(b) A sample of height of 6400 soldiers has a mean of 67.85 inches and standard deviation of 2.56 inches while a sample of heights 1600 soldiers has a mean of 68.55 inches and standard deviation of 2.52 inches. Do the data indicate that the soldiers on the average taller than soldiers at 0.05 level of significance? (7M) CO4

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ME221 (R20)

Hall Ticket Number:

ME221 (R20)

B.TECH. DEGREE EXAMINATION, NOVEMBER-2023

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) Write the standard form of linear equation of first order. CO1
   (b) Classify the equation $\frac{\partial^2 u}{\partial x^2}+4\frac{\partial^2 u}{\partial x \partial y}+2\frac{\partial^2 u}{\partial y^2}=0$ CO1
   (c) Write one dimensional heat flow equation. CO1
   (d) Write the formula for Newton-Raphson method. CO2
   (e) Evaluate $\Delta \sin(f(x))$. CO2
   (f) Write inverse lagrange's interpolation formula. CO2
   (g) Write Newton's backward interpolation formula CO2
   (h) Write trapezoidal rule formula. CO3
   (i) Write Euler's method formula CO3
   (j) Write Laplace's equation. CO3
   (k) Write formulas for mean and standard deviation of binomial distribution. CO4
   (l) Write the properties of binomial distributions. CO4
   (m) Define the hypothesis. CO4
   (n) Explain about the F-test. CO4

UNIT – I

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

(OR)

3. Solve the heat conduction problem $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$; subjected to the conditions $u(x, 0) = 20$, $0 \le x \le 5$ and $u(0, t) = 0$, $u(5, t) = 100$. Also compute $u(0.6, 0.04)$. CO1

UNIT – II

4. (a) Vapor pressure data for water is given in the table at different temperature. Find vapor pressure at 48°C using Newton's forward interpolation method. (7M) CO2

T (°C)	45	50	55	60
P (torr)	0.7071	0.7660	0.8192	0.8660

(b) Find a root $3x = -\cos x + 1$ using Newton Raphson's method correct to four decimal places. (7M) CO2

(OR)

5. (a) Use Lagrange's interpolation formula to find the value of y when x = 8, if the following values of x and y are given. (7M) CO2

x	5	6	9	11
y	12	13	14	18

(b) Given that

x	10	12	13	12	16	15
y	40	38	43	45	37	43

Find $\frac{dy}{dx}, \frac{d^2y}{dx^2}$ at x = 10. (7M) CO2

UNIT – III

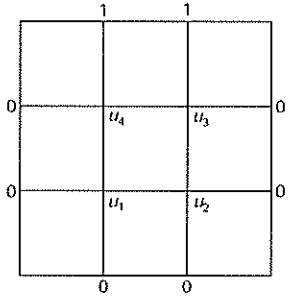
6. (a) Evaluate $\int_0^2 \frac{dx}{x}$ by using Simson's 1/3 rule taking n = 4. (7M) CO3

(b) $\frac{dy}{dx} = x + y^2$ with y(0) = 1. Estimate y (0.2) by using R-K fourth order method. Take h = 0.2. (7M) CO3

(OR)

7. (a) 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

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



UNIT – IV

8. (a) Given a random variable having the normal distribution with $\mu = 16.2$ and $\sigma^2 = 1.5625$, find the probabilities that it will take on a value (7M) CO4
(i) Greater than 16.8
(ii) Between 13.6 and 18.8

(b) If 20% of the memory chips made in a certain plant are defective. What are the probabilities that in a lot of 100 randomly chosen for inspection (i) at most 15 will be defective (ii) exactly 15 will be defective? (7M) CO4

(OR)

9. (a) A certain stimulus administered to each of 12 patients resulted in the following increase of blood pressure: 5, 2, 8, 1, 3, 0, -2, 1, 5, 0, 4, 6. Can it be concluded at 0.05 level of significance that the stimulus will in general be accompanied by an increase in blood pressure. (7M) CO4

(b) Determine the COP and capacity of the refrigerator for the fluid flow rate of 5 kg/hr when a vapour compression refrigeration system is operating in between the pressure limits of 60 bar and 25 bar. The working fluid is dry at the beginning of compression and there is no undercooling before expansion valve. Take the following data: (7M) CO4

Pressure (bar)	Sat Temp(K)	Enthalpy(kJ/kg)		Entropy (kJ/kg K)	
		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) Show psychrometric chart and draw various lines appears in it. Also show how to represent different psychrometric processes of standard type. (7M) CO4

(b) Find (i) Initial and final relative humidity (ii) Final wet bulb temperature and (iii) Amount of heat removed when atmospheric air with DBT of 28^0C and a WBT of 17^0C is cooled to 15^0C without changing its moisture content (7M) CO4

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Hall Ticket Number:

ME222 (R20)

B.TECH. DEGREE EXAMINATION, NOVEMBER-2023

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) Define dryness fraction and degree of superheat. CO1
   (b) List out the advantages of superheated steam. CO1
   (c) What are the different accessories used in steam boilers? CO1
   (d) Show T-S diagram of a Regenerative cycle with two feed water heaters in operation. CO1
   (e) Discuss the effect of friction in the nozzle operation. CO2
   (f) List the assumptions made in the nozzle analysis. CO2
   (g) What is the main difference between Jet and Surface condensers? CO2
   (h) Define stage efficiency and reheat factor as applied to steam turbines. CO3
   (i) What is degree of reaction and what the condition for 50% degree of reaction in a turbine. CO3
   (j) What is the main difference between impulse and reaction turbines? CO3
   (k) Define COP and Ton of refrigeration. CO4
   (l) What are the advantages and disadvantages of VCR system? CO4
   (m) Show sensible heating and sensible cooling processes on a psychrometric chart. CO4
   (n) What is the psychrometric process used in summer seasons for hot and wet weather conditions? CO4

UNIT – I

2. (a) Explain the formation of steam with the help of P-v and T-s diagrams. (7M) CO1
   (b) Find the enthalpy, internal energy and entropy of one kg of steam at 15 bar, when the (i) the steam is dry and saturated (ii) the steam is 25% wet. Use steam tables only (7M) CO1

(OR)

3. (a) Explain the working of Benson boiler with the help of a neat sketch. (7M) CO1
   (b) Discuss briefly about the methods of (i) Reheating and (ii) Regeneration techniques applied to steam power plants for increasing the performance. (7M) CO1

UNIT – II

4. (a) Develop an expression for maximum discharge through the nozzle. (7M) CO2
   (b) Determine (i) throat pressure (ii) the number of nozzles required if the diameter of the nozzle at the throat is 5 mm (iii) the diameter at exit if 15% of the overall isentropic enthalpy drop reheats the steam by friction in divergent portion if steam at a pressure of 10 bar and dry saturated is to be discharged through a convergent-divergent nozzle to a pressure of 0.15 bar. The mass flow rate is 8 kg/kWh. The turbine develops 250 kW. (7M) CO2

(OR)

5. (a) Explain the working of an evaporative condenser with a neat sketch. (5M) CO2
   (b) The following readings were recorded during a trail on condenser: Barometer reading = 766 mm of Hg, Actual vacuum recorded by gauge = 716 mm of Hg, Temperature of exhaust steam = 35^0C, Temperature of hot well = 29^0C, Inlet temperature of cooling water = 15^0C, the Outlet temperature of cooling water = 24^0C. Determine: (i) Corrected vacuum to standard barometer reading of 760 mm of Hg (ii) Vacuum efficiency (iii) Undercooling of condensate and (iv) Condenser efficiency (9M) CO2

UNIT – III

6. (a) Derive the blade efficiency of a single stage reaction turbine with usual notation. (7M) CO3
   (b) Determine (i) Blade efficiency (ii) power developed and axial thrust if the steam flow rate is 8 kg/s for the following data refers to a single stage impulse turbine: Isentropic nozzle heat drop = 250 kJ/kg; nozzle efficiency = 90%; ratio of blade speed to whirl component of steam speed = 0.5; blade velocity coefficient = 0.9; The velocity of steam entering the nozzle = 20 m/s. (7M) CO3

(OR)

7. (a) Explain the working of a single stage impulse turbine with the help pressure and velocity variations across the stage. (7M) CO3
   (b) Determine (i) The blade inlet angle if the outlet blade angle is 22^0 (ii) Diagram efficiency (iii) The percentage increase in diagram efficiency and rotor speed if turbine is designed to run at the best theoretical speed for a multi-stage reaction turbine at one of the stages the rotor diameter is 1250 mm and speed ratio 0.72. The speed of the rotor is 3000 rpm. (7M) CO3

UNIT – IV

8. (a) Discuss the effect of the following on the performance of a VCR system (i) Effect of superheating and (ii) Effect of sub-cooling. (7M) CO4

(b) A thin cylindrical shell 3 m long closed at the ends has an internal diameter of 1 m and wall thickness of 16 mm. Determine the longitudinal and circumferential stresses induced and also change in dimensions, when it is subjected to an internal pressure of 1.5 N/mm^2.Take $E = 2 \times 10^5$ N/mm^2 and Poisson's ratio = 0.3. (8M) CO4

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Hall Ticket Number:

ME223 (R20)

B.TECH. DEGREE EXAMINATION, NOVEMBER-2023

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) What do you mean by linear elasticity? CO1
   (b) Define the term Poisson's ratio. CO1
   (c) Define the terms neutral axis and moment of resistance. CO3
   (d) What is the relationship for slope and deflection of a cantilever beam carrying UDL? CO2
   (e) Write the differences between thin and thick cylinders. CO4
   (f) Distinguish between resilience and proof resilience. CO1
   (g) State the relationship between S.F, B.M and rate of loading CO2
   (h) Differentiate between Shear force and Bending moment. CO2
   (i) Draw the shear stress distribution for an I-section. CO3
   (j) What is the ratio of maximum shear stress to average shear stress for a circular cross section? CO3
   (k) State the general equation of torsion for circular members. CO2
   (l) What do you mean by Macaulay's method? CO3
   (m) What are the stresses induced in thick cylindrical shells? CO4
   (n) What do you mean by principal stresses? CO4

UNIT – I

2. (a) Draw the stress strain diagram for mildsteel and explain the salient feature points. (8M) CO1
   (b) Explain briefly about how to find stresses in composite bars. (6M) CO1

(OR)

3. (a) A bar 600 mm long is having square cross section of size 50 mm x 50 mm. If the bar is subjected to an axial tensile load of 120 kN and lateral compression of 600 kN on face of size 50 mm x 600 mm. Calculate the changes in size and volume. (8M) CO1
   (b) Derive the relation between the Young's modulus and Bulk modulus. (6M) CO1

UNIT – II

4. (a) State the assumptions made in the torsion of shafts. (6M) CO2
   (b) A hollow shaft of external diameter 150 mm transmits 400 kW at 200 rpm. Determine the maximum internal diameter, if the maximum shear stress in the shaft is not to exceed 60 N/mm^2. (8M) CO2

(OR)

5. (a) Explain different types of beams, loads and supports. (7M) CO2
   (b) Draw the SFD and BMD of a cantilever beam carrying UDL over the entire length of the beam. (7M) CO2

UNIT – III

6. (a) A rectangular beam 200 mm deep and 300 mm wide is simply supported over a span of 8 m. Calculate what uniformly distributed load per metre the beam may carry, if the bending stress is not to exceed 120 N/mm^2. (7M) CO3

   (b) An I-section beam 350 mm x 150 mm has a web thickness of 10 mm and a flange thickness of 20 mm. If the shear force acting on the section is 40 kN. Determine the maximum shear stress developed in the I-section. (7M) CO3

(OR)

7. (a) Derive an expression for the slope at the supports of a simply supported beam, carrying a point load at the centre. (6M) CO3
   (b) A beam of length 6 m is simply supported at its ends and carries two point loads of 48 kN and 40 kN at a distance of 1 m and 3 m respectively from the left support. Determine: (i) deflection under each load and (ii) maximum deflection. Take $E = 2 \times 10^5$ N/mm^2 and $I = 85 \times 10^6$ mm^4. (8M) CO3

UNIT – IV

8. (a) The tensile stresses at a point across two mutually perpendicular planes are 120 N/mm^2 and 60 N/mm^2. Determine the normal, tangential and resultant stresses on a plane inclined at 30^0 to the axis of the minor stress. (5M) CO4
   (b) The stresses on two mutually perpendicular planes through a point in a body are 120 MPa and 30 MPa both tensile along with a shear stress of 60 MPa. Determine (i) the magnitude and direction of principal stresses stating whether the stress condition is uniaxial or biaxial (ii) the planes of maximum shear stress and (iii) the normal and shear stress on the planes of maximum shearing stresses. (9M) CO4

(OR)

9. (a) Derive the stresses induced in thin cylindrical shell subjected to internal pressure. (6M) CO4

Hall Ticket Number:

ME224 (R20)

B.TECH. DEGREE EXAMINATION, NOVEMBER-2023

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) What is steady rest and follower rest? CO1
   (b) Write short notes on face plate. CO1
   (c) How a drilling machine is specified? CO1
   (d) Outline various types of abrasives used in grinding wheels. CO2
   (e) Distinguish between wet and dry grinding processes. CO2
   (f) What are the favourable factors for continuous chip formation? CO3
   (g) Explain "Merchant force circle" with a neat sketch. CO3
   (h) List the important properties a cutting fluid is required to possess. CO3
   (i) Enumerate the factors on which tool wear and tool life depend. CO3
   (j) Classify non-traditional machining processes. CO3
   (k) Distinguish between traditional and non-traditional machining processes? CO4
   (l) Explain water jet machining process? CO4
   (m) Differentiate Jig and Fixture. CO4
   (n) Define degree of freedom. CO4

UNIT – I

2. (a) List and explain the various operations performed on lathe machine with neat sketches. (8M) CO1
   (b) Define taper. Discuss Taper Turning by Swiveling the Compound Rest method with a neat sketch. (6M) CO1

(OR)

3. (a) Sketch and explain the following drilling operations (i) Reaming (ii) Counter Boring (iii) Counter sinking and (iv) Trepanning (8M) CO1
   (b) Sketch Radial drilling machine, explain its basic parts and mention its advantages and applications. (6M) CO1

UNIT – II

4. (a) Write a note on (i) Truing (ii) Dressing (iii) Glazing and (iv) Loading of grinding wheel. (8M) CO2
   (b) What is Lapping? How and why it is performed. (6M) CO2

(OR)

5. (a) Describe the construction and working of horizontal spindle reciprocating table surface grinding machine. (7M) CO2
   (b) Briefly explain the process of Honing with neat sketches. (7M) CO2

UNIT – III

6. (a) Draw a neat sketch of a single point cutting tool indicating its complete geometry on it. (6M) CO3
   (b) In an orthogonal cutting operation, the following data have been observed: Uncut chip thickness = 0.127 mm, Width of cut = 6.35 mm, Cutting speed = 2 m/s, Rake angle = 10°, Cutting force = 567 N, Thrust force = 227 N, Chip thickness = 0.228 mm. Determine (i) Shear angle, (ii) Friction angle (iii) Shear stress along the Shear plane and (iv) Chip velocity. (8M) CO3

(OR)

7. (a) Discuss different types of cutting tool materials. (7M) CO3
   (b) Establish the simple tool-life equation with magnitudes of constants from the following data (Taylor's tool-life equation): A tool life of 100 min is obtained from a cutting tool at a cutting speed of 25 m/min, and 10 min, at 33.3 m/min. What is the cutting speed for a 60 min, tool life? (7M) CO3

UNIT – IV

8. (a) Describe the principle and working of Ultrasonic Machining (USM) with a neat sketch. (7M) CO4
   (b) With the help of a line diagram explain the construction and working of Plasma Arc Machining (PAM). (7M) CO4

(OR)

9. (a) What are the design considerations in jig and fixture design? (7M) CO4
   (b) Explain the principle of six point location with neat sketches. (7M) CO4

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ME224 (R20)

Hall Ticket Number:

ME225 (R20)

B.TECH. DEGREE EXAMINATION, NOVEMBER-2023

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 viscosity. CO1
   (b) Define Newtonian fluid. CO1
   (c) Write the expression for determining the pressure inside a liquid jet. CO1
   (d) State any two applications of Bernoulli's equation. CO1
   (e) Define steady and unsteady flow with examples. CO2
   (f) Write the Hagen-Poiseuille equation and state the parameters. CO2
   (g) State the applications of dimensionless parameters. CO2
   (h) State different types of similitude analysis. CO2
   (i) Differentiate between reaction and impulse turbine. CO3
   (j) Define specific speed of a turbine. CO3
   (k) Define hydraulic efficiency of a Francis turbine. CO3
   (l) Write any two limitations of a reciprocating pump. CO4
   (m) Define NPSH. CO4
   (n) State various losses in a centrifugal pump. CO4

UNIT – I

2. (a) A Newtonian fluid is filled in the clearance between a shaft and a concentric sleeve. The sleeve attains a speed of 50 cm/s, when a force of 40 N is applied to the sleeve parallel to the shaft. Determine the speed if a force of 200 N is applied. (8M) CO1

(b) The surface tension of water in contact with air at 20°C is 0.0725 N/m. The pressure inside a droplet of water is to be 0.02 N/cm^2 greater than the outside pressure. Calculate the diameter of the droplet of water. (6M) CO1

(OR)

3. (a) Derive an expression to determine the discharge through an orifice meter. (7M) CO1
   (b) Water is flowing through a pipe having diameter 300 mm and 200 mm at the bottom and upper end respectively. The intensity of pressure at the bottom end is 24.525 N/cm^2 and the pressure at the upper end is 9.81 N/cm^2. Determine the difference in datum head if the rate of flow through pipe is 40 lit/s. (7M) CO1

UNIT – II

4. (a) Derive an expression for the loss of head due to friction in pipes. (7M) CO2
   (b) The viscosity of an oil of sp. gr. 0.9 is measured by a capillary tube of diameter 50 mm. The difference of pressure head between two points 2 m apart is 0.5 m of water. The mass of oil collected in a measuring tank is 60 kg in 100 seconds. Find the viscosity of oil. (7M) CO2

(OR)

5. (a) Explain the different types of hydraulic similarities that must exists between a prototype and model. (7M) CO2
   (b) The pressure difference ∇p in a pipe of diameter D and length l due to viscous flow depends on the velocity V, viscosity μ and density ρ. Using Buckingham's p-theorem, obtain an expression for ∇p. (7M) CO2

UNIT – III

6. (a) Show that the force exerted by a jet of water on an inclined fixed plate in the direction of the jet is given by
   $$F_x = \rho a V^2 \sin^2\theta$$ (7M) CO3
   (b) A jet of water of diameter 50 mm strikes a fixed plate in such a way that the angle between the plate and the jet is 30°. The force exerted in the direction of the jet is 1471.5 N. Determine the rate of flow of water. (7M) CO3

(OR)

7. (a) Explain the construction and working of Kaplan turbine with a neat sketch. (7M) CO3
   (b) Describe the constant head characteristics of Pelton turbine. (7M) CO3

UNIT – IV

8. (a) Describe the significance of air vessel in improving the efficiency of reciprocating pumps. (7M) CO4
   (b) Draw and explain the indicator diagram considering the effect of acceleration and friction in suction and deliver pipes. (7M) CO4

(OR)

9. (a) Differentiate between series and parallel multistage pumps. (7M) CO4
   (b) Describe the concept of limiting suction lift. (7M) CO4

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ME225 (R20)