[4656] – 201

Seat No.	

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 : **8**

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 $20\,\Omega$ resistor and 0.01 F capacitor. Find the charge and current at any time, assuming that there is no initial charge on capacitor. **4**

OR

2. a) Solve : **4**

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

b) Solve the following.

i) Find the orthogonal trajectory to of $x^2 + cy^2 = 1$. **8**

ii) A body originally at 85°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.

P.T.O.

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

x°	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 $I_n = \frac{1}{n\, 2^{n+1}} + \frac{2n-1}{2n} I_n$ **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 $\frac{x-1}{2}=\frac{y-2}{-1}=\frac{z-3}{4}$ and semi-vertical angle is 60°. **4**

c) Find the equation of the right circular cylinder of radius 3 whose axis is the line $\frac{x-1}{2}=\frac{y-3}{2}=\frac{z-5}{-1}$. **4**

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

Change the order of integration and evaluate :

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

b) Find the volume of the tetrahydron bounded by the co-ordinate planes and the plane $\frac{x}{a}+\frac{y}{b}+\frac{z}{c}=1$. **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 $\frac{x}{a}+\frac{y}{b}=1$. **6**

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