CBCS SCHEME

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18MAT31

Third Semester B.E. Degree Examination, Aug./Sept.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 $L\{e^{-2t}t\cos 2t\}$. **(06 Marks)**

b. Express the function in terms of unit step function and hence find Laplace transform of :

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

c. Solve the equation $y''(t)+3y'(t)+2y(t)=0$ under the condition $y(0)=1, y'(0)=0$. **(07 Marks)**

OR

2 a. Find :

i) $L^{-1}\left\{\frac{s+3}{s^2-4s+13}\right\}$ ii) $L^{-1}\left\{\log\frac{(s^2+1)}{s(s+1)}\right\}$. **(06 Marks)**

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

c. A periodic function of period 2a is defined by

$$f(t)=\begin{cases}E & 0\le t\le a\\ -E & a<t\le 2a\end{cases}$$

Where E is a constant and show that $\text{trim}\,L\{f(t)\}=\frac{E}{S}\tan h\left(\frac{as}{2}\right)$. **(07 Marks)**

Module-2

3 a. Express $f(x)=x^2$ as a Fourier series in the interval $-\pi<x<\pi$. Hence deduce that $\frac{1}{1^2}-\frac{1}{2^2}+\frac{1}{3^2}-\frac{1}{4^2}----=\frac{\pi^2}{12}$. **(07 Marks)**

b. Obtain the Fourier seires expression of $f(x)=\begin{cases}\pi x & 0<x<1\\ \pi(2-x) & 1<x<2\end{cases}$. **(07 Marks)**

c. Obtain the half range cosine series for the function $f(x)=(x-1)^2\ 0\le x\le 1$. **(06 Marks)**

OR

4 a. Obtain the Fourier series of $f(x)=\left(\frac{\pi-x}{2}\right)$ $0 < x < 2\pi$. Hence deduce that $1-\frac{1}{3}+\frac{1}{5}-\frac{1}{7}\cdots=\frac{\pi}{4}$. **(07 Marks)**

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

c. Express f(x) as a Fourier series upto first harmonic.

x	0	1	2	3	4	5
f(x)	4	8	15	7	6	2

(06 Marks)

Module-3

5 a. Find the Fourier cosine transform of

$$f(x)=\begin{cases} x & \text{for } 0<x<1 \\ (2-x) & \text{for } 1<x<2 \\ 0 & \text{for } x>2 \end{cases}.$$ **(07 Marks)**

b. Find the Fourier transform by $f(x) = e^{-|x|}$. **(07 Marks)**

c. Obtain the inverse Z – transform by $u(z)=\frac{z}{(z-2)(z-3)}$. **(06 Marks)**

OR

6 a. Find the Fourier transform by

$$f(x)=\begin{cases} 1-|x| & |x|<1 \\ 0 & |x|>1 \end{cases}$$

and show that $\int_0^\infty \frac{\sin^2 t}{t^2}dt=\frac{\pi}{2}$. **(07 Marks)**

b. Find the z-transform of : i) $\cos n\theta$ ii) $\sin n\theta$. **(06 Marks)**

c. Solve using Z –transform $u_{n+2} - 4u_n = 0$ given that $u_0 = 0$ and $u_1 = 2$. **(07 Marks)**

Module-4

7 a. Using Taylor's series method solve $y(x) = x + y$, $y(0) = 1$ then find y at $x = 0.1, 0.2$ consider upto 4^{th} degree. **(07 Marks)**

b. Solve $y'(x)=1+\frac{y}{z}$, $y(1)=2$ then find $y(1.2)$ with $n = 0.2$ using modified Euler's method. **(06 Marks)**

c. Solve $y'(x) = x - y^2$ and the data is $y(0) = 0$, $y(0.2) = 0.02$, $y(0.4) = 0.0795$, $y(0.6) = 0.1762$ then find $y(0.8)$ by applying Milne's method and applying corrector formula twice.

OR

8 a. Solve $y'(x) = 3x + \frac{y}{2}, y(0) = 1$ then find y(0.2) with n = 0.2 using modified Euler's method. **(06 Marks)**

b. Solve $y(x) = 3e^x + 2y$, $y(0) = 0$ then find y(0.1) with h = 0.1 using Runge-Kutta method of fourth order. **(07 Marks)**

c. Solve $y'(x) = 2e^x - y$ and data is

x	0	0.1	0.2	0.3
y	2	2.010	2.040	2.090

Then find y(0.4) by using Adam's Bash forth method. **(07 Marks)**

Module-5

9 a. By applying Milne's predictor and corrector method to compute y(0.4) give the differential equation $\frac{d^2y}{dx^2} = 1 - \frac{dy}{dx}$ and the following table by initial value. **(07 Marks)**

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

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 extremal of the functional $\int_{x_1}^{x_2} (y' + x^2y'^2)dx$. **(07 Marks)**

OR

10 a. By 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 condition $y(0) = 1$, $y'(0) = 0$. **(07 Marks)**

b. Prove that the shortest distance between two points in a plane is a straight line. **(06 Marks)**

c. Find the curve on which the functional $\int_0^1 [y'^2 + 12xy]dx$ with $y(0) = 0$, $y(1) = 1$. **(07 Marks)**

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18MATDIP31

Third Semester B.E. Degree Examination, Aug./Sept.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. Prove that $(1+i)^n + (1-i)^n = 2^{\frac{n}{2}+1}\cos\frac{n\pi}{4}$ **(08 Marks)**

b. Expression the complex number $(2+3i)+\frac{1}{1-i}$ in the form a + ib. **(06 Marks)**

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

OR

2 a. If $\vec{A} = i+2j-3k$, $\vec{B} = 3i-j+2k$ show that $\vec{A}+\vec{B}$ is perpendicular to $\vec{A}-\vec{B}$. Also find the angle between $2\vec{A}+3\vec{B}$ and $\vec{A}+2\vec{B}$. **(08 Marks)**

b. Show that the vectors $i-2j+3k$, $2i+j+k$, $3i+4j-k$ are coplanar. **(06 Marks)**

c. Find the sine of the angle between $\vec{A} = 4i-j+3k$ and $\vec{B} = -2i+j-2k$. **(06 Marks)**

Module-2

3 a. Obtain the Maclaurin's series expansion of $\sin x$ upto term containing x^4. **(08 Marks)**

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

c. If $u = f(x-y, y-z, z-x)$ prove that $\frac{\partial u}{\partial x}+\frac{\partial u}{\partial y}+\frac{\partial u}{\partial z} = 0$. **(06 Marks)**

OR

4 a. Prove that $\log(1+x) = x-\frac{x^2}{2}+\frac{x^3}{3}-\frac{x^4}{4}+\ldots\ldots$ by using Maclaurin's series. **(08 Marks)**

b. If $x = r\cos\theta$, $y = r\sin\theta$ find $\frac{\partial(x,y)}{\partial(r,\theta)}$. **(06 Marks)**

c. If $z = e^{ax+by} f(ax-by)$ then show that $b\frac{\partial z}{\partial x}+a\frac{\partial z}{\partial y} = 2abz$. **(06 Marks)**

Module-3

5 a. Find the angle between the surfaces $x^2+y^2+z^2 = 9$ and $z = x^2+y^2-3$ at the point $(2,-1,2)$ **(08 Marks)**

b. Find the unit vector normal to the surface $x^2y+2xz = 4$ at $(2,-2,3)$. **(06 Marks)**

c. Show that the vector $(-x^2+yz)i+(4y-z^2x)j+(2xz-4z)k$ is solenoidal. **(06 Marks)**

OR

6 a. A particle moves along the curve $x = t^3 + 1$, $y = t^2$, $z = 2t + 3$ where t is the time. Find the components of its velocity and acceleration at $t = 1$ in the direction $i + j + 3k$. **(08 Marks)**

b. Find the values of a, b, c such that $\vec{F} = (x + y + az)i + (bx + 2y - z)j + (x + cy + 2z)k$ is irrotational. **(06 Marks)**

c. Find $\text{div}\,\vec{F}$ and $\text{curl}\,\vec{F}$ where $\vec{F} = \nabla(x^3 + y^3 + z^3 - 3xyz)$. **(06 Marks)**

Module-4

7 a. Obtain the reduction formula for $\int_0^{\pi/2} \cos^n x\, dx$, $n > 0$. **(08 Marks)**

b. Evaluate $\int_0^1 \frac{x^9}{\sqrt{1-x^2}}\, dx$ **(06 Marks)**

c. Evaluate $\iint xy(x+y)dx\,dy$ over the area between $y = x^2$ and $y = x$. **(06 Marks)**

OR

8 a. Obtain the reduction formula for $\int_0^{\pi/2} \sin^n x\, dx$, $n > 0$. **(08 Marks)**

b. Evaluate $\int_0^{\infty} \frac{x^2}{(1-x^2)^{7/2}}\, dx$ **(06 Marks)**

c. Evaluate $\int_0^a \int_0^x \int_0^{x+y} e^{x+y+z}\, dz\, dy\, dx$ **(06 Marks)**

Module-5

9 a. Solve $y(\log y)dx + (x - \log y)dy = 0$ **(08 Marks)**

b. Solve $x\frac{dy}{dx} + y = x^3y^6$ **(06 Marks)**

c. Solve $(xy^2 - e^{1/x^3})dx - x^2y\,dy = 0$ **(06 Marks)**

OR

10 a. Solve $(5x^4 + 3x^2y^2 - 2xy^3)\,dx + (2x^3y - 3x^2y^2 - 5y^4)dy = 0$ **(08 Marks)**

b. Solve $\frac{dy}{dx} + x\sin 2y = x^3\cos^2 y$ **(06 Marks)**

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

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18ME32

Third Semester B.E. Degree Examination, Aug./Sept.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 (i) Hooke's law (ii) True stress **(04 Marks)**

b. Derive an expression for the extension of uniformly tapering rectangular bar subjected to axial load P. **(06 Marks)**

c. A stepped bar of steel, held between two supports as shown in Fig.Q1(c), is subjected to loads $P_1 = 80$ kN and $P_2 = 60$ kN. Find the reactions developed at the ends A and B.

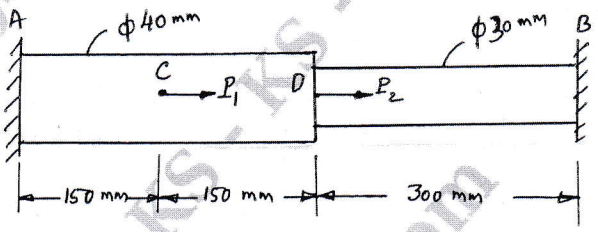

Fig.Q1(c) **(10 Marks)**

OR

2 a. A steel bar is placed between two copper bars, each having the same area and length and the steel bar at 15°C. At this stage, they are rigidly connected together at both the ends. When the temperature is raised to 315°C, the length of the bars increases by 1.5mm. Determine the original length and find stresses in the bars. Take $E_s = 2.1\times10^5$ N/mm^2, $E_c = 1\times10^5$ N/mm^2, $\alpha_S = 0.000012$/°C, $\alpha_C = 0.0000175$/°C. **(10 Marks)**

b. Establish a relationship between the modulus of elasticity and modulus of rigidity. **(10 Marks)**

Module-2

3 a. Derive an expression for the normal stress and shear stress on plane inclined at 'θ' to the vertical axis in two dimensional stress system with shear. Also prove that the sum of normal stresses on any two mutually perpendicular planes are always constant. **(12 Marks)**

b. A thin cylinder, 2 m long and 200 mm in diameter with 10mm thickness is filled completely with a fluid, at an atmospheric pressure. If an additional 25mm^3 fluid is pumped in, find the longitudinal and loop stress developed. Also find the change in the diameter, if $E = 2\times10^5$ N/mm^2 and Poisson's ratio = 0.3. **(08 Marks)**

OR

4 a. At a point in a loaded elastic member, there are normal stresses of 60 MPa and 40 MPa, (both tensile) at right angles to each other with positive searing stress of 20 MPa. Draw the Mohr's circle diagram and find (i) Principal stresses and their planes (ii) Maximum shear stress and its plane. **(10 Marks)**

b. The internal and external diameters of a thick cylinder are 300mm and 500mm respectively. It is subjected to an external pressure of 4 N/mm^2. Find the internal pressure that can be applied if the permissible stress in cylinder is limited to 13 N/mm^2. Sketch the variation of hoop stress and radial stress across the thickness of the cylinder. **(10 Marks)**

Module-3

5 a. A cantilever of length 2 m carries an uniformly distributed load of 1 kN/m run over a length of 1.5m from the free end. Draw the shear force and bending moment diagrams for the cantilever. **(06 Marks)**

b. 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(b).

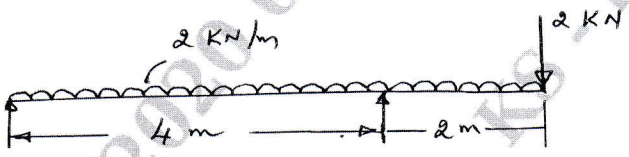

Fig.Q5(b) **(14 Marks)**

OR

6 a. Derive an expression for the shear stress distribution across the rectangular section of width 'b' and depth 'd'. Draw the figure showing the shear stress variation across the section. Also show that the maximum shear stress is 1.5 times the average shear stress. **(10 Marks)**

b. A 200mm × 80mm I-beam is to be used as a simply supported beam of 6.75m span. The web thickness is 6mm and the flanges are of 10mm thickness. Determine what concentrated load can be carried at a distance of 2.25 m from one support if the maximum permissible stress is 80 MPa. **(10 Marks)**

Module-4

7 a. A shaft is subjected to a maximum torque of 14 kN-m and a maximum bending moment of 10 kN-m at a particular section. Determine the diameter of the shaft according to maximum shear stress theory if the elastic limit in simple tension is 180 MPa. **(08 Marks)**

b. Derive the equation $\frac{T}{J} = \frac{\tau}{r} = \frac{G\theta}{L}$ with usual notations. State the assumptions. **(12 Marks)**

OR

8 a. A solid shaft is to transmit 192 kW at 450 rpm. Taking allowable stress for the shaft material as 70 MPa, find the diameter of the solid shaft. What percentage of saving in weight would be obtained, if this shaft was to be replaced by hollow shaft, whose internal diameter is 0.8 times its external diameter? The length of the shaft, power to be transmitted and the speed are equal in both cases. **(10 Marks)**

b. The allowable shear stress in brass is 80 N/mm^2 and in steel 100 N/mm^2. Find the maximum torque that can be applied in the stepped shaft as shown in Fig.Q8(b). Find also the total rotation of free end with respect to the fixed end if $G_b = 40$ kN/mm^2 and $G_s = 80$ kN/mm^2.

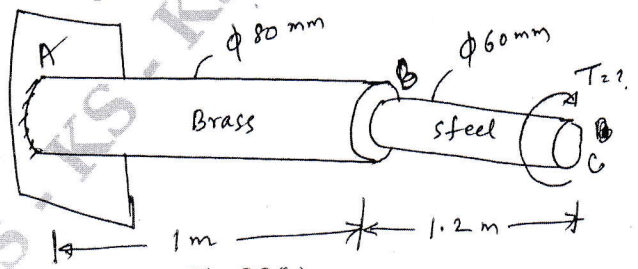

Fig.Q8(b) **(10 Marks)**

Module-5

9 a. Derive an expression for Euler's buckling load in long elastic column when both ends are fixed. State the assumptions. **(10 Marks)**

b. Derive an expression for strain energy stored in a beam under bending. Also find the strain energy in a cantilever beam carrying a point load at the free end. **(10 Marks)**

OR

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

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

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18ME33

Third Semester B.E. Degree Examination, Aug./Sept.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 Thermodynamics data hand book permitted.

Module-1

1 a. Define the following with example:
i) Closed system ii) Open-system iii) Isolated system iv) Intensive-property
v) Extensive property. **(10 Marks)**

b. The temperature 't' on a thermometric scale is defined interms of a property 'P' by the relation t = alnp + b, where 'a' and 'b' are constants. The temperature of the Ice point and steam point are assigned numbers '0' and '100' respectively. Experiment gives values of 'P' as 1.86 and 6.81 at the Ice point and steam point respectively. Evaluate the temperature corresponding to a reading of P = 2.5 on the thermometers. **(10 Marks)**

OR

2 a. State Zeroth law of thermodynamics and explain in detail. **(04 Marks)**

b. Define Quasistatic process. What are its characteristics? **(06 Marks)**

c. The Emf in millivoltmeter in a thermocouple with the test junction at t°C on a gas thermometer scale and reference junction at Ice point is given by $e = (0.0367t + 1.33 \times 10^{-4}t^2)$mV. The millivoltmeter is calibrated at Ice and steam points. What will this thermometer read in a place where the gas thermometer reads 50°C? **(10 Marks)**

Module-2

3 a. Explain the pdv work and prove that work is a path function. **(05 Marks)**

b. Explain path and point function. **(05 Marks)**

c. A closed system undergoes a Quasistatic process according to the law $P = \left(V^2 + \frac{8}{V}\right)$, where 'P' is in N/cm^2 and 'V' is in m^3. Calculate work-done when 'V' changes from 10 to 30m^3. **(10 Marks)**

OR

4 a. Briefly describe internal energy in a property of the system. **(04 Marks)**

b. Derive the steady flow energy equation for a single stream of fluid entering and leaving the control volume. **(06 Marks)**

c. A turbine operates under steady flow conditions receiving steam at the following state; pressure is 1.2MPa, temperature is 188°C, enthalpy is 2785kJ/kg velocity is 34m/s and elevation is 3m. The steam leaves the turbine at the following state: pressure is 200MPa, enthalpy is 2512kJ/kg velocity is 100m/s and elevation is 0m. Heat is lost to the surroundings at a rate of 0.29kJ/s. If the steam flow rate is 0.42kg/s. Determine the power output from the turbine. **(10 Marks)**

Module-3

5 a. Establish the equivalence of Kelvin-Planck and Clausius statement. **(08 Marks)**

b. What is perpetual motion of II-kind? Explain. **(04 Marks)**

c. In a heat engine, the temperature of the source and sink are 700°C and 50°C respectively. The heat supplied is 5MJ/min. Find the power developed by the engine. **(08 Marks)**

OR

6 a. Show that entropy is a property of a system. **(04 Marks)**

b. State and explain Clausius inequality. **(08 Marks)**

c. 2.5kg of air at a pressure of a 2bar and 26°C forms a closed system, which undergoes a constant pressure process with a heat addition of 650kJ. Calculate: i) Find temperature ii) Change in internal energy iii) Work transfer iv) Change in entropy. **(08 Marks)**

Module-4

7 a. Derive the expression of maximum work obtainable from two finite bodies at temperatures of T_1 and T_2. **(10 Marks)**

b. $1.2m^3$ of air is heated reversibly at a constant pressure from 300°K to 600°K and is then cooled reversibly at constant volume back to initial temperature. If the initial pressure is 1 bar. Calculate net heat flow and overall change in entropy. Also represent the process on T-S diagram. Take $C_p = 1.005 \frac{kJ}{kg^\circ K}$; $R = 0.287 \frac{kJ}{kg^\circ K}$; $C_v = 0.7165 \frac{kJ}{kg^\circ K}$. **(10 Marks)**

OR

8 a. With neat sketch, explain the method of measurement of dryness fraction of steam using separating throttling calorimeter. **(10 Marks)**

b. Define the terms i) Sensible heat ii) Dryness fraction. **(04 Marks)**

c. Find the entropy of one kg of superheated steam at 25bar and a temperature of 290°C. The specific heat of the superheated steam is 2.1kJ/kg°K. **(06 Marks)**

Module-5

9 a. State the i) Gibb's Dalton's law of partial pressure ii) Amagat's law. **(04 Marks)**

b. A tank has a volume of $5m^3$ and contains 20kg of an ideal gas having a molecular mass of 25. The temperature is 15°C. What is the pressure? **(06 Marks)**

c. A vessel of $2.5m^3$ capacity contains 1kg-mole of Nitrogen (N_2) at 100°C. Evaluate the specific volume and pressure. If the gas is cooled to 30°C, calculate the final pressure, change in specific internal energy and specific enthalpy. The ratio of specific heats is 1.4. One kg-mole of Nitrogen is 28kg. **(10 Marks)**

OR

10 Define the following:

i) Ideal and real gas

ii) State and explain the Vander Waal's equation of state

iii) Compressibility factor

iv) Law of corresponding states

v) Beattie-Bridgeman equation. **(20 Marks)**

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18ME34

Third Semester B.E. Degree Examination, Aug./Sept.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 APF for HCP cell. **(08 Marks)**

b. Differentiate edge dislocation and screw dislocation. **(06 Marks)**

c. State and explain Fick's I and II law of diffusion. **(06 Marks)**

OR

2 a. Define: (i) Ductility (ii) Tensile strength (iii) Hardness (iv) Toughness (v) Resilliance **(10 Marks)**

b. A cylindrical specimen of steel having an original diameter of 12.5 mm is tensile tested to fracture, and the fracture strength is 450 MPa, if the cross sectional diameter at fracture is 10.5 mm, determine:

(i) Ductility in term of percentage reduction in area

(ii) True stress at fractures **(10 Marks)**

Module-2

3 a. Differentiate between ductile and brittle fractures with sketches. **(06 Marks)**

b. What is fatigue? What are the factors affecting the fatigue life? **(08 Marks)**

c. What is creep? Explain creep curve. **(06 Marks)**

OR

4 a. Draw Fe-Fe_3C diagram and indicate the phase temperatures and also write the invariant reaction. **(12 Marks)**

b. Define homogeneous and heterogeneous nucleation. Obtain an expression for critical radius of nucleation. **(08 Marks)**

Module-3

5 a. What is Heat treatment? What are the purpose of Heat treatment? **(06 Marks)**

b. Differentiate between annealing and normalizing. **(06 Marks)**

c. Explain Austempering and Martempering with neat sketch. **(08 Marks)**

OR

6 a. With a neat sketch explain Nitriding process and applications. **(08 Marks)**

b. Discuss the precipitation hardening of AC 4 percentage weight copper alloy. **(06 Marks)**

c. Give the compositions and applications of Grey Cast Iron. **(06 Marks)**

Module-4

7 a. What are composite materials? What are advantages, limitations and application of composite materials? **(08 Marks)**

b. What is the role of (i) matrix (ii) reinforcement (iii) interface in a composite **(12 Marks)**

OR

8 a. Derive the rule of mixtures for the modulus of elasticity of a fiber reinforced composite when a stress (σ) is applied along the axis of fibers. **(08 Marks)**

b. With a neat sketch explain injuction moulding. **(06 Marks)**

c. Calculate the tensile modulus of elasticity of unidirectional carbon fiber-reinforced composite material which contains 62% by volume of carbon fibers in iso-strain and iso-stress condition. Take $E_{carbonfibres} = 3.86 \times 10^4$ kgf/mm^2 and $E_{epoxy} = 4.28 \times 10^2$ kgf/mm^2. **(06 Marks)**

Module-5

9 a. Define ceramic. Explain briefly the types of ceramics. **(06 Marks)**

b. Differentiate the thermo plastics and thermo setting plastics. **(06 Marks)**

c. Define smart material. Explain briefly the types of smart material. **(08 Marks)**

OR

10 a. Explain briefly shape memory alloys – Nitinol. **(06 Marks)**

b. Write a note on piezoelectrical material. **(06 Marks)**

c. Explain use of Non-Destructive Testing (NDT) for residual life assessment. **(08 Marks)**

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18ME35A/18MEA305

Third Semester B.E. Degree Examination, Aug./Sept.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. Explain the different between orthogonal cutting and oblique cutting **(06 Marks)**
b. Briefly explain the mechanism and types of chip formation. **(08 Marks)**
c. Briefly explain the elements of a single point with a neat sketch. **(06 Marks)**

OR

2 a. Derive an expression for shear plane angle with respect to orthogonal cutting. **(08 Marks)**
b. List and explain the various operations carried out on lathe machine. **(12 Marks)**

Module-2

3 a. Define Milling. Explain with a neat sketch the 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 tool wear. Explain crater wear and flank wear. **(08 Marks)**
b. Define tool life and explain the factors which affect the tool life. **(08 Marks)**
c. Briefly explain the different types of cutting fluids. **(04 Marks)**

OR

6 Write the short notes on the following :
a. Choice of feed
b. Tool life for minimum cost
c. Minimum production time
d. Choice of Cutting Speed. **(20 Marks)**

Module-4

7 a. How sheet metal operations are classified? Explain with a neat sketch. **(14 Marks)**
b. A 90° bend is to be made from steel sheet by air bending process. The bend length is 30cm, thickness of sheet 3mm and width 4cm. The ultimate tensile strength of the sheet material is 400 N/mm^2. Calculate the bending force. Suppose if the bend is to be made by edge bending process, with die and punch radius = 10mm. Find the bending force required. (Assume die opening factor k = 1.33 for Air bending and 0.67 for edge bending). **(06 Marks)**

OR

8 a. How are dies classified? Explain with figures working of progressive and compound die arrangements in sheet metal working. **(12 Marks)**
b. List and explain variables that affect during deep drawing. **(08 Marks)**

Module-5

9 a. With a neat sketch explain the classification of metal working process on the basis of force applied. **(10 Marks)**

b. With a neat sketch, explain different types of rolling mill arrangements. **(10 Marks)**

OR

10 a. Differentiate between direct and indirect extrusion process. **(06 Marks)**

b. Explain the different types of rolling defects. **(05 Marks)**

c. Mention the advantages, disadvantages and applications of forging. **(09 Marks)**

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