Total No. of Questions—8]

[Total No. of Printed Pages—4+2]

Seat	
No.	

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F.E. (Second Semester) EXAMINATION, 2015

ENGINEERING MATHEMATICS-II

(2012 **PATTERN**)

Time: Two Hours

Maximum Marks: 50

- N.B. :— (i) Attempt four questions: Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4, Q. No. 5 or Q. No. 6, Q. No. 7 or Q. No. 8.
 - (ii) Neat diagrams must be drawn whenever necessary.
 - (iii) Figures to the right indicate full marks.
 - (iv) Use of electronic non-programmable calculator is allowed.
 - (v) Assume suitable data whenever necessary.
- 1. (a) Solve the following differential equations: [8]
 - (i) $\frac{dy}{dx} = \cos x \cos y + \sin x \sin y$
 - (ii) $(x^2 + y^2 + 1)dx 2xy dy = 0$.
 - (b) In a circuit containing inductance L, resistance R and voltage E, the current I is given by:

$$E = RI + L \frac{dI}{dt}.$$

Given:

 $L = 640 \text{ H}, R = 250 \Omega, E = 500 \text{ Volts}.$

I being zero when t = 0. Find the time that elapses before it reaches 80% of its maximum value. [4]

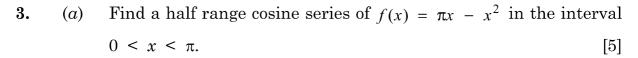
Or

2. (a) Solve: [4]

$$x\frac{dy}{dx} + y = y^2 \log x$$

- (b) Solve the following: [8]
 - (i) A body at temperature 100°C is placed in a room whose temperature is 20°C and cools to 60°C in 5 minutes. Find its temperature after a further inverval of 3 minutes.
 - (ii) A steam pipe 20 cm in diameter is protected with a covering 6 cm thick for which the coefficient of thermal conductivity is k = 0.003 cal/cm deg. sec in steady state. Find the heat lost per hour through a meter length of the pipe, if the surface of pipe is at 200°C and outer surface of the covering is at 30°C.

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$$\int_{0}^{\infty} \frac{x^3}{3^x} dx.$$

(c) Trace the following curve (any one): [4]

(i)
$$y^2 = x^5 (2a - x)$$

(ii) $r = a \sin 2\theta$.

Or

$$I_n = \int_{\pi/4}^{\pi/2} \cot^n \theta \, d\theta$$

prove that $I_n = \frac{1}{n-1} - I_{n-2}$. Hence evaluate I_3 .

(b) Using differentiation under Integral sign prove that: [4]

$$\int_{0}^{\infty} \frac{e^{-x} - e^{-ax}}{x \sec x} dx = \frac{1}{2} \log \left(\frac{a^2 + 1}{2} \right)$$

for a > 0

(c) Find the length of the curve

$$x = a(\theta - \sin \theta), y = a(1 - \cos \theta)$$

between $\theta = 0$ to $\theta = 2\pi$.

[4]

- 5. (a) Show that the plane 4x 3y + 6z 35 = 0 is tangential to the sphere $x^2 + y^2 + z^2 y 2z 14 = 0$ and find the point of contact. [5]
 - (b) Find the equation of the right circular cone whose vertex is given by (1, -1, 2) and axis is the line $\frac{x-1}{2} = \frac{y+1}{1} = \frac{z-2}{-2}$ and semi-vertical angle is 45° . [4]
 - (c) Find the equation of right circular cylinder of radius 2 and axis is given by: [4]

$$\frac{x-1}{2} = \frac{y-2}{-3} = \frac{z-3}{6}$$

Or

- **6.** (a) Find the equation at the sphere through the circle $x^2 + y^2 + z^2 = 1$, 2x + 3y + 4z = 5 and which intersects the sphere $x^2 + y^2 + z^2 + 3(x y + z) 56 = 0$ orthogonally. [5]
 - (b) Find the equation of right circular cone with vertex at origin making equal angles with the co-ordinate axes and having generator with direction cosines proportional to 1, −2, 2. [4]

(c) Obtain the equation of the right circular cylinder of radius 5 where axis is:

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

- 7. Attempt any two of the following:
 - (a) Change the order of integration in the double integral: [6]

$$\int_{0}^{5} \int_{2-x}^{2+x} f(x, y) dy dx$$

(b) Evaluate: [7]

$$\int_{0}^{2} \int_{0}^{x} \int_{0}^{2x+2y} e^{x+y+z} dx dy dz$$

(c) Find the centroid of the loop of the curve: [6]

$$r^2 = a^2 \cos 2\theta.$$

Or

8. Attempt any two of the following:

(a) Evaluate: [6]

$$\int_{0}^{a} \int_{0}^{\sqrt{a^{2}-x^{2}}} e^{-x^{2}-y^{2}} dx dy.$$

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(b) Evaluate: [6]

$$\iiint \sqrt{1 - \frac{x^2}{a^2} - \frac{y^2}{b^2} - \frac{z^2}{c^2}} \ dx \ dy \ dz$$

throughout the volume of ellipsoid $\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$.

(c) Prove that the moment of inertia of the area included between the curves $y^2 = 4 ax$ and $x^2 = 4 ay$ about x-axis is $\frac{144}{35} \text{M}a^2$, where M is the mass of the area included between the curves.