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B.Tech. DEGREE EXAMINATION, NOVEMBER 2019
First to Eighth Semester

15MA101 – CALCULUS AND SOLID GEOMETRY
(For the candidates admitted during the academic year 2015-2016 to 2017-2018)

Note:

(i) **Part - A** should be answered in OMR sheet within first 45 minutes and OMR sheet should be handed over to hall invigilator at the end of 45th minute.

(ii) **Part - B** and **Part - C** should be answered in answer booklet.

Time: Three Hours Max. Marks: 100

PART – A (20 × 1 = 20 Marks)
Answer **ALL** Questions

1. A homogeneous polynomial of second degree in any number of variables is
   (A) Canonical form (B) Quadratic form
   (C) Orthogonal form (D) Diagonal form

2. Find the Eigen values of A^2 *if* $A=\begin{pmatrix}3 & 2 & 1\\ 0 & 2 & 3\\ 0 & 0 & 1\end{pmatrix}$
   (A) 1, 2, 3 (B) 1, 4, 9
   (C) 2, 4, 6 (D) 0, 1, 2

3. Find the sum and product of the Eigen values of $A=\begin{pmatrix}2 & 1 & 1\\ 0 & 2 & 1\\ 0 & 0 & 1\end{pmatrix}$
   (A) 5, 4 (B) 4, 5
   (C) 4, 4 (D) 5, 5

4. Using Cayley Hamilton, find A^{-1} *if* $A=\begin{pmatrix}1 & 2\\ 4 & 3\end{pmatrix}$
   (A) $\frac{1}{5}\begin{pmatrix}-3 & 2\\ 4 & -1\end{pmatrix}$ (B) $\frac{1}{5}\begin{pmatrix}-3 & -2\\ 4 & -1\end{pmatrix}$
   (C) $\begin{pmatrix}3 & 2\\ 4 & 1\end{pmatrix}$ (D) $\begin{pmatrix}-3 & 2\\ 4 & -1\end{pmatrix}$

5. If $z=x^2+y^2+3xy$ *then* $\frac{\partial z}{\partial x}=$
   (A) $2y+3x$ (B) $3y$
   (C) $2x+2y$ (D) $2x$

6. If $f(x,y)$ is an implicit function, then $\frac{dy}{dx}=$

(A) $-\frac{(\partial f/\partial x)}{(\partial f/\partial y)}$ (B) $\frac{(\partial f/\partial x)}{(\partial f/\partial y)}$

(C) $\frac{(\partial f/\partial y)}{(\partial f/\partial x)}$ (D) $-\frac{(\partial f/\partial y)}{(\partial f/\partial x)}$

7. If $f(x,y)=\tan^{-1}\left(\frac{y}{x}\right), then f_x(1,1)=$

(A) $\pi/4$ (B) 1/2

(C) $-1/2$ (D) 0

8. If $rt-s^2<0$ at (a,b) then the point is

(A) Maximum point (B) Minimum point

(C) Saddle point (D) Stationary point

9. The particular integral of $\left(D^2+6D+9\right)y=3e^{4x}$

(A) $\frac{3}{49}e^{4x}$ (B) $\frac{3}{49}$

(C) $(C_1+C_2x)e^{-3x}$ (D) $(C_1+C_2x)e^{-3x}+\frac{3}{49}e^{4x}$

10. The particular integral of $\left(D^2+2D+1\right)y=7$ is

(A) 7 (B) -7

(C) 7/2 (D) 7/3

11. The value of $\frac{e^{ax}}{D-a}$

(A) xe^{ax} (B) e^{ax}

(C) x^2e^{ax} (D) $\frac{x^2}{2}e^{ax}$

12. If $y_1=\cos x, y_2=\sin x,$ then the value of $y_1y'_2-y_2y'_1$ is

(A) -1 (B) 0

(C) 1 (D) 1/2

13. The curvature of the straight line is

(A) 1 (B) 2

(C) -1 (D) 0

14. Evolute of a curve is the envelope of _____ of that curve

(A) Tangent (B) Normal

(C) Parallel (D) Locus

15. What is the curvature of a circle of radius 3?
(A) 3 (B) −3
(C) 1/3 (D) −1/3

16. The radius of curvature of $y = e^x$ at $x = 0$ is
(A) $2\sqrt{2}$ (B) $\frac{2}{\sqrt{2}}$
(C) $\sqrt{2}$ (D) $\frac{1}{\sqrt{2}}$

17. The number of great circles of any sphere is
(A) 0 (B) 1
(C) 2 (D) Many

18. Section of a sphere by a plane is a
(A) Parabola (B) Ellipse
(C) Circle (D) Straight line

19. The radius of a great circle of a sphere is
(A) Greater than the radius of the sphere (B) Not equal to the radius of the sphere
(C) Less than the radius of the sphere (D) Equal to the radius of the sphere

20. The equation of the right circular cylinder whose axis is the z-axis and radius a is
(A) $x^2 + y^2 = a^2$ (B) $x^2 - y^2 = a^2$
(C) $x^2 + z^2 = a^2$ (D) $y^2 + z^2 = a^2$

PART – B (5 × 4 = 20 Marks)
Answer **ANY FIVE** Questions

21. Find the Eigen values of $A = \begin{pmatrix} 1 & 2 \\ 5 & 4 \end{pmatrix}$.

22. Find the constants a and b such that the matrix $A = \begin{pmatrix} a & 4 \\ 1 & b \end{pmatrix}$ has 3 and −2 as its Eigen values.

23. Find $\frac{dy}{dx}$ if $(\cos x)^y = (\sin y)^x$.

24. If $x = r\cos\theta, y = r\sin\theta, z = z$, evaluate $\frac{\partial(x,y,z)}{\partial(r,\theta,z)}$.

25. Solve $\left(D^2 - 7D + 12\right)y = 0$.

26. Find the radius of curvature of the curve $r = a(1+\cos\theta)$ at $\theta = \frac{\pi}{2}$.

27. Find the equation of the sphere whose centre is at (−6,1,3) and radius 4.

PART – C (5 × 12 = 60 Marks)
Answer ALL Questions

28.a. Reduce the matrix $A=\begin{pmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{pmatrix}$ to a diagonal form using orthogonal transformation.

(OR)

b. Verify Cayley – Hamilton theorem for the matrix $A=\begin{pmatrix} 1 & 2 & -2 \\ -1 & 3 & 0 \\ 0 & -2 & 1 \end{pmatrix}$ and hence find A^{-1}.

29.a. Expand $e^x \cos y$ in powers of x and y upto terms of third degree.

(OR)

b. Identify the saddle point and extreme points of
$f(x,y)=x^3+y^3-12x-3y+20$
Also find minimum and maximum values.

30.a. Solve $\left(D^2+6D+8\right)y=e^{-2x}+\cos^2 x$.

(OR)

b. Solve $\left(D^2+D+1\right)y=x^2e^{-x}$.

31.a. Find the radius of curvature of $\left(\frac{1}{4},\frac{1}{4}\right)$ on the curve $\sqrt{x}+\sqrt{y}=1$.

(OR)

b. Find the equation of the circle of curvature of the curve $x^3+y^3=3axy$ at $\left(\frac{3a}{2},\frac{3a}{2}\right)$.

32.a. Find the equation of the sphere through the four points $(0,0,0),(0,1,-1),(-1,2,0)$ and $(1,2,3)$.

(OR)

b. Find the equation of the sphere through the circle
$x^2+y^2+z^2-2x+4y+z-2=0, x+3y-z=4$ and through the point $(1,2,-1)$.

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