Basavarajeswari Group of Institutions

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 Examinations, February 2025

MATHEMATICS FOR COMPUTER SCIENCE & ENGINEERING 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
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. $$\begin{bmatrix} 0 & 1 & -3 & -1 \\ 1 & 0 & 1 & 1 \\ 3 & 1 & 0 & 2 \\ 1 & 1 & -2 & 0 \end{bmatrix}$$	**06**	**(2 :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**	**(3 :1 : 1.2.1)**
	c.	Solve the 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 system of equations by Gauss-Jordan elimination method $x+y+z=8; -x-y+2z=-4; 3x+5y-7z=-14$	**06**	**(3 :1 : 1.2.1)**
	b.	Solve the 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 $$A=\begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$$ by Rayleigh's power method taking the initial Eigen vector as $\begin{bmatrix} 1 & 1 & 1 \end{bmatrix}^T$.	**07**	**(2 :1 : 1.2.1)**
		Module-2		
3.	**a.**	Prove with usual notations, $\tan\phi = r\dfrac{d\theta}{dr}$	**06**	**(3 :2 : 1.2.1)**
	b.	Find the angle between the pair of curves $r=\sin\theta+\cos\theta$ and $r=2\sin\theta$	**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 - Performance Indicator)**

4.	**a.**	For the curve $y=\dfrac{ax}{(a+x)}$, show that $\left(\dfrac{2\rho}{a}\right)^{2/3}=\left(\dfrac{x}{y}\right)^{2}+\left(\dfrac{y}{x}\right)^{2}$.	**06**	**(2 :2 : 1.2.1)**
	b.	Prove with usual notation $\rho=\dfrac{(r^2+r_1^2)^{3/2}}{r^2+2r_1^2-rr_2}$	**07**	**(3 :2 : 1.2.1)**
	c.	Find the radius of curvature of the curve $r^n=a^n\cos n\theta$	**07**	**(2 :2 : 1.2.1)**

Module-3

5.	**a.**	Expand $\log(\sec x)$ upto the term containing x^6 using Maclaurin's series.	**06**	**(2 :3 : 1.2.1)**
	b.	If $u=\log\left(\dfrac{x^2+y^2}{x+y}\right)$ verify that $\dfrac{\partial^2 u}{\partial x\partial y}=\dfrac{\partial^2 u}{\partial y\partial x}$.	**07**	**(3 :3 : 1.2.1)**
	c.	If $u=\log\sqrt{x^2+y^2+z^2}$ show that $\left(x^2+y^2+z^2\right)\left(\dfrac{\partial^2 u}{\partial x^2}+\dfrac{\partial^2 u}{\partial y^2}+\dfrac{\partial^2 u}{\partial z^2}\right)=1.$	**07**	**(3 :3 : 1.2.1)**

(OR)

6.	**a.**	If $x=r\sin\theta\cos\varphi,\ y=r\sin\theta\sin\varphi,\ z=r\cos\theta$, show that $\dfrac{\partial(x,y,z)}{\partial(r,\theta,\phi)}=r^2\sin\theta.$	**06**	**(3 :3 : 1.2.1)**
	b.	Examine the function $\sin x+\sin y+\sin(x+y)$ for extreme values.	**07**	**(3 :3 : 1.2.1)**
	c.	Write a Python Program to find partial derivatives of functions $u=e^{x}\left[x\cos(y)-y\sin(y)\right]$ then $U_{xx}+U_{yy}=0.$	**07**	**(3 :3 : 1.2.1)**

Module-4

7.	**a.**	Solve $r\sin\theta-\cos\theta\left(\dfrac{dr}{d\theta}\right)=r^2$	**06**	**(3 :4 : 1.2.1)**
	b.	Solve $\left(x^2-4xy-2y^2\right)dx+\left(y^2-4xy-2x^2\right)dy=0.$	**07**	**(3 :4 : 1.2.1)**
	c.	Find the orthogonal trajectories of the family $\dfrac{x^2}{a^2}+\dfrac{y^2}{b^2+\lambda}=1.$ where λ is a parameter	**07**	**(3 :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 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 $\dfrac{dy}{dx}-\dfrac{dx}{dy}=\dfrac{x}{y}-\dfrac{y}{x}$	**07**	**(3 :4 : 1.2.1)**
	c.	Show that the equation $xp^2+px-py+1-y=0$ is Clairaut's equation. Hence obtain the general and singular solution	**07**	**(2 :4 : 1.2.1)**

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

Module-5

			Marks	(RBTL : CO : PI)
9.	a.	Evaluate $\int_0^1 \int_0^{\sqrt{1-x^2}} \int_0^{\sqrt{1-x^2-y^2}} xyz\,dz\,dy\,dx$	06	(3 :5 : 1.2.1)
	b.	Change the order of the integration and hence evaluate $\int_0^\infty \int_x^\infty \frac{e^{-y}}{y} dy\,dx.$	07	(3 :5 : 1.2.1)
	c.	Find the volume of the tetrahedron bounded by the planes $x = 0, y = 0, z = 0, \quad x + y + z = 1$	07	(2 :5 : 1.2.1)

(OR)

			Marks	(RBTL : CO : PI)
10.	a.	Prove that $\Gamma(1/2) = \sqrt{\pi}$	06	(3 :5 : 1.2.1)
	b.	Evaluate $\int_0^{\pi/2} \sqrt{\tan\theta}\,d\theta$ by expressing in terms of gamma functions	07	(3 :5 : 1.2.1)
	c.	Prove that $\beta(m,n) = \frac{\Gamma(m).\Gamma(n)}{\Gamma(m+n)}.$	07	(3 :5 : 1.2.1)

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