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M.A./M.Sc. Semester II Examination, 2019 (under DDE)

Subject: Mathematics

Paper: MCG 202

Partial Differential Equations

Time: 2 Hours | Full Marks: 45

The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.
[Notation and symbols have their usual meaning]
Write the answer to Questions of each Group in separate books.

Group - B (Partial Differential Equations)

(Marks: 27)

Answer any **three** questions. Only **first three** answers will be evaluated. $9\times3 = 27$

1 (a) Eliminate the arbitrary function f from the equation $x+y+z=f(x^2+y^2+z^2)$. [4]

(b) Explain Cauchy's problem of first order partial differential equation. [5]

2 (a) Find the general solution of $y^2p-xyq=x(z-2y)$. [4]

(b) Construct the general integral of the equation $(x-y)p+(y-x-z)q=z$ and particular solution through the circle $z=1, x^2+y^2=1$. [5]

3 (a) Classify the linear partial differential equation of second order. [3]

(b) Reduce $\frac{\partial^2 z}{\partial x^2}=x^2\frac{\partial^2 z}{\partial y^2}$ to canonical form. [6]

4 (a) Discuss Charpit's method for solution of first order non-linear partial differential equation. Hence find the complete integral of $2zx-px^2-2qxy+pq=0$. [5+4]

5 (a) Solve the Neumann problem for a circle. [5]

(b) Determine the solution of [4]

$U_{xx}-U_{yy}=1$

subject to

$U(x,0)=\sin x, U_y(x,0)=x$.

Group - B (Differential Geometry)

(Marks: 18)

Answer any **two** questions. Only **first two** answers will be evaluated. $9\times2 = 18$

1 (a) Prove that the intrinsic derivative of an invariant coincides with its total derivative. [3]

(b) Deduce Serret-Frenet formulae for a space curve. [6]

2 (a) Obtain a necessary and sufficient condition for a vector field in E^3 to be parallel. [5]

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(b) Find the first fundamental form of the surface [4]

$$x^1 = a \cos u^1 \sin u^2$$
$$x^2 = a \sin u^1 \sin u^2$$
$$x^3 = c \cos u^2$$

where a and c are constants.

3 (a) State and prove Meusnier's theorem. [1+4]

(b) Prove that a curve (regular) on a surface is a geodesic if and only if its geodesic curvature is zero everywhere. [4]