May - June - 2011

F.E. Sem - II

2008 pattern

[3961] – 107

F.E. (Semester – II) Examination, 2011
ENGINEERING MATHEMATICS – II
(2008 Pattern)

Time : 3 Hours | Max. Marks : 100

Instructions : *1) In Section – **I**, solve Q. No.**1** or Q. No. **2**, Q. No. **3** or Q. No. **4**, Q. No. **5** or Q. No. **6**. In Section – **II**, solve Q. No. **7** or Q. No. **8**, Q. No. **9** or Q. No. **10**, Q. No. **11** or Q. NO. **12**.*

*2) Answers to the **two** Sections should be written in **separate** answer books.*

*3) Black figures to the **right** indicate **full** marks.*

*4) Assume **suitable** data, if **necessary**.*

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SECTION – I

1. a) Form the differential equation whose general solution is

$y = ae^{4x} + be^{3x}$

where a and b are arbitrary constants. **6**

b) Solve **any two** : **10**

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

2) $(e^y + 1)\cos x\, dx + e^y \sin x\, dy = 0$

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

OR

2. a) Form the differential equation whose general solution is

$$\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$$

where a and b are arbitrary constants. **6**

b) Solve **any two** : **10**

1) $\left(xy-x^2\right)\frac{dy}{dx}=y^2$

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

3) $\left(x^4e^x-2mxy^2\right)dx+2mx^2y\,dy=0$.

3. Attempt **any three** : **18**

a) Find the orthogonal trajectories of the family of $r=a\left(1-\sin\theta\right)$.

b) A metal ball is heated to a temperature of 100° C and at time t = 0 it is placed in water which is maintained at 40° C. If the temperature of the ball reduces to 60° C in 4 minutes, find the time at which the temperature of the ball is 50° C.

c) A resistance of 100 ohms and an inductance of 0.5 henries are connected in series with a battery of 20 volts. Find the current in the circuit when initially i = 0 at t = 0. Also find the time that elapses before the current reaches one half of its maximum value.

d) Assuming the resistance to the motion of a ship through water is $a^2 + b^2 v^2$, where v is the velocity of the ship and a, b are constants, write down the differential equation for the retardation of the ship moving with engine stopped. Prove further that the time in which the speed falls to one half of its original value is given by $\frac{W}{abg} \tan^{-1}\left[\frac{abu}{2a^2 + b^2u^2}\right]$, where u is initial velocity, W is weight of ship.

OR

4. Solve **any three** : **18**

a) A pipe 20 cms in diameter contains steam at 150° C and is protected with a covering 5 cm thick, for which k = 0.0025. If the temperature of the outer surface of the covering is 40° C, find the temperature half way through the covering.

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

c) The distance x descended by a parachuter satisfies the equation $v\frac{dv}{dx} = g\left(1 - \frac{v^2}{k^2}\right)$, where v is velocity, k, g are constants. If $v = 0$ and $x = 0$ at time $t = 0$, show that $x = \frac{k^2}{g} \log \cosh\left(\frac{gt}{k}\right)$.