SEAT No._____ No. of Printed Pages : 02

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SARDAR PATEL UNIVERSITY
T.Y.B.Sc. Examination, Semester – 5
Saturday, 26TH December 2020
Time: 02.00 pm To 04.00 pm
Applied Physics Course Code: US05CAPH22
Course Title: Mathematical Methods

Total Marks : 70

Q-1 Write answers to the following multiple-choice questions in your answer book by selecting the proper option. (All questions are compulsory. One mark each.) [10]

(1) To obtain transpose of a matrix we __ rows and columns.
(a) add (b) multiply (c) reverse (d) interchange

(2) The process of row reduction of a matrix is __.
(a) additive (b) cummulative (c) reversible (d) irreversible

(3) Transpose of a column matrix is a _ matrix.
(a) irreversible (b) reversible (c) row (d) column

(4) The surface of revolution of a curve can be evaluated using __ method.
(a) digital (b) analogue (c) differentiation (d) integration

(5) For the examples involving integrals over a plane, the use of __ coordinate system is much more convenient.
(a) cartesian (b) spherical (c) cylindrical (d) polar

(6) What is the complex conjugate property of a fourier series?
(a) It leads to convolution (b) It leads to time reversal
(c) It leads to multiplication (d) It leads to addition of signals

(7) What is the function of an odd signal among the following?
(a) $x(t) = -x(t)$ (b) $x(t) = x(-t)$ (c) $x(t) = -x(-t)$ (d) $x(t) = x(t+1)$

(8) If the signal x(t) is even, what will be the fourier series coefficients?
(a) Real and even (b) Odd (c) Real only (d) Imaginary and odd

(9) Which of these does not come under partial differential equations?
(a) Laplace's equation (b) Equations of motion
(c) 1-D wave equation (d) Heat equation

(10) Linear partial differential equations are reduced to ordinary differential equations in which of these methods?
(a) Change of variables (b) Fundamental equations
(c) Superposition principle (d) Separation of variables

Q-2 Fill in the blanks, or answer in True OR False in the following questions. (All questions are compulsory. One mark each.) [08]

(1) A vector having zero magnitude is known as ____ vector.

(2) The scalar product of two vectors is commutative. True or False?

(3) Change in variables of integration is required when we convert an integral from one coordinate system to other. True or False?

(4) Jacobians are written in terms of _____.

(5) There are maxima and minima not possible in Dirichlet's conditions. True or False?

(6) Dirichlet's conditions is not possible in case of _____ signals.

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(7) When solving a 1-Dimensional heat equation using a variable separable method, we get the solution if k is _____.

(8) While solving any partial differentiation equation using a variable separable method which is of order 1 or 2, we use the formula of Fourier series to find the coefficients at last. True or False?

Q-3 Answer the following questions in brief. (Answer any Ten Questions. Two marks each.) [20]

(1) What is row reduction?
(2) What is a zero matrix?
(3) Define Identity matrix.
(4) Express the cartesian coordinates x, y and z in terms of cylindrical coordinates.
(5) Represent cartesian coordinates x and y in terms of polar coordinates. Also represent area element in polar coordinates.
(6) An integral is the 'limit of a sum'. Explain briefly.
(7) Write the Fourier series expansion of a periodic function f(x) in terms of sines and cosines.
(8) Write mathematical expressions for Fourier coefficients a_0, a_n and b_n.
(9) Define even and odd functions.
(10) What is a boundary value problem?
(11) What is wave equation? State its application.
(12) Discuss in brief about Poisson's equation.

Q-4 Answer the following questions in detail. (Answer any Four questions. Eight marks for each question) [32]

(1) Discuss the multiplication and addition of matrices in detail.
(2) Write a note on line and planes.
(3) What are Jacobians? Obtain the integrals of volume and area element in spherical and cylindrical coordinate systems in terms of Jacobians.
(4) Answer the following(4 Marks each)
(a) Find the mass of a rectangular plate bounded by x=0, x=2, y=0, y=1, if its density is given by f(x,y)=xy.
(b) Write a note on surface integrals.
(5) Obtain the formula for the Fourier coefficients a_0, a_n and b_n.
(6) Write a note on even and odd functions.
(7) Using Laplace's equation obtain the expression for the steady-state temperature in a rectangular plate.
(8) Write a note on diffusion equation in case of a heat flow through a material.

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