May - June 2010
Sem - II
F.E. (2008 Course)

Total No. of Questions : 12] **[Total No. of Printed Pages : 7**

[3761]-106

F. E. (Semester - II) Examination - 2010

ENGINEERING MATHEMATICS - II

(June 2008 Pattern)

Time : 3 Hours] **[Max. Marks : 100**

Instructions :

(1) In section I, attempt Q. No. 1 or 2, Q. No. 3 or 4, Q. No. 5 or 6. In section II, attempt Q. No. 7 or 8, Q. No. 9 or 10, Q. No. 11 or 12.

*(2) Answers to the **two sections** should be written in **separate answer-books.***

(3) Figures to the right indicate full marks.

(4) Neat diagram must be drawn wherever necessary.

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

(6) Assume suitable data, if necessary.

SECTION - I

Q.1) (A) Form a Differential Equation whose general solution is

$xy = ae^{x} + be^{-x} + x^{3}$ **[05]**

(B) Solve the following : **(Any Three)** **[12]**

(1) $(x^2y - 2xy^2)\, dx = (x^3 - 3x^2y)\, dy$

(2) $\tan y \dfrac{dy}{dx} + \tan x = \cos y \cos^2 x$

(3) $x dy - y dx = (x^2 + y^2)(x dx + y dy)$

(4) $(x^2y + y^4)\, dx + (2x^3 + 4xy^3)\, dy = 0$

OR

Q.2) (A) Form a Differential Equation whose general solution is $y = \log \cos(x - a) + b$ **[05]**

(B) Solve the following : **(Any Three)** **[12]**

(1) $x\frac{dy}{dx} + 3y = x^4 e^{1/x^2} y^3$

(2) $\left[\log(x^2 + y^2) + \frac{2x^2}{x^2 + y^2}\right] dx + \frac{2xy}{x^2 + y^2} dy = 0$

(3) $\left(\frac{y}{x} \sec y - \tan y\right) dx = (x - \sec y \log x)\, dy$

(4) $\frac{dy}{dx} = \frac{2x - 3y + 1}{3x + 4y - 5}$

Q.3) Solve **any three** :

(a) A body originally at 80°C cools down to 60°C in 20 minutes, the temperature of air being 40°C. What will be the temperature of the body after 40 minutes from the original ? **[05]**

(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 = 640H, R = 250 ohms, E = 500 volts, I being zero when t = 0, find the time that elapses, before I reaches 90% of its maximum value. **[06]**

(c) A particle of mass m is projected upward with velocity V. Assuming the air resistance is k times its velocity, write the equation of motion and show it will reach maximum height in time $\frac{m}{k}\log\left(1 + \frac{kV}{gm}\right)$. Find also the distance travelled at any time t. **[06]**

(d) A particle executes S.H.M. When it is 2 cm from the mid path, its velocity is 10cm/sec. and when it is 6 cm., from centre its velocity is 2 cm/sec. Find its period and greatest acceleration. **[05]**

OR

Q.4) Solve **any three** of the following :

(a) A steam pipe 20 cm in diameter is protected with a covering 6cm thick for which the coefficient of thermal conductivity is k = 0.0003. Find the heat lost per hour through a meter length of the pipe, if the inner surface of the pipe is at 200°C and the outer surface of the covering is at 30°C. Also, find temperature at a distance 12 cm from the centre of the pipe. **[06]**

(b) The charge Q on a plate of condenser of capacity C is charged through a resistance R, by steady voltage V. If Q = 0 at t = 0, find charge as a function of t. **[05]**

(c) A particle is moving in a straight line with an acceleration $k\left[x + a^4/x^3\right]$, directed towards origin. If it starts from rest at a distance 'a' from the origin, prove that it will arrive at origin at the end of time $\pi/4\sqrt{k}$. **[06]**

(d) Find the orthogonal trajectories of $r = a(1 - \cos\theta)$. **[05]**

Q.5) (A) Expand $f(x) = x\sin x$ as a Fourier Series in the interval $0 \le x \le 2\pi$. **[08]**

(B) Show that $B(m, n) = \int_0^1 \frac{x^{m-1} + x^{n-1}}{(1 + x)^{m+n}}\, dx$. **[04]**

(C) If $I_n = \int_0^{\pi/2} \cos^n x \cos nx\, dx$ prove that $I_n = \frac{1}{2} I_{n-1} = \frac{\pi}{2^{n+1}}$. **[05]**

OR