Basavarajeswari Group of Institutions

BALLARI INSTITUTE OF TECHNOLOGY & MANAGEMENT

(Autonomous Institute under Visvesvaraya Technological University, Belagavi)

USN | | | | | | | | | | | **Course Code** 2 2 M A T E 1 1

First Semester B.E. Degree Examinations, February 2024
MATHEMATICS FOR EEE STREAM-I

Duration: 3 hrs **Max. Marks: 100**

Note: *1. Answer any* **FIVE** *full questions choosing ONE full Question from each Module.*
2. Missing data, if any, may be suitably assumed

Q. No		Question	Marks	(RBTL:CO:PO)
		Module-1		
1.	a.	**Find the rank of the following matrix by row echelon form** $\begin{pmatrix} 1 & 2 & 4 & 3 \\ 2 & 4 & 6 & 8 \\ 4 & 8 & 12 & 16 \\ 1 & 2 & 3 & 4 \end{pmatrix}$	06	(2 :1 : 1.2.1)
	b.	**Test for consistency and solve the following system of equations.** $5x + y + 3z = 20; 2x + 5y + 2z = 18; 3x + 2y + z = 14$	07	(3 :1 : 1.2.1)
	c.	**Solve the following system of equations by Gauss elimination method** $3x + 4y + 5z = 18; 2x - y + 8z = 13; 5x - 2y + 7z = 20$	07	(3 :1 : 1.2.1)
		OR		
2.	a.	**Solve the following system of equations by Gauss-Jordon elimination method** $2x + y + 3z = 1; 4x + 4y + 7z = 1; 2x + 5y + 9z = 3$	06	(3 :1 : 1.2.1)
	b.	**Solve the following system of equations using Gauss Seidel method** $20x + y - 2z = 17;\ 3x + 20y - z = -18;\ 2x - 3y + 20z = 25$	07	(3 :1 : 1.2.1)
	c.	**Find the numerically largest eigen value and the corresponding eigen vector of the matrix A=**$\begin{bmatrix} 4 & 1 & -1 \\ 2 & 3 & -1 \\ -2 & 1 & 5 \end{bmatrix}$ **by taking the initial approximation to the eigen vector as** $[1, 0.8, -0.8]^T$**. Perform 5 iterations.**	07	(2 :1 : 1.2.1)
		Module-2		
3.	a.	**Prove with usual notation** $\frac{1}{p^2} = \frac{1}{r^2} + \frac{1}{r^4}\left(\frac{dr}{d\theta}\right)^2$	06	(3 :2 : 1.2.1)
	b.	**Show that the following pairs of curves intersect each other orthogonally** $r = a(1+\cos\theta)$ **and** $r = b(1-\cos\theta)$.	07	(2 :2 : 1.2.1)
	c.	**Find the pedal equation of the curve** $r(1-\cos\theta) = 2a.$	07	(2 :2 : 1.2.1)
		OR		

Note: (RBTL - Revised Bloom's Taxonomy Level: CO - Course Outcome: PI – Programme Outcome)

4.	a.	Prove with usual notation: $\rho = \frac{\left(1+y_1^2\right)^{3/2}}{y_2}$	06	(3 :2 : 1.2.1)
	b.	Find the radius of curvature of the curve $r^n = a^n cos n\theta$	07	(2 :2 : 1.2.1)
	c.	Write a program to Plot the cardioid $r = 3(1 + cos\theta)$	07	(1 :2 : 1.7.1)

Module-3

5.	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	(3 :3 : 1.2.1)
	b.	If $z = f(x+ct) + g(x-ct), prove\ that\ \frac{\partial^2 z}{\partial t^2} = c^2 \frac{\partial^2 z}{\partial x^2}$	07	(3 :3 : 1.2.1)
	c.	If $u = f\left(\frac{x}{y}, \frac{y}{z}, \frac{z}{x}\right)$, prove that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} + z\frac{\partial u}{\partial z} = 0.$	07	(3 :3 : 1.2.1)

OR

6.	a.	If $u = e^{-x}(xcosy + ysiny),\ show\ that\ \frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0.$	06	(3 :3 : 1.2.1)
	b.	Find $\frac{\partial(u,v,w)}{\partial(x,y,z)}$ at (1,-1,0), where $u = x + 3y^2 - z^3$, $v = 4x^2 yz$, $w = 2z^2 - xy.$	07	(2 :3 : 1.2.1)
	c.	Find the extreme values of the function $f(x,y) = x^3 + y^3 - 3x - 12y + 20.$	07	(2 :3 : 1.2.1)

Module-4

7.	a.	Solve: $x\frac{dy}{dx} + y = x^3 y^6.$	06	(3 :4 : 1.2.1)
	b.	Solve: $\left(x^2 + y^3 + 6x\right)dx + y^2 x dy = 0.$	07	(3 :4 : 1.2.1)
	c.	Find the orthogonal trajectories of the family of parabolas $y^2 = 4ax$	07	(2 :4 : 1.2.1)

OR

8.	a.	A series circuit with resistance R, inductance L and electromotive force E is governed by the differential equation $L\frac{di}{dt} + Ri = E$, where L and R are constants and initially the current i is zero. Find the current at any time t	06	(2 :4 : 1.2.1)
	b.	Solve: $xyp^2 + (3x^2 - 2y^2)p - 6xy = 0$	07	(3 :4 : 1.2.1)

Note: (RBTL - Revised Bloom's Taxonomy Level: CO - Course Outcome: PI – Programme Outcome)

	c.	**Show that the equation $xp^2 + px - py + 1 - y = 0$ is Clairaut's equation. Hence obtain the general and singular solution.**	**07**	(3 :4 : 1.2.1)

Module-5

9.	**a.**	**Evaluate:** $\int_0^1 \int_0^{1-x} \int_0^{1-x-y} dz\, dy\, dx$	**06**	(2 :5 : 1.2.1)
	b.	**Change the order of the integration and hence evaluate** $\int_0^1 \int_{\sqrt{y}}^1 dxdy$.	**07**	(2 :5 : 1.2.1)
	c.	**Find the area of the circle** $x^2 + y^2 = a^2$ **by double integration.**	**07**	(2 :5 : 1.2.1)

OR

10	**a.**	**Find the volume of the tetrahedron bounded by the planes x=0, y=0, z=0,** $x/a + y/b + z/c = 1$.	**06**	(2 :5 : 1.2.1)
	b.	**Prove that** $\beta(m,n) = \frac{\Gamma(m).\Gamma(n)}{\Gamma(m+n)}$	**07**	(3 :5 : 1.2.1)
	c.	**Evaluate** $\int_0^{\pi/2} \sqrt{\tan\theta}\, d\theta$ **by expressing in terms of gamma functions.**	**07**	(2 :5 : 1.2.1)

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