

OCTOBER 2021

Time: Three hours

Maximum Marks: 75

- Note:
1. Answer ALL the questions in PART-A (1 mark each)
 2. Answer any ONE question from each unit in PART-B (3 marks each)
 3. Answer any ONE question from each unit in PART-C (10 marks each)
 4. The question paper contains TWO Pages

PART-A (1x10=10)

1. Find the equation of circle whose centre (5, -4) and radius 7 units.
2. Write down the condition for two circles $x^2+y^2+2gx+2fy+c=0$ and $x^2+y^2+2g_1x+2f_1y+c_1=0$ to cut orthogonally.
3. If the position vectors of A and B are $3\vec{i} - \vec{j} + 2\vec{k}$ and $2\vec{i} + \vec{j} + \vec{k}$. Find $|\vec{AB}|$.
4. Find the projection of a vector $2\vec{i} - 5\vec{j} + 3\vec{k}$ on the vector $\vec{i} + \vec{j} + 2\vec{k}$.
5. If $\vec{a} = 2\vec{i} + 3\vec{j} - \vec{k}$ and $\vec{b} = \vec{i} - 2\vec{k}$. Find $\vec{a} \times \vec{b}$.
6. What are the values of (i) $\vec{i} \cdot \vec{i}$ (ii) $\vec{i} \times \vec{j}$
7. Evaluate $\int \cot^2 x \, dx$.
8. Evaluate $\int \frac{dx}{x^2+25}$
9. Evaluate $\int \log x \, dx$.
10. Evaluate $\int_0^1 \frac{dx}{\sqrt{1-x^2}}$

PART-B (3x5=15)

UNIT-I

11. Find the equation of circle concentric with circle $x^2+y^2-8x+4y+7=0$ and passing through the point (7, 5).
12. Find the equation of the circle whose end points of the diameter are (-1,2) and (4,-3).

UNIT-II

13. Show that the points with position vectors $2\vec{i} - \vec{j} + 3\vec{k}$, $3\vec{i} - 5\vec{j} + \vec{k}$ and $-\vec{i} + 11\vec{j} + 9\vec{k}$ are collinear.
14. Show that $|\vec{a} + \vec{b}|^2 + |\vec{a} - \vec{b}|^2 = 2(|\vec{a}|^2 + |\vec{b}|^2)$.

UNIT-III

15. Find the area of the parallelogram having diagonal vectors $3\vec{i} + \vec{j} - 2\vec{k}$ and $\vec{i} - 3\vec{j} + 4\vec{k}$.
16. Find 'm' if the vectors $2\vec{i} - \vec{j} + \vec{k}$, $\vec{i} + m\vec{j} - 3\vec{k}$ and $3\vec{i} - 4\vec{j} + 5\vec{k}$ are coplanar.

UNIT-IV

17. Evaluate: $\int \frac{\sin^2 x}{1+\cos x} \, dx$
18. Evaluate: $\int \frac{e^{\tan^{-1} x}}{1+x^2} \, dx$

UNIT-V

19. Evaluate $\int x \sin 3x \, dx$
20. Evaluate $\int x^2 \cos 2x \, dx$

UNIT-I

21. a) Find the equation of the circle two of whose diameters are $x+y=6$ and $x+2y=4$ and whose radius 10 units.
 b) Show that the circles $x^2+y^2-4x-6y-12=0$ and $x^2+y^2+6x+18y+26=0$ touch each other.
22. a) Find the value of 'p' such that $3x^2+2xy+py^2+7x+17y-6=0$ represents a pair of straight line.
 b) Find the equation of the circle passing through the point $(-7, 1)$ and having centre at $(-4, -3)$.

UNIT-II

23. a) Show that the points with position vectors $3\vec{i} - \vec{j} + 6\vec{k}$, $5\vec{i} - 2\vec{j} + 7\vec{k}$ and $6\vec{i} - 5\vec{j} + 2\vec{k}$ form a right angled triangle.
 b) If \vec{a} is any vector, show that $(\vec{a} \cdot \vec{i}) \vec{i} + (\vec{a} \cdot \vec{j}) \vec{j} + (\vec{a} \cdot \vec{k}) \vec{k} = \vec{a}$
24. a) Prove that the vectors $\vec{i} + 2\vec{j} + \vec{k}$, $\vec{i} + \vec{j} - 3\vec{k}$ and $7\vec{i} - 4\vec{j} + \vec{k}$ are mutually perpendicular.
 b) A particle acted on by the forces $3\vec{i} + 2\vec{j} - 3\vec{k}$ and $\vec{i} + 7\vec{j} + 7\vec{k}$ is displaced from the point $\vec{i} + 2\vec{j} + 3\vec{k}$ to the point $3\vec{i} - 5\vec{j} + 4\vec{k}$. Find the total work done.

UNIT-III

25. a) Find the unit vector perpendicular to each of the vectors $2\vec{i} - \vec{j} + 2\vec{k}$ and $10\vec{i} - 2\vec{j} + 7\vec{k}$. Also find the sine angle between them.
 b) Find the magnitude of the torque about the point $(4, 3, -1)$ of the force represented by $6\vec{i} + \vec{j} - \vec{k}$ acting through the point $(0, 1, -1)$.
26. a) If $\vec{a} = 2\vec{i} - \vec{j} + 2\vec{k}$, $\vec{b} = \vec{i} + \vec{j} + \vec{k}$, $\vec{c} = \vec{i} + 2\vec{j} + 3\vec{k}$ and $\vec{d} = \vec{i} - \vec{j} - \vec{k}$. Find $(\vec{a} \times \vec{b}) \cdot (\vec{c} \times \vec{d})$.
 b) Find the area of the triangle whose vertices are having position vectors $3\vec{i} + 2\vec{j} - \vec{k}$, $2\vec{i} - 3\vec{j} + \vec{k}$ and $5\vec{i} + \vec{j} + 3\vec{k}$.

UNIT-IV

27. a) Evaluate: (i) $\int \sqrt{1 + \sin 2x} dx$, (ii) $\int \sin^3 x dx$
 b) Evaluate: $\int \frac{dx}{3-2x-x^2}$
28. a) Evaluate: (i) $\int \frac{\cos x}{(3+5\sin x)^6} dx$, (ii) $\int \frac{x+2}{x^2+4x-3} dx$
 b) Evaluate: $\int \frac{dx}{\sqrt{4-x^2-3x}}$

UNIT-V

29. a) Evaluate: (i) $\int x \log x dx$, (ii) $\int x e^{2x} dx$
 b) Evaluate: (i) $\int x^2 \sin 3x dx$, (ii) $\int x^2 e^{-x} dx$
30. a) Evaluate: (i) $\int x \sin nx dx$, (ii) $\int x^n \log x dx$
 b) Evaluate: $\int_0^{\frac{\pi}{2}} \log(\tan x) dx$
