KATHMANDU UNIVERSITY
Internal Examination
June, 2026

Level : Undergraduate (CE)
Year : II

Course : MATH 207
Semester : II

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1. Define exact differential equation. If the equation of the form [1+2+2]

$$P(x,y)dx + Q(x,y)dy = 0$$

is not an exact, we can make it exact by multiplying with suitable factor, called integrating factor. Find it. Solve $(e^{x+y} + ye^y)dx + (xe^y - 1)dy = 0$.

OR

State Bernoulli equation and write its solution procedure. Solve the logistic equation

$$y' = Ay - By^2. \qquad [2+3]$$

2. Experiments show that the time rate of change of the temperature T of a body is proportional to the difference between T and the temperature T_s of the surrounding medium. A cup of coffee initially at 85°C is placed in a room where the constant ambient temperature is 22°C. After 3 minutes, the temperature of the coffee has dropped to 65°C. How long will it take from the time it was placed in the room for the coffee to cool to 35°C? [3]

3. Define orthogonal trajectories and find the orthogonal trajectories of $y = ce^{-x^2}$. [2]

4. Solve the homogeneous linear ordinary differential equation with constant coefficients

$$y'' + ay' + by = 0$$

for the case where the characteristic equation has complex conjugate roots. Use the result to solve the initial value problem [2+3]

$$y'' + 25y = 0, \quad y(0) = 4.6, \quad y'(0) = -1.2.$$

5. Solve the Euler-Cauchy equation

$$x^2y'' + axy' + by = 0$$

for the case where the characteristic equation has distinct and real roots. Use the result to solve the following initial value problem [2+3]

$$x^2y'' + 1.5xy' - 0.5y = 0, y(1) = 6, y'(1) = 2$$

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