

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

Supplementary Examination - August 2023
(B.Tech) Program: Computer Engineering / I.T. / AI-DS Scheme: II
Examination: SY Semester: III
Course Code: CEC301/ ITC301/ AIC301
Course Name: Applications of Mathematics in Engineering - I

Date of Exam: 22-Aug-2023

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.

		Max. Marks	CO	BT level								
Q 1	Solve any six questions out of eight:	12										
i)	State whether true or false and justify : Both the coefficients of regression always have same sign.	2	5	Ap								
ii)	Obtain the Fourier coefficient a_0 in the Fourier expansion of the function $f(x) = \begin{cases} 2, & -2 < x < 0 \\ x, & 0 < x < 2 \end{cases}$	2	3	Ap								
iii)	Find $L^{-1}\left(\frac{s+2}{s^2+4s+7}\right)$.	2	2	Ap								
iv)	Find $L\left(\frac{(1-e^{2t})}{t}\right)$.	2	1	Ap								
v)	Determine whether the following function $f(x) = x^2 - y^2 + 2ixy$ is analytic and if so find its derivative.	2	4	Ap								
vi)	Find $L(\sqrt{1 + \sin 2t})$.	2	1	Ap								
vii)	Find the value of k from the following data <table border="1" style="margin: 5px auto; border-collapse: collapse;"> <tr> <td style="padding: 5px;">x</td> <td style="padding: 5px;">0</td> <td style="padding: 5px;">10</td> <td style="padding: 5px;">15</td> </tr> <tr> <td style="padding: 5px;">P(x)</td> <td style="padding: 5px;">$\frac{k-6}{5}$</td> <td style="padding: 5px;">$\frac{2}{k}$</td> <td style="padding: 5px;">$\frac{14}{5k}$</td> </tr> </table>	x	0	10	15	P(x)	$\frac{k-6}{5}$	$\frac{2}{k}$	$\frac{14}{5k}$	2	6	Ap
x	0	10	15									
P(x)	$\frac{k-6}{5}$	$\frac{2}{k}$	$\frac{14}{5k}$									
viii)	Obtain the Fourier coefficient a_n in the Fourier expansion of the function $f(x) = x$ in $(0, 2\pi)$.	2	3	Ap								
Q.2	Solve any four questions out of six.	16										
i)	Find $L\left(e^{-4t} \int_0^t u \sin 3u \, du\right)$.	4	1	Ap								
ii)	Find $L^{-1}\left(\log\left(1 + \frac{a^2}{s^2}\right)\right)$.	4	2	Ap								

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iii)	Obtain the Fourier expansion of the function $f(x) = x^3$ in $(-\pi, \pi)$.	4	3	Ap														
iv)	Determine the constants a, b, c, d if $f(z) = x^2 + 2axy + by^2 + i(cx^2 + 2dxy + y^2)$ is analytic.	4	4	Ap														
v)	The equations of the two regression lines are $3x + 2y = 26$ and $6x + y = 31$. Find (i) the mean of x and y (ii) coefficient of correlation between x and y .	4	5	Ap														
vi)	There are in a bag three true coins and one false coin with head on both sides. A coin is chosen at random and tossed four times. If head occurs all the four times, what is the probability that the false coin was chosen and used?	4	6	Ap														
Q.3	Solve any two questions out of three.	16																
i)	Evaluate $\int_0^{\infty} e^{-2t} \left(\frac{\cos 2t \sin 3t}{t} \right) dt$	8	1	Ap														
ii)	Find the Fourier series expansion of $f(x) = x^2, -\pi \leq x \leq \pi$ and hence, prove that $\frac{\pi^2}{6} = \sum_1^{\infty} \frac{1}{n^2}$.	8	3	Ap														
iii)	Obtain the rank correlation coefficient from the following data. <table border="1" style="margin-left: auto; margin-right: auto;"> <tbody> <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> </tbody> </table>	X	10	12	18	18	15	40	Y	12	18	25	25	50	25	8	5	Ap
X	10	12	18	18	15	40												
Y	12	18	25	25	50	25												
Q.4	Solve any two questions out of three.	16																
i)	Find $L^{-1} \left(\frac{s}{(s^2+4)(s^2+1)} \right)$ using Convolution theorem.	8	2	Ap														
ii)	Find an analytic function whose real part is $u = e^x(x \cos y - y \sin y)$.	8	4	Ap														
iii)	If X is a continuous random variable with probability density function given $f(x) = \begin{cases} k(x - x^3), & 0 \leq x \leq 1 \\ 0, & \text{otherwise} \end{cases}$ Find (i) k (ii) mean (iii) variance	8	6	Ap														
