Assignment -1
Self Study Topic

Class: FE-Sem-II **Subject: Applied Mathematics -II** **Div:ALL**

1) Application of First and Higher order Differential Equation
2) Taylor series Method
3) Cauchy's homogeneous linear differential equation and Legendre's Differential equation

(Part A)

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

(2) $x^3 \frac{d^3y}{dx^3} + 2x^2 \frac{d^2y}{dx^2} + 2y = 10(x + x^{-1})$

(3) $x^2 \frac{d^2y}{dx^2} + 5x\ \frac{dy}{dx} + 3y = \log x\ \ (x + x^{-1})^2$

(4) $(1 + 2x)^2 \frac{d^2y}{dx^2} - 2(1 + 2x)\frac{dy}{dx} - 12y = x^2$

(5) $(2 + 3x)^2 \frac{d^2y}{dx^2} + 5(2 + 3x)\frac{dy}{dx} - 3y = x^2 + x + 1$

(6) $(-1 + 2x)^3 \frac{d^3y}{dx^3} + 2(-1 + 2x)\frac{dy}{dx} - 2y = 0$

(7) Solve $\frac{di}{dt} + \frac{R}{L}i = \frac{E}{L}$ for the case in which the circuit has the initial current $i_0$at time $t = 0$ and the e.m.f. impressed is given by $E = E_0e^{-kt}$

(8) Solve $L\ \frac{di}{dt} + Ri = E\ sin\omega t$ for I, where $i = 0$ for $t = 0$

(9) An uncharged condenser of capacity C is charged by applying an e.m.f. $Esin\ nt$ through the leads of an inductance L and negligible resistance. The charge Q on the plate of the condenser satisfies the differential Equation $L\ \frac{d^2Q}{dt} + \frac{Q}{C} = Esin\ nt$. Prove that charge at any time t is given by

$Q = \frac{EC}{2}(\sin nt - nt\cos nt)$ where $n^2 = \frac{1}{LC}$

(10) An electric circuit consists of condenser of capacity C ,an inductance and e.m.f. $E = E_0 cos\omega t$. The charge Q satisfies the differential Equation $\frac{d^2Q}{dt} + \frac{Q}{CL} = \frac{E_0 cos\omega t}{L}$.

If $\omega = \frac{1}{\sqrt{CL}}$ and initially $Q = Q_0$ and current $I = I_0$ at $t = 0$, show that

$$Q = Q_0 cos\omega t + \frac{I_0}{\omega} sin\omega t + \frac{E_0 t\ sin\omega t}{2L\omega}$$

(**Part B**)

Solve by Taylor series Method

a) $\frac{dy}{dx} = y - xy; y(0) = 2$; compare your result with exact solution **(Roll No. 1 to 10)**

b) $\frac{dy}{dx} = 2y + 3e^x; y(0) = 1$ for $x = 0.1\ and\ 0.2$ **(Roll No. 11 to 20)**

c) $\frac{dy}{dx} = \frac{1}{x^2+y^2}; y(4) = 4$; for $x = 4.1\ and\ 4.2$ **(Roll No. 21 to 30)**

d) $\frac{dy}{dx} = ysinx + \cos x\,; y(0) = 0$ **(Roll No. 31 to 40)**

e) $\frac{dy}{dx} = (0.1)(x^3 + y^2); y(0) = 1$**(Roll No. 41 to 50)**

f) $\frac{dy}{dx} = x^3 + y; y(1) = 1$; for $x = 1.1$ and $x = 1.2$ with $h = 0.1$**(Roll No. 51 to 60)**

g) $x\frac{dy}{dx} = x - y; y(2) = 2$; for $x = 2.1$ and $x = 2.2$ with $h = 0.1$**(Roll No. 61 onwards)**