Hall Ticket Number:

ME221 (R20)

B.TECH. DEGREE EXAMINATION, JANUARY-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) Solve $p + q = 1$. CO1
   (b) Write the one dimensional wave equation. CO1
   (c) Solve $xp + yq = 3z$ CO1
   (d) Write Newton's forward interpolation formula. CO2
   (e) Evaluate $\Delta^n a^x$, $h = 1$ CO2
   (f) Write the Newton's backward difference formula for finding first order derivative. CO2
   (g) Write Simpson's $1/3^{rd}$ rule. CO3
   (h) If $\frac{dy}{dx} = x^2 + y^2$, $y(0) = 1$, find $y(0.1)$ using Euler's method. CO3
   (i) Write Poisson's equation. CO3
   (j) Write the mean and variance of Poisson distribution. CO4
   (k) If n = 7, p = 0.7 find the mean of binomial distribution. CO4
   (l) Write any two properties of normal distribution. CO4
   (m) Define type 1 error. CO4
   (n) Define alternative hypothesis. CO4

UNIT – I

2. (a) Using the method of separation of variables solve $px^2 + qy^2 = 0$ (7M) CO1
   (b) Solve the solution of a one dimensional heat equation. (7M) CO1

(OR)

3. Solve the equation $\frac{\partial u}{\partial t}=\frac{\partial^2 u}{\partial x^2}$ with boundary conditions $u(x,0)=3\sin n\pi x$, $u(0,t)=0$ and $u(1,t)=0$, where $0<x<1, t>0$ CO1

UNIT – II

4. (a) Using Newton-Raphson method find the real root of the equation $x^3-5x+3=0$ (7M) CO2
   (b) Solve the equations $27x + 6y - z = 85$, $x + y + 54z = 110$, $6x + 15y + 2z = 72$ by Gauss-Seidel method. (7M) CO2

(OR)

5. (a) Using Lagrange's interpolation formula find $f(7)$ (7M) CO2

X	1	5	6	13
Y	10	23	9	15

   (b) Evaluate $f'(1)$ from the following table (7M) CO2

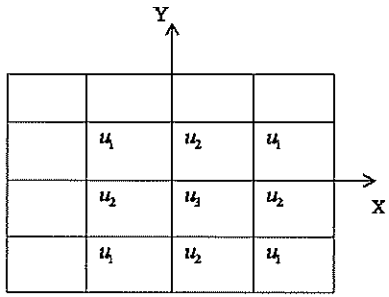
x	1	3	5	7	9
f(x)	12	16	19	21	13

UNIT – III

6. (a) Evaluate $\int_0^5 \frac{5}{\sqrt{1+x^3}}dx$, using Trapezoidal rule and Simpson's $1/3^{rd}$ rule for n = 4. (7M) CO3
   (b) Using Runge - Kutta method of order 4, find $y(0.1)$ given that $\frac{dy}{dx}=2x+y$, $y(0)=1$, h = 0.1 (7M) CO3

(OR)

7. Solve the Poisson equation $u_{xx} + u_{yy} = 8x^2y^2$, $0 < x < 1$, $0 < y < 1$ for the square mesh of given figure with $u(x,y)=0$ on the boundary and mesh length = 1. CO3



UNIT – IV

8. (a) For a normally distributed variate with mean 1 and S.D. 3, find the probabilities that (7M) CO4
   (i) $3.43 \le x \le 6.19$ (ii) $-1.43 \le x \le 6.19$
   (b) Ten coins are thrown simultaneously. Find the probability of getting at least seven heads (7M) CO4

(OR)

9. (a) The following are the average weekly losses of worker-hours due to accidents in 10 industrial plants before and after a certain safety program was put into operation:

Before	45	73	46	124	33	57	83	34	26	17
After	36	60	44	119	35	51	77	29	24	11

   Use the 0.05 level of significance to test whether the safety program is effective (7M) CO4
   (b) Fit a Poisson distribution to the following data and test the goodness of fit. (7M) CO4

X	0	1	2	3	4
F	318	387	434	92	47

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ME221 (R20)

UNIT – IV

8. (a) Explain the working of a Bell-Coleman refrigerator with the help of a schematic diagram and show the processes on P-v and T-s diagrams. (7M) CO4

   (b) Determine (i) The maximum and minimum temperature of the air in the refrigerator (ii) The refrigerating capacity if the air flow rate is 3.5 kg/min (iii) The power required to drive the compressor (iv) The COP when the air is compressed in an air standard Bell Coleman refrigerator from 1 bar, 5^0C to 5 bar. The inlet temperature of the air before it enters the expansion cylinder is 20^0C. (7M) CO4

(OR)

9. (a) Explain the following terms (i) DBT (ii) WBT (iii) DPT (iv) Specific humidity (v) Relative humidity (vi) Degree of saturation and (vii) Enthalpy of moisture air. (7M) CO4

   (b) Determine the following (i) Specific humidity (ii) Relative humidity (iii) Dew point temperature (iv) Degree of saturation and (v) Enthalpy of moist air. Take atmospheric pressure = 1.01325 bar when the readings from a sling psychrometer are as follows: DBT = 33^0C and WBT = 28^0C. (7M) CO4

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Hall Ticket Number:

ME222 (R20)

B.TECH. DEGREE EXAMINATION, JANUARY-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 sensible heat of the water and latent heat. CO1
   (b) What would be the dryness fraction of wet steam when it contains 35 kg of dry steam and 2.5 kg of water vapor? CO1
   (c) What is the function of a feed check valve? CO1
   (d) Show T-S diagram of a Simple Rankine cycle. CO1
   (e) Determine the exit velocity from a nozzle which has an enthalpy drop of 522 kJ/kg and friction loss in the nozzle is 12% neglecting entry velocity. CO2
   (f) List any two sources for air leakage in the condenser. CO2
   (g) List any two advantages of jet condensers over surface condensers. CO2
   (h) What is the blade velocity in an impulse turbine for the maximum efficiency condition when the absolute velocity is 300 m/s and the inlet nozzle angle is 18^0. CO3
   (i) What is a Parson's reaction turbine? CO3
   (j) Classify the steam turbines based on the direction of flow. CO3
   (k) Determine the heat rejection rate to the room air when a household refrigerator has COP 1.2 and collects heat from the refrigerated space at a rate of 60 kJ/min. CO4
   (l) What are the advantages of an air refrigeration system? CO4
   (m) What will be the partial pressure of water vapor if the saturated partial pressure at the same temperature of air is 0.04563 bar and the relative humidity of air at that location is 60%. CO4
   (n) Define the air conditioning system. Name its basic components. CO4

UNIT – I

2. (a) Explain the term quality of steam. Distinguish between Wet, Dry saturated and Superheated steam. (7M) CO1
   (b) List out the various mountings used in the operation of the boiler by stating the function of each. (7M) CO1

(OR)

3. (a) Explain and derive Rankine cycle thermal efficiency with reheating. Also, draw T-s and h-s diagrams. (7M) CO1
   (b) Determine (i) The pump work (ii) The turbine work (iii) The Rankine efficiency (iv) The condenser heat flow (v) The dryness fraction at the end of the expansion in a Rankine cycle, when the steam at the inlet to the turbine is saturated at a pressure of 35 bar and the exhaust pressure is 0.2 bar. (7M) CO1

UNIT – II

4. (a) Develop an expression for the exit velocity from the nozzle starting from fundamentals and stating the assumptions made in the analysis. (7M) CO2
   (b) Determine the necessary throat and exit diameters of the nozzle for a steam discharge of 500 kg/h, assuming that the expansion is in thermal equilibrium throughout a convergent-divergent nozzle and friction reheat amounting to 12 % of total isentropic enthalpy drop to be effective in the divergent part of the nozzle is to be designed in which steam initially at 14 bar and 250^0C is to be expanded down to a back pressure of 1.5 bar. (7M) CO2

(OR)

5. (a) Explain the following: (7M) CO2
      (i) Vacuum measurement
      (ii) Vacuum efficiency
      (iii) Condenser efficiency
   (b) Determine (i) The mass of air present per kg of steam (ii) The Vacuum efficiency for a surface condenser, when the vacuum maintained is 655 mm of Hg. The barometer reads 756 mm of Hg, if the temperature of condensate is 20^0 C. (7M) CO2

UNIT – III

6. (a) Distinguish between Impulse and Reaction turbines. (7M) CO3
   (b) Estimate (i) Blade angles (ii) Relative velocity of steam entering the blades (iii) Power developed (iv) Blade efficiency of a De-Laval turbine when steam issues from nozzles with a velocity of 1500 m/s. The nozzle angle is 22^0, the mean blade velocity is 450 m/s and the inlet and outlet angle of blades are equal. The mass of steam flowing through the turbine per hour is 500 kg. Assume blade velocity coefficient as 0.89. (7M) CO3

(OR)

7. (a) List out the various losses occurring in steam turbines. (7M) CO3
   (b) Find the mean diameter of the drum and the volume of steam flowing per second. Take blade tip angles at inlet and exit as 35^0 and 20^0 respectively for a Parson's reaction turbine, while running at 400 rpm consumes 30 tonnes of steam per hour. The steam at a cartage stage is at 1.6 bar with a dryness fraction of 0.9 and the stage develops 10 kW. The axial velocity of flow is constant and equal to 0.8 of the blade velocity. (7M) CO3

Library

Hall Ticket Number:

ME223 (R20)

B.TECH. DEGREE EXAMINATION, JANUARY-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) Define Poisson's ratio and what are its limits. CO1
   (b) State Hooke's law. CO1
   (c) What is bulk modulus? CO1
   (d) Define beam. CO1
   (e) Define the term torsional rigidity. CO2
   (f) A cantilever beam of length 'L' is subjected to a couple 'M' at its free end. Draw SFD and BMD. CO2
   (g) In what way, calculation of slope and deflection of beams is useful in analyzing the structure. CO3
   (h) The deflection at the end of a cantilever of length carrying a udl 'w' per unit length over the whole span is given by_____. CO3
   (i) Write the differential equation for deflection. List the sign conventions used in deriving this equation. CO3
   (j) Sketch the bending stress distribution for an I-section. CO3
   (k) What is the radius of Mohr's circle? CO4
   (l) Define radial pressure in thin cylinder. CO4
   (m) Distinguish between circumferential stress and longitudinal stress in a cylindrical shell when subjected to internal pressure. CO4
   (n) Define plane stress and principal stress. CO4

UNIT – I

2. (a) Draw stress-strain diagram for mild-steel and explain salient points. (7M) CO1

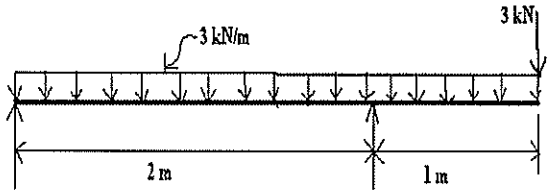
(b) A bar of cross-section 8 mm x 8 mm is subjected to an axial pull of 7000 N. The lateral dimension of the bar is found to be changed to 7.9985 mm x 7.9985 mm. If the Modulus of rigidity of the material is 0.8 x 10^5 N/mm^2, determine the Poisson's ratio and Modulus of elasticity. (7M) CO1

(OR)

3. Determine the contraction of a 12 mm thick flat aluminium plate of trapezoidal section which tapers uniformly from a width of 60 mm to 40 mm in a length of 300 mm when an axial compressive load of 90 kN is applied? Take Young's modulus as 78 GPa. CO1

UNIT – II

4. Draw the shear force and bending moment diagrams for the over hanging beam carrying uniformly distributed load of 3 kN/m over the entire length and a point load of 3 kN as shown in figure. Locate the point of contraflexure. CO2



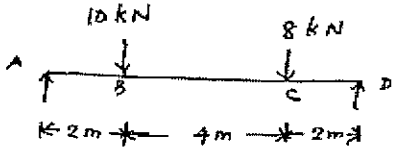
(OR)

5. (a) A solid steel shaft has to transmit 75 kW at 200 rpm. Taking allowable shear stress as 70 N/mm^2, find suitable diameter for the shaft, if the maximum torque transmitted at each revolution exceeds the mean by 30%. (8M) CO2

(b) In a hollow circular shaft of outer and inner diameter of 20 cm and 10 cm respectively, the shear stress is not to exceed 40 N/mm^2. Find the maximum torque which the shaft can safely transmit. (6M) CO2

UNIT – III

6. Determine the slope at the supports and maximum deflection for the beam shown in figure. Use Macaulays method. E = 2 x 10^5 N/mm^2 and I = 20 x 10^6 mm^4. CO3



(OR)

7. The tension flange of a girder of I-section is 240 mm x 40 mm, where as the compression flange is 120 mm x 20 mm. The web is 300 mm deep and 20 mm thick. If the girder is used as a simply supported beam of span 8 m, determine the load per meter run if the allowable stress is 90 MPa in compression and 30 MPa in tension. CO3

UNIT – IV

8. Draw the Mohr's circle for a plane stress element subjected to stresses σ_x = 180 N/mm^2, σ_y = 120 N/mm^2, τ_{xy} = 80 N/mm^2. Determine the principal stresses, maximum shear stress and their directions using Mohr's circle. CO4

(OR)

9. (a) A pipe of 800 mm diameter is used to carry water under a head of 50 m. Determine the thickness of the pipe if the permissible stress is to be 18 MPa. (7M) CO4

(b) A cylindrical shell is 3 m long, and is having 1 m internal diameter and 15 mm thickness. Calculate the maximum intensity of shear stress induced and also the changes in the dimensions of the shell, if it is subjected to an internal fluid pressure of 1.5 N/mm^2. Take E = 2 x 10^5 N/mm^2 and υ = 0.3. (7M) CO4

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Hall Ticket Number:

ME224 (R20)

B.TECH. DEGREE EXAMINATION, JANUARY-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) Classify Lathe Machines. CO1
   (b) How a lathe is specified? Discuss. CO1
   (c) Name different types of drilling machines? CO1
   (d) Explain why surface finishing is an important manufacturing process. CO2
   (e) What is glazing? CO2
   (f) Write short notes on truing operation of a grinding wheel. CO2
   (g) Discuss types of chips formed during metal cutting. CO3
   (h) Differentiate Orthogonal and Oblique cutting. CO3
   (i) Define Tool Life. CO3
   (j) Distinguish between traditional and non-traditional machining processes? CO3
   (k) Differentiate Water Jet Machining and Abrasive Water Jet Machining. CO4
   (l) Write the types of abrasives used in USM. CO4
   (m) What are the advantages of using jigs in mass production? CO4
   (n) Discuss the design considerations of jigs and fixtures. CO4

UNIT – I

2. (a) List and explain any eight lathe accessories with neat sketches. (8M) CO1
   (b) Explain with schematic diagram the principle of thread cutting on a lathe. (6M) CO1

(OR)

3. (a) List and explain the various operations performed on drilling machine with neat sketches. (8M) CO1
   (b) Sketch radial drilling machine, explain its basic parts and mention its advantages and applications. (6M) CO1

UNIT – II

4. (a) Describe various types of surface grinders with simple sketches. (8M) CO2
   (b) Briefly explain the process of Honing with neat sketches. (6M) CO2

(OR)

5. (a) Outline various types of abrasives used in grinding wheels. (4M) CO2
   (b) Describe the construction and working of centreless grinding machine with neat sketch. (10M) CO2

UNIT – III

6. (a) Derive the expression for shear angle in terms of rake angle and chip thickness. (7M) CO3
   (b) The following data is recorded in an orthogonal cutting operation. Feed force = 900 N, Chip thickness ratio = 0.26, Tool rake angle = 12^{O}, Cutting force = 1800 N. Determine: (7M) CO3
   (i) Coefficient of friction on the chip tool face
   (ii) Shear Force.

(OR)

7. (a) Discuss different types of cutting fluids. (7M) CO3

   (b) When cutting steel with a H.S.S. cutter, the tool has a life of 100 minutes between consecutive grinds when operating at 80 m/min. and a life of 33 minutes at a speed of 100 m/min. Determine the values of 'n' and 'C' in Taylor equation. (7M) CO3

UNIT – IV

8. (a) Discuss with neat diagram working of AJM process. (6M) CO4
   (b) With the help of line diagram, explain the construction and working of Electric Discharge Machining (EDM) and also mention its advantages & applications. (8M) CO4

(OR)

9. (a) Explain 3-2-1 location principle. (7M) CO4
   (b) What is the principle of clamping? List various types of clamping devices. (7M) CO4

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(b) The diameter of an impeller of a centrifugal pump at inlet and outlet are 30 cm and 60 cm respectively. Determine the minimum starting speed of the pump if it works against a head of 30 m. (7M) CO4

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Hall Ticket Number:

ME225 (R20)

B.TECH. DEGREE EXAMINATION, JANUARY-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) Distinguish between Venturimeter and Orificemeter? CO1
   (b) Distinguish between dynamic viscosity and kinematic viscosity? CO1
   (c) Define compressibility? CO1
   (d) Distinguish between Uniform and non uniform flow? CO2
   (e) Distinguish between major loss and minor loss? CO2
   (f) Define the terms dimensional analysis and model analysis? CO2
   (g) What is a 'breaking jet' in Pelton wheel? CO3
   (h) Define Degree of Reaction? CO3
   (i) What is meant by speed ratio of a Pelton wheel? CO3
   (j) Define indicator diagram. CO4
   (k) What is the function of air vessels in a reciprocating pump? CO4
   (l) What is priming? CO4
   (m) What is the effect of cavitation in performance of centrifugal pump? CO4
   (n) What is the expression to calculate minimum starting speed of a centrifugal pump? CO4

UNIT – I

2. (a) The dynamic viscosity of an oil used for lubrication between a shaft and sleeve is 6 Poise. The shaft is of diameter 0.4 m and

rotates at 190 rpm. Calculate the power lost in the bearing for a sleeve length of 90 mm. The thickness of oil film is 1.5 mm. (9M) CO1

(b) The pressure outside the droplet of water of diameter 0.04 mm is 10.32 N/cm^2 (atmospheric pressure). Calculate the pressure within the droplet if surface tension is given as 0.0725 N/m of water. (5M) CO1

(OR)

3. (a) What is a venturimeter? Derive an expression for the discharge through a venturimeter. (7M) CO1

(b) The water is flowing through a taper pipe of length 100 m having diameters 600 mm at the upper end and 300 mm at the lower end, at the rate of 50 litres/s. The pipe has a slope of 1 in 30. Find the pressure at the lower end if the pressure at the higher level is 19.62 N/cm^2. (7M) CO1

UNIT – II

4. (a) Explain Reynold's experiment with a neat sketch. (7M) CO2

(b) Derive Darcy's Weisbach equation for the loss of head due to friction in the pipe line. (7M) CO2

(OR)

5. (a) The pressure difference Δp 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 π theorem, obtain an expression for Δp. (7M) CO2

(b) Derive Hagen Poiseuille equation. (7M) CO2

UNIT – III

6. (a) Obtain an expression for the force exerted by jet of water on a stationary curved plate when the jet of water strikes at one end tangentially when the plate is symmetrical. (7M) CO3

(b) A jet of water of diameter 7.5 cm strikes a curved plate at its centre with a velocity of 20 m/s. The curved plate is moving with a velocity of 8 m/s in the direction of jet. The jet is deflected through an angle of 165°. Assuming the plate smooth, find : (7M) CO3

(i) Force exerted on the plate in the direction of jet
(ii) Power of the jet
(iii) Efficiency of the jet

(OR)

7. (a) Explain the working of Pelton wheel with a neat sketch. (8M) CO3

(b) Define and explain hydraulic efficiency, mechanical efficiency and overall efficiency 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. (7M) CO4

(b) Define indicator diagram? How will you prove that area of indicator diagram is proportional to the work done by a reciprocating pump? (7M) CO4

(OR)

9. (a) A centrifugal pump is to discharge 0.118 m^3/s at a speed of 1450 rpm against a head of 25 m. The impeller diameter is 250 rpm, its width at outlet is 50 mm and manometric efficiency is 75%. Determine the vane angle at the outer periphery of the impeller. (7M) CO4