Total No. of Questions : 8]

SEAT No. :

P2019

[Total No. of Pages : 3

F.E. (Semester - II)
ENGINEERING MATHEMATICS - II
(2012 Course)

Time : 2 Hours] *[Max. Marks : 50*

Instructions to the candidates:

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

Q1) a) Solve the following **[8]**

i) $\frac{dy}{dx} = \frac{x^2 + y^2 + 1}{2xy}$

ii) $(1 - x^2)\frac{dy}{dx} = 1 + xy$

b) An electric circuit contains an inductance of 0.5 henries and a resistance of 100 ohms in series with an e.m.f. of 20 volts. Find the current at any time t,if it is zero at $t = 0$. **[4]**

OR

Q2) a) Solve : **[4]**

$(2x + 3y - 1)dx = (6x + 9y + 6)dy$

b) Solve the following : **[8]**

i) A bullet is fired into sand tank, its retardation is proportional to square root of its velocity. Show that the bullet will come to rest in time $\frac{2\sqrt{v}}{k}$, where V is initial velocity.

ii) A pipe 20 cm in diameter contains steam at 150°C and is protected with a covering 5 cm thick for which k = 0.0025. If the temperature of the outer surface of the covering is 40°C, find the temperature half-way through the covering under steady state conditions.

P.T.O.

Q3) a) Find the half range cosine series for the function $F(x) = x - x^2, 0 \le x \le 1$ **[5]**

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

c) Trace the curve (Any One) **[4]**

i) $x = a(t + \sin t), y = a(1 - \cos t)$

ii) $x^2 y^2 = a^2 (y^2 - x^2)$

OR

Q4) a) If $I_n = \int_0^\infty e^{-x} \sin^n x \, dx$ obtain the relation between I_n and I_{n-2} **[4]**

b) Show that $\int_a^b e^{-x^2} dx = \frac{\sqrt{\pi}}{2}[erf(b) - erf(a)]$ **[4]**

c) Find the arclength of one loop of Lemniscate $r^2 = a^2 \cos 2\theta$ **[4]**

Q5) a) Find the equation of right circular cylinder of radius a, whose axis passes through the origin and makes equal angles with the coordinate axes. **[4]**

b) Lines are drawn from the origin with direction co-sines proportional to (1,2,2), (2,3,6) (3,4,12). Find direction co-sines of the axis of right circular cone through them, and prove that the semivertical angle of cone is $\cos^{-1} \frac{1}{\sqrt{3}}$. **[4]**

c) Find the equation of the sphere which passes through the points $(1,-4,3)(1,-5,2)(1,-3,0)$ and whose centre lies on the plane $x + y + z = 0$. **[5]**

OR

Q6) a) A sphere of constant radius K passes through the origin and meets the axes in A,B,C. Prove that the centroid of the triangle ABC lies on the sphere $9(x^2 + y^2 + z^2) = 4K^2$ **[5]**

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

c) Find the equation of the right circular cylinder of radius 3 and axis $\frac{x-1}{2} = \frac{y-3}{2} = \frac{z-5}{-1}$ **[4]**

Q7) Solve any two:

a) Evaluate $\iint (x+y)^2 dxdy$ over the area bounded by an ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ **[7]**

b) Find the volume of the tetrahedron bounded by the co-ordinate planes and the plane $x + y + z = 1$ **[6]**

c) Find the moment of inertia about the initial line of the cardioide $r = a(1 + \cos\theta)$ **[6]**

OR

Q8) Solve any two

a) Find the area bounded by the parabola $y = x^2$ & the Line $y = 2x + 3$. **[7]**

b) Evaluate $\iiint z(x^2 + y^2) dxdydz$ over the volume of the cylinder $x^2 + y^2 = 1$ intercepted by the planes z = 2 and z = 3. **[6]**

c) Find the x – co-ordinate of center of gravity of an area bounded by the parabola $y^2 = x$ and the line $x + y = 2$. **[6]**