RAN-2103000206021006

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T. Y. B. Sc. (Physics) (Sem. - VI) Examination April - 2023

Physics : Paper - XI - PH-611

Mathematical Methods of Physics and C-Programming (New)

[Total Marks: 50

સૂચના : / Instructions

(1)

નીચે દર્શાવેલ ☛ નિશાનીવાળી વિગતો ઉત્તરવહી પર અવશ્ય લખવી.
Fill up strictly the details of ☛ signs on your answer book

Name of the Examination:

☛ **T. Y. B. Sc. (Physics) (Sem. - VI)**

Name of the Subject :

☛ **Physics : Paper - XI - PH-611 Mathematical Methods of Physics and C-Programming (New)**

Subject Code No.: **2103000206021006**

Seat No.:

Student's Signature

(2) Draw neat diagrams wherever necessary.
(3) Symbols used in the paper have their usual meaning.
(4) Question 1 is compulsory and figures to the right indicate full marks of the question.

Q. 1. Answer the following questions in short: (10)

i. Differentiate between an ordinary differential equation and a partial differential equation.

ii. What do you mean by a soliton?

iii. What is a Bessel differential equation?

iv. Define matrices giving an example.

v. If matrix $A = \begin{bmatrix} 1 & 2 & 6 \\ 4 & 7 & 0 \end{bmatrix}$ then write the transpose of matrix A.

vi. What is the significance of declaring a variable name as representing an array?

vii. Give an example of a 4 x 3 matrix. How is this matrix declared in a C program?

viii. What is a switch statement? State its use.

ix. Which are the two different categories of C-functions? What is the main distinction between the two categories?

x. State the main disadvantages of global variables in C-language.

Q. 2. (A) **Attempt any one of the following:** **(07)**

(i) What are partial differential equations? Give examples of few commonly encountered partial differential equations in physics and discuss the significance of any three of them.

(ii) Discuss the method of separation of variables for solving a partial differential equation in the spherical polar coordinate system.

(B) **Attempt any one of the following:** **(03)**

(i) Discuss the different boundary conditions required to be satisfied by a differential equation. For a parabolic second order partial differential equation, when do you get a unique and stable solution for an open surface?

(ii) Show that Legendre's equation has regular singularities at $x = -1, 1$ and ∞.

Q. 3. (A) **Attempt any two of the following:** **(07)**

(i) If $P = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 4 \end{bmatrix}$ and $Q = \begin{bmatrix} 3 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 2 \end{bmatrix}$ then show that multiplication of these diagonal matrices is communicative.

(ii) Verify that $A = \frac{1}{3}\begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & -2 \\ -2 & 2 & -1 \end{bmatrix}$ is a orthogonal matrix.

(iii) If $A = \begin{bmatrix} 1 & -1 & 1 \\ -3 & 2 & -1 \\ -2 & 1 & 0 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 4 & 6 \\ 1 & 2 & 3 \end{bmatrix}$ then prove that A.B is a null matrix.

(B) **Attempt any one of the following:** **(03)**

(i) If two matrices A and B are given by $A = \begin{bmatrix} 1 & 2 \\ 3 & 5 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & 3 \\ 5 & 1 \end{bmatrix}$ then prove that the direct product of A and B is not commutative.

(ii) If A, B and C are two dimensional vectors given by $\vec{A} = \begin{bmatrix} x_0 \\ x_1 \end{bmatrix}$, $\vec{B} = \begin{bmatrix} y_0 \\ y_1 \end{bmatrix}$ and $\vec{C} = \begin{bmatrix} z_0 \\ z_1 \end{bmatrix}$ then calculate the direct product of A, B and C. (i.e. A $\otimes$ B $\otimes$ C).

Q. 4. (A) **Attempt any one of the following:** **(07)**

(i) What is an array variable? Also write and explain a program in C to illustrate the use of arrays.

(ii) Explain a logical quantity and the use of a logical operator in C program. Discuss the precedence rules for logical operators giving an example.

(B) **Attempt any one of the following:** **(03)**

(i) There are 350 physics students in third year B. Sc. and the total marks obtained by each student's in an examination are typed in one or more lines. Write a program in C using the arrays to print out the highest and the second highest marks obtained in the examination.

(ii) Write a program in C to read and print a 4 x 3 matrix.

Q. 5. (A) **Attempt any one of the following:** **(07)**

(i) What are functions in C language program? Write the syntax of a function in C. Discuss the primary merits of functions in program development.

(ii) Discuss the syntax rules for a C-function declaration. Also state the essential rules for defining functions.

(B) **Attempt any one of the following:** **(03)**

(i) Write a program in C to define a function to reverse a given integer.

(ii) If a bank gives simple interest at 3.5% per year if the balance in the individuals bank account is Rs. 5000/- or more then write a program in C to define a function to calculate the interest earned.

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