CBCS SCHEME

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Third Semester B.E. Degree Examination, July/August 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. Find the Laplace transform,
(i) $e^{-2t}(2\cos 5t - \sin 5t)$ (ii) $\cosh^2 3t$ **(06 Marks)**

b. Find the Laplace transform of the full wave rectifier $f(t) = E\sin\omega t \quad 0 < t < \frac{\pi}{\omega}$ having a period $\frac{\pi}{\omega}$. **(07 Marks)**

c. Find the inverse Laplace transform $\left[\frac{s^2+4}{s(s+4)(s-4)}\right]$. **(07 Marks)**

OR

2 a. Find the Laplace transform, $\frac{\cos at - \cos bt}{t}$. **(06 Marks)**

b. Solve by using Laplace transform method $y'''(t) + 2y''(t) - y'(t) - 2y(t) = 0$, given $y(0) = y'(0) = 0$ and $y''(0) = 6$ **(07 Marks)**

c. Express the function f(t) in terms of unit step function and hence find its inverse LT,

$$f(t) = \begin{cases} \cos t & 0 < t \le \pi \\ 1 & \pi < t \le 2\pi \\ \sin t & t > 2\pi \end{cases}$$ **(07 Marks)**

Module-2

3 a. Obtain the Fourier series of $f(x) = \frac{\pi - x}{2}$, in $0 < x < 2\pi$. Hence deduce that $1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \ldots = \frac{\pi}{4}$. **(06 Marks)**

b. Show that the sine half range series for the function, $f(x) = Lx - x^2$, in $0 < x < L$ is $\frac{8L^2}{\pi^3}\sum_0^\infty \frac{1}{(2n+1)^3}\sin\left(\frac{2n+1}{L}\right)\pi x$. **(07 Marks)**

c. Obtain the Fourier series of y up to the first harmonics for the following values :

x°	45	90	135	180	225	270	315	360
y	4.0	3.8	2.4	2.0	−1.5	0	2.6	3.4

(07 Marks)

OR

4 a. Expand the function $f(x) = x\sin x$, as a Fourier series in the interval $-\pi \le x \le \pi$. Deduce that $\frac{1}{1,3} - \frac{1}{3,5} + \frac{1}{5,7} ..... = \frac{\pi - 2}{4}$ **(06 Marks)**

b. Obtain the half range cosine series of $f(x) = x\sin x \quad 0 \le x \le \pi$. **(07 Marks)**

c. Obtain the constant term and the first three coefficients in the Fourier cosine series for y using the following data :

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

(07 Marks)

Module-3

5 a. Find the complex Fourier transform of the function, $f(x) = \begin{cases} 1 & \text{for } |x| \le a \\ 0 & \text{for } |x| > a \end{cases}$.

Hence evaluate $\int_0^\infty \frac{\sin x}{x} dx$. **(06 Marks)**

b. If $\overline{f(z)} = \frac{2z^2 + 3z + 12}{(z-1)^4}$ find the value of u_0, u_1, u_2, u_3 **(07 Marks)**

c. Solve by using z-transforms, $u_{n+2} + 5u_{n+1} + 6u_n = 2^n : u_1 = 0, u_0 = 0$ **(07 Marks)**

OR

6 a. Find the Fourier sine transform of e^{-ax}, $a > 0$. **(06 Marks)**

b. Find the Fourier sine and cosine transform of $2e^{-3x} + 3e^{-2x}$. **(07 Marks)**

c. Solve by using Z-transforms,
$y_{n+2} + 2y_{n+1} + y_n = n$, with $y(0) = 0 = y_1$ **(07 Marks)**

Module-4

7 a. Use Taylor's series method to find y(4.1) given that $\frac{dy}{dx} = \frac{1}{x^2 + y}$ and $y(4) = 4$. **(06 Marks)**

b. Use Fourth order Runge-Kutta method to solve $(x+y)\frac{dy}{dx} = 1$, $y(0.4) = 1$ at $x = 0.5$. Correct to four decimal places. **(07 Marks)**

c. The following table gives the solution of $5xy^1 + y^2 - 2 = 0$, find the value of y at x = 4.5 using Milne's Predictor and Corrector formulae, use the corrector formulae twice.

x	4	4.1	4.2	4.3	4.4
y	1	1.0049	1.0097	1.0143	1.0187

(07 Marks)

OR

8 a. Using modified Euler's method find y at x = 0.2 given $\frac{dy}{dx} = 3x + \frac{y}{2}$, with $y(0) = 1$ taking $h = 0.1$. **(06 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 $h = 0.2$ **(07 Marks)**

c. Apply Adams-Bashforth method to solve the equation $(y^2 + 1)dy - x^2 dx = 0$, at x = 1, given y(0) = 1, y(0.25) = 1.0026, y(0.5) = 1.0206, y(0.75) = 1.0679. Apply the corrector formulae twice. **(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 order 4. **(06 Marks)**

b. A necessary condition for the integral $I = \int_{x_1}^{x_2} f(x, y, y')dx$ where $y(x_1) = y_1$ and $y(x_2) = y_2$ to be extremum that $\frac{\partial f}{\partial y} - \frac{d}{dx}\left(\frac{\partial f}{\partial y'}\right) = 0$. **(07 Marks)**

c. Show that the extremal of the functional $\int_0^1 y^2\{3x(y'^2 - 1) + yy'^3\}dx$, subject to the conditions $y(0) = 0$, $y(1) = 2$, is the circle $x^2 + y^2 - 5x = 0$. **(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. **(06 Marks)**

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

b. Find the extremal of the functional $\int_a^b (x^2y'^2 + 2y^2 + 2xy)dx$. **(07 Marks)**

c. Prove that Geodesics on a plane are straight line. **(07 Marks)**

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CBCS SCHEME

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18MATDIP31

Third Semester B.E. Degree Examination, July/August 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. Express $\frac{(3+i)(1-3i)}{(2+i)}$ in the form x + iy. **(06 Marks)**

b. If $\vec{a} = \hat{i} - 2\hat{j} + 3\hat{k}$, $\vec{b} = -\hat{i} + 2\hat{j} + \hat{k}$ and $\vec{c} = 3\hat{i} + \hat{j}$. Find the value of 'ρ' such that $\vec{a} - \rho\vec{b}$ is perpendicular to $\vec{c}$. **(07 Marks)**

c. Find the angle between the vector $\vec{a} = 5\hat{i} - \hat{j} + \hat{k}$ and $\vec{b} = 2\hat{i} - 3\hat{j} + 6\hat{k}$. **(07 Marks)**

OR

2 a. Find the modulus and amplitude of the complex number $1 + \cos\alpha + i\sin\alpha$. **(06 Marks)**

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

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

Module-2

3 a. Find the n^{th} derivative of cosx cos2x. **(06 Marks)**

b. Obtain the Maclaurin's series expansion of the function $\sqrt{1+\sin 2x}$ upto the term containing x^4. **(07 Marks)**

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

OR

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

b. If $z = xy^2 + x^2y$ where $x = at^2$ and $y = 2at$. Find $\frac{dz}{dt}$. **(07 Marks)**

c. If $x = e^u \sec v$, $y = e^u \tan v$. Find $J\left(\frac{x,y}{u,v}\right)$. **(07 Marks)**

Module-3

5 a. A particle moves along the curve $\vec{r} = \cos 2t\hat{i} + \sin 2t\hat{j} + t\hat{k}$ where t is the time variable. Determine the components of velocity and acceleration vectors at $t = \pi/8$ in the direction of $\sqrt{2}\hat{i} + \sqrt{2}\hat{j} + \hat{k}$. **(06 Marks)**

b. Find div $\vec{f}$ for $\vec{f} = \nabla(x^3 + y^3 + z^3 - 3xyz)$. **(07 Marks)**

c. Show that $\vec{f} = (2xy + z^2)\hat{i} + (x^2 + 2yz)\hat{j} + (y^2 + 2xz)\hat{k}$ is irrotional and find φ such that $\vec{f} = \nabla\varphi$. **(07 Marks)**

OR

6 a. Find the unit normal to the surface $x^3y^3z^2 = 4$ at the point P(-1, -1, 2). **(06 Marks)**

b. If $\vec{f} = 2x^2\hat{i} - 3yz\hat{j} + xz^2\hat{k}$ and $\varphi = 2z - x^3y$, find $\vec{f} \bullet (\nabla\varphi)$ and $\vec{f} \times (\nabla\varphi)$ at (1, -1, 1). **(07 Marks)**

c. Show that $\vec{f} = \dfrac{x\hat{i} + y\hat{j}}{x^2 + y^2}$ is both solenoidal and irrotational. **(07 Marks)**

Module-4

7 a. Obtain a reduction formula for $\int_0^{\pi/2} \sin^n x\,dx\,(n > 0)$. **(06 Marks)**

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

c. Evaluate $\int_0^1 \int_0^{\sqrt{1-x^2}} \int_0^{\sqrt{1-x^2-y^2}} xyz\,dz\,dy\,dx$. **(07 Marks)**

OR

8 a. Obtain a reduction formula for $\int_0^{\pi/2} \cos^n x\,dx\ (n > 0)$. **(06 Marks)**

b. Evaluate $\iint_R xy\,dx\,dy$ where R is the first quadrant of the circle $x^2 + y^2 = a^2$, $x \geq 0$, $y \geq 0$. **(07 Marks)**

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

Module-5

9 a. Solve $x^2\dfrac{dy}{dx} - 2xy - x + 1 = 0$. **(06 Marks)**

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

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

OR

10 a. Solve $\left[y\left(1 + \dfrac{1}{x}\right) + \cos y\right]dx + [x + \log x - x\sin y]dy = 0$. **(06 Marks)**

b. Solve $\dfrac{dy}{dx} + y\cot x = \sin x$. **(07 Marks)**

c. Solve $\dfrac{dy}{dx} + \dfrac{y}{x} = y^2x$. **(07 Marks)**

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CBCS SCHEME

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18ME32

Third Semester B.E. Degree Examination, July/August 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 the following :
i) True stress ii) Resilience iii) Ductility iv) Toughness. **(04 Marks)**

b. Derive the expression for the extension of uniformly tapering circular rod subjected to axial load. **(08 Marks)**

c. A steel bar ABCD 4mt long subjected to forces as shown in Fig. Q1(c). Find the elongation of bar. Take E for the steel as 200 GPa. **(08 Marks)**

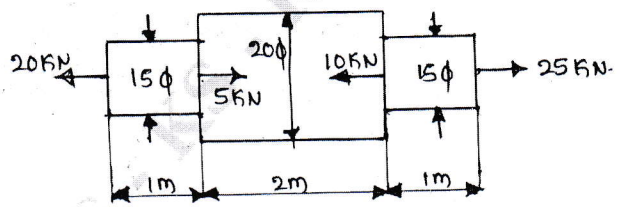

Fig. Q1(c)

OR

2 a. Define the following : i) Poisson's Ratio ii) Young's Modulus iii) Modulus of Rigidity iv) Bulk modulus. **(04 Marks)**

b. A bar of 20mm diameter is tested in tension. It is observed that when a load of 37.7 KN is applied. The extension measured over a gauge length of 200mm is 0.12mm and contraction in diameter is 0.0036mm. Find Poisson's ratio and elastic constant E, G and K. **(08 Marks)**

c. A composite bar is rigidly fitted at the supports A and B as shown in Fig. Q2(c). Determine the reactions at the supports when the temperature rises by 20°C. Take $E_a = 70\ GN/m^2$, $E_s = 200GN/m^2$, $\alpha_a = 11 \times 10^{-6}/°C$ and $\alpha_s = 12 \times 10^{-6}/°C$. **(08 Marks)**

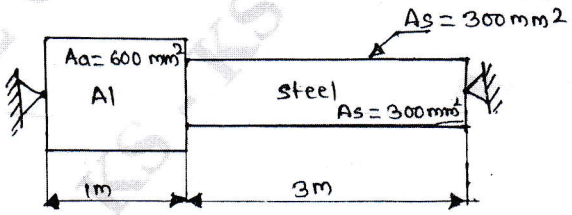

Fig. Q2(c)

Module-2

3 The state of stress in a two dimensionally stressed body is as shown in Fig. Q3. Determine the Principal planes , Principal stress , Maximum shear stress and their planes Analytically and Validate answer by graphically (using Mohr's circle). **(20 Marks)**

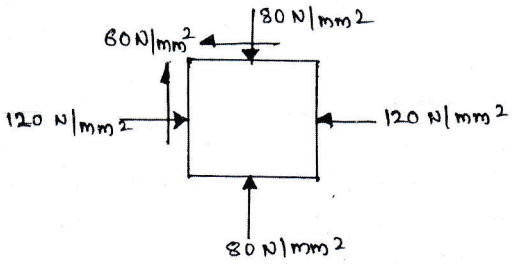

Fig. Q3

OR

4 a. Derive the expression for circumferential and radial stresses in the wall of thick cylinder [Lame's equation] with assumptions made. **(10 Marks)**

b. A thin cylindrical vessel made of steel plates 4mm thick with plane ends, carries fluid under pressure of $3N/mm^2$. The diameter of cylinder is 25cms and the length is 75cms. Calculate the longitudinal and hoop stresses in the cylinder wall and determine the change in diameter, length and volume of the cylinder. Take $E = 2.1 \times 10^5$ N/mm^2 and $1/m = 0.286$. **(10 Marks)**

Module-3

5 a. Explain different types of loads in beams. **(04 Marks)**

b. For the beam as shown in Fig. Q4(b). Determine the magnitude of load 'P' acting at point C, such that the reactions at supports A & B are equal. Draw shear force and bending moment diagram for the beam. Mark the silent points and their values on the diagram. Locate the point of contra flexure if any. **(16 Marks)**

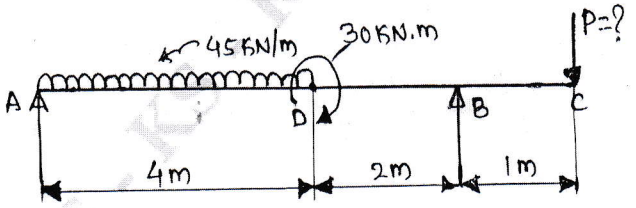

Fig. Q4(b)

OR

6 a. Derive the relation $\frac{M}{I} = \frac{\sigma b}{Y} = \frac{E}{R}$ with usual notations and list the basic assumptions. **(10 Marks)**

b. A rolled steel joint of I – Section used as simply supported beam has the following dimensions : Flange (250×25)mm , Web – 15mm thick , Overall depth – 50mm. If this beam carries a UDL of 50kN/m on a span of 4m, calculate the maximum stress produced due to bending. **(10 Marks)**

Module-4

7 a. Explain i) Maximum principal stress theory ii) Maximum shear stress theory. **(10 Marks)**

b. A shaft is required to transmic 245 KW power at 240 rpm. The maximum torque may be 1.5 times the mean torque. The shear stress in the shaft should not exceed $40N/mm^2$ and the twist 1° per meter length. Determine the diameter required, if i) the shaft is solid
ii) the shaft is hollow with external diameter twice the internal diameter.
Take modulus of rigidity = $80KN/mm^2$. **(10 Marks)**

OR

8 a. List all assumptions and derive the torsional formula in standard form
$\frac{T}{J} = \frac{\tau}{R} = \frac{G\theta}{L}$. **(10 Marks)**

b. In a plate of C45 steel (σ_{yt} = 353 Mpa) subjected to a system of loads, following stresses are induced at critical point : $\sigma_x = 150$ N/mm^2 , $\sigma_y = 100N/mm^2$ and $\tau_{xy} = 50N/mm^2$. Check wheather there is failure according to i) Maximum Principal Stress theory.
ii) Maximum shear stress theory. If the material is safe, find the factor of safety as per both theories. **(10 Marks)**

Module-5

9 a. Derive the expression for strain energy due to shear. **(07 Marks)**

b. Define : i) Strain energy ii) Resilience iii) Proof Resilience
iv) Modulus of Resilience. **(04 Marks)**

c. A 2m long pin ended column of square cross section is to be made up of wood. Assuming E = 12GPa and allowable stress being limited to 12MPa. Determine the size of the column to support the following load safety. i) 95 KN ii) 200 KN. Use factor of safety of 3 and Euler's crippling loads for buckling. **(09 Marks)**

OR

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

b. Derive the expression for strain energy due to impact load for axial load applications. **(10 Marks)**

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CBCS SCHEME

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18ME33

Third Semester B.E. Degree Examination, July/August 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 data hand book permitted.

Module-1

1 a. Define Thermodynamic system, differentiate between open, closed and isolated system. **(08 Marks)**

b. Explain the following: i) State ii) Process iii) Cyclic process. **(06 Marks)**

c. A temperature scale of a certain thermometer is given by the relation $t = a \ln p + b$, where a and b are constants and p is Thermometric property. If at ice point and steam point the properties are found to be 2.5 and 9.5 respectively, what will be the temperature corresponding to the thermometric property of 4.5 on Celsius scale. **(06 Marks)**

OR

2 a. Explain briefly Zeroth law of Thermo dynamics. **(06 Marks)**

b. Explain the following:
i) Quasistatic process
ii) Adiabatic and dia thermal wall
iii) Reversible process. **(06 Marks)**

c. Estimate the % variation in temperature from a thermocouple from a thermocouple having its test junction in gas and other reference junction at ice point. The temperature of gas using gas thermometer is found to be 50°C. Thermocouple is calibrated with emf varying linearly between ice point and steam point. When thermocouple's test junction is kept in gas t°C and reference junction at ice point, the emf produced in millivolts is $e = 0.18t - 5.2 \times 10^{-4}t^2$. **(08 Marks)**

Module-2

3 a. Compare heat and work. **(06 Marks)**

b. Derive an expression for work in a polytropic process. **(06 Marks)**

c. A fluid at a pressure of 3 bar, and with specific volume of $0.18 m^3/kg$ contained in a cylinder behind a piston expands reversibly to a pressure of 0.6bar, according to a Law $P = \frac{c}{v^2}$ where c is a constant. Calculate the workdone by the fluid on the piston. Show the process on p-v diagram. **(08 Marks)**

OR

4 a. State first law of thermodynamics and show that internal energy is property of a system. **(08 Marks)**

b. What do you mean by "Perpetual Motion Machine of first kind, PMM-1"? **(04 Marks)**

c. A stream of gases at 7.5 bar, 750°C and 140m/s is passed through a turbine of a jet engine. The gases comes out of the turbine at 2 bar, 550°C and 280m/s. The process may be assumed adiabatic. The enthalpies of gas at the entry and exit of the turbine are 950kJ/kg and 650kJ/kg of gas respectively. Determine the capacity of the turbine in KW if the gas flow rate is 5kg/s. **(08 Marks)**

Module-3

5 a. Give the following statements of second law of thermodynamics:
i) Clausius statement ii) Kelvin Plank statement. **(06 Marks)**

b. Show that the efficiency of a Reversible heat engine is more than a Irreversible heat engine, both heat engines working between the same temperature limits. **(06 Marks)**

c. A heat pump working on a reversed carnot cycle takes in energy from a reservoir, maintained at 5°C and delivers it to another reservoir where temperature is 77°C. The heat pump derives power for its operation from a reversible engine operating with in the higher and lower temperature of 1077°C and 77°C. For 100kJ/kg of energy supplied to reservoir at 77°C, estimate the energy taken from the reservoir at 1077°C. **(08 Marks)**

OR

6 a. State and prove Clausius Inequality. **(08 Marks)**

b. Prove that entropy is a property of a system. **(06 Marks)**

c. In an air turbine the air expands from 7 bar 460°C to 1.012 bar and 160°C. The heat loss from the turbine can be assumed to be negligible. Estimate the change in entropy. **(06 Marks)**

Module-4

7 a. Explain the concept of available and unavailable energy. When does the system becomes dead? **(06 Marks)**

b. Explain the concept of second law efficiency. **(06 Marks)**

c. A heat engine is working between 700°C and 30°C. The temperature of surroundings is 17°C. Engine receives heat at the rate of 2×10^4kJ/min and the measured output of engine is 0.13MW. Determine the availability, rate of irreversibility and second law efficiency of engine. **(08 Marks)**

OR

8 a. Define the following: i) Triple point ii) Critical point iii) Enthalpy of wet steam iv) Dryness fraction. **(08 Marks)**

b. Draw a neat sketch of throttling calorimeter and explain how dryness fraction is determined. **(06 Marks)**

c. A throttling calorimeter is attached to the steam pipe carrying steam at 11 bar. The pressure and temperature of steam after throttling are 1.2 bar and 120°C. Find the dryness fraction of steam. Take $C_P = 2.1$ for super heated steam. What is the maximum dryness fraction that can be measured under above condition? **(06 Marks)**

Module-5

9 a. Define the terms partial pressure, massfraction and mole fraction. **(06 Marks)**

b. Develop an expression to determine the gas constant and molecular weight of a mixture of ideal gases. **(06 Marks)**

c. A mixture of gases has the following volumetric composition.
$CO_2 = 12\%$, $O_2 = 4\%$, $N_2 = 82\%$, $CO = 2\%$.
Calculate: i) The gravimetric composition ii) Molecular weight of mixture iii) R for mixture. **(08 Marks)**

OR

10 a. Explain the following: i) Compressibility factor ii) Reduced properties iii) Law of corresponding states. **(06 Marks)**

b. Write a note on compressibility chart. **(06 Marks)**

c. Determine the pressure of Nitrogen in a steel vessel having a volume of 15 litres and containing 3.4kg at 400°C by using i) Ideal gas equation ii) Vander Walls equation. **(08 Marks)**

CBCS SCHEME

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18ME34

Third Semester B.E. Degree Examination, July/August 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. Calculate ADF of BCC crystal structure. **(06 Marks)**

b. Discuss briefly edge dislocation in crystals. **(06 Marks)**

c. State and explain Fick's laws of diffusion. Also explain factors affecting diffusion. **(08 Marks)**

OR

2 a. Explain with the help of stress-strain diagram stiffness, yield strength, ductility and toughness. **(08 Marks)**

b. Deduce the relation between true stress and engineering stress. **(06 Marks)**

c. A tensile load of 500N applied on a carbon steel rod of 10mm diameter, the diameter after elongation reduces to 9mm. Find true stress, engineering stress, true stain and engineering strain. **(06 Marks)**

Module-2

3 a. Discuss ductile and brittle fracture with clear differences. **(06 Marks)**

b. What is fatigue? Explain R.R.Moore fatigue testing method with S – N diagram. **(07 Marks)**

c. What is creep? Explain three stages of creep with neat graph also explain why 2nd stage is very important. **(07 Marks)**

OR

4 a. Explain Hume-Rothery rules for the formation of substitutional solid-solution. **(06 Marks)**

b. Draw the Iron-Carbon diagram and label all the phases, temperatures and invariant points on it. **(07 Marks)**

c. Derive the expression for critical radius in homogeneous nucleation. **(07 Marks)**

Module-3

5 a. Superimpose CCT diagram on TTT diagram and explain the importance of both the diagrams. **(07 Marks)**

b. Explain Annealing and Normalising with necessary figures. **(06 Marks)**

c. Discuss Martempering and Austempering processes with neat figures. **(07 Marks)**

OR

6 a. With the help of Aluminium – Copper phase diagram discuss age hardening process. **(07 Marks)**

b. Discuss Gray cast iron composition, properties and uses. **(07 Marks)**

c. Discuss Induction hardening and Flame hardening with neat diagrams. **(06 Marks)**

Module-4

7 a. What is composite? Classify the composites. **(06 Marks)**

b. State the advantages, disadvantages and applications of composites. **(08 Marks)**

c. Explain any one process of manufacturing composites. **(06 Marks)**

OR

8 a. Deduce the expression for iso-stress and iso-strain conditions of composites of Young's modulus. **(08 Marks)**

b. Explain fultrusion process with neat sketch. **(06 Marks)**

c. Briefly explain metal matrix and ceramic matrix composites. **(06 Marks)**

Module-5

9 a. Explain properties and different types of ceramics. **(06 Marks)**

b. With the help of neat sketch explain injection moulding process. **(06 Marks)**

c. State the applications and advantages of ceramics and polymers. **(08 Marks)**

OR

10 a. What is shape memory alloy? Discuss the same. **(07 Marks)**

b. Discuss the optical and thermal materials. **(06 Marks)**

c. Discuss the fiber optics, piezo – electrics and smart materials. **(07 Marks)**

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18ME35A/18MEA305

Third Semester B.E. Degree Examination, July/August 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. With neat sketch, explain briefly the working of a lathe machine. **(08 Marks)**

b. Explain the concept of oblique and orthogonal cutting with neat sketch. **(06 Marks)**

c. Draw a Merchant's circle diagram using usual notations and state the assumptions. **(06 Marks)**

OR

2 a. Briefly explain the different types of chips produced during metal cutting with neat sketches. **(08 Marks)**

b. Explain, Knurling, Turning, Facing and Boring operations performed on lathe machine. **(06 Marks)**

c. A bar of 90 mm diameter is reduced to 87.6 mm by cutting tool while cutting orthogonally. If the mean length of the cut chip is 88.2 mm, find the cutting ratio. If the rake angle is 15°, what is the shear angle? **(06 Marks)**

Module-2

3 a. With a neat sketch, explain briefly the working of a horizontal milling machine. **(08 Marks)**

b. Explain following milling operations with relevant sketches:
(i) Form milling. (ii) Gang milling. **(06 Marks)**

c. With a neat sketch, explain briefly the working of drilling machine. **(06 Marks)**

OR

4 a. With a neat sketch, explain the constructional features of a centreless grinding machine. **(08 Marks)**

b. Difference between shaping and planning machine. **(06 Marks)**

c. Differentiate up milling and down milling with sketch. **(06 Marks)**

Module-3

5 a. With neat sketch, explain crater wear and flank wear. **(08 Marks)**

b. List the various types of cutting fluids used in metal cutting, briefly explain. **(06 Marks)**

c. Define tool life. Explain the factors which affect the tool life. **(06 Marks)**

OR

6 a. A tool life of 80 minutes is obtained at a speed of 30 mpm and 8 minutes at 60 mpm. Deteremine the tool life equation and cutting speed for 4 minutes tool life. **(08 Marks)**

b. What is machinability? List out the machinability criteria. **(06 Marks)**

c. What do you understand by economics of machining? How do you evaluate machining cost? **(06 Marks)**

Module-4

7 a. With neat sketches, explain the classification of metal working processes on the basis of force applied. **(08 Marks)**

b. Distinguish between the hot working and cold working process. **(06 Marks)**

c. Explain different types of forging defects. **(06 Marks)**

OR

8 a. Explain the following rolling mills:
(i) Two high mill
(ii) Cluster mill
(iii) Tandem mill
(iv) Three high mill. **(08 Marks)**

b. Define extrussion process and explain hydrostatic extrussion process with a neat sketch. **(06 Marks)**

c. With a neat sketch, explain a tube drawing process. **(06 Marks)**

Module-5

9 a. Define, piercing, blanking, bending and stretch forming, process with a neat sketch. **(08 Marks)**

b. What are different types of bending dies? How to calculate bending force? **(06 Marks)**

c. Define Embossing, Coining and shearing in sheet metal working. **(06 Marks)**

OR

10 a. Explain with neat sketch,
(i) Progressive die.
(ii) Compound die. **(10 Marks)**

b. Explain different types of defects in deep drawn products. **(05 Marks)**

c. Write a note on die and punch material in sheet metal forming. **(05 Marks)**

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