Shirpur Education Society's

R. C. PATEL INSTITUTE OF TECHNOLOGY, SHIRPUR

An Autonomous Institute

(Affiliated to Dr. Babasaheb Ambedkar Technological University, Lonere)

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(स्वायत्त महाविद्यालय)

Academic Year (2024-25)

Year: Second **Semester: III** **Max. Marks: 60**

Program: SY B.Tech. ((ELECTRICAL ENGG.) **Time: 9 am To 11 am**

Subject: Engineering Mathematics for Electrical Engineering (RCP23LCPC301)

Date: 09/12/2024 **Duration: 2 Hours**

END SEM EXAMINATION –ODD SEM- III 2024-25 Regular

Instructions: Candidates should read carefully the instructions printed on the question paper and on the cover page of the Answer Book, which is provided for their use.

(1) This question paper contains 02 pages.

(2) All Questions are Compulsory.

(3) All questions carry equal marks.

(4) Answer to each new question is to be started on a fresh page.

(5) Figures in the brackets on the right indicate full marks.

(6) Assume suitable data wherever required, but justify it.

(7) Draw the neat labelled diagrams, wherever necessary.

Question No.		Max. Marks
Q1 (a)	Verify Cayley Hamilton theorem for A= $\begin{bmatrix} 3 & 10 & 5 \\ -2 & -3 & -4 \\ 3 & 5 & 7 \end{bmatrix}$ and hence find A^{-1}.	[07]
Q1 (b)	Show that the matrix A= $\begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}$ is diagonalizable and find the transforming matrix and diagonal matrix.	[08]
	OR	
	i) Find $f(A) = 4^A$, where A = $\begin{bmatrix} \frac{3}{2} & \frac{1}{2} \\ \frac{1}{2} & \frac{3}{2} \end{bmatrix}$.	[04]
	ii) Obtain the Complex form of Fourier series for $f(x) = e^{2x}, in\ (-\pi, \pi)$.	[04]
Q2 (a)	Obtain the Fourier series expansion for the function $f(x) = \frac{\pi - x}{2}, in\ (0, 2\pi)$. Hence deduce that $\frac{\pi}{4} = 1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7}$....	[07]
Q2 (b)	Obtain the Fourier series expansion for the function $f(x) = 4 - x^2, in\ (0, 2)$. Hence deduce that $\frac{\pi^2}{3} = -\frac{1}{1^2} - \frac{1}{2^2} - \frac{1}{3^2}$....	[08]
	OR	
	i) Show that $\{\sin x, \sin 3x, \sin 5x, \dots\} = \{\sin(2n+1)x, x = 0, 1, 2, 3, \dots\}$ is orthogonal over $\left[0, \frac{\pi}{2}\right]$.	[04]
	ii) Obtain the Half range Fourier sine series expansion for the function $f(x) = x(\pi - x), in\ (0, \pi)$.	[04]

Q3 (a)	Find the directional derivative of $\emptyset(x,y,z) = x^2y + y^2z + z^2x$ at (2,2,2) in the direction of the normal to the surface $4x^2y + 2z^2 = 2$ at the point (2,-1,3). **OR** Using Green's theorem evaluate $\int_C (xy + y^2)dx + x^2dy$ where C is the closed curve of the region bounded by $y = x$ and $y = x^2$.	[07] [07]
Q3 (b)	Find the bilinear transformation which maps the points (1, i, -1) in z plane onto the points (0, 1, ∞) in w plane. **OR** Find the analytic function $f(z) = u + iv$, whose real part is $u = e^x cosy - x^2 + y^2$ and also find the conjugate function v .	[08] [08]
Q4 (a)	Find Laplace Transform of $f(t) = e^{-t}\sin 4t + \cos 2t \sin t - e^{2t}t^2$	[07]
Q4 (b)	(i) Find $L\left\{\frac{d}{dt}\left(\frac{sint}{t}\right)\right\}$ (ii) Find $L\left\{\int_0^t ue^{-u}du\right\}$ OR Using Laplace Transform, solve the following differential equation, $\frac{d^2y}{dt^2} - \frac{3dy}{dt} + 2y = 4e^{2t}, where\ y(0) = -3, y'(0) = 5.$	[04] [04] [08]