

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

Nov – Dec 2024		
Program: B. Tech Scheme: III		
Regular Examination: SY Semester: III		
Course Code: AIC301_III and Course Name: Applications of Mathematics in Engineering-I		
Date of Exam: 23/06/25	Duration: 02.5 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 two questions out of three: (05 marks each)	10															
a)	Find $L(t.\sin 2t.\cos ht)$.		CO1	03													
b)	For the function $f(x) = x^2$ in $(-\pi, \pi)$ the values of constants are $a_0 = \frac{\pi^2}{2}, a_n = \frac{4}{n^2}(-1)^n, b_n = 0$. Then prove that $\frac{\pi^4}{90} = \frac{1}{1^4} + \frac{1}{2^4} + \frac{1}{3^4} + \dots$		CO3	03													
c)	Obtain the rank correlation coefficient from the following data <table border="1"><tr><td>X</td><td>10</td><td>12</td><td>18</td><td>18</td><td>15</td><td>40</td></tr><tr><td>Y</td><td>12</td><td>18</td><td>25</td><td>25</td><td>50</td><td>25</td></tr></table>		X	10	12	18	18	15	40	Y	12	18	25	25	50	25	CO5
X	10	12	18	18	15	40											
Y	12	18	25	25	50	25											
Q 2	Solve any two questions out of three: (05 marks each)	10															
a)	Using partial fraction method, find $L^{-1}\left(\frac{s+29}{(s^2+9)(s+4)}\right)$.		CO2	03													
b)	Find the orthogonal trajectories of family of curves $e^{-x}\cos y + xy = a$		CO4	03													
c)	A continuous random variable X has the following probability law $f(x) = kx^2, 0 \leq x \leq 2$ Find k and find the probability that (i) $(0.2 \leq x \leq 0.5)$ (ii) $x \geq \frac{3}{4}$, given that $x \geq \frac{1}{2}$.		CO6	03													
Q.3	Solve any two questions out of three. (10 marks each)	20															
a)	i) Prove that $\int_0^\infty e^{-\sqrt{2}t} \cdot \frac{\sin t \sinh t}{t} dt = \frac{\pi}{8}$	7	CO1	03													

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	ii) Find $L[tsin^3t]$	3														
b)	i) Find the Fourier series $f(x) = 2x - x^2, 0 \leq x \leq 3$	7	CO3	03												
	ii) For the function $f(x) = e^x, -\pi < x < \pi$, find a_0, b_n .	3														
c)	i) Fit a second degree parabolic curve to the following data <table border="1" style="margin: 10px auto;"> <tr> <td>x</td> <td>0</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> </tr> <tr> <td>y</td> <td>1.0</td> <td>1.8</td> <td>1.3</td> <td>2.5</td> <td>6.3</td> </tr> </table>	x	0	1	2	3	4	y	1.0	1.8	1.3	2.5	6.3	7	CO5	03
	x	0	1	2	3	4										
y	1.0	1.8	1.3	2.5	6.3											
ii) If two lines of regression are $x + 3y - 5 = 0$ and $4x + 3y - 8 = 0$ then find the correlation coefficient.	3															
Q.4	Solve any two questions out of three. (10 marks each)	20														
a)	i) Using convolution method, find $L^{-1} \left[\frac{s^2+s}{(s^2+1)(s^2+2s+2)} \right]$	6	CO2	03												
	ii) Find $L^{-1} \left[\log \left(1 + \frac{a^2}{s^2} \right) \right]$	4														
b)	i) Find the analytic function $f(z) = u + iv$ in terms of z by Milne Thomson method if if $u + v = e^x(\cos y + \sin y) + \frac{x-y}{x^2+y^2}$	6	CO4	03												
	ii) Find k such that $f(z) = \frac{1}{2} \log(x^2 + y^2) + i \tan^{-1} \frac{kx}{y}$ is analytic.	4														
c)	i) Find the value of k , if the function $f(x) = \begin{cases} kx^2(1-x^3) & , 0 \leq x \leq 1 \\ 0 & , otherwise \end{cases}$ is a probability density function. Also find $P(0 \leq x \leq 1/2)$, mean, variance.	5	CO6	03												
	ii) If a random variable has the moment generating function $M_t = \frac{1}{t} [e^t - 1]$. Find $V(x)$.	5														
