CBCS SCHEME

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18MAT31

Third Semester B.E. Degree Examination, Jan./Feb. 2023
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. Find the Laplace transform of:
i) $(3t+4)^2 + 5^t$
ii) $e^{-t}\cos^2 3t$
iii) $\dfrac{\cos at - \cos bt}{t}$ **(10 Marks)**

b. Given $f(t) = \begin{cases} E, & 0 < t < a/2 \\ -E, & a/2 < t < a \end{cases}$ where $f(t+a) = f(t)$, show that $L[f(t)] = \dfrac{E}{S}\tanh(as/4)$. **(05 Marks)**

c. Employ Laplace transform to solve the equation: $y'' + 5y' + 6y = 5e^{2t}$, taking $y(0) = 2$, $y'(0) = 1$. **(05 Marks)**

OR

2 a. Find the Inverse Laplace transform of:
i) $\dfrac{(s+2)^2}{s^6}$ ii) $\dfrac{s+1}{s^2+6s+9}$ iii) $\dfrac{3s+2}{s^2-s-2}$ **(10 Marks)**

b. Express $f(t) = \begin{cases} 1, & 0 < t \le 1 \\ t, & 1 < t \le 2 \\ t^2, & t > 2 \end{cases}$ in terms Heaviside's unit step function and hence find its Laplace transform. **(05 Marks)**

c. Find the Laplace transform of $\dfrac{s}{(s^2+a^2)^2}$ using convolution theorem. **(05 Marks)**

Module-2

3 a. Find the Fourier series expansion of $f(x) = x - x^2$ in $-\pi \le x \le \pi$. Hence deduce that $\dfrac{x^2}{12} = \dfrac{1}{1^2} - \dfrac{1}{2^2} + \dfrac{1}{3^2} - \dfrac{1}{4^2} + \ldots$ **(07 Marks)**

b. Find the half-range cosine series of $f(x) = 2x-1$ in the interval $0 < x < 1$. **(06 Marks)**

c. Determine the constant term and the first cosine and sine terms of the Fourier series expansion of y from the following data:

x°	0	45	90	135	180	225	270	315
y	2	3/2	1	1/2	0	1/2	1	3/2

(07 Marks)

OR

4 a. Obtain the Fourier series of $f(x) = |x|$ in $(-l, l)$. Hence show that $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \ldots\ldots = \frac{\pi^2}{8}$. **(07 Marks)**

b. Find the sine half range series of $f(x) = \begin{cases} \frac{1}{4} - x & \text{in} \quad 0 < x < \frac{1}{2} \\ x - \frac{3}{4} & \text{in} \quad \frac{1}{2} < x < 1 \end{cases}$ **(06 Marks)**

c. The following table gives the variations of a periodic current A over a certain period T:

t(sec)	0	T/6	T/3	T/2	2T/3	5T/6	T
A(amp)	1.98	1.30	1.05	1.30	-0.88	-0.25	1.98

Show that there is a constant part of 0.75amp. in the current A, and obtain the amplitude of the first harmonic. **(07 Marks)**

Module-3

5 a. If $f(x) = \begin{cases} 1 - x^2, & |x| < 1 \\ 0, & |x| \geq 1 \end{cases}$ find the Fourier transform of f(x) and hence find the value of $\int_0^\infty \frac{x\cos x - \sin x}{x^3} dx$. **(07 Marks)**

b. Find the Fourier sine and cosine transform of $f(x) = e^{-\alpha x}$, $\alpha > 0$. **(06 Marks)**

c. Solve $u_{n+2} + 4u_{n+1} + 3u_n = 3^n$, given $u_0 = 0$, $u_1 = 1$ by using z-transform. **(07 Marks)**

OR

6 a. Find the Fourier sine transform of $f(x) = e^{-|x|}$ and hence evaluate $\int_0^\infty \frac{x \sin mx}{1 + x^2} dx$, $m > 0$. **(07 Marks)**

b. Find the Z-transform of $\cos\left(\frac{n\pi}{2} + \frac{\pi}{4}\right)$. **(06 Marks)**

c. Find the inverse Z-transform of $\frac{3z^2 + 2z}{(5z-1)(5z+2)}$. **(07 Marks)**

Module-4

7 a. Solve $\frac{dy}{dx} = x - y^2$, $y(0) = 1$ using Taylor's series method considering upto fourth degree terms and find the value of $y(0.1)$. **(07 Marks)**

b. Using Runge-Kutta method of fourth order, find $y(0.2)$ for the equation $\frac{dy}{dx} = \frac{y - x}{y + x}$, $y(0) = 1$ taking $h = 0.2$. **(06 Marks)**

c. Apply Milne's method to compute $y(1.4)$ correct to four decimal places given $\frac{dy}{dx} = x^2 + \frac{y}{2}$ and the data: $y(1) = 2$, $y(1.1) = 2.2156$, $y(1.2) = 2.4649$, $y(1.3) = 2.7514$. **(07 Marks)**

OR

8 a. Using modified Euler's method find y(20.2) given that $\frac{dy}{dx} = \log_{10}\left(\frac{x}{y}\right)$ with y(20) = 5 taking h = 0.2. **(07 Marks)**

b. Use Fourth order Runge-Kutta method to compute y(1.1) given that $\frac{dy}{dx} = xy^{1/3}$, y(1) = 1. **(06 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) using Adams – Bashforth predictor-corrector method. **(07 Marks)**

Module-5

9 a. Given $\frac{d^2y}{dx^2} - x^2\frac{dy}{dx} - 2xy = 1$, y(0) = 1, y′(0) = 0, evaluate y(0.1) using Runge-Kutta method of 4th order. **(07 Marks)**

b. Find the external of the functional $\int_{x_1}^{x_2}\left(y^{1^2} - y^2 + 2y\sec x\right)dx$. **(06 Marks)**

c. Derive Euler's equation in the standard form:

$$\frac{\partial f}{\partial y} - \frac{d}{dx}\left(\frac{\partial f}{\partial y^1}\right) = 0.$$ **(07 Marks)**

OR

10 a. Apply Milne's method to compute y(0.8) given that $\frac{d^2y}{dx^2} = 1 - 2y\frac{dy}{dx}$ and the following table of initial values:

x	0	0.2	0.4	0.6
y	0	0.02	0.0795	0.1762
y′	0	0.1996	0.3937	0.5689

(07 Marks)

b. Find the external of the functional $\int_0^{\pi/2}(y^2 - y^{1^2} - 2y\sin x)\,dx$ under the end conditions y(0) = 0, y(π/2) = 0. **(06 Marks)**

c. Prove that the geodesics on a plane are straight lines. **(07 Marks)**

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CBCS SCHEME

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18MATDIP31

Third Semester B.E. Degree Examination, Jan./Feb. 2023
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. Express the complex number $\frac{5+5i}{3-4i}$ in the form x + iy. **(06 Marks)**

b. Find the amplitude and modulus of the complex number $\frac{4+2i}{2-3i}$ **(07 Marks)**

c. Prove that $(1+\cos\theta+i\sin\theta)^n+(1+\cos\theta-i\sin\theta)^n = 2^{n+1}.\cos^n\frac{\theta}{2}\cos\left(\frac{n\theta}{2}\right)$ **(07 Marks)**

OR

2 a. Show that the points A(–1, 4, –3), B(3, 2, –5), C(–3, 8, –5) and D(–3, 2, 1) are coplanar. **(06 Marks)**

b. Find the cube roots of $1-i$ **(07 Marks)**

c. Find the sine of the angle between $\vec{a}=4\hat{i}-\hat{j}+3\hat{k}$ and $\vec{b}=-2\hat{i}+\hat{j}-2\hat{k}$. **(07 Marks)**

Module-2

3 a. Prove that $\sqrt{1+\sin 2x}=1+x-\frac{x^2}{2}-\frac{x^3}{6}+\frac{x^4}{24}+\ldots\ldots$ by using Maclaurin's series. **(06 Marks)**

b. 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)**

c. If $u=\tan^{-1}\left(\frac{x^3y^3}{x^3+y^3}\right)$ prove that $x.\frac{\partial u}{\partial x}+y.\frac{\partial u}{\partial y}=\frac{3}{2}\sin 2u$. **(07 Marks)**

OR

4 a. Obtain the Maclaurin's series expansion of e^x. **(06 Marks)**

b. If $u=e^{x^3+y^3}$ prove that $x.\frac{\partial u}{\partial x}+y.\frac{\partial u}{\partial y}=3u\log u$ **(07 Marks)**

c. If $u=x-y$ and $v=\frac{1}{x-y}$, find $\frac{\partial(u,v)}{\partial(x,y)}$ **(07 Marks)**

Module-3

5 a. Find the directional derivative of x^2yz^3 at (1, 1, 1) in the direction of $\hat{i}+\hat{j}+2\hat{k}$. **(06 Marks)**

b. A particle moves along a curve $x=e^{-t}$, $y=2\cos 3t$, $z=2\sin 3t$, where t is the time. Determine the component of velocity and acceleration at t = 0 in the direction of $\hat{i}+\hat{j}+\hat{k}$. **(07 Marks)**

c. Find the angle between the tangents to the curve $x=t^2$, $y=t^3$, $z=t^4$ at t = 2 and t = 3. **(07 Marks)**

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

OR

6 a. Find $\operatorname{div}\vec{F}$ and $\operatorname{curl}\vec{F}$ where $\vec{F} = \nabla(xy + yz + zx)$ **(06 Marks)**

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

c. 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 $(1, -1, 1)$. **(07 Marks)**

Module-4

7 a. Find the reduction formula for $\int \cos^n x.dx \;:\; n > 0$ **(06 Marks)**

b. Evaluate $\int_0^a \frac{x^4}{\sqrt{a^2 - x^2}}\, dx$ **(07 Marks)**

c. Evaluate $\int_0^1 \int_{x^2}^{x} (x^2 + 3y + 2)\, dy.dx$ **(07 Marks)**

OR

8 a. Find the reduction formula for $\int \sin^n x.dx \;:\; n > 0$ **(06 Marks)**

b. Evaluate $\int_0^{\pi} x.\cos^6 x.dx$ **(07 Marks)**

c. Evaluate $\int_0^a \int_0^a \int_0^a e^{x+y+z}\, dx\, dy\, dz$ **(07 Marks)**

Module-5

9 a. Solve : $\frac{dy}{dx} = -\frac{y}{x} + y^2 x$ **(06 Marks)**

b. Solve $y \sin 2x\, dx - (1 + y + \cos^2 x)dy = 0$ **(07 Marks)**

c. Solve $x.\frac{dy}{dx} + y = x^3 y^6$ **(07 Marks)**

OR

10 a. Solve $\frac{dy}{dx} = \frac{x^2 - 2xy}{x^2 - \sin y}$ **(06 Marks)**

b. Solve $dx + x\, dy = e^{-y}.\sec y\, dy$ **(07 Marks)**

c. Solve $3x(x + y^2)dy + (x^3 - 3xy - 2y^3)dx = 0$ **(07 Marks)**

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CBCS SCHEME

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Third Semester B.E. Degree Examination, Jan./Feb. 2023
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. Derive an expression for extension of the uniformly tapered rectangular bar subjected to an axial load. **(10 Marks)**

b. A steel circular bar has three segments as shown in Fig.Q1(b). Determine :
(i) The total elongation of the bar
(ii) The length of the middle segment to have zero elongation of the bar.
Take $E = 2.05 \times 10^5$ N/mm^2.

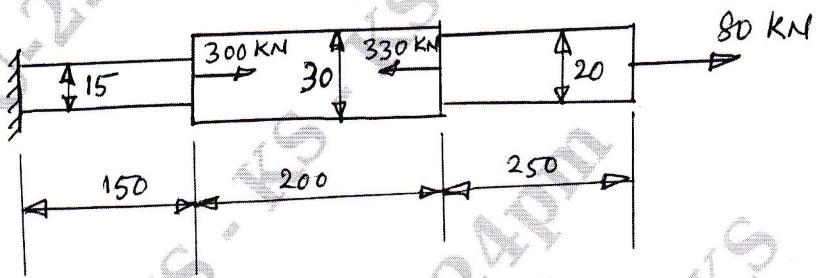

Fig.Q1(b) Dimensions in mm **(10 Marks)**

OR

2 a. Derive relationship between modulus of elasticity and modulus of rigidity. **(10 Marks)**

b. A 15 mm diameter steel rod passes centrally through a copper tube 50 mm external diameter and 40 mm internal diameter. The tube is closed at each end by rigid plates of negligible thickness. If the temperature of the assembly is raised by 60°C, calculate the stresses developed in copper and steel. Neglect the effect of tightening the nut. Take $E_s = 210$ GPa, $E_c = 105$ GPa, $\alpha_s = 12 \times 10^{-6}$/°C, $\alpha_c = 17.5 \times 10^{-6}$/°C. **(10 Marks)**

Module-2

3 a. For the element subjected to biaxial stress state, derive expressions for normal and tangential stresses acting on a plane inclined at an angle θ with the Y-axis. **(10 Marks)**

b. A thin cylindrical shell 2 m long has 200 mm internal diameter and thickness of the metal 10 mm. It is filled completely with a fluid at atmospheric pressure. If an additional 25000 mm^3 fluid is pumped in, find the pressure developed and hoop stress developed. Also find the change in diameter. Take $E = 2 \times 10^5$ N/mm^2 and Poisson's ratio $\frac{1}{m} = 0.3$. **(10 Marks)**

OR

4 a. A point in a machine is subjected to the stresses as shown in Fig.Q4(a). Draw the Mohr's circle and determine:
(i) Stresses on a plane which is at an angle of 60° with respect 80 MPa stress plane.
(ii) Magnitude of principal stresses and their orientations
(iii) Maximum and minimum shear stresses and orientations of their planes.

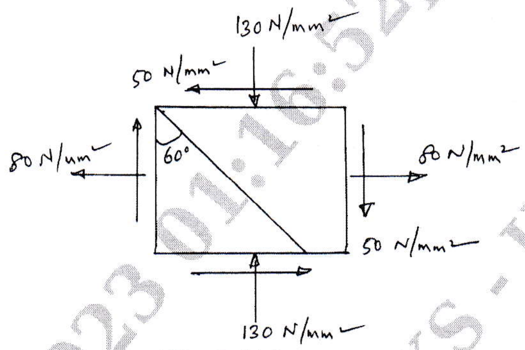

Fig.Q4(a) **(10 Marks)**

b. A thick cylindrical pipe of outside diameter 300 mm and internal diameter of 200 mm is subjected to an internal fluid pressure of 20 N/mm^2 and external fluid pressure of 5 N/mm^2. Determine the maximum hoop stress developed and draw the variation of hoop stress and radial stress across the thickness. **(10 Marks)**

Module-3

5 a. Draw the shear force and bending moment diagrams for the overhanging beam carrying uniformly distributed load of 2 kN/m over the entire length and a point load of 2 kN as shown in Fig.Q5(a). Locate the point of contra flexure.

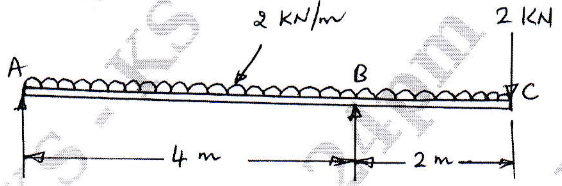

Fig.Q5(a) **(10 Marks)**

b. Derive the equation $\frac{M}{I} = \frac{\sigma_b}{Y} = \frac{E}{R}$ with usual notations. State the assumptions in the derivation. **(10 Marks)**

OR

6 a. Draw the shear force and bending moment diagrams for the cantilever beam shown in Fig.Q6(a).

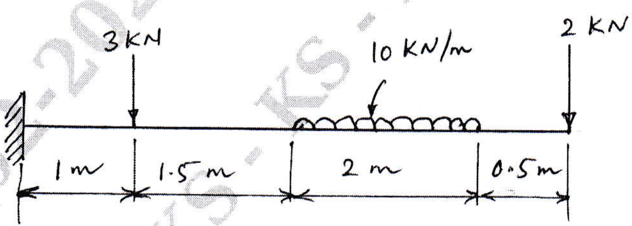

Fig.Q6(a) **(10 Marks)**

b. A beam of an I-section 200 mm × 300 mm has web thickness 10 mm and flange thickness 10 mm. It carries a shearing force of 10 kN at a section. Sketch the shear stress distribution across the section. **(10 Marks)**

Module-4

7 a. Derive the torsion equation $\frac{T}{J} = \frac{\tau}{r} = \frac{G\theta}{L}$ with usual notations. State the assumptions made in the derivation. **(10 Marks)**

b. The load on a bolt consists of an axial pull of 10 kN together with a transverse shear force of 5 kN. Find the diameter of the bolt :
   (i) Maximum principal stress theory
   (ii) Maximum shear stress theory **(10 Marks)**

OR

8 a. Determine the diameter of a solid shaft which transmits 300 kW at 250 rpm. The maximum shear stress should not exceed 30 N/mm^2 and twist should not be more than 1° in a shaft length of 2 m. Take modulus of rigidity $G = 1 \times 10^5$ N/mm^2. **(10 Marks)**

b. A hollow shaft is to transmit 250 KW power at 100 rpm. If the shear stress is not to exceed 60 MPa and internal diameter is 0.6 times the external diameter, find the external and internal diameters, assuming that the maximum torque is 1.4 times the mean torque. **(10 Marks)**

Module-5

9 a. Derive Euler's buckling equation for a long column when both ends are hinged. Also state the assumptions made in the derivation. **(10 Marks)**

b. Determine the buckling load for a strut of T-section, the flange width being 100 mm, overall depth 80 mm and both flange and stem 10 mm thick. The strut is 3 m long and is hinged at both ends. Take $E = 200$ GN/m^2. **(10 Marks)**

OR

10 a. Derive expressions for strain energy due to: (i) axial load (ii) torsion **(10 Marks)**

b. State and prove Castigliano's first theorem. **(10 Marks)**

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CBCS SCHEME

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18ME33

Third Semester B.E. Degree Examination, Jan./Feb. 2023
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 Thermodynamic handbook is permitted.***

Module-1

1 a. Distinguish between the following with an example for each
   i) Open system and closed system
   ii) Macroscopic and microscopic approach
   iii) Point function and path function
   iv) Diathermic walls and adiabatic walls
   v) Intensive and extensive property. **(10 Marks)**

b. The temperature 't' on a Celsius scale is defined in terms of property 'P' by the relation $P = e(t - B)/A$. Where A and B are constants. Experiments gives value of P is 1.86 and 6.81 at the ice and steam point respectively. Obtain relation for 't' and also find temperature 't' for the reading of P = 2.5. **(10 Marks)**

OR

2 a. Explain what do you understand by thermodynamic equilibrium. **(06 Marks)**

b. State Zeroth law of thermodynamics. Write its importance in thermodynamics. **(04 Marks)**

c. A platinum wire is used as a resistance thermometer. The wire resistance was found to be 10Ω and 16Ω at ice point and steam point respectively and 30Ω at sulphur boiling point of 444.6°C. Find the resistance of the wire at 750°C, it the resistance varies with temperature by the relation $R = R_0(1 + \alpha t + \beta t^2)$. **(10 Marks)**

Module-2

3 a. Distinguish between heat and work. **(04 Marks)**

b. A system undergoes a process in which the pressure and volume are related by an equation of the form P_v^n = constant. Derive an expression for displacement work during this process. **(06 Marks)**

c. A cylinder contains 1Kg of certain fluid at an initial pressure of 20 bar. The fluid is allowed to expand reversible behind a piston according to a law $Pv^2 = C$ until the volume is doubled the fluid is then cooled reversibly at constant pressure until the piston regains its original positions, heat is then supply reversibly with the piston firmly locked in position until the pressure rises to original value. Calculate the net work done by the fluid for an initial volume of $0.05m^3$. **(10 Marks)**

OR

4 a. Starting from the first law of thermo-dynamics for a closed system undergoing a non cyclic process, derive the steady state, steady flow energy equation for a control volume. **(06 Marks)**

b. State the limitations of first law of thermodynamic. Illustrate with examples. **(04 Marks)**

c. The properties of system during a reversible constant pressure non-flow process at P = 1.6 bar change from $V_1 = 0.3\ m^3/Kg$, $T_1 = 20°C$ to $V_2 = 0.55\ m^3/Kg$, $T_2 = 260°C$. The specific heat of the fluid is given by

$$C_p = \left(1.5 + \frac{75}{T+45}\right) kJ/Kg°C.$$

Determine: i) Heat added/Kg ii) Work done/Kg iii) $\Delta V = ?$ iv) $\Delta H / Kg = ?$ **(10 Marks)**

Module-3

5 a. State and prove that Kelvin Plank and Clausius statements of second law of Thermodynamic are equivalent. **(10 Marks)**

b. A reversible heat engine operating between two thermal reservoirs at 800°C and 30°C respectively. If drives refrigerator operating between -15°C and 30°C. The heat input to the heat engine is 1900kJ and the network output from the combined plant is 290KJ. Calculate the heat absorbed by the refrigerant and the total heat transferred to 30°C reservoir. **(10 Marks)**

OR

6 a. State and prove principle of increase of entropy. **(06 Marks)**

b. A heat engine is supplied with 278kJ/sec of heat at a constant fixed temperature of 283°C and the heat rejection take place at 5°C. The following results were reported.

i) 208kJ/sec of heat rejected
ii) 139kJ/Sec of heat rejected
iii) 70 kJ/sec of heat rejected

Classify which of the result report reversible cycle irreversible cycle or impossible cycle. **(06 Marks)**

c. 2Kg of water at 80°C are mixed adiabatically with 3Kg of water at 30°C in a constant pressure process at 1 atmosphere. Determine the increase in entropy due to mixing process. Assume for water $C_p = 4.187$ kJ/Kg. **(08 Marks)**

Module-4

7 a. Explain briefly available and unavailable energies referred to a cyclic process. **(10 Marks)**

b. 5 Kg of air at 555K and 4 bar is enclosed in a system.

i) Determine the availability of the system if the surrounding temperature and pressure are 290K and 1 bar respectively.
ii) If the air is cooled at constant pressure to the atmospheric temperature and if $C_p = 1.005$kJ/Kg K and $C_v = 0.718$ kJ/Kg K for air, determine the availability and effectiveness. **(10 Marks)**

OR

8 a. Sketch and explain separating and throttling colorimeter to find out the dryness fraction of pure substance. **(10 Marks)**

b. A vessel of volume $0.04\ m^3$ contains a mixture of saturated water and saturated steam of a temperature of 240°C. The mass of liquid present is 8 kg. Find the pressure, mass, specific volume, enthalpy, entropy of the internal energy. **(10 Marks)**

Module-5

9 a. Define mass fraction and mole fraction. **(04 Marks)**

b. State Gibb's Dalton law of partial pressures and hence device an expression for the gas 'R' of a mixture of gases. **(06 Marks)**

c. A mixture of ideal gases consists of 3Kg of nitrogen and 5Kg of carbon dioxide at a pressure of 300 KPa and a temperature of 20°C find :

i) Mole fraction of each constituent
ii) The equivalent molecular weight of the mixture
iii) The equivalent gas constant of the mixture
iv) The partial pressure and partial volume
v) The volume and density of the mixture. **(10 Marks)**

OR

10 a. Explain the following :

i) Compressibility factor
ii) Law of corresponding states
iii) Compressibility chart **(10 Marks)**

b. Determine the specific volume of H_2 gas when its pressure is 60 bar and temperature is 100K

i) By using compressibility chart
ii) By using Vander Waal's equation

Take for H_2 $T_c = -239.76°C$

$P_c = 12.92$ bar

$a = 0.25105 \times 10^5 \text{ Nm}^2/\text{Kg mole}^4$

$b = 0.0262 \text{m}^3/\text{Kg mole}$ **(10 Marks)**

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CBCS SCHEME

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18ME34

Third Semester B.E. Degree Examination, Jan./Feb. 2023
Material Science

Time: 3 hrs. Max. Marks: 100

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

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-1

1 a. Define APF. Calculate APF for FCC unit cell. **(07 Marks)**

b. Explain briefly crystal imperfections/defects. Classify it and with neat sketches, explain grain boundary and tilt boundary defects. **(07 Marks)**

c. State and explain Fick's 2^{nd} law of diffusion. **(06 Marks)**

OR

2 a. Define true stress and true strain. Show that

$$\sigma' = \sigma(\varepsilon + 1)$$

where σ = Engineering/conventional stress, σ' = True stress

ε = Engineering/conventional strain, ε' = True strain **(08 Marks)**

b. Explain the following: (i) Toughness (ii) Resilience (iii) Secant modulus **(06 Marks)**

c. Explain the following mechanisms of strengthening in metal:

(i) Grain size reduction

(ii) Solid solution strengthening

(iii) Strain hardening **(06 Marks)**

Module-2

3 a. Define creep. Explain with a neat sketch, primary, secondary and tertiary creep. **(07 Marks)**

b. What is fatigue? Explain S-N curve with a neat sketch. **(04 Marks)**

c. Draw iron-carbon equilibrium diagram showing all the phases. Explain the phases in iron-carbon equilibrium diagram. **(09 Marks)**

OR

4 a. Define solid solution. Explain the types of solid solutions with neat sketches. **(05 Marks)**

b. Write notes on: (i) Effect of non-equilibrium cooling (ii) Coring **(04 Marks)**

c. Define nucleation. Obtain an expression for critical radius in homogeneous nucleation. **(11 Marks)**

Module-3

5 a. Define heat treatment. Explain the TTT diagram for 0.83% C, showing all the phases. **(07 Marks)**

b. Define annealing. Explain full annealing and spherodizing annealing with neat sketches. **(07 Marks)**

c. Explain induction hardening with a neat sketch. **(06 Marks)**

OR

6 a. Define heat treatment. Give its purpose and classification. **(06 Marks)**

b. What is hardenability? Explain with a neat sketch, Jominy End Quench Test. **(07 Marks)**

c. Explain the composition, properties and uses of Grey C.I., White C.I. and Malleable C.I. **(07 Marks)**

Module-4

7 a. Define composite. Explain the role of matrix, reinforcement and interface. **(07 Marks)**
b. Explain with neat sketches, Pressure bag moulding and vacuum bag moulding process. **(06 Marks)**
c. Explain filament winding process. **(07 Marks)**

OR

8 a. Derive an expression for Young's modulus for FRPs for ISO-strain condition. **(06 Marks)**
b. Explain resin transfer moulding process. **(06 Marks)**
c. Explain powder metallurgy technique for the manufacture of composites. **(08 Marks)**

Module-5

9 a. Define ceramic. Explain the types of ceramics. **(07 Marks)**
b. Explain ISO-static pressing and hot pressing. **(06 Marks)**
c. Explain slip casting and tape casting processes. **(07 Marks)**

OR

10 a. Explain compression moulding process. **(07 Marks)**
b. Define smart material. Write a note on piezoelectrics and Shape Memory Alloys (SMA). **(07 Marks)**
c. Explain environmental considerations and sustainability. **(06 Marks)**

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CBCS SCHEME

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18ME35A/18MEA305

Third Semester B.E. Degree Examination, Jan./Feb. 2023

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. With a neat sketch, explain single point cutting tool nomenclature. **(12 Marks)**

b. Differentiate between orthogonal and oblique cutting. **(08 Marks)**

OR

2 a. With a sketch, explain parts of a lathe. **(12 Marks)**

b. Differentiate between Turret and Capstan lathe. **(08 Marks)**

Module-2

3 a. With a neat sketch, explain Horizontal milling machine. **(10 Marks)**

b. Differentiate between upmilling and downmilling process. **(10 Marks)**

OR

4 a. With sketches explain the following:
i) Reaming ii) Boring iii) Counter boring iv) Counter sinking. **(12 Marks)**

b. With a neat sketch, explain centerless grinding machine. **(08 Marks)**

Module-3

5 a. Define tool life. What are the factors affecting tool life. **(10 Marks)**

b. Briefly explain different types of cutting fluids and their applications. **(10 Marks)**

OR

6 a. Explain the effect of machining parameters on surface finish. **(10 Marks)**

b. A 150mm long 12.7mm diameter stainless steel rod is turned to 12.19mm diameter on a center lathe with spindle speed 400 rev/min and axial speed 203.2 mm/min. Calculate MRR and machining time. **(10 Marks)**

Module-4

7 a. Differentiate between Hot working and cold working. **(08 Marks)**

b. With a sketch explain Hydraulic forging press. **(12 Marks)**

OR

8 a. Explain the following rolling mills: i) Two-high rolling mill ii) Three-high rolling mill iii) Cluster rolling mill. **(12 Marks)**

b. Explain various types of Extrusion process. **(08 Marks)**

Module-5

9 a. With a sketches, explain blanking, piercing and punching. **(12 Marks)**

b. With a sketch, explain combination die. **(08 Marks)**

OR

10 Write a note on:

a. Drawing ratio b. Bending force

c. Compound die d. Progressive die. **(20 Marks)**

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Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.