Total No. of Questions : 9]

SEAT No. :

PD4032

[Total No. of Pages : 4

[6401]-1909

F.E.

ENGINEERING MATHEMATICS - II

(2019 Pattern) (Credit System) (Semester - I/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 logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
6) *Assume suitable data, if necessary.*

Q1) Write the correct option for the following multiple choice questions :

a) $\int_0^{2\pi} \sin^6 t \, dt =$ **[2]**

i) $\frac{5\pi}{8}$ ii) $\frac{5\pi}{32}$

iii) $\frac{5}{4}$ iv) 0

b) The equation of asymptote parallel to x-axis to the curve represented by the equation $y\left(1+x^2\right)=x$ is **[2]**

i) $x=0$ ii) $y=0$

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

c) Centre (c) & radius (r) of the sphere $x^2+y^2+z^2-4x+6y-2z-11=0$ is **[2]**

i) $c\equiv(2,3,1)$ & $r=5$ ii) $c\equiv(2,3,1)$ & $r=\sqrt{14}$

iii) $c\equiv(2,-3,1)$ & $r=5$ iv) $c\equiv(2,-3,1)$ & $r=\sqrt{14}$

P.T.O.

d) The value of the double integration $\int_0^1\int_0^1 xy^2\,dxdy$. **[2]**

i) $\frac{1}{4}$

ii) $\frac{1}{9}$

iii) $\frac{1}{2}$

iv) $\frac{1}{6}$

e) $\lceil\overline{n+1} =$ **[1]**

i) $(n+1)!$

ii) $(n-1)!$

iii) $(n+2)!$

iv) $n!$

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

i) Pole

ii) $\theta = 0$

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

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

Q2) a) If $I_n = \int_0^{\pi/2} x\sin^n x\,dx$ then prove that $I_n = \frac{n-1}{n} I_{n-2} + \frac{1}{n^2}$. **[5]**

b) Evaluate $\int_0^\infty x^2 e^{-h^2x^2}\,dx$. **[5]**

c) Evaluate $\frac{d}{dx} erf\left(ax^n\right)$. **[5]**

OR

Q3) a) If $I_n = \int_0^{\pi/2} \cos^n x \cos nx\,dx$, then prove that $I_n = \frac{1}{2} I_{n-1}$. **[5]**

b) Evaluate $\int_0^2 x\left(8-x^3\right)^{1/3} dx$. **[5]**

c) Show that $\int_0^\infty \frac{e^{-bx}\sin ax}{x}\,dx = \tan^{-1}\frac{a}{b}$ **[5]**

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

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

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

OR

Q5) a) Trace the curve $y\left(x^2 + 4a^2\right) = 8a^3$. **[5]**

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

c) Find the arc length of cardioide $r = a\left(1 + \cos\theta\right)$ which lies outside the circle $r + a\cos\theta = 0$. **[5]**

Q6) a) Prove that the sphere $x^2 + y^2 + z^2 + 2x - 4y - 2z - 3 = 0$ touch the plane $2x - 2y - z + 16 = 0$ and Find the point of contact. **[5]**

b) Find the equation of right circular cone with vertex at origin and axis as the line $\frac{x}{1} = \frac{y}{2} = \frac{z}{3}$ & semivertical angle is 30°. **[5]**

c) Find the equation of right circular cylinder of radius '2', whose axis passes through (1, 2, 3) and has direction cosines proportional to 2, 1, 2. **[5]**

OR

Q7) a) Show that the sphere $x^2+y^2+z^2-10x-10y-2z+2=0$ and $x^2+y^2+z^2+6x+2y-2z+2=0$ touches externally. Also find the point of contact. **[5]**

b) Find the equation of right circular cone whose vertex at (0, 0, 10) & whose intersection with $X \circ Y$ plane is a circle of radius '5'. **[5]**

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

Q8) a) Evaluate $\iint e^{-\left(x^2+y^2\right)}dxdy$ over the positive quadrant of the circle $x^2+y^2=a^2$. **[5]**

b) Find the area between the curve $y=(x-4)(x+2)$ and the x-axis. **[5]**

c) Find the centre of gravity of the area enclosed by the parabolas $y^2=x$ and $x^2=y$. **[5]**

OR

Q9) a) Evaluate the following integration by changing the order : **[5]**

$$\int_0^\infty\int_y^\infty \frac{e^{-x}}{x}\,dx\,dy$$

b) Evaluate $\iiint \frac{dxdydz}{1+x^2+y^2+z^2}$ taken throughout the volume of the sphere $x^2+y^2+z^2=1$ in the positive octant. **[5]**

c) Find the moment of inertia of one loop of the rose curve $r=a\cos 2\theta$ about initial line. (Given that density $\rho=\frac{8M}{a^2\pi}$, where M is Mass of the area). **[5]**

✈ ✈ ✈