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Reg. No. : .....

Code No. : 20379 E      Sub. Code : CMMA 21

B.Sc. (CBCS) DEGREE EXAMINATION,  
NOVEMBER 2022.

Second Semester

Mathematics — Core

DIFFERENTIAL EQUATIONS AND ANALYTICAL  
GEOMETRY OF THREE DIMENSIONS

(For those who joined in July 2021 onwards)

Time : Three hours

Maximum : 75 marks

PART A — ( $10 \times 1 = 10$  marks)

Answer ALL questions.

Choose the correct answer:

1. Let  $m$  be the order of a given differential equation then
- (a)  $m$  is any integer
  - (b)  $m$  is any real number
  - (c)  $m$  is any positive integer
  - (d) None of the above

2. What is the degree of the differential equation  $3y = x \frac{dy}{dx} + \sin\left(\frac{dy}{dx}\right)$ ?

- (a) 1
- (b) 2
- (c) 8
- (d) None of the above

3. The roots of the auxiliary equation of the differential equation  $(D^2 + 3D + 2)y = 0$  is

- (a) 1, 2
- (b) -1, -2
- (c) -1, 2
- (d) 1, -2

4. The roots of the auxiliary equation of the differential equation  $x^2 \frac{d^2 y}{dx^2} + 3x \frac{dy}{dx} + y = 0$  is

- (a) 1, 1
- (b)  $1 \pm i$
- (c) -1, -1
- (d) 1, -1

5. If  $a_1, b_1, c_1$  and  $a_2, b_2, c_2$  are the direction ratios of two perpendicular lines then  $a_1a_2 + b_1b_2 + c_1c_2 =$  \_\_\_\_\_

- (a) 1
- (b) -1
- (c) 0
- (d) None of the above

6. Angle between two diagonals of a cube is \_\_\_\_\_

- (a)  $\cos(1/3)$       (b)  $\sin(1/3)$
- (c)  $\cos^{-1}(1/3)$       (d)  $\sin^{-1}(1/3)$

7. If the line is parallel to the plane then  $\sin \theta =$  \_\_\_\_\_

- (a) 0
- (b) 1
- (c)  $\frac{1}{\sqrt{2}}$
- (d) None of the above

8. If the shortest distance in zero the lines are \_\_\_\_\_

- (a) coplanar      (b) non coplanar
- (c) skewlines      (d) none

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9. Radius of the sphere  $x^2 + y^2 + z^2 - 2x - 4y - bz - 2 = 0$  is \_\_\_\_\_

- (a) 2      (b) 3
- (c) 4      (d) 5

10. The condition for orthogonality of two sphere is \_\_\_\_\_

- (a)  $2uu' + 2vv' + 2ww' = d + d'$
- (b)  $uu' + vv' + ww' = d + d'$
- (c)  $2uu' + 2vv' + 2ww' = d - d'$
- (d)  $uu' + vv' + ww' = d - d'$

PART B — (5 × 5 = 25 marks)

Answer ALL questions choosing either (a) or (b).

11. (a) Solve  $xp^2 - 2yp + x = 0$

Or

(b) Solve  $y = xp + x(1 + p^2)^{1/2}$

12. (a) Solve  $(D^2 + 4)y = x \sin x$

Or

(b) Solve  $x^2 \frac{d^2y}{dx^2} + 3x \frac{dy}{dx} + y = \frac{1}{(1-x)^2}$

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13. (a) If the line whose direction cosines are given by  $al + bm + cn = 0$  and  $mn + nl + lm = 0$  are perpendicular, prove  $\frac{1}{a} + \frac{1}{b} + \frac{1}{c} = 0$ .

Or

- (b) Find the angle between  $13x + 6y + 5z + 1 = 0$  and  $6z - 4y - 2x + 81 = 0$

14. (a) Find the equation of the straight line through  $(1, 0, 2)$  and parallel to the planes  $2x + 3y - z = 1$  and  $2x + y + z = 7$ .

Or

- (b) Find the angle between the line  $\frac{x+1}{2} = \frac{y-2}{3} = \frac{z-1}{6}$  and plane  $3x + y + z = 1$ .

15. (a) Find the equation of the sphere which passes through the points  $(3, 4, 2)$ ,  $(2, 0, 5)$ ,  $(2, 4, 5)$ ,  $(3, 3, 1)$ .

Or

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

### PART C — (5 × 8 = 40 marks)

Answer ALL questions choosing either (a) or (b).

16. (a) Solve  $Z = px + qy + p^2q^2$

Or

- (b) Solve  $\frac{dx}{dt} + 2x - 3y = t$ ;  $\frac{dy}{dt} - 3x + 2y = e^{2t}$

17. (a) Solve  $(D^2 + 1)y = x^2 e^{2x} + x \cos x$

Or

- (b) Solve

$$(5 + 2x)^2 \frac{d^2 y}{dx^2} - 6(5 + 2x) \frac{dy}{dx} + 8y = 6x$$

18. (a) Find the equation of the plane passing through the three points  $(2, 3, 4)$ ,  $(-3, 5, 1)$  and  $(4, -1, 2)$ .

Or

- (b) Find the equation of the plane through the line of intersection of the planes  $3x + 2y + 3 = 0$ ,  $2x + y - z + 2 = 0$  and parallel to  $x + y + z = 2$ .