

K. J. Somaiya Institute of ~~Engineering and Information~~ Technology, Sion, Mumbai-22

(Autonomous College Affiliated to University of Mumbai)

End Semester Exam

Supplementary Examination Aug 2023

Program: B.Tech

Examination: SY Semester: III

Course Code: EXC301

Course Name: Applications of Mathematics in Engineering-I

Duration: 2 ~~30~~ Hours

Date: 22.08.23

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 six questions out of eight:	12		
i)	Evaluate $\int_0^{\infty} e^{-t} t^5 dt$	2	CO1	3
ii)	Find Inverse L.T. of $\frac{3}{s^2-16}$.	2	CO2	3
iii)	In the Fourier series of $f(x) = \begin{cases} x, & 0 \leq x \leq \pi \\ 0, & \pi \leq x \leq 2\pi \end{cases}$ then find the value of the Fourier Coefficient a_n of $\cos(nx)$	2	CO3	3
iv)	If $u(x,y) = x^2 - y^2$ is the real part of an analytic function $(z) = u(x,y) + iv(x,y)$, then find its corresponding harmonic conjugate.	2	CO4	3
v)	Find the value of a if $\vec{F} = (x - 2z)i + (y - 5x)j + (az + 2x)k$ is solenoidal	2	CO6	3
vi)	$A = \begin{bmatrix} 1 & 2 & 3 \\ -1 & 3 & 1 \\ 0 & 0 & 2 \end{bmatrix}$ Then find sum and Product of all eigenvalues of A	2	CO5	3
vii)	If $u(x,y) = (\sin x)(\sin y)$ is the real part of an analytic function $f(z) = u + iv$, then $f(z)$ is equal to	2	CO4	3

viii)	Find $L[(\sin 3t)(\sin 5t)]$	2	CO1	3
Q.2	Solve any four questions out of six.	16		
i)	Find L.T. of the following functions:- $te^{-t} \sin t$	4	CO1	3
ii)	Find the inverse Laplace Transform of the following functions $\text{Log}[s(s-4)(s-6)]$	4	CO2	3
iii)	Find the Fourier Series for $f(x)=x^2; -1 < x < 1$	4	CO3	3
iv)	Find constants a, b if $f(z) = (3x^2y + 2x^2 + ay^3 - 2y^2) + i(bxy - x^3 + 3xy^2)$ is analytic	4	CO4	3
v)	Using Cayley Hamilton Theorem find $A^9 - 6A^8 + 10A^7 - 3A^6 + A + I$ where $A = \begin{bmatrix} 1 & 2 & 3 \\ -1 & 3 & 1 \\ 1 & 0 & 2 \end{bmatrix}$	4	CO5	3
vi)	Prove that $\int_{(0,0,0)}^{(1,1,1)} \vec{F} \cdot d\vec{r}$ where $\vec{F} = yzi + xzj + xyk$ is independent of path joining $(0,0,0)$ and $(1,1,1)$	4	CO6	3
Q.3	Solve any two questions out of three.	16		
i)	Using convolution theorem find inverse Laplace transform of $\frac{s}{(s^2+1)(s^2+4)}$	8	CO2	3
ii)	Find the Fourier series of $f(x) = \begin{cases} -1, & -\pi < x < 0 \\ 1, & 0 < x < \pi \end{cases}$ Hence deduce : $1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \dots = \frac{\pi}{4}$	8	CO3	3
iii)	Is the matrix $A = \begin{bmatrix} 3 & 1 & 4 \\ 0 & 2 & 6 \\ 0 & 0 & 5 \end{bmatrix}$ diagonalizable? If so find Diagonal form and Transforming matrix of A .	8	CO5	3
Q.4	Solve any two questions out of three.	16		
i)	Evaluate $\int_0^\infty e^{-2t} \left[\int_0^t \frac{1-e^{-t}}{t} dt \right]$ using L.T	8	CO1	3
ii)	Find the orthogonal trajectory of the family of curves $(x-1)^3 - 3xy^2 + 3y^2 = \text{constant}$	8	CO4	3
iii)	Show that the vector, $\vec{F} = (x^2 - yz)i + (y^2 - xz)j + (z^2 - xy)k$ is irrotational and hence, find ϕ such that $\vec{F} = \nabla\phi$.	8	CO6	3