

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

Nov-Dec 2024 Jan / Feb 2025 (B. Tech) Program: EXTC Engineering Scheme III Regular /Supplementary Examination: SY Semester: III Course Code: EXC301 and Course Name: Applications of Mathematics in Engineering I		
Date of Exam: 03-02-25	Duration: 2.5 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 $L\left(\frac{1}{t}(e^{-at} - e^{-bt})\right)$.	5	1	3
b)	Using Partial fraction evaluate $L^{-1}\left(\frac{s}{(s+2)(s+3)}\right)$.	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)	Prove that the function $f(z) = e^x(\cos y + i \sin y)$ is analytic and find its derivative.	5	4	3
b)	If the matrix $A = \begin{bmatrix} 4 & 6 & 6 \\ 1 & 3 & 2 \\ -1 & -4 & -3 \end{bmatrix}$, find Eigen values of A^t , A^{-1} and A^2 .	5	5	3
c)	If $\phi = 3x^2y - y^3z^2$, find $\text{grad } \phi$ at the point $(1, -2, -1)$.	5	6	3
Q.3	Solve any two questions out of three. (10 marks each)	20		
a)	i) Find $L(te^t \sin 2t \cos t)$.	6	1	3
	ii) Find $L(e^{-2t}(2 \cos 3t - 3 \sin 3t))$.	4		
b)	i) Using Convolution theorem find $L^{-1}\left(\frac{s}{(s^2+4)(s^2+1)}\right)$.	6	2	3

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

Nov - Dec 2024 Jan / Feb 2025 (B. Tech) Program: EXTC Engineering Scheme III Regular/Supplementary Examination: SY Semester: III Course Code: EXC301 and Course Name: Applications of Mathematics in Engineering I		
Date of Exam: 09-02-25	Duration: 2.5 Hours	Max. Marks: 60

	ii) Find $L^{-1}\left(\frac{1}{s^3} + \frac{3}{s+3} + \frac{3}{s^2+2^2} + \frac{s}{s^2-2^2}\right)$.	4		
c)	i) Find Fourier series of $f(x) = \left(\frac{\pi-x}{2}\right)^2$ in $(0, 2\pi)$.	6	3	3
	ii) Find Fourier coefficient a_n of the Fourier series of $f(x) = \begin{cases} -\pi, & -\pi < x < 0 \\ x, & 0 < x < \pi \end{cases}$	4		
Q.4	Solve any two questions out of three. (10 marks each)	20		
a)	i) Find the analytic function whose real part is $u = x^3 - 3xy^2 + 3x^2 - 3y^2 + 1$.	6	4	3
	ii) Prove that $x^2 - y^2 - 2xy - 2x + 3y$ is Harmonic.	4		
b)	i) Verify Cayley-Hamilton theorem and find A^{-1} , for the following matrices $\begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$	6	5	3
	ii) Determine whether following matrix is diagonalizable, if yes find the diagonal form D $A = \begin{bmatrix} 5 & 7 & -5 \\ 0 & 4 & -1 \\ 2 & 8 & -3 \end{bmatrix}$	4		
c)	i) Using Green's theorem, evaluate $\int (x^2 y dx + x^2 dy)$, along c, where c is the boundary described by counter clockwise of the triangle with vertices (0,0), (1,0), (1,1).	6	6	3
	ii) Evaluate $\int_0^{1+i} x^2 dx - i y dy$, along the path $y = x^2$.	4		
