647510 **BSC2MatC201x** **Seat No :________**

B.Sc. Semester - 2 (*CBCS*) Examination

March/April – 2026 (New Course)

MATHEMATICS (CORE)

Time: 2:30 Hours **Marks: 70**

Instructions:

1. All questions are compulsory.
2. Figures to the right indicate marks.

Que.1(A) Answer any two out of three (10)

(1) Find Centre and Radius of the circle $x^2+y^2+z^2-x+z-2=0$; $x+2y-z=4$.

(2) Show that the plane $2x-2y+z+12=0$ touches the sphere $x^2+y^2+z^2-2x-4y+2z-3=0$ and find the point of contact.

(3) Find equation of right circular cylinder with axis $\frac{x-\alpha}{l}=\frac{y-\beta}{m}=\frac{z-\gamma}{n}$ and radius r.

Que.1(B) Answer any one out of two. (04)

(1) Find Centre and Radius of the sphere $|\bar{r}^2| + 4\bar{r}\cdot(1,1,1)-13=0$.

(2) Find equation of cylinder whose generator is parallel to $\frac{x}{2}=\frac{y}{3}=\frac{z}{4}$ and passing through $x^2+xy+y^2=1$; $z=0$.

Que.2(A) Answer any two out of three (10)

(1) If $u=\tan^{-1}\frac{x^3+y^3}{x-y}$ then show that $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}=\sin 2u$

(2) If $u=f(x,y)$, and $x=r\cos\theta$, $y=r\sin\theta$ then prove that $\left(\frac{\partial u}{\partial x}\right)^2+\left(\frac{\partial u}{\partial y}\right)^2=\left(\frac{\partial u}{\partial r}\right)^2+\frac{1}{r^2}\left(\frac{\partial u}{\partial \theta}\right)^2$

(3) If $u=\log(x^2+y^2)+\tan^{-1}(y/x)$, find the value of $\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial y^2}$.

Que.2(B) Answer any one out of two. (04)

(1) If $u=f(y-z, z-x, x-y)$ then show that $\frac{\partial u}{\partial x}+\frac{\partial u}{\partial y}+\frac{\partial u}{\partial z}=0$.

(2) Find $\frac{dy}{dx}$ for the implicit function $\sin(xy)=e^{xy}+x^2y$.

Que.3(A) Answer any two out of three (10)

(1) If $u=\frac{x+y}{1-xy}$, $v=\tan^{-1}x+\tan^{-1}y$, then find $\frac{\partial(u,v)}{\partial(x,y)}$

(2) If $u=x^2-2y$, $v=x+y+z$, $w=x-2y+3z$ then find $\frac{\partial(u,v,w)}{\partial(x,y,z)}$.

(3) Expand log xy in powers of (x-1) and (y-1).

Que.3(B) Answer any one out of two. (04)

(1) In usual notations prove that $\frac{\partial(x,y,z)}{\partial(r,\theta,\varnothing)}=r^2\sin\varnothing$.

(2) If $f(x,y)=x^2y-3y$ then find the approximate value of f(5.12,6.85)

Que.4(A) Answer any two out of three (10)

(1) Prove that every square Matrix can be expressed uniquely as the sum of a symmetric and a skew symmetric Matrix.

(2) State and prove associative property for matrix multiplication.

(3) In usual notations prove that $(AB)^T=B^T A^T$

Que.4(B) Answer any one out of two. (04)

(1) If A= $\begin{bmatrix} 0 & 2m & n \\ l & m & -n \\ l & -m & n \end{bmatrix}$ is orthogonal then find values of l,m,n.

(2) If A= $\begin{bmatrix} cos\theta & \sin\theta \\ -\sin\theta & cos\theta \end{bmatrix}$ then prove that A^n= $\begin{bmatrix} cosn\theta & \sin n\theta \\ -sinn\theta & cosn\theta \end{bmatrix}$; $n \in \mathbb{N}$.

Que.5(A) Answer any two out of three (10)

(1) State and prove Cayley- Hamilton theorem.

(2) Verify Cayley- Hamilton theorem for $\begin{bmatrix} 0 & 1 & 2 \\ 1 & 0 & 3 \\ 2 & 3 & 0 \end{bmatrix}$.

(3) Using Cayley- Hamilton theorem find inverse of $\begin{bmatrix} 1 & 0 & 2 \\ 2 & -1 & 3 \\ 4 & 1 & 8 \end{bmatrix}$.

Que.5(B) Answer any one out of two. (04)

(1) Find eigen values and eigen vectors of Matrix A= $\begin{bmatrix} 5 & 3 \\ -1 & 1 \end{bmatrix}$.

(2) Find eigen values and eigen vectors of Matrix A= $\begin{bmatrix} 2 & 1 \\ 3 & 4 \end{bmatrix}$.

****