

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

Feb - March 24

Supplementary exam

Program: B.Tech Scheme II/II B

Examination: SY Semester: III

Course Code: EXC301 and Course Name: Application of Mathematics in Engineering - I

Date of Exam: 26.02.24

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.

		Max. Marks	CO	BT level
<b>Q 1</b>	<b>Solve any six questions out of eight:</b>	<b>12</b>		
i)	Find $L[\cos^2(2bt)]$	2	CO1	Ap
ii)	Find Inverse Laplace Transform of $\frac{s+2}{s^2-4s+13}$	2	CO2	Ap
iii)	Find the Fourier coefficient $a_0$ for $f(x) = e^{\alpha x} (\alpha \neq 0)$ , in $(0, 2\pi)$	2	CO3	Ap
iv)	Show that the following function is not analytic $f(z) = 2x + ixy^2$	2	CO4	Ap
v)	If $A = \begin{bmatrix} 2 & 4 \\ 0 & 3 \end{bmatrix}$ , then find the eigenvalues of $6A^{-1} + A^3 + 2I$	2	CO5	Ap
vi)	Find the directional derivatives of $4xz^3 - 3x^2yz^2$ at $(2, -1, 2)$ along z-axis.	2	CO6	Ap
vii)	Find the eigen values of following matrix without solving the characteristic equation $\begin{bmatrix} 1 & 0 & 0 & 0 \\ 3 & 2 & 0 & 0 \\ 4 & -2 & -1 & 0 \\ 5 & 2 & 3 & 3 \end{bmatrix}$	2	CO5	Ap
viii)	Find Laplace Transform of $\sqrt{1 + \sin t}$	2	CO1	Ap
<b>Q.2</b>	<b>Solve any four questions out of six.</b>	<b>16</b>		
i)	Find Laplace Transform of $\frac{1}{t}[1 - \cos at]$	4	CO1	Ap
ii)	Find Inverse Laplace Transform of $\log \frac{s^2+a^2}{s^2+b^2}$	4	CO2	Ap
iii)	Find the Fourier Series Expansion of $f(x) = x^2, -\pi \leq x \leq \pi$	4	CO3	Ap

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

*Supplementary Exam*

*Feb-March 24*

Program: B.Tech Scheme II/II B  
 Examination: SY Semester: III

Course Code: EXC301 and Course Name: Application of Mathematics in Engineering - I

Date of Exam: *26-02-24*

Duration: **2.5 Hours**

Max. Marks: 60

iv)	Find the analytic functions $f(z) = u + iv$ whose imaginary part is $v = x^4 - 6x^2y^2 + y^4 + x^2 - y^2 + 2xy$	4	CO4	Ap
v)	Find the characteristic equation of each of the following matrices and obtain the inverse $\begin{bmatrix} 1 & 0 & 2 \\ 0 & 2 & 1 \\ 2 & 0 & 3 \end{bmatrix}$	4	CO5	Ap
vi)	Find div $\mathbf{F}$ and curl $\mathbf{F}$ , where $\mathbf{F} = \text{grad}(x^3 + y^3 + z^3 - 3xyz)$	4	CO6	
<b>Q.3</b>	<b>Solve any two questions out of three.</b>	<b>16</b>		
i)	Evaluate using Laplace Transform $\int_0^\infty e^{-3t} t^2 \sinh 2t dt$	8	CO1	Ap
ii)	Find Inverse Laplace Transform of $\frac{1}{(s-1)(s^2+4)}$ using Convolution theorem	8	CO2	Ap
iii)	Obtain the Fourier Series expansion of $f(x) = \left(\frac{\pi-x}{2}\right)^2$ in the interval $0 \leq x \leq 2\pi$	8	CO3	Ap
<b>Q.4</b>	<b>Solve any two questions out of three.</b>	<b>16</b>		
i)	Find the orthogonal trajectories of the family of curves $e^{-x}(x \sin y - y \cos y) = c$	8	CO4	Ap
ii)	Show that the following matrix are diagonalisable. Also find the diagonal form and a diagonalising matrix $\begin{bmatrix} -9 & 4 & 4 \\ -8 & 3 & 4 \\ -16 & 8 & 7 \end{bmatrix}$	8	CO5	Ap
iii)	A vector field is given by $\bar{F} = (x^2 + xy^2)i + (y^2 + x^2y)j$ show that $\bar{F}$ is irrotational. And find its scalar potential.	8	CO6	Ap

\*\*\*\*\*