

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

Nov – Dec 2025
Program: B. Tech , Scheme: III
Regular Examination: FY , Semester: I
Course Code: BSC101 and Course Name: Engineering Mathematics-I
Date of Exam: 12-Jan-2026 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)	For the matrix A find non-singular matrices P and Q such that PAQ is in normal form and find the rank of A where $A = \begin{bmatrix} 2 & -2 & 3 \\ 3 & -1 & 2 \\ 1 & 2 & -1 \end{bmatrix}$	5	5	3
b)	Expand $\sin^4 \theta \cos^3 \theta$ in a series of cosines of multiples of θ .	5	1	3
c)	Prove that $\operatorname{sech}^{-1}(\sin \theta) = \log \cot \left(\frac{\theta}{2} \right)$	5	2	3
Q 2	Solve any two questions out of three: (05 marks each)	10		
a)	If $v = \frac{f(\theta)}{r}$; $x = r \cos \theta$, $y = r \sin \theta$, prove that $x \frac{\partial v}{\partial x} + y \frac{\partial v}{\partial y} + v = 0$	5	3	3
b)	Find the length of the shortest line from the point $(0, 0, \frac{25}{9})$ to the surface $z = xy$ using method of Lagrange's multipliers.	5	4	3
c)	Prove that $\log \left[\log \left((1+x)^{\frac{1}{x}} \right) \right] = -\frac{1}{2}x + \frac{5}{24}x^2 - \frac{1}{8}x^3 + \frac{251}{2880}x^4 + \dots$	5	6	3

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

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

Q.3	Solve any two questions out of three. (10 marks each)	20		
a)	Reduce the following matrix to normal form and find its rank. $A = \begin{bmatrix} 1 & 2 & 1 & 0 \\ 3 & 2 & 1 & 2 \\ 2 & -1 & 2 & 5 \\ 5 & 6 & 3 & 2 \\ 1 & 3 & -1 & -3 \end{bmatrix}$	10	5	3
b)	Using De Moiver's Theorem p rove that $\frac{1+\cos 9\theta}{1+\cos \theta} = (x^4 - x^3 - 3x^2 + 2x + 1)^2$ where $x = 2\cos \theta$	10	1	3
c)	Prove that 1) $\cos \left[i \log \left(\frac{a-ib}{a+ib} \right) \right] = \frac{a^2-b^2}{a^2+b^2}$. 2) $\tan \left[i \log \left(\frac{a-ib}{a+ib} \right) \right] = \frac{2ab}{a^2-b^2}$	5 5	2	3
Q.4	Solve any two questions out of three. (10 marks each)	20		
a)	If $u = f\left(\frac{x^2}{y}\right)$, prove that $x^2 u_{xx} + 3xy u_{xy} + 2y^2 u_{yy} = 0$	10	3	3
b)	Find the n^{th} derivative of $y = \frac{x^4}{(x-1)(x-2)}$.	10	4	3
c)	Using Newton-Raphson Method find the root of $x^4 - x - 10 = 0$; Correct upto three decimal places	10	6	3
