SC 105
Calculus and Complex Variables
Dhirubhai Ambani Institute of Information and Communication Technology (DA-IICT)
Version 3 (Fall 2010)

INSTRUCTIONS:

- There are 3 double sided pages (6 printed pages). Ensure that you have all the pages.

- Answer **all questions**, writing clearly in the space provided.

- Show all your work and explain how you arrived at your answers, unless explicitly told to do otherwise.

- Write your name and student number **clearly** at the top of each page. If you do not follow this you will get zero right away.

- You have **two hours** to complete the test

- Marks for each question are indicated in brackets at right. You may use point form for your answers, but make sure the points are clear and unambiguous. I am more interested in your thought process.

- You may use last page (page number 6) for rough work. If you need more paper for rough work please ask for supplementary sheets. Do not ask for full answer sheets. Your answers should be on the question paper in the space provided.

FOR MARKER'S USE ONLY

Question	Possible	Received
1	5	
2	5	
3	5	
4	5	
TOTAL	20	

1. Linear Differential Equation

   (a) Show that the following functions are linearly independent. Determine the differential equation with these as independent solutions.

   $$x, x^2 \text{ and } x^3 (x \neq 0).$$

   (5)

2. D.E.

   (a) Solve the following equation for the general solution

$$y'' + n^2 y = x \cos nx, n \in \mathbb{N}.$$

(5)

3. Series Solution

    (a) Find one ordinary point and two singular points of the following differential equation. Then find the power series solution about $x = 0$,

$$(1 - x^2)y'' - 2xy' + 2y = 0.$$

(5)

4. BVP

   (a) Classify the following equation into one of the three classes (parabolic, hyperbolic or elliptical) and then solve using Fourier method.

$$\frac{\partial^2 u}{\partial x^2} = \frac{1}{c^2}\frac{\partial^2 u}{\partial t^2},$$

   with the Cauchy boundary conditions: $u(0,t) = u(l,t) = 0, t \geq 0$, $u(x,0) = f(x), 0 \leq x \leq l$ and $\left(\frac{\partial u}{\partial t}\right)_{t=0} = g(x), 0 \leq x \leq l$. Where f and g are given functions, l is a given constant. (5)

Rough