EXTC
IV

Date : 13/12/2022

old course | scheme-1

K. J. Somaiya Institute of Engineering and Information Technology, Sion, Mumbai-22
(Autonomous College Affiliated to University of Mumbai)
End Semester Exam
NOV-DEC-2022
B.Tech. Program: Electronics and Telecommunication Engineering
Examination: SY Semester: IV
Course Code: 1UEXC401
Course Name: Application of Mathematics in Engineering -II

Duration: 03 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 the integral $\int_0^{1+i}(x-y+ix^2)\,dz$ along the line from $z=0$ to $z=1+i$.	**2**	1	3
ii)	A discrete random variable has the probability density function given below. Find the value of k and the mean. X: -2, -1, 0, 1, 2, 3 $P(X=x)$: 0.2, k, 0.1, 2k, 0.1, 2k	**2**	3	3
iii)	Define Basis and Dimension of a vector space.	**2**	4	3
iv)	If for a Poisson variate $m=2$, find the probabilities of $x=1$ using recurrence relation of Poisson distribution.	**2**	3	3
v)	State Sylvester's law of inertia. Also state the value classes of a quadratic form.	**2**	5	3
vi)	State the normal equations for fitting a straight line.	**2**	2	3
vii)	State Euler-Lagrange equation and define Isoperimetric problems.	**2**	6	3
viii)	State true or false with reasoning. "The two regression coefficients are both positive or both negative".	**2**	2	3
Q.2	**Solve any four questions out of six.**	**16**		
i)	Evaluate $\int_C \frac{7z-1}{(z-3)(z+5)}\,dz$, where C is the circle $\lvert z\rvert=1$.	**4**	1	3

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ii)	Find the extremal of the function $\int_0^{\frac{\pi}{2}} (y'^2 - y^2 + 2xy)\, dy$ with $y(0) = 0$, $y\left(\frac{\pi}{2}\right) = 0$.	4	6	3
iii)	If X is a Poisson variate and $P(X = 0) = 6P(X = 3)$, find $P(X = 2)$.	4	3	3
iv)	Given two lines of regression $6y = 5x + 90$, $15x = 8y + 130$. Find (i) $\bar{x}, \bar{y}$ (ii) correlation coefficient r.	4	2	3
v)	Verify that $v_1 = \left(-\frac{3}{5}, \frac{4}{5}, 0\right)$, $v_2 = \left(-\frac{4}{5}, \frac{3}{5}, 0\right)$, $v_3 = (0,0,1)$ are orthonormal and if $u = (1,-1,2)$ then express u as a linear combination of v_1, v_2, v_3.	4	4	3
vi)	Determine the nature of the following quadratic form $x^2 + 2y^2 + 2z^2 - 2xy - 2yz + zx$	4	5	3
Q.3	**Solve any two questions out of three.**	**16**		
i)	Find the singular value decomposition of the matrix $\begin{bmatrix} 2 & 3 \\ 0 & 2 \end{bmatrix}$.	8	5	3
ii)	Obtain Taylor's and Laurent's series expansions of $f(z) = \frac{z-1}{z^2-2z-3}$. Also indicate the regions of convergence.	8	1	3
iii)	Compute Karl Pearson's coefficient of correlation (r) and The Spearson's Rank correlation coefficient(R) and for the data X: 18 20 34 52 12 Y: 39 23 35 18 46	8	2	3
Q.4	**Solve any two questions out of three.**	**16**		
i)	Using the relation that the length of the arc between two points $A(x_1, y_1)$ and $B(x_2, y_2)$ is given by $S = \int_{x_1}^{x_2} \sqrt{1 + y'^2}\, dx$, show that the shortest smooth plane curve between two points on a plane is a straight line.	8	6	3
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 bases where $u_1 = (1,1,1), u_2 = (0,1,1), u_3 = (0,0,1)$.	8	4	3
iii)	(A) The marks obtained by 1000 students in an examination are found to be normally distributed with mean 70 and standard deviation 5. Estimate the number of students whose marks will be (1) between 60 and 75 (ii) more than 75. (B) A man speaks truth 3 times out of 5. When a die is thrown, he states that it gave an ace. What is the probability that this event has actually happened?	8	3	3