'DSY

K. J. Somaiya Institute of Technology, Sion, Mumbai-22
(Autonomous College Affiliated to University of Mumbai)
April – May 2023 DSY
Program: B.Tech Scheme : II
Examination: SY Semester: IV Course Code: EXC301
Course Name: Applications of Mathematics in Engineering-I
Date of Exam: 25/05/2023 **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
Q 1	**Solve any six questions out of eight**	**12**		
i)	Find the Laplace transform of $t\cosh 3t$	**2**	**1**	**3**
ii)	Find the Laplace inverse of $\frac{s+1}{(s+4)^2}$	**2**	**2**	**3**
iii)	Show that $\Phi = \sin x \cosh y$ is a harmonic function.	**2**	**4**	**3**
iv)	If $X = \begin{bmatrix} 1 \\ 2 \\ -1 \end{bmatrix}$ an eigen vector of a matrix A corresponding to eigen value $\lambda = 2$, then find $A^{-1}X$ and A^3X.	**2**	**5**	**3**
v)	Find the Laplace transform of $e^{4t}\sin 2t\cos t$.	**2**	**1**	**3**
vi)	Show that $f(z) = \frac{1}{z}$ is an analytic function except at $z = 0$.	**2**	**4**	**3**
vii)	If $\psi = xy + yz + xz$, then find $\nabla\cdot(\nabla\times\nabla\psi)$.	**2**	**6**	**3**
viii)	Find the Fourier series expansion of $f(x) = x,\ -\pi < x < \pi$.	**2**	**3**	**3**
Q.2	**Solve any four questions out of six**	**16**		

May/June 2023/SY/Sem III/DSY/AM
(KT) 25/05/

i)	Find the Laplace transform of $\int_0^t t \sin 3t \, dt$.	4	1	3
ii)	Find the Laplace inverse of $\log\left(\frac{s^2+1}{s-2}\right)$.	4	2	3
iii)	Find the family of orthogonal trajectories to the family of curves $3x^2y - y^3 + x = c$.	4	4	3
iv)	If $A = \begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & 2 \\ 2 & 2 & 1 \end{bmatrix}$, find the eigen values of $A^2 + 3A - 5I$	4	5	3
v)	Find the Fourier series of $f(x) = \lvert x \rvert$, $(-\pi, \pi)$.	4	3	3
vi)	Verify Caley Hamilton theorem for $A = \begin{bmatrix} 2 & 3 \\ -2 & 2 \end{bmatrix}$	4	5	3
Q.3	**Solve any two questions out of three**	**16**		
i)	Find the Laplace transform of $e^{-2t} \frac{\cos 3t - \cos 2t}{t}$.	8	1	3
ii)	Show that matrix A is diagonalizable. Find the diagonalising and the diagonal matrix. $\begin{bmatrix} 3 & -1 & 1 \\ -1 & 5 & -1 \\ 1 & -1 & 3 \end{bmatrix}$	8	5	3
iii)	Obtain the Fourier series of $f(x) = \frac{(\pi - x)^2}{4}$, $0 \le x \le 2\pi$ and evaluate the value of $1 + \frac{1}{2^2} + \frac{1}{3^2} + \ldots$	8	3	3
Q.4	**Solve any two questions out of three**	**16**		
i)	Find the Laplace inverse of $\frac{1}{(s^2+9)^2}$ using the convolution property.	8	2	3

May-June 2023 / DSY / sem III / AME-I / 25.05.23

ii)	Find the analytic function $u+iv$ where $v=\dfrac{\sin 2x}{\cosh 2y+\cos 2x}$	8	4	3
iii)	Prove that $\bar{f}=(4xy+3x^2z)i+(2x^2+2z)j+(x^3+2y)k$ is a conservative field. Determine the scalar potential of $\bar{f}$ at $(1,0,1)$.	8	6	3