BALLARI INSTITUTE OF TECHNOLOGY & MANAGEMENT

(Autonomous Institute under Visvesvaraya Technological University, Belagavi)

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

First Semester B.E. Degree Examinations, March/April 2023
MATHEMATICS FOR CIVIL 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: PI)
		MODULE – 1		
1.	**a.**	Find the rank of the matrix $A=\begin{bmatrix}2&1&3&5\\4&2&1&3\\8&4&7&13\\8&4&-3&-1\end{bmatrix}$	06	2:1:1.2.1
	b.	Test for consistency and solve : $x+2y+3z=14,\ 4x+5y+7z=35,\ 3x+3y+4z=21.$	07	2:1:1.2.1
	c.	Solve by Gauss elimination method . $x+2y+z=3,\ 2x+3y+2z=5,\ 3x-5y+5z=2.$	07	2:1:1.2.1
		OR		
2.	**a.**	Solve the following system of equation by Gauss-Jordan method . $2x_1+x_2+3x_3=1,\ 4x_1+4x_2+7x_3=1,\ 2x_1+5x_2+9x_3=3.$	06	2:1:1.2.1
	b.	Solve the following system of equation by Gauss-Seidel method. $10x+2y+z=9,\ x+10y-z=-22,\ -2x+3y+10z=22.$	07	2:1:1.2.1
	c.	Find the largest eigen value and the corresponding eigen vector of the matrix A, by using the power method by taking initial vector $[1,1,1]'$ $A=\begin{bmatrix}2&-1&0\\-1&2&-1\\0&-1&2\end{bmatrix}$	07	2:1:1.2.1
		MODULE – 2		
3.	**a.**	Prove with usual notations , $\tan\phi=r\left(\frac{d\theta}{dr}\right)$.	06	2:2:1.2.1
	b.	Show that the following pairs of curves intersect each other orthogonally. $r=a(1+\sin\theta)\ \ and\ \ r=a(1-\sin\theta).$	07	2:2:1.2.1

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

	c.	Find the pedal equation for the curve , $\frac{2a}{r}=(1+\cos\theta)$.	07	2:2:1.2.1
		OR		
4.	**a.**	With usual notations prove that , $\rho=\frac{\left(1+y_1^2\right)^{3/2}}{y_2}$.	06	2:2:1.2.1
	b.	Find the radius curvature for the curve $r^n=a^n\cos n\theta$.	07	2:2:1.2.1
	c.	Find ρ of the curve $y^2=\frac{a^2(a-x)}{x}$ at the point $(a,\ 0)$.	07	2:2:1.2.1
		MODULE – 3		
5.	**a.**	Expand $e^{\sin x}$ as Maclaurin's series up to the terms containing x^4.	06	2:3:1.2.1
	b.	If $u=\log\sqrt{x^2+y^2+z^2}$, show that $\left(x^2+y^2+z^2\right)\left(\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial y^2}+\frac{\partial^2 u}{\partial z^2}\right)=1$.	07	2:3:1.2.1
	c.	If $z(x+y)=x^2+y^2$, show that $\left[\frac{\partial z}{\partial x}-\frac{\partial z}{\partial y}\right]^2=4\left[1-\frac{\partial z}{\partial x}-\frac{\partial z}{\partial y}\right]$.	07	2:3:1.2.1
		OR		
6.	**a.**	If $u=f\left(\frac{x}{y},\frac{y}{z},\frac{z}{x}\right)$, prove that $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}+z\frac{\partial u}{\partial z}=0$.	06	2:3:1.2.1
	b.	Examine the function $f(x,y)=x^4+y^4-2(x-y)^2$ for extreme values.	07	2:3:1.2.1
	c.	If $x+y+z=u,\ y+z=uv,\ and\ z=uvw$, Show that $\frac{\partial(x,y,z)}{\partial(u,v,w)}=u^2v$.	07	2:3:1.2.1
		MODULE – 4		
7.	**a.**	Solve : $ye^{xy}dx+(xe^{xy}+2y)dy=0$	06	2:4:1.2.1
	b.	Solve : $(x^3+y^2+x)dx+xy\,dy=0$.	07	2:4:1.2.1
	c.	Solve : $r\sin\theta-\cos\theta\frac{dr}{d\theta}=r^2$.	07	3:4:1.2.1
		OR		
8.	**a.**	Find the orthogonal trajectories of the family $y^2=cx^3$.	06	2:4:1.2.1
	b.	A series circuit with resistance R, inductance L and electromotive force E is generated 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.	07	3:4:1.2.1

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	c.	Solve : $xy\left(\frac{dy}{dx}\right)^2-\left(x^2+y^2\right)\frac{dy}{dx}+xy=0.$	07	2:4:1.2.1

<u>MODULE – 5</u>

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	2:5:1.2.1
	b.	Change the order of integration and hence evaluate $\int_0^{4a}\int_{x^2/4a}^{2\sqrt{ax}} xy\,dy\,dx$.	07	2:5:1.2.1
	c.	Findby double integration the area enclosed by the curve $r=a(1+\cos\theta)$ between $\theta=0$ *and* $\theta=\pi$.	07	3:5:1.2.1

OR

10.	**a.**	Find the volume of the solid bounded by the planes $x=0,\ y=0,\ z=0,$ $x=y+z=1.$	06	2:5:1.2.1
	b.	Prove that : $\beta(m,n)=\frac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$.	07	2:5:1.2.1
	c.	Show that : $\int_0^{\pi/2}\frac{d\theta}{\sqrt{\sin\theta}}\times\int_0^{\pi/2}\sqrt{\sin\theta}\;d\theta=\pi.$	07	3:5:1.2.1

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