	DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSIT	TY, LONERE		
	End Semester Examination – Winter 2022			
	Course: B. Tech. (Common to all Branches) Seme	Semester : I		
	Subject Code & Name: Engineering Mathematics – I (BTBS 101)			
	Max Marks: 60 Date: Durat	tion: 3 Hrs.		
	Instructions to the Students: 1. All the questions are compulsory. 2. The level of question/expected answer as per OBE or the Course Outcome (CO) on which the question is based is mentioned in () in front of the question. 3. Use of non-programmable scientific calculators is allowed. 4. Assume suitable data wherever necessary and mention it clearly.			
		(Level/CO)	Marks	
Q. 1	Solve Any Three of the following.		12	
A)	Reduce to the Normal form and find the rank of the given matrix. $A = \begin{bmatrix} 1 & -2 & 0 & 1 \\ 2 & -1 & 1 & 0 \\ 3 & -3 & 1 & 1 \\ -1 & -1 & -1 & 1 \end{bmatrix}$	Understand/ CO1	4	
B)	Test the consistency and solve: 3x + y + 2z = 3, 2x - 3y - z = -3, x + 2y + z = 4	Understand/ CO1	4	
C)	Find the eigen value & eigen vector for least positive eigen value of the matrix: $A = \begin{bmatrix} 1 & 0 & -1 \\ 1 & 2 & 1 \\ 2 & 2 & 3 \end{bmatrix}$	Understand/ CO1	4	
D)		Understand/ CO1	4	
Q.2	Solve Any Three of the following:		12	
A)	If $u = \log(x^2 + y^2) + \tan^{-1}\left(\frac{y}{x}\right)$ then find the value of $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2}$	Understand/ CO2	4	
B)	If $v = \log(x^2 + y^2 + z^2)$, prove that $(x^2 + y^2 + z^2) \left(\frac{\partial^2 v}{\partial x^2} + \frac{\partial^2 v}{\partial y^2} + \frac{\partial^2 v}{\partial z^2} \right) = 2$	Understand/ CO2	4	
C)	$u = \sin^{-1}(x^2 + y^2)^{\frac{1}{5}}$ then find the value of $x^2 \frac{\partial^2 u}{\partial x^2} + 2xy \frac{\partial^2 u}{\partial x \partial y} + y^2 \frac{\partial^2 u}{\partial y^2}$	Understand/ CO2	4	
D)	Find $\frac{du}{dt}$ when $u = xy^2 + x^2y$, $x = at^2$, $y = 2at$	Understand/ CO2		
Q. 3	Solve Any Three of the following:		12	
A)	If $u = x^2 - 2y^2$, $v = 2x^2 - y^2$ Where $x = r\cos\theta$, $y = r\sin\theta$ then show	Understand/ CO3	4	

that $\frac{\partial(u,v)}{\partial(r,\theta)} = 6r^3 \sin 2\theta$ B) Show that $JJ' = 1$ if $x = u(1-v)$, $y = uv$ C) Discuss the maxima and minima of the function $x^2 + y^2 + 6x + 12$ C) Discuss the maxima and minima of the function $x^2 + y^2 + 6x + 12$ C) Discuss the maxima and minima of the function $x^2 + y^2 + 6x + 12$ C) Discuss the maxima and minima of the function $x^2 + y^2 + 6x + 12$ C) Discuss the maxima and minima of the function $x^2 + y^2 + 6x + 12$ C) Discuss the maxima and minima of the function $x^2 + y^2 + 6x + 12$ C) Discuss the maxima and minima of the function $x^2 + y^2 + 6x + 12$ C) Discuss the maxima and minima of the function $x^2 + y^2 + 6x + 12$ C) Understand/ C) C) And Discuss the maxima and minima of the function $x^2 + y^2 + 6x + 12$ C) Understand/ C) C) Understand/ C) Cod C) Trace the Curve $x = a(t - \sin t)$, $y = a(1 - \cos t)$ C) Understand/ C) Understand/ C) Cod C) Solve the following: D) Understand/ C) Cod C) Understand/ C) Cod C) Cod C) Cod C) Find the volume bounded by paraboloid $x^2 + y^2 = az$, the cylinder C) Cod C) Find the volume bounded by paraboloid $x^2 + y^2 = az$, the cylinder C) Cod C) Find the volume bounded by paraboloid $x^2 + y^2 = az$, the cylinder C) Cod C) Find the volume bounded by paraboloid $x^2 + y^2 = az$, the cylinder C) Cod C) Cod			
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D) Expand $f(x,y) = x$, $y + 3y = 2$ in the powers of $(x - 1)$ and $(y + 2)$ using Taylor's theorem Q.4 Solve Any Three of the following: A) Prove that $\int_0^\infty \frac{t^4}{(1+t^2)^3} dt = \frac{3\pi}{16}$ B) Trace the Curve $a^2y^2 = x^2(a^2 - x^2)$ C) Trace the Curve $x = a(t - \sin t)$, $y = a(1 - \cos t)$ Understand/ CO4 D) Trace the Curve $r = a\cos 2\theta$ Understand/ CO4 Q.5 Solve the following: 12 A) Evaluate $\int_0^1 \int_0^y xy dx dy$ Understand/ CO5 A) Evaluate $\int_0^1 \int_0^y xy dx dy$ Co5 Change the order of integration $\int_0^a \int_0^{\sqrt{a^2 - x^2}} f(x, y) dy dx$ C) Find the volume bounded by paraboloid $x^2 + y^2 = az$, the cylinder $x^2 + y^2 = 2ay$ and the plane $z = 0$	C)	Discuss the maxima and minima of the function $x^2 + y^2 + 6x + 12$	4
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C) $x^2 + y^2 = 2ay$ and the plane $z = 0$	B)	Change the order of integration $\int_0^a \int_0^{\sqrt{a^2-x^2}} f(x,y) dy dx$	4
*** End ***	C)		4
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