



[4656] – 201

Seat No.	
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**F.E. Examination, 2014**  
**ENGINEERING MATHEMATICS – II**  
**(2012 Pattern)**

Time : 2 Hours

Max. Marks : 50

**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 :

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

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OR

2. a) Solve :

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

b) Solve the following.

i) Find the orthogonal trajectory to of  $x^2 + cy^2 = 1$ .

8

ii) A body originally at  $85^\circ\text{C}$  cools to  $65^\circ\text{C}$  in 25 minutes, the temperature of air being  $40^\circ$ , what will be the temperature of the body after 40 minutes.

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3. a) Find the Fourier expansion for y in terms of x upto first harmonic as given in following table. 5

$x^\circ$	0	30	60	90	120	150	180	210	240	270	300	330
$y$	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**) : 4
- i)  $x = a(t - \sin t)$ ,  $y = a(1 - \cos t)$
- ii)  $r = a \sin 3\theta$ .

OR

4. a) If  $I_n = \int_0^{\pi/4} \cos^{2n} x dx$ , prove that  $I_n = \frac{1}{n 2^{n+1}} + \frac{2n-1}{2n} I_{n-1}$  4

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

- c) Find the length of the arc of cardioide  $r = a(1 - \cos \theta)$  which lies outside the circle  $r = a \cos \theta$ . 4

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  $(1, 1, -3)$ . 5

- 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. 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

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

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

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

$$\frac{x-1}{2} = \frac{y-3}{2} = \frac{z-5}{-1}. \quad 4$$

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

Change the order of integration and evaluate :

$$\int_0^\infty \int_x^\infty \frac{e^{-y}}{y} dx dy. \quad 6$$

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

$$\frac{x}{a} + \frac{y}{b} + \frac{z}{c} = 1. \quad 6$$

- c) Find the centre of gravity of one loop of the curve  $r = a \sin 2\theta$ . 7

OR

8. Attempt **any two** of the following : 7

- 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  $r = a(1 - \cos\theta)$ . 7

- c) Find the moment of inertia about the x-axis of the area enclosed by the lines  $x = 0, y = 0$

$$\frac{x}{a} + \frac{y}{b} = 1. \quad 6$$