(OR)

9. (a) The means of random samples of sizes 9 and 7 are 196.42 and 198.82. The sum of the squares of the deviations from their means is 26.94 and 18.73 respectively. Can the samples be considered to have been from the same normal distribution? (7M) CO4

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

x	0	1	2	3	4
f	419	352	154	56	19

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Hall Ticket Number:

ME221 (R20)

B.TECH. DEGREE EXAMINATION, SEPTEMBER-2024

Semester IV [Second Year] (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) Solve $p\sqrt{x}+q\sqrt{y}=\sqrt{z}$ CO1
   (b) Classify the equation $\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial y^2}=0$ CO1
   (c) Write the solution of one dimensional steady state heat flow equation. CO1
   (d) When does the Newton-Raphson formula fail? CO2
   (e) Evaluate $\Delta^{10}\left[(1-x)(1-2x^2)(1-3x^3)(1-4x^4)\right]$ CO2
   (f) Find the interpolating polynomial for the data (1, 2) and (2, 4). CO2
   (g) Write $\frac{dy}{dx}$ at x_n using backward differences. CO3
   (h) State Simpson's 3/8th rule for evaluating $\int_{x_0}^{x_n} f(x)dx$ CO3
   (i) Briefly explain the Euler's method. CO3
   (j) State the Poisson's equation CO4
   (k) Write the mean and variance of Poisson distribution. CO4
   (l) Distinguish between type-I and type-II errors. CO4
   (m) What is the test statistic for small samples concerning difference between two means? CO4
   (n) When do you apply F-test? CO4

UNIT – I

2. (a) Solve $p\tan x+q\tan y=\tan z$. (7M) CO1

(b) A string is stretched and fastened at two points l apart. Motion is started by displacing the string in the form $y = a\sin\left(\frac{\pi x}{l}\right)$ from which it is released at time t = 0. Show that the displacement of the string $y(x,t) = a\sin\left(\frac{\pi x}{l}\right)\cos\left(\frac{\pi ct}{l}\right)$. (7M) CO1

(OR)

3. An infinitely long plane uniform plate is bounded by two parallel edges and an end at right angles to them. The breadth is π; this end is maintained at a temperature u_0 at all points and other edges are at zero temperature. Determine the temperature at any point of the plate in the steady state. CO1

UNIT – II

4. (a) Using Newton-Raphson method find $\sqrt[3]{18}$ correct to four decimals. (7M) CO2

(b) The population of a town in decimal census was as given below. Estimate the population for the year 1955. (7M) CO2

Year x	1921	1931	1941	1951	1961
Population y	46	66	81	93	101

(OR)

5. (a) Using Lagrange's interpolation formula, calculate y(2) from the table (7M) CO2

x	0	1	3	4
y	-12	0	12	24

(b) Given that (7M) CO2

x:	1.0	1.1	1.2	1.3	1.4	1.5	1.6
f(x):	7.989	8.403	8.781	9.129	9.451	9.750	10.031

Find $\frac{dy}{dx}$ at x = 1.0

UNIT – III

6. (a) Evaluate $\int_0^{\frac{\pi}{2}} \sqrt{\cos\theta}\, d\theta$ by dividing the interval into 6 parts using trapezoidal rule and Simpson's 1/3rd rule. (7M) CO3

(b) Given $\frac{dy}{dx} = x + y^2$, y(0) = 1, h = 0.2, Calculate y(0.2) using Runge-Kutta method of 4th order. (7M) CO3

(OR)

7. (a) Using Euler's method solve for y at x = 0.1 from $\frac{dy}{dx} = x + y + xy$, y(0) = 1 taking step size 0.025. (7M) CO3

(b) Solve $\nabla^2 u = 0$ under the conditions (h = 1, k = 1), u(0, y) = 0, u(4, y) = 12 + y, for $0 \le y \le 4$, u(x, 0) = 3x, u(x, 4) = x^2 for $0 \le x \le 4$. (7M) CO3

UNIT – IV

8. (a) In a bombing action there is 50% chance that any bomb will strike the target. Two direct hits are needed to destroy the target completely. How many bombs are required to be dropped to give a 99% chance or better of completely destroying the target? (7M) CO4

(b) In a test of 2000 electric bulbs, it was found that the life of a particular type was normally distributed with an average life of 2040 hours and standard deviation of 60 hours. Estimate the number of bulbs like to burn for (i) more than 2150 hours (ii) less than 1950 hours (iii) more than 1920 and less than 2160 hours. (7M) CO4

Hall Ticket Number:

ME222 (R20)

B.TECH. DEGREE EXAMINATION, SEPTEMBER-2024

Semester IV [Second Year] (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 vaporization. CO1
   (b) Define critical state. CO1
   (c) State the function of boiler accessories CO1
   (d) Name the processes of simple Rankine cycle? CO1
   (e) State the function of nozzle. CO2
   (f) Define nozzle efficiency. CO2
   (g) What is the use of condenser in power plant? CO2
   (h) How the pressure and velocity varies in reaction turbine. CO3
   (i) Define reheat factor in steam turbines. CO3
   (j) Which is an example of pressure compounded steam turbine. CO3
   (k) Define degree of reaction. CO3
   (l) State the basic difference between refrigerator and heat pump. CO4
   (m) Define dew point temperature. CO4
   (n) How the wet bulb temperature lines are represented on psychometric chart. CO4

UNIT – I

2. (a) Explain h-s diagram for pure substance with constant property lines. (7M) CO1
   (b) Steam at 1000 kPa and 300°C enters an engine and expands to 20 kPa. If the exhaust steam has a dryness fraction of 0.9, make calculation for drop in enthalpy and change in entropy. (7M) CO1

(OR)

3. (a) What is the function of boiler and how boilers are classified? (7M) CO1
   (b) Explain any method to improve performance of Rankine cycle with block diagram and h-s plot. (7M) CO1

UNIT – II

4. (a) Describe effect of friction in the flow through steam nozzle with help of h-s diagram (7M) CO2
   (b) Determine the throat area, exit area and exit velocity for a steam nozzle to pass a mass flow of 0.2 kg/s, when inlet conditions are 10 bar and 250°C and the final pressure is 2 bar. Assume expansion is isentropic and that the inlet velocity is negligible. Use $Pv^{1.3}$ constant. (7M) CO2

(OR)

5. (a) Explain evaporative type surface condensers with neat sketch. (7M) CO2
   (b) Calculate the vacuum efficiency of condenser from following data: Vacuum at steam inlet to condenser 725 mm, barometer 760 mm and hot well temperature 26.4°C. (7M) CO2

UNIT – III

6. (a) Explain velocity compounding impulse turbine with neat sketch. (7M) CO3
   (b) In a DeLavel turbine steam issues from the nozzle with a velocity 1200 m/s. the nozzle is 20°, the mean blade velocity is 400 m/s and the inlet and outlet angles of blades are equal. The mass of steam flowing through the turbine per hour is 1000 kg. Calculate (i) blade angle (ii) relative velocity of stream entering (iii) power developed (iv) blade efficiency. Take blade velocity coefficient as 0.8 (7M) CO3

(OR)

7. The following data related to a stage of reaction turbine: mean rotor diameter 1.5 m, speed ratio 0.72, blade outlet angle 20° and rotor speed 3000 rpm. Determine (i) the diagram efficiency (ii) the percentage increase in diagram efficiency and rotor speed if the rotor is designed to run at best theoretical speed, the exit angle being 20°. CO3

UNIT – IV

8. (a) Explain construction and working of Bell Coleman cycle with P-v and T-s diagram. (7M) CO4
   (b) A vapour compression refrigerator works between the pressure limits of 60 bar and 25 bar. The working fluid is just dry at the end of compression and there is no undercooling of the liquid before expansion valve. Determine (i) COP of the cycle and (ii) capacity of the refrigerator, if the fluid is at the rate of 5 kg/min. (7M) CO4

Pressure (bar)	Saturation Temperature (K)	Enthalpy (kJ/kg)		Entropy (kJ/kgK)	
		Liquid	vapour	liquid	vapour
60	295	151.96	293.29	0.554	1.0332
25	261	56.32	322.58	0.226	1.2464

(OR)

9. (a) Explain process used in winter air conditioning system with help of psychrometric chart. (7M) CO4
   (b) The readings from a sling psychrometer are as follows: DBT = 30°C, WBT = 20°C, barometer reading = 740 mm of Hg. Determine (i) Dew point temperature (ii) Relative humidity (iii) specific humidity. (7M) CO4

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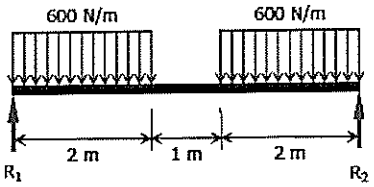
ME222 (R20)

(b) Determine the slope of the beam at left support and deflections at 2 m and 3 m from the left support for the beam shown in figure. Take Elastic modulus E = 210 kN/mm^2. (8M) CO3



UNIT – IV

8. (a) Draw the Mohr's circle when $\sigma_x = 0$, $\sigma_y = 0$ and $\tau_{xy} = 50$ MPa. (4M) CO4

(b) The state of stress at a point is $\sigma_x = 40$ MPa, $\sigma_y = 60$ MPa and $\tau_{xy} = 30$ MPa. Determine stresses on a plane oriented at $\theta = 60$ degrees with horizontal, principal stresses, orientation of principal planes, maximum shear stresses and orientation of maximum shear planes using analytical method. (10M) CO4

(OR)

9. (a) A thin cylindrical pressure vessel of 1.2 m diameter generates steam at a pressure of 1.75 N/mm^2. Find the minimum required wall thickness if the hoop and longitudinal stresses are not to exceed 42 MPa and 28 MPa respectively. (6M) CO4

(b) A cast iron thick cylinder of internal diameter 200 mm and wall thickness 50 mm is subjected to an internal fluid pressure of 5 MPa. Calculate the tangential and radial stresses at the inner, middle and outer surfaces of the thick cylinder. (8M) CO4

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Hall Ticket Number:

ME223 (R20)

B.TECH. DEGREE EXAMINATION, SEPTEMBER-2024

Semester IV [Second Year] (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 creep. CO1
   (b) Define allowable stress. CO1
   (c) Distinguish between maximum stress and failure stress. CO1
   (d) State the relation between load, shear force and bending moment. CO2
   (e) Classify various loads that act on a beam. CO2
   (f) Define Torsion. CO2
   (g) State the equation of simple bending. CO3
   (h) Draw the typical shear stress distribution pattern in a symmetrical I-section beam. CO3
   (i) State the expression for differential equation of deflecting curve of the beam. CO3
   (j) Define shear planes. CO4
   (k) State any two assumptions in Mohr's circle method. CO4
   (l) State expression for hoop stress in a thick cylinder of outer radius r_o, inner radius r_i subjected to pressure P CO4
   (m) State location of maximum hoop stress in a hollow thick cylinder. CO4
   (n) State relation between hoop and longitudinal stresses in thin spherical pressure vessels. CO4

UNIT – I

2. A tensile test on steel bar has the following data:
Diameter of the steel bar = 25 mm;
Gauge length of a bar = 200 mm
Load at the elastic limit = 150 kN;
Extension at a load of 100 kN = 0.15 mm
Maximum load = 300 kN;
Total extension = 60 mm
Diameter of the rod at the failure = 12 mm
Determine: (i) Young's modulus (ii) Stress at the elastic limit (iii) Ultimate stress (iv) Percentage elongation (v) Percentage decrease in area (vi) Poisson's ratio. CO1

(OR)

3. (a) A steel wire is stretched between rigid supports. The initial pre stress in the wire is 30 MPa when the temperature is 20°C. Find the stress in the wire when the temperature drops to 0°C and also find the temperature at which the stress in the wire becomes zero. Take $\alpha = 14 \times 10^{-6}/^{0}C$ and E = 210 GPa. (7M) CO1

(b) A copper bar AB of length 1m is placed vertically on the floor such that a gap of 0.1 mm is present between the top end of the bar and ceiling of the room at room temperature. Calculate the axial compressive stress in the bar if the temperature rises by 40°C. Take for copper $\alpha = 17 \times 10^{-6}/^{o}C$ and E = 110 GPa. (7M) CO1

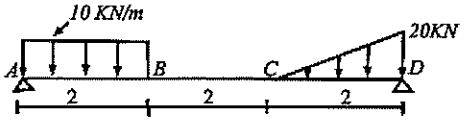
UNIT – II

4. (a) A solid steel shaft of diameter 60 mm is to be designed using an allowable shear stress of 40 MPa and an allowable angle of twist of 1 degree per meter length. Determine the maximum permissible torque that may be applied. Assume G = 80 GPa. (6M) CO2

(b) Compare & analyze the weights, angle of twists and shear strengths of hollow & solid shafts made of same material, having same outer radius 'r', length L and subjected to same torque T. The inside radius of hollow shaft is 0.6r. (8M) CO2

(OR)

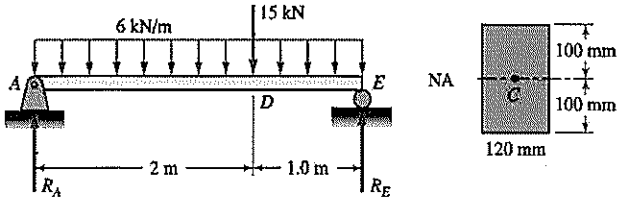
5. Draw the shear force and bending moment for the simply supported beam shown in figure. CO2



Distance in meters

UNIT – III

6. Plot the bending and shear stress distribution in a rectangle section simply supported beam loaded as shown in figure. Also determine the maximum bending stress and shear stress in beam section. CO3



(OR)

7. (a) Determine the maximum central deflection of a simply supported beam carrying UDL of intensity w/m, throughout its length L. Also, find the slope of the beam at the point of maximum deflection. (6M) CO3

Hall Ticket Number:

ME224 (R20)

B.TECH. DEGREE EXAMINATION, SEPTEMBER-2024

Semester IV [Second Year] (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)	Draw the principle of lathe.	CO1
(b)	What is eccentric turning?	CO1
(c)	List the work holding devices used in lathe machine.	CO1
(d)	List the types of drilling machines.	CO2
(e)	List the constituents of grinding wheel.	CO2
(f)	Classify the centre type grinding machines.	CO2
(g)	What are the disadvantages of centre type external cylindrical grinding?	CO3
(h)	List the applications of honing process.	CO3
(i)	List the assumptions for drawing Merchant's circle.	CO3
(j)	What are the parameters effecting the tool life?	CO4
(k)	List the properties desirable properties required for cutting tool materials.	CO4
(l)	List the types of clamps.	CO4
(m)	What is the purpose of locating pins?	CO4
(n)	Draw a neat sketch of USM principle.	CO4

UNIT – I

2. (a)	Draw the schematic layout of engine lathe and label all parts.	(7M)	CO1
(b)	Explain spindle feed mechanism of drilling machine with a diagram.	(7M)	CO1

(OR)

3. (a) List and explain any three drilling operations. (7M) CO1
   (b) Explain taper turning attachment method with a diagram. (7M) CO1

UNIT – II

4. (a) Explain the principle of operation of centre less grinding machine using a neat sketch. (7M) CO2
   (b) Differentiate between honing and lapping process. (7M) CO2

(OR)

5. (a) Explain the following terms briefly: (7M) CO2
   (i) Loading
   (ii) Truing
   (b) Describe the principle of operation and main components of surface grinder. (7M) CO2

UNIT – III

6. (a) Draw the nomenclature of single point cutting tool and explain the various elements briefly. (7M) CO3
   (b) Explain tool wear with a sketch. (7M) CO3

(OR)

7. (a) Let n = 0.5 and C = 90 in the Taylor equation for tool wear. What is the percent increase in tool life if the cutting speed is reduced by (i) 50% and (ii) 75%? (7M) CO3
   (b) Differentiate between orthogonal and oblique cutting. (7M) CO3

UNIT – IV

8. (a) List and explain any one fixture with a neat diagram. (7M) CO4
   (b) Explain mechanism of material removal in ECM process with a neat sketch (7M) CO4

(OR)

9. (a) Explain the working of EDM process with a neat sketch. (7M) CO4
   (b) Explain 3-2-1 principle of location with a neat sketch. (7M) CO4

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9. (a) Compare and contrast centrifugal and reciprocating pumps. (6M) CO4
   (b) Derive the expression for minimum starting speed of a centrifugal pump. (8M) CO4

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ME225 (R20)

Hall Ticket Number:

ME225 (R20)

B.TECH. DEGREE EXAMINATION, SEPTEMBER-2024

Semester IV [Second Year] (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 weight of a fluid. CO1
   (b) Define compressibility of a fluid. CO1
   (c) Define the equation of continuity. CO1
   (d) What is meant by incompressible fluid flow? CO2
   (e) Define momentum thickness. CO2
   (f) What is the significance of Reynold's number? CO2
   (g) State Buckingham's Pi theorem. CO2
   (h) Find the force exerted by a jet of water of diameter 70 mm on a stationary flat plate, normally with a velocity of 25 m/s. CO3
   (i) What is meant by impact of jet? CO3
   (j) Differentiate between radial flow and tangential flow in turbines. CO3
   (k) What is the velocity of whirl and velocity of flow in the case of velocity diagrams? CO3
   (l) Define the terms slip and negative slip in reciprocating pumps. CO4
   (m) Define manometric efficiency of a centrifugal pump. CO4
   (n) What is the limitation of suction lift? CO4

UNIT – I

2. (a) Explain the phenomenon of surface tension on the top surface of liquids. What are the examples of surface tension? (6M) CO1

(b) A clean tube of internal diameter 3 mm is immersed in a liquid with a surface tension of 0.48 N/m. The angle of contact of the liquid with the glass can be assumed to be 130 degrees. The density of the liquid is 13600 kg/m^3. What would be the level of the liquid in the tube relative to the free surface of the liquid outside the tube? (8M) CO1

(OR)

3. (a) State Euler's equation of motion for a three dimensional flow and derive Bernoulli's equation from these equations, stating clearly the assumptions involved. (7M) CO1
   (b) Explain the working principle of Orifice meter with a neat sketch. (7M) CO1

UNIT – II

4. (a) Explain Reynold's experiment with a neat sketch. (6M) CO2
   (b) State Hagen-Poiseulle law and derive the expression for velocity distribution across a section for a flow of viscous fluid through a circular pipe. (8M) CO2

(OR)

5. (a) Derive on the basis of dimensional analysis (using Buckingham's π-theorem) suitable parameters to present the thrust developed by a propeller. Assume that the thrust 'P' depends up on the angular velocity 'ω', speed of advance 'V', diameter 'D', dynamic viscosity 'μ', mass density 'ρ', elasticity of fluid medium which can be denoted by the speed of the sound in the medium 'C'. (8M) CO2
   (b) What is meant by model analysis? Explain different types of model laws. (6M) CO2

UNIT – III

6. (a) A jet of water of 60 mm diameter strikes a curved vane at its centre with a velocity of 18 m/s. The curved vane is moving with a velocity of 6 m/s in the direction of the jet. The jet is deflected through an angle of 165°. Assuming the plate to be smooth. Find the force exerted on the plate in the direction of jet. (7M) CO3
   (b) A jet of water of diameter 50 mm moving with a velocity of 20 m/s strikes a fixed plate in such a way that the angle between the jet and the plate is 60°. Find the force exerted by the jet on the plate (i) in the direction normal to the plate, and (ii) in the direction of the jet. (7M) CO3

(OR)

7. (a) Explain working principle of Francis turbine with a neat sketch. (8M) CO3
   (b) What is draft tube? What are the functions of draft tube? Explain different types with figures. (6M) CO3

UNIT – IV

8. (a) What is reciprocating pump? Describe the principle and working of a reciprocating pump with a neat sketch. (8M) CO4
   (b) A single acting reciprocating pump running at 50 r.p.m., delivers 0.01 m^3/s of water. The diameter of the piston is 200 mm and stroke length 400 mm. Determine the theoretical discharge of the pump, coefficient of discharge, slip and percentage slip of the pump (6M) CO4

(OR)