

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

End Semester Exam

Nov – Dec 2022

(B. Tech) Program: Computer/I.T./AIDS Engineering

Examination: DSY Semester: III

Course Code: UCEC301/UITC301/UAIC301

Course Name: Applications of Mathematics in Engineering-I

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 six questions out of eight:	12																		
i)	Find $L^{-1}\left(\frac{s-3}{(s-3)^2+5^2}\right)$	2	CO2	3																
ii)	Check whether $f(z) = e^z$ is analytic.	2	CO4	3																
iii)	Find $(t e^t \cosh 2t)$.	2	CO1	3																
iv)	Find the value of Fourier coefficient a_n for $f(x) = e^x$ in $-\pi < x < \pi$.	2	CO3	3																
v)	If probability density of a random variable is given by $f(x) = \begin{cases} ke^{3x}, & x > 0 \\ 0, & x \leq 0 \end{cases}$ Find the value of k .	2	CO6	3																
vi)	The regression lines of a sample are $3x + 2y = 26$ and $6x + y = 31$, find sample means \bar{x} and \bar{y} .	2	CO5	3																
vii)	Obtain the value of the Fourier coefficient b_n for $f(x) = \begin{cases} x + \frac{\pi}{2}, & -\pi < x < 0 \\ \frac{\pi}{2} - x, & 0 < x < \pi \end{cases}$	2	CO3	3																
viii)	Find the Laplace transform of $\frac{\sin at}{t}$.	2	CO1	3																
Q.2	Solve any four questions out of six.	16																		
i)	Calculate the coefficient of regression b_{yx} for the following data <table border="1" style="margin: 10px auto;"> <tr> <td>X</td> <td>5</td> <td>6</td> <td>7</td> <td>8</td> <td>9</td> <td>10</td> <td>11</td> </tr> <tr> <td>Y</td> <td>11</td> <td>14</td> <td>14</td> <td>15</td> <td>12</td> <td>17</td> <td>16</td> </tr> </table>	X	5	6	7	8	9	10	11	Y	11	14	14	15	12	17	16	4	CO5	3
X	5	6	7	8	9	10	11													
Y	11	14	14	15	12	17	16													
ii)	Find inverse Laplace transform of $2 \tanh^{-1} s$.	4	CO2	3																

iii)	Determine the constants a,b,c,d if $f(z) = x^2 + 2axy + by^2 + i(cx^2 + 2dxy + y^2)$ is analytic	4	CO4	3																						
iv)	Find $L\left(e^{-4t} \int_0^t u \sin 3u \, du\right)$	4	CO1	3																						
v)	Expand x^3 , $-\pi < x < \pi$ as a Fourier series.	4	CO3	3																						
vi)	If the probability density of a random variable is given by $f(x) = \begin{cases} k(x - x^2), & 0 \leq x \leq 1 \\ 0, & \text{otherwise} \end{cases}$ Find (i) k (ii) Mean (iii) Variance.	4	CO6	3																						
Q.3	Solve any two questions out of three.	16		3																						
i)	Find Laplace transform of $\frac{d}{dt} \left(\frac{1 - \cos 2t}{t} \right)$	8	CO1	3																						
ii)	Expand $f(x) = \begin{cases} -\pi, & -\pi \leq x \leq 0 \\ x, & 0 \leq x \leq \pi \end{cases}$ as a Fourier series.	8	CO3	3																						
iii)	A random variable X has the following probability distribution <table border="1" style="display: inline-table; vertical-align: middle;"> <tbody> <tr> <td>X</td> <td>-2</td> <td>-1</td> <td>0</td> <td>1</td> <td>2</td> <td>3</td> </tr> <tr> <td>P(X=x)</td> <td>0.1</td> <td>k</td> <td>0.2</td> <td>2k</td> <td>0.3</td> <td>3k</td> </tr> </tbody> </table> Find (i) k (ii) $P(X \geq 2)$ (iii) $P(-2 < X < 2)$ (iv) $P(X < 2)$	X	-2	-1	0	1	2	3	P(X=x)	0.1	k	0.2	2k	0.3	3k	8	CO6	3								
X	-2	-1	0	1	2	3																				
P(X=x)	0.1	k	0.2	2k	0.3	3k																				
Q.4	Solve any two questions out of three.	16		3																						
i)	State convolution theorem and find $L^{-1} \left(\frac{1}{(s-a)(s+a)^2} \right)$ using convolution theorem.	8	CO2	3																						
ii)	Find the orthogonal trajectories of the family of curves $e^{-x} \cos xy = \alpha$, where α is the real constant in the xy-plane.	8	CO4	3																						
iii)	Find the Spearman's Rank correlation coefficient between X and Y <table border="1" style="display: inline-table; vertical-align: middle;"> <tbody> <tr> <td>X</td> <td>68</td> <td>64</td> <td>75</td> <td>50</td> <td>64</td> <td>80</td> <td>75</td> <td>40</td> <td>55</td> <td>64</td> </tr> <tr> <td>Y</td> <td>62</td> <td>58</td> <td>68</td> <td>45</td> <td>81</td> <td>60</td> <td>68</td> <td>48</td> <td>50</td> <td>70</td> </tr> </tbody> </table>	X	68	64	75	50	64	80	75	40	55	64	Y	62	58	68	45	81	60	68	48	50	70	8	CO5	3
X	68	64	75	50	64	80	75	40	55	64																
Y	62	58	68	45	81	60	68	48	50	70																