Hall Ticket Number:

ME221 (R20)

B.TECH. DEGREE EXAMINATION, JULY-2023

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 Lagrange's linear equation. CO1
   (b) Classify the equation $\frac{\partial^2 u}{\partial x^2}+4\frac{\partial^2 u}{\partial x \partial y}+4\frac{\partial^2 u}{\partial y^2}-\frac{\partial u}{\partial x}+2\frac{\partial u}{\partial y}=0$ CO1
   (c) Write the solution of two dimensional steady state heat flow equation. CO1
   (d) Write the Newton-Raphson formula to find the approximate root of the equation $f(x) = 0$. CO2
   (e) Evaluate $\Delta^{10}[(1-ax)(1-bx^2)(1-cx^3)(1-dx^4)]$. CO2
   (f) State Newton's backward interpolation formula. CO2
   (g) Write $\frac{dy}{dx}$ at x_0 using forward differences. CO2
   (h) State Simpson's $3/8^{th}$ rule. CO3
   (i) Write the formula to find K_4 in R-K method of 4^{th} order. CO3
   (j) State the Poisson's equation CO3
   (k) Identify whether the following data follow a Binomial distribution or not, mean = 3; variance = 4. CO4
   (l) What do you mean by Alternative hypothesis? CO4
   (m) State F-test for ratio of variances. CO4
   (n) In goodness of fit, which type of distribution is used? CO4

UNIT – I

2. (a) Solve $(mz-ny)\frac{\partial z}{\partial x}+(nx-lz)\frac{\partial z}{\partial y}=ly-mx.$ (7M) CO1

(b) Find the solution of one dimensional wave equation. (7M) CO1

(OR)

3. An insulated rod of length l has its ends A and B maintained at 0^0C and 100^0C respectively until steady state prevail. If B is suddenly reduced to 0^0C and maintained at 0^0C, find the temperature at a distance x from A at time t. CO1

UNIT – II

4. (a) Find by Newton-Raphson method, the real root of the equation 3x = cosx + 1 correct to four decimal places. (7M) CO2

(b) Solve by Gauss-Seidal iteration method, the equations 20x + y – 2z = 17; 3x + 20y – z = –18; 2x –3y + 20z = 25. (7M) CO2

(OR)

5. (a) Estimate the values of $f(22)$ and $f(42)$ from the following data. (7M) CO2

x	20	25	30	35	40	45
f(x)	354	332	291	260	231	204

(b) Given the values (7M) CO2

x:	5	7	11	13	17
f(x):	150	392	1492	2366	5202

Evaluate f(9), using Lagrange's formula.

UNIT – III

6. (a) Evaluate $\int_0^6 \frac{dx}{1+x^2}$ Using Trapezoidal and Simpson's 1/3rd rule, Simpson's 3/8th rule. (7M) CO3

(b) Use Runge-Kutta method of fourth order to find y when $x = 1.2$, given that $\frac{dy}{dx}=x^2+y^2$ and $y(1)=1.5$. (7M) CO3

(OR)

7. (a) Solve $u_{xx}+u_{yy}=0$ in $0<x<1$, $0<y<1$ with step size 1/3, $u(x,1)=u(0,y)=0$, $u(1,y)=9(y-y^2)$, $u(x,0)=9(x-x^2)$. (7M) CO3

(b) Solve the partial differential equation $\nabla^2 u=-10(x^2+y^2+10)$ over the square mesh with sides $x=0=y$, $x=3=y$ with $u=0$ on the boundary and mesh length 1. (7M) CO3

UNIT – IV

8. (a) If the probability of a bad reaction from a certain injection is 0.001, determine the chance that out of 2000 individuals more than two will get a bad reaction. (7M) CO4

(b) In a normal distribution 7% items are under 35 and 89% are under 63. What are the mean and standard deviation of the distribution? (7M) CO4

(OR)

9. (a) A random sample of 9 boys had heights (inches): 45, 47, 50, 52, 48, 47, 49, 53 and 51. In the light of the data, discuss the suggestion that the mean height in the population is 47.5. (7M) CO4

(b) Fit a Binomial distribution to the given data and test the goodness of fit. (7M) CO4

x	0	1	2	3	4	5	6
f	13	25	52	58	32	16	4

****

circulated per minute for production of 1440 kg of ice per day at 0°C from water at 25°C (iii) Capacity of the plant in terms of kJ/s.

(OR)

9. (a) Explain the following processes with the help of a psychrometric chart (7M) CO4
   (i) Cooling dehumidification
   (ii) Heating and humidification
   (iii) Adiabatic mixing of two air streams
   (b) Describe the working of winter air-conditioning with a neat sketch. Draw the process on a psychrometric chart. (7M) CO4

****

Hall Ticket Number:

B.TECH. DEGREE EXAMINATION, JULY-2023

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) What is dryness fraction of steam? CO1
   (b) What is the function of a fusible plug? State where it is loaded in a boiler. CO1
   (c) What is the effect of reheating steam in a Rankine cycle? CO1
   (d) What is critical pressure? CO2
   (e) Define nozzle efficiency. Show it on a T-s diagram. CO2
   (f) Write the differences between jet and surface condensers. CO2
   (g) List the effects of air leakage into a condenser. CO3
   (h) Write the differences between impulse and reaction turbines. CO3
   (i) "Impulse turbines operates at high speeds". State the reason for it. CO3
   (j) Why Parson's reaction turbine is called as 50-50 reaction turbine? CO4
   (k) Define dew point temperature. CO4
   (l) State the difference between a refrigerator and a heat pump. CO4
   (m) Draw subcooling and superheating of a refrigerant on T-s and P-h diagrams. CO4
   (n) Define (i) relative humidity and (ii) specific humidity. CO4

UNIT – I

2. (a) Draw and explain h-s (enthalpy-entropy) diagram for a pure substance. (7M) CO1

(b) A pressure cooker contains 1.75 kg of saturated steam at 6 bar. Calculate the quantity of heat which must be rejected so as to reduce the quality to 65% dry. Also determine the pressure and temperature of the steam at the new state. (7M) CO1

(OR)

3. (a) Explain the working of a Benson boiler with a neat sketch. (7M) CO1
   (b) Describe the working of a regenerative Rankine cycle with a neat sketch. (7M) CO1

UNIT – II

4. (a) Describe the method of calculation to find throat and exit areas in a convergent-divergent nozzle. (7M) CO2
   (b) The nozzles of a Deleval steam turbine are supplied with dry saturated steam at a pressure of 10 bar. The pressure at the outlet of the turbine is 1.2 bar. The turbine has two nozzles with a throat diameter of 2.54 cm. Assuming nozzle and turbine rotor efficiency as 92% and 40% respectively. Calculate the quality of steam used per hour and the power developed. (7M) CO2

(OR)

5. (a) Explain the working of ejector type jet condenser with a neat sketch. (7M) CO2
   (b) A primemover uses 14500 kg of steam per hour and develops 2400 kW. The steam supplied at 30 bar and 350°C. The exhaust from the primemover is condensed at 725 mm of Hg when barometer records 760 mm of Hg. The condensate temperature from the condenser is 30°C and the rise in temperature of circulating water is from 10°C to 25°C. Determine : (7M) CO2
   (i) The quality of steam entering the condenser.
   (ii) The quality of circulating water and ratio of cooling.

UNIT – III

6. (a) What do you mean by compounding of steam turbine? Describe the velocity compounding of steam turbines with a neat sketch. (7M) CO3
   (b) In an impulse turbine the nozzles are inclined at 24°C to the plane of rotation of the blades. The steam velocity is 915 m/s and the blade speed is 420 m/s. Assuming equiangular blades. Calculate: (7M) CO3
   (i) Blade angles
   (ii) Axial thrust
   (iii) Power developed for a steam flow rate of 970 kg/hr.

(OR)

7. (a) What is reheat factor? Write its significance and why is its magnitude always greater than unity? (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 35° and 21° respectively. The mean blade speed is 78 m/s and the steam consumption is 23,200 kg per hour. Determine the power developed in the pair, if the isentropic heat drop for the pair is 24 per kg. (7M) CO3

UNIT – IV

8. (a) Explain the working of a vapour compression refrigeration cycle with a neat sketch. Draw the cycle on p-V and T-s diagrams. (7M) CO4
   (b) An air-refrigeration system operating on a Bell-Coleman cycle, takes in air from cold room at –10°C and compresses it from 1.01 bar to 5.05 bar. The index of compression being 1.2. The compressed air is cooled to 15°C. The ambient temperature is 25°C. Air expands in an expander where the index of expansion is 1.32. Calculate (7M) CO4
   (i) COP of the system (ii) Quantity of air

(OR)

9. (a) Deduce expression for hoopstress in a thin cylindrical shell subjected to internal fluid pressure. (6M) CO4

   (b) A thick cylinder with internal diameter of 100 mm and external diameter of 200 mm is subjected to an internal fluid pressure of 30 MPa. Draw the variation of radial and hoop stresses across the section. (8M) CO4

****

Hall Ticket Number:

ME223 (R20)

B.TECH. DEGREE EXAMINATION, JULY-2023

Semester IV [Second Year] (Regular & Supplementary)

STRENGTH OF MATERIALS

Time: Three hours Maximum Marks: 70

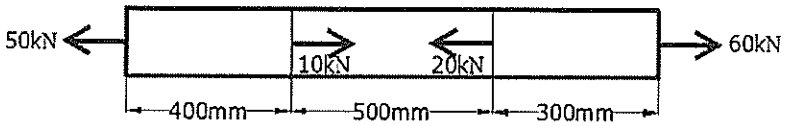
Answer Question No.1 compulsorily. (14 x 1 = 14)
Answer One Question from each unit. (4 x 14 = 56)

1. Answer the following:
   (a) Define yield stress. CO1
   (b) State Hooke's law. CO1
   (c) Define plasticity. CO1
   (d) What is the thermal stress? CO1
   (e) State general equation of torsion for circular bars. CO2
   (f) Classify beams based on support conditions. CO2
   (g) Draw BM diagram for simply supported beam of length 'L' subjected to point load 'P' at its mid span. CO2
   (h) Sketch the shear stress distribution in a rectangle section beam. CO3
   (i) State the assumptions made in the theory of simple bending. CO3
   (j) What is the maximum deflection in a cantilever of length 'L' subjected to point load 'P' at its free end? CO3
   (k) Define principal stresses and principal planes. CO4
   (l) Define a pressure vessel. CO4
   (m) Estimate hoop stress in a thin cylinder of diameter 60 mm, wall thickness 3 mm subjected to internal pressure of 20 MPa. CO4
   (n) Write Lame's equations in case of thick cylindrical pressure vessel. CO4

UNIT – I

2. (a) Define Elastic modulus, shear modulus and bulk modulus. (6M) CO1

(b) Find the maximum stress and total elongation of a bar subjected to loads as shown in figure. The bar has a diameter 30 mm and E for the bar 105 GPa. (8M) CO1



(OR)

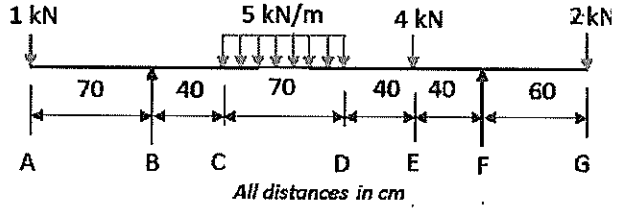
3. A 20 mm diameter steel rod passes centrally through a copper tube 40 mm external diameter and 30 mm internal diameter. The tube is closed at each end by rigid washers of negligible thickness and the nuts are tightened until it is just snug. If the temperature of the assembly is raised by 50°C, calculate the stresses developed in copper tube and steel rod. Take $E_s = 2 \times 10^5$ N/mm^2; $E_c = 1.1 \times 10^5$ N/mm^2. $\alpha_s = 1.4 \times 10^{-5}$/°C; $\alpha_c = 1.8 \times 10^{-5}$/°C. CO1

UNIT – II

4. A hollow shaft of diameter ratio 3/5 is required to transmit 450 kW at 1200 pm, the shearing stress in the shaft must not exceed 60 N/mm^2 and the twist in a length of 2.5 m is not to exceed 1°. Calculate the minimum external diameter of the shaft. Take G = 8.0 kN/mm^2. CO2

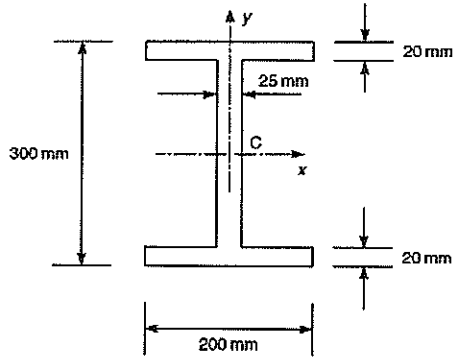
(OR)

5. Draw the shear force and bending moment diagrams for the overhanging beam shown and identify locations of points of contra-flexure if any? CO2



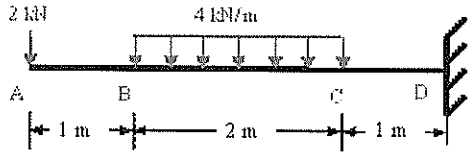
UNIT – III

6. Plot the shear stress distribution in a I-Section beam of following dimensions carrying a Maximum shear force V = 40 kN. CO3



(OR)

7. (a) Derive differential equation of deflecting curve of the beam. (7M) CO3
   (b) Determine the deflections at points A and B of the beam shown in figure. Take Elastic modulus E = 200 kN/mm^2. (7M) CO3



UNIT – IV

8. (a) Explain the procedure to draw Mohr's circle. (6M) CO4
   (b) For the state of stress given by $\sigma_x = -60$ MPa, $\sigma_y = -45$ MPa and $\tau_{xy} = 25$ MPa, Determine stresses on a plane oriented at $\theta = 45°$ with horizontal, principal stresses, orientation of principal planes , maximum shear stresses and orientation of maximum shear planes. (8M) CO4

Hall Ticket Number:

ME224 (R20)

B.TECH. DEGREE EXAMINATION, JULY-2023

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) Define feed in drilling operation. CO1
   (b) How do you specify drilling machine? CO1
   (c) List the types of lathe machines? CO1
   (d) What is the purpose of grinding CO2
   (e) How do you specify a grinding wheel? CO2
   (f) Write the difference between hand and machine lapping process. CO2
   (g) Write the formula for calculating shear strain in metal cutting. CO3
   (h) What are the parameters effect the tool life? CO3
   (i) List the conditions for formation of continuous chips. CO3
   (j) Write the assumptions considered in Merchant's theory. CO3
   (k) List the applications of Wirecut EDM process. CO4
   (l) List the types of jigs used in drilling machines. CO4
   (m) What are the applications of ECM? CO4
   (n) What are the properties required for dielectric fluid used in EDM? CO4

UNIT – I

2. (a) Explain the components of lathe machine with a neat sketch. (7M) CO1
   (b) List and explain any one lathe accessories with a sketch. (7M) CO1

(OR)

3. (a) Draw and explain the working of sensitive drilling machine. (7M) CO1
   (b) Discuss any four lathe operations with a sketch. (7M) CO1

UNIT – II

4. (a) Explain the centre less grinding process. What are the various feeding methods used in centre less grinding. (7M) CO2
   (b) Explain the surface grinding machines briefly. (7M) CO2

(OR)

5. (a) List the advantages and limitations of honing process. (7M) CO2
   (b) Explain the working centre type cylindrical grinding machine briefly with a sketch. (7M) CO2

UNIT – III

6. (a) Explain single point cutting tool nomenclature with a sketch. (7M) CO3
   (b) In orthogonal cutting if the feed is 1.25 mm/rev. and chip thickness after cutting is 2 mm. The tool bit has a rake angle of 10^0
   Shear strength = 6000 kg/cm^2
   width of cut = 10 mm
   cutting speed = 30 m/min
   coefficient of friction = 0.9
   Determine the following: (7M) CO3
   (i) shear angle
   (ii) shear force
   (iii) friction angle
   (iv) horse power at the cutting tool

(OR)

7. (a) For a cutting tool, the tool life is expressed by the equation $VT^n = C$.
   In a certain tool test a single point cutting tool had a life of 10 minutes when operating at 240 m/min. At what speed should the tool have to be operated in order to have a tool life of 3 hours. Assume n = 0.2. (7M) CO3
   (b) Draw a Merchants circle diagram and derive expressions to show relationships among the different forces acting on the cutting tool and different parameters involved in metal cutting. (7M) CO3

UNIT – IV

8. (a) List out the differences between jigs and fixtures. (7M) CO4
   (b) What is plasma arc machining? Explain its principle of operation. (7M) CO4

(OR)

9. (a) Explain the USM process with a neat sketch and list the applications. (7M) CO4
   (b) What is meant by location? Describe 3-2-1 principle of location. (7M) CO4

****

ME224 (R20)

Hall Ticket Number:

ME225 (R20)

B.TECH. DEGREE EXAMINATION, JULY-2023

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 in brief:
   (a) Define specific gravity of a fluid. CO1
   (b) Differentiate between dynamic and kinematic viscosity. CO1
   (c) State Bernoulli's principle. CO1
   (d) List out fluid flow types. CO2
   (e) Define displacement thickness. CO2
   (f) What is the need of dimension analysis? CO2
   (g) List out various types of similitude. CO2
   (h) How do you classify water turbines? CO3
   (i) Differentiate between impulse and reaction turbines. CO3
   (j) Quote the expression for force exerted by the jet of water on the moving flat plate in the direction of the jet. CO3
   (k) State the significance of drawing velocity diagrams. CO3
   (l) What is an air vessel? CO4
   (m) Draw an ideal indicator diagram of a reciprocating pump? CO4
   (n) Define manometric head of a centrifugal pump. CO4

UNIT – I

2. (a) Differentiate between: (i) Liquids and gases (ii) Real fluid and ideal fluids (iii) Specific weight and specific volume of a fluid. (6M) CO1

(b) The space between two square flat parallel plates is filled with oil. Each side of the plate is 60 cm. The thickness of the oil film is 12.5 mm. The upper plate, which moves at 2.5 m per sec, requires a force of 98.1 N to maintain the speed. Determine: (i) The dynamic viscosity of the oil in Poise and (ii) The kinematic viscosity of the oil in Stokes if the specific gravity of the oil is 0.95. (8M) CO1

(OR)

3. (a) State and explain continuity equation. Derive continuity equation for one dimensional flow. (7M) CO1
   (b) A 300 mm diameter pipe conveying water branches into two pipes of diameter 250 mm and 200 mm and respectively. If the average velocities in the 300 mm and the 200 mm pipes be 2.5 m/sec and 1 m/sec, calculate the velocity in the 250 mm pipe. (7M) CO1

UNIT – II

4. (a) Derive Darcy's Wiesbach equation for the loss of head obtained due to friction in the pipe line. (9M) CO2
   (b) Outline the concept of boundary layer and measures of its thickness. (5M) CO2

(OR)

5. (a) The drop in pressure Δp due to an obstruction in a pipe depends upon the pipe diameter D, average velocity in the pipe V, characteristics length of obstruction d, mass density ρ and viscosity of fluid μ. Using Buckingham's π-theorem, determine a set of dimensionless parameters. (7M) CO2

   (b) What is dimensional homogeneity? Explain Geometric, Kinematic and Dynamic similarity. (7M) CO2

UNIT – III

6. (a) Obtain an expression for the force exerted by a jet of water on a stationary inclined flat plate in the direction of the jet. (7M) CO3
   (b) Construct the velocity diagrams when the jet strikes centrally over radial curved vanes? Indicate the meaning of each term. (7M) CO3

(OR)

7. (a) Elucidate the working principle of Kaplan turbine with a neat sketch. (8M) CO3
   (b) Illustrate the three types of characteristic curves of a turbine. (6M) CO3

UNIT – IV

8. (a) Enumerate the effect of acceleration of piston on velocity and pressure in suction and delivery pipes of a reciprocating pump. (8M) CO4
   (b) Explain with neat sketch the functions of air vessels in a reciprocating pump. (6M) CO4

(OR)

9. (a) Explain the operating principle of centrifugal pump with neat labeled sketch. (8M) CO4
   (b) Define and mention an expression for manometric efficiency, mechanical efficiency and overall efficiency of a centrifugal pump. (6M) CO4

****

ME225 (R20)