

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

May-June 2026		
Program: B.Tech. Scheme III		
Regular Examination: SY Semester: IV		
Course Code: EXC401	Course Name: Application of Mathematics in Engineering-II	
Date of Exam: 19/05/2026	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)	Compute Karl Pearson's Coefficient of correlation between X and Y . <table border="1"><tr><td>X</td><td>22</td><td>28</td><td>35</td><td>40</td><td>18</td><td>30</td></tr><tr><td>Y</td><td>25</td><td>30</td><td>45</td><td>50</td><td>20</td><td>35</td></tr></table>		X	22	28	35	40	18	30	Y	25	30	45	50	20	35	2	3
X	22		28	35	40	18	30											
Y	25		30	45	50	20	35											
b)	Let R^3 have the Euclidean inner product. Use Gram-Schmidt process to transform the basis $\{u_1, u_2, u_3\}$ into orthogonal basis, where $u_1 = (1, 0, 0), u_2 = (3, 7, -2), u_3 = (0, 4, 1)$.	4	3															
c)	Find the extremals of the functional $\int_0^1 (e^y + xy') dx$ that satisfy the boundary conditions $y(0) = 0, y(1) = 0$.	6	3															
Q 2	Solve any two questions out of three: (05 marks each)	10																
a)	Find the sum of residues of $f(z) = \frac{z}{(z-1)(z+2)^2}$ at their poles.		1	3														
b)	If X is a normal variate with mean 10 and standard deviation 4, find (i) $P(5 \leq X \leq 18)$, (ii) $P(X \leq 12)$ Note: Area from $z = 0$ to $z = 0.5$ is 0.1015, Area from $z = 0$ to $z = 0.4$ is 1.285, Area form $z = 0$ to $z = 1.25$ is 0.3944, Area from $z = 0$ to $z = -2$ is 0.4772.		3	3														
c)	Express each of the following transformations $x_1 = 2y_1 - 3y_2; x_2 = 4y_1 + y_2$ and $y_1 = z_1 - 2z_2; y_2 = 2z_1 + 3z_2$ in the matrix form and find the composite transformation which expresses x_1, x_2 in terms of z_1, z_2 .		5	3														
Q.3	Solve any two questions out of three. (10 marks each)	20																
a)	(i) Obtain the rank correlation coefficient from the following data. <table border="1"><tr><td>$X :$</td><td>10, 12, 18, 18, 15, 40</td></tr><tr><td>$Y :$</td><td>12, 18, 25, 25, 50, 25</td></tr></table>	$X :$	10, 12, 18, 18, 15, 40	$Y :$	12, 18, 25, 25, 50, 25	6	2	3										
$X :$	10, 12, 18, 18, 15, 40																	
$Y :$	12, 18, 25, 25, 50, 25																	

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	(ii) Calculate both regression coefficient from the data: $N = 10, \sum x = 100, \sum y = 150, \sum (x - 10)^2 = 180,$ $\sum (y - 15)^2 = 215, \sum (x - 10)(y - 15) = 60$ Where x, y denotes the actual values.	4		
b)	Prove that the set $S = \left\{ \begin{bmatrix} a & 0 \\ 0 & b \end{bmatrix} : a, b \in \mathbb{R} \right\}$ form a vector space with usual addition of matrices and scalar multiplication.	10	4	3
c)	Solve the boundary value problem $I = \int_0^1 (2xy - y^2 - y'^2) dx$ given $y(0) = y(1) = 0$ by Rayleigh-Ritz method.	10	6	3
Q.4	Solve any two questions out of three. (10 marks each)	20		
a)	(i) Expand $f(z) = \frac{1}{(z+1)(z+3)}$ valid for the region (a) $ z < 1$ (b) $1 < z < 3$.	6	1	3
	(ii) Evaluate $\int_C y dx + x^2 dy$ along $y = x$ from $(0, 0)$ to $(1, 1)$	4		
b)	(i) A man is known to speak truth 3 out of 4 times. He throws a die and reports that it is four. Using Baye's theorem find the probability that it is actually, a four.	6	3	3
	(ii) If a random variable X follows Poisson distribution such that, $P(X = 1) = 2P(X = 2)$, find the mean and variance of the distribution. Also find $P(X = 3)$.	4		
c)	Reduce the quadratic form $21x_1^2 + 11x_2^2 + 2x_3^2 - 30x_1x_2 + 12x_1x_3 - 8x_2x_3$ to canonical form and find its rank and signatures. Also write linear transformation which brings about the normal reduction.	10	5	3
