Hall Ticket Number:

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |

**ME221 (R20)**

B.TECH. DEGREE EXAMINATION, MAY-2024

Semester IV [Second Year] (Regular & Supplementary)

**MATHEMATICS-III**

Time: Three hours | Maximum Marks: 70

Answer Question No.1 compulsorily. (14 x 1 = 14)
Answer One Question from each unit. (4 x 14 = 56)

1. Answer the following:
   (a) Write the standard form of linear partial differential equation of second order. CO1
   (b) Classify the equation $\frac{\partial^2 u}{\partial x^2}+2\frac{\partial^2 u}{\partial y^2}=0$ CO1
   (c) Solve $2x\frac{\partial u}{\partial x}-3y\frac{\partial u}{\partial y}=0$ CO1
   (d) Write the about Gauss Seidel iteration method. CO2
   (e) Evaluate $\Delta e^x$. CO2
   (f) Write Lagrange's interpolation formula. CO2
   (g) Write Newton's forward interpolation formula CO3
   (h) Write Simpson's 3/8 rule formula. CO3
   (i) Write Runge-Kutta method of fourth order formula CO3
   (j) Write Laplace's equation. CO4
   (k) Write formulas for mean and standard deviation of Poission distribution. CO4
   (l) Write the properties of normal distributions. CO4
   (m) Define the test of hypothesis. CO4
   (n) Define level of significance. CO4

UNIT – I

2. (a) Solve $x(y-z)p + y(z-x)q = z(x-y)$. (7M) CO1
   (b) Find the solution of one dimensional heat flow equation. (7M) CO1

(OR)

3. Solve the Laplace equation $\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial y^2}=0$; subjected to the conditions $u(0,y) = u(l,y) = u(x,0) = 0$, $u(x,a)=\sin\frac{n\pi x}{l}$ CO1

UNIT – II

4. (a) Use Newton's backward interpolation formula to find the value of y when x = 9, if the following values of x and y are given.

| x | 5 | 6 | 7 | 8 |
|---|---|---|---|---|
| y | 12 | 13 | 14 | 16 |

(7M) CO2

(b) Find a root of the equation $x^3 - 5x - 7 = 0$ using Newton-Raphson's method correct to one decimal place. (7M) CO2

(OR)

5. (a) Use Lagrange's interpolation formula to find the value of y when x = 10, if the following values of x and y are given. (7M) CO2

| x | 5 | 6 | 9 | 11 |
|---|---|---|---|---|
| y | 12 | 13 | 14 | 16 |

(b) Given that

| x | 8 | 10 | 12 | 14 | 15 | 16 |
|---|---|---|---|---|---|---|
| y | 40 | 38 | 43 | 45 | 37 | 43 |

Find $\frac{dy}{dx}, \frac{d^2y}{dx^2}$ at x = 12. (7M) CO2

UNIT – III

6. (a) Evaluate $\int_0^1 \frac{dx}{1+x^2}$ by using trapezoidal rule taking h = 0.2. (7M) CO3

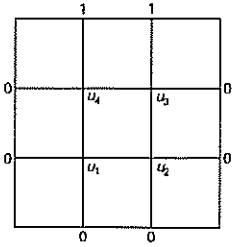
(b) $\frac{dy}{dx} = x^2 + y^2$ with y(0) = 1. Estimate y (0.2) by using Euler's method. Take h = 0.1. (7M) CO3

(OR)



7. (a) Explain Laplace equation and its solution methods. (7M) CO3

(b) Solve the equation $u_{xx} + u_{yy} = 0$ for the following network: (7M) CO3




UNIT – IV

8. (a) In a normal distribution, 31% of the items are under 45 and 8% are under 64. Determine the mean and variance of the distribution. (7M) CO4

(b) An agriculture cooperative claims that 90% of the watermelons shipped out are ripe and ready to eat. Find the probabilities that among 18 watermelons shipped out (7M) CO4

(i) All 18 are ripe and ready to eat.
(ii) At least 16 are ripe and ready to eat.
(iii) At most 14 are ripe and ready to eat.

(OR)

9. (a) If a random variable has a poisson distribution such that P(X = 1) = P(X = 2), find (i) mean of the distribution (ii) P(X = 4) (iii) P(1 < X < 4). (7M) CO4

(b) A random sample of 10 boys has the following IQ's 70, 120, 110, 88, 83, 95, 98, 107, 100, 78. Do these data support the assumption of a population mean IQ of 100? (7M) CO4

****

**ME221 (R20)**

9. (a) Explain process used in summer air conditioning system with help of psychrometric chart. (7M) CO4

(b) The humidity ratio of atmospheric air at 28°C DBT and 760 mm of mercury is 0.016 kg/ kg of dry air. Determine (i) Dew point temperature (ii) Relative humidity (iii) specific humidity. (7M) CO4

****



**ME222 (R20)**

Hall Ticket Number:

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |

**ME222 (R20)**

B.TECH. DEGREE EXAMINATION, MAY-2024

Semester IV [Second Year] (Regular & Supplementary)

## APPLIED THERMODYNAMICS

Time: Three hours Maximum Marks: 70

Answer Question No.1 compulsorily. (14 x 1 = 14)
Answer One Question from each unit. (4 x 14 = 56)

1. Answer the following:
   (a) State latent heat of fusion. CO1
   (b) Define triple point state. CO1
   (c) State the function of boiler mountings CO1
   (d) Define specific steam consumption. CO1
   (e) List different types of nozzles. CO2
   (f) Represent nozzle efficiency on Mollier chart. CO2
   (g) Can able to run the power plant without condenser (YES / NO)? CO2
   (h) How the pressure and velocity varies in impulse turbine. CO3
   (i) What is the use of compounding in steam turbines? CO3
   (j) List atleast two major losses occurring in steam turbines. CO3
   (k) Give an example of pressure-velocity compounded steam turbine. CO3
   (l) Name the processes of Bell Coleman Cycle. CO4
   (m) Define relative humidity. CO4
   (n) How the dew point temperature lines are represented on psychometric chart. CO4

UNIT – I

2. (a) Explain P-v diagram for pure substance with constant property lines. (7M) CO1

(b) Steam initially at 1.5 MPa, 300°C expands reversibly and adiabatically in a steam turbine to 40°C. Determine the ideal work output of the turbine/ kg of steam. (7M) CO1

(OR)

3. (a) Illustrate Benson boiler with neat sketch. (7M) CO1
   (b) In steam turbine steam at 20 bar, 350°C is expanded to 0.08 bar. If then enters a condenser, where it is condensed to saturated liquid water. The pump feeds back the water into the boiler. Find per kg of steam, the network and cycle efficiency. (7M) CO1

UNIT – II

4. (a) Derive the expression for critical pressure ratio through steam nozzle. (7M) CO2
   (b) Estimate the mass flow rate of steam in a nozzle with the following data: inlet pressure and temperature is 10 bar and 200°C, back pressure is 0.5 bar and throat diameter is 12 mm. (7M) CO2

(OR)

5. (a) Explain low level and high level jet condenser with neat sketch. (7M) CO2
   (b) A surface condenser is designed to handle 10000 kg of steam per hour. The steam enters at 0.08 bar abs. and 0.9 dryness and the condensate leaves at the corresponding saturation temperature. The pressure is constant throughout the condenser. Estimate the cooling water flow per hour, If the cooling water temperature rise is limited to 10°C. (7M) CO2

UNIT – III

6. (a) Explain pressure compounding impulse turbine with neat sketch (7M) CO3



(b) In single row impulse turbine the nozzle angle is 30° and the blade speed is 215 m/s, the steam speed is 550 m/s, the blade friction coefficient is 0.85. Assuming axial exit and a flow rate of 700 kg/hr, determine (i) blade angles (ii) absolute velocity of steam at exit (iii) the power output of the turbine. (7M) CO3

(OR)

7. (a) Show that reaction turbine blades are identical with each other for 50% reaction. (7M) CO3
   (b) In one stage of a reaction steam turbine, both the fixed and moving blades have inlet and outlet blade tip angles of 30° and 20° respectively. The mean blade speed is 80 m/sec and the steam consumption is 22,500 kg per hour. Determine the power developed in the pair, if the isentropic heat drop for the pair is 23.5 per kg. (7M) CO3

UNIT – IV

8. (a) Explain working of vapour absorption cycle with neat sketch. (7M) CO4
   (b) The temperature limits of an ammonia refrigerating system are 25°C and -10°C. If the gas is dry at the end of compression, calculate (i) COP of cycle and (ii) capacity of the refrigerator, if the fluid flow is at 5 kg/min. Assuming no undercooling of the liquid ammonia. (7M) CO4

| Temperature (°C) | Liquid heat (kJ/kg) | Latent heat (kJ/kg) | Liquid entropy (kJ/kgK) |
|---|---|---|---|
| 25 | 298.9 | 1166.94 | 1.1242 |
| -10 | 135.37 | 1297.68 | 0.5443 |

(OR)

Hall Ticket Number:

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |

**ME223 (R20)**

B.TECH. DEGREE EXAMINATION, MAY-2024

Semester IV [Second Year] (Regular & Supplementary)

## STRENGTH OF MATERIALS

Time: Three hours | Maximum Marks: 70

Answer Question No.1 compulsorily. (14 x 1 = 14)

Answer One Question from each unit. (4 x 14 = 56)

1. Answer the following:
   (a) State Hooke's law. CO1
   (b) Define the terms stress and strain. CO1
   (c) What is factor of safety? CO1
   (d) Differentiate between uniform and non-uniform torsion. CO2
   (e) Define torsional rigidity. CO2
   (f) What are the different types of beams? CO2
   (g) Sketch the bending moment diagram for a cantilever of length 'L' subjected to point load 'P' at the free end. CO2
   (h) State any two assumptions in theory of simple bending. CO3
   (i) Define section modulus. CO3
   (j) Draw the shear stress distribution for a beam of an I-section. CO3
   (k) Write the differential equation of deflection curve. CO3
   (l) What do you mean by principal stresses? CO4
   (m) Write the expressions for hoop stress and longitudinal stress in a thin cylindrical pressure vessel. CO4
   (n) Write the Lami's equations in thick cylinders. CO4

### UNIT – I

2. (a) Explain stress-strain diagram for mild steel under tension with the help of neat sketch. (7M) CO1

(b) A bar of 30 mm diameter is subjected to a pull of 60 kN. The measured extension on guage length of 200 mm is 0.1 mm and change in diameter is 0.004 mm. Calculate (i) Young's modulus (ii) Poisson's ratio and (iii) Bulk modulus. (7M) CO1

(OR)

3. (a) Derive the relationship between modulus of elasticity and modulus of rigidity. (6M) CO1
   (b) A steel rod of 15 m long is at a temperature of 15°C. Find the free expansion of the length when the temperature is raised to 65°C. Also find the thermal stress produced when the expansion of the rod is prevented. Take $\alpha = 12 \times 10^{-6}$ /°C and E = 200 GPa. (8M) CO1

UNIT – II

4. Determine the diameter of a solid shaft which will transmit 300 kW at 250 rpm. The maximum shear stress should not exceed 30 N/mm$^2$ and twist should not be more than 1° in a shaft length of 2 m. Take Modulus of rigidity G = 100 GPa. CO2

(OR)

5. A simply supported beam AB, 8 m long carrying a point load 3 kN at 2 m from A and a point load 2 kN at 5 m from A and a uniformly distributed load of 2 kN/m between the point loads. Determine the position and magnitude of maximum bending moment. Draw the SF and BM diagrams. CO2

UNIT – III

6. Starting from fundamentals, derive simple bending relation. CO3

$$\frac{\sigma}{y} = \frac{M}{I} = \frac{E}{R}$$



(OR)

7. (a) A rectangular beam 100 mm wide and 250 mm deep is subjected to a maximum shear force of 50 kN. Determine: (i) Average shear stress (ii) Maximum shear stress and (iii) Shear stress at a distance of 25 mm above the neutral axis. (7M) CO3
   (b) Determine the slope and deflection of the free end of a cantilever of length 3 m which is carrying a UDL of 10 kN/m over a length of 2 m from the fixed end. (7M) CO3

UNIT – IV

8. (a) Explain the Mohr's circle for plane stress. (6M) CO4
   (b) At a certain point in a strained material, the stresses on two planes at right angles to each other are 20 N/mm$^2$ and 10 N/mm$^2$ both tensile. They are accompanied by a shear stress of a magnitude of 10 N/mm$^2$ (positive). Calculate (i) the principal stresses and (ii) Maximum shear stress. (8M) CO4

(OR)

9. (a) Differentiate between thin and thick cylinders. (6M) CO4
   (b) Determine the thickness necessary for a thick cylindrical pressure vessel of internal diameter 160 mm to withstand an internal pressure of 50 MPa. The maximum hoop stress in the section is not to exceed 125 MPa. (8M) CO4

****

Hall Ticket Number:

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |

**ME224 (R20)**

B.TECH. DEGREE EXAMINATION, MAY-2024

Semester IV [Second Year] (Regular & Supplementary)

# MANUFACTURING TECHNOLOGY

Time: Three hours | Maximum Marks: 70

Answer Question No.1 compulsorily. (14 x 1 = 14)
Answer One Question from each unit. (4 x 14 = 56)

1. Answer the following:

| | | |
|---|---|---|
| (a) | How do you specify a lathe machine? | CO1 |
| (b) | List the components in lathe carriage. | CO1 |
| (c) | Define feed in drilling operation. | CO1 |
| (d) | List the types of lathe machines. | CO1 |
| (e) | List the advantages of honing process. | CO2 |
| (f) | Classify types of surface grinding machines. | CO2 |
| (g) | What are the advantages of grinding process? | CO2 |
| (h) | Define grinding ratio. | CO2 |
| (i) | List the elements of single point cutting tool. | CO3 |
| (j) | Define machinability index. | CO3 |
| (k) | Explain crater wear briefly. | CO3 |
| (l) | List the applications of PAM process. | CO4 |
| (m) | What is the purpose of dielectric in EDM process? | CO4 |
| (n) | What are the advantages of jigs and fixtures? | CO4 |

## UNIT – I

| | | | |
|---|---|---|---|
| 2. (a) | List and explain briefly different methods of tapper turning on a lathe with sketches. | (7M) | CO1 |
| (b) | Explain any two wok holding devices used for holding irregular shape components with sketches. | (7M) | CO1 |

(OR)

3. (a) Explain thread cutting operation on engine lathe with a diagram. (7M) CO1
   (b) List and explain various drilling operations with sketches. (7M) CO1

UNIT – II

4. (a) Explain types of centreless grinding process with a diagram. (7M) CO2
   (b) Explain lapping process with a neat sketch. (7M) CO2

(OR)

5. (a) Explain the following terms briefly: (7M) CO2
   (i) Truing
   (ii) Glazing
   (iii) Dressing
   (b) Explain working of horizontal spindle reciprocating table surface grinding machine with a sketch. (7M) CO2

UNIT – III

6. (a) Write short notes on the following: (7M) CO3
   (i) Built up edge formation.
   (ii) Taylor's tool life equation.
   (b) Draw Merchant's circle and derive relationship between various cutting forces in metal cutting process. (7M) CO3

(OR)

7. (a) Prove that $Tan\,\emptyset = \frac{r\cos\alpha}{1-r\sin\alpha}$, where r = chip thickness ratio, $\alpha$ = rake angle and $\emptyset$ = shear angle. (7M) CO3
   (b) The life of a turning tool while turning steel at 20 m/min and 40 m/min was observed to be 40 minutes and 10 minutes respectively. Establish the tool life equation, and estimate the tool life if the cutting speed employed is 60 m/min. (7M) CO3



UNIT – IV

8. (a) Explain the working of WJM process with a neat sketch. (7M) CO4
   (b) Explain the principle considered in design of jigs and fixtures. (7M) CO4

(OR)

9. (a) Explain the working of WEDM process with a neat sketch. (7M) CO4
   (b) Differentiate between a jig and fixture. (7M) CO4

****

**Hall Ticket Number:**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |

**ME225 (R20)**

B.TECH. DEGREE EXAMINATION, MAY-2024

Semester IV [Second Year] (Regular & Supplementary)

# FLUID MECHANICS & HYDRAULIC MACHINES

Time: Three hours Maximum Marks: 70

Answer Question No.1 compulsorily. (14 x 1 = 14)
Answer One Question from each unit. (4 x 14 = 56)

1. Answer the following:

| | | |
|---|---|---|
| (a) | Define specific gravity. | CO1 |
| (b) | Define ideal fluid and real fluid. | CO1 |
| (c) | Write the expression for determining the pressure inside a soap bubble. | CO1 |
| (d) | State the forces considered in deriving Euler's equation. | CO1 |
| (e) | Distinguish between laminar and turbulent flows. | CO2 |
| (f) | Write the Darcy-Weisbach equation and state the parameters in the equation. | CO2 |
| (g) | Define boundary layer thickness. | CO2 |
| (h) | State Buckingham-π therom. | CO2 |
| (i) | State and define impulse-momentum equation. | CO3 |
| (j) | Write the head-based classification of turbines with examples. | CO3 |
| (k) | State the advantage of reaction turbines over impulse turbines. | CO3 |
| (l) | Define slip and coefficient of discharge. | CO4 |
| (m) | Define manometric efficiency. | CO4 |
| (n) | Write any two classifications of centrifugal pumps. | CO4 |

UNIT – I

2. (a) Calculate the dynamic viscosity of an oil, which is used for lubrication between a square plate of size 0.8 m × 0.8 m and an inclined plane with angle of inclination 30°. The weight of the square plate is 300 N and it slides down the inclined plane with a uniform velocity of 0.3 m/s. The thickness of oil film is 1.5 mm. (7M) CO1
   (b) Explain the following: (7M) CO1
   (i) Surface tension
   (ii) Newtons law of viscosity
   (iii) Compressibility

(OR)

3. (a) Derive the expression for determining discharge through a venturimeter. (7M) CO1
   (b) A pipe, through which water is flowing, is having diameters, 20 cm and 10 cm at the cross-sections 1 and 2 respectively. The velocity of water at section 1 is given 4.0 m/s. Find the velocity head at sections 1 and 2 and also rate of discharge. (7M) CO1

UNIT – II

4. (a) Explain the Reynold's experiment with a neat sketch. (7M) CO2
   (b) Explain the phenomenon of boundary layer formation on a flat plate. (7M) CO2

(OR)

5. (a) State the methods of dimensional analysis and describe the Rayleigh's method for dimensional analysis. (8M) CO2
   (b) Define the terms (i) model (ii) prototype (iii) hydraulic similitude. (6M) CO2



UNIT – III

6. (a) Show that the efficiency of a free jet striking normally on a series of flat plates mounted on the periphery of a wheel can never exceed 50%. (7M) CO3
   (b) A nozzle of 50 mm diameter delivers a stream of water at 20 m/s perpendicular to a plate that moves away from the jet at 5 m/s. Find: (i) the force on the plate (ii) the work done and (iii) the efficiency of jet. (7M) CO3

(OR)

7. (a) Explain the construction and working of Francis turbine with a neat sketch. (7M) CO3
   (b) Differentiate between impulse and reaction turbines. (7M) CO3

UNIT – IV

8. (a) Differentiate between reciprocating and centrifugal pumps. (7M) CO4
   (b) Explain the construction and working of reciprocating pump with neat sketch. (7M) CO4

(OR)

9. (a) Derive an expression to determine the minimum starting speed of a centrifugal pump. (7M) CO4
   (b) Explain the working and construction of a series multistage pump. (7M) CO4

****