UNIVERSITY OF PETROLEUM & ENERGY STUDIES, DEHRADUN

Program	B. Tech SCS	Semester	II
Course	Mathematics II	Course Code	MATH 1005
Session	Jan-May 2018	Topic	Differential Equations

1. Solve: $xdy - ydx = x\sqrt{x^2 - y^2}\,dx$.

2. Solve the differential equation $y'' + 4y' + 8y = \sin x$, $y(0) = 1$ and $y'(0) = 0$.

3. Solve the differential equation $\left(D^2 + D + 1\right)y = \left(1 + e^x\right)^2$.

4. Solve the differential equation $\left(D^3 + 1\right)y = e^{2x}\sin x + e^{\frac{x}{2}}\sin\frac{\sqrt{3}}{2}x$

5. Solve the differential equation $\left(D^2 - 2D + 1\right)y = xe^x \sin x$

6. A condenser of capacity C is discharged through the inductance L and a resistance R in series and the change q at any time t satisfies the equation $L\frac{d^2q}{dt^2} + R\frac{dq}{dt} + \frac{q}{C} = 0$, given that $L = 0.25$ henary, $R = 25$ ohms, $C = 2\times10^{-6}$ farad and that when $t = 0$, the charge q is 0.002 coulombs, and the current $\frac{dq}{dt} = 0$. Obtain q in term of t.

7. By changing the independent variable, solve the following differential equation

$$\cos x\frac{d^2y}{dx^2} + \sin x\frac{dy}{dx} - 2y\cos^3 x = 2\cos^5 x$$

8. Solve by method of variation of parameters $\frac{d^2y}{dx^2} + (1 - \cot x)\frac{dy}{dx} - y\cot x = \sin^2 x$.

9. Solve $y''-4xy'+\left(4x^2 - 2\right)y = 0$, given that $y = e^{x^2}$ is a solution.

10. Solve the differential equation $x^2\frac{d^2y}{dx^2} + x\frac{dy}{dx} + y = \log x\sin\log x$.