

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

End Semester Exam

Nov – Dec 2021

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

Examination: SY Semester: III

Course Code: IUCEC301/IUITC301/1UAIC301

Course Name: Applications of Mathematics in Engineering-I

Duration: 03 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)	1) If $L\left(\frac{1}{\sqrt{\pi t}}\right) = \frac{1}{\sqrt{s}}$, find $L\left(\sqrt{\frac{\pi}{t}}\right)$	2	CO1	3
ii)	Find Inverse L.T. of $\frac{1}{(s+1)^2} + \frac{s-2}{s^2-4s+5} + \frac{s-2}{s^2-4s+3}$	2	CO2	3
iii)	If $f(x) = e^{ax} (a \neq 0)$ in $(0, 2\pi)$ Find the Fourier Coefficient a_1 .	2	CO3	3
iv)	Find the constants a, b, c, d if $f(z) = x^2 + 2axy + by^2 + i(cx^2 + 2dxy + y^2)$ is analytic.	2	CO4	3
v)	The regression lines of a sample are $5X+90 = 6Y$ and $15X-8Y = 130$, find sample means \bar{X} and \bar{Y} .	2	CO5	3
vi)	Find the mean of the probability distribution of the number of heads obtained in two flips of a balanced coin.	2	CO6	3
vii)	Find p if $f(z) = r^2 \cos 2\theta + i r^2 \sin p\theta$ is analytic.	2	CO4	3
viii)	Find $L\left[\frac{\sin t}{t}\right]$	2	CO1	3
Q.2	Solve any four questions out of six.	16		
i)	Find L.T. of the following function $\int_0^t e^{-u} u^4 du$	4	CO1	3

ii)	Find the inverse Laplace Transform of the following functions $\frac{3s+7}{s^2-2s-3}$	4	CO2	3																						
iii)	Find the Fourier Series for $f(x)= x $; $-2 < x < 2$	4	CO3	3																						
iv)	If the imaginary part $v(x,y) = e^x(x \sin y + y \cos y)$, construct the analytic function $f(z)=u+iv$ in terms of z .	4	CO4	3																						
v)	The Regression lines of a sample are $3x + 2y = 26$ and $6x + y = 31$. Find the coefficient of correlation between x and y	4	CO5	3																						
vi)	A random variable X has the following probability function: <table style="margin-left: auto; margin-right: auto;"> <tr> <td>X:</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>6</td> <td>7</td> </tr> <tr> <td>P(X):</td> <td>k</td> <td>2k</td> <td>3k</td> <td>k^2</td> <td>$k^2 + k$</td> <td>$2k^2$</td> <td>$4k^2$</td> </tr> </table> Find $P(X < 4)$, $P(X \geq 5)$, $P(3 < X \leq 6)$	X:	1	2	3	4	5	6	7	P(X):	k	2k	3k	k^2	$k^2 + k$	$2k^2$	$4k^2$	4	CO6	3						
X:	1	2	3	4	5	6	7																			
P(X):	k	2k	3k	k^2	$k^2 + k$	$2k^2$	$4k^2$																			
Q.3	Solve any two questions out of three.	16																								
i)	Using convolution theorem find inverse Laplace transform of $\frac{s^2+10s+13}{(s^2-5s+6)(s-1)}$	8	CO2	3																						
ii)	Find the Fourier Series Expansion of $f(x) = \begin{cases} -x - \pi, & -\pi < x < 0 \\ x + \pi, & 0 < x < \pi \end{cases}$	8	CO3	3																						
iii)	Compute Spearman's rank correlation coefficient and Karl Pearson's coefficient of correlation from the following data <table style="margin-left: auto; margin-right: auto;"> <tr> <td>X</td> <td>85</td> <td>74</td> <td>85</td> <td>50</td> <td>65</td> <td>78</td> <td>74</td> <td>60</td> <td>74</td> <td>90</td> </tr> <tr> <td>Y</td> <td>78</td> <td>91</td> <td>78</td> <td>58</td> <td>60</td> <td>72</td> <td>80</td> <td>55</td> <td>68</td> <td>70</td> </tr> </table>	X	85	74	85	50	65	78	74	60	74	90	Y	78	91	78	58	60	72	80	55	68	70	8	CO5	3
X	85	74	85	50	65	78	74	60	74	90																
Y	78	91	78	58	60	72	80	55	68	70																
Q.4	Solve any two questions out of three.	16																								
i)	Evaluate $\int_0^\infty e^{-4t} \left(\cosh t \int_0^t e^u \cdot \cosh u \, du \right) dt$ using L.T	8	CO1	3																						
ii)	Find the orthogonal trajectory of the family of curves $e^x(x \cos y - y \sin y) = \text{constant}$	8	CO4	3																						
iii)	Let X be a continuous random variable with probability density function $f(x) = kx(1-x)$, $0 \leq x \leq 1$. Find k and determine a number b such that $P(X \leq b) = P(X \geq b)$.	8	CO6	3																						