



Department of Mathematics, SOPS, Doon University Dehradun
Mid-Semester Examination 2017-18
Integrated M.Sc. Mathematics-I (Second Semester)
Course Title & Course Code: Differential Equations (MAC-152)

Time: 02 Hour

Total Marks: 30

Note: (i) Attempt ALL the questions. (ii) Do neat and clean work.

Section A

Attempt ALL:

(2x3=6)

1. Find the complete solution of the differential equation, $\frac{d^2 y}{dx^2} - y = e^{-x} \sin(e^{-x}) + \cos(e^{-x})$
2. Solve the differential equation $\frac{d^4 y}{dx^4} - y = \cos x \cosh x$
3. Define with examples, Order and degree of a differential equation.
4. By the elimination of constants A and B, find the differential equation of which $y = e^x (A \cos x + B \sin x)$ is a solution.

Section B

Attempt ALL:

(4x3=12)

1. Reduce the differential equation $x^2 y'' - 2x(1+x)y' + 2(1+x)y = x^3, x > 0$, into the normal form.
2. Verify that e^x and x are solutions of the homogeneous equation corresponding to $(1-x)y_2 + xy_1 - y = 2(x-1)^2 e^{-x}, 0 < x < 1$, thus find its solution by the method of Variation of parameters.
3. Solve the diff. equation $(D^2 - 4D + 4)y = 8x^2 e^{2x} \sin 2x$
4. Solve the differential equation $(x \sin x + \cos x)y'' - x \cos x y' + y \cos x = \sin x (x \sin x + \cos x)^2$.

Section C

Attempt ALL:

(4x3=12)

1. Solve the simultaneous equation $\frac{d^2 x}{dt^2} + \frac{dy}{dt} + 3x = e^{-t}, \frac{d^2 y}{dt^2} - 4 \frac{dx}{dt} + 3y = \sin 2t$

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2. (a) Find the value of λ for which the differential equation $(xy^2 + \lambda x^2 y)dx + (x + y)x^2 dy = 0$ is exact, and hence solve the equation for this value of λ .

(b) Solve the diff. equation $y \frac{d^2 y}{dx^2} = \left\{ \frac{dy}{dx} \right\}^2 \left[1 - \frac{dy}{dx} \cos y + y \frac{dy}{dx} \sin y \right]$

3. Solve the differential $\frac{d^2 y}{dx^2} + y = x - \cot x$
4. Solve $y'' - 4xy' + (4x^2 - 2)y = 0$, given that $y = e^{x^2}$ is an integral included in the complementary function.
