

Total No. of Questions : 8]

SEAT No. :

P4354

[Total No. of Pages : 3

[5458]-101

F.E.

ENGINEERING MATHEMATICS - II
(2015 Pattern)

Time : 2 Hours]

[Max. Marks : 50

Instructions to the candidates:

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

Q1) a) Solve the following differential equations.

i) $\frac{dy}{dx} = 1 - x \tan(x - y)$ [4]

ii) $\frac{dy}{dx} = \frac{y + 1}{(y + 2)e^y - x}$ [4]

- b) A particle of mass m falls under gravity in a fluid whose resistance to motion at any instant is mk times the velocity where k is constant. Find the terminal velocity of the body. [4]

OR

Q2) a) Solve $\frac{dy}{dx} + y \cot x = \sin 2x$. [4]

- b) i) A body of temperature 100°C is placed in a room whose temperature is 20°C and cools to 60°C in 5 minutes. What will be its temperature after 10 minutes? [4]

- ii) A resistance of 250 ohms and an inductance of 640 H are connected in series with a battery of 500 volts. Find the current in the circuit if $i = 0$ at $t = 0$. [4]

P.T.O.

Q3) a) Find the Fourier series to represent the function $f(x) = x$ in the interval $-\pi < x < \pi$ and $f(x + 2\pi) = f(x)$. [5]

b) Evaluate $\int_0^{\infty} x^9 e^{-2x^2} dx$. [3]

c) Trace the curve (Any ONE) [4]

i) $y^2(a + x) = x^2(a - x)$

ii) $r = a(1 + \sin\theta)$

OR

Q4) a) Establish reduction formula for $I_n = \int_0^{\pi/4} \sec^n \theta d\theta$. [4]

b) Prove that $\int_0^1 \frac{x^a - 1}{\log x} dx = \log(1 + a)$, $a \geq 0$ [4]

c) Find complete arclength of the astroid $x^{2/3} + y^{2/3} = a^{2/3}$. [4]

Q5) a) Show that the spheres $x^2 + y^2 + z^2 = 25$ and $x^2 + y^2 + z^2 - 18x - 24y - 40z + 225 = 0$ touch externally and find their point of contact. [5]

b) Find the equation of right circular cone which has its vertex at $(0,0,10)$ and whose intersection with the XOY-plane is a circle of radius 5. [4]

c) Find the equation of right circular cylinder of radius 3 whose axis is the line: [4]

$$\frac{x-1}{2} = \frac{y-3}{2} = \frac{z-5}{-1}$$

OR

Q6) a) Show that the plane $2x - 2y + z + 12 = 0$ touches the sphere $x^2 + y^2 + z^2 - 2x - 4y + 2z - 3 = 0$. Also find the point of contact. [5]

b) Find the equation of right circular cone with vertex at origin, axis is the y-axis and semi-vertical angle of 30° . [4]

c) Find the equation of right circular cylinder of radius 2 whose axis passes through $(1, 2, 3)$ and has direction ratios 2, 1, 2. [4]

Q7) Attempt any two of the following :

a) Evaluate, $\int_0^{a/\sqrt{2}} \int_0^{\sqrt{a^2-y^2}} \log_e (x^2 + y^2) dx dy$ [6]

b) Evaluate, $\iiint \frac{dx dy dz}{\sqrt{1-x^2-y^2-z^2}}$ taken throughout the volume of the sphere $x^2 + y^2 + z^2 = 1$. [7]

c) Find the moment of inertia about the line $\theta = \frac{\pi}{2}$ of the area enclosed by $r = a(1 + \cos \theta)$. [6]

OR

Q8) Attempt any two of the following :

a) Find the total area included between the two cardiodes $r = a(1 + \cos \theta)$ and $r = a(1 - \cos \theta)$. [6]

b) Find volume of the region bounded by paraboloid $x^2 + y^2 = 2z$ and the cylinder $x^2 + y^2 = 4$. [7]

c) Find the centroid of one loop of the Laminscate $r^2 = a^2 \cos 2\theta$. [6]

