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

Supplementary Examination - August 2023
(B.Tech) Program: Electronics and Telecommunication Engineering Scheme: I / II
Examination: SY Semester: IV
Course Code: 1UEXC401 / EXC401
Course Name: Applications of Mathematics in Engineering - II
Date of Exam: 24-Aug-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
Q 1	Solve any six questions out of eight:	12		
i)	Evaluate $\int_C \frac{e^{2z}}{(z-1)^4}\,dz$ where C is $\lvert z\rvert = 0.5$.	2	1	Ap
ii)	A discrete random variable has probability density function given below. Find k and expectation of . . $X = x_i$: -2, -1, 0, 1, 2, 3 $P(x_i)$: 0.2, k, 0.1, 2k, 0.1, 2k	2	3	Ap
iii)	Determine the pole of the function $f(z) = \frac{z^2}{(z-1)^2(z+2)}$ and find the residue at pole one of the poles.	2	1	Ap
iv)	Write down the matrix in quadratic forms. $x_1^2 + x_2^2 - 3x_3^2 + 2x_1x_2 + 6x_2x_3 - 4x_1x_3$.	2	5	Ap
v)	State any two formulas of Euler Lagrange's differential equation.	2	6	Ap
vi)	Given $b_{yx} = \frac{5}{6}$ and $b_{xy} = \frac{8}{15}$. Find the value of r.	2	2	Ap
vii)	Verify Cauchy-Schwartz inequality for the vectors $u = (-4, 2, 1)$ and $v = (8, -4, -2)$.	2	4	Ap
viii)	The probability density function of a random variable X is X: 0, 1, 2, 3, 4, 5, 6 P(X=x): k, 3k, 5k, 7k, 9k, 11k, 13k Find the value of k.	2	3	Ap
Q.2	Solve any four questions out of six.	16		
i)	Evaluate $\int z^2\,dz$ from $P(1,1)$ to $Q(2,4)$ where C is the curve $x = t$ and $y = t^2$.	4	1	Ap
ii)	A discrete random variable A has the following probability distribution function $X = x_i$: -2, -1, 0, 1, 2, 3 $P(x_i)$: 0.1, k, 0.2, 2k, 0.3, 3k	4	3	Ap

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	Find (i) k (ii) $P(X \geq 2)$ (iii) $P(-2 < x < 2)$.			
iii)	Find a vector orthogonal to both $u = (-6, 4, 2)$, $v = (3, 1, 5)$.	4	4	Ap
iv)	Calculate Spearman's rank correlation coefficient R X : 18 20 34 52 12 Y : 39 23 35 18 46	4	2	Ap
v)	Show that the quadratic form $3x^2 + 5y^2 + 3z^2 - 2xy + 2xz - 2yz$ is positive definite.	4	5	Ap
vi)	Find the curve on which functional $\int_0^1 (y'^2 + 12xy)\,dx$ with $y(0) = 0$ and $y(1) = 1$ is extremal.	4	6	Ap
Q.3	Solve any two questions out of three.	16		
i)	Calculate the coefficients of regression and hence the equations of the lines of regression for the following data X: 5 6 7 8 9 10 11 Y: 11 14 14 15 12 17 16	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 the diagonal form through congruent transformations. $x^2 + 2y^2 - 3z^2 + 5w^2 - 4xy + 8yz + 2yw - 2zx$	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) $P(\lvert X - 14\rvert < 1)$ (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 Gram Schmidt process to transform the basis $\{u_1, u_2, u_3\}$ into orthonormal basis where $u_1 = (1, 1, 1)$, $u_2 = (-1, 1, 0)$, $u_3 = (1, 2, 1)$.	8	4	Ap
iii)	Using Rayleigh-Ritz method, solve the boundary value problem $I = \int_0^1 (2xy + y^2 - y'^2)\,dx$; $0 \leq x \leq 1$, given $y(0) = y(1) = 0$.	8	6	Ap

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