Module 1

Linear Differential Equations with constant coefficients.

Q.No	Question
1.	a) Solve: $(4D^4 - 8D^3 - 7D^2 + 11D + 6)y = 0$ b) Solve: $(D^4 + 2D^3 - 5D^2 - 6D)y = 0$
2.	a) Solve: $(D^3 + D^2 + 4D + 4)y = 0$ b) Solve: $(D^3 - 3D^2 + 3D - 1)y = 0$
3.	a) Solve: $(4D^4 - 4D^3 - 23D^2 + 12D + 36)y = 0$ b) Solve: $(D^4 - 2D^3 + D^2)y = 0$
4.	a) Solve: $(D^2 - 4)y = \cosh(2x-1)+3^x$ b) Solve: $(D^2 - 4D + 13)y = e^{3x}\cosh 2x$
5.	a) Solve: $\frac{d^3y}{dx^3} + 6\frac{d^2y}{dx^2} + 11\frac{dy}{dx} + 6y = e^{2x} + e^x + 1$ b) Solve: $\frac{d^3y}{dx^3} + 3\frac{d^2y}{dx^2} + 3\frac{dy}{dx} + y = 6e^{-x} + \log 2$
6.	a) Solve: $(D^2-4D+4)y = \cos 2x$ b) Solve: $(D^4 + 8D^2 + 16)y = 2\cos^2 x$
7.	a) Solve: $(D^3-1)y = 3\sin 2x$ b) Solve: $D^2(D^2+4)(D^2+9)y = 2\sin\frac{x}{2}\cos\frac{x}{2}$
8.	a) Solve $\frac{d^3y}{dx^3} + \frac{d^2y}{dx^2} + 4\frac{dy}{dx} + 4y = x^2 - 4x - 6$ b) Solve $\frac{d^3y}{dx^3} - 7\frac{dy}{dx} + 6y = x^2 - x + 1$
9.	a) Solve $\frac{d^2y}{dx^2} + 3\frac{dy}{dx} + 2y = x^2 + 3x + 1$ b) Solve $\frac{d^2y}{dx^2} + \frac{dy}{dx} = x^2 + 2x + 4$
10.	a) Solve: $(D^2-2D+4)y = e^x\cos x$

	b) Solve: $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + 5y = e^{2x}\sin x$
11.	a) Solve: $(D^3 - 3D^2 + 3D - 1)y = 60\,x^2e^x$ b) Solve: $(D^3+8)y = x^2e^{-2x}$
12.	a) Solve: $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = xe^x\sin x$ b) Solve: $(D^2+16)y = x\sin 3x$
13.	a) Solve: $\frac{d^2y}{dx^2} - 4\frac{dy}{dx} + 4y = 8x^2e^{2x}\sin x$ b) $(D^2-2D+1)y = x\cos x$
14.	a) Solve $\frac{d^3y}{dx^3} + \frac{d^2y}{dx^2} - 4\frac{dy}{dx} - 4y = 3e^{-x} - 4x - 6$ b) Solve $(D^2+2)y = x^2e^{3x} + \cos 2x$
15.	a) Solve: $(D^2+4D)y = x^2 + \cos 2\,x + 2^{-x}$ b) Solve: $(D-2)^2y = 8(e^{2x}+\sin 2x)$
16.	a) Solve: $(D^2-3D+2)y = 2\sin x\cos x + xe^x$ b) Solve: $\frac{d^2y}{dx^2} - 4\frac{dy}{dx} + 4y = e^{2x} + \cos 2x + 4$
17.	a) Solve: $\frac{d^2y}{dx^2} + 5\frac{dy}{dx} + 6y = 0$ given that $y(0) = 0, \frac{dy}{dx}(0) = 15$ b) Solve: $\frac{d^2y}{dx^2} - 9\frac{dy}{dx} = 2\sin 3x$ given that $y(0) = 0, \frac{dy}{dx}(0) = 0$
18.	a) Solve: $\frac{d^2y}{dx^2} - 4\frac{dy}{dx} + 5y = 0$ given that $y(0) = 1, \frac{dy}{dx}(0) = 2$ b) Solve: $\frac{d^2y}{dx^2} + 4\frac{dy}{dx} + 5y = -2\cosh x$, given that $y(0) = 0, \frac{dy}{dx}(0) = 1$
19.	a) A body weighing 10kg is hung from a spring. A pull of 20kg wt. will stretch the spring to 10 cm. The body is pulled down to 20 cm below the static equilibrium position and then released. Find the displacement of the body from its equilibrium position at time t sec., the maximum velocity and the period of oscillation. b) A particle undergoes forced vibrations according to the law $\frac{d^2x}{dt^2} + 25\frac{dx}{dt} = 21\cos 2t$. If the particle starts from rest at t=0. Find the displacement at any time t>0.

20.	a) In an LCR circuit, the charge q on a plate of a condenser is given by $L\frac{d^2q}{dt^2} + R\frac{dq}{dt} + \frac{q}{C} = E\sin pt$. The circuit is tuned to resonance so that $p^2 = \frac{1}{LC}$. if initially the current I and the charge q be zero, show that for small values of R/L, the current in the circuit at time t is given by (Et/2L)sinpt b) The Differential equation for a circuit in which self-inductance and capacitance neutralize each other is $L\frac{d^2i}{dt^2} + \frac{i}{C} = 0$. Find the current i as a function of t given that I is the maximum current and i=0 when t=0