Reg. No. : ....

Name : ....

K19U 3321

I Semester B.Sc. Degree CBCSS (OBE) - Regular Examination, November - 2019

(2019 Admissions)

COMPLEMENTARY ELECTIVE COURSE IN MATHEMATICS

1C01MAT-PH : MATHEMATICS FOR PHYSICS - I

Time : 3 Hours | Max. Marks : 40

PART-A
(Short Answer)

Answer any **Four** questions out of five questions. Each question carries 1 mark. **(4×1=4)**

1. Find the derivative of $e^x - \sin x + \cos x$
2. Write the Maclaurin's series of $\tan\theta$
3. Find the rank of the matrix $A = \begin{bmatrix} 3 & 3 & 3 \\ 2 & 2 & 2 \\ 1 & 1 & 1 \end{bmatrix}$.
4. Find the polar equation of the Cartesian coordinate $x^2 - y^2 = 1$
5. Identify the graph $r\cos\theta = 2$

PART-B
(Short Essay)

Answer any **Seven** questions out of ten questions. Each question carries 2 marks. **(7×2=14)**

6. Find the derivative of $y = (x^3 + 2)(x^2 + 2x + 1)$ by
   i) Using product rule
   ii) Without using Product rule
7. If $x = e^{-t^2}$ and $y = \tan^{-1} t$, then find $\frac{dy}{dx}$.
8. Find the derivative of $y = t^{\cos t}$

9. Verify Rolle's theorem for $f(x)=\sin x$ in $[0,\pi]$

10. Find $Lt_{x\to 0}\left[\frac{\log x}{\cot x}\right]$

11. For what values of λ the matrix $A=\begin{bmatrix}1 & 2 & 10 & 2\\ 1 & 2 & 10 & \lambda\end{bmatrix}$ has rank 2? Give reason for your answer.

12. Test for consistency of the linear system of equations $x+2y+4z=5,\ 3x+6y+12z=15,\ 4x+8y+16z=0$

13. Prove that the matrix $A=\begin{bmatrix}\cos\theta & 0 & \sin\theta\\ 0 & 1 & 0\\ \sin\theta & 0 & -\cos\theta\end{bmatrix}$ is orthogonal

14. Find $\frac{ds}{d\theta}$ for the curve $r=a(1-\cos\theta);a>0$, where S is the arc length.

15. Find a spherical coordinate equation for the sphere $x^2+y^2+(z-3)^2=9$.

PART-C
(Essay)

Answer any **Four** Questions out of seven questions. Each question carries **3** marks. **(4x3=12)**

16. Find $\frac{d}{dx}(\cos^{-1}x)$, where $x\in(0,1)$.

17. If $x^y.y^x=1$, then find $\frac{dy}{dx}$

18. Prove that $Lt_{x\to 1}\left[\frac{x^x-x}{x-1-\log x}\right]=2$.

19. In the mean value theorem $\frac{f(b)-f(a)}{(b-a)}=f'(c)$, determine c lying between a and b if $f(x)=\sqrt{x-1}$, $a=1$ and $b=3$.

20. Solve the equations $x+y+z=3,\ x+2y+3z=4,\ x+4y+9z=6$ by Cramer's rule.

21. Are the vectors $x_1=(1,1,1,0), x_2=(2,2,2,0), x_3=(3,3,3,0)$ and $x_4=(3,3,3,1)$ linearly dependent? If so express one of these as a linear combination of the others.

22. Find the radius of curvature of the curve $y^4+x^3+a(x^2+y^2)-a^2y=0$.

PART-D
(Long Essay)

Answer any **Two** questions out of four questions. Each question carries 5 marks. **(2x5=10)**

23. a) If $y\sqrt{1-x^2}+x\sqrt{1-y^2}=1$, then find $\frac{dy}{dx}$.

    b) If $y=\left[x^{\tan x}+(\sin x)^{\cos x}\right]$, then find $\frac{dy}{dx}$.

24. a) Expand $\sin x$ upto the term containing x^5.

    b) Expand $\log(1+\sin^2 x)$ in powers of x as far as the term in x^6.

25. a) Reduce the matrix $A=\begin{bmatrix}1 & 3 & 4 & 0\\ 4 & 8 & 8 & 0\\ 2 & 2 & 4 & 1\end{bmatrix}$ into its normal form and hence find its rank.

    b) Using the Gauss-Jordan method, find the inverse of $A=\begin{bmatrix}4 & 3\\ 1 & 1\end{bmatrix}$.

26. a) Find the radius of curvature at any point of the cycloid $x=a(\theta+\sin\theta), y=a(1-\cos\theta)$.

    b) Find all polar coordinates of the point $\left(1,\frac{\pi}{2}\right)$.