

**FACULTY OF SCIENCE**  
**M. Sc. I – Semester Examination, January 2018**

**Subject : Physics & 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 (8 x 4 = 32 Marks)**

**(Short Answer Type)**

- 1 Obtain the Rodrigue's formula of legendre's differential equation
- 2 Find the values of  $J_{\frac{1}{2}}(x)$  and  $J_{-\frac{1}{2}}(x)$ .
- 3 Discuss the wave equation for the vibration of a rectangular membrane.
- 4 Obtain the generating function of Hermite polynomials  $H_n(X)$ .
- 5 Find the fourier sine transform of the function  $f(X)=X^2, 0 < X < 4$ .
- 6 Write note on laplace transforms and their applications.
- 7 Define addition and subtraction of a matrix.
- 8 What are covariant of contravariant tensors? Explain.

**PART – B (4 x 12 = 48 Marks)**

**(Essay Answer Type)**

- 9 (a) Write Legendre's differential equation and find its solution by power series method. Where do they appear in physics problem.

**OR**

- (b) Solve the Bessel's differential equation and prove that  $J_{n-1}(x) - J_{n+1}(x) = 2J_n(x)$ .

- 10 (a) Derive Rodrigues formula for Hermitian polynomials. Evaluate Hermite polynomial  $H_3(x)$ .

**OR**

- (b) Solve the hypergeometric equation  $x(1-x)\frac{d^2y}{dx^2} + [C - (a+b+1)x]\frac{dy}{dx} - aby = z$  at  $x = 0$ .

- 11 (a) What are Fourier Sine and Cosine transforms? Find the Fourier Sine and Cosine transform of second derivative of the function  $f(t)$ .

**OR**

- (b) Find  $L^{-1}\left\{\frac{1}{s^2(s^2 - A^2)}\right\}$  using convolution theorem.

- 12 (a) What is transpose of a matrix? Show that  $(AB)^T = B^T A^T$ ; A and B bring comfortable for Multiplication.

**OR**

- (b) (i) Prove that symmetric properties of a tensor and invariant under a rotation of the coordinate axis.
- (ii) State and prove the transformation law for the Christoffel symbol of the first kind.

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