CBCS SCHEME

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18MAT31

Third Semester B.E. Degree Examination, Dec.2019/Jan.2020
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) $\left(\frac{4t+5}{e^{2t}}\right)^2$ (ii) $\left(\frac{\sin 2t}{\sqrt{t}}\right)^2$ (iii) $t\cos at$. **(10 Marks)**

b. The square wave function f(t) with period 2a defined by $f(t)=\begin{cases}1 & 0\le t<a\\ -1 & a\le t<2a\end{cases}$. Show that $\left(\frac{1}{s}\right)\tanh\left(\frac{as}{2}\right)$. **(05 Marks)**

c. Employ Laplace transform to solve $\frac{d^2y}{dt^2}-\frac{dy}{dt}=0,\ y(0)=y_1(0)=3$. **(05 Marks)**

OR

2 a. Find (i) $L^{-1}\left\{\frac{s^2-3s+4}{s^3}\right\}$ (ii) $\cot^{-1}\left(\frac{s}{2}\right)$ (iii) $L^{-1}\left\{\frac{s}{(s+2)(s+3)}\right\}$ **(10 Marks)**

b. Find the inverse Laplace transform of, $\frac{1}{s(s^2+1)}$ using convolution theorem. **(05 Marks)**

c. Express $f(t)=\begin{cases}2 & \text{if } 0<t<1\\ \frac{t^2}{2} & \text{if } 1<t<\frac{\pi}{2}\\ \cos t & t>\frac{\pi}{2}\end{cases}$ in terms of unit step function and hence find its Laplace transformation. **(05 Marks)**

Module-2

3 a. Obtain the Fourier series of $f(x)=\begin{cases}2 & -2<x<0\\ x & 0<x<2\end{cases}$. **(08 Marks)**

b. Find the half range cosine series of, $f(x)=(x+1)$ in the interval $0\le x\le 1$. **(06 Marks)**

c. Express $f(x)=x^2$ as a Fourier series of period 2π in the interval $0<x<2\pi$. **(06 Marks)**

OR

4 a. Compute the first two harmonics of the Fourier Series of f(x) given the following table : **(08 Marks)**

x°	0	60°	120°	180°	240°	300°
y	7.9	7.2	3.6	0.5	0.9	6.8

b. Find the half range size series of e^x in the interval $0 \le x \le 1$. **(06 Marks)**

c. Obtain the Fourier series of $f(x) = \frac{\pi^2}{12} - \frac{x^2}{4}$ valid in the interval $(-\pi \quad \pi)$ **(06 Marks)**

Module-3

5 a. Find the Infinite Fourier transform of $e^{-|x|}$. **(07 Marks)**

b. Find the Fourier cosine transform of $f(x) = e^{-2x} + 4e^{-3x}$. **(06 Marks)**

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

OR

6 a. If $f(x) = \begin{cases} 1 & \text{for } |x| \le a \\ 0 & \text{for } |x| > a \end{cases}$, find the infinite transform of f(x) and hence evaluate $\int_0^\infty \frac{\sin x}{x} dx$. **(07 Marks)**

b. Obtain the Z-transform of $\cosh n\theta$ and $\sinh n\theta$. **(06 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 $\frac{dy}{dx} = e^x - y$, $y(0) = 2$ using Taylor's Series method upto 4th degree terms and find the value of y(1.1). **(07 Marks)**

b. Use Runge-Kutta method of fourth order to solve $\frac{dy}{dx} + y = 2x$ at x = 1.1 given $y(1) = 3$ (Take h = 0.1) **(06 Marks)**

c. Apply Milne's predictor-corrector formulae to compute y(0.4) given $\frac{dy}{dx} = 2e^x y$, with **(07 Marks)**

x	0	0.1	0.2	0.3
y	2.4	2.473	3.129	4.059

OR

8 a. Given $\frac{dy}{dx} = x + \sin y$; $y(0) = 1$. Compute y(0.4) with h = 0.2 using Euler's modified method. **(07 Marks)**

b. Apply Runge-Kutta fourth order method, to find y(0.1) with h = 0.1 given $\frac{dy}{dx} + y + xy^2 = 0$; $y(0) = 1$. **(06 Marks)**

c. Using Adams-Bashforth method, find y(4.4) given $5x\left(\frac{dy}{dx}\right) + y^2 = 2$ with

x	4	4.1	4.2	4.3
y	1	1.0049	1.0097	1.0143

(07 Marks)

Module-5

9 a. Solve by Runge Kutta method $\frac{d^2y}{dx^2} = x\left(\frac{dy}{dx}\right)^2 - y^2$ for $x = 0.2$ correct 4 decimal places, using initial conditions $y(0) = 1$, $y'(0) = 0$, $h = 0.2$. **(07 Marks)**

b. Derive Euler's equation in the standard form, $\frac{\partial f}{\partial y} - \frac{d}{dx}\left[\frac{\partial f}{\partial y'}\right] = 0$. **(06 Marks)**

c. Find the extramal of the functional, $\int_{x_1}^{x_2} y^2 + (y')^2 + 2ye^x dx$. **(07 Marks)**

OR

10 a. Apply Milne's predictor corrector method to compute $\frac{d^2y}{dx^2} = 1 + \frac{dy}{dx}$ and the following table of initial values:

x	0	0.1	0.2	0.3
y	1	1.1103	1.2427	1.3990
y′	1	1.2103	1.4427	1.6990

(07 Marks)

b. Find the extramal for the functional, $\int_0^{\frac{\pi}{2}} [y^2 - y'^2 - 2y\sin x]dx$; $y(0) = 0$; $y\left(\frac{\pi}{2}\right) = 1$. **(06 Marks)**

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

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18MATDIP31

Third Semester B.E. Degree Examination, Dec.2019/Jan.2020
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 following complex number in the form of $x+iy$: $\frac{(1+i)(1+3i)}{1+5i}$. **(06 Marks)**

b. Prove that $\left(\frac{\cos\theta+i\sin\theta}{\sin\theta+i\cos\theta}\right)^4=\cos 8\theta+i\sin 8\theta$. **(07 Marks)**

c. If $\vec{a}=(3,-1,4)$, $\vec{b}=(1,2,3)$ and $\vec{c}=(4,2,-1)$, find $\vec{a}\times\left(\vec{b}\times\vec{c}\right)$. **(07 Marks)**

OR

2 a. Find the angle between the vectors, $\vec{a}=5\hat{i}-\hat{j}+\hat{k}$ and $\vec{b}=2\hat{i}-3\hat{j}+6\hat{k}$. **(06 Marks)**

b. Prove that $\left[\vec{a}\times\vec{b},\vec{b}\times\vec{c},\vec{c}\times\vec{a}\right]=\left[\vec{a},\vec{b},\vec{c}\right]^2$ **(07 Marks)**

c. Find the fourth roots of $-1+i\sqrt{3}$ and represent them on the argand diagram. **(07 Marks)**

Module-2

3 a. Obtain the Maclaurin's expansion of $\log_e(1+x)$. **(06 Marks)**

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

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

OR

4 a. Obtain the Maclauvin's series expansion of the function $\log_e \sec x$. **(06 Marks)**

b. If $u=x^2-2y$; $v=x+y$ find $\frac{\partial(u,v)}{\partial(x,y)}$. **(07 Marks)**

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

Module-3

5 a. Find the velocity and acceleration of a particle moves along the curve, $\vec{r}=e^{-2t}\hat{i}+2\cos 5t\hat{j}+5\sin 2t\hat{k}$ at any time t. **(06 Marks)**

b. Find $\operatorname{div}\vec{F}$ and $\operatorname{curl}\vec{F}$, where $\vec{F}=\nabla\left(x^3+y^3+z^3-3xyz\right)$. **(07 Marks)**

c. Show that $\vec{F}=(2xy+z^2)\hat{i}+\left(x^2+2yz\right)\hat{j}+\left(y^2+2xz\right)\hat{k}$ is conservative force field and find the scalar potential. **(07 Marks)**

OR

6 a. Show that the vector field, $\vec{F} = (3x+3y+4z)\hat{i} + (x-2y+3z)\hat{j} + (3x+2y-z)\hat{k}$ is solenoidal. **(06 Marks)**

b. Find the directional derivative of $\phi = \frac{xz}{x^2+y^2}$ at (1, −1, 1) in the direction of $\vec{A} = \hat{i} - 2\hat{j} + \hat{k}$. **(07 Marks)**

c. Find the constant 'a' such that the vector field $\vec{F} = 2xy^2z^2\hat{i} + 2x^2yz^2\hat{j} + ax^2y^2z\hat{k}$ is irrotational. **(07 Marks)**

Module-4

7 a. Find the reduction formula for $\int_0^{\frac{\pi}{2}} \sin^n x dx$. **(06 Marks)**

b. Evaluate $\int_0^1 \int_0^3 x^3y^3 dxdy$. **(07 Marks)**

c. Evaluate $\int_0^3 \int_0^2 \int_0^1 (x+y+z) dzdxdy$. **(07 Marks)**

OR

8 a. Evaluate : $\int_0^{\frac{\pi}{6}} \sin^6(3x) dx$. **(06 Marks)**

b. Evaluate : $\int_0^1 \int_x^{\sqrt{x}} xy\, dydx$. **(07 Marks)**

c. Evaluate : $\int_0^1 \int_0^{1-x} \int_0^{1-x-y} xyz dzdydx$. **(07 Marks)**

Module-5

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

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

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

OR

10 a. Solve : $(5x^4 + 3x^2y^2 - 2xy^3)dx + (2x^3y - 3x^2y^2 - 5y^4)dy = 0$. **(06 Marks)**

b. Solve : $\frac{dy}{dx} + x\sin 2y = x^3\cos^2 y$. **(07 Marks)**

c. Solve : $[1 + (x+y)\tan y]\frac{dy}{dx} + 1 = 0$. **(07 Marks)**

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18ME32

Third Semester B.E. Degree Examination, Dec.2019/Jan.2020
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 terms:
(i) Stress (ii) Strain (iii) Young's Modulus (iv) Poisson's ratio (v) Hooke's law. **(05 Marks)**

b. Derive an expression for the total elongation of a tapered circular bar cross section of diameter 'D' and 'd', when subjected to an axial load 'P'. **(05 Marks)**

c. A brass bar having cross sectional area of 1000 mm^2, is subjected to axial forces shown in Fig. Q1 (c). Find the total elongation of the bar. Take E = 100 GN/m^2. **(10 Marks)**

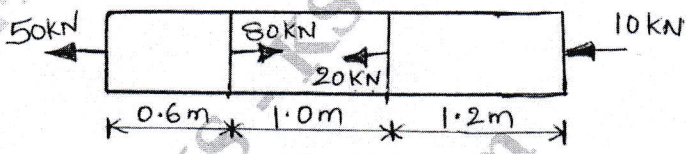


Fig. Q1 (c)

OR

2 a. Draw stress strain diagram for mild-steel and mark all the salient points. **(04 Marks)**

b. A concrete column of cross sectional area 400mm × 400mm is re-inforced by 4 longitudinal 50 mm diameter steel bars placed at each corner. If the column carries a comprehensive load of 300 kN, determine (i) Loads carried (ii) Stress produced in the concrete and Steel bars. **(08 Marks)**

c. A steel rod 15 m long at a temperature of 15°C. Find the free expansion of length when the temperature is raised to 65°C. Find the temperature stresses produced, when
(i) The expansion of the rod is prevented.
(ii) The rod is permitted to expand by 6 mm.
Take $\alpha = 12\times10^{-6}$ /° C and $E = 2\times10^{5}$ N/mm^2 **(08 Marks)**

Module-2

3 The state of stress at a point in a strained material is shown in Fig. Q3. Determine
a) The direction of the principal planes.
b) The magnitude of principal stresses.
c) The magnitude of the maximum shear stress and its direction.
d) Draw Mohr's circle and verify the results obtained analytically.

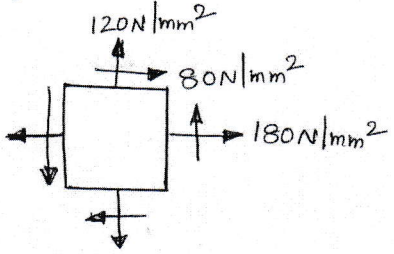


Fig. Q3 **(20 Marks)**

OR

4 a. Differentiate between thin and thick cylinders. **(04 Marks)**

b. Derive an expression for circumferential stress and longitudinal stress for a thin cylinder subjected to an internal pressure 'P'. **(06 Marks)**

c. A thick cylinder of 400 mm internal diameter and 100 mm thickness contains a fluid at a pressure 80 N/mm^2. Find hoop stresses across the section. Also sketch the radial and hoop stress distribution across the section. **(10 Marks)**

Module-3

5 Draw shear force and Bending Moment Diagrams for the beam shown in Fig. Q5. Locate the point of contraflexure. **(20 Marks)**

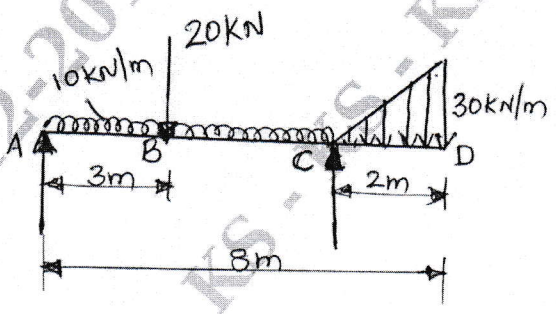
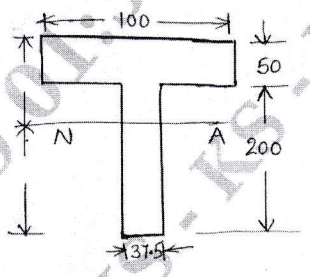


Fig. Q5

OR

6 a. Prove the relation $\frac{M}{I} = \frac{\sigma}{y} = \frac{E}{R}$ with usual notations. **(10 Marks)**

b. The T-section of a beam is shown in Fig. Q6 (b). The material of the beam has yield strength of 250 MPa. Determine maximum moment of resistance that the beam can support if yielding is to be avoided. **(10 Marks)**



Note : All dimensions are in mm.

Fig. Q6 (b)

Module-4

7 a. A mild steel shaft 120 mm diameter is subjected to a maximum torque of 20×10^6 N-mm and a maximum bending moment of 12×10^6 N-mm at a particular section. Find the factor of safety (FoS) according to the maximum stress theory, if the elastic limit in simple tension is 220 N/mm^2. **(10 Marks)**

b. Prove that a hollow shaft is stronger and stiffer than the solid shaft of the same material, length and weight. **(10 Marks)**

OR

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

b. A hollow shaft is to transmit 300 kW power at 80 rpm. If the shear stress is not to exceed 60 N/mm^2 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. **(10 Marks)**

Module-5

9 a. Derive an expression for a critical load in a column subjected to compressive load, when both ends are fixed. **(10 Marks)**

b. A 2 m long column has a square cross section of side 40 mm. Taking the factor of safety as 4, determine the safe load for the end conditions,

(i) Both ends are hinged.
(ii) One end fixed and other end is free.
(iii) Both ends are fixed.
(iv) One end fixed and other end is hinged.

Take E = 210 GPa **(10 Marks)**

OR

10 a. Derive an expression for a critical load in a column subjected to compressive load, when both ends are hinged. **(10 Marks)**

b. The bar with circular cross section shown in Fig. Q10 (b) is subjected to a load of 10 KN. Determine the strain energy stored in it. Take $E = 2.1 \times 10^5$ N/mm^2 **(10 Marks)**

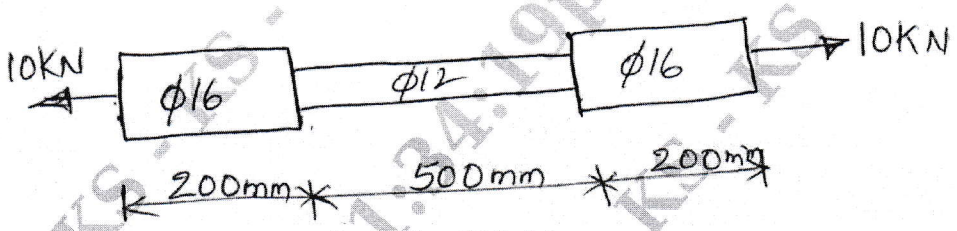


Fig. Q10 (b)

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18ME33

Third Semester B.E. Degree Examination, Dec.2019/Jan.2020
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 data hand book and steam tables is permitted.***
3. ***Assume missing data suitably.***

Module-1

1 a. Differentiate between micro and macroscopic approach. **(04 Marks)**

b. Define the following terms with neat sketch:
(i) Open system
(ii) Closed system
(iii) Isolated system
(iv) Quasi-static process **(08 Marks)**

c. The temperature 'T' on a thermometric scale is defined as $T = a\ln(K) + b$, where a and b are constants. The values of K are found to be 1.83 and 6.78 at 0°C and 100°C, respectively. Calculate the temperature for value of K = 2.42. **(08 Marks)**

OR

2 a. Define:
(i) Thermodynamic equilibrium
(ii) Zeroth law of thermodynamics **(04 Marks)**

b. With neat sketch explain the working principle of:
(i) Electrical resistance thermometer
(ii) Thermocouple **(08 Marks)**

c. Two Celsius thermometer 'A' and 'B' agree at ice point and steam point, and related by the equation $t_A = L + Mt_B + Nt_B^2$, where L, M and N are constants. When both thermometers are immersed in a fluid, 'A' registers 26°C, while 'B' registers 25°C. Determine the reading of 'A' when 'B' reads 37.4°C. **(08 Marks)**

Module-2

3 a. Define thermodynamic work and heat. **(04 Marks)**

b. Write an expression for displacement of work for the following process with P-V diagrams.
(i) Constant pressure
(ii) Constant volume
(iii) Constant temperature
(iv) Polytropic process **(08 Marks)**

c. A quantity of gas is compressed in a piston-cylinder from a volume of 0.8611 m^3 to a final volume of 0.1721 m^3. The pressure in (bar) and as a function of volume (m^3) is given by:

$$P = \left(\frac{0.8611}{V} - \frac{8.6067\times10^{-5}}{V^2}\right)$$

(i) Find the amount of work done in KJ.
(ii) If the atmospheric pressure is 1 bar, acting on the other side of piston is considered. Find the net work done in KJ. **(08 Marks)**

OR

4 a. State 1st law of thermodynamics. Derive an expression for 1st law of thermodynamics for open system (SFEE). **(10 Marks)**

b. The working fluid, in a steady flow process at a rate of 220 kg/min. The fluid rejects 100 KJ/s of heat passing through the system. The condition of the fluid at inlet and outlet are given as $\overline{V}_1$ = 220 m/s, p_1 = 6.0 bar, u_1 = 2000 KJ/kg, υ_1 = 0.36 m^3/kg and p_2 = 1.2 bar, $\overline{V}_2$ = 140 m/s, u_2 = 1400 kJ/kg, υ_2 = 1.3 m^3/kg. The suffix 1 and 2 indicates at inlet and outlet conditions respectively. Determine the power capacity of the system in MW. **(10 Marks)**

Module-3

5 a. Define the following terms:
(i) Thermal reservoir
(ii) Heat engine
(iii) Kelvin-Plank statement of 2nd law
(iv) Clausius statement of 2nd law
(v) Heat pump **(10 Marks)**

b. A heat engine working on a Carnot cycle absorbs heat from three thermal reservoirs at 1000 K, 800 K and 600 K, respectively. The engine does 10 KW of net work and rejects 400 kJ/min of heat to a heat sink at 300 K. If the heat supplied by the reservoir at 1000 K is 60% of heat supplied by the reservoir at 600K. Find the quantity of heat supplied by each reservoirs. **(10 Marks)**

OR

6 a. Define entropy and prove that it is a point function. **(04 Marks)**

b. Discuss the Clausius Inequality. **(08 Marks)**

c. A steel ball mass of 10 kg at 627°C is dropped in 100 kg of oil at 30°C. The specific heat of steel and oil are 0.5 kJ/kgK and 3.5 kJ/kgK, respectively. Calculate the entropy change of steel, oil and the universe. **(08 Marks)**

Module-4

7 a. With neat sketch, explain available and Unavailable energy on T-S diagram. **(06 Marks)**

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

c. A Carnot engine works between the temperature limits 225°C and 25°C in which water is used as the working fluid. If heat is supplied to the saturated liquid at 225°C, until it is converted into saturated vapour, determine per kg of water.
(i) Amount of heat absorbed by the fluid
(ii) Available energy
(iii) Unavailable energy
(Take latent heat of water = 1858.5 kJ/kg) **(08 Marks)**

OR

8 a. With neat sketch explain the working of separating and throttling calorimeter. **(10 Marks)**

b. A vessel of volume 0.04 m^3 contains a mixture of saturated water and saturated state at a temperature of 250°C. The mass of the liquid present is 9 kg. Find the mass, specific volume, enthalpy, entropy and internal energy of the steam. **(10 Marks)**

Module-5

9 a. Define:
(i) Mole fraction
(ii) Mass fraction
(iii) Dalton's law
(iv) Amgat's law of volume additives **(10 Marks)**

b. A mixture of gases contain 1 kg of CO_2 and 1.5 kg of N_2. The pressure and temperature of the mixture are 3.5 bar and 27°C. Determine:
(i) Mole fraction of each constituent
(ii) Partial pressure
(iii) Partial volume
(iv) Volume of mixture
(v) Density of mixture **(10 Marks)**

OR

10 a. State and explain the following terms:
(i) Compressibility factor
(ii) Reduced properties
(iii) Real gases
(iv) Relative humidity **(08 Marks)**

b. With usual notations, write the Vandeer Waal equation and explain the terms involved in it. **(04 Marks)**

c. Determine the pressure exerted by CO_2 in a container of 1.5 m^3 capacity when it contains 5 kg at 27°C:
(i) Using ideal gas relation
(ii) Using Vandeer Waal's equation
[Take a = 364.3 kPa $(m^3/kg.mol)^2$; b = 0.0427 $(m^3/kg.mol)$ for Vandeer Waal's constants] **(08 Marks)**

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18ME34

Third Semester B.E. Degree Examination, Dec.2019/Jan.2020
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. Define APF. Calculate the APF for BCC Unit cell. **(07 Marks)**

b. Explain edge dislocation and screw dislocation. **(08 Marks)**

c. State and explain Fick's 1st law of diffusion. **(05 Marks)**

OR

2 a. Define Stiffness , Yield strength , Toughness and Ultimate tensile strength. **(08 Marks)**

b. Explain Plastic deformation by Slip and twinning. **(06 Marks)**

c. Explain strain hardening and solid state hardening process of strengthening of metals. **(06 Marks)**

Module-2

3 a. Draw and explain the S – N curve. **(04 Marks)**

b. Derive and expression for stress relaxation. **(04 Marks)**

c. Draw the Iron carbon diagram indicating the phase temperatures. Explain the different phases in Iron carbon diagram. **(12 Marks)**

OR

4 a. State and explain Hume Rothery Rules. **(06 Marks)**

b. Explain the effect of any 4 alloying elements in steel. **(06 Marks)**

c. Two metals A & B are alloyed in the proportion of 60% A and 40% B. The melting temperature of A & B are 650^0C and 450^0C. When they are alloyed together they do not form any compound or intermediate phase, but form an Eutetic of composition 40% A and 60% B which solidifies at 300^0C. The maximum and minimum solid solubilities of B in A and A in B are 10% at 300^0C and remains constant till 0^0C. Assume solidus , liquidus and solves lines to be straight.

i) Draw the equilibrium diagram and label all the fields.

ii) The temperature at which solidification start and complete.

iii) Percentage of Eutectic at room temperature. **(08 Marks)**

Module-3

5 a. Define Heat treatment and give its classification. **(06 Marks)**

b. Explain how a TTT diagram is drawn. **(08 Marks)**

c. Explain Austempering and Martempering. **(06 Marks)**

OR

6 a. Draw the TTT diagram for Eutectoid steel and explain it. **(07 Marks)**

b. With neat sketch, explain induction hardening process. **(05 Marks)**

c. Explain the composition , properties and uses of Gray Cast Iron, White Cast Iron and SG Iron and Malleable Iron. **(08 Marks)**

Module-4

7 a. Define Composite. Give its classification. **(06 Marks)**

b. Explain metal matrix composites and ceramic matrix composites. **(06 Marks)**

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

OR

8 a. Derive an expression for Young's modulus for ISO stress and ISO strain condition. **(12 Marks)**

b. With neat sketch, explain Pultrusion process. **(08 Marks)**

Module-5

9 a. Define Ceramic. Explain the types of ceramics. **(05 Marks)**

b. Differentiate between Thermoplastic and Thermosetting plastics. **(05 Marks)**

c. With neat sketch, explain Processing of plastic by Injection Moulding method. **(10 Marks)**

OR

10 a. Explain the different Non – destructive testing methods used for accessing residual life. **(10 Marks)**

b. Define Smart Material. Explain the types of smart materials. **(10 Marks)**

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18ME35A/18MEA305

Third Semester B.E. Degree Examination, Dec.2019/Jan.2020
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. Name and explain with example the different types of chips formed during metal cutting. **(06 Marks)**

b. Draw Merchant's circle diagram and state the assumptions made in establishing the relationship among the various forces. **(08 Marks)**

c. During an orthogonal cutting process the following observations were made-chip thickness = 0.62mm feed 0.2 mm rake angle 15°. Calculate the chip reduction coefficient and shear angle. **(06 Marks)**

OR

2 a. Differentiate between Turret lathe and Capstan lathe. **(06 Marks)**

b. Draw the tool layout for producing a hexagonal headed bolt on a capstan lathe from a hexagonal bar stock. Assume the dimensions. **(08 Marks)**

c. Write the functions of following lathe accessories :
(i) Live centre (ii) Dead centre (iii) Steady rest (iv) Follower rest
(v) Dogs and face plates. **(06 Marks)**

Module-2

3 a. With sketch write the comparison between up milling and down milling. **(06 Marks)**

b. Sketch and explain radial drilling machine highlighting its advantages and disadvantages. **(08 Marks)**

c. What is indexing? Name the different methods of indexing and explain compound indexing. **(06 Marks)**

OR

4 a. Differentiate Shaper and Planer? **(06 Marks)**

b. With sketch explain the external centreless grinding highlighting the feed mechanism. **(08 Marks)**

c. How the shapers are classified? How a vertical shaper is different from slotter. **(06 Marks)**

Module-3

5 a. Write a note on functions and types of cutting fluids used in metal cutting. **(06 Marks)**

b. Explain the various mechanisms responsible for different forms of tool wear. **(08 Marks)**

c. A cast iron plate of dimensions 450×150×60 mm, is to be rough shaped along its wider face. Calculate the machining time taking cutting speed = 10 mpm, return speed = 15 mpm, approach length = 30mm, over travel length = 30 mm, allowance on either side of the plate width = 6mm and feed per cycle = 15mm. **(06 Marks)**

OR

6 a. Which are the different forms of wear on the cutting edge of a tool? With appropriate sketch explain. **(06 Marks)**

b. Explain the critical cutting parameters which effect the tool life. **(08 Marks)**

c. The tool life for a HSS tool is expressed by the relation $VT^{1/7} = C_1$ and for Tungsten-Carbide $VT^{1/5} = C_2$. If the tool life for cutting speed of 24 mpm is 128 min, compare the life of the two tools at a speed of 30 mpm. **(06 Marks)**

Module-4

7 a. List the differences between cold working and hot working. **(06 Marks)**

b. What is forging? Explain the working of board hammer with sketch. **(08 Marks)**

c. With sketch explain : (i) Two high rolling mill (ii) Planetary rolling mill. **(06 Marks)**

OR

8 a. How the extrusion process is classified? Write a note on the difference between direct and indirect extrusion. **(06 Marks)**

b. With neat sketch explain the wire drawing process. **(08 Marks)**

c. Explain the defects in extruded products. **(06 Marks)**

Module-5

9 a. With a neat sketch explain V-bending and edge bending operations. **(06 Marks)**

b. What do you mean by dies? Write brief note on (i) Progressive dies (ii) Combination dies. **(08 Marks)**

c. With neat sketch explain shearing of sheet metal. **(06 Marks)**

OR

10 a. What is stripper? With neat sketch explain fixed plate stripper. **(06 Marks)**

b. With a neat labeled sketch explain the parts of open back inclinable press. **(08 Marks)**

c. Calculate the bending force for the 90° bend part from the steel sheet with air bending. The bend length is 30 cm, the material thickness is 2.5 mm and beam length is 25mm. The tensile strength of the material is 32 kN/cm^2. Die opening factor = 1.33. **(06 Marks)**

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