

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

Supplementary

(B.Tech.) Program: B.Tech. (Computer, IT; AI-DS) Scheme: II
Examination: SY Semester: III

Feb March 24

Course Code: CE301,IT301,AI301 and Course Name: Applications of Mathematics in Engineering-II

Date of Exam: ~~26-02-24~~

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)	Find the value of m so that $2x - x^2 + my^2$ is harmonic	2	4	Ap
ii)	Verify whether the following function is probability density function. $f(x) = 12x^3 - 21x^2 + 10x$, $0 \leq x \leq 1$.	2	6	Ap
iii)	Find the inverse Laplace transform of $\frac{4s+15}{16s^2-25}$.	2	2	Ap
iv)	If $u = x^2 - y^2$, find a corresponding analytic function.	2	4	Ap
v)	If the Fourier series of $f(x) = 4 - x^2$, $0 < x < 2$, is $a_0 + \sum_{n=1}^{\infty} a_n \cos\left(\frac{n\pi}{l}\right)x + \sum_{n=1}^{\infty} b_n \sin\left(\frac{n\pi}{l}\right)x$, find the value of a_0 .	2	3	Ap
vi)	Find the Laplace transform of $e^{-t}t^4$.	2	1	Ap
vii)	If $L\{f(t)\} = \frac{8(s-3)}{(s^2-6s+25)^2}$, find $L\{f(2t)\}$	2	1	Ap
viii)	The lines of regression are $6y = 5x + 90$, $15x - 8y = 130$. Find the mean \bar{x} & \bar{y}	2	5	Ap
Q2	Solve any four questions out of six.	16		
i)	Find the constants a,b,c,d,e if $f(z) = (ax^3 + bxy^2 + 3x^2 + cy^2 + x) + i(dx^2y - 2y^3 + exy + y)$ is analytic function.	4	4	Ap
ii)	Find $L^{-1}\left\{\log\left(\frac{s^2+1}{s^2}\right)\right\}$.	4	2	Ap
iii)	If $f(t) = e^{-4t} \sinh t \sin t$, find $L\{f(t)\}$.	4	1	Ap
iv)	A random variable X has the following distribution	4	5	Ap

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	<table border="1"> <tr> <td>X</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>6</td> </tr> <tr> <td>P(X=x)</td> <td>$\frac{1}{36}$</td> <td>$\frac{3}{36}$</td> <td>$\frac{5}{36}$</td> <td>$\frac{7}{36}$</td> <td>$\frac{9}{36}$</td> <td>$\frac{11}{36}$</td> </tr> </table> <p>Find (i) mean, (ii) $P(1 < X < 6)$.</p>	X	1	2	3	4	5	6	P(X=x)	$\frac{1}{36}$	$\frac{3}{36}$	$\frac{5}{36}$	$\frac{7}{36}$	$\frac{9}{36}$	$\frac{11}{36}$					
X	1	2	3	4	5	6														
P(X=x)	$\frac{1}{36}$	$\frac{3}{36}$	$\frac{5}{36}$	$\frac{7}{36}$	$\frac{9}{36}$	$\frac{11}{36}$														
v)	Find the Fourier sine transform of $f(x) = e^{-ax}$	4	3	Ap																
vi)	Find the constant k such that the function $f(x) = kx^2, 0 < x < 3$ $= 0$, otherwise is a probability density function and compute $P(1 < x < 2)$.	4	6	Ap																
Q.3	Solve any two questions out of three.	16																		
i)	Evaluate $\int_0^{\infty} e^{-t} t^2 \sinh t \cosh t dt$.	8	1	Ap																
ii)	Calculate the coefficient of correlation between the ages of cars and annual maintenance costs. <table border="1"> <tr> <td>Age of Cars(year)</td> <td>2</td> <td>4</td> <td>6</td> <td>7</td> <td>8</td> <td>10</td> <td>12</td> </tr> <tr> <td>Annual maintenance Cost</td> <td>1600</td> <td>1500</td> <td>1800</td> <td>1900</td> <td>1700</td> <td>2100</td> <td>2000</td> </tr> </table>	Age of Cars(year)	2	4	6	7	8	10	12	Annual maintenance Cost	1600	1500	1800	1900	1700	2100	2000	8	5	Ap
Age of Cars(year)	2	4	6	7	8	10	12													
Annual maintenance Cost	1600	1500	1800	1900	1700	2100	2000													
iii)	Obtain the Fourier expansion of $f(x) = \left(\frac{\pi-x}{2}\right)^2, 0 \leq x \leq 2\pi$.	8	3	Ap																
Q.4	Solve any two questions out of three.	16																		
i)	Show that $e^{2x} \sin 2y - 2xy$ is harmonic and find its harmonic conjugate.	8	4	Ap																
ii)	Find the Inverse Laplace Transform of the following function using convolution theorem $\frac{s^2}{(s^2+a^2)(s^2+b^2)}$	8	2	Ap																
iii)	In a bolt factory, machine A,B,C manufacture 20%, 35% and 40% of the total output and out of the total manufacturing, 5%, 4% and 2% are defective bolts. A bolt is drawn at random from the product and is found to be defective. Find the probabilities that it is manufactured from (i) Machine A, (ii) Machine B, (iii) Machine C.	8	6	Ap																
