

Indian Statistical Institute, Bangalore

B. Math. Third Year

Second Semester - Differential Equation

Back Paper Exam

Duration: 3 hours

Date : July 13, 2016

Max Marks: 50

Each question carries 5 marks

1. Find a necessary and sufficient condition for the equation $Mdx + Ndy = 0$ to have an integrating factor that is a function of $z = x + y$.
2. If y_1 and y_2 are independent solutions of the of a second order homogeneous linear differential equation, prove that any solution is of the form $ay_1 + by_2$ for some constants a and b .
3. Solve $y'' + y = 2 \cos x$.
4. Solve $y'' + xy' + y = 0$ using power series method.
5. Find a Frobenius series solution of $x^2y'' - 3xy' + (4x + 4)y = 0$.
6. For what points (x_0, y_0) does the equation $y' = |y|, y(x_0) = y_0$ have a unique solution around x_0 .
7. Prove the maximum principle for harmonic functions.
8. Find solutions $\Delta u = 0$ for which $u(x, y) = f(x)g(y)$.
9. Prove mean value property for one-dimensional harmonic functions.
10. Solve $yu_x + xu_y + 2xy = 0, u(s, 2s) = 2s^2$.