Bachelor of Arts 3rd Semester

Mathematics (Differential Equations - 1)

Time allowed: 3 Hours Max. Marks: 30

***Note*:** *Attempt five questions in all selecting at least two questions from each section. All questions carry equal marks.*

I. **UNIT-I**

(a) $IF\ \frac{I}{N}\left(\frac{\partial M}{\partial y}-\frac{\partial N}{\partial X}\right)$ is function of x only, say f(x), then show that $e^{\int f(x)dx}$is an integrating factor of Mdx+Ndy=0.

(b) Given that the differential equation (3,3)

$(2x^2y^2+y)dx-(x^3y-3x)dy=o$ has an integrating factor of the form x^hy^k, find its general solution.

II. (a) Solve:

$$xyp^2-(x^2+y^2-1)p+xy=0.$$

(b) Solve the differential equation: (3,3)

$$p=tan\left(x-\frac{p}{1+p^2}\right)$$

III. (a) Obtain the primitive and singular solution, if it exists of the equation,

$$xp^2-2yp+4x=0.$$

(b) Find the orthogonal trajectories of the family of coaxial circles $x^2+y^2+2gx+c=0$,where g is the parameter. (3,3)

IV. (a) Solve the differential equation:

$$\frac{d^2y}{dx^2}+a^2y=\sec ax.$$

(b) Solve: (3,3)

$$\frac{d^3y}{dx^3}+2\frac{d^2y}{dx^2}+\frac{dy}{dx}=e^{2x}+x^2+x.$$

UNIT-II

V. (a) Solve the differential equation:

$$x^2\frac{d^3y}{dx^3}+3x\frac{d^2y}{dx^2}+\frac{dy}{dx}+\frac{y}{x}=\log x.$$

(b) Solve: (3,3)

$$(x+3)^2\frac{d^2y}{dx^2}-4(x+3)\frac{dy}{dx}+6y=x.$$

VI. (a) Solved by the method of variation of parameters:

$$(D^2+3D+2)y=\sin e^x$$

(b) $solve\ \frac{d^2y}{dx^2}-2\tan x\ \frac{dy}{dx}+5y=e^x\sec$ by the method of removal of first derivative,

VII. (a) Solve:

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

by changing the dependent variable.

(b) Transform the differential equation: (3,3)

$$(\cos x)y''+(\sin x)y'-2y\,cos^3\mathrm{x}=2cos^5\mathrm{x}$$

Into the one having as independent variable where z=sin x and solve it.

VIII. (a)

$$\frac{dx}{dt}+\frac{dy}{dt}=3x-6y$$

$$\frac{dx}{dt}-\frac{dy}{dt}+x+4y=0$$

(b) Solve: $D^2X-3Dy+4x=0\ and\ 3Dx+D^2y+4y=0\ where\ D=\frac{d}{dt}$ (3,3)

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