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

April – May 2023

(B.Tech.) Program: B.Tech. (Electronic and Telecommunication) Scheme: II

Examination: SY   Semester: IV

Course Code: _ EXC401 and   Course Name: Applications of Mathematics in Engineering-II

Date of Exam: 13th May, 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
		12		
Q 1	Solve any six questions out of eight:	2	1	Ap
i)	Evaluate $\int_0^{1+i} z^2\, dz$ along the line $y = x$.	2	4	Ap
ii)	Is $W = \{(a,0,0)/a \in R\}$ a subspace of R^3 ?	2	5	Ap
iii)	State the value classes of a quadratic form.	2	6	Ap
iv)	Find the extremal of $\int_{x_1}^{x_2}(1 + x^2 y')y'\, dx$	2	1	Ap
v)	Evaluate $\int_C \left(\frac{z+2}{(z-3)(z-4)}\right) dz$ where c is the circle $|z| = 1$..	2	2	Ap
vi)	State whether following statement is true or false with justification: "Both the coefficients of regression for the given data always have same sign."	2	3	Ap
vii)	Justify your answer. " Can we have a Poisson distribution with mean 4 and variance 5? "	2	3	Ap
viii)	If Probability density function of a continuous random variable is $(x) = \begin{cases} kx^2(1 - x^3), & 0 \le x \le 1 \\ 0, & otherwise \end{cases}$, find the value of k and $P(0 \le x \le 0.5)$.			
		16		
Q2	Solve any four questions out of six.	4	1	Ap
i)	Using Cauchy Residue theorem evaluate $\int_C \frac{z^2}{(z-1)^2(z-2)}\, dz$ where C is the circle $|z| = 2.5$.	4	3	Ap
ii)	A discrete random variable has the probability density function given below.			

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	X | -2 | -1 | 0 | 1 | 2 | 3 $P(X=x)$ | 0.2 | k | 0.1 | 2k | 0.1 | 2k Find k, mean and variance.				
iii)	Find a vector orthogonal to both $u = (-6, 4, 2)$, $v = (3,1,5)$.	4	4	Ap	
iv)	Fit a first degree curve to the following data X | 10 | 12 | 15 | 23 | 20 Y | 14 | 17 | 23 | 25 | 21	4	2	Ap	

* Questions v & vi are on page no.3.

Q.3	Solve any two questions out of three.	16		
i)	Calculate the coefficient of correlation for the following data X | 28 | 45 | 40 | 38 | 35 | 33 | 40 | 32 | 36 | 33 Y | 23 | 34 | 33 | 34 | 30 | 26 | 28 | 31 | 36 | 35	8	2	Ap
ii)	Find all possible Laurent's expansions of the function $f(z) = \frac{1}{z^2(z-1)(z+2)}$ about $z = 0$.	8	1	Ap
iii)	Reduce the following quadratic form to canonical form. Also find its rank, index and signature. $3x_1^2 + 5x_2^2 + 3x_3^2 - 2x_1x_2 - 2x_2x_3 + 2x_3x_1$.	8	5	Ap
Q.4	Solve any two questions out of three.	16		
i)	If X is a normal variate with mean 10 and standard deviation 4, find (i) $P(|X - 14| < 1)$ (ii) $P(5 \leq X \leq 18)$ (iii) $P(X \leq 12)$	8	3	Ap
ii)	Let R^3 have the Euclidean inner product. Use the Gram-Schmidt process to transform the basis $\{u_1, u_2, u_3\}$ into orthonormal basis where $u_1 = (1, 0, 0)$, $u_2 = (3, 7, -2)$, $u_3 = (0, 4, 1)$.	8	4	Ap
iii)	Find the curve $y = f(x)$ for which $\int_{x_1}^{x_2} y \sqrt{1 + y'^2}\, dx$ is extremum subject to the constraint $\int_{x_1}^{x_2} \sqrt{1 + y'^2}\, dx = l$.	8	6	Ap

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Q 2		12		
v)	Find the extremal of $$\int_{x_1}^{x_2} \left(y^2 + y'^2 + 6y\sin x \right) dx$$	4	6	Ap
vi)	Reduce the following quadratic form into canonical form. $x_1{}^2 + 2x_2{}^2 + 3x_3{}^2 - 2x_1x_3 + 2x_2x_3 + 2x_2x_1$	4	5	Ap