	DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE **End Semester Examination – Winter 2022** **Course: B. Tech. (Common to all Branches)** **Semester : I** **Subject Code & Name: Engineering Mathematics – I (BTBS 101)** **Max Marks: 60** **Date:** **Duration: 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)	Verify Cayley Hamilton theorem for the matrix $A=\begin{bmatrix}1 & 0 & 2\\ 0 & 2 & 1\\ 2 & 0 & 3\end{bmatrix}$	**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)	$u=\sin^{-1}\left(x^2+y^2\right)^{\frac{1}{5}}$ 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 $x = u(1-v)$, $y = uv$	**Understand/ CO3**	**4**
C)	Discuss the maxima and minima of the function $x^2 + y^2 + 6x + 12$	**Understand/ CO3**	**4**
D)	Expand $f(x,y) = x^2y + 3y - 2$ in the powers of $(x-1)$ and $(y+2)$ using Taylor's theorem	**Understand/ CO3**	**4**
Q.4	**Solve Any Three of the following:**		**12**
A)	Prove that $\int_0^\infty \frac{t^4}{(1+t^2)^3} dt = \frac{3\pi}{16}$	**Understand/ CO4**	**4**
B)	Trace the Curve $a^2y^2 = x^2\left(a^2 - x^2\right)$	**Understand/ CO4**	**4**
C)	Trace the Curve $x = a\left(t - \sin t\right)$, $y = a\left(1 - \cos t\right)$	**Understand/ CO4**	**4**
D)	Trace the Curve $r = a\cos 2\theta$	**Understand/ CO4**	**4**
Q. 5	**Solve the following:**		**12**
A)	Evaluate $\int_0^1 \int_0^y xy\, dxdy$	**Understand/ CO5**	**4**
B)	Change the order of integration $\int_0^a \int_0^{\sqrt{a^2-x^2}} f(x,y)\, dydx$	**Understand/ CO5**	**4**
C)	Find the volume bounded by paraboloid $x^2 + y^2 = az$, the cylinder $x^2 + y^2 = 2ay$ and the plane $z = 0$	**Understand/ CO5**	**4**
	***** End *****		

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