19P107 (Pages: 2) Name: …….……

Reg. No…….……...

FIRST SEMESTER M.Sc. DEGREE EXAMINATION, NOVEMBER 2019

(CUCSS PG)

CC19P PHY1 C02 – MATHEMATICAL PHYSICS - I

(Physics)

(2019 Admission Regular)

Time: Three Hours Maximum: 30 Weightage

Section A

Answer ***all*** questions. Each question carries 1 weightage.

1. Discuss the rotation of Cartesian coordinate axes in two dimensional case. Write the transformation equations of any vector in this coordinates.
2. 'The transpose of an orthogonal matrix is its inverse'. Is this statement correct? Explain.
3. Write and explain quotient rule of 'Tensors'.
4. Prove that $\beta(m,n) = \beta(n,m)$
5. Explain the concept and importance of singularities in differential equations.
6. Prove that when 'n' is an integer $J_{-n}(x) = (-1)^n J_n(x)$
7. Obtain the Laplace transform of the function $F(t) = \frac{e^{at} - 1}{a}$
8. Prove that $H_n'(x) = 2n\, H_{n-1}(x)$

(8 × 1 = 8 Weightage)

Section B

Answer any ***two*** questions. Each question carries 5 weightage.

9. Explain orthogonal Curvilinear Coordinates. Derive an expression for gradient, Divergence and Curl in this system.
10. Write and derive 'Convolution' theorem for the Fourier transform of the product of two functions. Also derive the method to evaluate the convolution integral.
11. Explain Gram-Schmidt orthogonalization process. Using that form an orthogonal set of functions from the set of functions $g_n(x) = x^{n-1}$, $n = 0, 1, 2....$ in the interval $-1 \le x \le 1$. (Use weight function as 1)
12. Derive the Orthonormal conditions for Legendre Polynomials.

(2 × 5 = 10 Weightage)

Section C

Answer any ***four*** questions. Each question carries 3 weightage.

13. Explain ‘unitary’ and ‘hermitian’ matrices with examples.
14. Prove that $\vec{\nabla}\varphi$ is a vector perpendicular to the surface $\varphi(x, y, z) = c$ where ‘c’ is a constant.
15. Obtain the value of $\Gamma_{3/2}$
16. Show that the contraction of the tensor A_q^p is a scalar or invariant.
17. Show that $J_{1/2}(x) = \sqrt{\frac{2}{\pi x}} \sin x$
18. Write down the Rodrigue’s formula for Lagurre Polynomials. Using it write down the first four Lagurre’s polynomials.
19. Derive the Fourier series corresponding to the output of half wave rectifier.

(4 × 3 = 12 Weightage)

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