Basavarajeswari Group of Institutions **2022 SCHEME**

BALLARI INSTITUTE OF TECHNOLOGY & MANAGEMENT

(Autonomous Institute under Visvesvaraya Technological University, Belagavi)

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

First Semester B.E. Degree Summer Semester Examinations, September/October 2025

MATHEMATICS-I FOR COMPUTER SCIENCE & ENGINEERING STREAM

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
3. Use of Mathematics Formula Handbook is permitted.

Q. No		Question	Marks	(RBTL:CO:PI)
		Module-1		
1.	**a.**	Find the rank of the following matrix by row echelon form $A=\begin{bmatrix}2 & 3 & -1 & -1\\ 1 & -1 & -2 & -4\\ 3 & 1 & 3 & -2\\ 6 & 3 & 0 & 7\end{bmatrix}$	**06**	**(1 :1 : 1.2.1)**
	b.	Investigate the values of λ and μ such that the system of equations x+y+z=6; x+2y+3z=10, x+2y+ $\lambda z=\mu$ may have (i) Unique solution (ii) Infinite solution (iii) No solution.	**07**	**(2 :1 : 1.2.1)**
	c.	Solve the following system of equations by Gauss elimination method 2x+y+4z=12, 4x+11y-z=33, 8x-3y+2z=20.	**07**	**(3 :1 : 1.2.1)**
		(OR)		
2.	**a.**	Solve the following system of equations by Gauss-Jordon elimination method $2x+3y-z=5$; $4x+4y-3z=3$; $2x-3y+2z=2$.	**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 dominant Eigen value and the corresponding Eigen vector of the matrix A=$\begin{bmatrix}2 & 0 & 1\\ 0 & 2 & 0\\ 1 & 0 & 2\end{bmatrix}$ by Rayleigh's power method taking the initial Eigen vector as $\begin{bmatrix}1 & 1 & 1\end{bmatrix}^T$.	**07**	**(3 :1 : 1.2.1)**
		Module-2		
3.	**a.**	Prove that for the curve $r=f(\theta)$ $\frac{1}{p^2}=u^2+\left(\frac{du}{d\theta}\right)^2$ *where* $u=\frac{1}{r}$.	**06**	**(2: 2 : 1.2.1)**
	b.	Find the angle between the pairs of curves $r=a(1+\cos\theta)$ and $r=b(1-\cos\theta)$	**07**	**(3 :2 : 1.2.1)**
	c.	Find the pedal equation of the curve $r^n=a^n\cos\theta$	**07**	**(3 :2 : 1.2.1)**
		(OR)		

Note: (**RBTL - Revised Bloom's Taxonomy Level: CO - Course Outcome: PI - Performance Indicator)**

4.	**a.**	Prove with usual notation: $\rho = \dfrac{\left(1+y_1^2\right)^{3/2}}{y_2}$	**06**	**(2 :2 : 1.2.1)**
	b.	Find the radius of curvature of $a^2y = x^3 - a^3$ where the curve cuts the x-axis.	**07**	**(3 :2 : 1.2.1)**
	c.	Find the radius of curvature of the curve $r^n = a^n \cos n\theta$.	**07**	**(3 :2 : 1.2.1)**

Module-3

5.	**a.**	Obtain the Maclaurin's series expansion of $e^{\sin x}$ upto the term containing x^4.	**06**	**(2 :3 : 1.2.1)**
	b.	If $z = f(x+ct) + g(x-ct)$, prove that $\dfrac{\partial^2 z}{\partial t^2} = c^2 \dfrac{\partial^2 z}{\partial x^2}$.	**07**	**(2 :3 : 1.2.1)**
	c.	If $u = \log\left(x^3+y^3+z^3-3xyz\right)$, then prove that $\dfrac{\partial u}{\partial x} + \dfrac{\partial u}{\partial y} + \dfrac{\partial u}{\partial z} = \dfrac{3}{x+y+z}$.	**07**	**(2 :3 : 1.2.1)**

(OR)

6.	**a.**	If $u = f(x-y, y-z, z-x)$, show that $\dfrac{\partial u}{\partial x} + \dfrac{\partial u}{\partial y} + \dfrac{\partial u}{\partial z} = 0$	**06**	**(2 :3 : 1.2.1)**
	b.	If $u = x^2+y^2+z^2$, $v = xy+yz+zx$, $w = x+y+z$ then find $\dfrac{\partial(u,v,w)}{\partial(x,y,z)}$.	**07**	**(3 :3 : 1.2.1)**
	c.	Examine the function $z(x,y) = x^4 + y^4 - 2(x-y)^2$ for extreme values.	**07**	**(2 :3 : 1.2.1)**

Module-4

7.	**a.**	Solve: $6y^2dx - x(x^3+2y)dy = 0$	**06**	**(3 :4 : 1.2.1)**
	b.	Solve: $ye^{xy}dx + (xe^{xy}+2y)dy = 0$.	**07**	**(3 :4 : 1.2.1)**
	c.	Find the orthogonal trajectories of the family $x^{2/3} + y^{2/3} = a^{2/3}$.	**07**	**(1 :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 $L\dfrac{di}{dt} + Ri = E$ Where R and L are constants and initially current i = 0. Find the current at any time't'.	**06**	**(1 :4 : 1.2.1)**
	b.	Solve: $xy\left(\dfrac{dy}{dx}\right)^2 - (x^2+y^2)\dfrac{dy}{dx} + xy = 0$	**07**	**(3 :4 : 1.2.1)**
	c.	Modify the following equation into Clairut's form. Hence obtain the associated general and singular solutions. $xp^2 + px - py + 1 - y = 0$	**07**	**(2 :4 : 1.2.1)**

Module-5

9.	**a.**	Evaluate : $\displaystyle\int_{-1}^{1}\int_{0}^{z}\int_{x-z}^{x+z} (x+y+z)\,dy\,dx\,dz.$	**06**	**(3 :5 : 1.2.1)**

Note: (**RBTL - Revised Bloom's Taxonomy Level: CO - Course Outcome: PI - Performance Indicator)**

	b.	Change the order of the integration and hence evaluate $\int_0^1 \int_{\sqrt{y}}^{2-y} xy\ dxdy$.	**07**	**(3 :5 : 1.2.1)**
	c.	Write a Python Program to find $\int_0^1 \int_x^{\sqrt{x}} \left(x^2 + y^2\right) dy\ dx$	**07**	**(1 :5 : 1.2.1)**

(OR)

10.	**a.**	Prove that: $\Gamma(1/2) = \sqrt{\pi}$	**06**	**(1 :5 : 1.2.1)**
	b.	Prove that $\beta(m,n) = \dfrac{\Gamma(m).\Gamma(n)}{\Gamma(m+n)}$.	**07**	**(1 :5 : 1.2.1)**
	c.	Express the following integrals in terms of beta functions and hence evaluate $\int_0^{\infty} \dfrac{dx}{1+x^4}$.	**07**	**(1 :5 : 1.2.1)**

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