III ME, CV (S)

CBCS Scheme

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15MAT31

Third Semester B.E. Degree Examination, Dec.2017/Jan.2018
Engineering Mathematics – III

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Express $f(x)=(\pi-x)^2$ as a Fourier series of period 2π in the interval $0<x<2\pi$. Hence deduce the sum of the series $1+\frac{1}{2^2}+\frac{1}{3^2}+......$ **(08 Marks)**

b. The turning moment T units of the Crank shaft of a steam engine is a series of values of the crank angle θ in degrees. Find the first four terms in a series of sines to represent T. Also calculate T when $\theta = 75^\circ$. **(08 Marks)**

θ:	0°	30°	60°	90°	120°	150°	180°
T:	0	5224	8097	7850	5499	2626	0

OR

2 a. Find the Fourier Series expansion of the periodic function,

$$f(x)=\begin{cases} l+x, & -l\le x\le 0 \\ l-x, & 0\le x\le l \end{cases}.$$ **(06 Marks)**

b. Obtain a half-range cosine series for $f(x)=x^2$ in $(0,\pi)$. **(05 Marks)**

c. The following table gives the variations of periodic current over a period:

t sec:	0	$\frac{T}{6}$	$\frac{T}{3}$	$\frac{T}{2}$	$\frac{2T}{3}$	$\frac{5T}{6}$
A amp:	1.98	1.30	1.05	1.30	-0.88	-0.25

Show that there is a direct current part 0.75 amp in the variable current and obtain the amplitude of the first harmonic. **(05 Marks)**

Module-2

3 a. Find the Fourier transform of $f(x)=\begin{cases} 1 & \text{for } |x|<1 \\ 0 & \text{for } |x|>1 \end{cases}$ and evaluate $\int_0^\infty \left(\frac{\sin x}{x}\right)dx$ **(06 Marks)**

b. Find the Fourier cosine transform of, $f(x)=\begin{cases} x & \text{for } 0<x<1 \\ 2-x & \text{for } 1<x<2 \\ 0 & \text{for } x>2 \end{cases}$. **(05 Marks)**

c. Obtain the inverse Z-transform of the following function, $\frac{z}{(z-2)(z-3)}$. **(05 Marks)**

OR

4 a. Find the Z-transform of $\cos\left(\frac{n\pi}{2}+\alpha\right)$. **(06 Marks)**

b. Solve $u_{n+2}-5u_{n+1}+6u_n=36$ with $u_0=u_1=0$, using Z-transforms. **(05 Marks)**

c. If Fourier sine transform of f(x) is $\frac{e^{-a\alpha}}{\alpha}$, $\alpha\neq 0$. Find f(x) and hence obtain the inverse Fourier sine transform of $\frac{1}{\alpha}$. **(05 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.

Module-3

5 a. Calculate the Karl Pearson's co-efficient for the following ages of husbands and wives: **(06 Marks)**

Husband's age x:	23	27	28	28	29	30	31	33	35	36
Wife's age y:	18	20	22	27	21	29	27	29	28	29

b. By the method of least square, find the parabola $y = ax^2 + bx + c$ that best fits the following data: **(05 Marks)**

x:	10	12	15	23	20
y:	14	17	23	25	21

c. Using Newton-Raphson method, find the real root that lies near x = 4.5 of the equation $\tan x = x$ correct to four decimal places. (Here x is in radians). **(05 Marks)**

OR

6 a. In a partially destroyed laboratory record, only the lines of regression of y on x and x on y are available as $4x - 5y + 33 = 0$ and $20x - 9y = 107$ respectively. Calculate $\bar{x}$, $\bar{y}$ and the coefficient of correlation between x and y. **(06 Marks)**

b. Find the curve of best fit of the type $y = ae^{bx}$ to the following data by the method of least squares: **(05 Marks)**

x:	1	5	7	9	12
y:	10	15	12	15	21

c. Find the real root of the equation $xe^x - 3 = 0$ by Regula Falsi method, correct to three decimal places. **(05 Marks)**

Module-4

7 a. From the following table of half-yearly premium for policies maturing at different ages, estimate the premium for policies maturing at age of 46: **(06 Marks)**

Age:	45	50	55	60	65
Premium (in Rupees):	114.84	96.16	83.32	74.48	68.48

b. Using Newton's divided difference interpolation, find the polynomial of the given data: **(05 Marks)**

x	3	7	9	10
f(x)	168	120	72	63

c. Using Simpson's $\left(\frac{1}{3}\right)^{rd}$ rule to find $\int_0^{0.6} e^{-x^2} dx$ by taking seven ordinates. **(05 Marks)**

OR

8 a. Find the number of men getting wages below ₹ 35 from the following data: **(06 Marks)**

Wages in ₹ :	0 – 10	10 – 20	20 – 30	30 – 40
Frequency :	9	30	35	42

b. Find the polynomial f(x) by using Lagrange's formula from the following data: **(05 Marks)**

x:	0	1	2	5
f(x):	2	3	12	147

c. Compute the value of $\int_{0.2}^{1.4} (\sin x - \log_e x + e^x) dx$ using Simpson's $\left(\frac{3}{8}\right)^{th}$ rule. **(05 Marks)**

Module-5

9 a. A vector field is given by $\vec{F} = \sin y\,\hat{i} + x(1+\cos y)\hat{j}$. Evaluate the line integral over a circular path given by $x^2 + y^2 = a^2$, $z = 0$. **(06 Marks)**

b. If C is a simple closed curve in the xy-plane not enclosing the origin. Show that $\int_C \vec{F}.d\vec{R} = 0$, where $\vec{F} = \frac{y\hat{i} - x\hat{j}}{x^2 + y^2}$. **(05 Marks)**

c. Derive Euler's equation in the standard form viz., $\frac{\partial f}{\partial y} - \frac{d}{dx}\left[\frac{\partial f}{\partial y'}\right] = 0$. **(05 Marks)**

OR

10 a. Use Stoke's theorem to evaluate $\int_C \vec{F}.d\vec{R}$ where $\vec{F} = (2x - y)\hat{i} - yz^2\hat{j} - y^2z\hat{k}$ over the upper half surface of $x^2 + y^2 + z^2 = 1$, bounded by its projection on the xy-plane. **(06 Marks)**

b. Show that the geodesics on a plane are straight lines. **(05 Marks)**

c. Find the curves on which the functional $\int_0^1 \left((y')^2 + 12xy\right)dx$ with $y(0) = 0$ and $y(1) = 1$ can be extremized. **(05 Marks)**

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CBCS Scheme

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15ME/MA32

Third Semester B.E. Degree Examination, Dec.2017/Jan.2018

Material Science

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Define APF. Calculate the APF for an ideally packed HCP unit cell. **(07 Marks)**

b. Classify the crystal defects. Explain point defect with neat sketches. **(07 Marks)**

c. Calculate the rate of diffusion of iron at 700°C. Take A = 4.9×10^{-5} m^2/s, E = 153.2 kJ/mol. **(02 Marks)**

OR

2 a. List linear and non-linear elastic properties. Explain non-linear elastic properties. **(06 Marks)**

b. Draw S-N curve and typical creep curve. Explain them briefly. **(10 Marks)**

Module-2

3 a. Explain the rules governs the formation of solid solution. **(04 Marks)**

b. What are the different cast metal structures? Explain with neat sketches. **(04 Marks)**

c. Draw Fe-Fe_3C diagram. Explain the reactions in it. **(08 Marks)**

OR

4 a. Define homogeneous and heterogeneous nucleation. Obtain an expression for critical radius of nucleus. **(06 Marks)**

b. Explain the effect of alloying elements to the steel. **(04 Marks)**

c. Two metals A and B have their melting points at 600°C and 400°C respectively. These metals do not form any compound or intermetallic phase. The maximum solubility in each other is 4% which remains the same until 0°C. An eutectic reaction occurs at 300°C for 65% A.

i) Draw the phase diagram and label all the phases and fields.

ii) Find the temperature at which 20% A and 80% B starts and ends solidification.

iii) Find the temperature at which the same alloy contain 50% liquid and 50% solid. **(06 Marks)**

Module-3

5 a. Define heat treatment. Give its classification. **(05 Marks)**

b. Distinguish between Austempering and Martempering. **(05 Marks)**

c. Draw TTT diagram. Explain briefly. **(06 Marks)**

OR

6 a. With neat sketch explain Jominy end quench test. **(06 Marks)**

b. Explain age hardening of Al-Cu alloys. **(04 Marks)**

c. Explain the properties, compositions and uses of gray cast iron and SG iron. **(06 Marks)**

Module-4

7 a. Define ceramic. Explain briefly the types of ceramics. **(05 Marks)**

b. List the applications and mechanical properties of ceramics. **(06 Marks)**

c. Define smart material. Explain briefly the types of smart materials. **(05 Marks)**

OR

8 Write a note on:

a. Shape memory alloys

b. Piezo electric materials

c. Fibre optic materials

d. Use of non-destructive testing **(16 Marks)**

Module-5

9 a. Define composite. How do you classify composites? **(06 Marks)**

b. Explain the role of matrix and reinforcement in composite material. **(06 Marks)**

c. With flow chart explain the production of carbon fibres. **(04 Marks)**

OR

10 a. With a neat sketch explain pultrusion process. **(07 Marks)**

b. List the advantages and applications of composites. **(05 Marks)**

c. Calculate the tensile modulus of elasticity of unidirectional carbon fibre reinforced composite material which contain 62% by volume of carbon fibres in iso-strain and iso-stress condition. Take Young's modulus of carbon fibre as 37.86×10^4 N/mm^2. Young's modulus of epoxy = 42×10^2 N/mm^2. **(04 Marks)**

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CBCS Scheme

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15ME33

Third Semester B.E. Degree Examination, Dec.2017/Jan.2018
Basic Thermodynamics

Time: 3 hrs. Max. Marks: 80

Note: 1. ***Answer FIVE full questions, choosing one full question from each module.***
2. Use of thermodynamic data book is permitted.

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.

Module-1

1 a. Define the following with examples: (i) Open system (ii) Closed system (iii) Isolated system. **(06 Marks)**

b. List out similarities and dissimilarities between work and heat. **(04 Marks)**

c. The temperature t on a Celsius thermometer scale is defined interms of property P by the relation $p = e^{(t-B)/A}$ where A and B are constants. At ice and steam points the value of p is 1.86 and 6.81 respectively. Find the value of 't' for p = 2.5. **(06 Marks)**

OR

2 a. With examples, distinguish between :
(i) Intensive property and extensive property.
(ii) Point function and path function. **(04 Marks)**

b. Obtain an expression for work done by the isothermal process. **(04 Marks)**

c. A fluid in a horizontal cylinder fitted with a frictionless leak proof piston is continuously agitated by means of stirrer passing through the cylinder cover. The cylinder diameter is 400 mm. During a stirring process of 10 minutes, the piston moves slowly outwards to a distance of 485 mm against the atmospheric pressure. The net work done by the fluid during this process is 2000 Nm. Given that the speed of electric motor driving the stirrer is 840 rpm, estimate the torque required in driving the shaft and shaft output of the motor. **(08 Marks)**

Module-2

3 a. State the first law of thermodynamics applied to cyclic and non-cyclic processes. **(04 Marks)**

b. What is PMMK2? Why is it impossible? **(04 Marks)**

c. A centrifugal pump delivers 50 kg of water per second. The inlet and outlet pressures are 1 bar and 4.2 bar. The suction is 2.2 m below the centre of the pump and delivery is 8.5 m above the centre of the pump. The suction and delivery pipe diameter are 20 cm and 10 cm respectively. Determine the capacity of the electric motor to run the pump if pump efficiency is 85%. **(08 Marks)**

OR

4 a. Give Kelvin-Planck and Clausius statements of second law of thermodynamics. **(04 Marks)**

b. Show that for constant pressure process, the heat transfer is equal to change in enthalpy. **(04 Marks)**

c. Two Carnot engines work in series beween the source and sink temperatures of 550 K and 350 K. If both engines develop equal power, determine the intermediate temperature. **(08 Marks)**

Module-3

5 a. Explain how free expansion and friction makes the process irreversible. **(08 Marks)**

b. $0.12\ m^3$ of air at 1 bar and 120°C is compressed to $\frac{1}{10}$ of the original volume and a pressure of 35 bar. Heat is then added at constant pressure until the volume is doubled. Determine the change of entropy during each of these process. Take $C_p = 1.005$ kJ/kgK, $C_V = 0.7165$ kJ/kgK, $R = 0.287$ kJ/kgK. **(08 Marks)**

OR

6 a. What is internal and external irreversibility? **(03 Marks)**

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

c. A heat engine receives 300 kJ/min of heat from a source at 327°C and rejects heat to a sink at 27°C. Three hypothetical amounts of heat rejections are given below (i) 200 kJ/min (ii) 150 kJ/min (iii) 100 kJ/min. From these results state which of these cases is a reversible cycle, irreversible cycle and impossible one. **(07 Marks)**

Module-4

7 a. Define available and unavailable energy. **(04 Marks)**

b. Draw phase equilibrium diagram for water on P-V coordinates and indicate relevant parameters on it. **(04 Marks)**

c. Write a note on Maxwell relations. **(08 Marks)**

OR

8 a. With a neat sketch, explain the working of combined separating and throttling calorimeter. **(08 Marks)**

b. Steam at 10 bar and dry state is cooled under constant pressure until it becomes 0.85 dry. Using steam tables, find the work done, change in enthalpy, heat transferred and change in entropy. **(08 Marks)**

Module-5

9 a. Give the statement of. (i) Dalton's law of additive pressures (ii) Amagat's law of volume additives. **(04 Marks)**

b. With usual notations, write the Beattie-Bridgeman equation of state. **(04 Marks)**

c. A mixture of ideal gas consists of 3 kg of N_2 and 5 kg of CO_2 and at a pressure of 300 kPa and temperature of 20°C. Find (i) Mole fraction of each constituent (ii) Equivalent gas constant of the mixture (iii) Equivalent molecular weight (iv) Partial pressures and volumes. **(08 Marks)**

OR

10 a. State and explain law of corresponding states. **(04 Marks)**

b. Define the following:

(i) Dry bulb temperature.
(ii) Wet bulb temperature.
(iii) Specific humidity.
(iv) Dew point temperature **(04 Marks)**

c. Determine the pressure in a steel vessel having a volume of 15 lit and containing 3.4 kg of N_2 at 400°C using (i) Ideal gas equation (ii) Vander-Waals equation. Also calculate the compressibility factor by using the answer obtained from the Vander –Waals equation of state. **(08 Marks)**

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CBCS Scheme

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15ME/MA34

Third Semester B.E. Degree Examination, Dec.2017/Jan.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) Hooke's law ii) Poisson's ratio iii) Factor of safety
iv) Bulk modulus v) Modulus of elasticity. **(05 Marks)**

b. Draw and explain stress-strain diagram of a mild steel specimen subjected to tension test. **(05 Marks)**

c. A circular rod of 100mm diameter and 500mm length is subjected to a tensile load of 1000kN. Determine the i) Modulus of rigidity ii) Bulk modulus iii) Change in volume. Take Poisson's ratio = 0.30 and E = 200GPa. **(06 Marks)**

OR

2 a. Define :
i) Elasticity ii) Plasticity iii) Resilience iv) Toughness v) Stiffness. **(05 Marks)**

b. Derive a relation between modulus of elasticity and bulk modulus. **(05 Marks)**

c. A bar of brass 25mm diameter is enclosed in a steel tube of 50mm external diameter and 25mm internal diameter. The bar and the tube fastened at the ends and are 1.5m long. Find the stresses in the two materials when the temperature raises from 30°C to 80°C.
Take : $E_{steel} = 200$ GPa ; $E_{brass} = 100$GPa,
$\alpha_{steel} = 11.6 \times 10^{-6}/°C$; $\alpha_{brass} = 18.7 \times 10^{-6}/°C$. **(06 Marks)**

Module-2

3 a Derive an expression for normal stress, shear stress and resultant stress on an oblique plane inclined at an angle θ with vertical axis (x-plane) in a biaxial stress system subjected to σ_x, σ_y and τ_{xy} also find angle of obliquity ϕ. **(10 Marks)**

b. Derive expressions for hoop stress and longitudinal stress for a thin cylinder subjected to internal fluid pressure. **(06 Marks)**

OR

4 a. A point in a strained material in subjected to a tensile stress of 500N/mm^2 and 300N/mm^2 in two mutually perpendicular planes and also these planes carries a shear stress of 100N/mm^2. Calculate the normal, tangential, resultant stresses (σ_θ, τ_θ, σ_r) on a plane making an angle of 30° with the vertical axis (x-plane). Also find principal stresses. **(10 Marks)**

b. A thin cylindrical shell 1.2m in diameter and 3m long has a metal wall thickness of 12mm. It is subjected to an internal pressure of 3.2MPa. Find the circumferential and longitudinal stress in the wall. Also determine change in volume of the cylinder. Assume E = 210 GPA and $\mu = 0.30$. **(06 Marks)**

Module-3

5 For the beam shown in Fig. Q5. Draw shear force and bending moment diagrams. Locate the point of contraflexure if any. **(16 Marks)**

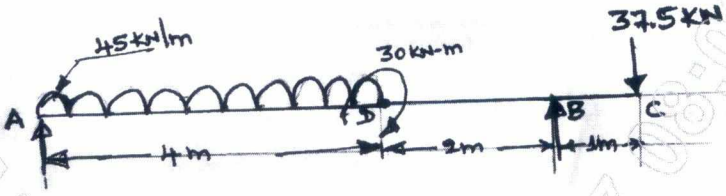

Fig Q5

OR

6 a. Derive the relationship between load shear force and bending moment for UDL. **(04 Marks)**

b. List the assumptions made in theory of pure bending. Write the bending equation with usual notations with their meanings. **(06 Marks)**

c. Derive an expression relating slope, deflection and radius of curvature in a beam in terms of E, I an M with usual notations. **(06 Marks)**

Module-4

7 a. State the assumption made in pure torsion and derive $\frac{T}{J_p} = \frac{G\theta}{L} = \frac{\tau}{R}$ with usual meanings. **(08 Marks)**

b. A 1.5m long column has circular cross section of 50mm diameter. One end of the column is fixed in direction and position and the other end is free. Taking the factor of safety as 3 calculate :

i) Safe load according to Rankine's formula taking $\sigma_c = 560MPa$ and $\alpha = \frac{1}{1600}$

ii) Safe load according to Euler's formula taking E = 120GPa. **(08 Marks)**

OR

8 a. State the assumptions made while deriving Euler's column formula. Also derive Euler's expression of buckling load for column with both ends hinged. **(08 Marks)**

b. A solid circular shaft has to transmit a power of 1000 kW at 120rpm. Find the diameter of the shaft if the shear stress of the material must not exceed $80N/mm^2$. The maximum torque is 1.25 times the mean torque. If this solid shaft is replaced by hollow one whose internal diameter is 0.6 times its external diameter, find diameter of hollow shaft. **(08 Marks)**

Module-5

9 a. Explain: i) Castigliano's first theorem ii) Castigliano's second theorem. **(08 Marks)**

b. Write a note on :

i) Maximum principal stress theory ii) Maximum shear stress theory. **(08 Marks)**

OR

10 a. A hollow circular shaft of 2m length has an external diameter of 100mm and a thickness of 10mm. If it is subjected to a torque of 10kN-m, determine the strain energy stored in the shaft. Take G= 80Gpa. **(04 Marks)**

b. The plane state of stress at a point is given $\sigma_x = 70MPa$; $\sigma_y = 140MPa$; $\tau_{xy} = -35MPa$. If the yielding stress in tension in 175MPa, check whether there is failure according to

i) Maximum principal stress theory

ii) Maximum shear stress theory

If the material is safe then find the factor of safety. **(12 Marks)**

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CBCS Scheme

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15ME35A

Third Semester B.E. Degree Examination, Dec.2017/Jan.2018
Metal Casting and Welding

Time: 3 hrs. Max. Marks: 80

Note: *Answer 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. **(06 Marks)**
b. What is Pattern? What are the functions of pattern? **(04 Marks)**
c. What are the different allowance given to the pattern? Explain briefly. **(06 Marks)**

OR

2 a. What are the ingredients of moulding sand? Explain briefly. **(04 Marks)**
b. With a neat sketch, explain Shell moulding process. **(06 Marks)**
c. Describe the working operation of squeeze type moulding machine. **(06 Marks)**

Module-2

3 a. What are the zones in cupola? With a neat sketch, explain cupola furnace. **(08 Marks)**
b. What is the principle of Electric Arc Furnace? Explain with sketch. **(08 Marks)**

OR

4 a. Differentiate between Gravity and pressure die casting. **(04 Marks)**
b. With a neat sketch, explain the working principle of Hot – Chamber die casting method. **(06 Marks)**
c. Explain with neat sketch, Centrifugal casting process. **(06 Marks)**

Module-3

5 a. Define Solidification. **(02 Marks)**
b. Explain Nucleation process in Solidification of metals. **(06 Marks)**
c. What is Degasification in liquid metals? Explain the methods of Degasification, with neat sketches. **(08 Marks)**

OR

6 a. Explain briefly Sand Casting defects. **(04 Marks)**
b. What are the advantages and limitations of Aluminum castings? **(06 Marks)**
c. Sketch and explain Stir casting setup. **(06 Marks)**

Module-4

7 a. How welding process is classified? **(04 Marks)**
b. Explain with sketch, principle of Flux Shielded Metal Arc Welding. **(06 Marks)**
c. Explain Submerged Arc Welding. **(06 Marks)**

OR

8 a. Explain principle of Resistance Welding. **(04 Marks)**
b. With a neat sketches, explain : i) Spot Welding ii) LASER Welding. **(08 Marks)**
c. Explain Thermit Welding. **(04 Marks)**

Module-5

9 a. Explain different zones which are formed during welding process. **(08 Marks)**

b. What are Welding defects? Explain the methods to detect the welding defects. **(08 Marks)**

OR

10 a. Differentiate between Soldering and Brazing. **(04 Marks)**

b. Explain with a sketch, Principle of Oxy – Acetylene Welding. **(06 Marks)**

c. Explain the methods used for Inspection of casting and welding. **(06 Marks)**

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15ME35B

Third Semester B.E. Degree Examination, Dec.2017/Jan.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. What is Drilling, sketch and explain the common parts of a Radial Drilling Machine. **(08 Marks)**

b. Define Milling. Differentiate between up milling and down milling with neat sketch. **(08 Marks)**

OR

2 a. With a suitable sketch, explain the working principle of centerless grinding Machine. **(08 Marks)**

b. List out the differences between shaper and planer. **(08 Marks)**

Module-2

3 a. With a suitable, sketch, explain the following milling operations.
i) Gang milling ii) Saw milling. **(08 Marks)**

b. Draw and explain the following operations using drilling machine.
i) Reaming ii) Counter Boring. **(08 Marks)**

OR

4 a. Describe the properties of the cutting tool materials and types of cutting tool materials. **(08 Marks)**

b. A work piece of diameter 38mm and Length 400mm was turned on a lathe using a suitable cutting tool. Determine the machining time to reduce the work piece to 36.5mm diameter is one pass with cutting speed of 30mpm and forced 0.7mm/rev. **(08 Marks)**

Module-3

5 a. With suitable sketch, elaborate the types of operations performed on a Turret Lathe. **(08 Marks)**

b. Sketch and explain in brief the process of Gear milling and thread milling operations. **(08 Marks)**

OR

6 a. What is Grinding, with a suitable sketch, Describe vertical spindle grinding machine, with reciprocating table. **(08 Marks)**

b. State the functions of cutting fluid. Briefly, explain the properties of cutting fluids. **(08 Marks)**

Module-4

7 a. Define Indexing. With suitable sketch describe simple indexing mechanisms. **(08 Marks)**

b. Draw and explain the driving mechanism of a bench drilling machine. **(08 Marks)**

OR

8 a. Define the following terms :
   i) Cutting speed
   ii) Feed
   iii) Depth of cut
   iv) Machining time with equations for turning operations. **(08 Marks)**

   b. Calculate the required rpm of work piece of 100mm diameter to provide a cutting speed to 50mpm. Also find machining time of length of work is 400mm and feed is 0.4mm/rev. **(08 Marks)**

Module-5

9 a. What do you mean by the term chip formation? Describe types of chips with a neat sketch. **(08 Marks)**

   b. With a suitable sketch. Describe orthogonal and oblique cutting operations. **(08 Marks)**

OR

10 a. Define Tool wear. Explain the following terms :
   i) Crater wear
   ii) Flank wear **(08 Marks)**

   b. Explain the terms Tool failure and Tool life. Describe the effects of cutting parameter on Tool life. **(08 Marks)**

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CBCS Scheme

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15MEB306/15ME36B

Third Semester B.E. Degree Examination, Dec.2017/Jan.2018
Mechanical Measurement and Metrology

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. With neat sketches, explain the material length standards. **(08 Marks)**

b. Mention the methods of measurement with suitable example to each method. **(08 Marks)**

OR

2 a. Using M112 slip gauge set build the following dimensions with minimum number of slip gauges:
(i) 49.3115 (ii) 78.3665 **(08 Marks)**

b. Explain with a neat sketch working principle of sine bar and mention its limitation. **(08 Marks)**

Module-2

3 a. Distinguish between interchangeability and selective assembly. **(06 Marks)**

b. How are plain gauges classified? **(04 Marks)**

c. State and explain Taylor's principle of gauge design. **(06 Marks)**

OR

4 a. Mention the functional requirements of comparators. **(06 Marks)**

b. With a neat sketch, explain the construction and working of Johanson's Mikrokator. **(10 Marks)**

Module-3

5 a. With a neat sketch of a screw thread mention the screw thread parameters and define each one of them. **(08 Marks)**

b. Give the applications of Toolmaker's microscope and with neat sketch show its principal parts. **(08 Marks)**

OR

6 a. Define the following Gear teeth Terminology:
(i) Pitch circle diameter.
(ii) Pressure angle.
(iii) Addendum.
(iv) Dedendum.
(v) Module.
(vi) Diametral pitch.
(vii) Involute.
(viii) Circular pitch. **(08 Marks)**

b. Give the application of CMM and explain the working principle and construction of CMM. **(08 Marks)**

Module-4

7 a. Define the following terms:
   (i) Calibration
   (ii) Repeatability
   (iii) Accuracy
   (iv) Precision
   (v) Reproduceability
   (vi) Linearity
   (vii) System response
   (viii) Sensitivity **(08 Marks)**

   b. Explain any two types of electrical transducers. **(08 Marks)**

OR

8 a. Explain electronic amplifier with a neat sketch. **(08 Marks)**

   b. With a neat sketch, explain the principle and working of stylus type oscillograph. **(08 Marks)**

Module-5

9 a. Explain with a neat sketch unequal arm balance. **(08 Marks)**

   b. With a neat sketch, explain the principle and working of pirani gauge. **(08 Marks)**

OR

10 a. What is a thermo couple? Explain the working principle of a thermocouple with a neat sketch. **(08 Marks)**

   b. Define gauge factor of a strain gauge and explain with a neat sketch measurement of strain using wheat stone bridge circuit. **(08 Marks)**

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CBCS SCHEME

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15MATDIP31

Third Semester B.E. Degree Examination, Dec.2017/Jan.2018
Additional Mathematics – I

Time: 3 hrs. Max. Marks: 80

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

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.

Module-1

1 a. Express complex numbers $\frac{(5-3i)(2+i)}{4+2i}$ in the form a + ib. **(06 Marks)**

b. If $x = \cos\theta + i\sin\theta$, then show that $\frac{x^{2n}-1}{x^{2n}+1} = i\tan\theta$ **(05 Marks)**

c. Prove that the area of the triangle whose vertices are A, B, C is $\frac{1}{2}[B\times C + C\times A + A\times B]$. **(05 Marks)**

OR

2 a. Find the cube root of $\sqrt{3} + i$. **(06 Marks)**

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

c. Prove that the vectors $i - 2j + 3k$, $-2i + 3j - 4k$ and $i - 3j + 5k$ are coplanar. **(05 Marks)**

Module-2

3 a. Find the n^{th} derivative of $e^{ax}\sin(bx + c)$. **(06 Marks)**

b. If $y = e^{a\sin^{-1}x}$, prove that $(1-x^2)y_{n+2} - (2n+1)xy_{n+1} - (n^2+a^2)y_n = 0$ **(05 Marks)**

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

OR

4 a. Find the pedal equation $r = a(1 + \cos\theta)$. **(06 Marks)**

b. Expand $\tan x$ in ascending powers of x. **(05 Marks)**

c. If $u = x + y + z$, $v = y + z$, $w = z$ then find $\frac{\partial(u,v,w)}{\partial(x,y,z)}$ **(05 Marks)**

Module-3

5 a. Evaluate $\int_0^{\pi/2}\sin^n x\,dx$. **(06 Marks)**

b. Evaluate $\int_0^a \frac{x^3}{\sqrt{a^2-x^2}}dx$. **(05 Marks)**

c. Evaluate $\int_1^2\int_1^3 xy^2\,dxdy$ **(05 Marks)**

OR

6 a. Evaluate $\int_0^1 \int_0^2 \int_1^2 x^2 yz \, dx \, dy \, dz$ **(06 Marks)**

b. Evaluate $\int_0^{\pi/6} \cos^4 3x \, dx$. **(05 Marks)**

c. Evaluate $\int_0^2 \frac{x^4}{\sqrt{4-x^2}} dx$. **(05 Marks)**

Module-4

7 a. A 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 $t = 1$ in the direction $i - 3j + 2k$. **(06 Marks)**

b. Find the unit vector normal to the surface $x^2 - y^2 + z = 2$ at the point $(1, -1, 2)$. **(05 Marks)**

c. Show that the vector $f = (2x - 5y)i + (x - y)j + (3x - z)k$ is a solenoidal. **(05 Marks)**

OR

8 a. If $f(x, y, z) = 3x^2y - y^3z^2$ then find grad f at the point $(1, -2, -1)$. **(06 Marks)**

b. Evaluate (i) div R, (ii) curl R, if $R = xi + yj + zk$. **(05 Marks)**

c. Find a, if $(axy - z^2)i + (x^2 + 2yz)j + (y^2 - axz)k$ is an irrotational vector. **(05 Marks)**

Module-5

9 a. Solve $(x^2 + y^2)dx + 2xydy = 0$ **(06 Marks)**

b. Solve $(e^x + 1)\cos x \, dx + e^y \sin x \, dy = 0$ **(05 Marks)**

c. Solve $(1 + xy)ydx + (1 - xy)xdy = 0$ **(05 Marks)**

OR

10 a. Solve $(x \log x)\frac{dy}{dx} + y = 2 \log x$ **(06 Marks)**

b. Solve $(x + 2y^3)\frac{dy}{dx} = y$ **(05 Marks)**

c. Solve $(1 + e^{x/y})dx + e^{x/y}\left(1 - \frac{x}{y}\right)dy = 0$ **(05 Marks)**

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