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

May-June 2024
Program: B.Tech Scheme :II/IIB
Regular Examination: SY Semester: IV
Course Code: EXC401and Course Name: Applications of Mathematics in Engineering-II
Date of Exam: 14-MAY-2024 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.
(4) Write final answer in decimals not in fraction wherever applicable.

		Max. Marks	CO	BT level
Q 1	Solve any six questions out of eight:	12		
i)	Evaluate $\int \bar{z}\, dz$ where C is the upper half of the circle $r = 1$	2	1	3
ii)	State Bayes theorem.	2	3	3
iii)	Given $6Y = 5X + 90$, $15X = 8Y + 130$, ${\sigma_x}^2 = 16$. *Find* $\bar{X}$ *and* $\bar{Y}$	2	2	3
iv)	Verify Cauchy-Schwartz inequality for vectors u = (-4,2,1) , v = (8,-4,-2) .	2	4	3
v)	Write down the matrix of each of the following quadratic form (i) $x^2 - 2y^2 + 3z^2 - 2xy - 6xz + 10zy$ (ii) ${2x_1}^2 - {3x_2}^2 + {4x_3}^2 + {x_4}^2 - 2x_1x_2 + 3x_1x_3 - 4x_1x_4 - 5x_2x_3 + 6x_2x_4 + x_3x_4$	2	5	3
vi)	Find extremals of the functional $\int_{x_1}^{x_2} \frac{{y'}^2}{x^3}\, dx = 0.$	2	6	3
vii)	Find the unit vector in R^3 orthogonal to both (1,0,1) and (0,1,1).	2	4	3
viii)	Evaluate $\int_0^{1+i} (x^2 + iy)dz$ along the path $y = x$.	2	1	3
Q.2	Solve any four questions out of six.	16		
i)	Expand $f(z) = \cos z$ as a Taylor's series around $z = \frac{\pi}{2}$.	4	1	3
ii)	Check whether true or false and justify your answer. If X is a Poisson variate such that $P(X = 2) = 9P(X = 4) + 90P(X)$, then the mean of X is 1. $P(X=6)$	4	3	3

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

May-June 2024
Program: B.Tech Scheme :II/IIB
Regular Examination: SY Semester: IV
Course Code: EXC401and Course Name: Applications of Mathematics in Engineering-II
Date of Exam: 14-MAY-2024 Duration: 2.5 Hours Max. Marks: 60

iii)	Obtain the equation of the line of regression of Y on X from the following data and estimate Y for X=73 X 70 72 74 76 78 80 Y 163 170 179 188 196 220	4	2	3
iv)	Show that any plane passing through origin is a subspace of R^3.	4	4	3
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 transformations.	4	5	3
vi)	Find extremals of the functional $\int_0^{\frac{3\pi}{2}} (y^2 - y'^2)\, dx$, given $y(0) = 0$ and $y(\frac{3\pi}{2}) = 1$.	4	6	3
Q.3	Solve any two questions out of three.	16		
i)	Evaluate $\int_C \frac{z+6}{z^2-4} dz$ where C is the circle (i) $\|z\| = 1$ (ii) $\|z-2\| = 1$ (iii) $\|z+2\| = 1$.	8	1	3
ii)	In a competitive examination the top 15% of the students appeared will get grade A, while the bottom 20% will be declared fail. If the grades are normally distributed with mean % of marks 75 and SD 10 , determine the lowest % of marks to receive grade A and the lowest % of marks that passes.	8	3	3
iii)	From the following data calculate the coefficient of rank correlation between X and Y X 32 55 49 60 43 37 43 49 10 20 Y 40 30 70 20 30 50 72 60 45 25	8	2	3
Q.4	Solve any two questions out of three.	16		
i)	Let R^3 have the Euclidean inner product. Use Gram-Schmidt process to transform the basis of subspace$\{\mathbf{u_1},\mathbf{u_2},\mathbf{u_3}\}$ into orthonormal basis, where $\mathbf{u_1}$=(1,1,1),$\mathbf{u_2}$=(-1,1,0), $\mathbf{u_3}$=(1,2,1)	8	4	3
ii)	Find the Singular value decomposition of $\begin{bmatrix} 1 & 2 \\ 1 & 2 \end{bmatrix}$.	8	5	3
iii)	Find the extremal of $\int_{x_0}^{x_1} (y''^2 - y^2 + x^2)\, dx$.	8	6	3

****