Total No. of Questions : 9]

SEAT No. :

P3924

[Total No. of Pages : 4

[6001]-4009

F.E.

ENGINEERING MATHEMATICS-II

(2019 Pattern) (Semester - I/II) (107008)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) *Q. No.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 wherver 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 option for the following multiple choice questions

a) $\int_0^{\pi/2} \sin^4 + dt =$ **[2]**

i) $\frac{3\pi}{16}$ ii) $\frac{3}{8}$

iii) $\frac{3}{16}$ iv) $\frac{3\pi}{8}$

b) The equation of the tangent to the curve $y(1+x^2)=x$ at origin, if exist is **[2]**

i) X=0 ii) Y=0

iii) $x=1, x=-1$ iv) $y=x$

c) The value of double integration $\int_0^1\int_0^1 \frac{1}{1+x^2}\cdot\frac{1}{1+y^2}\,dxdy =$ **[2]**

i) $\frac{\pi}{2}$ ii) $\frac{\pi^2}{2}$

iii) $\frac{\pi}{4}$ iv) $\frac{\pi^2}{8}$

P.T.O.

d) Centre (C) of sphere $x^2 + y^2 + z^2 - 2z = 4$ is **[2]**

i) $C \equiv (0,0,0)$ ii) $C \equiv (0,0,1)$

iii) $C \equiv (0,1,0)$ iv) $C \equiv (1,0,0)$

e) The curve $r = 2a\sin\theta$ is symmetrical about **[1]**

i) Pole ii) $\theta = 0$

iii) $\theta = \frac{\pi}{2}$ iv) $\theta = \frac{\pi}{4}$

f) $\iiint_V dxdydz$ represents **[1]**

i) Area ii) Mass

iii) Mean Value iv) Volume

Q2) a) If $I_n = \int_0^{\frac{\pi}{4}} sec^n\theta \, d\theta$, then prove that $I_n = \frac{\left(\sqrt{2}\right)^{n-2}}{n-1} + \frac{n-2}{n-1} I_{n-2}$ **[5]**

b) Evaluate $\int_2^5 (x-2)^3 (5-x)^2 dx$ **[5]**

c) Using DUIS, prove that $\int_0^\infty \frac{e^{-x} - e^{-ax}}{x\sec x} dx = \frac{1}{2}\log\left(\frac{a^2+1}{2}\right), a > 0$ **[5]**

OR

Q3) a) Evaluate

i) $\int_0^{2\pi} \sin^2\frac{\theta}{2} \cos^{10}\frac{\theta}{2} \, d\theta$ **[3]**

ii) $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \cos^4 t \; dt$ **[2]**

b) Evaluate : $\int_0^1 (x\log x)^4 \, dx$ **[5]**

c) Prove that: $\frac{1}{x}\frac{d}{da}erf_c(ax) = -\frac{1}{a}\frac{d}{dx}erf(ax)$ **[5]**

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

b) Trace the curve $r = a(1+\cos\theta)$. **[5]**

c) Find the are length of Astroid $x^{2/3} + y^{2/3} = a^{2/3}$ **[5]**

OR

Q5) a) Trace the curve $x^3 + y^3 = 3axy$. **[5]**

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

c) Trace the curve $x = a(t + \sin t),\ y = a(1+\cos t)$. **[5]**

Q6) a) Show that the plane $x - 2y - 2z = 7$ touches the sphere $x^2 + y^2 + z^2 - 10y - 10z - 31 = 0$. Also find the point of contact. **[5]**

b) Find the equation of right circular cone whose vertex is at origin, whose axis is the line $\frac{x}{1} = \frac{y}{2} = \frac{8}{3}$ and which has a semi-vertical angle of 60°. **[5]**

c) Find the equation of right circular cylinder of radius 3 and axis is the line $\frac{x-1}{2} = \frac{y-2}{1} = \frac{z-3}{2}$. **[5]**

OR

Q7) a) Show that the two spheres: $x^2 + y^2 + z^2 = 25$ and $x^2 + y^2 + z^2 - 18x - 24y - 40z + 225 = 0$ touches externally. Also find the point of contact. **[5]**

b) Find the equation of right circular cone whose vertex is at (0,0,10), axis is the Z-axis and the semi-vertical angle is $\cos^{-1}\left(\frac{2}{\sqrt{5}}\right)$ **[5]**

c) Find the equation of right circular cylinder of radius $\sqrt{6}$, whose axis passes through the origin and has direction cosines $\frac{1}{\sqrt{3}}, \frac{-1}{\sqrt{3}}, \frac{1}{\sqrt{3}}$. **[5]**

Q8) a) Evaluate $\iint_R xy\,dx\,dy$, where R is $x^2 = y, y^2 = -x$. **[5]**

b) Find area of cardioide $r = a(1 - \cos\theta)$ using double integration. **[5]**

c) Find the moment of inertia of one loop of the lemniscate $r^2 = a^2 \cos 2\theta$ about initial line. Givenl that density $\rho = \frac{2m}{a^2}$, m is a mass of the area. **[5]**

OR

Q9) a) Change order of integration $\int_0^5 \int_{2-x}^{2+x} f(x, y)\,dxdy$. **[5]**

b) Find the volume bounded by the cone $x^2 + y^2 = z^2$ and paraboloid $x^2 + y^2 = z$. **[5]**

c) Find the x - co-ordinate of centre of gravity of one loop of $r = a\cos 2\theta$, which is in the first quadrant, given that area of loop is $A = \frac{\pi a^2}{8}$. **[5]**