

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

Supplementary July-Aug 2024  
 (B.Tech) Program: EXTC Scheme : II / IIB  
 Examination: SY Semester: IV  
 Course Code: EXC401 and Course Name: AME-II  
 Date of Exam: 07/08/2024 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.
- (4) Write final answer in decimals not in fraction wherever applicable.

		Max. Marks	CO	BT level
<b>Q 1</b>	<b>Solve any six questions out of eight:</b>	<b>12</b>		
i)	Evaluate $\int_{1-i}^{2+i} (2x + iy + 1) dz$ along the straight line joining $(1 - i)$ to $(2 + i)$ .	2	1	3
ii)	Show that the vectors $v_1 = (1,0,1)$ , $v_2 = (2,1,4)$ and $v_3 = (1,1,3)$ do not span the vector space $R^3$ .	2	4	3
iii)	Determine the nature of the quadratic form $4x_1^2 + 4x_2^2 + 4x_3^2 + 4x_1x_2 + 4x_1x_3 + 4x_2x_3$	2	5	3
iv)	Find the extremal of $\int_0^1 (xy + y^2 - 2y^2y') dx$	2	6	3
v)	Evaluate $\int_C \left(\frac{1}{z^3(z+4)}\right) dz$ , where c is the circle $ z  = 2$ .	2	1	3
vi)	A computer while calculating correlation coefficient between two variables x and y from 25 observations obtained the following results $\sum x = 125$ , $\sum y = 100$ , $\sum x^2 = 650$ , $\sum y^2 = 960$ , $\sum xy = 508$ Where x and y denote the actual values of variables. Find the value of correlation coefficient?	2	2	3
vii)	The probability that a Poisson variable X takes a positive value $\geq 1$ is $1 - e^{-1.5}$ . Find the mean and the variance.	2	3	3
viii)	Find k if $f(x) = kxe^{-4x^2}$ , $0 \leq x \leq \infty$ is probability density function.	2	3	3
<b>Q.2</b>	<b>Solve any four questions out of six.</b>	<b>16</b>		
i)	Evaluate $\int_C \frac{z+3}{2z^2+3z-2} dz$ where C is the circle $ z - i  = 2$	4	1	3
ii)	If $X_1$ has mean 5 and variance 5, $X_2$ has mean -2 and variance 3 and if $X_1, X_2$ are independent then find i) $E(2X_1+3X_2-5)$ , ii) $V(2X_1+3X_2-5)$	4	3	3
iii)	Let $R^3$ have the Euclidean inner product. Use Gram-Schmidt process to transform the basis $\{u_1, u_2, u_3\}$ into an orthonormal basis where $u_1 = (1,1,1)$ , $u_2 =$	4	4	3

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	$(-1,1,0), u_3 = (1,2,1).$																	
iv)	Fit a straight line to the following data <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>X</td> <td>10</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>6</td> </tr> <tr> <td>Y</td> <td>49</td> <td>54</td> <td>60</td> <td>73</td> <td>80</td> <td>86</td> </tr> </table>	X	10	2	3	4	5	6	Y	49	54	60	73	80	86	4	2	3
X	10	2	3	4	5	6												
Y	49	54	60	73	80	86												
v)	Reduce the following quadratic form $6x_1^2 + 3x_2^2 + 14x_3^2 + 4x_1x_2 + 18x_1x_3 + 4x_2x_3$ To diagonal form through congruent transformation.	4	5	3														
vi)	Find the extremal of the functional $\int_{x_1}^{x_2} (y'^2 + 2yy' - 16y^2) dx.$	4	6	3														
<b>Q.3</b>	<b>Solve any two questions out of three.</b>	<b>16</b>																
i)	Compute Spearman's rank correlation coefficient from the following data X : 36, 56, 20, 42, 33, 44, 50, 15, 60 Y : 50, 35, 70, 58, 75, 60, 45, 80, 38	8	2	3														
ii)	Expand $f(z) = \frac{z^2-1}{z^2+5z+6}$ around $z=1.$	8	1	3														
iii)	Find the singular value decomposition of $\begin{bmatrix} 4 & 4 \\ -3 & 3 \end{bmatrix}.$	8	5	3														
<b>Q.4</b>	<b>Solve any two questions out of three.</b>	<b>16</b>																
i)	The daily sales of a firm are normally distributed with mean Rs.8000 and variance of Rs.10000. i)What is the probability that on a certain day the sales will be less than Rs.8210? ii)What is % of days on which the sales will be between Rs.8100 and Rs 8200?	8	3	3														
ii)	Check whether the set of all pairs of real numbers of the form $(1,x)$ with operations $(1,y) + (1,y') = (1, y + y')$ and $k(1,y) = (1, ky)$ is a vector space?	8	4	3														
iii)	Find the curve $y = f(x)$ for which $\int_{x_1}^{x_2} y \sqrt{1 + y'^2} dx$ is minimum subject to the constraint $\int_{x_1}^{x_2} \sqrt{1 + y'^2} dx = l.$	8	6	3														

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