

**Birla Institute of Technology & Science, Pilani (Raj.)**  
Second Semester 2016-2017, MATH F343 (Partial Differential Equations)  
End Semester Examination

Time: 180 Min.

Date: May 6, 2017 (Saturday)

Max. Marks: 80

1. Write solution of each question on fresh page.
2. All questions are compulsory and carry equal marks.

**CLOSED BOOK QUESTIONS**

- Q. 1 Find the singular solution of  $6yz - 6pxy - 3qy^2 + pq = 0$ , if exists.
- Q. 2 Find the equation of the surface that passes through the circle  $x^2 + y^2 = 9, z = 0$ , and cuts orthogonally the family of surfaces  $2xz + 3yz = k(z + 2)$ , where  $k$  is an arbitrary constant.
- Q. 3 Transform the following PDE to canonical form:

$$4u_{xx} + 5u_{xy} + u_{yy} + u_x + u_y = 2.$$

- Q. 4 Use Jacobi's method to find the complete solution of  $p^2x + q^2y = z$ .

**OPEN BOOK QUESTIONS**

- Q. 1 Use the method of separation of variables to solve the following IVBP:

$$u_{xx} + u_{yy} = 0, \quad 0 < x < \pi, \quad 0 < y < 2\pi,$$

$$u(x, 0) = 1 + \sin x - 2\sin^2 x, \quad u(x, 2\pi) = 0, \quad u(0, y) = 0, \quad u(\pi, y) = 0.$$

- Q. 2 Use suitable Fourier transform to solve the following IVBP:

$$u_{xx} + u_{yy} = 0, \quad 0 < x < 1, \quad 0 < y < \infty,$$

$$u(0, y) = e^{-2y}, \quad u(1, y) = 0, \quad u_y(x, 0) = 0..$$

- Q. 3 Solve the Neumann problem:

$$u_{xx} + u_{yy} + u_{zz} = 0, \quad 0 < x < 1, \quad 0 < y < 1, \quad 0 < z < 1$$

$$u_x(0, y, z) = 0, \quad u_x(1, y, z) = 0, \quad u_y(x, 0, z) = 0,$$

$$u_y(x, 1, z) = 0, \quad u_z(x, y, 0) = \cos(\pi x) \cos(\pi y), \quad u_z(x, y, 1) = 0.$$

- Q. 4 Use Laplace transform to solve the following IVBP:

$$u_{tt} = c^2 u_{xx} + \sin(\pi x), \quad 0 < x < 1, \quad t > 0,$$

$$u(x, 0) = 0, \quad u_t(x, 0) = 0, \quad u(0, t) = 0, \quad u(1, t) = 0.$$

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