(DPHY 01)

M.Sc. Physics (Previous) **DEGREE EXAMINATION, DECEMBER 2005.**

Paper I - **MATHEMATICAL PHYSICS**

Time : Three hours Maximum : 100 marks

Answer any FIVE questions.

All questions carry equal marks.

1. (a) Obtain the power series solution of Legendre differential equation

   (b) Show that is the coefficient of in the expansion of $\left(- + \right)^{-}$ in ascending powers of z.

2. (a) Find the solution of Bessel differential equations $\left(\right) + \left(\right) + \left(+ \right) =$

   (b) Discuss the recursion relations relating to Legendre Polynomial.

3. (a) State and prove Cauchy integral theorem

   $$\left(\right) = \frac{}{\Pi} \int \frac{}{-}$$

   (b) Show that $\int^{\infty} \left(+ \right) = \Pi$

4. (a) State the Taylor's and Laurent's theorem.

   (b) Define poles and residues. Find out the poles and residues for the function

   $$= \frac{-}{- + -}$$

5. (a) Explain the gradient and divergence of a tensor.

   (b) what is a Cartesian tensor ? Classify the Cartesian tensors. Give the concept of derivative of a tensor.

6. (a) Disuss Riemann space associated tensors.

   (b) Explain Christoffel's symbols and transformation laws of Christoffel's symbols.

7. (a) Define a Laplace transform. State and explain first and second shifting theorems.

   (b) Define a Fourier transform. Obtain the Fourier transform of Delta function.

8. (a) Find the Laplace transform of the function $F(t) = t \sin at$.

   (b) Find the Fourier transform of $\begin{matrix} - \left| \right| < \\ = \left| \right| > \end{matrix}$ and hence evaluate $\int^{\infty} \left(\right)$

9. Answer any TWO of the following

   (a) Cauchy - Riemann equations and their applications.

   (b) Quotient law of tensors and difference between symmetric and antisymmetric tensors.

   (c) Laplace transform of a derivative and integral form.

   (d) Find the values of the Bessel function $_{+} \quad _{-}$.