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[3561]-201

F. E. (Semester - II) Examination - 2009

ENGINEERING MATHEMATICS - II

(June 2008 Course)

Time : 3 Hours]

[Max. Marks : 100

Instructions :

- (1) In section I, attempt Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4, Q. No. 5 or Q. No. 6. In section II, attempt Q. No. 7 or Q. No. 8, Q. No. 9 or Q. No. 10, Q. No. 11 or Q. No. 12.
- (2) Answer to the **two sections** should be written in **separate answer-books**.
- (3) Figures to the right indicate full marks.
- (4) Neat diagrams 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 the differential equation whose solution is

$$xy = ae^x + be^{-x} + x^2.$$

[05]

(B) Solve any three :

[12]

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

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



$$(3) \tan y \frac{dy}{dx} + \tan x = \cos y \cos^3 x$$

$$(4) y (2x^2y + e^x) dx = (e^x + y^3) dy$$

OR

Q.2) (A) Form the differential equation whose solution is $y = ae^{-3t} \sin(2t + b)$ [05]

(B) Solve any three : [12]

$$(1) \left[\frac{y}{(x-y)^2} - \frac{1}{2\sqrt{1-x^2}} \right] dx - \frac{x}{(x-y)^2} dy = 0$$

$$(2) y(xy + 2x^2y^2) dx + x(xy - x^2y^2) dy = 0$$

$$(3) (3x + 2y^2) y dx + 2x(2x + 3y^2) dy = 0$$

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

Q.3) Solve any three :

(a) 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 the temperature of the body after a further interval of 5 minutes. [05]

(b) An electrical circuit contains an inductance of 0.2 henries and a resistance of 10 ohms in series with an e.m.f. $150 \cos(200t)$. Find the current at any time t , if it is zero when $t = 0$. What value does it approach after a long time ? [06]

(c) A body of mass m falls from rest under the influence of gravity and a retarding force, proportional to square of velocity. Find the velocity and distance described as function of time. Find also the limiting value of the velocity. [06]

(d) Find the orthogonal trajectories of the family of curves given by the equation $x^2 + cy^2 = 1$. [05]

OR

Q.4) Solve any three :

(a) A voltage $E e^{-at}$ is applied at time $t = 0$ to a circuit consisting of resistance R ohms and capacitance C farads. Find the charge and current in the circuit at any time t . [05]

(b) A particle moves in a horizontal line OA with an acceleration k/r^3 at a distance r and directed towards O . If initially the particle was at rest at a distance a from O , find the time when it will be at a distance $\frac{a}{2}$ from O . [05]

(c) A pipe 20 cms in diameter contains steam at 200°C and is protected with a covering 5 cms thick for which $k = 0.0015$. If the temperature of the outer surface of the covering is 50°C , find the temperature half-way through the covering, under steady state conditions. [06]

(d) A tank is initially filled with 100 litres of salt solution containing 1 gm. of salt per litre. Fresh salt solution containing 2 gms of salt per litre runs into the tank at the rate of 5 litres per minute and the mixture kept uniform by stirring runs out at the same rate. Find the amount of salt in the tank at any time and find how long it will take for this amount to reach 150 gms. [06]

