DHANAMANJURI UNIVERSITY

Examination- 2024 (Dec)

Four year course B.Sc./B.A. 2^{nd} Semester

Name of Programme : B.Sc./B.A. Mathematics
Paper Type : Core V(Theory)
Paper Code : CMA-105
Paper Title : Differential equations
Full Marks : 40
Pass Marks : 16 **Duration: 2 Hours**

The figures in the margin indicate full marks for the questions:
Answer any four of the following questions:

Answer the following: **10 × 4 = 40**

1. Is the equation $xdx + ydy + \dfrac{xdy - ydx}{x^2 + y^2} = 0$ an exact? If so solve it.
2. What is the Bernoullis form of ordinary differential equation? Show that such an equation can be reduced to the linear form of differential equation? Hence, Solve $\dfrac{dy}{dx} + y\cos x = y^n \sin 2x$.
3. Find the condition of integrability of total differential equation
   Pdx + Qdy + Rdz = 0, where P,Q,R are functions of x,y,z respectively.
4. Find the orthogonal trajectories of the family of co-axial circles
   $x^2 + y^2 + 2gx + c = 0$, where g is the parameter.
5. Find the complete primitive and singular solution of $y = px + \sqrt{b^2 + a^2p^2}$ where $p = \dfrac{dy}{dx}$. Interpret your result geometrically.
6. The population of a country doubles in 40 years. Assuming that the rate of increasing is proportional to the number of inhabitants, find the number of the years in which it would triple itself.
7. A radioactive substance has a half life of h days. Find a formula for its mass m in terms of t, the time, if the initial mass is m_0. What is the initial decay rate?
8. Solve: $(x^2D^2 - xD + 4)y = \cos(\log x) + x\sin(\log x)$

   or

   Solve by the method of variation of parameters, the equation $\dfrac{d^2y}{dx^2} + 4y = 4\tan 2x$.

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