Mech - R-20

Hall Ticket Number:

ME221(R20)

B.TECH. DEGREE EXAMINATION, OCTOBER-2022

Semester IV [Second Year] (Regular)

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 in brief:

(a)	Solve $p+q=1$	CO1
(b)	Write the one dimensional heat equation.	CO1
(c)	Solve $xp+yq=z$	CO1
(d)	Write Newton's backward interpolation formula.	CO2
(e)	Evaluate Δx^2, $h=1$	CO2
(f)	Write the Newton's forward difference formula for finding first order derivative.	CO2
(g)	Write Simpson's $3/8^{th}$ rule.	CO3
(h)	If $\frac{dy}{dx}=x+y$, $y(0)=1$, find $y(0.1)$ using Euler's method.	CO3
(i)	Write the Laplace equation.	CO3
(j)	Write the mean and variance of binomial distribution.	CO4
(k)	What is Poisson distribution?	CO4
(l)	What is mean of normal distribution?	CO4
(m)	Define type 2 error.	CO4
(n)	Define null hypothesis.	CO4

UNIT – I

2.	(a)	Solve $x(y-z)p+y(z-x)q=z(x-y)$	(7M)	CO1
	(b)	Solve one dimensional wave equation.	(7M)	CO1

(OR)

3. A tightly stretched string with fixed end points x = 0 and x = l is initially in a position given by $y = y_0 \sin^3 \frac{\pi x}{l}$. If it is released from rest from this position, determine the displacement $y(x, t)$. CO1

UNIT – II

4. (a) Using Newton–Raphson method find the real root of the equation $e^x = 2x+1$ (7M) CO2

   (b) Using Newton's interpolation formula find the value of the f(1.2) upto three decimals, given that f(1) = 3.49, f(1.4) = 4.82, f(1.8) = 5.96, f(2.2) = 6.5. (7M) CO2

(OR)

5. (a) Using Lagrange's interpolation formula find $f(10)$ (7M) CO2

x	5	6	9	11
y	12	13	14	16

   (b) Find $y^1(0)$ from the following table: (7M) CO2

x	0	1	2	3	4	5
y	4	8	15	7	6	2

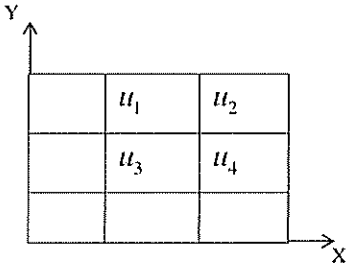
UNIT – III

6. (a) Evaluate $\int_0^2 \frac{1}{x^4+5} dx$ using Trapezoidal and Simpson's $1/3^{rd}$ rule. (7M) CO3

   (b) Using Runge-Kutta method of fourth order, solve $\frac{dy}{dx} = \frac{y^2-x^2}{y^2+x^2}, y(0)=1$ at $x = 0.2$ with h = 0.1 (7M) CO3

(OR)

7. Solve the Poisson equation $u_{xx} + u_{yy} = -81xy,\ 0 < x < 1, 0 < y < 1$ for the square mesh of given figure with $u(0,y) = 0, u(x,0) = 0, u(1,y) = 100,$ $u(x,1) = 100$ and h = 1/3. CO3



UNIT – IV

8. (a) The weights of 800 students are normally distributed with mean 140 pounds and standard deviation 10 pounds. Find the number of students whose weights are between 138 and 148 pounds. (7M) CO4

   (b) The average number of phone calls / minute coming into a switch board between 2 p.m. and 4 p.m. is 2.5. Determine the probability that during one particular minute there will be (i) 4 or fewer (ii) more than 6 calls. (7M) CO4

(OR)

9. (a) The nine items of a sample have the following values: 45, 47, 50, 52, 48, 47, 49, 53, 51. Does the mean of these differ significantly from the assumed mean of 47.5? (7M) CO4

   (b) Fit a P.D to the following data and test the goodness of fit. (7M) CO4

X	0	1	2	3	4
F	492	512	634	67	24

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gross efficiency, assuming carry over coefficient as 0.75 and the efficiency conversion of heat energy into kinetic energy in the blade channel as 0.90. (7M) CO3

UNIT – IV

8. (a) Explain the working of a simple vapour absorption refrigeration cycle with a neat sketch. (7M) CO4

   (b) An vapour compression system working with Ammonia as refrigerant works between 25°C and −10°C. The refrigerant is dry at the end of the compression and there is no under cooling of the liquid. Calculate the theoretical COP of the cycle. Consider property values from refrigeration tables. (7M) CO4

(OR)

9. (a) Describe the working of summer air-conditioning with a neat sketch. Draw the process on a psychrometric chart. (7M) CO4

   (b) A 215 m^3 of air per minute at 20°C DBT, 60% RH is heated until its temperature is 35°C. Calculate the following: (i) RH of heated air, (ii) WBT of heated air and (iii) Heat added to the air per minute. (7M) CO4

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B.TECH. DEGREE EXAMINATION, OCTOBER-2022

Semester IV [Second Year] (Regular)

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 in brief:
   (a) What is triple point? CO1
   (b) Define equivalent evaporation and boiler efficiency. CO1
   (c) What is the functional difference between boiler mountings and boiler accessories? CO1
   (d) What is the function of a regenerator in a Rankine steam turbine cycle? CO2
   (e) What is the effect of friction on the flow through a steam nozzle? CO2
   (f) Write the difference between over expansion and under expansion nozzles. CO2
   (g) Define vacuum efficiency and condenser efficiency. CO3
   (h) How steam turbines are classified? CO3
   (i) What is the function of guide vanes in a steam turbine? CO3
   (j) State the necessity of governing in a steam turbine. CO4
   (k) What is the effect of subcooling in a vapour compression refrigeration cycle? CO4
   (l) What is the function of an absorber in a vapour absorption refrigeration cycle? CO4
   (m) Define (i) Degree of saturation (ii) Relative humidity in psychrometry. CO4
   (n) State the functional difference between a refrigerator and an air-conditioner. CO4

UNIT – I

2. (a) Draw and explain a *p-T* (pressure-temperature) diagram for a pure substance. (7M) CO1
   (b) A vessel having a volume of 0.65 m^3 contains 3.2 kg of liquid water and water vapour mixture in equilibrium at a pressure of 0.6 MPa. Calculate: (i) Dryness fraction of the mixture (ii) Mass and volume of the liquid (iii) Mass and volume of the vapour. (7M) CO1

(OR)

3. (a) List the different boiler accessories. Explain the working of steam separator with a neat sketch. (7M) CO1
   (b) Describe the working of a reheat Rankine cycle with a neat sketch. (7M) CO1

UNIT – II

4. (a) What is critical pressure ratio for a nozzle. Derive its expression. (7M) CO2
   (b) Determine the throat area, exit area and exit velocity for a steam nozzle to pass a mass flow rate of 0.24 kg/s when inlet conditions are 12 bar and 250°C and the final pressure 1.5 bar. Assume expansion is isentropic and that the inlet velocity is negligible. Use $pv^{1.3}$ constant. Do not calculate from *h-s* chart. (7M) CO2

(OR)

5. (a) What are the effects of air leakage in a condenser? Explain the methods of obtaining maximum vacuum in condensers. (7M) CO2
   (b) A condensing plant condenses 14 kg of steam per hour and the leakage of air in the system is 1.2 kg per 2650 kg of steam. The vacuum in the air pump suction is 72 cm (barometer 76 cm) and the temperature 32°C. Compute the capacity of the air pump, which removes both air and water in m^3/min, taking the volumetric efficiency as 82%. (7M) CO2

UNIT – III

6. (a) Why compounding is required in steam turbines? Describe the pressure compounding of steam turbines with a neat sketch. (7M) CO3
   (b) In an Impulse turbine (with a single row wheel) the mean diameter of the blades 1.2 m and the speed is 3250 rpm. The nozzle angle is 20°, the ratio of blade speed to steam speed is 0.4 and the ratio of the relative velocity at outlet from the blades to that at inlet is 0.85. The outlet angle of the blade is to be made 4° less than the inlet angle. The steam flow is 10.4 kg/s. Draw the velocity diagram for the blades and determine the following: (7M) CO3
      (i) Tangential thrust on the blades,
      (ii) Axial thrust on the blades,
      (iii) Power developed in the blades and
      (iv) Blade efficiency

(OR)

7. (a) Define the term degree of reaction used in reaction turbines. Prove that moving and fixed blades should have the same shape for 50% reaction. (7M) CO3
   (b) A certain stage of a Parson's turbine consists of one row of fixed blades and one row of moving blades. The details of the turbine are as below:
      The mean diameter of the blades = 70 cm,
      Speed of the turbine = 2,750 rpm,
      The mass of steam passing per sec = 14.6 kg,
      Steam velocity at exit from fixed blades = 144 m/s,
      The blade exit angle = 22°,
      Calculate the power developed in the stage and

(OR)

9. A thick cylindrical pipe of outside diameter 300 mm and thickness of metal 50 mm is subjected to an internal fluid pressure of 40 MPa. Calculate the maximum and minimum intensities of circumferential and radial stresses in the pipe section. Also sketch the circumferential and radial stresses across the thickness. CO4

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B.TECH. DEGREE EXAMINATION, OCTOBER-2022

Semester IV [Second Year] (Regular)

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 in brief:
   (a) Define Poisson's ratio. CO1
   (b) Define factor of safety. CO1
   (c) What is Resilience? CO1
   (d) Define Torsional rigidity. CO2
   (e) Write the relation between intensity of loading, shear force and bending moment. CO2
   (f) What is meant by point of contraflecture? CO2
   (g) Where the maximum deflection occurs in cantilever beam? CO3
   (h) Sketch the shear stress distribution across T- section. CO3
   (i) State any two assumptions made in deriving theory of simple bending equation. CO3
   (j) Why shear stress changes abruptly at the junction of the flange and web? CO3
   (k) Write the significance of Mohr's circle and its uses. CO4
   (l) State the assumptions made in Lame's theory. CO4
   (m) Give the radial and hoop stress equations and their distribution across the thickness for a thick cylinder. CO4
   (n) What is diameter of Mohr's circle if the principal stresses are 200 MPa and -100 MPa? CO4

UNIT – I

2. A bar of brass 30 mm diameter is enclosed in a steel tube of 50 mm external diameter and 30 mm internal diameter. The bar and the tube are both initially 1.5 m long and are rigidly fastened at both ends using 20 mm diameter pins.

Find the stresses in the two materials when the temperature rises from 30^0C to 100^0C. Take E_s = 200 kN/mm^2, E_b = 100 kN/mm^2, α_s = 11.6 x $10^{-6}/^0$C, α_b= 18.7 x $10^{-6}/^0$C. CO1

(OR)

3. (a) Sketch and explain the stress-strain curve of a mild steel specimen in tensile test. (6M) CO1

(b) A tensile test was conducted on a mild steel bar. The following data was obtained from the test:
Diameter of the steel bar = 20 mm;
Gauge length of a bar =150 mm;
Load at the elastic limit = 200 kN;
Extension at a load of 100 kN = 0.2 mm;
Maximum load = 300 kN;
Total extension = 50 mm;
Diameter of the rod at the failure = 12.5 mm;
Determine (i) Young's modulus (ii) Stress at the elastic limit (iii) Ultimate stress (iv) Percentage elongation (v) Percentage decrease in area. (8M) CO1

UNIT – II

4. (a) State the assumptions and derive equation of simple torsion. (7M) CO2

(b) Determine the diameter of a solid shaft which will transmit 330 kW at 300 rpm. The angle of twist must not exceed one degree in a 2-metre length and the maximum shear stress should not exceed 40 MPa. Modules of rigidity G = 84 GPa. (7M) CO2

(OR)

5. Draw the bending moment diagram and shear force diagram for the beam loaded as shown in figure and indicate point of contraflexure if any? CO2

UNIT – III

6. (a) Derive the expression $M/I = \sigma/y = E/R$ from first principles. (7M) CO3

(b) A beam of rectangular section 400 mm deep is simply supported over a span of 8 m. Determine the uniformly distributed load per metre which the beam may carry, if the bending stress should not exceed 130 N/mm^2. Take I = 8 x 10^6 mm^4. (7M) CO3

(OR)

7. (a) A timber beam of rectangular cross-section of length 8 m is simply supported. The beam carries a U.D.L of 12 kN/m run over the entire length and a point load of 10 kN at 3 m from the left support. If the depth is two times the width and the stress in the timber is not to exceed 8 N/m^2. Find the suitable dimensions of the section. (8M) CO3

(b) A cantilever of length 3.0 m carries a point load of 12.5 kN at the free end. If moment of inertia of the beam is 1.00 x 10^8 mm ^{4} and value of E = 2 x 10^5 N/mm^2, determine the deflection at the free end. (6M) CO3

UNIT – IV

8. (a) A plane element in a boiler is subjected to tensile stresses of 500 MPa on one plane and 400 MPa on the other at right angles to the former. Each of the above stresses is accompanied by a shear stress of 200 MPa. Determine: (i) the magnitude and direction of the principal stresses and (ii) the magnitude and direction of the maximum shear stress. (10M) CO4

(b) Differentiate between thin cylinder and thick cylinder. (4M) CO4

Hall Ticket Number:

ME224(R20)

B.TECH. DEGREE EXAMINATION, OCTOBER-2022

Semester IV [Second Year] (Regular)

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 in brief:
   (a) What is the difference between drilling and reaming? CO1
   (b) List the lathe accessories. CO1
   (c) How do you specify lathe machine? CO1
   (d) Name the work holding device used to hold in surface grinding machine. CO2
   (e) What is the meaning of C (constant) in Taylors tool life equation? CO2
   (f) List the precession grinding machines. CO2
   (g) List the types of cutting tool materials. CO3
   (h) What are the limitations of centre type grinding process? CO3
   (i) What is the purpose of cutting fluids in metal cutting process? CO3
   (j) Draw ECM principle and label parts. CO4
   (k) What is the difference between conventional machining and non-conventional machining? CO4
   (l) Write the difference between jigs and fixtures CO4
   (m) Draw a neat sketch of USM process principle. CO4
   (n) What are the applications of WJM? CO4

UNIT – I

2. (a) Explain spindle feed mechanism used in sensitive drilling machine. (7M) CO1
   (b) Explain taper turning attachment method with a sketch. (7M) CO1

(OR)

3. (a) Draw and explain the working of radial drilling machine. (7M) CO1
   (b) List and explain any two work holding devices used in lathe machine. (7M) CO1

UNIT – II

4. (a) Explain with the help of neat diagram the construction and working of centreless grinding machine. (7M) CO2
   (b) Explain the following terms briefly related to grinding wheel (7M) CO2
   (i) Glazing
   (ii) Loading
   (iii) dressing

(OR)

5. (a) Differentiate between lapping and honing processes. (7M) CO2
   (b) Explain any one type of surface grinding machine with a neat sketch. (7M) CO2

UNIT – III

6. (a) Explain the properties of tool materials. (7M) CO3
   (b) A medium carbon steel bar 40 mm diameter is turned on a lathe with a cutting tool having top rake angle 30^0 and with a cutting speed of 24 mpm (meter per minute). If the cutting forces is 200 kg, feed force 80 kg and feed given to tool is 0.12 mm/rev. Length of chip in one revolution = 70 mm. Determine the following: (7M) CO3
   (i) Shear angle
   (ii) Chip thickness
   (iii) Velocity of chip along tool face.

(OR)

7. (a) Explain types of tool wear with a sketch. (7M) CO3
   (b) If the Taylors tool life constants for a given operation are specified as n = 0.5 and C = 400, what is the percentage increase in tool life when cutting speed is reduced by half. (7M) CO3

UNIT – IV

8. (a) Explain the principle of ECM process with neat sketch. (7M) CO4
   (b) Explain any two clamps with a neat sketch. (7M) CO4

(OR)

9. (a) Explain the process of EDM process stating its main advantages. (7M) CO4
   (b) List and explain essential characteristics in the proper design of jigs and fixture. (7M) CO4

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Hall Ticket Number:

ME225(R20)

B.TECH. DEGREE EXAMINATION, OCTOBER-2022

Semester IV [Second Year] (Regular)

FLUID MECHANICS & HYDRAULUC 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 the terms density and specific gravity. CO1
   (b) Define kinematic viscosity. CO1
   (c) How does viscosity of a fluid vary with temperature? CO1
   (d) Distinguish between steady and unsteady flow. CO2
   (e) What are the methods of dimensional analysis? CO2
   (f) Define Buckingham's pi theorem. CO2
   (g) Distinguish between turbines and pumps. CO3
   (h) Classify the turbines. CO3
   (i) What are the uses of a draft tube? CO3
   (j) Define a centrifugal pump. CO4
   (k) What is the difference between single stage and multistage pumps? CO4
   (l) What is the purpose of performance characteristic curves related to centrifugal pump? CO4
   (m) Distinguish between centrifugal and reciprocating pumps. CO4
   (n) Define slip and percentage slip. CO4

UNIT – I

2. (a) A 15 cm diameter vertical cylinder rotates concentrically inside another cylinder of diameter 15.10 cm. Both cylinders are 25 cm high. The space between the cylinders is filled with a liquid whose viscosity is unknown. If a torque of 12.0 N-m is required to rotate the inner cylinder at 100 rpm, determine the viscosity of the fluid. (8M) CO1

(b) Distinguish between ideal fluids and real fluids. Explain the importance of compressibility in fluid flow. (6M) CO1

(OR)

3. (a) Derive Bernoulli's equation from fundamentals. State all assumptions made. (8M) CO1
   (b) What is a pitot-tube? How will you determine the velocity at any point with the help of pitot-tube? (6M) CO1

UNIT – II

4. (a) Derive an expression for the velocity distribution for viscous flow through a circular pipe. Also sketch the velocity distribution and shear stress distribution across a section of the pipe. (9M) CO2
   (b) An oil of sp. gr. 0.7 is flowing through a pipe of diameter 300 mm at the rate of 500 litres/s. Find the head lost due to friction and power required to maintain the flow for a length of 1000 m. Take $\upsilon = 0.29$ stokes. (5M) CO2

(OR)

5. (a) What are the different methods of preventing the separation of boundary layers? (6M) CO2
   (b) Explain the term dimensionally homogeneous equation. What is meant by geometric, kinematic and dynamic similarities? (8M) CO2

UNIT – III

6. (a) Obtain an expression for the force exerted by jet of water on a moving curved plate in the direction of jet when the jet of water strikes at the centre of the plate. (7M) CO3

   (b) A jet of water of diameter 75 mm moving with a velocity of 25 m/s strikes a fixed plate in such a way that the angle between the jet and 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 the working of Kaplan turbine with a neat sketch. (7M) CO3
   (b) A Pelton wheel is to be designed for the following specifications :
   Shaft power = 11772 kW, Head = 380 m, Speed = 750 rpm, Overall efficiency = 86%, Jet diameter is not to exceed one-sixth of the wheel diameter. Determine: (i) wheel diameter (ii) the number of jet required (iii) diameter of the jet. Take $K_{vl} = 0.985$ and $K_{ul} = 0.45$. (7M) CO3

UNIT – IV

8. (a) Explain the principle and working of centrifugal pump with a neat sketch. (7M) CO4
   (b) Derive an expression to find minimum speed for starting a centrifugal pump. (7M) CO4

(OR)

9. (a) What is negative slip in a reciprocating pump? Explain with a neat sketch the function of air vessels in a reciprocating pump. (7M) CO4
   (b) A double acting reciprocating pump, running at 40 rpm is discharging 1.0 m^3 of water per minute. The pump has a stroke of 400 mm. The diameter of piston is 200 mm. The delivery and suction head are 20 m and 5 m respectively. Find the slip of the pump and power required to drive the pump. *(7M) CO4*

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