CBCS SCHEME

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18MAT41

Fourth Semester B.E. Degree Examination, June/July 2023
Complex Analysis, Probability and Statistical Methods

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Find analytic function u + iv, where u is given to be $u = e^x[(x^2 - y^2)\cos y - 2xy \sin y]$. **(06 Marks)**

b. Derive Cauchy Reimann equations in polar form. **(07 Marks)**

c. Show that $u = e^{2x}[x\cos 2y - y\sin 2y]$ is harmonic. Find the analytic function f(z) = u + iv. **(07 Marks)**

OR

2 a. Derive Cauchy Reimann equation in Cartesian form. **(06 Marks)**

b. Determine analytic function f(z) = u + iv if $u - v = e^x[\cos y - \sin y]$. **(07 Marks)**

c. Show that $w = z^n$ is analytic and hence find its derivative. **(07 Marks)**

Module-2

3 a. Discuss the transformation $w = z + \frac{1}{z}, z \neq 0$. **(06 Marks)**

b. Find the Bilinear transformation which maps the points z = 1, i, -1 onto w = 0, 1, ∞. **(07 Marks)**

c. Evaluate $\int_0^{2+i} (\bar{z})^2 \, dz$ along i) line y = x/2 ii) real axis to 2 and then vertically to 2 + iy. **(07 Marks)**

OR

4 a. Discuss the transformation $w = z^2$. **(06 Marks)**

b. State and prove Cauchy's integral formula $f(a) = \frac{1}{2\pi i}\int_C \frac{f(z)}{(z-a)} dz$. **(07 Marks)**

c. Evaluate using Cauchy's integral formula.

$\int_C \frac{e^{2z}}{(z-1)(z-2)} dz \quad C: |z| = 3$. **(07 Marks)**

Module-3

5 a. Define: i) Random variable ii) Discrete probability distribution with an example. **(06 Marks)**

b. The probability that man aged 60 will live upto 70 is 0.65. What is the probability that out of 10 men, now aged 60 i) Exactly 9 ii) atmost 9 iii) Atleast 7 will live up to age of 70 years. **(07 Marks)**

c. In a normal distribution, 3% of items are under 45 and 8% are over 64. Find the mean and standard deviation, given that A(0.5) = 0.19 and A(1.4) = 0.42. **(07 Marks)**

OR

6 a. The probability distribution of a finite random variable X is given by

X :	-2	-1	0	1	2	3
P(x) :	0.1	K	0.2	2K	0.3	K

Find 'K', mean and variance of X. **(06 Marks)**

b. If probability of bad reaction from certain injection is 0.001. Determine the chance that out of 2000 individuals more than two will get bad reaction, and less than two will get bad reaction. **(07 Marks)**

c. The frequency of accidents per shift in a factory is shown in the following table:

Accidents per shift	0	1	2	3	4
Frequency	192	100	24	3	1

Calculate mean numbers of accidents per shift. Find the corresponding Poisson distribution. **(07 Marks)**

Module-4

7 a. Fit a second degree parabola $y = a + bx + cx^2$ for the following data:

x	0	1	2	3	4	5
y	1	3	7	3	21	31

(06 Marks)

b. Find the coefficient of correlation, lines of regression of x on y and y on x. Given,

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

(07 Marks)

c. If θ is an acute angle between line of regression, then show that $\tan\theta = \frac{\sigma x}{\sigma_x^2 + \sigma_y^2}\left(\frac{1-r^2}{r}\right)$.

Indicate the significance of the cases $r = 0$ and $r = \pm 1$. **(07 Marks)**

OR

8 a. Fit the curve of the form ax^b and hence estimate y when x = 8.

x	5	10	15	20	25	30	35
y	2.76	3.17	3.44	3.64	3.81	3.95	4.07

(06 Marks)

b. Find the rank correlation coefficient for the following data:

x	93	44	53	08	71	81	6	10	32	31
y	45	62	12	28	92	84	73	3	51	32

(07 Marks)

c. With the usual notations compute $\bar{x}$, $\bar{y}$ and r from the following lines of regression:
$y = 0.516x + 33.73$ and $x = 0.512y + 32.52$. **(07 Marks)**

Module-5

9 a. The joint probability distribution for following data

X / Y	-2	-1	4	5
1	0.1	0.2	0	0.3
2	0.2	0.1	0.1	0

Determine the marginal distributions of X and Y also calculate E(x), E(y), COV (xy). **(06 Marks)**

b. Define: i) Null hypothesis ii) Confidence limits iii) Type I, Type II errors. **(07 Marks)**

c. The following table gives the distribution of digits in the numbers chosen at random from a telephone directory:

Digits	0	1	2	3	4	5	6	7	8	9
Frequency	1026	1107	997	966	1075	933	1107	972	964	853

Test whether the digits may be taken to occur equally frequently in the directory. (given $\chi^2_{0.05} = 16.92$ at n = 9). **(07 Marks)**

OR

10 a. A fair coin is tossed thrice. The random variable X and Y are defined as follows. X = 0 or 1 according as head or tail occurs on first loss, Y = number of heads.
   i) Determine distribution of X and Y.
   ii) Joint probability distribution of X and Y.
   iii) Expectation of X, Y and XY. **(06 Marks)**

b. It is claimed that a random sample of 49 tyres has a mean life of 15200km. Is the sample drawn from population whose mean is 15,150km and standard deviation is 200km? Test the significance level at 0.05 level. **(07 Marks)**

c. Ten individuals are choosen at random from the population and their height in inches are found to be 63, 63, 66, 67, 68, 69, 70, 70, 71, 71. Test the hypothesis that the mean height of universe is 66′ (value of $t_{0.05} = 2.262$ for 9.D.F). **(07 Marks)**

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18MATDIP41

Fourth Semester B.E. Degree Examination, June/July 2023
Additional Mathematics – II

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 rank of the matrix by applying elementary row operations :

$$A = \begin{bmatrix} 0 & 2 & 3 & 4 \\ 2 & 3 & 8 & 4 \\ 4 & 8 & 13 & 12 \end{bmatrix}$$ **(06 Marks)**

b. Test for consistency and solve the system :

$x + y + z = 6$
$x - y + 2z = 5$
$3x + y + z = 8.$ **(07 Marks)**

c. Find the eigen value and the corresponding eigen vectors of the matrix :

$$A = \begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}.$$ **(07 Marks)**

OR

2 a. Reduce the matrix A to the echelon firm, where

$$A = \begin{bmatrix} 2 & -1 & -3 & -1 \\ 1 & 2 & 3 & -1 \\ 1 & 0 & 1 & 1 \\ 0 & 1 & 1 & -1 \end{bmatrix}.$$ **(06 Marks)**

b. Find the values of λ and μ such that the system

$x + y + z = 6$
$x + 2y + 3z = 10$
$x + 2y + \lambda z = \mu$

may have
i) unique solution
ii) infinite solution
iii) no solution. **(07 Marks)**

c. Solve :

$2x + y + 4z = 12$
$4x + 11y - z = 33$
$8x - 3y + 2z = 20$

By Gauss elimination method. **(07 Marks)**

Module-2

3 a. The area of a circle (A) corresponding to diameter (D) is given in the following table :

D	80	85	90	95	100
A	5026	5674	6362	7088	7854

Find the area when D = 105 using an appropriate interpolation formula. **(06 Marks)**

b. Find the real root of the equation cos x = 3x – 1 correct to three decimal places using Regula – Falsi method. **(07 Marks)**

c. Evaluate $\int_0^1 \frac{x\,dx}{1+x^2}$ using Weddle's rule. Take seven ordinates. **(07 Marks)**

OR

4 a. Find $u_{0.5}$ from the data $u_0 = 225$, $u_1 = 238$, $u_2 = 320$, $u_3 = 340$ by using an appropriate interpolation formula. **(06 Marks)**

b. Use Newton – Raphson method to find a real root of the equation $x^3 + 5x - 11 = 0$ correct to the three decimal places. **(07 Marks)**

c. Using Simpson's $1/3^{rd}$ rule, evaluate $\int_0^1 \frac{dx}{1+x^2}$ by dividing the interval [0, 1] into six equal parts. Hence deduce the value of $\log_e 2$. **(07 Marks)**

Module-3

5 a. Solve $(D^3 - 6D^2 + 11D - 6)\,y = 0$. **(06 Marks)**

b. Solve $(D^2 - 4)y = \cos h\,(2x - 1) + 3^x$. **(07 Marks)**

c. Solve $\frac{d^2y}{dx^2} + 3\frac{dy}{dx} + 2y = 4\cos^2 x$. **(07 Marks)**

OR

6 a. Solve $\frac{d^3y}{dx^3} + y = 0$. **(06 Marks)**

b. Solve $y'' + 9y = \cos 2x \cdot \cos x$ **(07 Marks)**

c. Solve $y'' - (a + b)y' + aby = e^{ax} + e^{bx}$. **(07 Marks)**

Module-4

7 a. Form a partial differential equation by eliminating the arbitrary constants in $ax^2 + by^2 + z^2 = 1$. **(06 Marks)**

b. Form the partial differential equation by eliminating the arbitrary function from $\ell x + my + nz = \phi(x^2 + y^2 + z^2)$. **(07 Marks)**

c. Solve $\frac{\partial^2 z}{\partial x^2} = a^2 z$, given that when x = 0, z = 0 and $\frac{\partial z}{\partial x} = a \sin y$. **(07 Marks)**

OR

8 a. Form a partial differential equation by eliminating the arbitrary constructs from :

$z = xy + y\sqrt{x^2 - a^2} + b$. **(06 Marks)**

b. Solve $\frac{\partial^2 z}{\partial x^2} = x + y$ by direct integration. **(07 Marks)**

c. Solve $\frac{\partial^2 z}{\partial y^2} = z$, given that $z = 0$, $\frac{\partial z}{\partial y} = \sin x$, when $y = 0$. **(07 Marks)**

Module-5

9 a. Define :
i) Sample space
ii) Mutually exclusive events
iii) Mutually independent events. **(06 Marks)**

b. A box contains 4 black, 5 white and 6 red balls. If 2 balls are drown at random, what is the probability that :
i) both are red
ii) one black and one white. **(07 Marks)**

c. State and prove Baye's theorem. **(07 Marks)**

OR

10 a. If A and B are events with $P(A \cup B) = \frac{7}{8}$, $P(A \cap B) = \frac{1}{4}$ and $P(A \cap \bar{B}) = \frac{1}{3}$.
Find :
i) P(A)
ii) P(B)
iii) $P(\bar{A} \cap B)$. **(06 Marks)**

b. A problem is given to four students A, B, C, D whose chances of solving it are $\frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \frac{1}{5}$ respectively. Find the probability that the problem is solved. **(07 Marks)**

c. Three machines A, B and C produce 50%, 30% and 20% of the items in a factory. The percentage of defective outputs of these machines are 3, 4, and 5 respectively. If an item is selected at random, what is the probability that it is defective? If a selected item is defective, what is the probability that it is from machine A? **(07 Marks)**

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18ME42

Fourth Semester B.E. Degree Examination, June/July 2023
Applied Thermodynamics

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Define the following terms :
(i) Compression ratio.
(ii) Cut off ratio.
(iii) Thermal efficiency.
(iv) Relative efficiency. **(04 Marks)**

b. Derive an expression for air standard efficiency of a diesel cycle. **(08 Marks)**

c. Calculate the loss in the ideal efficiency of a diesel engine with compression ratio 14 if the cut off ratio is delayed from 5% to 8%. **(08 Marks)**

OR

2 a. What do you mean by detonation? Name the factors affecting detonation. **(04 Marks)**

b. With a P-θ diagram describe the stages of combustion in CI engine. **(08 Marks)**

c. During a 60 minutes trial on a single cylinder oil engine having cylinder dia 300 mm, stroke 450 mm and working on two stroke cycle. The following observations were made :
Total fuel used = 9.6 ltr, Heating value of fuel = 45000 kJ/kg,
Total number of revolution = 12624, Gross mep = 7.24 bar,
Pumping mep = 0.34 bar, Net brake load = 3150 N
Brake drum dia = 1.78 m, Rope dia = 40 mm
Cooling water circulated = 545 ltr
Cooling water temperature rise = 25 $^{\circ}$C
Specific gravity of oil = 0.8
Determine : IP, BP, mechanical efficiency and Draw the Heat balance sheet. **(08 Marks)**

Module-2

3 a. Explain Brayton cycle with line diagram, P-V diagram and derive an expression for pressure ratio for maximum work. **(10 Marks)**

b. A gas turbine unit has a pressure ratio of 6 : 1 and maximum cycle temperature of 610 $^{\circ}$C. The Isentropic efficiencies of compressor and Turbine are 0.8 and 0.82 respectively. Calculate the power output in kW of an electric generator geared to the turbine when the air enters the compressor at 15 $^{\circ}$C at the rate of 16 kg/sec.
Take C_P = 1.005 kJ/kg, γ = 1.4 for air.
C_P = 1.11 kJ/kg, γ = 1.333 for gas. **(10 Marks)**

OR

4 a. Explain the methods for the improvement of thermal efficiency of a open cycle gas turbine. **(10 Marks)**

b. Explain the following jet propulsion system :
(i) Ramjet Engine (ii) Rocket Engine. **(10 Marks)**

Module-3

5 a. Why Carnot cycle is practically not possible? **(04 Marks)**

b. State the advantages of regenerative cycle over Rankine cycle. **(04 Marks)**

c. Explain with sketch, the parameters affecting the Rankine cycle. **(12 Marks)**

OR

6 a. Explain with sketch, T-S and S-H diagram, the regenerative Rankine cycle. **(10 Marks)**

b. A simple Rankine Cycle works between pressure 30 bar and 0.04 bar, the initial condition of steam being dry saturated. Calculate the cycle efficiency, work ratio and specific steam consumption. **(10 Marks)**

Module-4

7 a. For a reversed Brayton cycle show that $COP = \frac{1}{r_P^{\gamma-1}} - 1$. **(10 Marks)**

b. With neat diagram, explain steam jet refrigeration. **(10 Marks)**

OR

8 a. Define the following terms :

(i) Dry bulb temperature
(ii) Dew point temperature
(iii) Specific humidity
(iv) Relative humidity
(v) Degree of saturation **(10 Marks)**

b. The atmospheric conditions are 20°C and specific humidity of 0.0095 kJ/kg of dry air. Calculate :

(i) Partial pressure of water vapour
(ii) Relative humidity **(10 Marks)**

Module-5

9 a. Derive an expression for isothermal efficiency of a single stage air compressor. **(10 Marks)**

b. An air compressor takes in air at 1 bar and 30°C compresses it according to the law $PV^{1.2} = C$. Air is delivered to a receiver at a constant pressure of 10 bar, determine temperature at the end of compression, WD and Heat transferred during compression/kg air. Neglect clearance. Take R = 0.287 kJ/kgK. **(10 Marks)**

OR

10 a. Define steam Nozzle and Name the types of nozzle. **(04 Marks)**

b. With a neat sketch, describe the working of a steam injector. **(06 Marks)**

c. Steam approaches a nozzle with a velocity of 250 m/s, 3.5 bar and dryness fraction 0.95. If the back pressure is 2 bar, assuming flow to be isentropic, find the final condition of steam and drop in Enthalpy. Also find the exit velocity and the area at exit of steam nozzle if the flow rate is 2700 kg/h. **(10 Marks)**

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18ME43

Fourth Semester B.E. Degree Examination, June/July 2023
Fluid Mechanics

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Define the following properties of fluids and write their SI units:
(i) Specific weight (ii) Kinematic viscosity (iii) Specific volume **(06 Marks)**

b. Define surface tension of a fluid. Derive an expression for surface tension of a :
(i) liquid droplet (ii) Liquid jet **(06 Marks)**

c. The dynamic viscosity of an oil used for lubrication between a shaft and sleeve is 6 poise. The shaft is of diameter 0.4 m. It rotates at 190 rpm. Calculate the power lost in the bearing for a sleeve length of 90 mm. The thickness of the oil film is 1.5 mm. **(08 Marks)**

OR

2 a. State and prove Pascal's law. **(06 Marks)**

b. Derive an expression for total pressure and depth of centre of pressure for a vertical surface submerged in water. **(06 Marks)**

c. Determine the total pressure and centre of pressure on an isosceles triangular plate of base 4 m and altitude 4m when it is immersed vertically in an oil of specific gravity 0.9. The base of the plate coincides with the free surface of oil. **(08 Marks)**

Module-2

3 a. Define:
(i) Buoyancy (ii) Centre of Buoyancy
(iii) Meta centre (iv) Meta centric height **(08 Marks)**

b. Explain the method to find the metacentric height experimentally. **(06 Marks)**

c. A block of wood of specific gravity 0.7 floats in water. Determine the metacentric height of the block if its size is 2m × 1m × 0.8m. **(06 Marks)**

OR

4 a. Differentiate between:
(i) Steady and unsteady flow
(ii) Laminar and turbulent flow
(iii) Compressible and incompressible flow **(06 Marks)**

b. Derive the continuity equation in three dimensional Cartesian coordinates for a steady, incompressible fluid flow. **(08 Marks)**

c. The diameter of a pipe at sections 1 and 2 are 10 cm and 15 cm respectively. Find the discharge through the pipe if the velocity of water at section 1 is 5 m/s. Determine also the velocity at section 2. **(06 Marks)**

Module-3

5 a. Derive Euler's equation of motion along a stream line. Deduce Bernoulli's equation from Euler's equation. State the assumptions made. **(10 Marks)**

b. A pipe line carrying oil of specific gravity 0.87 changes in diameter from 200 mm at a position A to 500 mm at a position B which is 4 m at higher level. If the pressure at A and B are 10 N/cm^2 and 6 N/cm^2 respectively and the discharge is 200 litres/s. determine the loss of head and the direction of fluid flow. **(10 Marks)**

OR

6 a. Derive Hagen-Posseuille's equation for laminar flow through a circular pipe. **(12 Marks)**

b. Water at 15°C flows between two parallel plates at a distance of 1.6 mm apart. Determine: (i) Maximum velocity (ii) Pressure loss per unit length (iii) Shear stress at the plate if the average velocity is 0.2 m/s. Viscosity of water at 15°C is 0.01 Poise. Take unit width of the plate. **(08 Marks)**

Module-4

7 a. Define the following with respect to boundary layer:
(i) Boundary layer thickness (ii) Displacement thickness
(iii) Momentum thickness (iv) Energy thickness **(08 Marks)**

b. Define Drag and Lift. **(04 Marks)**

c. A flat plate 2m × 2m movers with a velocity of 50 km/hr in air of density 1.15 kg/m^3. If the coefficient of list and drag are 0.75 and 0.15 respectively, calculate:
(i) Drag force (ii) Lift force
(iii) Resultant force (iv) Power exerted on the plate **(08 Marks)**

OR

8 a. Explain the following similarities:
(i) Geometric similarity
(ii) Kinematic similarity
(iii) Dynamic similarity **(10 Marks)**

b. The frictional torque T of a disc of diameter D rotating at a speed N in a fluid of viscosity μ and density ρ in a turbulent flow is given by $T = \rho N^2 D^5 \phi\left[\frac{\mu}{\rho N D^2}\right]$. Prove this by using Buckingham's π - theorem method. **(10 Marks)**

Module-5

9 a. Define Mach number. Explain the significance of Mach number in compressible fluid flow. **(06 Marks)**

b. Derive an expression for the velocity of a sound wave in a compressible fluid in terms of change of pressure and change of density. **(08 Marks)**

c. A projectile travel in air of pressure 10.1043 N/cm^2 at 10°C at a speed of 1500 km/hr. Find the Mach number and Mach angle. Take $\gamma = 1.4$ and R = 287 J/kgK. **(06 Marks)**

OR

10 a. Define stagnation temperature and stagnation pressure. Derive the relation between them in terms of Mach number. **(08 Marks)**

b. What is CFD? Mention the applications of CFD. **(06 Marks)**

c. List any six limitations of CFD. **(06 Marks)**

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18ME44

Fourth Semester B.E. Degree Examination, June/July 2023
Kinematics of Machines

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Define the following :
i) Link ii) Kinematic pair iii) Mechanism iv) Degree of freedom v) Inversion **(10 Marks)**

b. Explain with a neat sketch, the crank and slotted lever mechanism. **(10 Marks)**

OR

2 a. What is completely constrained motion and partially constrained motion? Explain with example. **(05 Marks)**

b. State Grashoff's law and list inversions of Grashoff's chain. **(05 Marks)**

c. With a neat sketch explain, Ackermann steering gear mechanism. **(10 Marks)**

Module-2

3 a. In a slider crank mechanism, the crank OB is 30mm long and the connecting rod BC is 120mm long. The crank rotates at a uniform speed of 300 rpm clockwise about center 'O'. For a crank position BOC equal to 60° draw the configuration and find
(i) Velocity of piston C and angular velocity of connecting rod BC.
(ii) Acceleration of piston C and angular acceleration of connecting rod BC. **(16 Marks)**

b. Define instantaneous center and state the types of instantaneous centers. **(04 Marks)**

OR

4 a. State and prove Kennedy's theorem. **(08 Marks)**

b. A four bar mechanism ABCD has AB = 20cm, BC = 30cm, CD = 32 cm and AD = 60cm. Crank AB rotates at a uniform speed of 300 r.p.m in anticlockwise direction. When the crank AB has turned 60°, locate all the instantaneous centers and find the angular velocity of link BC, where AD is fixed. **(12 Marks)**

Module-3

5 a. What is meant by Loop-Closure equation? Deduce the loop closure equation for the closed loop of a four bar mechanism. **(10 Marks)**

b. The crank of an engine is 50 cm long and the connecting rod length to crank radius is 4. Determine the velocity of the piston, when the crank has turned through 40° from top dead center position. The crank is rotating at 100 rad/sec in clockwise direction. By complex algebra analysis method, find out the velocity of the piston. **(10 Marks)**

OR

6 a. Explain the following with a diagram wherever required:
i) Function generation
ii) Precision points
iii) Structural error
iv) Mechanical error **(08 Marks)**

b. A schematic of a four bar mechanism with input link 'a' and output link 'c' is shown in Fig.Q6(b). The angles θ and ϕ for three successive positions are given in the table below:

Angles	1	2	3
θ	55	25	-25
ϕ	110	40	-50

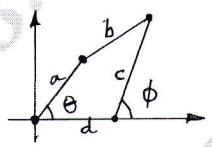

Fig.Q6(b)

If the length of the grounded link 'd' is 40mm, using Frendenstein's equation, find out length of other links to satisfy the given positional conditions. **(12 Marks)**

Module-4

7 A cam with 30mm as minimum radius is rotating clockwise at a uniform speed of 1200 rpm and has to give the motion to the knife edge follower as follows:
i) Follower to move outward through 30mm during 120° of CAM rotation with SHM.
ii) Dwell for the next 60°.
iii) Follower to return to its starting position during the next 90° with SHM.
iv) Dwell for the remaining period.
Draw the CAM profile when the follower axis passes through CAM axis. Also find the maximum velocity and acceleration during the outward and return stroke. **(20 Marks)**

OR

8 A cam rotating clockwise at uniform speed of 300 rpm operates a reciprocating follower through a roller 1.5 cm diameter. The follower motion is defined as below:
i) Outward during 150° with UARM
ii) Dwell for next 30°
iii) Return during next 120° with SHM.
iv) Dwell for the remaining period.
Stroke of the follower is 3cm. Minimum radius of cam is 3cm. Draw the cam profile when the follower axis passes through cam axis. **(20 Marks)**

Module-5

9 a. State and prove the law of gearing for constant velocity ratio. **(10 Marks)**
b. Two involute gears with number of teeth 28 and 45 are in mesh. If they have standard addendum of 3 mm and pressure angle is 20°, find the following ;
i) Path of approach ii) Path of recess iii) Contact ratio
Assume module is 3mm. **(10 Marks)**

OR

10 The arm C of an epicyclic gear train rotates at 100 rpm in anticlockwise direction. The arm carries two wheels A and B having 36 and 45 teeth respectively. The wheel A is fixed and the arm rotates about the center of wheel A. Find the speed of wheel B. What will be the speed of B, if wheel A instead of being fixed makes 200 rpm clockwise? **(20 Marks)**

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18ME46B/18MEB406

Fourth Semester B.E. Degree Examination, June/July 2023
Mechanical Measurements and Metrology

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Define Metrology. State the objectives of Metrology. **(05 Marks)**

b. Discuss with a neat sketch of International proto type meter. **(08 Marks)**

c. Define Standard in Measurement. How are the standards classified? Explain with example. **(07 Marks)**

OR

2 a. Identify different parts of sine center and explain how taper angles are measured. **(08 Marks)**

b. Describe the steps in wringing of slip gauges. **(04 Marks)**

c. Build the following dimensions using M – 87 set :
i) 49.3825mm ii) 87.3215mm. **(08 Marks)**

Module-2

3 a. Distinguish between Interchangeability and Selective assembly. **(06 Marks)**

b. Discuss 'Hole based' and 'Shaft based' system of fits with sketches. **(08 Marks)**

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

OR

4 a. Mention important functional requirements of a comparators. **(05 Marks)**

b. With a neat sketch, explain the construction and working of Johanson's Mikrokator. **(07 Marks)**

c. What is LVDT? With a diagram, explain the Operating principle / working and applications of LVDT. **(08 Marks)**

Module-3

5 a. Explain Terminology of screw thread. **(04 Marks)**

b. How do you find effective diameter of a screw thread using Two – Wire method? **(08 Marks)**

c. Explain Tool Maker's Microscope with a neat sketch. Give its applications. **(08 Marks)**

OR

6 a. Illustrate the construction and working of co-ordinate measuring machine. **(10 Marks)**

b. Explain Constant Chord Method of Tooth thickness measurement of gear. **(10 Marks)**

Module-4

7 a. With the aid of a block diagram, explain the three stages of a generalized measurement system. **(10 Marks)**

b. Discuss the terms with relevant sketches : i) Accuracy ii) Precision iii) Linearity iv) Calibration v) Threshold. **(10 Marks)**

OR

8 a. Mention any five Mechanical and five Electrical transducers. (05 Marks)
b. Describe in detail a ballast circuit. (07 Marks)
c. What are X – Y plotters? With block diagram, explain working of X – Y plotters. (08 Marks)

Module-5

9 a. Discuss the working of McLeod gauge. (10 Marks)
b. Explain the working of Prony brake dynamometer. (10 Marks)

OR

10 a. Summarize the laws of Thermocouple and Resistance Thermo meter with sketch. (10 Marks)
b. Define Gauge factor of a strain gauge and explain with a neat sketch, measurement of strain using wheat stone bridge circuit. (10 Marks)

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