5. Explain the following models in detail : 15

(i) Lake pollution

(ii) Drug assimilation into the blood of a single cold pill.

6. (a) Find the solution of the differential equation :

$$y = 2xp - yp^2$$

Also find the singular solution. 8

(b) Solve :

$$\left(\frac{dy}{dx}\right) = \frac{x+2y-3}{2x+y-3}.$$ 7

7. (a) Explain radioactive decay model in detail. 8

(b) Solve :

$$x^2\left(\frac{d^2y}{dx^2}\right) - 2x\left(\frac{dy}{dx}\right) + 2y = x^3.$$ 7

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Roll No. ..... Total Pages : 04

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May 2026

B.Sc. (Mathematics)/B.Sc. (Mathematics & Computing) (Second Semester)

Differential Equations (BMH23-203)

Time : 3 Hours] [*Maximum Marks : 75*

Note : It is compulsory to answer all the questions (1.5 marks each) of Part A in short. Answer any *four* questions from Part B in detail. Different sub-parts of a question are to be attempted adjacent to each other.

Part A

1. (a) Define order and degree of a differential equation. 1.5

(b) Write a short note on 'Bernoulli's equation'. 1.5

(c) Find the integrating factor of the following differential equation :

$$\left(x^2+y^2+x\right)dx+(xy)dy=0.$$ **1.5**

(d) State Picard's theorem for the existence and uniqueness of the solutions of the first order differential equations. **1.5**

(e) Find the singular solution of the following differential equation :

$$4p^2=9x.$$ **1.5**

(f) State principle of superposition for a homogenous linear differential equation. **1.5**

(g) Define general form of 'Euler-Cauchy Equation'. **1.5**

(h) Explain Wronskian and its properties. **1.5**

(i) Write a short note on 'Compartmental Model'. **1.5**

(j) Explain stability of a system. **1.5**

Part B

2. (a) Solve : **8**

$$\left(x^3+3xy^2\right)dx+\left(y^3+3x^2y\right)dy=0.$$

(b) Solve :

$$\left(x^2-4xy-2y^2\right)dx+\left(y^2-4xy-2x^2\right)dy=0.$$ **7**

3. (a) Solve the following differential equation :

$$y=2px+y^2p^3.$$ **8**

(b) Solve the following differential equation :

$$y+px=x^4p^2.$$ **7**

4. (a) Apply the method of variation of parameter to solve the following differential equation :

$$y_2+y=\tan x.$$ **8**

(b) Use the method of undermined coefficient to solve the following differential equation :

$$y_2-2y_1+y=x^2.$$ **7**