

RAN-2103000205021006
B.Sc. (Sem.- V) Examination October - 2025
Physics : Paper - XI (old)
Mathematical Methods of Physics and C- Programming
[Total Marks: 50
સૂચના : / Instructions

- (1) ઉપરોક્ત દર્શાવેલ વિગતો ઉત્તરવહી પર અવશ્ય લખવી.
Fill up strictly the above details on your answer book
- (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

Seat No.:

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Student's Signature

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

1. What is the relevance of the curvilinear coordinates?
2. What is meant by an orthogonal coordinate system? Give example.
3. What do you mean by a solenoidal vector?
4. State an advantage and a disadvantage of the Newton-Rapson method.
5. What is a forward difference operator?
6. Which of the following are invalid hexadecimal constants? Why?
 - (a) 0x14AF;
 - (b) 0345;
 - (c) 0X342E;
 - (d) 0x43H.
7. What do you mean by a compiler?
8. What is a compound statement?
9. What do you mean by a logical expression?
10. What do you mean by normal flow of control?

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

1. 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 polar coordinate system.
2. Obtain the scale factors h_1 , h_2 and h_3 in the circular cylindrical coordinate system.

(B) Attempt anyone of the following:
(03)

1. With $\hat{q}_1$ a unit vector in the direction of increasing q_1 show that:

$$\vec{\nabla} \cdot \hat{q}_1 = \frac{1}{h_1 h_2 h_3} \frac{\partial(h_2 h_3)}{\partial q_1}$$
2. With $\hat{q}_2$ a unit vector in the direction of increasing q_2 , show that :

$$\vec{\nabla} \times \hat{q}_2 = \frac{1}{h_2} \left[\hat{q}_3 \frac{1}{h_1} \frac{\partial h_2}{\partial q_1} - \hat{q}_1 \frac{1}{h_3} \frac{\partial h_2}{\partial q_2} \right]$$

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

1. Explain the Bisection method to obtain the real root of an equation $f(x) = 0$. Using the Bisection method, find the real root of $e^x - 3x = 0$ if the root lies near 1.4.
2. Explain the Newton_Raphson method to find the real root of an equation $f(x) = 0$. Use the Newton-Raphson method to find the root of the equation $x \sin x + \cos x = 0$

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

1. Evaluate $y = e^{2x}$ for $x = 0.05$ using the following table:

x	0.00	0.10	0.20	0.30	0.40
$y = e^{2x}$	1.0000	1.2214	1.4918	1.8221	2.255

2. Calculate the value of $f(x)$ for $x = 1.5$ for the data given below :

x	1	2	3	4	5	6	7	8
$f(x)$	1	8	27	64	125	216	343	512

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

1. Discuss numeric constants and its different types in C program. Also discuss the rules for specifying constants.
2. 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)

1. Write a program in C to convert temperature in degree celcius to kelvin.
2. Write a program in C to read the radius of a sphere and hence calculate it's volume

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

1. Explain in details, the output functions and input functions in C-programming.
2. Explain how the "while" loop is used in C programming.

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

1. Write a program in C to read the mass, length, breadth and height of a cuboid and hence calculate its total surface area and density.
2. Write a program in C to find the largest of three given numbers.
