	**20**	**20**	**40**	**20**	**100**	**50**
10	HU-410	Employability Skills Lab	**1**	**0**	**2**	**45**	**1.25**	**20**	**20**	**20**	**40**	**20**	**100**	**50**
			28	6	8	630	20	200	200	200	400	164	1000	410

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 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

Fourier Series: **Duration: 13 Periods (L:10 – T:3)**

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

Laplace Transformations: **Duration: 12 Periods (L: 10 – T: 2)**

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. Spigel, 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:

1.0 Solve Differential Equations in engineering problems

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 Equati

1.8 Solve the first order Linear Differential Equation of the form $\frac{dy}{dx} + \text{Py} = \text{Q}$,where P and Q are functions in *x* alone or constants.

1.9 Solve the first order Bernoulli's equations of the form $\frac{dy}{dx} + \text{Py} = \text{Q}y^n$,where P and Q are Functions of *x* alone or constants.

1.10 Solve the problems leading to engineering applications by using above methods.

2.0 **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.

3.0 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.

4.0 **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 $(-\pi, \pi)$.

5.1 **Understand the Laplace Transforms:**

5.2 Define Laplace Transform.
5.3 Explain sufficient conditions for existence of Laplace Transform.
5.4 Obtain Laplace Transforms of some elementary functions.
5.5 State the Linearity Property of Laplace transforms.
5.6 State the First Shifting Theorem on Laplace Transforms.
5.7 Explain the Laplace transform of $f'(t)$ and $f^{(n)}(t)$ in terms of Laplace transform of f(t).
5.8 Explain the Laplace transform of $\int_0^t f(u)du$ in terms of Laplace transform f(t).
5.9 Explain the Laplace transform of $t^n f(t)$ in terms of Laplace transform of f(t).
5.10 Explain the Laplace transform of $\frac{f(t)}{t}$ in terms of Laplace transform of f(t).
5.11 Solve problems on above methods.

6.0 Understand the Inverse Laplace transforms:

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

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 $(x^4 - 2xy^2 + y^4)dx - (2x^2y - 4xy^3 + siny)dy = 0$.

8(a) Solve $(D^3 + 3D^2 - 4)y = 0$.

OR

8 b) Solve $(D^3 - 8)y$ =0.

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DIPLOMA EXAMINATIONS (C - 24)SC-401

SEMESTER IV, MID –II EXAM, MODEL PAPER

ADVANCED 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 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 $(D^2 - D - 6)y = e^x cosh3x$.

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 (– π, π).

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 π.

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 $f(x) = \begin{cases} x \ \ if\ 0 < x < \pi \\ 2\ if\ \pi < x < 2\pi \end{cases}$.

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DIPLOMA EXAMINATIONS (C - 24)

SC-401 SEMESTER IV, SEMESTER END EXAM, MODEL PAPER

ADVANCED 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 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 $\mathcal{L}(5\cos 3t + 7\sinh 2t)$.
6. Find $\mathcal{L}(t\, e^{\omega t})$.
7. Find $\mathcal{L}^{-1}\left(\frac{s}{s^2+81}\right)$.
8. Find $\mathcal{L}^{-1}\left(\frac{3}{(s-3)^2}\right)$.

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 $\mathcal{L}(2\cos^2 3t)$.

10(a) Solve $(D^2 + D - 2)y = 16$.

OR

10(b) Evaluate $\mathcal{L}^{-1}\left(\frac{6}{s^2-4s+7}\right)$.

11(a) Evaluate $\mathcal{L}(2\cos^2 3t)$.

OR

11(b) Evaluate $\mathcal{L}\left(5e^{3t}\cosh 2t\right)$.

12(a) Evaluate $\mathcal{L}^{-1}\left(\log\left(\frac{s-2}{s+3}\right)\right)$.

OR

12(b) Evaluate $\mathcal{L}^{-1}\left(\frac{1}{s^2(16+s^2)}\right)$.

PART- C

Instructions: 1. Answer **ALL** questions. $04 \times 05 = 20$

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

13(a) Solve: $x\log x \quad \frac{dy}{dx} + y = \frac{\log x}{x}$.

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 $\mathcal{L}^{-1}\left(\frac{s}{(s+1)^2(s^2+1)}\right)$.

15(a) Evaluate $\mathcal{L}(f(t))$, where $f(t) = \begin{cases} t & if \quad 0 \le t < 2 \\ 3 & if \quad t \ge 2 \end{cases}$.

OR

15(b) Evaluate $\mathcal{L}\left(\left(t^2 + 2t + 3\right)\sin 2t\right)$.

16(a) Evaluate $\mathcal{L}^{-1}\left(\frac{1}{(s+1)(s+3)}\right)$ 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 Sold 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:

<table>
<tr><th rowspan="2">Unit No</th><th rowspan="2">Unit Name</th><th rowspan="2">Periods</th><th colspan="4">Questions to be set for SEE (QNo)</th></tr>
<tr><th colspan="3">R</th><th>U</th><th>A</th></tr>
<tr><td>1</td><td>Introduction to Design and Design of Bolts Nuts, Screws</td><td>12</td><td rowspan="6">4</td><td colspan="2" rowspan="2">1</td><td rowspan="2">9(a)</td><td rowspan="2">13(a)</td></tr>
<tr><td>2</td><td>Design of Shafts</td><td>12</td></tr>
<tr><td>3</td><td>Design of Keys and Couplings</td><td>12</td><td colspan="2" rowspan="2">2</td><td rowspan="2">10(a)</td><td rowspan="2">14(a)</td></tr>
<tr><td>4</td><td>Design of Belts and Gear Drives</td><td>14</td></tr>
<tr><td>5</td><td>Design of Bearings</td><td>13</td><td rowspan="2">3</td><td>5,6</td><td>9(b),11(a), 11(b)</td><td>13(b),15(a), 15(b)</td></tr>
<tr><td>6</td><td>Design of Cams & Latest developments in design of machine elements.</td><td>12</td><td>7,8</td><td>10(b),12(a),12(b)</td><td>14(b),16(a), 16(b)</td></tr>
<tr><td colspan="2">Total</td><td>75</td><td colspan="3">8</td><td>8</td><td>8</td></tr>
</table>

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 ofBolts, 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 empiricalrelations.

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 collarbearings 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 Sold 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 x3 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*10^5 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/mm^2 and compression stress is 75 N/mm^2.

(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/mm^2 and 60 N/mm^2.

8 (a) A belt is required to transmit 15 KW from a pulley of 1000mm diameter at 420 rpm. The angle of lap is 160^0 and coefficient of friction is 0.3. If the safe working stress of belt material is 1.2 N/mm^2, 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 0.0+6 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 0015. (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 90^0 of cam rotation with simple harmonic motion.
2. Dwell for the next 30^0.
3. During the next 60^0 of cam rotation, the follower returns to its original position with simple harmonic motion.
4. Dwell during the remaining 180^0.

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 120^0 of cam rotation
2. Dwell for the next 30^0 of cam rotation
3. Return stoke during 120^0 of cam rotation
4. Dwell for the remaining 90^0 of the cam rotation

The stoke 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 5,6	9(b) 11(a) 11(b)	13(b) 15(a) 15(b)	
6	Steam Condensers		7,8	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-lavel 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, polytrophic 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 thecontentbut 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 $PV^{1.25}$ = 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 Lamount 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 $PV^{1.3}$= Constant until the pressure becomes 2.8 bar. Calculate (a) Final condition of stem (b)Work done and (c) Heat transfer

(OR)

8(b). A bioler generates 18,000 kg of steam per hour at 12 bar 95% quality. Feed water temperature is 110^0C . 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 ENEERING

Time :2Hours **Total Marks : 40**

PART-A

08X01=08

Instructions :1. Answer ALLquestions.

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 digram.
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 1.5kg/s . The nozzles are inclined at 16^o to the plane of rotation of wheel, taking friction factor as 0.85 and outlet angle of blade as 30^o, 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 temperatur
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^o and 30^o respectively. Assume specific heat of water as 4.2kJ/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 Q6	Q9(b) Q11(a) Q11(b)	Q13(b) Q15(a) Q15(b)	
	6. Estimation of Fabrication Cost, Forging Cost& Foundry Cost	15			Q7 Q8	Q10(b) Q12(a) Q12(b)	Q14(b) Q16(a) 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'sPremium 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	**3**	**3**	**3**	**2**	**2**		**2**
CO2	**2**	**2**	**2**		**2**		
CO3	**3**	**3**	**3**	**2**		**2**	**2**
CO4	**2**	**2**	**2**				
CO5	**3**	**2**	**2**				
CO6	**3**	**3**	**3**		**2**		**2**

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). Discussfour 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_2 H_2 each 1 m^3/hr
(b) Welding Speed = 2m/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/m^3
(f) Cost of C_2H_2 = Rs 50/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 periods	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	Q9(b) Q11(a) Q11(b)	Q13(b) Q15(a) Q15(b)	
	6. Green Hydrogen for a Clean Energy Future	15		Q5 Q6	Q10(b) Q12(a) Q12(b)	Q14(b) Q16(a) Q16(b)	
				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 in tegration, 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 role in 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 Ashok Kumar 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 energy within 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, bioenergy plants, 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, in solation, spectraldistribution).
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

andindustrial 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, andperformance estimation..

2.15 Illustrate the processes involved in solar PV power generation, from cell level to gridintegration, using diagrams or schematics.

2.16 Evaluate various applications of solar PV power considering their advantages andlimitations.

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

EnergyIntroduction 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 andefficiency.

5.2 Compare green bio energy and conventional bio energy, highlighting differences infeed stocks, environmental impact, and long-term sustainability.

5.3 Contrast green bio energy and fossil fuels based on renewability, greenhouse gasemissions, 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, providingadvantages 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 a biofertilizer, 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 FutureFundamentals

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 Asses 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 hydrogen transportation.

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 hydrogen adoption in India.

6.18 Assess how technological advancements and policy support could drive cost reduction.

6.19 Hypothesize the potential trajectory and impact of green hydrogen on India's energy sector.

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 revised taxonomy

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 **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 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 butnot 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 simplediagram

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 Misson"

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 ethanol14(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 thetransportation 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

<table>
<tr><th rowspan="2">Unit No</th><th rowspan="2">Unit Name</th><th rowspan="2">Periods</th><th colspan="4">Questions to be set for SEE</th></tr>
<tr><th colspan="3">R</th><th>U</th><th>A</th></tr>
<tr><td>1</td><td>Electrical Engineering Fundamentals</td><td>10</td><td rowspan="6">Q4</td><td colspan="2" rowspan="2">Q1</td><td rowspan="2">Q9(a)</td><td rowspan="2">Q13(a)</td></tr>
<tr><td>2</td><td>D.C. Machines and Batteries</td><td>15</td></tr>
<tr><td>3</td><td>A.C. Fundamentals and Transformers</td><td>10</td><td colspan="2" rowspan="2">Q2</td><td rowspan="2">Q10(a)</td><td rowspan="2">Q14(a)</td></tr>
<tr><td>4</td><td>A.C. Machines</td><td>15</td></tr>
<tr><td>5</td><td>Wring system, tools & Safety procedures</td><td>10</td><td rowspan="2">Q3</td><td>Q5, Q6</td><td>Q9(b), Q11(a), Q11(b)</td><td>Q13(b), Q15(a), Q15(b)</td></tr>
<tr><td>6</td><td>Basic Electronics</td><td>15</td><td>Q7, Q8</td><td>Q10(b), Q12(a), Q12(b)</td><td>Q14(b), Q16(a), Q16(b)</td></tr>
<tr><td colspan="2">Total</td><td>75</td><td colspan="3">8</td><td>8</td><td>8</td></tr>
</table>

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/electriical-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'sLaw.

1.4 State Work, Power and Energy from electrical and mechanical aspects and understand their units.

1.5 Sate 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 Eg= øzN/60 x 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-phospate,Ni-Cd)

2.13 Define trickle charging

2.14 List the indications of full charg

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-phaseinduction 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-phaseinduction .

4.10 Know the AC motor used in Electric Vehicles

4.11 List different breaking 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'sLaw.
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 moror

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 differnt 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 breaking in EV Vehicles .

BOARD DIPLOMA EXAMINATIONS
DIPLOMA IN MECHANICAL ENGINEERING
SUBCODE: EE-416
Basic Electrical and Electronics Engineering
SEMESTER END EXAM MODELPAPER

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 wrire the rleation 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 equisites

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)

CO4Connect 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 DOLStarter to a 3 Phase Induction motor and run the motor in either direction.

CO-PO Mapping Matrix

	Basic and Discipline Specific knowledge	Problem Analysis	Design/Development of Solutions	Engineering Tools, Experimentation & Testing	Engineering practices for society,	Project Management	Lifelong learning	Linked PO
CO\ PO	PO 1	PO2	PO3	PO4	PO5	P O 6	PO 7	
CO1				2			1	4,7
CO2				2			1	4,7
CO3				2			1	4,7
CO4				2			1	4,7

STATE BOARD OF TECHNICAL EDUCATION &TRAINING ,TELANGANA

MID SEM - I

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. 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 Plateearthing.

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 EXERCISEUsing 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 (av
erage 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 atwo-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 andRevolving 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 date hand book – Vol I & II – Dr. K. Lingaiah, (Suma Publishers, Bangalore).
3. IS Code on fits and tolerances.
4. Blur print reading for Mechanical Tradesby 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

1.11Distinguish the machine drawing from a production drawing.

1.12 Identify the components of a production drawingindicated 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

1.31Need 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 DrawStandard 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

3.0Production 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 mechanicalcomponents:

   (a)Square bolt M10 × 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-

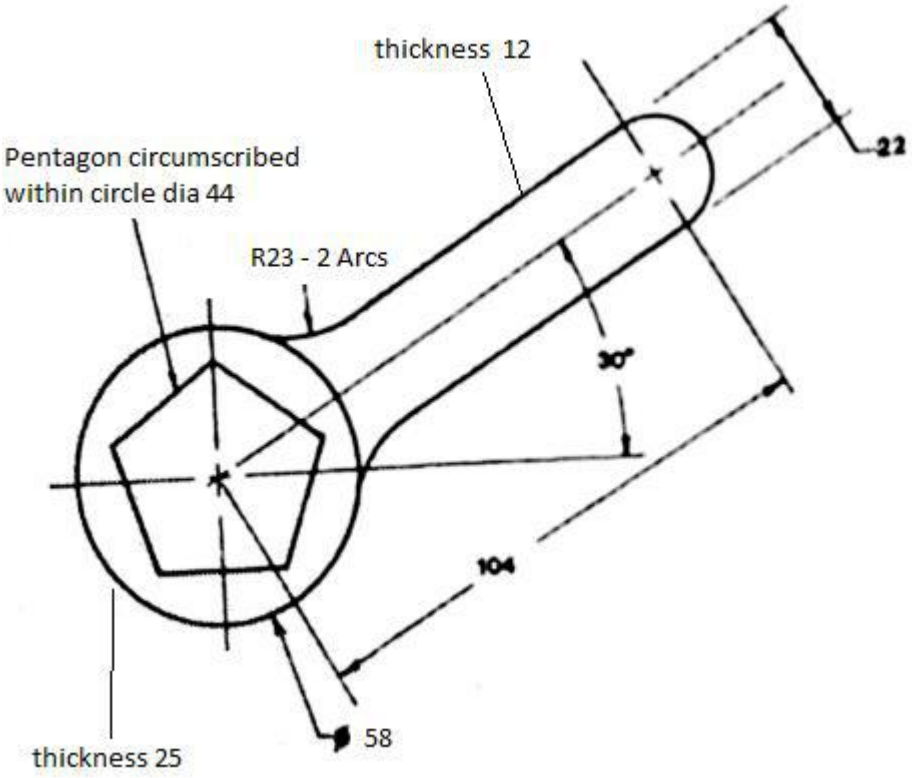
ME-408 -COMPUTER ASSISTED PRODUCTION DRAWING

Time: 1 Hours Max. Marks: 20

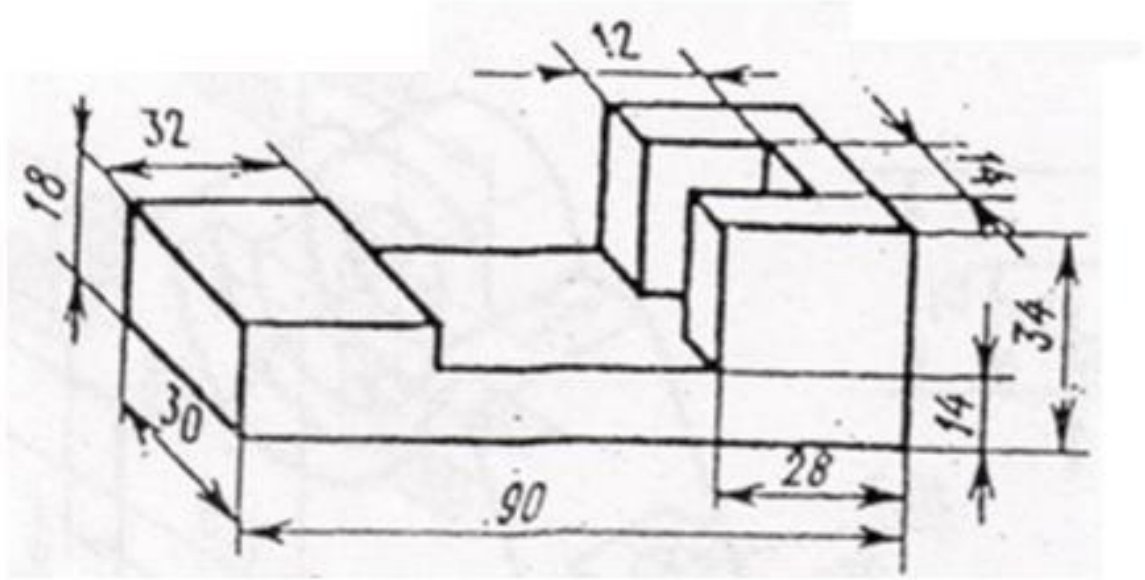
Instructions :

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 4**X3=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 :

Hole : $30^{+0.039}_{+0.000}$ Shaft : $30^{+0.062}_{+0.041}$

Find *(a)* maximum allowance, *(b)* minimum allowance and *(c)* type of fit.

2.The dimensions of a shaft and a hole are given 35Hg7

(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

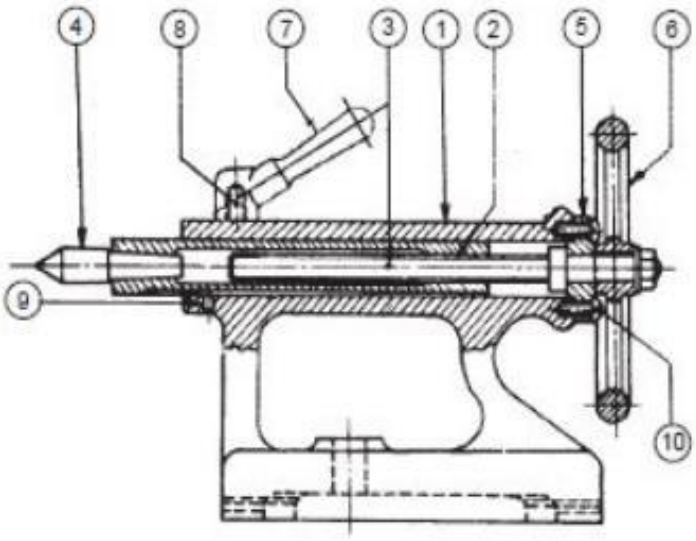


Fig. 18.18A Lathe tail-stock

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

6. Draw the Component drawings of Plummer block with suitable tolerances and fits using CAD 2D software and write the process sheet for bolt

Component drawing views..... 20 marks

- limits fits and tolerances..... 2 marks
- Geometrical tolerances..... 1 mark
- Surface finish..... 2 marks
- Process sheet ..... 3 marks

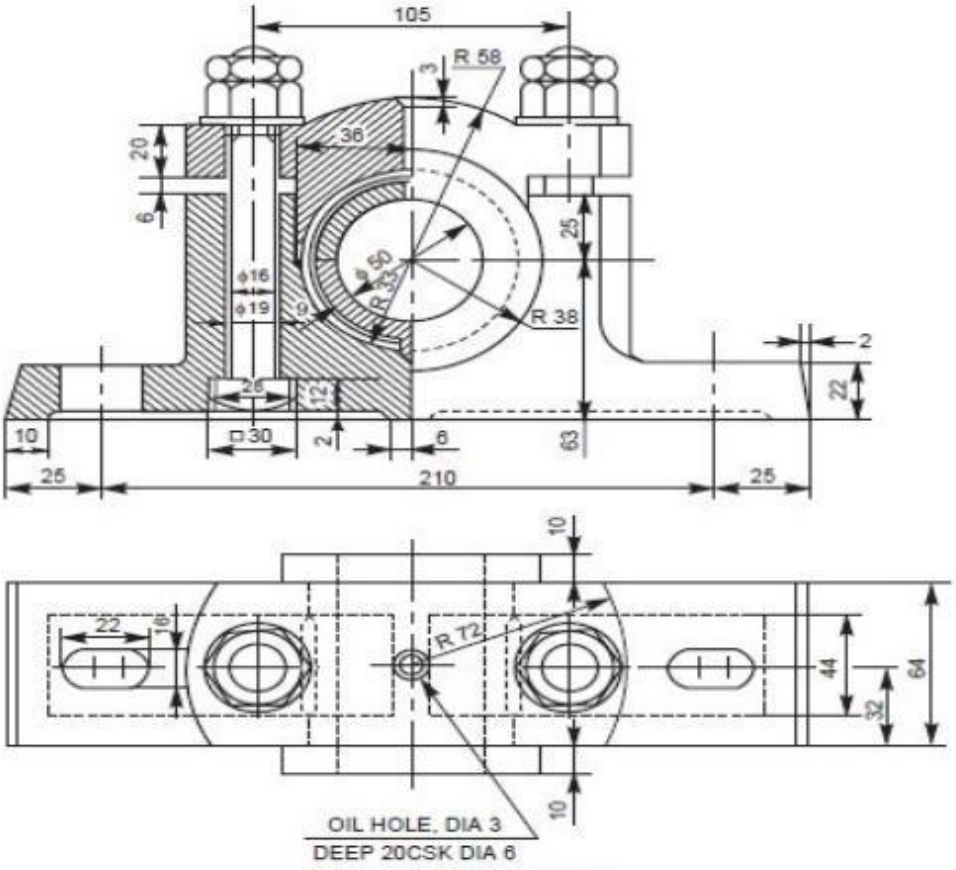


Fig. 12.4 Plummer block

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

C01	DetermineFlashandFirepointofgivensampleoffuelsandLubricantsbyusing given Apparatus (Cleveland /Abel's/ Pensky Martens)
C02	Compute the Viscosity of a given fuel or Lubricating oil using a given apparatus (Redwood/Saybolt viscometers)
C03	MeasureCalorific value of gaseous fuels byusingJunker'scalorimeter
C04	Calculate the power developed by multicylinder engineusingMorseTest
C05	UnderstandthePerformanceCharacteristicsofgiven ICEngine/ EstimateHeatBalanceofGiven ICengine
C06	UnderstandworkingprincipleofMorcetBoiler

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	MorseTest on a 4-stroke multicylinder IC Engine	6
7	Estimate Heat Balance of given IC Engine	6
8	Performanceteston4strokeIC.Engine	6
9	Study of Morcet Boiler	3
	Total	**45**

BLUEPRINTOFMARKSFORSEE

S.N	Unit Name	Periods	MarksforSEE			Marks weightage	%Weightage
			Hand ling	Manipulation	Precision		
1	Flash and Fire point test using ClevelandApparatus(opencup test)	3	10	10	20	40	100
2	Flash and Fire point test usingPensky Martens Apparatus/ Abels Apparatus (closedcup 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	MorseTest on a 4-stroke multicylinder I.Cengine	6	15	15	10	40	100
7	Estimate Heat Balance of Given IC engine	6	15	15	10	40	100
8	Performance test on 4stroke I.C engine	6	15	15	10	40	100
9	Study of Boiler	3	10	10	20	40	100

X

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	MappedPOs
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

Level3-HighlyaddressedLevel 2-ModeratelyaddressedLevel 1-Lowlyaddressed,

SUGGESTEDLEARNINGOUTCOMES

S.No	Exercise	Key competency
1	FlashandFirepointtestusing Cleveland Apparatus	a. Define flashand fire points b. Knowtheimportanceofflashand fire points c. Knowtherangeofflashpointmeasuredby the meter d. Identify various parts of the apparatus
2	FlashandFirepointtestusing Pensky Marten Apparatus FlashandFirepointtestusing Abels Apparatus	a. Differentiateflashandfire points b. Understandfactorsaffectingthe flashpoint c. Identify various parts of the apparatus d. Knowthe rangeofflashpointmeasuredby the meter
3	Viscosity measurement testRedwood viscometer	a. State theimportance of viscosity b. Identifyvariousfactorsaffectingth e viscosity c. Knowdifferenttypesofviscometers d. Differentiatebetweenabsoluteviscosityand kinematic viscosity e. Know the units of viscosity f. Find various parts of the redwood viscometer
4	Viscosity measurement test Saybolt viscometer	a. State theimportance of viscosity b. Identifyvariousfactorsaffectingth e viscosity c. Knowdifferenttypesofviscometers d. Differentiatebetweenabsoluteviscosityand kinematic viscosity e. Know the units of viscosity Find various parts of the Sayboltviscometer
5	Calorificvaluetestusing Junkers gas calorimeter	a. Understand the principleof operation b. Know various components of the calorimeter c. KnowtheapplicationsofJunker’ s calorimeter
6	MorseTestona4-strokemulticylinderI.Cengine	a. Identify various parts of an I.Cengine 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	Performanceteston4strokeI.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 Efficiency4.6.Knowthe loading of IC Engine 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

BOARDDIPLOMAEXAMINATIONS(C24)
ModelPaperMIDSEM -I
DMEIV
SEMESTEREXAMINATION
Thermal Engineering Lab

Time:1Hours **Max.Marks:20**

Answer any**one** ofthefollowing 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 teston 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 teston IC engine at constant speed and draw the performance curves
8. Using a boiler evaluate relationship between pressure and temperature of saturated steam.

Note:MidExamshouldbeconductedfromthe experiments inwhichstudentundergonetraining only as experiments are conducted on rotation basis.

ME-409

BOARDDIPLOMAEXAMINATIONS(C24)
Model Paper MIDSEM -II
DME IV SEMESTER
EXAMINATION Thermal
Engineering Lab

Time:1Hours **Max.Marks:20**

Answer any**one** ofthefollowing questions

1. Determinethe flashandfirepointof givensample usingClevelandapparatus
2. Determinetheflashandfirepointofgivensample usingAbelsapparatus/Determinethe flashand firepointof givensample usingPenskymartenapparatus
3. DetermineViscosityofgivensampleof oilusingRedwoodviscometer
4. DetermineViscosityofgivensampleofoilusing Sayboltviscometer
6. Determine Calorific value of given gaseous fuel using Junkers gas calorimeter.
5. Conductateston IC engineanddetermineBP,FPand IP andmechanicalefficiency.
6. Conduct testonICengineandpreparetheHeatbalancesheet
7. Conduct a teston ICengineatconstantspeedanddrawtheperformance curves
8. Using a boiler evaluate relationship between pressure and temperature of saturatedsteam.

Note: Mid Exam should be conducted from the experiments in which student undergone training only as experiments are conducted on rotation basis.

ME-409

BOARDDIPLOMAEXAMINATIONS(C24)
ModelPaper (SEE)
DME-IV SEMESTER
Thermal Engineering Lab

Time:2Hours **Max.Marks:40**

Answer any**one** ofthefollowing 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 teston 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 teston 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

Evaluation Pattern:

I.ContinuousInternalExamination:		**60Marks**
a.MidSem- I	20marks	
Syllabus: i. Presentation Skills		
ii. JAM b.MidSem—II	20Marks	
Syllabus: i. Group Discussion		
ii. Interview Skills		
c.**Internalassessment:**	20marks	
i. Seminars:	10marks	
ii.Assignments:	5marks	
iii.Labrecordsubmission:	5marks	
II.SemesterEndExamination: a.Listening:	10Marks	**40Marks**

*b.*LifeSkillstopics:	15Marks	
c.VivaVoice	15Marks	

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.phphttp://www.owlnet.rice.edu/~cainproj/http://www.thehumorsource.com/
- http://www.indiabix.com/group-discussion/topics-with-answers/http://networketiquette.net/
- https://public.wsu.edu/~brians/errorshttp://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 Voice