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SB—154—2022

FACULTY OF SCIENCE

B.Sc. (Second Year) (Fourth Semester) EXAMINATION

MAY/JUNE, 2022

(New Pattern)

MATHEMATICS

Paper–XI

(Partial Differential Equation)

(Wednesday, 22-6-2022) **Time : 2.00 p.m. to 4.30 p.m.**

Time— 2½ *Hours* *Maximum Marks*—40

N.B. :— (*i*) *All* questions are compulsory.

(*ii*) Figures to the right indicate full marks.

1. Prove that the solution of Lagrange's linear equation of type $Pp + Qq = R$ where P, Q, R are the functions of x, y, z and $p = \frac{\partial z}{\partial x}, q = \frac{\partial z}{\partial y}$ is $f(u, v) = 0$.

Hence solve $yq - xp = z$. 15

Or

(*a*) Solve $(mz - ny) \frac{\partial z}{dx} + (nx - lz) \frac{\partial z}{\partial y} = ly - mx$. 8

(*b*) Explain the method of multipliers to solve the linear equation $Pp + Qq = R$. 7

2. Explain the Charpit's method to solve partial differential equation $f(x, y, z, p, q) = 0$. 15

Or

(*a*) Explain the Monge's method to solve non-linear equation of second order $Rr + Ss + Tt = V$ where R, S, T, V are functions of x, y, z, p and q, $r = \frac{\partial^2 f}{\partial t^2}$, $S = \frac{\partial^2 f}{\partial t \partial y}, t = \frac{\partial^2 f}{\partial y^2}$. 8

P.T.O.

(*b*) Using the method of separation of variables, solve : 7

$$\frac{\partial u}{\partial x} = 2\frac{\partial u}{\partial t} + u$$

$$u(x, 0) = 6e^{-3x}.$$

3. Attempt any *two* of the following : 10

(*a*) Derive solution of wave equation :

$$\frac{\partial^2 y}{\partial t^2} = c^2 \frac{\partial^2 y}{\partial x^2}$$

by D'Alembert's method.

(*b*) Solve :

$$\frac{\partial^2 u}{\partial r^2} + \frac{1}{r}\frac{\partial u}{\partial r} + \frac{1}{r^2}\frac{\partial^2 u}{\partial \theta^2} = 0$$

by the method of separation of variables.

(*c*) Solve :

$$\frac{\partial^3 z}{\partial x^3} - 3\frac{\partial^3 z}{\partial x^2 \partial y} + 4\frac{\partial^3 z}{\partial y^3} = e^{x+2y}$$

(*d*) Form a partial differential equation from $x^2 + y^2 + (z - c)^2 = a^2$.