0371

MATHEMATICS PAPER - I : MTH - 121
Differential Equations
(12115)

P. Pages : 3

Time : Two Hours   Max. Marks : 40

Instructions to Candidates :
1. Do not write anything on question paper except Seat No.
2. Graph or diagram should be drawn with the black ink pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. All questions are compulsory.
5. Figures to the right indicate full marks.

1.   Attempt **any eight** of the following.   8

   i)   Define an integrating factor.

   ii)   State differential equation $\frac{dy}{dx} + 2y \tan x = \sin x$ is liner or not.

   iii) Define Bernoulli's differential equation.

   iv)   Define general differential equation of first order and higher degree.

   v)   Is differential equation $p^2 - 6p + 5 = 0$ solvable for p?

   vi)   Define Clairaut's equation.

   vii) Define homogeneous differential equation.

   viii) P. I. of LDE with constant coefficients of type $(D - a)^t \, y = e^{ax}$ is ....

   ix)   If $f(-a^2) \neq 0$ then $\frac{1}{f(D^2)} \sin(ax + b) =$ ....

x) To reduce the equation

$$(3x+2)^2 \frac{d^2y}{dx^2} + (3x+2) \frac{dy}{dx} - 36y = 3x^2$$

into homogeneous differential equation form put.......

2. a) Attempt **any two** of the following.   6

  i) If the differential equation Mdx+Ndy = 0 is exact then show that $\frac{\partial M}{\partial y} = \frac{\partial N}{\partial x}$.

  ii) Solve $x^2 y\,dx - (x^3 + y^3)dy = 0$.

  iii) Solve $\frac{dy}{dx} + x^2 y = x^5$.

b) Find an I. F. of $y(xy + 1)dx + (x^2y^2 + xy + 1)xdy = 0$.   2

3. Attempt **any two** of the following.   8

  i) Explain the method of solving the differential equation $F(x,y,p) = 0$, where $P + \frac{dy}{dx}$, solvable for x.

  ii) Solve $p^2 - 8p + 12 = 0$.

  iii) Solve $y - 2px = f(xp^2)$.

4. a) Attempt **any two** of the following.   6

  i) If $f(D)y = e^{ax}$ be a LDE with constant coefficient with $f(a) \neq 0$ then show that

$$P.\,I. = \frac{1}{f(D)}e^{ax} = \frac{e^{ax}}{f(a)}.$$

  ii) Solve $(D^2 + 2D + 3)y = x - 2x^2$

  iii) Solve $(D^2 + 4)y = \sin 3x$

b) Find the general solution of $(D-1)^2 (D^2-1) y = 0$.   2

5. a) i)   Solve $(1+x)^2 \dfrac{d^2y}{dx^2} + (1+x) \dfrac{dy}{dx} + y = 4 \cos [\log(1+x)]$ 4

   ii) Solve $x^2 \dfrac{d^2y}{dx^2} - 3x \dfrac{dy}{dx} + 4y = 2x^2$ 4

<div align="center">OR</div>

   i)   Solve $(x+2)^2 \dfrac{d^2y}{dx^2} - (x+2) \dfrac{dy}{dx} + y = 3x + 4$ 4

   ii) Explain the method of solving the homogeneous linear differential equation.   4

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