

[4656] - 201

Seat No.

F.E. Examination, 2014 ENGINEERING MATHEMATICS – II (2012 Pattern)

Time : 2 Hours

Max. Marks : 50

8

4

4

8

Instructions: 1) Answer Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4, Q. No. 5 or

Q. No. **6** and *Q. No.* **7** or **8**.

2) Figures to the **right** indicate **full** marks.

3) Assume suitable data, if necessary.

4) Neat diagrams must be drawn wherever necessary.

5) Use of electronic non-programmable calculator is allowed.

1. a) Solve the following :

i)
$$\frac{dy}{dx} = \frac{x + y - 2}{y - x - 4}$$

ii)
$$\frac{dy}{dx} = x^2 \cos^2 y - x \sin 2y$$

b) An e.m.f. $200 e^{-5t}$ is applied to a series circuit consisting 20Ω resistor and 0.01 F capacitor. Find the charge and current at any time, assuming that there is no initial charge on capacitor.

OR

2. a) Solve :

$$\frac{dy}{dx} = \frac{y}{x} + \tan \frac{y}{x}$$

- b) Solve the following.
 - i) Find the orthogonal trajectory to of $x^2 + cy^2 = 1$.
 - ii) A body originally at 85°C cools to 65°C in 25 minutes, the temperature of air being 40°, what will be the temperature of the body after 40 minutes.

[4656] - 201

-2-

5

4

4

5

4

3. a) Find the Fourier expansion for y in terms of x upto first harmonic as given in following table.

X°	0	30	60	90	120	150	180	210	240	270	300	330
у	10.5	20.2	26.4	29.3	27	21.5	12.5	1.6	-19.2	-18.0	-15.8	-0.4

b) Evaluate:
$$\int_{0}^{\infty} \sqrt[4]{x} e^{\sqrt{x}} dx$$
. 3

c) Trace the following curve (any one):

$$x = a(t - sint), y = a (1 - cos t)$$

ii) $r = a \sin 3\theta$.

- /

i)

OR

4. a) If
$$I_n = \int_{0}^{\frac{\pi}{4}} \cos^{2n} x \, dx$$
, prove that $I_n = \frac{1}{n \, 2^{n+1}} + \frac{2n-1}{2n} I_n$ 4

b) Prove that
$$\phi(a) = \int_{\frac{\pi}{6a}}^{\frac{\pi}{2a}} \frac{\sin ax}{x} dx$$
 is independent of 'a'. 4

c) Find the length of the arc of cardioide $r = a (1 - \cos \theta)$ which lies outside the circle $r = a \cos \theta$.

- 5. a) Find the equation of the sphere tangential to the plane x 2y 2z = 7 at (3, -1, -1) and passing through the point (1, 1, -3).
 - b) Find the equation of the right circular cone which passes through the point (1, 1, 2) has its axis at the line $\sigma x = -3y = 4z$ and vertex at origin.

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).

OR

6. a) A sphere s has points (1, -2, 3) and (4, 0, 6) as opposite ends of a diameter. Find the equation of the sphere having the intersection of s with the plane x + y - 2z = 6 = 0 as its great circle.

5

b) Find the equation of right circular cone whose vertex is (1, 2, 3) and the axis is given by

$$\frac{x-1}{2} = \frac{y-2}{-1} = \frac{z-3}{4}$$
 and semi-vertical angle is 60°.

c) Find the equation of the right circular cylinder of radius 3 whose axis is the line

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

7. a) Attempt **any two** of the following :

Change the order of integration and evaluate :

$$\int_{0}^{\infty} \int_{x}^{\infty} \frac{e^{-y}}{y} dx dy.$$

b) Find the volume of the tetrahydron bounded by the co-ordinate planes and the plane

$$\frac{x}{a} + \frac{y}{b} + \frac{z}{c} = 1.$$

c) Find the centre of gravity of one loop of the curve $r = a \sin 2\theta$.

OR

8. Attempt any two of the following :

a) Evaluate :
$$\iint_{R} \sin (x^2 + y^2) dx dy$$
, where R is circle $x^2 + y^2 = a^2$. 6

- b) Find the total area included between the two cardiodes $r = ac (1 + cos \theta)$ and $r = a (1 cos \theta)$.
- c) Find the moment of inertia about the x-axis of the area enclosed by the lines x = 0, y = 0

$$\frac{x}{a} + \frac{y}{b} = 1.$$

B/II/14/

7

7

7

[4656] - 201