

## FACULTY OF SCIENCE

M.Sc. I – Semester (CBCS) Examination, December 2016

Subject: Physics &amp; Applied Electronics

Paper -- I  
Mathematical Physics

Time: 3 Hours

Max.Marks: 80

Note: Answer all questions from Part – A and Part – B.

Each question carries 4 marks in Part-A and 12 marks in Part-B.

## PART – A (8x4 = 32 Marks)

[Short Answer Type]

- 1 Define Gamma and Beta functions.
- 2 Obtain the Generating function for Legendre's differential equation.
- 3 Prove that  $H_n''(x) - 2xH_n'(x) + 2nH_n(x) = 0$
- 4 Show that  $(1+x)^n$  is a hyper geometric function.
- 5 Write note on applications of Fourier Transforms.
- 6 Find the Laplace transform of  $e^{-at}$
- 7 Define symmetric, skew symmetric and hermitian matrices.
- 8 Explain what is meant by covariant, contravariant and mixed tensors?

## PART – B (4x12 = 48 Marks)

[Essay Answer Type]

- 9 a) Obtain the power series solution for Bessel function.

OR

- b) Prove the following:

i)  $r(n+1) = nr(n)$

ii)  $\beta(m,n) = \frac{r(m)r(n)}{r(m+n)}$

- 10 a) Show that Hermite polynomials are generated by the function  $e^{2zx - z^2}$ .

OR

- b) State and prove recurrence relations for Hermite polynomials.

- 11 a) Obtain the Fourier Transform of the function

$$F(x) = \begin{cases} 0 & -\pi < x < 0 \\ 1 & 0 < x < \pi \end{cases}$$

OR

- b) Prove the Laplace transform of derivatives property and evaluate  $L\left\{\frac{\cos \sqrt{t}}{\sqrt{t}}\right\}$ .

- 12 a) What do you mean by diagonal matrix? Show that the Eigen values of a Hermitian matrix are all real and its Eigen vectors corresponding to two distinct Eigen values are orthogonal.

OR

- b) What are symmetric and anti symmetric tensors? Show that any tensor of rank '2' can be expressed as a sum of symmetric and an anti symmetric tensor both of rank '2'.

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