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

July-Aug 2025
Program: B.Tech. Scheme III
Carry-On Supplementary Examination: SY Semester: III
Course Code: AIC301, ITC301 and Course Name: Application of Mathematics in Engineering-I / Mathema
Date of Exam: ~~08~~/08/2025 Duration: 02.5 Hours Max. Marks: 60 Has for
22 Data Science

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)	Using Laplace Transform, Prove that $\int_0^\infty e^{-t}\left(\frac{\sin^2 t}{t}\right)dt = \frac{1}{4}\log 5$		CO1	03
b)	Find the Fourier expansion of $f(x) = x^2, -\pi \le x \le \pi$.		CO3	03
c)	From 10 observations on price X and supply Y of a commodity the following summary figures were obtained $\sum X = 130, \sum Y = 220, \sum X^2 = 2288, \sum XY = 3467$. Compute the equation of the line of regression of Y on X and interpret the result. Estimate the supply when price is 16 units		CO5	03
Q 2	Solve any **two** questions out of three: (05 marks each)	10		
a)	Find $L^{-1}\left[\frac{s^2}{(s^2+a^2)^2}\right]$ using convolution theorem		CO2	03
b)	Find k such that $\frac{1}{2}log(x^2+y^2) + itan^{-1}\frac{kx}{y}$ is analytic.		CO4	03
c)	Urn I contains 3 white, 2 black and 2 green balls, urn II contains 2 white, 3 black and 4 green balls; Urn III contains 5 white, 2 black and 2 green balls. An urn is chosen at random and two balls are drawn, they happen to be black and green. What is the probability that they come from urns I OR II?		CO6	03
Q.3	Solve any **two** questions out of three. (10 marks each)	20		
a)	**(i)** $L[f(t)] = \frac{s}{s^2+s+4}$, find $L[e^{-3t}f(2t)]$	4	CO1	03
	(ii) Find $L\left[\int_0^t ue^{-3u}\sin^2 u\, du\right]$	6		

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b)	Find the Fourier Series expansion for $f(x) = \begin{cases} \pi x, & 0 \le x \le 1 \\ \pi(2-x), & 1 \le x \le 2 \end{cases}$ Hence deduce that $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \cdots = \frac{\pi^2}{8}$	10	CO3	03
c)	**(i)** Calculate the correlation coefficient between x and y from the following data $N = 10, \sum x = 140, \sum y = 150, \sum(x-10)^2 = 180, \sum(y-15)^2 = 215, \sum(x-10)(y-15) = 60$ **(ii)** Obtain the rank correlation coefficient from the following data. X : 10, 12, 18, 18, 15, 40 Y : 12, 18, 25, 25, 50, 25	5 5	CO5	03
Q.4	Solve any **two** questions out of three. (10 marks each)	20		
a)	**(i)** Find $L^{-1}\left[\tan^{-1}\left(\frac{2}{s^2}\right)\right]$ **(ii)** Find $L^{-1}\left[\frac{s+29}{(s+4)(s^2+9)}\right]$	4 6	CO2	03
b)	Show that $u = \sin x \cos hy + 2\cos x \sin hy + x^2 - y^2 + 4xy$ is harmonic. Also find the corresponding harmonic conjugate function and analytic function.	10	CO4	03
c)	A continuous random variable X has the probability distribution $f(x) = \frac{4}{81}x(9-x^2)$ when $0 \le x \le 3$ and $f(x) = 0$ otherwise. Find the four moments about the origin and the mean.	10	CO6	03

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