Total No. of Questions : 4] **SEAT No. :** [ ]

PB-1 **[Total No. of Pages : 2**

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

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

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

OR

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

b) Solve : $\cos y - x\sin y\frac{dy}{dx}=\sec^2 x$ **[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 $\frac{L\log 5}{R}$ seconds. **[5]**

P.T.O.

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 $xv\frac{dv}{dx}+v^2=gx$, where g is gravitational constant. Show that if $v = 0$ at $x = 0$, then $v^2=\frac{2}{3}gx$ **[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]**