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

April ~~Nov – Dec 2025~~ 2026
Program: B. Tech , Scheme: III
Supplementary ~~Regular~~ Examination: FY ,Semester: I
Course Code: BSC101 and Course Name: Engineering Mathematics-I
Date of Exam: ~~12 Jan 2026~~ 06/04/26 Duration: 02.5 Hours Max. Marks: 60

Instructions:
(1)All questions are compulsory.
(2)Draw neat diagrams wherever applicable.
(3)Assume suitable data, if necessary.
(4) Write numerical values in decimals not in fractions.
(5) Write numerical values till four decimal places

Q. No.	Question	Max. Marks	CO	BT level
Q 1	Solve any **two** questions out of three: (05 marks each)	10		
a)	Express $\begin{bmatrix} 2 & 4 & -2 \\ 6 & -2 & 0 \\ 0 & 8 & -4 \end{bmatrix}$ as the sum of a symmetric and a skew-symmetric matrices and check your results.	5	5	3
b)	Show that $\sin 5\theta = 5\sin\theta - 20\sin^3\theta + 16\sin^5\theta$	5	1	3
c)	If $5\sinh x - \cosh x = 5$, find $\tanh x$ then find the values of $\tanh x$.	5	2	3
Q 2	Solve any **two** questions out of three: (05 marks each)	10		
a)	If $u = \frac{x^2y^2}{x^2+y^2} + \cos\left(\frac{xy}{x^2+y^2}\right)$, prove that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = 2\left(\frac{x^2y^2}{x^2+y^2}\right)$	5	3	3
b)	If $y = \frac{x^2+4x+1}{x^3+2x^2-x-2}$, find y_n .	5	4	3
c)	Prove that $\sec^2 x = 1 + x^2 + \frac{2x^4}{3} + \cdots$	5	6	3
Q.3	Solve any **two** questions out of three. (10 marks each)	20		

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a)	(I) Define Hermitian matrix , Unitary matrix (II) Find the value of p for which the following matrix A will have (i) rank 1 (ii) rank 2 (iii) rank 3 $A = \begin{bmatrix} 3 & p & p \\ p & 3 & p \\ p & p & 3 \end{bmatrix}$	2 8	5	3
b)	If α *and* β are the roots of $z^2 sin^2\theta - z \sin 2\theta + 1 = 0$, then prove that (i) $\alpha^n + \beta^n = 2 \cos n\theta \; cosec^n\theta$ (ii) $\alpha^n\beta^n = cosec^{2n}\theta$	10	1	3
c)	Separate into real and imaginary part $\sqrt{i}^{\sqrt{i}}$	10	2	3
Q.4	Solve any **two** questions out of three. (10 marks each)	20		
a)	If $z = f(u,v)$, $u = lx + my$, $v = ly - mx$, show that $\frac{\partial^2 z}{\partial x^2} + \frac{\partial^2 z}{\partial y^2} = (l^2 + m^2)\left(\frac{\partial^2 z}{\partial u^2} + \frac{\partial^2 z}{\partial v^2}\right)$.	10	3	3
b)	Find the extreme values of $x^4 + y^4 - 2x^2 + 4xy - 2y^2$ if any.	10	4	3
c)	Solve the following equations using Jacobi's Method (take 4 iterations) $5x + 2y + z = 12$; $x + 4y + 2z = 15$; $x + 2y + 5z = 20$	10	6	3

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