



# RAN-1012

## Third Year B.Sc. Sem-V Examination

March / April - 2019

Physics : Paper XI

Numerical Analysis and Materials Science

[ Total Marks: 50

### सूचना : / Instructions

नीचे दृशविले निशानीवाणी विगतो उत्तरवही पर अवश्य लभवी.  
Fill up strictly the details of signs on your answer book

Name of the Examination:

Third Year B.Sc. Sem-V

Name of the Subject :

Physics : Paper XI

Subject Code No.: 1 0 1 2

Seat No.:

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Student's Signature

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

1. Answer the following questions in brief:

(08)

- (1) What are significant figures? How many significant figures does the following numbers have: 3.1416; 0.66667 and 4.0687
- (2) If thickness of a beam is 0.611 cm, then calculate the relative error in this measurement.
- (3) Define a backward difference operator.
- (4) Define interpolation.
- (5) What do you mean by electrical resistivity? On what factors does it depend?
- (6) What are superconductors?

- (7) On what factors does magnetic susceptibility depend?  
(8) Define Curie temperature for a ferromagnetic material.

**2 (a) Attempt any one of the following in details: (10)**

- (i) What are polynomials? Explain the iteration method to obtain the real root of an equation  $f(x) = 0$   
(ii) Define a forward difference operator. Derive the Newton's forward interpolation formula.

**(b) Attempt any one of the following: (04)**

- (i) Given that the equation  $f(x) = \tan x + x = 0$  has a root between 2 and 2.1, find the root using the bisection method correct to two decimal places.  
(ii) Using the Newton-Raphson method, find the root of  $f(x) = x \sin x + \cos x$  correct to three decimal places.

**3 (a) Attempt any one of the following in details: (10)**

- (i) Discuss the relation between electrical conductivity and thermal conductivity for a metal and hence obtain the Wiedemann-Franz law.  
(ii) Define critical current and critical magnetic field for a superconductor. Also discuss in details a type - I and a type - II superconductor.

**(b) Attempt any one of the following: (04)**

- (i) If the electrical conductivity and thermal conductivity of Cu at 25°C is  $0.641 \times 10^{+8} \Omega^{-1} \text{ m}^{-1}$  and  $395 \text{ W-m}^{-1} \text{ K}^{-1}$  respectively, then calculate Lorentz number (L).  
(ii) If the conductivity of a metal at 20°C is  $0.5 \times 10^8 \Omega^{-1} \text{ m}^{-1}$  and the relaxation time of free electrons in it is 0.01 ns, then calculate the number density of free electrons in it. ( $m_e = 9.11 \times 10^{-31} \text{ kg}$ ;  $e = 1.6 \times 10^{-19} \text{ C}$ )

**4 Write a short note on any two of the following (14)**

(i) The bisection method for obtaining the real root of an equation  $f(x) = 0$ .

(ii) Construct a backward difference table for the following data.

$x$	0	5	10	15	20	25
$y$	7	11	14	18	24	32

(iii) Potential applications of a superconductor.

(iv) Properties of a paramagnet and a diamagnet.

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