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Roll No. | | | | | | | | | | | | Total No. of Pages : 02

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M.Sc Mathematics (2017 Batch) (Sem.–2)

PARTIAL DIFFERENTIAL EQUATIONS

Subject Code : MSM-204

M.Code : 75011

Time : 3 Hrs. **Max. Marks : 80**

INSTRUCTION TO CANDIDATES :

1. **SECTION-A is COMPULSORY consisting of EIGHT questions carrying TWO marks each.**
2. **SECTION - B & C. have THREE questions in each section carrying SIXTEEN marks each.**
3. **Select atleast TWO questions from SECTION - B & C each.**

SECTION-A

1. Answer the following :

a) Form the partial differential equation by eliminating the arbitrary function from $f(x^2 + y^2, z - xy) = 0$.

b) Classify the partial differential equation $u_{xx} + u_{yy} = f(x, y)$.

c) Find the complete solution of the partial differential equation $p^3 - q^3 = 0$

d) Write all possible solutions of two-dimensional Laplace equation.

e) Solve $(D^3 - D^2 D' - 8 D D'^2 + 12D'^3)z = 0$.

f) Give an example of a linear and nonlinear partial differential equation.

g) Find the partial differential equation of all surfaces of revolution having z-axis as the axis of rotation.

h) State the assumptions in deriving one-dimensional wave equation.

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SECTION-B

2. a) Find the partial differential equation of all planes which are at a constant distance k units from the origin. (8)

   b) Find the equation of the system of surfaces which cut orthogonally the cones of the system $x^2 + y^2 + z^2 = cxy$. (8)

3. a) Show that the characteristics of the equation $Rr + Ss + Tt = f(x, y, z, p, q)$ are invariant with respect to any transformations of the independent variables. (10)

   b) Find the complete integral of the partial differential equation $(p^2 + q^2)\,x = pz$ and deduce the solution which passes through the curve $x = 0$, $z^2 = 4y$. (6)

4. a) Solve the equation $r + (a + b)\,s + abt = xy$ by Monge's method. (8)

   b) Solve : $(D^3 - 2D^2 D')z = 2e^{2x} + 3x^2y$. (8)

SECTION-C

5. a) Solve $p^2x + q^2y = z$ by Jacobi's method. (8)

   b) Find the complete solution of $p^2 + x^2y^2q^2 = x^2z^2$. (8)

6. Find the solution of three dimensional diffusion equation in the region $0 < x < a$, $0 < y < b$, $0 < z < c$, $t > 0$, $\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial y^2}+\frac{\partial^2 u}{\partial z^2}=\frac{1}{k}\frac{\partial u}{\partial t}$ with the boundary and initial conditions: $u(0, y, z, t) = 0 = u(a, y, z, t)$; $u(x, 0, z, t) = 0 = u(x, b, z, t)$; $u(x, y, 0, t) = 0 = u(x, y, c, t)$ and $u(x, y, z, 0) = f(x, y, z)$. (16)

7. A tightly stretched violin string of length l and fixed at both ends is plucked at $x = l/3$ and assumes initially the shape of a triangle of height a. Find the displacement $u(x, t)$ at any distance x and any time t after the string is released from rest. (16)

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.

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