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

~~Nov-Dec 2024~~ Jan/Feb 2025

~~Supplementary~~ 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: 03-02-25   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 $L(t^2 e^{3t} \sin 4t)$		CO1	03
b)	Find the Fourier series of $f(x) = \begin{cases} x + \frac{\pi}{2} & -\pi < x < 0 \\ \frac{\pi}{2} - x & 0 < x < \pi \end{cases}$		CO3	03
c)	Fit a straight line to the following data and estimate the value of y for x = 3.5 	x	0	1	2	3	4 | 	---	---	---	---	---	--- | 	y	1	1.8	3.3	4.5	6.3			CO5	03
Q 2	Solve any two questions out of three: (05 marks each)	10		
a)	Using partial fraction method, find $L^{-1}\left(\frac{3s+1}{(s+1)(s^2+2)}\right)$		CO2	03
b)	Construct an analytic function $f(z) = u + iv$ by using Milne Thompson's method whose imaginary part is $v = e^{-x}(y\sin y + x\cos y)$.		CO4	03
c)	If X denotes the outcome when a fair die is tossed, find M.G.F. of X about origin hence find μ_1', μ_2', $V[X]$.		CO6	03
Q.3	Solve any **two** questions out of three. (10 marks each)	20		
a)	i) Evaluate $\int_0^\infty e^{-t}\left(t\int_0^t e^{-4u}\cos u\, du\right) dt$	6	CO1	03
	ii) Find $L\left(\frac{d}{dt}\left(\frac{\sin 3t}{t}\right)\right)$	4		
b)	i) Find the Fourier series of $f(x) = \frac{1}{2}(\pi - x)$ in $(0, 2\pi)$.	6	CO3	03

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	ii) Obtain Fourier series of $f(x) = 1 - x^2$ in (-1,1)	4		
c)	i) Fit a second degree parabolic curve to the following data and estimate the production in 1982	6	CO5	03

Year(X)	1974	1975	1976	1977	1978	1979	1980	1991
Producti on(Y) (in tons)	12	14	26	42	40	50	52	53

	ii) Obtain the rank correlation coefficient from the following data	4		

X	10	12	18	18	15	40
Y	12	18	25	25	50	25

Q.4	Solve any **two** questions out of three. (10 marks each)	20		
a)	i) Using convolution theorem, find $L^{-1}\left[\frac{1}{s^2(s+a)^2}\right]$	6	CO2	03
	ii) Find $L^{-1}\left(\log\left(\frac{s^2+a^2}{s^2+b^2}\right)\right)$	4		
b)	i) Find the analytic function $f(z) = u + iv$ in terms of z, if $u - v = x^3 + x^2 - 3xy^2 - y^2 - 3x^2y + y^3 - 2xy$	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) A box contains three biased coins A, B and C. The probability that a head will result when A is tossed is 1/3, when B is tossed, it is 2/3 and when C is tossed, it is 3/4. If one of the coins is chosen at random and is tossed 3 times, head resulted twice and tail once. What is the probability that the coin chosen was A?	6	CO6	03
	ii) A continuous random variable has probability density function $f(x) = k(x - x^2)$, $0 \le x \le 1$ Find i) k ii) mean iii) variance	4		

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