Nov – Dec 2024
Program: B. Tech ,   Scheme: III/II
Regular Examination: FY ,Semester: I
Course Code: BSC101 and Course Name: Engineering Mathematics-I
Date of Exam:13-Jan-2025   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)	Reduce the following matrix to normal form and find its rank $$\begin{bmatrix} 3 & 2 & 5 & 7 & 12 \\ 1 & 1 & 2 & 3 & 5 \\ 3 & 3 & 6 & 9 & 15 \end{bmatrix}$$	5	5	3
b)	Prove that $sin^5\theta = \frac{1}{16}[sin 5\theta - 5 sin 3\theta + 10 sin\theta]$.	5	1	3
c)	Separate into real and imaginary parts $tan^{-1}(e^{i\theta})$	5	2	3
Q 2	Solve any two questions out of three: (05 marks each)	10		
a)	If $z = x^y + y^x$, verify that $\frac{\partial^2 z}{\partial y \partial x} = \frac{\partial^2 z}{\partial x \partial y}$	5	3	3
b)	Find the nth derivative of $\frac{2}{(x-1)(x-2)(x-3)}$	5	4	3
c)	Prove that $sec^2 x = 1 + x + \frac{2x^4}{3} + \dots\dots$	5	6	3
Q.3	Solve any **two** questions out of three. (10 marks each)	20		

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a)	(i) Solve the following equations $x_1 + x_2 - x_3 + x_4 = 0,\ 3x_1 + x_2 + x_4 = 0,\ x_1 + 3x_2 + 2x_3 + 4x_4 = 0.$ (ii) Test for consistency of the following equations and solve if consistent $x_1 - 2x_2 + x_3 - x_4 = 2,\ x_1 + 2x_2 + 2x_4 = 1,\ 4x_2 - x_3 + 3x_4 = -1.$	5 5	5	3
b)	Show that the roots of the equation $(x + 1)^6 + (x - 1)^6 = 0$ are given by $-i \cot \left[\frac{(2k+1)\pi}{12} \right]$, k=0,1,2,3,4,….	10	1	3
c)	If $u + iv = \frac{1}{i} \log \left(\frac{1+ie^{i\theta}}{1-ie^{i\theta}} \right)$, prove that $u = \frac{\pi}{2}$ and $v = \log(\sec\theta + \tan\theta)$	10	2	3
Q.4	Solve any **two** questions out of three. (10 marks each)	20		
a)	If $u = \sin^{-1} \left[\frac{x^{\frac{1}{3}}+y^{\frac{1}{3}}}{x^{\frac{1}{2}}+y^{\frac{1}{2}}} \right]^{\frac{1}{2}}$, prove that $x^2 \frac{\partial^2 u}{\partial x^2} + 2xy \frac{\partial^2 u}{\partial x \partial y} + y^2 \frac{\partial^2 u}{\partial y^2} = \frac{\tan u}{144} [\tan^2 u + 13]$	10	3	3
b)	Examine the function $f(x, y) = x^3 + 3xy^2 - 15x^2 - 15y^2 + 72x$ for extreme values.	10	4	3
c)	Solve the following equations by Gauss-Seidel method, $15x + 2y + z = 18, 2x + 20y - 3z = 19, 3x - 6y + 25z = 22$	10	6	3

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