

Date : 23-05-22

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

End Semester Exam

April-May 2022

B. Tech Program: **EXTC**

Examination: SY Semester: IV

Course Code: IUEX401

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		3
i)	Find the value of the integral $\int_0^{1+i} (x^2 - iy) dz$ along the path $y = x$	2	1	3
ii)	Evaluate $\int_c \frac{z-1}{(z-3)(z+7)} dz$, where c is the circle $ z =1$	2	1	3
iii)	A meeting has 12 employees. Given that 8 of the employees are women, find the probability that all the employees are women?	2	3	3
iv)	A continuous random variable has probability density function $f(x) = k(x - x^2)$, $0 \leq x \leq 1$. Find k	2	3	3
v)	Given two lines of regression $6y - 5x = 90$, $15x - 8y = 130$, find \bar{x} and \bar{y}	2	2	3
vi)	Show that the following vectors are orthonormal $\left(\frac{-4}{5}, \frac{3}{5}, 0\right)$ and $\left(\frac{3}{5}, \frac{4}{5}, 0\right)$	2	4	3
vii)	Define index and signature of the quadratic form	2	5	3
viii)	State two different forms of Euler-Lagrange's equation.	2	6	3
Q.2	Solve any four questions out of six.	16		
i)	Show that the plane passing through the origin is a subspace of \mathbb{R}^3 .	4	4	3

ii)	Fit a parabola to the following data <table border="1" style="margin-left: 20px;"> <tr> <td>X</td> <td>3</td> <td>3.5</td> <td>4</td> <td>4.5</td> <td>5</td> <td>5.5</td> <td>6</td> </tr> <tr> <td>Y</td> <td>3.1</td> <td>3.3</td> <td>3.6</td> <td>4</td> <td>4.7</td> <td>5.4</td> <td>6.1</td> </tr> </table>	X	3	3.5	4	4.5	5	5.5	6	Y	3.1	3.3	3.6	4	4.7	5.4	6.1	4	2	3
X	3	3.5	4	4.5	5	5.5	6													
Y	3.1	3.3	3.6	4	4.7	5.4	6.1													
iii)	Using Cauchy's Residue theorem evaluate $\int_C \frac{\sin 3z}{z + \frac{\pi}{2}} dz$ where C is $ z = 1$.	4	1	3																
iv)	Find the extremal of $\int_0^1 (xy + y^2 - 2y^2 y') dx$.	4	6	3																
v)	Determine value class of the quadratic form $6x_1x_2 + 6x_1x_3 + 6x_2x_3 + 6x_1^2 + 6x_2^2 + 6x_3^2$	4	5	3																
vi)	A continuous random variable has probability density function $f(x) = A + Bx$, $0 \leq x \leq 1$. If the mean of the distribution is $1/3$, find A and B.	4	3	3																
Q.3	Solve any two questions out of three	16																		
i)	Find the singular value decomposition of the matrix $A = \begin{bmatrix} 3 & 1 & 1 \\ -1 & 3 & 1 \end{bmatrix}$	8	5	3																
ii)	Find all possible Laurent's series expansion of $f(z) = \frac{4z+3}{z(z-3)(z+2)}$	8	1	3																
iii)	Find the Karl Pearson's coefficient of correlation and Spearman's rank correlation coefficient between X and Y X: 100, 102, 108, 111, 115, 116, 118 Y: 110, 100, 104, 108, 112, 116, 120	8	2	3																
Q.4	Solve any two questions out of three.	16																		
i)	Using Rayleigh-Ritz method solve the following boundary value problem $\int_0^1 (2xy + y^2 - y'^2) dx$, $0 \leq x \leq 1$, given $y(0) = 0, y(1) = 0$	8	6	3																
ii)	In an examination Marks obtained by students in Mathematics, Physics, Chemistry are normally distributed with means 51, 53, 46 with standard deviation 15, 12, 16 respectively. Find the probability of securing total marks (i) 180 or above. (ii) 80 or below.	8	3	3																
iii)	Use Gram-Schmidt process to transform the basis (u, v, w) into orthonormal basis, where $u = (1,1,1), v = (0,1,1), w = (0,0,1)$	8	4	3																