RAN-2103000205021006

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B.Sc. (Sem.-V) Examination November - 2023

Physics -PH-511-XI

Mathematical Methods of Physics and C - Programming

[Total Marks: 50

સૂચના : / Instructions

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

Name of the Examination:

☛ **B.Sc. (Sem.-V)**

Name of the Subject :

☛ **Physics -PH-511-XI Mathematical Methods of Physics and C - Programming**

Subject Code No.: **2103000205021006**

Seat No.:

Student's Signature

(2) Draw neat diagrams wherever necessary.
(3) Symbols used in the paper have their usual meaning.
(4) Figures to the right indicate full marks of the question.
(5) Scientific calculator may be used.

1. Answer the following questions in brief : (10)

1. What are curvilinear coordinates? What is the relevance of the curvilinear coordinates?
2. What do you mean by a solenoidal vector?
3. State atleast one advantage and a disadvantage of the Newton-Rapson method.
4. What is a transcendental function?
5. What do you mean by backward differences and a backward difference operator?
6. How do we define a constant in C program? When should one use #define line to specify a constant? *
7. What are header files?
8. What do you mean by an algorithm?
9. What is a computer program?
10. What do you mean by normal flow of control?

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

(i) Discuss in details the spherical polar coordinate system drawing necessary diagram. Also write the expression for gradient, divergence, curl and the laplacian in the spherical coordinate system.

(ii) Show that the scale factors in the spherical polar coordinate system is given by $h_r = 1$, $h_\theta = r$ and $h_\phi = r\sin\theta$.

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

(i) Resolve the circular cylindrical unit vectors into their cartesian components.

(ii) With $\hat{q}_2$ a unit vector in the direction of increasing q_2, show that: $\vec{\nabla} \times \hat{q}_2 = \frac{1}{h_2}\left[\hat{q}_3 \frac{1}{h_1}\frac{\partial h_2}{\partial q_1} - \hat{q}_1 \frac{1}{h_3}\frac{\partial h_2}{\partial q_3}\right]$.

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

(i) Explain the iteration method to obtain a real root of an equation $f(x) = 0$. Using the iteration method, find the real root of the equation $xe^x = 1$ given that the root lies between 0 and 1.

(ii) What do you mean by interpolation? Derive Newton's forward difference interpolation formula.

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

(i) Use the Newton - Raphson method to find the root of the equation $f(x) = \sin x - \frac{x}{2}$ given that the root lies between $\frac{\pi}{2}$ and π.

(ii) Values of x (in degrees) and $\sin x$ are given in the following table:

x	15	20	25	30	35	40
$\sin x$	0.2588	0.3420	0.4226	0.5000	0.5735	0.6427

Determine the value of $\sin 18^0$.

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

(i) Discuss numeric constants and its different types in C program. Also discuss the rules for specifying constants.

(ii) What are variables and scalar variables in a C program? Discuss the rules for declaring an identifier used as a variable name. Give few examples of valid and invalid identifiers.

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

(i) Write a program in C alongwith its algorithm and flow chart to calculate the average of any three given numbers.

(ii) Write a program in C to calculate the surface area and volume of a sphere for a given value of its radius.

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

(i) Explain in details, the output functions and input functions in C - programming.

(ii) Discuss in details, the conditional statements in C programming.

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

(i) Write a program in C to calculate the cost of 45 pencils, if the cost of one dozen pencil is 75 rupees.

(ii) Write a program in C to pick the largest of three given numbers. Also draw the flow chart alongwith the algorithm.

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