SEAT No. :

PB-1

[6267]-1
F.E. (Insem)
ENGINEERING MATHEMATICS - II
(2019 Pattern) (Semester - II) (107008)

Time : 1 Hour] *[Max. Marks : 30*

Instructions to the candidates:

1) Attempt Q.1 or Q.2 and Q.3 or Q.4.
2) Neat diagrams must be drawn wherever necessary.
3) Figures to the right indicate full marks.
4) Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.
5) Assume suitable data, if necessary.

Q1) a) Solve : $(1+\log xy)dx+\left(1+\dfrac{x}{y}\right)dy = 0$ **[5]**

b) Solve : $(x^2 - 3xy + 2y^2)dx + (3x^2 - 2xy)dy = 0$ **[5]**

c) Solve : $\dfrac{dy}{dx} + \dfrac{2y}{x} = x^2 y^2$ **[5]**

OR

Q2) a) Solve : $(e^{-y}\sec^2 y - x)\, dy = dx$ **[5]**

b) Solve : $\cos y - x \sin y \dfrac{dy}{dx} = \sec^2 x$ **[5]**

c) Solve : $(x^2 + y^2 + x)dx + xy\, dy = 0$ **[5]**

Q3) a) Water at temperature 70°c cools down to 50°C in 5 minutes in the surrounding temperature of 20°C. Find the temperature of the water after 15 minutes from the beginning. **[5]**

b) An electromotive force E volts is applied to a circuit containing a resistance R ohms in series and an inductance L henries (E, R, L are constants). If the initial current is zero, show that the current builds up to 80% of its theoretical maximum in $\dfrac{L\log 5}{R}$ seconds. **[5]**

c) A chain is coiled up near the edge of a smooth table and it just starts to fall over the edge. When a length x has fallen, its velocity v is given by

$xv\dfrac{dv}{dx} + v^2 = gx$, where g is gravitational constant. Show that if $v = 0$ at

$x = 0$, then $v^2 = \dfrac{2}{3}gx$ **[5]**

OR

Q4) a) Find the orthogonal trajectories of the family of parabolas : $y^2 = 4ax$.**[5]**

b) In a R-C-circuit voltage $200e^{-5t}$ is applied and the circuit contains resistance R = 20 ohms and condenser of capacity C = 0.01 farad in series. If at time t = 0, charge q = 0, prove that $q = 10te^{-5t}$ **[5]**

c) A steam pipe of inner radius 10 cm is protected with a covering 6 cm thick for which K = 0.0003 in steady state. Find the heat lost per hour through a one meter long pipe if the inner surface of the pipe is at 200°C and the outer surface of the covering is at 30°C. **[5]**

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