

S-489

Total Pages : 3

Roll No.

MSCPH-501

Mathematical Physics

M.Sc. Physics (MSCPH)

1st Semester Examination, 2022 (Dec.)

Time : 2 Hours]

Max. Marks : 70

Note : This paper is of Seventy (70) marks divided into two (02) Sections A and B. Attempt the questions contained in these sections according to the detailed instructions given therein.

SECTION–A

(Long Answer Type Questions)

Note : Section 'A' contains Five (05) long answer type questions of Nineteen (19) marks each. Learners are required to answer any Two (02) questions only.

(2×19=38)

1. Establish the relation $\text{curl curl } \vec{f} = \vec{\nabla} \text{div } \vec{f} - \nabla^2 \vec{f}$. 19

2. (a) Show that any tensor can be expressed as a sum of two tensors, one of which is symmetric and the other Skew-symmetric in a pair of covariant and contravariant indices. 9

- (b) Determine the eigen values and eigen vectors of matrix :

$$A = \begin{bmatrix} 0 & 1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix} \quad 10$$

3. Solve the differential equations :

$$\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + 2y = \sin hx \quad 19$$

4. (a) Find Rodrigue's formula for Legendre polynomials. 9

- (b) Obtain any two recurrence relations of Laguerre polynomials. 10

5. Show that the Laplace transform passess the properties of linearity. Shifting and change of scale. Find the laplace transform of $(1 + \sin 2t)$. 19

SECTION-B

(Short Answer Type Questions)

Note : Section 'B' contains Eight (08) short answer type questions of Eight (08) marks each. Learners are required to answer any Four (04) questions only. $(4 \times 8 = 32)$

1. Find the value of $\text{div } \vec{V}$ in terms of curvilinear coordinates.

2. Define covariant and contravariant tensors.
 3. Convert Hermite polynomial :
$$2H_4(x) + 3H_3(x) - H_2(x) + 5H_1(x) + 6H_0(x)$$
into ordinary polynomial.
 4. Define Cauchy residues theorem.
 5. What do you mean by Fourier transform and inverse Fourier transform ?
 6. If A is any square matrix show that $A + A^\circ$ is Hermitian.
 7. Show that the Fourier transform of a Gaussian function is also Gaussian in the corresponding fourier space.
 8. Find the laplace transform of the function $t.e^{2t}$.
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