Total No. of Questions : 9]

SEAT No. :

**PE-903**

[Total No. of Pages : 3

# [6581]-1909
# F.E. (Common)
# ENGINEERING MATHEMATICS - II
# (2019 Course) (Semester - II) (107008)

*Time : 2½ Hours]* *[Max. Marks : 70*

***Instructions to the candidates:***

1) ***Q.1 is compulsory.***
2) ***Solve Q.2 or Q.3, Q.4 or Q.5, Q.6 or Q.7, Q.8 or Q.9.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right indicate full marks.***
5) ***Use of electronic pocket calculator is allowed.***
6) ***Assume suitable data, if necessary.***

***Q1)*** Write the correct options for the following multiple choice questions.

a) $\int_0^{\pi/2} \cos^4 x\,dx =$ **[2]**

i) 0 ii) $\frac{3}{8}\pi$

iii) $\frac{3}{16}\pi$ iv) $\frac{\pi}{2}$

b) The curve $y^2 = x^2(2 - x)$ is symmetric about **[2]**

i) X-axis ii) Y-axis

iii) both X & Y axis iv) Origin

c) Centre (C) and radius (r) of the sphere $x^2 + y^2 + z^2 - 2x - 2y - 2z - 6 = 0$ are **[2]**

i) $C \equiv (1, 1, 1), r = \sqrt{3}$ ii) $C \equiv (-1, -1, -1), r = 3$

iii) $C \equiv (1, 1, 1), r = 3$ iv) $C \equiv (-1, -1, -1), r = 9$

d) $\int_{y=0}^{y=1} \int_{x=0}^{2} x\,dx\,dy = \ldots$ **[2]**

i) 0 ii) 1

iii) 2 iv) 4

***P.T.O.***

e) Total number of loops for the curve $r = a \sin 3\theta$ are **[1]**

i) 2 ii) 3

iii) 4 iv) 5

f) $\int\int\int 1\, dx\, dy\, dz$ represents **[1]**

i) Area ii) Centre of gravity

iii) Volume iv) Moment of Inertia

***Q2)*** a) If $U_n = \int_0^{\pi/4} \tan^n\theta\, d\theta$, then Prove that, $n(U_{n+1} + U_{n-1}) = 1$ **[5]**

b) Evaluate, $\int_0^{\infty} \frac{x^4}{4^x} dx$ **[5]**

c) Evaluate, $\frac{d}{dx} erf_c\left(\sqrt{x}\right)$ **[5]**

OR

***Q3)*** a) If $I_n = \int_0^{\pi/3} \cos^n x\, dx$ then prove that,

$$I_n = \frac{\sqrt{3}}{n \cdot 2^n} + \frac{n-1}{n} I_{n-2}$$ **[5]**

b) Evaluate, $\int_3^5 (x-3)^{1/2} \cdot (5-x)^{1/2} dx$ **[5]**

c) Prove that $\int_0^1 \frac{x^a - 1}{\log x} dx = \log(a+1)$ **[5]**

***Q4)*** a) Trace the curve $xy^2 = a^2(a - x)$ **[5]**

b) Trace the curve $r^2 = a^2\cos(2\theta)$ **[5]**

c) Show that in the Astroid

$x^{2/3} + y^{2/3} = a^{2/3}$, $S^3 \propto x^2$. **[5]**

S being measured from the cusp which lies on Y axis

OR

**Q5)** a) Trace the curve $x^2y^2 = a^2(y^2 - x^2)$ **[5]**

b) Trace the curve $\gamma = a\cos(3\theta)$ **[5]**

c) Trace the curve $x = t^2$, $y = t - \frac{t^3}{3}$ **[5]**

**Q6)** a) 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. **[5]**

b) Find the equation of right circular cone whose vertex is at (1, –1, 2), axis is the line $\frac{x-1}{2} = \frac{y+1}{1} = \frac{z-2}{-2}$ and semivertical angle 45°. **[5]**

c) Find the equation of right circular cylinder whose axis is $\frac{x}{2} = \frac{y}{1} = \frac{z}{-2}$ and radius is 4. **[5]**

OR

**Q7)** a) Find the sphere through the circle, $x^2 + y^2 + z^2 = 4$, z = 0, meeting the plane $x + 2y + 2z = 0$ in a circle of radius 3. **[5]**

b) Find the equation of the right circular cone whose vertex is at origin, axis is y axis and semivertical angle 30°. **[5]**

c) Find the equation of right circular cylinder of radius 2, whose axis passes through origin and makes equal angles with coordinate axes. **[5]**

**Q8)** a) Evaluate $\int_0^1 \int_{x^2}^{x} xy(x+y)dxdy$ **[5]**

b) Find the area bounded by the curves $y^2 = 4ax$ & $x^2 = 4ay$ **[5]**

c) A thin plate of uniform thickness and density is in the form of lamina bounded by the parabola $x^2 = y$ and the line $y = x + 2$. Find the moment of inertia of the lamina about Y - axis. **[5]**

OR

**Q9)** a) Evaluate $\int_0^1 dx \int_0^2 dy \int_1^2 x^2 yz\, dz$ **[5]**

b) Find the volume of the region enclosed by the paraboloid $z = x^2 + y^2$ and the plane $z = 4$ **[5]**

c) Find the centre of gravity of loop of the rose curve $r = a \sin 2\theta$ in the first quadrant. **[5]**