Total No. of Questions : 4]

SEAT No. :

P-01

[Total No. of Pages : 2

[6007]-121

F.E. (Insem.)

ENGG. MATHEMATICS - II

(2019 Pattern) (Semester - II) (107008)

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

Instructions to the candidates :

1) *Solve Q.No.1 or Q.No.2 and Q.No.3 or Q.No.4.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right indicate full marks.*
4) *Use of calculator is allowed.*
5) *Assume suitable data, if necessary.*

Q1) a) Solve $\frac{dy}{dx}+\frac{y\cos x+\sin y+y}{\sin x+x\cos y+x}=0$. [5]

b) Solve $(1+xy)ydx+(1-xy)xdy=0$. [5]

c) Solve $(x^2+1)\frac{dy}{dx}+4xy=\frac{1}{(x^2+1)^2}$. [5]

OR

Q2) a) Solve $\frac{dx}{dy}-x\tan y=x^4\sec y$. [5]

b) Solve $\cos y\frac{dy}{dx}-\frac{\sin y}{1+x}=(1+x)e^x$. [5]

c) Solve $y(x^2y+e^x)dx-e^x\,dy=0$. [5]

P.T.O.

Q3) a) A body originally at 80°C cools down to 60°C in 20 minutes, the temperature of the air being 40°C. What will be the temperature of the body after 40 minutes from the original? **[5]**

b) A voltage $E = 20\,e^{-10t}$ is applied at $t = 0$ to a circuit containing inductance $L = 0.5$ H and resistance $R = 100\Omega$. Show that current at any time t is

$$I = \frac{20}{95}\left[e^{-10t} - e^{-200t}\right]$$ **[5]**

c) A body of mass m, falling from rest is subjected to the force of gravity and an air resistance proportional to the square of the velocity kv^2. If it falls through a distance x and possesses a velocity v at that instant, prove that

$$\frac{2kx}{m} = \log\left(\frac{a^2}{a^2 - v^2}\right)$$ where $mg = ka^2$. **[5]**

OR

Q4) a) Find the orthogonal trajectories of the family of curves given by $x^2 + 2y^2 = c^2$ where c is a parameter. **[5]**

b) The charge q on the plate of a condenser of capacity c charged through a resistance R by a steady voltage v satisfies the differential equation $R\frac{dq}{dt} + \frac{q}{c} = v$. If $q = 0$ at $t = 0$, show that $q = cv\,(1 - e^{-t/Rc})$. Find the current flowing into the plate. **[5]**

c) A steam pipe 20 cm in diameter is protected with a convering 6 cm thick for which the coefficient of thermal conductivity is $k = 0.0003$ in steady state. Find the heat lost per hour through a meter length of the pipe, if the surface of the pipe is at 200°C and the outer surface of the covering is at 30°C. **[5]**

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