9. (a) Discuss the properties of one dimensional Green's function.

(b) Determine the Green's function associated with the boundary value problem $\frac{d^2y}{dx^2} = f(x)$, where, $f(x)$ is a known function any $y(0) = 0$ and $y'(1) = 0$

10. Write a note on the Poisson's distribution and determine its first four moments.

NOVEMBER/DECEMBER 2018

MPH11 - MATHEMATICAL PHYSICS - I

Time : Three hours Maximum : 75 marks

SECTION A — ($5 \times 6 = 30$ marks)

Answer ALL questions.

1. (a) Define a linear vector space. Explain how the set of all complex numbers forms a linear vector space over a complex field.

Or

(b) (i) Define Hermitian and Skew – Hermitian matrices with examples and

(ii) Show that the diagonal elements of a Skew – Hermitian are either zero or pure imaginary number.

2. (a) Define the Kronecker delta symbol and discuss its properties.

Or

(b) With an example, explain the contraction of tensors.

3. (a) Define Wronskian and prove that Wronskian of a general second order linear differential equation is identically zero inside the chosen interval or not zero at any point in that interval.

Or

(b) Obtain the generating function of Laguerre Polynomial.

4. (a) Discuss the properties of one dimensional Green's function.

Or

(b) Determine the Green's function associated with $\frac{d^2y}{dx^2} + \omega^2 y = f(x)$, where, $f(x)$ is a known function and $y(0) = 0$ and $y(L) = 0$.

5. (a) Give an account on the Binomial distribution and determine its first moment.

Or

(b) Discuss the properties of normal curve.

SECTION B — ($3 \times 15 = 45$ marks)

Answer any THREE questions.

6. (a) What are unitary matrices? Prove that

(i) the determinant of a unitary matrix can only have values +1 or –1 and

(ii) the products of unitary matrices are also unitary.

(b) Define the inner product of two tensors and thereby state and prove the Schwartz inequality.

7. (a) Define the Levi – Civita symbol ϵ_{ijk} and prove that

(i) $A_{il} A_{jm} A_{kn} \epsilon_{lmn} = \epsilon_{ijk} \det A_{ij}$

(ii) where, A_{ij} is any 3×3 matrix.

(b) What are invariant tensors? Prove that Kronecker delta is an invariant mixed tensor of rank two.

8. Establish the recurrence formulae of Legendre polynomials.