DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

End Semester Winter Examination – Dec 2019

Course: B. Tech (All Courses)

Sem: I

Subject Name: Engineering Mathematics-I

Subject Code: BTMA101

Max Marks: 60M

Duration:-3 Hrs.

Instructions to the Students:

- 1. All questions are compulsory.
- 2. Use of non-programmable calculator is allowed.
- 3. Figures to right indicate full marks.
- 4. Illustrate your answer with neat sketches, diagram etc. whatever necessary.
- 5. If some part of parameter is noticed to be missing you may appropriately assume it and should mention it clearly.

Date:-11/12/2019

	clearly.	
		Marks
Q. 1	Solve the following questions.	
A)	Reduce to the Normal form and find the rank of the given matrix. $A = \begin{bmatrix} 1 & 2 & 3 & -1 \\ -1 & -1 & -3 & -1 \\ 1 & 0 & 1 & 1 \\ 0 & 1 & 1 & -1 \end{bmatrix}$	4
B)	Test the consistency and solve: $2x_1 + x_2 - x_3 + 3x_4 = 11$, $x_1 - 2x_2 + x_3 + x_4 = 8$, $4x_1 + 7x_2 + 2x_3 - x_4 = 0$, $3x_1 + 5x_2 + 4x_3 + 4x_4 = 17$	4
C)	Find the eigen value & eigen vector for least positive eigen value of the matrix: $A = \begin{bmatrix} 4 & 2 & -2 \\ -5 & 3 & 2 \\ -2 & 4 & 1 \end{bmatrix}$	4
Q.2	Solve any three of the following.	
A)	If $x^x y^y z^z = c$ show that at point $x = y = z$, $\frac{\partial^2 z}{\partial x \partial y} = -[x \log ex]^{-1}$	4
B)	If $u = \sin\left(\frac{x}{y}\right)$ & $x = e^t$, $y = t^2$ verify $\frac{du}{dt} = \frac{\partial u}{\partial x} \frac{dx}{dt} + \frac{\partial u}{\partial y} \frac{dy}{dt}$	4
(C)	If $u = \sin^{-1}\left(\frac{x+y}{\sqrt{x}+\sqrt{y}}\right)$ then prove that $x^2 \frac{\partial^2 u}{\partial x^2} + 2xy \frac{\partial^2 u}{\partial x \partial y} + y^2 \frac{\partial^2 u}{\partial y^2} = \frac{-\sin u \cos 2u}{4\cos^3 u}$	4
D)	If $u = f(2x - 3y, 3y - 4z, 4z - 2x)$ prove that $\frac{1}{2} \frac{\partial u}{\partial x} + \frac{1}{3} \frac{\partial u}{\partial y} + \frac{1}{4} \frac{\partial u}{\partial z} = 0$	4
,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	Solve any three of the following.	
A)	Expand $f(x,y) = e^{x+y}$ in Maclaurin's theorem up to fourth term.	4
B)	If $x = u(1-v)$, $y = uv$ prove that $JJ' = 1$	4
(C)	A rectangular box open at the top is to have volume of 256 cubic feet, determine the dimensions of the box required least material for the construction of the box.	4
D)	Examine the function $x^3 + y^3 - 3axy$ for maxima & minima where $a > 0$	4

Q.4	Solve any three of the following.	
A)	Evaluate $\int_{0}^{2a} x \sqrt{(2ax - x^2)} dx$	4
B)	Trace the Curve $y^2(a-x) = x^2(a+x)$	4
(S)	Trace the Curve $x = a \cos^3 t$, $y = a \sin^3 t$	4
D)	Trace the Curve $r = a \cos 3\theta$	4
Q. 5	Solve the following questions.	
A)	Change the order of integration $I = \int_{0}^{a} \int_{x}^{a^{2}/x} f(x, y) dxdy$	4
B)	Change to polar and evaluate $\int_{0}^{a} \int_{\sqrt{ax-x^2}}^{\sqrt{a^2-x^2}} \frac{dxdy}{\sqrt{a^2-x^2-y^2}}$	4
C)	Find the volume bounded by the cylinders $x^2 + y^2 = ax \& z^2 = ax$	4
	END	

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