MAKE-UP EXAM

USN

BMATE101

First Semester B.E./B.Tech. Degree Examination, Nov./Dec.2023

Mathematics-I for EEE Stream

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. VTU Formula Hand Book is permitted.
3. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	With usual notations, prove that $\rho = \frac{\left(1+y_1^2\right)^{\frac{3}{2}}}{y_2}$.	06	L2	CO1
	b.	Find the angle between the radius vector and the tangent of polar curve : $r = a(1-\cos\theta)$.	07	L2	CO1
	c.	Find the radius of curvature of the curve $r = a\sin n\theta$ at the pole.	07	L3	CO1
		OR			
Q.2	a.	Show that the pair of curves intersect each other orthogonally. $r^n = a^n \cos n\theta$ and $r^n = b^n \sin n\theta$	08	L2	CO1
	b.	Find the pedal equation of the curve : $r^n = a^n \cos n\theta$.	07	L2	CO1
	c.	Using modern mathematical tool, write a programs/code to plot the sine and cosine curve.	05	L2	CO5
		Module – 2			
Q.3	a.	Using Maclaurin's series, prove that $\sqrt{1+\sin 2x} = 1 + x - \frac{x^2}{2} - \frac{x^3}{6} + -\frac{x^4}{24} + \ldots\ldots$	06	L2	CO1
	b.	Find $\frac{dy}{dt}$, when $u = x^3y^2 + x^2y^3$, with $x = at^2$, $y = 2at$. Use partial derivatives.	07	L2	CO1
	c.	If $u = x + 3y^2 - z^3$, $v = 4x^2yz$, $w = 2z^2 - xy$. Find the value of $\frac{\partial(u,v,w)}{\partial(x,y,z)}$ at the point $(1, \ -1, \ 0)$.	07	L3	CO1
		OR			
Q.4	a.	Evaluate, (i) $\lim_{x\to 0} \frac{\sin 2x - 2\sin x}{x^3}$. (ii) $\lim_{x\to 0} \left(a^x + x\right)^{\frac{1}{x}}$	08	L2	CO1
	b.	If $u = f(y-z, z-x, x-y)$, prove that $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} + \frac{\partial u}{\partial z} = 0$.	07	L2	CO1
	c.	Using modern mathematical tool, write a programs/code. Show that $u_{xx} + u_{yy} = 0$, given $u = e^x(x\cos y - y\sin y)$.	05	L2	CO5
		Module – 3			
Q.5	a.	Solve : $\frac{dy}{dx} + \frac{y}{x} = y^2 x$.	06	L2	CO2
	b.	Find the orthogonal trajectories of the family of asteroids $x^{\frac{2}{3}} + y^{\frac{2}{3}} = a^{\frac{2}{3}}$.	07	L3	CO2
	c.	Solve $xyp^2 - (x^2+y^2)p + xy = 0$.	07	L2	CO2

		OR			
Q.6	**a.**	Solve : $(x^2-4xy-2y^2)dx+(y^2-4xy-2x^2)dy=0$.	**06**	**L2**	**CO2**
	b.	The current i in an electrical circuit containing an inductance L and a resistance R in series and acted upon an emf $E\sin\omega t$ satisfies the differential equation $L\frac{di}{dt}+R_i=E\sin\omega t$. Find the value of the current at any time t, if initially there is no current in the circuit.	**07**	**L3**	**CO2**
	c.	Find the general and singular solution of $p=\log(px-y)$.	**07**	**L2**	**CO2**
		Module – 4			
Q.7	**a.**	Evaluate : $\int_{x=0}^{x=1}\int_{y=0}^{y=x}x(x^2+y)dydx$..	**06**	**L2**	**CO3**
	b.	Change the order of integration and evaluate $\int_0^1\int_0^{\sqrt{1-x^2}}y^2dxdy$.	**07**	**L2**	**CO3**
	c.	Prove that $\Gamma\left(\frac{1}{2}\right)=\sqrt{\pi}$.	**07**	**L2**	**CO3**
		OR			
Q.8	**a.**	Evaluate $\int_0^\infty\int_0^\infty e^{-(x^2+y^2)}dxdy$ by changing into polar co-ordinates.	**06**	**L2**	**CO3**
	b.	Find the relation between Beta and Gamma function $\beta(m,n)=\frac{\Gamma m\Gamma n}{\Gamma(m+n)}$.	**07**	**L2**	**CO3**
	c.	Find the area bounded by the parabola $y^2=4ax$ and $x^2=4ay$ by using double integration.	**07**	**L3**	**CO3**
		Module – 5			
Q.9	**a.**	Find the rank of the matrix $A=\begin{bmatrix}1&2&3&2\\2&3&5&1\\1&3&4&5\end{bmatrix}$.	**06**	**L2**	**CO4**
	b.	Solve by Gauss elimination method, $2x+y+4z=12$; $4x+11y-z=33$; $8x-3y+2z=20$.	**07**	**L3**	**CO4**
	c.	Find the dominant eigen value and the corresponding eigen vector of the matrix $A=\begin{bmatrix}6&-2&2\\-2&3&-1\\2&-1&3\end{bmatrix}$ taking the initial eigen vector as [1, 1, 1].	**07**	**L3**	**CO4**
		OR			
Q.10	**a.**	Find the rank of the matrix $A=\begin{bmatrix}4&0&2&1\\2&1&3&4\\2&3&4&7\\2&3&1&4\end{bmatrix}$.	**08**	**L2**	**CO4**
	b.	Investigate for what values of λ and μ the simultaneous equations $x+y+z=6$; $x+2y+3z=10$; $x+2y+\lambda z=\mu$ have (i) no solution (ii) a unique solution (iii) an infinite number of solution.	**07**	**L3**	**CO4**
	c.	Using modern mathematical tool to write a programs/code to test the consistency of the equations $x+2y-z=1$; $2x+y+4z=2$; $3x+3y+4z=1$	**05**	**L3**	**CO5**

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