CBCS Scheme

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15MAT31

Third Semester B.E. Degree Examination, June/July 2018
Engineering Mathematics – III

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Obtain the Fourier series for the function :

$$f(x) = \begin{cases} -\pi, & -\pi < x < 0 \\ x, & 0 < x < \pi \end{cases}$$

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

b. Obtain the half–range cosine series for the function $f(x) = (x-1)^2$, $0 \le x \le 1$. Hence deduce that $\frac{\pi^2}{6} = \frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + -----$. **(08 Marks)**

OR

2 a. Find the Fourier series of the periodic function defined by $f(x) = 2x - x^2$, $0 < x < 3$. **(06 Marks)**

b. Show that the half range sine series for the function $f(x) = \ell x - x^2$ in $0 < x < \ell$ is

$$\frac{8\ell^2}{\pi^3} \sum_0^\infty \frac{1}{(2n+1)^3} \sin\left(\frac{2n+1}{\ell}\right)\pi x .$$ **(05 Marks)**

c. Express y as a Fourier series upto 1st harmonic given :

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

(05 Marks)

Module-2

3 a. Find the Fourier transform of

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

and hence deduce that $\int_0^\infty \frac{\sin^2 t}{t^2} dt = \frac{\pi}{2}$. **(06 Marks)**

b. Find the Fourier Sine and Cosine transforms of $f(x) = e^{-\alpha x}$, $\alpha > 0$. **(05 Marks)**

c. Solve by using z – transforms $y_{n+1} + \frac{1}{4} y_n = \left(\frac{1}{4}\right)^n$ $(n \ge 0), y_0 = 0$. **(05 Marks)**

OR

4 a. Find the Fourier transform of $f(x) = e^{-|x|}$. **(06 Marks)**

b. Find the Z – transform of $\sin(3n + 5)$. **(05 Marks)**

c. Find the inverse Z – transform of : $\frac{z}{(z-1)(z-2)}$. **(05 Marks)**

Module-3

5 a. Find the correlation coefficient and the equation of the line of regression for the following values of x and y. **(06 Marks)**

x	1	2	3	4	5
y	2	5	3	8	7

b. Find the equation of the best fitting straight line for the data : **(05 Marks)**

x	0	1	2	3	4	5
y	9	8	24	28	26	20

c. Use Newton – Raphson method to find a real root of the equation $x \log_{10} x = 1.2$ (carry out 3 iterations). **(05 Marks)**

OR

6 a. Obtain the lines of regression and hence find the coefficient of correlation for the data :

x	1	2	3	4	5	6	7
y	9	8	10	12	11	13	14

(06 Marks)

b. Fit a second degree parabola to the following data : **(05 Marks)**

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

c. Use the Regula–Falsi method to find a real root of the equation $x^3 - 2x - 5 = 0$, correct to 3 decimal places. **(05 Marks)**

Module-4

7 a. Given $\sin45° = 0.7071$, $\sin50° = 0.7660$, $\sin55° = 0.8192$, $\sin60° = 0.8660$ find $\sin57°$ using an appropriate interpolation formula. **(06 Marks)**

b. Construct the interpolation polynomial for the data given below using Newton's divided difference formula :

x	2	4	5	6	8	10
y	10	96	196	350	868	1746

(05 Marks)

c. Use Simpson's $\frac{1}{3}$rd rule with 7 ordinates to evaluate $\int_2^8 \frac{dx}{\log_{10} x}$. **(05 Marks)**

OR

8 a. Given f(40) = 184, f(50) = 204, f(60) = 226, f(70) = 250, f(80) = 276, f(90) = 304, find f(38) using Newton's forward interpolation formula. **(06 Marks)**

b. Use Lagrange's interpolation formula to fit a polynomial for the data :

x	0	1	3	4
y	–12	0	6	12

Hence estimate y at x = 2. **(05 Marks)**

c. Evaluate $\int_0^1 \frac{x}{1+x^2}dx$ by Weddle's rule taking seven ordinates and hence find $\log_e 2$. **(05 Marks)**

Module-5

9 a. Find the area between the parabolas $y^2 = 4x$ and $x^2 = 4y$ using Green's theorem in a plane. **(06 Marks)**

b. Verify Stoke's theorem for the vector $\vec{F} = (x^2 + y^2)i - 2xyj$ taken round the rectangle bounded by x = 0, x = a, y = 0, y = b. **(05 Marks)**

c. Find the extremal of the functional : $\int_{x_1}^{x_2} [y' + x^2(y')^2]dx$. **(05 Marks)**

OR

10 a. Verify Green's theorem in a plane for $\oint_c (3x^2 - 8y^2)dx + (4y - 6xy)dy$ where c is the boundary of the region enclosed by $y = \sqrt{x}$ and $y = x^2$. **(06 Marks)**

b. If $\vec{F} = 2xyi + yz^2j + xzk$ and S is the rectangular parallelopiped bounded by x = 0, y = 0, z = 0, x = 2, y = 1, z = 3 evaluate $\iint_S \vec{F} \cdot \hat{n}\, ds$. **(05 Marks)**

c. Find the geodesics on a surface given that the arc length on the surface is $S = \int_{x_1}^{x_2} \sqrt{x[1 + (y')^2}\ dx$. **(05 Marks)**

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15ME/MA32

Third Semester B.E. Degree Examination, June/July 2018
Material Science

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Define atomic packing faction. Calculate the coordination No, atomic radius and APF for a HCP crystal structure. **(08 Marks)**

b. The surface of 1020 steel with 0.2% C to be carburized at 927°C. Calculate the time required to increase the carbon content to 0.4% at 1mm below the surface, if the carbon potential at the surface is 1.2% wt. Given $D = 1.28 \times 10^{-11}$ m^2/sec. **(08 Marks)**

Z	0.85	0.9	1.0
enf(z)	0.7707	0.797	0.842

OR

2 a. What is stress relaxation? Derive an expression for stress relaxation. **(08 Marks)**

b. Define Fatigue. Explain the different types of stress cycles that cause fatigue failure, with sketches. **(08 Marks)**

Module-2

3 a. What is solid solution? Mention the types of solid solution. Explain the factors given by Hume Rolhery that govern the formation of solid solution. **(08 Marks)**

b. Explain the effect of any 8 alloying elements on the properties of steel. **(08 Marks)**

OR

4 a. Draw the Iron Carbon diagram and label all the points and fields in it. Explain the different phases in it. **(08 Marks)**

b. Two metals A and B with melting temperatures 850°C and 1100°C respectively having unlimited liquid solubilities. They form an eutectic solid solution at 600°C and a composition of 35% A and 65%B. The maximum solid solubility of A in B is 10% at Eutectic temperature and 5% at room temperature. The maximum solubility of B in A is 16% at eutectic temperature and 7% at room temperature. Assume liquidus, solidus and solvers lines to be straight.

i) Draw the phase diagram and label all the regions.

ii) Determine the NO, relative amount of phases at room temperature for an alloy of 60% A and 40% B. **(08 Marks)**

Module-3

5 a. Draw a TTT diagram for plain carbon steel and label the fields. Show the cooling curve which form 100% marten site on it and explain it. **(08 Marks)**

b. Give the detailed classification of heat treatment types. Explain Mastempering and Austempering, with sketches. **(08 Marks)**

OR

6 a. What is age hardening? Explain age hardening of at 0.4% Cu alloy showing the microstructure, with sketch. **(08 Marks)**

b. Explain the composition, structure and properties of 4 types of Cast Iron. **(08 Marks)**

Module-4

7 a. State and explain the mechanical and electrical properties of ceramic materials. **(08 Marks)**

b. How are plastics classified based on structure and behaviour? Give the advantages and disadvantages of plastic materials. **(08 Marks)**

OR

8 a. What are smart materials? Write short notes on Piezo electric materials and shape memory alloys. **(08 Marks)**

b. What is residual life assessment and its importance? Explain any 3 non destructive testing methods used for accessing residual life. **(08 Marks)**

Module-5

9 a. Define composite material. Explain the role of matrix interface and reinforcement in a composite material. **(08 Marks)**

b. Explain Resin transfer moulding process, with a neat sketch. State its advantages and disadvantages. **(08 Marks)**

OR

10 a. Under Iso-Strain condition derive an expression for Youngs modulus of fiber reinforced composites. List the advantages and applications of composite materials. **(08 Marks)**

b. With a neat sketch explain injection moulding process and state its advantages. **(08 Marks)**

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15ME33

Third Semester B.E. Degree Examination, June/Jul 2018
Basic Thermodynamics

Time: 3 hrs. Max. Marks: 80

Note: 1. Answer any FIVE full questions, choosing one full question from each module.
2. Thermodynamics data hand book and steam tables are permitted.
3. Missing data may be assumed suitably.

Module-1

1 a. What is the difference between intensive and extensive property? Give examples. **(04 Marks)**

b. What is Quasi static process? Explain its importance in engineering. **(04 Marks)**

c. On some temperature scale 0°C is equivalent to 100°B and 100°C is equivalent to 300°B. Determine the temperature in °C corresponding to 200°B. Convert the temperature obtained in °C to Fahrenheit and Kelvin scale. **(08 Marks)**

OR

2 a. Define work and heat in thermodynamics. Explain why neither is a property. **(06 Marks)**

b. Derive an equation for work in Isobaric and Isochoric processes. **(04 Marks)**

c. A piston compresses a gas in a cylinder during quasi equilibrium process. The pressure in the cylinder varies according to the relationship $PV^{1.4}$ = constant. Initial pressure in the cylinder is 101,325 N/m^2 and the initial volume of the cylinder is 0.01m^3. Compute the work in compressing the gas to a final volume of 0.005m^3. **(06 Marks)**

Module-2

3 a. Write the first law of thermodynamics equation for closed system undergoing a non cyclic process and show that internal energy is property. **(06 Marks)**

b. Write the steady flow energy equation for a single entry stream and single exit stream. Indicate the SI unit for each term. **(04 Marks)**

c. Steam expands through a turbine in a steady flow adiabatic process. The mass flow rate of the steam is 1.36 kg/s. The entering state of steam is 34.48 bar and 538°C, while the existing state is 6.896 bar and 294°C. Neglecting the changes in kinetic and potential energies, find the power output for the turbine. Assume C_p for steam as 2.01 kJ/kg K. **(06 Marks)**

OR

4 a. What is a Thermal Reservoir, give example? **(02 Marks)**

b. Show that the efficiency of a reversible heat engine is higher than a irreversible heat engine when both are working between same temperature limits. **(06 Marks)**

c. A heat engine receives half of its heat at a temperature of 1000K and the rest at 500K while rejecting heat to a sink at 300K. What is the maximum possible efficiency of this heat engine? **(08 Marks)**

Module-3

5 a. What is a reversed heat engine? **(02 Marks)**

b. Mention the factors which render a process irreversible. **(06 Marks)**

c. The efficiency of the Carnot engine rejecting heat to a sink at 7°C is 32%. If the heat rejected to the sink is 16.66 kJ/s. What is the power developed by the engine? Also determine the source temperature. **(08 Marks)**

OR

6 a. Derive the two Tds expressions for change in entropy of an Ideal gas. **(08 Marks)**

b. Water is heated from 25°C to 90°C as it flows at a rate of 0.5kg/s through a tube that is immersed in a hot bath at 100°C. Calculate heat transfer, entropy change for water, oil bath and universe. **(08 Marks)**

Module-4

7 a. What is available energy, un available energy? **(03 Marks)**

b. Show that the Joule Thomson coefficient for a gas can be expressed as

$$\mu_h = \frac{1}{C_p}\left[T\left(\frac{\partial V}{\partial T}\right)_p - v\right].$$ **(08 Marks)**

c. Obtain an expression for availability of a non-flow process. **(05 Marks)**

OR

8 a. With the help of P-T diagram define i) Triple point ii) Critical point. **(06 Marks)**

b. Use steam table to determine the unknown properties in the following:

i) P = 1 bar $v = 2.41\ m^3/kg$ T = _____

ii) P = 1 MPa, T = 150°C, v = _____

iii) T = 100°C, $h_g = 2676\ kJ/kg$ P_s = _____

iv) P = 10 bar, T = 250°C, h = _____. **(04 Marks)**

c. Steam is throttled from a pressure of 15 bar to 1.5 bar. If the steam is dry saturated at the end of expansion, what is the dryness fraction at the beginning. Also calculate the change in entropy during throttling. **(06 Marks)**

Module-5

9 a. Derive the expressions for specific heat at constant pressure and constant volume for mixture of gases. **(08 Marks)**

b. A mixture of gases comprises 30% CO, 15% CO_2 and 55% H_2. Find the gravimetric analysis specific gas constant and molecular weight of the mixture. **(08 Marks)**

OR

10 a. Explain the following:

i) Reduced properties

ii) Law of corresponding state

iii) Gibbs-Daltons law

iv) Compressibility factor. **(08 Marks)**

b. 10 kg of Carbon dioxide is enclosed in a container at a temperature of 100°C and pressure of 1 bar. Compute the volume of the container by

i) Ideal gas equation

ii) Vander Walls equation

iii) Compressibility chart. **(08 Marks)**

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15ME/MA34

Third Semester B.E. Degree Examination, June/July 2018
Mechanics of Materials

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Define: i) True stress ii) Poissons ratio iii) Resilience iv) Rigidity Modulus. **(04 Marks)**

b. Derive an expression for the extension of a tapering bar whose diameter d_1 at one end tapers linearly to a diameter d_2 in a length L, under an axial pull 'P' and Young's modulus E. **(06 Marks)**

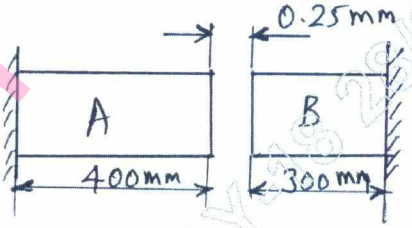
c. The tensile test was conducted on a mild steel bar. The following data was obtained from the test. Diameter of steel bar = 16mm, load at proportional limit = 72kN, load at failure = 80kN, diameter of the rod at failure = 12mm, gauge length = 80MM, extension at a load of 60kN = 0.115mm, final length = 104mm. Determine: i) Young's modulus ii) Proportionality limit stress iii) True breaking stress iv) Percentage Elongation in length v) Percentage reduction in area. **(06 Marks)**

OR

2 a. Derive relationship between Young's modulus (E), rigidity modulus (G) and bulk modulus (K). **(08 Marks)**

b. At room temperature the gap between bar A and bar B shown in Fig.Q.2(b) is 0.25mm. What are the stresses induced in the bars, if temperature rise is 35°C? Given.
$A_A = 1000mm^2$, $A_B = 800mm^2$,
$E_A = 2 \times 10^5$ N/mm^2, $E_B = 1 \times 10^5$ N/mm^2,
$\alpha_A = 12 \times 10^{-6}$/°C, $\alpha_B = 23 \times 10^{-6}$/°C,
$L_A = 400mm$, $L_B = 300mm$. **(08 Marks)**

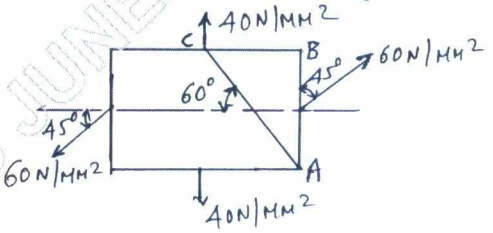
Fig.Q.2(b)



Module-2

3 a. An element is subjected to stresses as shown in Fig.Q.3(a). Determine: i) Principal stresses and their directions ii) Normal and tangential stress on plane AC. **(10 Marks)**

Fig.Q.3(a)



b. Prove that the change in volume in thin cylinder is equal to $\frac{Pd}{4tE}(5-4\mu)V$. **(06 Marks)**

OR

4 a. A pipe of 400mm internal diameter and 100mm thickness contains a internal fluid pressure 80N/mm^2. Calculate and sketch radial and hoop stress distribution across the section. **(10 Marks)**

b. Derive an expression for hoop stress and longitudinal stress for thin cylinder. **(06 Marks)**

Module-3

5 a. Classify beams and loads with sketch. **(04 Marks)**

b. Draw the shear force and bending moment diagrams for the beam shown in Fig.Q.5(b). Locate the salient point. **(12 Marks)**

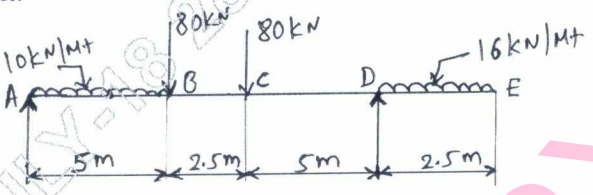


Fig.Q.5(b)

OR

6 a. A cast iron beam has an 'I' section with top flange 80mm × 40mm, web 120mm × 20mm and bottom flange 160mm × 40mm. If the tensile stress is not to exceed 30N/mm^2 and compressive stress 90N/mm^2, what is the maximum uniformly distributed load the beam carry over a simply supported span of 6m, if the large flange is in tension. **(10 Marks)**

b. Derive an expression for the maximum deflection of a cantilever beam carrying a point load at its free end. **(06 Marks)**

Module-4

7 a. State the assumption made in pure torsion and with usual notations derive torsion equation. **(08 Marks)**

b. A solid shaft is required to transmit 245 kW power at 240rpm. 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 is 1°/meter length. Determine the diameter required, if the shaft is solid. G = 80kN/mm^2. **(08 Marks)**

OR

8 a. Derive the expression for Euler's crippling load for a column when both ends are hinged or pinned. **(08 Marks)**

b. Determine the crippling load for a 'T' section of dimensions 100mm × 100mm × 20mm and length of column 12m with both ends fixed. Take E = 210 GPa. **(08 Marks)**

Module-5

9 a. Define: i) Strain energy ii) Castigliano's theorem iii) Modulus of resilience iv) Toughness. **(08 Marks)**

b. A cantilever beam of uniform cross section carries a point load at the free end. Determine strain energy and deflection at the free end. If F = 200kN, E = 200GPa, L = 3mt and I = 10^{-4}m^4. **(08 Marks)**

OR

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

b. A plate of 45C8 steel (σ_{yt} = 353MPa) is subjected to the following stresses. σ_x = 150 N/mm^2, σ_y = 100N/mm^2 and τ_{xy} = 50N/mm^2. Find the factor of safety by i) Rankine's theory ii) Guest's theory. **(08 Marks)**

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15MEA305/15ME35A

Third Semester B.E. Degree Examination, June/July 2018
Metal Casting and Welding

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Explain basic steps involved in a sand casting process. **(08 Marks)**

b. What is pattern? List the types and explain the following with neat sketches:
(i) Two piece pattern (ii) Match plate pattern **(08 Marks)**

OR

2 a. With neat sketch explain Jolt squeeze type molding machine showing pattern and molding box. **(08 Marks)**

b. Explain the different steps involved in shell molding process with neat sketches. **(08 Marks)**

Module-2

3 a. What is die-casting? With neat and labelled sketch explain cold chamber die casting process. **(08 Marks)**

b. With neat sketch explain continuous casting process and mention advantages and disadvantages. **(08 Marks)**

OR

4 a. With neat sketch explain the working of a direct arc electric furnace. **(08 Marks)**

b. Draw and explain the basic principle of a resistance furnace. **(08 Marks)**

Module-3

5 a. What is nucleation? Explain Homogeneous nucleation and Heterogeneous nucleation with sketches. **(08 Marks)**

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

OR

6 a. What is the need for directional solidification and explain any four methods of achieving directional solidification. **(08 Marks)**

b. Explain differential solidification variables with sketch. **(08 Marks)**

Module-4

7 a. Sketch and explain Metal Inert Gas welding & its advantages and disadvantages. **(08 Marks)**

b. What is the principle of resistance welding? Explain projection welding with sketch. **(08 Marks)**

OR

8 a. With neat sketch explain electron beam welding and write advantages, disadvantages and applications. **(08 Marks)**

b. Define welding process. Classify it and write advantages, disadvantages and applications of it. **(08 Marks)**

Module-5

9 a. Compare the soldering and brazing process mention their advantages, disadvantages and applications. **(08 Marks)**

b. Explain fluorescent penetrant method of inspection with neat sketch. **(08 Marks)**

OR

10 a. With neat sketch, explain heat affected zone (HAZ) and its various zones. **(08 Marks)**

b. Explain briefly welding defects and its causes. **(08 Marks)**

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CBCS SCHEME

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15MEB305/15ME35B

Third Semester B.E. Degree Examination, June/July 2018
Machine Tools and Operations

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Write comparison between central lathe, capston lathe and turret lathe. **(08 Marks)**

b. Sketch and explain Radial drilling machine. **(08 Marks)**

OR

2 a. Sketch and explain Horizontal boring machine. **(08 Marks)**

b. Write the types and classification of Milling machine. **(08 Marks)**

Module-2

3 a. Sketch and explain following boring operations :
(i) Facing (ii) Counter boring (iii) Counter sinking (iv) Trl panning. **(08 Marks)**

b. Write comparison of up and down milling. **(04 Marks)**

c. Explain the working and auxillary cutting motions in machine tool. **(04 Marks)**

OR

4 a. List the operations performed in lathe and drilling machines. **(08 Marks)**

b. With suitable sketch explain Milling arbor. **(04 Marks)**

c. Explain lathe setting. **(04 Marks)**

Module-3

5 a. Give expression for feed, speed, depth of cut and machining time for grinding. **(08 Marks)**

b. In a turning operation following data is observed, D = 100 mm, l = 400 mm, cutting speed = 600 mm/sec, feed = 0.4 mm/rev, calculate the machining time? What will be effect of machining time if cutting speed is increased by 50%. **(08 Marks)**

OR

6 a. Write the factors affecting feed for turning. **(04 Marks)**

b. Write a note on feed for milling operations. **(04 Marks)**

c. A solid cylinder is to be ground longitudinally on a cylindrical grinding machine. The length and diameter of cylinder are 220 mm and 50 mm respectively. The allowance per side is 0.3 mm. The grinding wheel diameter and width is 600 mm and 63 mm respectively. The cutting speed is 30 m/min. Determine machining parameters. **(08 Marks)**

Module-4

7 Explain the system of forces acting during cutting and show how they are brought together in Merchant's circle diagram. **(16 Marks)**

OR

8 a. With sketches explain the difference between orthogonal and oblique cutting. **(08 Marks)**

b. Discuss briefly the different types of chips encountered in metal cutting. **(06 Marks)**

c. Explain shear zone. **(02 Marks)**

Module-5

9 What is Tool life? List and explain the factors affecting the tool life along with relevant equations. **(16 Marks)**

OR

10 a. Explain the economics of metal machining. **(10 Marks)**

b. Explain cutting speed and tool life for minimum cost and maximum production. **(06 Marks)**

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CBCS SCHEME

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15ME36B/15MEB306

Third Semester B.E. Degree Examination, June/July 2018
Mechanical Measurements and Metrology

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. What is Metrology? State the objectives of metrology. **(05 Marks)**
b. Compare Line and End standards. **(05 Marks)**
c. Explain with a sketch, International prototype meter. **(06 Marks)**

OR

2 a. With neat sketch, explain wringing phenomena of slip gauge. **(05 Marks)**
b. Explain principle of sine bar. **(05 Marks)**
c. Build a slip gauge combination using M – 112 set for the given dimensions.
i) 49.3115mm ii) 68.208mm. **(06 Marks)**

Module-2

3 a. Define Limits, Fits and Tolerance. **(06 Marks)**
b. Explain with neat sketch, different types of fits. Give examples each. **(10 Marks)**

OR

4 a. Explain Johnson Microkater comparator, with neat sketch. **(08 Marks)**
b. With neat sketch, explain LVDT and state its advantages. **(08 Marks)**

Module-3

5 a. Explain with neat sketch, the method of measuring minor diameter of external thread and internal thread. **(08 Marks)**
b. Explain with neat sketch, measuring of gear tooth thickness using gear tooth vernier. **(08 Marks)**

OR

6 a. Explain Tool maker's microscope, with neat sketch. **(08 Marks)**
b. Explain Construction and working principle of CMM, with neat sketch. **(08 Marks)**

Module-4

7 a. Give complete classification of errors. **(04 Marks)**
b. Define Accuracy, Precision, Sensitivity and Repeatability. **(08 Marks)**
c. Explain Piezoelectric effect. **(04 Marks)**

OR

8 a. Explain Ballast Circuit. **(08 Marks)**
b. With neat sketch, explain Cathode ray Oscilloscope. **(08 Marks)**

Module-5

9 a. Explain Platform balance, with neat sketch. **(08 Marks)**
b. Describe with neat sketch, McLeod vaccum gauge. **(08 Marks)**

OR

10 a. State the laws of Thermocouples. **(05 Marks)**
b. Define Gauge factor. Explain foil type bonded resistance strain gauge. **(07 Marks)**
c. Mention Strain gauge materials and bonding materials. **(04 Marks)**

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CBCS Scheme

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15MATDIP31

Third Semester B.E. Degree Examination, June/July 2018
Additional Mathematics – I

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Find the modulus and amplitude of $\frac{(1+i)^2}{3+i}$. **(05 Marks)**

b. Prove that $\left(\frac{1+\cos\theta+i\sin\theta}{1+\cos\theta-i\sin\theta}\right)^n = \cos n\theta + i\sin n\theta$. **(05 Marks)**

c. If $z = \cos\theta + i\sin\theta$, then show that $x^n + \frac{1}{x^n} = 2\cos n\theta$, $x^n - \frac{1}{x^n} = 2i\sin n\theta$. **(06 Marks)**

OR

2 a. Find the sine of the angle between $\vec{a} = 2\hat{i} - 2\hat{j} + \hat{k}$ and $\vec{b} = \hat{i} - 2\hat{j} + 2\hat{k}$. **(05 Marks)**

b. Find the unit vector perpendicular to both $\vec{a}$ and $\vec{b}$, where $\vec{a} = \hat{i} - 2\hat{j} + 3\hat{k}$, $\vec{b} = 2\hat{i} + \hat{j} + \hat{k}$ **(05 Marks)**

c. Show that (3, –2, 4), (6, 3, 1), (5, 7, 3) and (2, 2, 6) are coplanar. **(06 Marks)**

Module-2

3 a. Find the n^{th} derivative of sin(3x)cosx. **(05 Marks)**

b. Find the angle between radius vector and tangent to the curve $\gamma^m \cos m\theta = a^m$. **(05 Marks)**

c. Find the pedal equation of $\gamma = a(1 + \cos\theta)$. **(06 Marks)**

OR

4 a. If $u = \tan^{-1}\left(\frac{x^3 + y^3}{x - y}\right)$, prove that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = \sin(2u)$. **(05 Marks)**

b. If $u = f\left(\frac{x}{y}, \frac{y}{z}, \frac{z}{x}\right)$, prove that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} + z\frac{\partial u}{\partial z} = 0$. **(05 Marks)**

c. If $u = x + y$, $v = y + z$, $w = z + x$, find $J\left(\frac{uvw}{xyz}\right)$. **(06 Marks)**

Module-3

5 a. Evaluate $\int_0^{\pi} x \cos^6 x \, dx$. **(05 Marks)**

b. Evaluate $\int_0^{\infty} \frac{x^2}{(1+x^6)^{7/2}} dx$ **(05 Marks)**

c. Evaluate $\int_0^1 x^5 (1-x^2)^{5/2} dx$. **(06 Marks)**

OR

6 a. Evaluate $\int_1^2 \int_3^4 (xy + e^y) \, dy \, dx$. **(05 Marks)**

b. Evaluate $\int_0^1 \int_x^{\sqrt{x}} xy \, dy \, dx$. **(05 Marks)**

c. Evaluate $\int_0^1 \int_0^1 \int_0^y xyz \, dx \, dy \, dz$. **(06 Marks)**

Module-4

7 a. Find the angle between the tangents to the curve $x = t^2, y = t^3, z = t^4$ at $t = 2$, and $t = 3$. **(05 Marks)**

b. Find the unit normal to the curve $\vec{\gamma} = 4\sin t\,\hat{i} + 4\cos t\,\hat{j} + 3t\,\hat{k}$. **(05 Marks)**

c. Find the velocity and acceleration to the curve $\vec{\gamma} = t^2\,\hat{i} - t^3\,\hat{j} + t^4\,\hat{k}$ at $t = 1$. **(06 Marks)**

OR

8 a. Find the directional derivative of $\varphi = x^3y^3z^3$ at (1, 2, 1) in the direction of $\hat{i} + 2\hat{j} + 2\hat{k}$. **(05 Marks)**

b. Find the unit normal to the surface $xy + x + zx = 3$ at $(1, 1, 1)$. **(05 Marks)**

c. If $\vec{F} = \nabla(x^3 + y^3 + z^3 - 3xyz)$, find div $\vec{F}$. **(06 Marks)**

Module-5

9 a. Solve $\frac{dy}{dx} = \frac{y^2}{xy - x^2}$. **(05 Marks)**

b. Solve $\frac{dy}{dx} + y\cot x = \sin x$. **(05 Marks)**

c. Solve $y(x + y)dx + (x + 2y - 1)dy = 0$. **(06 Marks)**

OR

10 a. Solve $(x^2 + y)dx + (y^3 + x)dy = 0$. **(05 Marks)**

b. Solve $\frac{dy}{dx} + \frac{y}{x} = xy^2$. **(05 Marks)**

c. Solve $(x^2 + y^2)\frac{dy}{dx} = xy$. **(06 Marks)**

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