CBCS SCHEME

USN | 1 | K | S | 1 | 5 | C | S | 0 | 2 | 1 |

17MAT31

Third Semester B.E. Degree Examination, Dec.2019/Jan.2020
Engineering Mathematics – III

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 Fourier series expansion of $f(x) = x - x^2$ in $(-\pi, \pi)$, hence deduce that $\frac{\pi^2}{12} = \frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + \text{----}$. **(08 Marks)**

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

c. Express y as a Fourier series upto first harmonics given :

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

(06 Marks)

OR

2 a. Obtain the Fourier series for the function :

$$f(x) = \begin{cases} 1 + \frac{4x}{3} & \text{in } \frac{-3}{2} < x \le 0 \\ 1 - \frac{4x}{3} & \text{in } 0 \le x < \frac{3}{2} \end{cases}$$

Hence deduce that $\frac{\pi^2}{8} = \frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \text{---}$. **(08 Marks)**

b. If $f(x) = \begin{cases} x & \text{in } 0 < x < \pi/2 \\ \pi - x & \text{in } \pi/2 < x < \pi \end{cases}$

Show that the half range sine series as

$$f(x) = \frac{4}{\pi}\left[\sin x - \frac{\sin 3x}{3^2} - \frac{\sin 5x}{5^2} - \text{---}\right].$$ **(06 Marks)**

c. Obtain the Fourier series upto first harmonics given :

x	0	1	2	3	4	5	6
y	9	18	24	28	26	20	9

(06 Marks)

Module-2

3 a. Find the complex Fourier transform of the function :

$$f(x) = \begin{cases} 1 & \text{for } |x| \le a \\ 0 & \text{for } |x| > a \end{cases}$$ and hence evaluate $\int_0^\infty \frac{\sin x}{x} dx$. **(08 Marks)**

b. Find the Fourier cosine transform of e^{-ax}. **(06 Marks)**

c. Solve by using z – transforms $u_{n+2} - 4u_n = 0$ given that $u_0 = 0$ and $u_1 = 2$. **(06 Marks)**

OR

4 a. Find the Fourier sine and Cosine transforms of :

$$f(x) = \begin{cases} x & 0 < x < 2 \\ 0 & \text{elsewhere} \end{cases}.$$ **(08 Marks)**

b. Find the Z – transform of : i) n^2 ii) ne^{-an}. **(06 Marks)**

c. Obtain the inverse Z – transform of $\frac{2z^2 + 3z}{(z+2)(z-4)}$. **(06 Marks)**

Module-3

5 a. Obtain the lines of regression and hence find the co-efficient of correlation for the data :

x	1	3	4	2	5	8	9	10	13	15
y	8	6	10	8	12	16	16	10	32	32

(08 Marks)

b. Fit a parabola $y = ax^2 + bx + c$ in the least square sense for the data :

x	1	2	3	4	5
y	10	12	13	16	19

(06 Marks)

c. Find the root of the equation $xe^x - \cos x = 0$ by Regula – Falsi method correct to three decimal places in (0, 1). **(06 Marks)**

OR

6 a. If $8x - 10y + 66 = 0$ and $40x - 18y = 214$ are the two regression lines, find the mean of x's, mean of y's and the co-efficient of correlation. Find σ_y if $\sigma_x = 3$. **(08 Marks)**

b. Fit an exponential curve of the form $y = ae^{bx}$ by the method of least squares for the data :

No. of petals	5	6	7	8	9	10
No. of flowers	133	55	23	7	2	2

(06 Marks)

c. Using Newton–Raphson method, find the root that lies near x = 4.5 of the equation tanx = x correct to four decimal places. **(06 Marks)**

Module-4

7 a. From the following table find the number of students who have obtained marks :
i) less than 45 ii) between 40 and 45.

Marks	30 – 40	40 – 50	50 – 60	60 – 70	70 – 80
No. of students	31	42	51	35	31

(06 Marks)

b. Using Newton's divided difference formula construct an interpolating polynomial for the following data :

x	4	5	7	10	11	13
f(x)	48	100	294	900	1210	2028

and hence find f(8). **(08 Marks)**

c. Evaluate $\int_0^1 \frac{dx}{1+x}$ taking seven ordinates by applying Simpson's $\frac{3}{8}^{th}$ rule. **(06 Marks)**

OR

8 a. In a table given below, the values of y are consecutive terms of a series of which 23.6 is the 6^{th} term. Find the first and tenth terms of the series by Newton's formulas.

x	3	4	5	6	7	8	9
y	4.8	8.4	14.5	23.6	36.2	52.8	73.9

(08 Marks)

b. Fit an interpolating polynomial of the form x = f(y) for data and hence find x(5) given :

x	2	10	17
y	1	3	4

(06 Marks)

c. Use Simpson's $\frac{1}{3}^{rd}$ rule to find $\int_0^{0.6} e^{-x^2} dx$ by taking 6 sub-intervals. **(06 Marks)**

Module-5

9 a. Verify Green's theorem in the plane for $\oint_C (3x^2 - 8y^2)dx + (4y - 6xy)dy$ where C is the closed curve bounded by $y = \sqrt{x}$ and $y = x^2$. **(08 Marks)**

b. Evaluate $\int_C xydx + xy^2dy$ by Stoke's theorem where C is the square in the x – y plane with vertices (1, 0)(–1, 0)(0, 1)(0, –1). **(06 Marks)**

c. Prove that Catenary is the curve which when rotated about a line generates a surface of minimum area. **(06 Marks)**

OR

10 a. If $\vec{F} = 2xy\,\hat{i} + yz^2\,\hat{j} + xz\,\hat{k}$ and S is the rectangular parallelepiped bounded by x = 0, y = 0, z = 0, x = 2, y = 1, z = 3 evaluate $\iint_S \vec{F}.\hat{n}\,ds$. **(08 Marks)**

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

c. Find the external of the functional $I = \int_0^{\pi/2} (y^2 - y^{12} - 2y\sin x)dx$ under the end conditions y(0) = y(π/2) = 0. **(06 Marks)**

* * * * *

CBCS SCHEME

USN | 1 | K | S | 1 | 8 | M | E | 4 | 1 | 2 |

17MATDIP31

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

b. If $x = \cos\theta + i\sin\theta$, then show that $\frac{x^{2n}-1}{x^{2n}+1} = i\tan n\theta$. **(07 Marks)**

c. Simplify $\frac{(\cos 3\theta + i\sin 3\theta)^4(\cos 4\theta + i\sin 4\theta)^5}{(\cos 4\theta + i\sin 4\theta)^3(\cos 5\theta + i\sin 5\theta)^{-4}}$ **(06 Marks)**

OR

2 a. Find the sine of the angle between $\vec{A} = 2\hat{i} + 2\hat{j} - \hat{k}$ and $\vec{B} = 6\hat{i} - 3\hat{j} + 2\hat{k}$. **(07 Marks)**

b. Find the value of λ, so that the vectors $\vec{a} = 2\hat{i} - 3\hat{j} + \hat{k}$, $\vec{b} = \hat{i} + 2\hat{j} - 3\hat{k}$ and $\vec{c} = \hat{i} + \lambda\hat{k}$ are coplanar. **(07 Marks)**

c. Prove that $\vec{a}\times(\vec{b}\times\vec{c}) + \vec{b}\times(\vec{c}\times\vec{a}) + \vec{c}\times(\vec{a}\times\vec{b}) = 0$. **(06 Marks)**

Module-2

3 a. Find the n^{th} derivative of $e^{ax}\cos(bx + c)$. **(07 Marks)**

b. If $y = a\cos(\log x) + b\sin(\log x)$ prove that $x^2y_{n+2} + (2n+1)xy_{n+1} + (n^2+1)y_n = 0$. **(07 Marks)**

c. 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)**

OR

4 a. Find the pedal equation of $r^n = a^n\cos n\theta$. **(07 Marks)**

b. Expand $\log_e(1 + x)$ in ascending powers of x as for as the term containing x^4. **(07 Marks)**

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

Module-3

5 a. Evaluate $\int_0^1\int_{y^2}^{y}(1+xy^2)\,dx\,dy$ **(07 Marks)**

b. Evaluate $\int_0^{2\pi}\sin^4 x\cos^6 x\,dx$ **(07 Marks)**

c. Evaluate $\int_0^2\frac{x^4}{\sqrt{4-x^2}}dx$ **(06 Marks)**

OR

6 a. Evaluate $\int_1^2 \int_3^4 (xy + e^y)\, dydx$ **(07 Marks)**

b. Evaluate $\int_0^{\pi} x \sin^8 x\, dx$ **(07 Marks)**

c. Evaluate $\int_1^2 \int_0^1 \int_{-1}^1 (x^2 + y^2 + z^2)\, dxdydz$ **(06 Marks)**

Module-4

7 a. If particle moves on the curve $x = 2t^2$, $y = t^2 - 4t$, $z = 3t - 5$ where t is the time. Find the velocity and acceleration at $t = 1$. **(07 Marks)**

b. Find the angle between the tangents to the curve $\vec{r} = t^2\hat{i} + 2t\hat{j} - t^3\hat{k}$ at the point $t = \pm 1$. **(07 Marks)**

c. If $\vec{F} = (3x^2y - z)\hat{i} + (xz^3 + y^4)\hat{j} - 2x^3z^2\hat{k}$ find grad(div $\vec{F}$) at (2, –1, 0). **(06 Marks)**

OR

8 a. Find the directional derivative of $\phi = 4xz^3 - 3x^2y^2z$ at (2, –1, 2) along $2\hat{i} - 3\hat{j} + 6\hat{k}$ **(07 Marks)**

b. Find the unit normal to the surface $x^2y + 2xz = 4$ at (2, –2, 3). **(07 Marks)**

c. Show that $\vec{F} = (2xy^2 + yz)\hat{i} + (2x^2y + xz + 2yz^2)\hat{j} + (2y^2z + xy)\hat{k}$ is irrotational. **(06 Marks)**

Module-5

9 a. Solve $\frac{dy}{dx} = \sin(x + y)$ **(07 Marks)**

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

c. Solve $(x - y + 1)dy - (x + y - 1)dx = 0$ **(06 Marks)**

OR

10 a. Solve $(1 + e^{x/4})dx + e^{x/y}\left(1 - \frac{x}{y}\right)dy = 0$. **(07 Marks)**

b. Solve $(x^3\cos^2 y - x\sin 2y)\, dx = dy$. **(07 Marks)**

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

* * * * *

CBCS SCHEME

USN | | | | | | | | | | |

17ME32

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. Explain crystal imperfections with necessary diagrams. **(12 Marks)**

b. Draw the neat sketches of HCP and FCC structures. Also find out APF of the above structures. **(08 Marks)**

OR

2 a. Explain R.R. MOORE Fatigue testing technique with neat diagram and plot S-N curves for MS, Aluminium and Copper. **(10 Marks)**

b. Explain three stages of creep with the help of creep curve and also explain creep properties. **(10 Marks)**

Module-2

3 a. Explain types of solid solutions and factors governing the formation of best substitutional solid solutions (Hume-Rothery Rules). **(10 Marks)**

b. Explain Gibb's phase rule and lever rule with the help of suitable examples. **(10 Marks)**

OR

4 a. What is meant by homogeneous and heterogeneous nucleations? Derive the equation for critical radius in homogeneous nucleation. **(10 Marks)**

b. Draw the Iron-carbon diagram, mark all the pahses on it, write invariant reactions and invariant points. **(10 Marks)**

Module-3

5 a. Draw the T-T-T diagram with the help of transformation curves. Explain the structure of Martensite, Bainite and Retained Austenite. **(12 Marks)**

b. Explain Annealing and normalizing with the help of necessary graphs and diagrams. **(08 Marks)**

OR

6 a. Explain in detail the surface hardening like, carburizing, cyaniding, nitriding flame hardening and induction hardening. **(16 Marks)**

b. Explain the concept of Austempering and Martempering. **(04 Marks)**

Module-4

7 a. Write note on structure, properties and applications of ceramics. **(12 Marks)**

b. Write note on mechanical and electrical behavior of ceramics. **(08 Marks)**

OR

8 a. Explain two plastic processing methods with neat diagrams. **(12 Marks)**

b. Write note on smart materials and shape memory alloys. **(08 Marks)**

Module-5

9 a. Write note on matrix materials and reinforcement materials. **(10 Marks)**

b. Write advantages, limitations and applications of composites. **(10 Marks)**

OR

10 a. Write note on any two polymer matrix composites production methods with neat diagrams. **(12 Marks)**

b. Derive the equation to calculate Young's modulus in iso-strain condition. **(08 Marks)**

* * * * *

CBCS SCHEME

USN | | | | | | | | | | |

17ME33

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. Thermodynamics Hand Book permitted.

Module-1

1 a. Can you define and give examples to the following? i) Closed system, ii) open system, iii) isolated system. **(06 Marks)**

b. Can you distinguish between the following:
i) Microscopic and Macroscopic point of study
ii) Intensive and Extensive properties
iii) Work and Heat
iv) Path and Point functions. **(08 Marks)**

c. State and explain Zeroth law of thermodynamics. **(06 Marks)**

OR

2 a. Can you define thermodynamic definitions of work and heat? Write three important similarities between them. **(05 Marks)**

b. Can you derive expressions for work done of the following types of processes?
i) The process which follow the law, $P = C$
ii) The process which follow the law, $PV^{\gamma} = C$. **(06 Marks)**

c. Air at 1.02 bar, 22°C, initially occupying a cylinder volume of $0.015m^3$, is compressed reversibly and adiabatically by a piston to a pressure of 6.8 bar. Calculate: i) The final temperature ii) The final volume iii) The work done. **(09 Marks)**

Module-2

3 a. Write the first law statements for a system undergoing:
i) a cycle ii) a process iii) a steady flow process. **(06 Marks)**

b. Prove that internal energy – a property. **(04 Marks)**

c. Air flows steadily at the rate of 0.4 kg/s through an air compressor, entering at 6 m/s with a pressure of 1 bar and a specific volume of 0.85 m^3/kg, and learning at 4.5 m/s with a pressure of 6.9 bar and a specific volume of $0.16m^3$/kg. The internal energy of air leaving is 88kJ/kg greater than that of the air entering. Cooling water in a jacket surrounding the cylinder absorbs heat from the air at the rate of 59 kJ/s. Calculate the power required to drive the compressor and the inlet and outlet pipe cross sectional areas. **(10 Marks)**

OR

4 a. Will you prove that two statements of second law of thermodynamics are equivalent? **(05 Marks)**

b. Can you explain carnot heat engine cycle with the help of P-V and T-S diagrams? **(07 Marks)**

c. A heat source S_1 can supply 6000 kJ/min at 300°C and another heat source S_2 can supply 60,000 kJ/min at 100°C. Which source between the two would you choose to supply energy to a carnot engine, that is to produce larger amount of power if the surroundings are at 27°C? Which engine is more efficient? **(08 Marks)**

Module-3

5 a. Can you define and give examples for reversible and irreversible processes? List the factors which makes the process irreversible. **(06 Marks)**

b. Will you prove that entropy a property of a system? **(06 Marks)**

c. A reversible heat engine converts one-sixth of the heat input into work. When the temperature of the sink is reduced by 62°C, its efficiency is doubled. Find the temperature of the source and the sink. **(08 Marks)**

OR

6 a. Derive an expression for change in entropy during constant pressure process. **(06 Marks)**

b. Explain the principle of increase of entropy. **(06 Marks)**

c. In a shell and tube heat exchanger 45kg of water per minute is heated from 60°C to 115°C by hot gases which enter the heat exchanger at 225°C. If the flow rate of gases is 90 kg/min, find the net change of entropy of the universe. C_p (water) = 4.18 kJ/kg.K; C_p(gas) = 1 kJ/kg.k. Assume that there are no losses. **(08 Marks)**

Module-4

7 a. Define available and unavailable energy and prove that the available portion of heat Q withdrawn from an infinite source is $(Q-T_0\Delta s)$. Where T_0 is dead state temperature and ΔS is change in entropy during the process. **(07 Marks)**

b. Obtain an expression for availability of a non-flow process. **(06 Marks)**

c. One kg of air at pressure P_1 and temperature 900K is mixed with one kg of air at the same pressure but at 500K. Determine the loss in availability if the atmospheric temperature is 300K. **(07 Marks)**

OR

8 a. Explain P-T diagram for water. **(06 Marks)**

b. Explain the method of determining the dryness fraction of the given sample of stream using throttling calorimeter with a neat sketch. **(07 Marks)**

c. Determine the enthalpy and internal energy of 2kg of steam at a pressure of 15 bar and 0.85 dryness. Also determine the heat supplied at constant pressure if the final condition of the steam is 70°C of superheat. Take Cp_s (superheated) = 2.25 kJ/kg. **(07 Marks)**

Module-5

9 a. Define the following terms: Mass fraction, Mole fraction, Specific humidity, Dry Bulb Temperature, Dew Point Temperature. **(05 Marks)**

b. Derive and expression for molecular weight and gas constant of a mixture of ideal gases in terms of mass fractions. **(06 Marks)**

c. A vessel of $0.2m^3$ capacity contains 2kg of CO_2 and 1.5kg of N_2 at 300K. Determine: i) Pressure in the vessel ii) Mole fraction of each constituent iii) R and M of the mixture. **(09 Marks)**

OR

10 a. Explain the reasons for deviations of Van-der Waal's equation from ideal gas equation. **(06 Marks)**

b. Explain the following:

i) Law of corresponding states

ii) Compressibility factor

iii) Gibbos-Dalton's law. **(06 Marks)**

c. A container of $3m^3$ capacity contains 10kg of CO_2 at 27°C. Estimate the pressure exerted by CO_2 by using:

i) Perfect gas equation

ii) Van-der Waal's equation

iii) Beattie Bridgeman equation. **(08 Marks)**

* * * * *

CBCS SCHEME

USN | 1 | K | S | 1 | 7 | M | E | 0 | 0 | 7 |

17ME34

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.

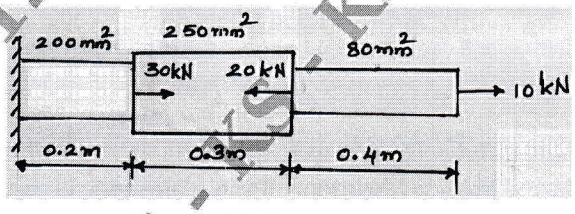
Module-1

1 a. Explain principle of superposition. **(03 Marks)**

b. Derive an expression for Young's Modulus (E) interms of bulk modulus (K) and Poisson's ratio (π). **(07 Marks)**

c. A stepped bar is subjected to forces as shown in Fig.Q.1(c). Determine the stress induced in different portions and Net deformation in the stepped bar. Take $E = 2\times10^5 \frac{N}{mm^2}$. **(10 Marks)**

Fig.Q.1(c)



OR

2 a. Derive an expression for the total elongation of tapered bar varying diameter from d_1 to d_2 subjected to axial load 'P'. **(10 Marks)**

b. A steel bar is placed between two copper bar, each having same area and length as the steel bar. These are rigidly connected together at a temperature of 25°C. When the temperature is raised to 325°C. The length of the bar is increased by 1.5mm compute the original length and find the stresses in each bar. Take E_{steel} = 210GPa, E_{cu} = 100GPa, $\alpha_{steel} = 12 \times 10^{-6}$/°C, α_{cu} = 17.5 × 10-6/°C. **(10 Marks)**

Module-2

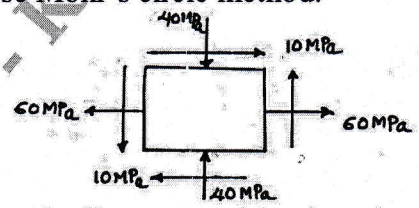
3 a. Derive the expression for normal stress and shear stress on a plane inclined at 'θ' angle to the vertical axis in a biaxial stress system with shear stress. **(10 Marks)**

b. Determine the wall thickness necessary for a thick steel cylinder shell having 200mm inner diameter to withstand an internal pressure of 40MPa. Permissible tensile stress in the material is 100MPa. Also sketch the variation of hoop stress and radial stress across the thickness. **(10 Marks)**

OR

4 a. A plane element subjected to stress shown in Fig.Q.4(a). Determine principal stresses, Max shear stress and their plane. Use Mohr's circle method. **(10 Marks)**

Fig.Q.4(a)



b. A cylindrical thin drum 800mm in diameter and 3m long has a shell thickness of 10mm, If the drum is subjected to an internal pressure of 25 bar. Calculate the change in diameter, change in length and change in volume. Take E = 200GPa, π = 0.25. **(10 Marks)**

Module-3

5 a. Explain different types of beams and loads. **(05 Marks)**

b. Draw SFD and BMD for the beam shown in Fig.Q.5(b).

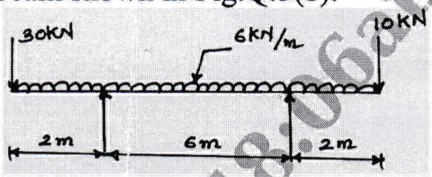


Fig.Q.5(b)

(15 Marks)

OR

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

b. A cantilever beam of square section 200mm × 200mm, 2m long just fails in bending, when a load of 20kN is placed at its free end. A beam of the same material having a rectangular cross-section 150mm × 300mm. Simply supported over a span of 3m is to be used under uniformly distributed load 'W' $\frac{N}{m}$. What can be maximum value of W? **(10 Marks)**

Module-4

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

b. A hollow shaft having diameter ratio of 0.4, transmits 562.5kW power at 100rpm. Determine cross-sectional dimensions of the shaft, if shear stress is not exceed 60MPa and twist in length of 2.5m should not exceed 1.3°. Maximum torque transmitted is 25% higher than average torque G = 90GPa. **(10 Marks)**

OR

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

b. A 1.5m long column has a circular cross-section of 50mm diameter. One end of the column is fixed and other end is free. Take factor of safety as 3, calculate the safe load using

i) Rankine's formula, take yield stress = 560 N/mm^2 and $a = \frac{1}{1600}$

ii) Euler's formula, Young's modulus = 1.2×10^5 N/mm^2. **(10 Marks)**

Module-5

9 a. Explain Factor of safety. **(04 Marks)**

b. Explain maximum normal stress theory and maximum shear stress theory. **(08 Marks)**

c. A bar of 5m long and 50mm diameter hangs vertically and it has collar attached to it to the lower end rigidly. Determine maximum stresses induced when

i) Weight of 3000N falls through a height of 100mm on the collar.

ii) Weight of 30kN falls through a height of 10mm on the collar. Take = 2×10^5 N/mm^2. **(08 Marks)**

OR

10 a. Derive the expression for strain energy due to shear stress and bending. **(10 Marks)**

b. The stresses induced at a critical point in a machine component made of steel (σ_y = 380MPa) are as follows: $\sigma_x = 100\frac{N}{mm^2}$, $\sigma_y = 40\frac{N}{mm^2}$, $\tau_{xy} = 80\frac{N}{mm^2}$ calculate factor of safety by

i) Rankine's theory ii) Guest's theory. **(10 Marks)**

* * * * *

CBCS SCHEME

USN 1KS18ME404 | **17ME35A/17MEA305**

Third Semester B.E. Degree Examination, Dec.2019/Jan.2020
Metal Casting and Welding

Time: 3 hrs. | Max. Marks: 100

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

Module-1

1 a. What is casting? Briefly discuss steps involved in making of castings. **(10 Marks)**

b. What is pattern? List the types and explain the following with neat sketches:
(i) Match plate pattern (ii) Two piece pattern **(10 Marks)**

OR

2 a. Enumerate the desirable properties of molding sand. **(10 Marks)**

b. Explain the different steps involved in shell molding process and mention advantages. **(10 Marks)**

Module-2

3 a. Describe with a neat sketch, Thixo casting process and mention its merits, limitations, applications. **(10 Marks)**

b. What is die casting? With neat sketch explain the hot die casting process. **(10 Marks)**

OR

4 a. Classify melting furnaces. Explain with a neat sketch the working of a direct-arc electric furnace. **(10 Marks)**

b. What are the zones in cupola? With a neat sketch, explain cupola furnace. **(10 Marks)**

Module-3

5 a. Define solidification and explain the methods available to achieve directional solidification with sketches. **(12 Marks)**

b. Explain different sand casting defects, its causes and remedies. **(08 Marks)**

OR

6 a. Explain melting of aluminum using stir casting setup. **(10 Marks)**

b. What is Degasification in liquid metals? Explain the methods of degasification with neat sketches. **(10 Marks)**

Module-4

7 a. Sketch and explain metal arc inert gas welding and its advantages and disadvantages. **(10 Marks)**

b. What is the principle of resistance welding? Explain projection welding with sketch. **(10 Marks)**

OR

8 a. With a neat sketch explain the principle, process of LASER welding and mention its advantages. **(10 Marks)**

b. Explain the Thermit welding with a neat sketch. **(10 Marks)**

Module-5

9 a. With neat sketch, explain Heat Affected Zone (HAZ) and its various zones. **(10 Marks)**

b. What are welding defects? Explain the methods to detect the welding defects. **(10 Marks)**

OR

10 a. Explain with a sketch, principle of oxy-acetylene gas welding. **(08 Marks)**

b. Differentiate between Soldering and Brazing. **(04 Marks)**

c. Explain the methods used for inspection of casting and welding. **(08 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.