



RAJARATA UNIVERSITY OF SRI LANKA

FACULTY OF APPLIED SCIENCES

B.Sc. (General) Degree

Second Year-Semester I Examination-October/November 2014

MAP 2203 – DIFFERENTIAL EQUATIONS II

Answer ALL Questions.

Time Allowed: Two hours.

1.

i. Solve the equation 2y'' + xy' + y = 0 about the ordinary point x = 0

ii. Find a series solution for the differential equation

$$xy''(x) + 4y'(x) - xy(x) = 0$$
, $x > 0$ about the point $x = 0$

2.

a) Find the general solution of the system of differential equations $\dot{x} = \begin{pmatrix} 1 & 0 & 1 \\ 0 & 1 & -1 \\ -2 & 0 & -1 \end{pmatrix} x$.

b) Find all solutions of
$$\dot{x} = \begin{pmatrix} 1 & -1 & 4 \\ 3 & 2 & -1 \\ 2 & 1 & -1 \end{pmatrix} x$$
.

3.

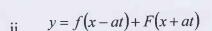
a) Form a partial differential equation by eliminating arbitrary constants a and b from the following equations:

$$i. \ z = a(x+y) + b$$

ii.
$$z = axe^y + (1/2)a^2e^y + b$$

b) Form a partial differential equation by eliminating the arbitrary functions f and F from the following equations:

i.
$$z = f(x+iy) + F(x-iy)$$
 where $i^2 = -1$



- c) Solve the following partial differential equations,
 - i. $p \tan x + q \tan y = \tan z$

ii.
$$xyp + y^2q = zxy - 2x^2$$
, where $p = \frac{\partial z}{\partial x}$ and $q = \frac{\partial z}{\partial y}$,

4.

i. Discuss the Frobenius method for solving a second order linear differential equation given, with the usual notations, as

$$a_2(x) y'' + a_1(x) y' + a_0(x) y = 0$$

- ii. Show that the differential equation $x^2 y'' 2(x + x^2) y' + (x^2 + 2x + 2) y = 0$ has a regular singular point at the origin.
- iii. Find the first three terms of the Frobenius solution around x=0 for

$$x^2y'' + e^xy = 0$$