MAKE-UP EXAM

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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 $\rho = \dfrac{\left(1+y_1^2\right)^{\frac{3}{2}}}{y_2}$.	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 $\sqrt{1+\sin 2x} = 1 + x - \dfrac{x^2}{2} - \dfrac{x^3}{6} + -\dfrac{x^4}{24} + \ldots\ldots$	06	L2	CO1
	b.	Find $\dfrac{dy}{dt}$, 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 $\dfrac{\partial(u, v, w)}{\partial(x, y, z)}$ at the point $(1, \ -1, \ 0)$.	07	L3	CO1
		OR			
Q.4	a.	Evaluate, (i) $\displaystyle\lim_{x\to 0}\dfrac{\sin 2x - 2\sin x}{x^3}$. (ii) $\displaystyle\lim_{x\to 0}(a^x + x)^{\frac{1}{x}}$	08	L2	CO1
	b.	If $u = f(y-z, z-x, x-y)$, prove that $\dfrac{\partial u}{\partial x} + \dfrac{\partial u}{\partial y} + \dfrac{\partial u}{\partial z} = 0$.	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 : $\dfrac{dy}{dx} + \dfrac{y}{x} = y^2 x$.	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 $xyp^2 - \left(x^2 + y^2\right)p + xy = 0$.	07	L2	CO2

		OR			
Q.6	a.	Solve : $\left(x^2 - 4xy - 2y^2\right)dx + \left(y^2 - 4xy - 2x^2\right)dy = 0$.	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 $L\dfrac{di}{dt} + R_i = E\sin\omega t$. 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 : $\displaystyle\int_{x=0}^{x=1}\int_{y=0}^{y=x} x(x^2 + y)dydx$..	06	L2	CO3
	b.	Change the order of integration and evaluate $\displaystyle\int_0^1\int_0^{\sqrt{1-x^2}} y^2 dxdy$.	07	L2	CO3
	c.	Prove that $\left|\dfrac{1}{2}\right. = \sqrt{\pi}$.	07	L2	CO3
		OR			
Q.8	a.	Evaluate $\displaystyle\int_0^\infty\int_0^\infty e^{-(x^2+y^2)}dxdy$ by changing into polar co-ordinates.	06	L2	CO3
	b.	Find the relation between Beta and Gamma function $\beta(m,n) = \dfrac{\Gamma m\Gamma n}{\overline{\overline{|m+n}}}$.	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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