Total No. of Questions : 8]

SEAT No. :

P4396

[Total No. of Pages : 3

[5251]-1008

F.E.

ENGINEERING MATHEMATICS - II

(2015 Pattern) (Credit System)

Time : 3 Hours] *[Max. Marks : 50*

Instructions to the candidates:

1) *Answer Q.1 or 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 calculator is allowed.*
5) *Assume suitable data, if necessary.*

Q1) a) Solve the following differential equations : **[8]**

i) $(1 + xy)\, y dx + (1 - xy) x dy = 0$

ii) $\dfrac{dy}{dx} = \dfrac{x-y+3}{2x-2y+5}$

b) A body of mass m falling from rest is subjected to the force of gravity and an air resistance proportional to the square of the velocity (Kv^2). If it falls through distance 'x' and possesses a velocity 'v' at that instant, prove that $\dfrac{2Kx}{m} = \log\left(\dfrac{a^2}{a^2-v^2}\right)$, where $mg = Ka^2$. **[4]**

OR

Q2) a) Solve : $(1+y^2) + (x - e^{-\tan^{-1} y})\dfrac{dy}{dx} = 0$ **[4]**

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

i) If the temperature of the body drops from 100ºC to 60ºC in one minute when the temperature of the surrounding is 20ºC, what will be the temperature of body at the end of third minute.

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ii) A constant electromotive force E volts is applied to a circuit containing a constant resistance R ohms in a series and a constant inductance L henries. If the initial current is zero, show that the current builts up to half its theoretical maximum in $\frac{L}{R}\log 2$.

Q3) a) Find half range cosine series for $f(x)=\sin^2 x, 0<x<\pi$ **[5]**

b) Evaluate $\int_0^{\infty}\frac{dx}{1+x^4}$. **[3]**

c) Trace the curve (Any one) : **[4]**

i) $y^2 (a - x) = x^3$

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

OR

Q4) a) Evaluate

$$\int_0^{2a} x\sqrt{2ax-x^2}\, dx.$$ **[4]**

b) Prove that

$$\int_0^{\infty}\frac{e^{-ax}-e^{-bx}}{x}dx=\log\frac{b}{a},\ a > 0,\ b > 0.$$ **[4]**

c) Find the arc length of the curve $x = e^{\theta}\cos\theta, y = e^{\theta}\sin\theta$ from $\theta = 0$ to $\theta = \frac{\pi}{2}$. **[4]**

Q5) a) Find the centre and radius of the circle which is the intersection of the sphere $x^2 + y^2 + z^2 - 2x + 4y + 2z - 6 = 0$ & the plane $x + 2y + 2z - 4 = 0$. **[5]**

b) Obtain the equation of a right circular cone which passes through the point (2, 1, 3) which the vertex (1, 1, 2) and axis parallel to $\frac{x-2}{2}=\frac{y-1}{-4}=\frac{z+2}{3}$. **[4]**

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

OR

Q6) a) Find the equation of the sphere through the circle $x^2 + y^2 + z^2 = 9$; $z = 0$ and the point (α, β, γ). **[5]**

b) Find the equation of right circular cone whose vertex is $(1, -1, 2)$, axis the line $\frac{x-1}{2}=\frac{y+1}{1}=\frac{z-2}{-2}$ and semi-vertical angle 45°. **[4]**

c) Find the equation of the right circular cylinder whose axis is $\frac{x-2}{2}=\frac{y-1}{1}=\frac{z}{3}$ and which passes through the point $(0, 0, 3)$. **[4]**

Q7) Attempt any two of the following :

a) Evaluate

$$\int_0^1\int_0^{\sqrt{1-y^2}} \frac{\cos^{-1}x\,dx\,dy}{\sqrt{\left(1-x^2-y^2\right)\left(1-x^2\right)}}.$$ **[6]**

b) Evaluate

$$\int_{-1}^1\int_0^z\int_{x-z}^{x+z}(x+y+z)\,dx\,dy\,dz.$$ **[7]**

c) Find the moment of inertia of the portion of the parabola $y^2 = 4ax$ bounded by x - axis and latus rectum, about x axis, if density at each point varies as the cube of the abscissa. **[6]**

OR

Q8) Attempt any two of the following :

a) Find the area outside the circle $r = a \sin\theta$ and outside the cardioide $r = a\ (1 - \cos\theta)$. **[6]**

b) Find the volume of the region enclosed by the cone $z=\sqrt{x^2+y^2}$ and paraboloid $z = x^2 + y^2$. **[7]**

c) Find the centroid of the one loop of the curve $r = a \sin2\theta$. **[6]**

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