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DG-3121

Third Year B. Sc. (Sem. V) Examination

March/April – 2016

Physics : Paper - XI

(PHY-5011 : Numerical Analysis & Materials Science)

(New Course)

Time : 2 Hours] [Total Marks : 50

Instructions :

(1)

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

Name of the Examination :

☛ B. Sc. (Sem. V)

Name of the Subject :

☛ Physics - XI (PHY-5011 : Numerical Anal. & Material Sci.) (New)

☛ Subject Code No. : 3 1 2 1 ☛ Section No. (1, 2,.....) : Nil

Seat No. :

Student's Signature

(2) Draw neat diagram 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 : **(08)**

(1) What are significant digits? How many significant figures are there in the number 0.00192?

(2) What is an algebraic equation?

(3) Prove that $E\Delta \equiv \Delta E$, where Δ is the forward difference operator and E is the shift operator.

(4) Define a backward difference operator (∇).

(5) State the classical law of Wiedemann and Franz.

(6) State Curie's law for paramagnetic substance.

(7) What is Meissner effect?

(8) What are Cooper - pairs? What is the essential condition for two electrons to form a Cooper – pair?

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

(i) Explain the Regula – Falsi method to obtain a real root of an equation f(x) = 0

(ii) Discuss and obtain the Newton's forward interpolation formula.

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

(i) Find a real root of the equation $x^3 + x^2 + x + 7 = 0$ using the bisection method, correct to three significant figures.

(ii) Using the method of separation of symbols, show that :

$$e^x (U_0 + x\Delta U_0 + \frac{x^2}{2!}\Delta^2 U_0 + \ldots\ldots) = U_0 + U_1 x + U_2 \frac{x^2}{2!}$$

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

(i) Discuss the classical theory of diamagnetism and obtain the equation $\omega = -\frac{eB}{2m} \pm \sqrt{\omega_0^2 + \frac{e^2B^2}{4m^2}}$ for the angular frequency of an electron in an atom in the presence of an external magnetic field.

(ii) Describe the classical theory of electric conduction and derive an expression for electrical resistivity $\rho = \frac{m}{ne^2\tau}$, using Ohm's law.

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

(i) Calculate the mean free path of an electron in a Cu wire if its resistivity at 20^0C is 1.69×10^{-8} Ω-m and the concentration of electrons is 8.5×10^{28} m^{-3}. ($m_e = 9.11 \times 10^{-31}$ kg, $e = 1.6 \times 10^{-19}$ C, $K_B = 1.38 \times 10^{-23} SI$)

(ii) Calculate the Lorentz number (L) for Cu at 20 ^{0}C, if its electrical resistivity and thermal conductivity are 1.72×10^{-8} Ω-m and 386 $Wm^{-1}K^{-1}$ respectively.

4 Discuss any two of the following in details: **(14)**

(i) The forward difference operator Δ, Δ^2 and Δ^3.

(ii) Detection of errors by use of difference tables.

(iii) Weiss theory of paramagnetism.

(iv) Important properties of a superconductor.
