K. J. Somaiya Institute of Technology, Sion, Mumbai-22
(Autonomous College Affiliated to University of Mumbai)

Nov – Dec 2024
(B. Tech) Program: EXTC Engineering Scheme III
Carry On Regular/Supplementary Examination: SY Semester: III
Course Code: EXC301 and Course Name: Applications of Mathematics in Engineering - I

Date of Exam: 23/06/25 Duration: 02.5 Hours Max. Marks: 60

Instructions:
(1)All questions are compulsory.
(2)Draw neat diagrams wherever applicable.
(3)Assume suitable data, if necessary.

Q. No.	Question	Max. Marks	CO	BT level
Q 1	Solve any **two** questions out of three: (05 marks each)	10		
a)	Find $L(t(2\sin 3t + e^{2t}))$.	5	1	3
b)	Find $L^{-1}\left[ln\left(\frac{s+a}{s+b}\right)\right]$.	5	2	3
c)	Obtain Fourier series of $f(x) = x^2$ in $(-\pi, \pi)$.	5	3	3
Q 2	Solve any **two** questions out of three: (05 marks each)	10		
a)	Determine whether the function $f(z) = x^2 + 2xy - y^2 + i(-x^2 + 2xy + y^2)$ is analytic and find its derivative.	5	4	3
b)	If the matrix $A = \begin{bmatrix} 1 & 0 & -1 \\ 1 & 2 & 1 \\ 2 & 2 & 3 \end{bmatrix}$, find Eigen values of A^t, A^{-1} and A^2.	5	5	3
c)	Find curl of the vector at $V = (xyz)i + (3x^2y)j + (xz^2 - y^2z)k$ at $(2, -1, 1)$.	5	6	3
Q.3	Solve any **two** questions out of three. (10 marks each)	20		
a)	i) Find $L\left(e^{-4t}\int_0^t u\sin 3u\, du\right)$.	6	1	3
	ii) Find $L(e^{2t}(1+t)^2)$.	4		
b)	i) Using Convolution theorem find $L^{-1}\left(\frac{1}{(s-2)(s+2)^2}\right)$.	6	2	3
	ii) Find $L^{-1}\left(\frac{1}{s^2} + \frac{2}{s-3} + \frac{s}{s^2+3^2} + \frac{1}{s^2-3^2}\right)$.	4		

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c)	i) Obtain Fourier series of $f(x) = e^x$ in $(-\pi, \pi)$.	6	3	3
	ii) Find Fourier coefficients a_0 and a_n of the Fourier series of $f(x) = \begin{cases} \pi x, & 0 < x < 1 \\ 0, & 1 < x < 2 \end{cases}$.	4		
Q.4	Solve any **two** questions out of three. (10 marks each)	20		
a)	i) Find the analytic function whose imaginary part is $v = 3x^2y - y^3$.	6	4	3
	ii) Determine whether the function $e^x \cos y - xy$ is Harmonic?	4		
b)	i) Verify Cayley-Hamilton theorem and find A^4 for the following matrices $\begin{bmatrix} 1 & 0 & -1 \\ 1 & 2 & 1 \\ 2 & 2 & 3 \end{bmatrix}$.	6	5	3
	ii) Determine whether following matrix is diagonalizable, if yes find the diagonal form D $A = \begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$.	4		
c)	i) Using Green's theorem, evaluate $\oint (3x^2 - 8y^2)\,dx + (4y - 6xy)dy$ along c, where c is the boundary of the region bounded by $x \geq 0, y \leq 0$ and $2x - 3y = 6$.	6	6	3
	ii) Evaluate the line integral $\int F.dr$ from $t = 0$ to $t = 1$ along the path c given by $x = 2t, y = t, z = t^3$ where $F = (2y + 3)i + xzj + (yz - x)k$.	4		

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