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18MAT31

Third Semester B.E. Degree Examination, Feb./Mar. 2022
Transform Calculus, Fourier Series and Numerical Techniques

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Evaluate (i) $L\left\{\frac{\cos 2t - \cos 3t}{t}\right\}$ (ii) $L(t^2 e^{-3t} \sin 2t)$ **(06 Marks)**

b. If $f(t) = \begin{cases} t, & 0 \le t \le a \\ 2a - t, & a \le t \le 2a \end{cases}$, $f(t + 2a) = f(t)$ then show that $L(f(t)) = \frac{1}{s^2}\tanh\left(\frac{as}{2}\right)$ **(07 Marks)**

c. Solve by using Laplace Transforms

$\frac{d^2y}{dt^2} + 4\frac{dy}{dt} + 4y = e^{-t}$, $y(0) = 0$, $y'(0) = 0$ **(07 Marks)**

OR

2 a. Evaluate $L^{-1}\left(\frac{4s+5}{(s+1)^2(s+2)}\right)$ **(06 Marks)**

b. Find $L^{-1}\left(\frac{s}{(s^2+a^2)^2}\right)$ by using convolution theorem. **(07 Marks)**

c. Express $f(t) = \begin{cases} \sin t, & 0 \le t < \pi \\ \sin 2t, & \pi \le t < 2\pi \\ \sin 3t, & t \ge 2\pi \end{cases}$

in terms of unit step function and hence find its Laplace Transform. **(07 Marks)**

Module-2

3 a. Obtain fourier series for the function $f(x) = |x|$ in $(-\pi, \pi)$ **(06 Marks)**

b. Expand $f(x) = \frac{(\pi - x)^2}{4}$ as a Fourier series in the interval $(0, 2\pi)$ and hence deduce that

$\frac{\pi^2}{12} = \frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + \ldots\ldots$ **(07 Marks)**

c. Express y as a Fourier series upto the second harmonic given :

x:	0	60	120	180	240	300
y:	4	3	2	4	5	6

(07 Marks)

OR

4 a. Find the Half-Range sine series of $\pi x - x^2$ in the interval $(0, \pi)$ **(06 Marks)**

b. Obtain fourier expansion of the function $f(x) = 2x - x^2$ in the interval $(0, 3)$. **(07 Marks)**

c. Obtain the Fourier expansion of y upto the first harmonic given :

x	0	1	2	3	4	5
y	9	18	24	28	26	20

(07 Marks)

Module-3

5 a. If $f(x) = \begin{cases} 1, & |x| < a \\ 0, & |x| > a \end{cases}$, find the Fourier transform of f(x) and hence find the value of $\int_0^\infty \frac{\sin x}{x}\,dx$ **(06 Marks)**

b. Find the infinite Fourier cosine transform of $e^{-\alpha x}$. **(07 Marks)**

c. Solve using z-transform $y_{n+2} - 4y_n = 0$ given that $y_0 = 0, y_1 = 2$ **(07 Marks)**

OR

6 a. Find the fourier sine transform of $f(x) = e^{-|x|}$ and hence evaluate $\int_0^\infty \frac{x \sin mx}{1+x^2}\,dx$; $m > 0$. **(06 Marks)**

b. Obtain the z-transform of $\cos n\theta$ and $\sin n\theta$. **(07 Marks)**

c. Find the inverse z-transform of $\frac{4z^2 - 2z}{z^3 - 5z^2 + 8z - 4}$ **(07 Marks)**

Module-4

7 a. Solve $\frac{dy}{dx} = x^3 + y$, $y(1) = 1$ using Taylor's series method considering up to fourth degree terms and find y(1.1). **(06 Marks)**

b. Given $\frac{dy}{dx} = 3x + \frac{y}{2}$, $y(0) = 1$ compute y(0.2) by taking h = 0.2 using Runge – Kutta method of fourth order. **(07 Marks)**

c. If $\frac{dy}{dx} = 2e^x - y$, $y(0) = 2$, $y(0.1) = 2.010$, $y(0.2) = 2.040$ and $y(0.3) = 2.090$, find y(0.4) correct to 4 decimal places using Adams-Bashforth method. **(07 Marks)**

OR

8 a. Use fourth order Runge-Kutta method, to find y(0.8) with h = 0.4, given $\frac{dy}{dx} = \sqrt{x+y}$, $y(0.4) = 0.41$ **(06 Marks)**

b. Use modified Euler's method to compute y(20.2) and y(20.4) given that $\frac{dy}{dx} = \log_{10}\left(\frac{x}{y}\right)$ with $y(20) = 5$ Taking h = 0.2. **(07 Marks)**

c. Apply Milne's predictor-corrector formulae to compute y(2.0) given $\frac{dy}{dx} = \frac{x+y}{2}$ with

x	0.0	0.5	1.0	1.5
y	2.000	2.6360	3.5950	4.9680

(07 Marks)

Module-5

9 a. Using Runge-Kutta method, solve

$\frac{d^2y}{dx^2} = x\left(\frac{dy}{dx}\right)^2 - y^2$, for x = 0.2, correct to four decimal places, using initial conditions $y(0) = 1, y'(0) = 0$ **(07 Marks)**

b. Derive Euler's equation in the standard form viz, $\frac{\partial f}{\partial y} - \frac{d}{dx}\left(\frac{\partial f}{\partial y'}\right) = 0$ **(07 Marks)**

c. Find the extremal of the functional $\int_{x_1}^{x_2} (y^2 + y'^2 + 2ye^x)\, dx$ **(06 Marks)**

OR

10 a. Given the differential equation $2\frac{d^2y}{dx^2} = 4x + \frac{dy}{dx}$ and the following table of initial values:

x	1	1.1	1.2	1.3
y	2	2.2156	2.4649	2.7514
y′	2	2.3178	2.6725	2.0657

Compute y(1.4) by applying Milne's Predictor-corrector formula. **(07 Marks)**

b. Prove that geodesics of a plane surface are straight lines. **(07 Marks)**

c. On what curves can the functional $\int_0^1 (y'^2 + 12xy)dx$ with y(0) = 0, y(1) = 1 can be extremized? **(06 Marks)**

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18MATDIP31

Third Semester B.E. Degree Examination, Feb./Mar. 2022
Additional Mathematics – I

Time: 3 hrs. Max. Marks: 100

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1 a. Find the modulus and amplitude of the complex number : $\frac{(2-3i)(2+i)^2}{1+i}$. **(07 Marks)**

b. Prove that $\left(\frac{1+\cos\theta+i\sin\theta}{1+\cos\theta-i\sin\theta}\right)^n = \cos n\theta + i\sin n\theta$. **(06 Marks)**

c. Show that the vectors $\vec{a}-2\vec{b}+3\vec{c}$, $-2\vec{a}+3\vec{b}-4\vec{c}$, $-\vec{b}+2\vec{c}$ are coplanar. **(07 Marks)**

OR

2 a. Given $\vec{a}=2\hat{i}+2\hat{j}-\hat{k}$, $\vec{b}=6\hat{i}-3\hat{j}+2\hat{k}$. Find : i) $\vec{a}\cdot\vec{b}$ ii) $\vec{a}\times\vec{b}$ iii) $|\vec{a}\times\vec{b}|$. **(07 Marks)**

b. Determine the value of λ, so that $\vec{a}=2\hat{i}+\lambda\hat{j}-\hat{k}$, and $\vec{b}=4\hat{i}-2\hat{j}-2\hat{k}$, are perpendicular. **(06 Marks)**

c. Express $1-i\sqrt{3}$ in the polar form and hence find its modulus and amplitude. **(07 Marks)**

Module-2

3 a. Using Euler's theorem, prove that $xu_x + yu_y = -3\cot u$ where $u = \sin^{-1}\left(\frac{x^2y^2}{x+y}\right)$. **(07 Marks)**

b. Using Maclaurin's series, prove that $\sqrt{1+\sin 2x} = 1+x-\frac{x^2}{2}-\frac{x^3}{3}+\frac{x^4}{24}+\ldots\ldots$. **(06 Marks)**

c. If $u = x + 3y^2$, $v = 4x^2yz$, $w = 2z^2 - xy$, evaluate $\frac{\partial(u,v,w)}{\partial(x,y,z)}$ at the point $(1, -1, 0)$. **(07 Marks)**

OR

4 a. Obtain Maclaurin's series expansion for the function e^x upto x^4. **(07 Marks)**

b. If $u = \sin^{-1}\left[\frac{x^3+y^3}{x+y}\right]$ prove that $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y} = 2\tan u$. **(06 Marks)**

c. If $u = f\left(\frac{x}{y},\frac{y}{z},\frac{z}{x}\right)$, prove that $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}+z\frac{\partial u}{\partial z}=0$. **(07 Marks)**

Module-3

5 a. A particle moves along the curve $x = (1 - t^3)$, $y = (1 + t^2)$, $z = (2t - 5)$ determine its velocity and acceleration at $t = 1$ sec. **(07 Marks)**

b. If $\vec{F} = 2x^2\hat{i} - 3yz\hat{j} + xz^2\hat{k}$, and $\phi = 2z - x^3y$, find $\vec{F}\cdot(\nabla\phi)$ and $\vec{F}\times(\nabla\phi)$ at $(1, -1, 1)$. **(06 Marks)**

c. Find the constants a, b, c so that $\vec{f} = (x+2y+az)\hat{i}+(bx-3y-z)\hat{j}+(4x+cy+2z)\hat{k}$ is irrotational. **(07 Marks)**

OR

6 a. Find the directional derivate of $\phi = x^2yz + 4xz^2$ at (1,–2,–1) along $\vec{a} = 2\hat{i} - \hat{j} - 2\hat{k}$ **(07 Marks)**

b. Find curl $\vec{f}$ given that $\vec{f} = xyz^2\,\hat{i} + xy^2z\hat{j} + x^2yz\hat{k}$. **(06 Marks)**

c. If $\vec{f} = x^2i + y^2j + z^2k$ and $\vec{g} = yzi + zxj + xyk$. Show that $\vec{f} \times \vec{g}$ is a solenoidal vector. **(07 Marks)**

Module-4

7 a. Obtain the reduction formula, $I_n = \int \cos^n x dx$, where n is a positive integer. **(07 Marks)**

b. Evaluate $\int_0^1 \int_x^{\sqrt{x}} xydydx$. **(06 Marks)**

c. Evaluate $\int_0^1 \int_0^1 \int_0^1 (x+y+z)dxdydz$. **(07 Marks)**

OR

8 a. Evaluate : $\int_0^{\pi/6} \sin^6(3x)dx$. **(07 Marks)**

b. Evaluate : $\int_0^{\pi} x \sin^4 x \cos^6 x\, dx$. **(06 Marks)**

c. Evaluate $\int_0^1 \int_0^1 \int_0^y xyz\, dxdydz$. **(07 Marks)**

Module-5

9 a. Solve : $(2x + y + 1)\,dx + (x + 2y + 1)\,dy = 0$. **(07 Marks)**

b. Solve : $(4xy + 3y^2 - x)\,dx + (x^2 + 2xy)\,dy = 0$. **(06 Marks)**

c. Solve : $y(2xy + e^x)\,dx - e^x\,dy = 0$. **(07 Marks)**

OR

10 a. Solve : $(5x^4 + 3x^2y^2 - 2xy^3)dx + (2x^3y - 3x^2y^2 - 5y^4)dy = 0$. **(07 Marks)**

b. Solve : $y(2xy + 1)dx - x\,dy = 0$. **(06 Marks)**

c. Solve : $\frac{dy}{dx} + y\cot x = \cos x$. **(07 Marks)**

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18ME32

Third Semester B.E. Degree Examination, Feb./Mar. 2022
Mechanics of Materials

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Module-1

1 a. Define i) Poisson's ratio ii) Stress iii) Percentage Reduction in area iv) Toughness. **(04 Marks)**

b. Derive the relationship between Modulus of Rigidity and Modulus of elasticity. **(06 Marks)**

c. A stepped bar is subjected to an external loading as shown in Fig. Q1(c). Calculate the change in the length of bar. Take E = 200GPa for steel , E = 70 GPA for Aluminum and E = 100 GPa for copper. **(10 Marks)**

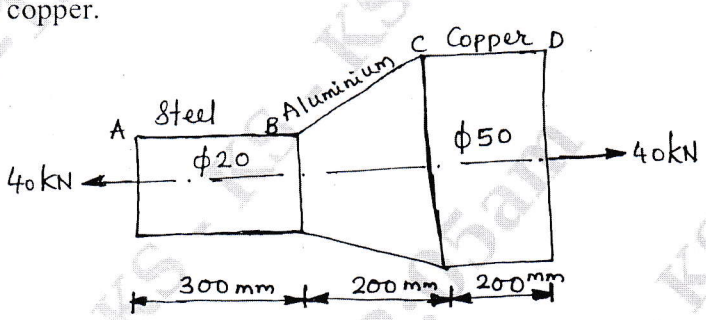

Fig. Q1(c)

OR

2 a. Draw Stress – Strain diagram for mild steel subjected to tension and indicate salient points on the diagram. **(06 Marks)**

b. A composite section comprises of a steel tube 10cm internal diameter and 12cm external diameter fitted inside a brass tube of 14cm internal diameter and 16cm external diameter. The assembly is subjected to a compressive load of 500kN. Find the load carried by each tube and change in the length of tubes. The length of tube is 150cm. Take E_S = 200 GPa and E_b = 100 GPa. **(08 Marks)**

c. The bronze bar 3m long with 320mm^2 cross sectional area is placed between two rigid walls. At -20°C there is a gap Δ = 2.5mm as shown in Fig. Q2(c). Find the magnitude and the type of stress induced in the bar when it is heated to a temperature 60°C. Take E = 80GPa and $\alpha_B = 18 \times 10^{-6}$/°C. **(06 Marks)**

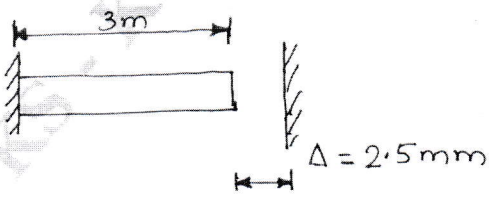

Fig. Q2(c)

Module-2

3 a. Derive the expression for normal stress and tangential stress on a plane inclined at θ° to the vertical axis in a biaxial stress system with shear stress as shown in Fig.Q3(a). Also find Resultant stress and Angle of Obliquity. **(10 Marks)**

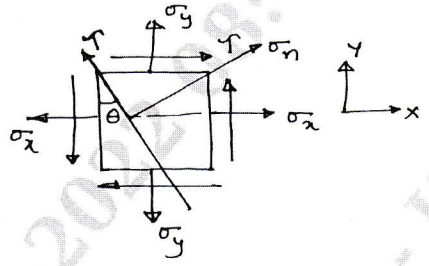

Fig. Q3(a)

b. The state of stress at a point in a strained material as shown in Fig. Q3(b). Determine
   i) The principal stresses and principal planes.
   ii) Maximum shear stress and plane on which it is acting. Also find the normal stress on the maximum shear plane.
   iii) Sketch the element aligned with planes of principal stresses and planes of maximum shear. **(10 Marks)**

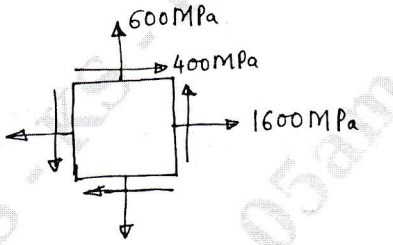

Fig. Q3(b)

OR

4 a. A thin cylinder of 75mm internal diameter and 250mm long has 2.5mm thick walls. The cylinder is subjected to an internal pressure of 7MN/m^2. Determine the change in internal diameter and change in length and change in volume of cylinder. Also compute the Hoop stress and Longitudinal stress and maximum shear stress. Take E = 200GPa and μ = 0.3. **(10 Marks)**

b. A thick cylinder with internal diameter 80mm and external diameter 120mm is subjected to an external pressure of 40kN/m^2, when the internal pressure is 120kN/m^2. Calculate the circumferential stress at external and internal surfaces of the cylinder. Plot the variation of circumferential stress and radial pressure on the thickness of the cylinder. **(10 Marks)**

Module-3

5 Draw Shear force and Bending moment diagrams for the beam shown in Fig. Q5. Locate the point of contra flexure if any. **(20 Marks)**

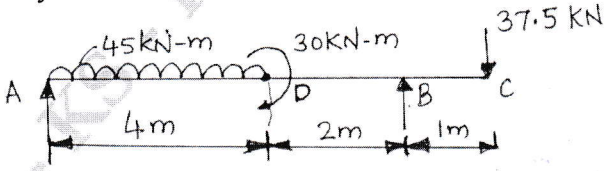

Fig. Q5

OR

6 a. A simply supported of beam span 5m has a cross section of 150mm × 250mm. If the permissible stress is 20N/mm^2. Find
   i) Maximum intensity of uniformly distributed load it can carry.
   ii) Maximum concentrated load P applied at 2m from one end it can carry. **(10 Marks)**

b. The cross section of a beam is a T section (Fig. Q6(b)) 150mm × 100mm × 15mm with 150mm horizontal. Find the maximum intensity of shear stress and sketch the shear stress distribution across the section if it has to resist a shear force of 90kN. **(10 Marks)**

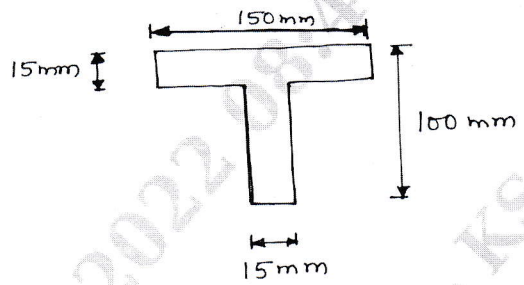

Fig. Q6(b)

Module-4

7 a. Derive the torsional equation for a circular shaft with usual notations. State the assumptions made. **(10 Marks)**

b. A solid circular shaft is subjected to a bending moment of 10kN-m and a torque of 15kN-m. The yield stress of the material in simple tension is 250MPa and E = 200GPa. If factor of safety is 3. Determine the maximum diameter of the shaft using Maximum Principal Stress theory and Maximum Shear Stress theory. **(10 Marks)**

OR

8 a. Write a note on :
i) Maximum Principal Stress theory ii) Maximum Shear Stress theory. **(08 Marks)**

b. A solid circular shaft is required to transmit 300kW at 120 rpm. The shear stress in the material is not to exceed 80N/mm^2. Find the diameter required. If the shaft is replaced by a hollow one whose internal diameter is 0.6 times its external diameter. The length material and maximum shear stress being same. Calculate the percentage saving in weight, that could be obtained. **(12 Marks)**

Module-5

9 a. Explain Castigliano's theorem I with its applications and Castigliano's theorem II. **(10 Marks)**

b. A hallow cast iron column whose outside diameter is 200mm and thickness of 20mm is 4.5m long and is fixed at both ends. Calculate the safe load by Rankine formula using factor of safety 2.5. Find the ratio of Euler's to Rankine's loads. Take E = 1 × 10^{5}N/mm^2 and Rankine constant = $\frac{1}{1600}$ for both ends fixed and σ_c = 550N/mm^2. **(10 Marks)**

OR

10 a. Derive an expression for a critical load in a column subjected to compressive load. When one end is fixed and other end is free. **(10 Marks)**

b. Calculate the strain energy stored in a bar shown in Fig. Q10(b), subjected to a gradually applied axial load of 80kN. Compare this value with what obtained in uniform bar of same length and having the same volume, when subjected to the same load. E = 2 × 10^{5}N/mm^2. **(10 Marks)**

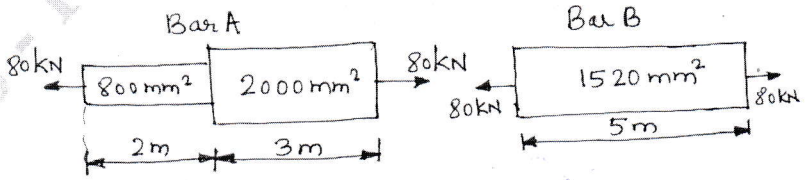

Fig. Q10(b)

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18ME33

Third Semester B.E. Degree Examination, Feb./Mar. 2022
Basic Thermodynamics

Time: 3 hrs. Max. Marks: 100

Note:* 1. *Answer any FIVE full questions, choosing ONE full question from each module.
2. Use of thermodynamics charts and tables are permitted.

Module-1

1 a. Distinguish between:
(i) Macroscopic and microscopic approaches
(ii) Intensive and extensive properties **(10 Marks)**

b. Define the following terms:
(i) System (ii) State (iii) Property
(iv) Quasi-static process (v) Thermodynamic cycle **(10 Marks)**

OR

2 a. Define Thermodynamic Equilibrium. Also explain Mechanical, Chemical and Thermal equilibrium. **(10 Marks)**

b. A constant volume gas thermometer containing helium gives readings of gas pressure 'P' as 1000 and 1366 mm of mercury at ice point and steam point respectively. Assuming a linear relationship of the form $t = a + bP$, express the gas thermometer celsius temperature 't' in terms of gas pressure P. What is the temperature recorded by the thermometer, when it registers a pressure of 1074 mm of mercury? **(10 Marks)**

Module-2

3 a. Compare work and heat. **(10 Marks)**

b. A fluid contained in a horizontal cylinder fitted with a frictionless leak proof piston is continuously agitated by a stirrer passing through the cylinder cover. The diameter of the cylinder is 40 cm and piston is held against the fluid due to atmospheric pressure equal to 100 kPa. The stirrer turns 7000 revolutions with an average torque of 1 Nm. If the piston slowly moves outwards by 50 cm determine the network transfer to the system. **(10 Marks)**

OR

4 a. With a neat diagram, explain Joule's experiments. Also state the first law of thermodynamics. **(10 Marks)**

b. A centrifugal compressor delivers 20 kg/min of air. Air enters the compressor of 5 m/s, 100 kPa and leaves at 9 m/s, 600 kPa. Heat lost to the surroundings during this process is 10 kJ/s. If the increase in enthalpy of the fluid is 180 kJ/kg and inlet and outlet specific volume of air are 0.5 m^3/kg and 0.16 m^3/kg respectively, determine the power of the motor to drive the compressor. Also calculate the ratio of inlet pipe diameter to the outlet pipe diameter. Assume zero elevation difference. **(10 Marks)**

Module-3

5 a. Describe the limitations of first law of thermodynamics. Also explain Kelvin-Plank and Clausius statements of second law of thermodynamics with representative diagrams. **(10 Marks)**

b. Two Carnot engines A and B are connected in series between two thermal reservoirs maintained at 1000 K and 100 K respectively. Engine A receives 1680 kJ of heat from high temperature reservoir and rejects heat to the Carnot engine B. Engine B takes in heat rejected by engine A and reject heat to the low temperature reservoir. If engines A and B have equal thermal efficiencies, determine:
(i) The heat rejected by engine B.
(ii) Temperature at which heat is rejected by engine A.
(iii) Work done by engine A and B. **(10 Marks)**

OR

6 a. Define entropy and explain the principle of increase of entropy. **(10 Marks)**

b. A closed system contains air at pressure 1 bar, temperature 290 K and volume 0.02 m^3. This system undergoes a thermodynamic cycle consisting of the following three process:
Process 1-2: Constant volume heat addition till pressure becomes 4 bar.
Process 2-3: constant pressure cooling.
Process 3-1: Isothermal heating to initial state. Evaluate the change in entropy for each process. Take C_V = 0.718 kJ/kgK, R = 287 J/kgK. Also represent the cycle on T-S and P-V plot. **(10 Marks)**

Module-4

7 a. Explain the concept of availability and unavailable energy by deducing suitable relevant equation. **(10 Marks)**

b. Superheated steam at 40 bar and 300°C expands to 4 bar and 0.97 dry in a turbine. Determine: (i) Availability (ii) Actual work done (iii) Loss in availability. Assume t_0 = 28°C. **(10 Marks)**

OR

8 a. Draw and explain the salient features of P-T diagram with water as an example. **(08 Marks)**

b. The following data were obtained with a separating and throttling calorimeter pressure in steam main = 15 bar, mass of water drained from the separator = 0.55 kg. Mass of steam condensed after passing through the throttle valve = 4.20 kg. Pressure and temperature after throttling is 1 bar and 120°C. Evaluate the dryness fraction of steam in the main. **(12 Marks)**

Module-5

9 a. Define and explain Dalton's law of partial pressures and Amagat's law of additive volumes. **(10 Marks)**

b. It is required to evacuate hydrogen gas from a 8 m^3 capacity tank form atmospheric pressure of 101.325 kPa to a pressure of 98.125 kPa vacuum at 400 K. Determine the mass of Hydrogen pumped out and pressure in kPa if the temperature of hydrogen left in the tank falls to 290 K. **(10 Marks)**

OR

10 a. Define and explain: (i) Dew Point temperature (ii) Relative humidity (iii) Humidity ratio (iv) Wet Bulb temperature (v) Degree of saturation **(10 Marks)**

b. One kg of carbon monoxide has a volume of 2 m^3 at 80°C. Determine its pressure using:
(i) Ideal gas equation (ii) Vander Waal's equation
Constants for Vander Waal's equations:
a = 147.90 kN-m^4/$(kgmol)^2$ and b = 0.0393 m^3/kgmol. **(10 Marks)**

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18ME34

Third Semester B.E. Degree Examination, Feb./Mar. 2022
Material Science

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. State and explain Fick's laws of diffusion. **(08 Marks)**

b. Sketch and explain Edge dislocations. **(04 Marks)**

c. Distinguish between SC, BCC, FCC and HCP with respect to structure, number of atoms, Lattice constant, coordination number and APF. **(08 Marks)**

OR

2 a. Draw stress-strain diagram of Ductile material and explain plastic properties. **(08 Marks)**

b. Derive expressions showing relationship between True Stress versus Engineering Stress and True Strain versus Engineering Strain. **(08 Marks)**

c. Sketch and explain plastic deformation by Twinning. **(04 Marks)**

Module-2

3 a. What is fatigue? Sketch and explain R.R. MOORE fatigue testing showing S-N curves. **(08 Marks)**

b. What is Creep? Explain the stages of creep using creep curve. **(08 Marks)**

c. Explain the application of Gibb's phase rule using binary phase diagram. **(04 Marks)**

OR

4 a. Draw Iron-Cementite diagram. Indicate phases, critical temperatures and explain invariant reactions. **(12 Marks)**

b. Briefly explain the effect of alloying elements on Iron-Carbon diagram. **(04 Marks)**

c. What is Solidification? Explain the mechanism of Solidification. **(04 Marks)**

Module-3

5 a. What is heat treatment? Mention the classification. **(06 Marks)**

b. Sketch and explain TTT diagram. **(06 Marks)**

c. Differentiate between hardness and hardenability. Sketch and explain 'JOMINY END QUENCH' test to determine hardenability. **(08 Marks)**

OR

6 a. Sketch and explain Annealing heat treatment process. **(06 Marks)**

b. What is Age hardening? Explain the Age hardening of Aℓ-Cu alloys using phase diagram. **(06 Marks)**

c. Explain the composition, properties and applications of Gray Cast Iron, White Cast Iron, Malleable iron and S.G. Iron. **(08 Marks)**

Module-4

7 a. What are composites? How do you classify them? **(06 Marks)**

b. Sketch and explain the fabrication of MMC's using stir casting process. **(08 Marks)**

c. Explain the functions of matrix and reinforcement. **(06 Marks)**

OR

8 a. Derive an expression for Elastic modulus of the composite under iso-strain condition. **(06 Marks)**

b. List advantages, disadvantages and applications of composite materials. **(08 Marks)**

c. Sketch and explain the fabrication of CMC's using "slurry infiltration process". **(06 Marks)**

Module-5

9 a. Briefly explain Thermoplastics, Thermosets and Elastomers. **(06 Marks)**

b. Sketch and explain the processing of plastics by "injection molding". **(08 Marks)**

c. What are ceramics? Mention the classification. **(06 Marks)**

OR

10 a. Briefly explain optical and thermal materials. **(06 Marks)**

b. What are smart materials? Explain briefly the types of smart materials. **(08 Marks)**

c. Write a brief note on Non-Destructive methods used for residual life assessment. **(06 Marks)**

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18ME35A/18MEA305

Third Semester B.E. Degree Examination, Feb./Mar. 2022
Metal Cutting and Forming

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Module-1

1 a. What are the difference between orthogonal cutting and oblique cutting? **(06 Marks)**
b. Briefly explain the mechanism and types of chip formation. **(08 Marks)**
c. Draw Mechant's circle diagram and state the assumptions made in establishing the relationship among the various forces. **(06 Marks)**

OR

2 a. Differentiate between Capston and Turret lattice. **(06 Marks)**
b. Draw the tool layout for producing a hexagonal headed bolt or a caster lathe from a hexagonal bar stock. Assume the dimensions. **(08 Marks)**
c. List and explain the various operations carried out on lattice machine. **(06 Marks)**

Module-2

3 a. Define Milling. Explain with a neat sketch vertical milling machine. **(10 Marks)**
b. Define Drilling. With a neat sketch explain a radial drilling machine. **(10 Marks)**

OR

4 a. Sketch and explain the fundamental parts of a horizontal shaping machine. **(10 Marks)**
b. With a neat sketch, explain the centerless grinding machine. **(10 Marks)**

Module-3

5 a. Define load wear. Explain creator wear and flank wear. **(06 Marks)**
b. Write a note on functions and types of cutting fluids used in metal cutting. **(06 Marks)**
c. Define tool life and explain the factors which affect the tool of life. **(08 Marks)**

OR

6 a. Which are the different forms of wear on the cutting edge of a tool? With suitable sketch explain. **(08 Marks)**
b. Explain the choice of cutting speed a feed. **(06 Marks)**
c. Explain the critical cutting parameters which affect the tool life. **(06 Marks)**

Module-4

7 a. What is forging? Explain working of board hammer with sketch. **(10 Marks)**
b. With a neat sketch explain the classification of metal working process on the basis of force applied. **(10 Marks)**

OR

8 a. With a neat sketch, explain different types of rolling mill arrangement. **(10 Marks)**
b. With a neat sketch, explain the wire drawing process. **(10 Marks)**

Module-5

9 a. How sheet metal operations are classified? Explain with a neat sketch. **(10 Marks)**
b. What do you mean by dies? Write a note on : i) Progressive dies ii) Combination dies. **(10 Marks)**

OR

10 a. With a neat sketch, explain V-bending and edge bending operations. **(10 Marks)**
b. With a neat sketch, explain the parts of open back inclinable press. **(10 Marks)**