

Model Question Paper-I with effect from 2022 (CBCS Scheme)

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First Semester B.E Degree Examination

Mathematics-I for Electrical and Electronics Engineering Stream (22MATE11)

TIME: 03 Hours

Max. Marks: 100

Note: Answer any **FIVE** full questions, choosing at least **ONE** question from each **MODULE**.

Module -1			Marks
Q.01	a	With usual notations prove that $\tan \varphi = r \frac{d\theta}{dr}$	06
	b	Find the angle between the curves $r = a(1 + \cos \theta)$ and $r = b(1 - \cos \theta)$	07
	c	Show that the radius of curvature at any point of the cycloid $x = a(\theta + \sin \theta), y = a(1 - \cos \theta)$ is $4a \cos \left(\frac{\theta}{2}\right)$	07
OR			
Q.02	a	If p be the perpendicular from the pole on the tangent, then show that $\frac{1}{p^2} = \frac{1}{r^2} + \frac{1}{r^4} \left(\frac{dr}{d\theta}\right)^2$	06
	b	Find the pedal equation of the curve $r^m = a^m(\cos m\theta + \sin m\theta)$	07
	c	Find the radius of curvature of the curve $x^3 + y^3 = 3xy$ at $\left(\frac{3}{2}, \frac{3}{2}\right)$	07
Module-2			
Q.03	a	Expand $e^{\sin x}$ by Maclaurin's series up to the term containing x^4	06
	b	If $u = f(2x - 3y, 3y - 4z, 4z - 2x)$, show that $6u_x + 4u_y + 3u_z = 0$	07
	c	Show that the function $f(x, y) = x^3 + y^3 - 3xy + 1$ is minimum at the point (1, 1)	07
OR			
Q.04	a	Evaluate (i) $\lim_{x \rightarrow 0} \left(\frac{\tan x}{x}\right)^{\frac{1}{x^2}}$ (ii) $\lim_{x \rightarrow 0} (\cos x)^{\frac{1}{x^2}}$	06
	b	If $u = \tan^{-1}(y/x)$ then find the value of $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2}$	07
	c	If $x + y + z = u, y + z = uv$ and $z = uvw$, find $\frac{\partial(x,y,z)}{\partial(u,v,w)}$	07
Module-3			
Q.05	a	Solve $x \frac{dy}{dx} + y = x^3 y^6$	06
	b	Find the orthogonal trajectories of the family of curves $\frac{x^2}{a^2} + \frac{y^2}{b^2 + \alpha} = 1$, where α is a parameter	07
	c	Solve $xyp^2 - (x^2 + y^2)p + xy = 0$	07
OR			
Q.06	a	Solve $(x^2 + y^2 + x)dx + xydy = 0$	06

	b	Show that a differential equation for the current i in an electrical circuit containing an inductance L and resistance R in series and acted on by an electromotive force $E\sin\omega t$, satisfies the equation $\frac{di}{dt} + Ri = E\sin\omega t$. Find the value of the current at any time t , if initially there is no current in the circuit.	07
	c	Find the general solution of the equation $(px - y)(py + x) = a^2p$ by reducing into Clairaut's form, taking the substitution $X = x^2, Y = y^2$	07
Module-4			
Q. 07	a	Evaluate $\int_{-c}^c \int_{-b}^b \int_{-a}^a (x^2 + y^2 + z^2) dx dy dz$	06
	b	Change the order of integration and evaluate $\int_0^1 \int_{\sqrt{y}}^y dx dy$	07
	c	Prove that $\int_0^{\frac{\pi}{2}} \sqrt{\sin\theta} d\theta \times \int_0^{\frac{\pi}{2}} \frac{d\theta}{\sqrt{\sin\theta}} = \pi$	07
OR			
Q. 08	a	Evaluate $\int_0^1 \int_0^{\sqrt{1-y^2}} (x^2 + y^2) dx dy$ by changing to polar coordinates.	06
	b	Derive the relation between beta and gamma function	07
	c	Using double integration find the area between the parabolas $y^2 = 4ax$ and $x^2 = 4ay$	07
Module-5			
Q. 09	a	Find the rank of the matrix $\begin{bmatrix} 2 & 1 & -1 & 3 \\ 1 & 2 & 4 & 3 \\ 3 & 6 & 12 & 9 \\ 3 & 3 & 3 & 6 \end{bmatrix}$	06
	b	Solve the system of equations by Jordan method $x + y + z = 10$ $2x - y + 3z = 19$ $x + 2y + 3z = 22$	07
	c	Using Rayleigh's power method find the dominant eigenvalue and the corresponding eigenvector of $\begin{bmatrix} 4 & 1 & -1 \\ 2 & 3 & -1 \\ -2 & 1 & 5 \end{bmatrix}$ by taking $[1 \ 0 \ 0]^T$ as initial eigenvector [carry out 6 iterations]	07
OR			
Q. 10	a	Find the rank of the matrix $\begin{bmatrix} 11 & 12 & 13 & 14 \\ 12 & 13 & 14 & 15 \\ 13 & 14 & 15 & 16 \\ 14 & 15 & 16 & 17 \end{bmatrix}$	06
	b	For what values λ and μ the system of equations $x + y + z = 6$; $x + 2y + 3z = 10$; $x + 2y + \lambda z = \mu$ has (ii) no solution (i) a unique solution and (iii) infinite number of solutions	07

	c	Solve the system of equations $2x - 3y + 20z = 25$ $20x + y - 2z = 17$ $3x + 20y - z = -18$ Using the Gauss-Seidel method, taking (0, 0, 0) as an initial approximate. (Carry out 4 iterations).	07
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Table showing the Bloom's Taxonomy Level, Course Outcome and Program Outcome				
Question		Bloom's Taxonomy Level attached	Course Outcome	Program Outcome
Q.1	(a)	L1	CO 01	PO 01
	(b)	L2	CO 01	PO 01
	(c)	L3	CO 01	PO 02
Q.2	(a)	L1	CO 01	PO 01
	(b)	L2	CO 01	PO 01
	(c)	L3	CO 01	PO 02
Q.3	(a)	L2	CO 02	PO 01
	(b)	L2	CO 02	PO 01
	(c)	L3	CO 02	PO 03
Q.4	(a)	L2	CO 02	PO 01
	(b)	L2	CO 02	PO 01
	(c)	L3	CO 02	PO 02
Q.5	(a)	L2	CO 03	PO 02
	(b)	L3	CO 03	PO 03
	(c)	L2	CO 03	PO 01
Q.6	(a)	L2	CO 03	PO 02
	(b)	L3	CO 03	PO 03
	(c)	L2	CO 03	PO 01
Q.7	(a)	L2	CO 04	PO 01
	(b)	L2	CO 04	PO 01
	(c)	L2	CO 04	PO 01
Q.8	(a)	L2	CO 04	PO 01
	(b)	L2	CO 04	PO 01
	(c)	L2	CO 04	PO 01
Q.9	(a)	L2	CO 05	PO 01
	(b)	L3	CO 05	PO 01
	(c)	L3	CO 05	PO 01
Q.10	(a)	L2	CO 05	PO 01
	(b)	L3	CO 05	PO 01
	(c)	L3	CO 05	PO 01
Lower order thinking skills				
Bloom's Taxonomy Levels	Remembering (Knowledge): L ₁		Understanding (Comprehension): L ₂	Applying (Application): L ₃
	Higher-order thinking skills			
	Analyzing (Analysis): L ₄		Valuating (Evaluation): L ₅	Creating (Synthesis): L ₆