

BACHELOR OF SCIENCE (CBCS-2018 COURSE)
T. Y. B. Sc. Sem-V : WINTER :- 2021
SUBJECT: PHYSICS : MATHEMATICAL METHODS IN PHYSICS

Day : Wednesday
Date 19-01-2022

W-18406-2021

Time : 02:00 PM-05:00 PM
Max. Marks: 60

N.B.

- 1) All questions are **COMPULSORY**.
- 2) Figures to the **RIGHT** indicate **FULL** marks.

- Q 1.** Attempt any **Two** of the following. (12)
- (a) Set up transformation equation for cartesian co-ordinates in terms of spherical polar co-ordinates and cartesian co-ordinates in terms of cylindrical co-ordinates.
 - (b) Solve two-dimensional Laplace's equation in Cartesian co-ordinates using method of separation of variables. Also obtain its solution.
 - (c) Discuss Michelson Morley experiment with diagram. Also obtain an expression for fringe shift (n).
- Q 2.** Attempt any **Two** of the following. (12)
- (a) Derive an expression for length elements and volume elements in curvilinear co-ordinate system.
 - (b) Solve Laplace's equation in Spherical Polar co-ordinates using method of separation of variables.
 - (c) Obtain the generating function for the Legendre polynomials. Hence generate $P_1(x)$, $P_2(x)$ and $P_3(x)$. Also prove, $P_n(-x) = (-1)^n P_n(x)$
- Q 3.** Attempt any **Two** of the following. (12)
- (a) Obtain the expressions for gradient, divergence and the curl in orthogonal curvilinear system.
 - (b) Obtain the generating function for the Hermite polynomials. Hence generate $H_0(x)$, $H_1(x)$ and $H_2(x)$. Also show that, $H_{n+1}(x) = 2x H_n(x) - 2n H_{n-1}(x)$
 - (c) Derive the Lorentz transformation equations.
- Q 4.** Attempt any **Three** of the following. (12)
- (a) If $u = 2x+3$, $v = y-4$, $w = z+2$ then show that u , v and w are orthogonal and find ds^2 . Also calculate numerical coefficients h_1 , h_2 and h_3 .
 - (b) Explain the terms degree, order, linearity and homogeneity of differential equation.
 - (c) Derive an expression for Bessel function of first kind $J_n(x)$.
 - (d) Derive an expression for Galilean transformation equations.
- Q 5.** Attempt any **Four** of the following. (12)
- (a) Obtain the expression for Laplacian in orthogonal curvilinear system.
 - (b) What is Fuchs's theorem? Describe its importance.
 - (c) Describe the singular points of a differential equation.
 - (d) Write any five partial differential equations occurring in Physics and explain each term in the equations.
 - (e) Derive an expression for Einstein's mass energy relation.
 - (f) Write the postulates of special theory of relativity.

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