

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

Jan / Feb - Nov - Dec 2025 2026		
Program: B. Tech (Electronics and Telecommunication Engineering) Scheme: III / II / II B		
Supplementary Regular Examination: SY Semester: III		
Course Code: EXC 301 and Course Name: Applications of Mathematics in Engineering-I		
Date of Exam: 25/11/2025	Duration: 2 Hours 30 Minutes	Max. Marks: 60
29/01/2026		

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 $L\left(\frac{1}{t}(e^{-at} - e^{-bt})\right)$.		1	3	
b)	Obtain Fourier series of $f(x) = x^2$ in $(-\pi, \pi)$.		3	3	
c)	If $\vec{F} = (x + 2y + az)i + (bx - 3y - z)j + (4x + cy + 2z)k$ is irrotational, find the constants a, b, c.		6	3	
Q 2	Solve any two questions out of three: (05 marks each)	10			
a)	Using partial fraction method, find $L^{-1}\left(\frac{1}{(s-2)(s+2)^2}\right)$.		2	3	
b)	Determine the constants a, b, c and d so that the function $f(z) = x^2 + axy + by^2 + i(cx^2 + dxy + y^2)$ is analytic.		4	3	
c)	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	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 $L\left(\int_0^t \frac{1-e^{-au}}{u} \, du\right)$		4		
b)	(i) Obtain the Fourier series for the function $f(x) = \begin{cases} \pi x & , 0 \leq x \leq 1 \\ 0 & , 1 \leq x \leq 2 \end{cases}$ Deduce that $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \frac{1}{7^2} \dots = \frac{\pi^2}{8}$	6	3	3	

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	(ii) Find the Fourier Transform of $f(x) = \begin{cases} 1 - x^2, & x \leq 1 \\ 0 & , x > 1 \end{cases}$	4		3
c)	i) Using Green's theorem evaluate $\oint (xy + y^2) dx + x^2 dy$ where c is the closed curve of the region bounded by $y = x$ & $y = x^2$.	6	6	3
	ii) If $\phi = 3x^2y - y^3z^2$, find $grad \phi$ at the point $(1, -2, -1)$.	4		3
Q.4	Solve any two questions out of three. (10 marks each)	20		
a)	i) Find the inverse Laplace Transform of $\tan^{-1} \left(\frac{2}{s^2} \right)$.	6	2	3
	ii) Using convolution theorem, find $L^{-1} \left(\frac{s^2}{(s^2+9)^2} \right)$	4		3
b)	i) Find the analytic function whose imaginary part is $v = 3x^2y - y^3$. Also, find the corresponding real part of the analytic function.	6	4	3
	ii) Show that the function $w = \log z$ is analytic except at $z = 0$.	4		3
c)	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 . $A = \begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$.	4		3
