Roll No. .... Total Pages : 4

336202

May 2019

B.Sc. (H)(Mathematics) II SEMESTER

DIFFERENTIAL EQUATION

(BMH-202)

Time : 3 Hours] [Max. Marks : 75

Instructions :

(i) It is compulsory to answer all the questions (1.5 marks each) of Part-A in short.

(ii) Answer any four questions from Part-B in detail.

(iii) Different sub-parts of a question are to be attempted adjacent to each other.

PART–A

1. (a) Find the differential equation of all circles of radius 'a' and centre (h, k). (1.5)

(b) Solve $(2xy + y - \tan y)dx + (x^2 - x \tan^2 y + \sec^2 y) dy = 0$. (1.5)

(c) Define explicit and implicit solution of differential equation by giving an example. (1.5)

(d) Find the complementary function of $(D^2 + 4)y = 0$, where $D = d/dx$. (1.5)

(e) Write the expression for the condition of integrability for the equation of the form $Pdx + Qdy + Rdz = 0$. (1.5)

(f) Find the particular integral only for the equation $(D^2-4)y = x^2$. (1.5)

(g) Solve the equation $\frac{xdx}{y^2 z} = \frac{dy}{xz} = \frac{dz}{y^2}$ by method of grouping. (1.5)

(h) Define Total Differential Equation. (1.5)

(i) Explain in short the compartmental model. (1.5)

(j) Write a short note on lake pollution model. (1.5)

PART–B

2. (a) Prove that the necessary and sufficient condition for the differential equation $Mdx + Ndy = 0$ to be exact is $\frac{\partial M}{\partial y} = \frac{\partial N}{\partial x}$, where M and N are functions of x and y having continuous first order derivatives at all points in the rectangular domain. (8)

(b) Solve $(x + 2y)(dx - dy) = dx + dy$. (7)

3. (a) Solve the Cauchy's-Euler equation $(x^2D^2 - xD + 2)y = x \log x$, where $D = d/dx$. (8)

(b) Solve the given equation by using the method of variation of parameters :
$(D^2 - 2D + 1)y = e^x \log x$, where $D = d/dx$. (7)

4. (a) Solve the given simultaneous linear differential equation :

$$2\frac{d^2x}{dt^2} + 3\frac{dy}{dt} = 4, \quad 2\frac{d^2y}{dt^2} - 3\frac{dx}{dt} = 0,$$ under the condition that x, y, dx/dt, dy/dt all vanish at $t = 0$.

(b) Solve the given equation by taking one variable as a constant :
$(mz-ny)dx + (nx-lz)dy + (ly-mx)dz = 0$. (7)

5. Define exponential decay model. Formulate an expression for it. Also find the solution of it. (15)

6. (a) Solve $\frac{dy}{dx} + x\sin 2y = x^2 \cos^2 y$. (8)

(b) Find the complete solution of
$(D^3 + D^2 - D - 1)y = \cos 2x$, where $D = d/dx$. (7)

7. (a) Solve the equation

$$\frac{dx}{x(y^2 - z^2)} = \frac{dy}{y(z^2 - x^2)} = \frac{dz}{z(x^2 - y^2)}$$

by method of multipliers. (8)

(b) Solve the Legendre's linear equatión :

$$(1+x)^2 \frac{d^2x}{dy^2} + (1+x)\frac{dy}{dx} + y = 4\cos\log(1+x). \quad (7)$$