2009

PHYSICS - II (Optional)

Standard : Degree   *Total Marks : 200*

Nature : Conventional   *Duration : 3 Hours*

Note :

(i) *Answers must be written in* **English.**

(ii) *Question* **No. 1** *is* **Compulsory.** *Of the remaining questions, attempt* **any four** *selecting one question from* **each section.**

(iii) *Figures to the* **RIGHT** *indicate marks of the respective question.*

(iv) *Make suitable assumptions, wherever be necessary and state the same.*

(v) *Number of optional questions upto the prescribed number in the order in which they have been solved will only be assessed. Excess answers will not be assessed.*

(vi) *Credit will be given for orderly, concise and effective writing.*

(vii) *Candidate should not write roll number, any name (including their own), signature, address or any indication of their identity anywhere inside the answer book otherwise he/she will be penalised.*

(viii) *For each slab of 10 and 15 marks, the examinee is expected to write answers in 125 and 200 words respectively.*

1. Answer **any four** of the following **(10 Marks each) :**   **40**

   (a) Explain the terms briefly :

        (i) Dielectric constant

        (ii) Permittivity

        (iii) Hysteresis

        (iv) Remanence

        (v) Coercivity

   (b) What are the main drawbacks of classical physics ? Derive Rayleigh-Jeans law and Wien's law.

   (c) State the special characteristics and any six applications of Lasers.

   (d) What do you mean by Geostationary Orbit ? Explain the basic operation of a communication satellite.

   (e) Write short note on :

   Global Positioning Satellite (GPS).

P.T.O.

Marks

SECTION - A

2. Answer the following sub-questions :
   (a) Discuss in detail method of electrostatic images with any one application of it.　　**10**
   (b) State Biot-Savart's law, Ampere's law and Faraday's law of electro-magnetic induction.　　**6**

   Explain in detail : Self Induction and Mutual Induction.　　**9**
   (c) State Poynting theorem. Show that the surface integral of the Poynting vector measures the rate of flow of electro–magnetic energy.　　**15**

3. Answer the following sub-questions :
   (a) Write down :　　**10**
   　　(i)　Poisson's equation
   　　(ii)　Laplace's equation
   　　Obtain the solution of Laplace's equation in rectangular co-ordinates.
   (b) An inductor (L), a capacitor (C) and a resistor (R) are connected in series. An alternating e.m.f. (e) have been applied to LCR series circuit. Obtain an expression for :　　**15**
   　　(i)　Current
   　　(ii)　Impendence and resonant frequency
   (c) Set up Maxwell's four electromagnetic field equations. Explain the concept of displacement current.　　**15**

SECTION - B

4. Answer the following sub-questions :
   (a) State and explain Heisenberg uncertainty principle. Describe Heisenberg's microscope arrangement for the simultaneous determination of position and momentum of an electron.　　**10**
   (b) Derive Schrondinger's time dependent wave equation.　　**15**
   (c) What do you understand by angular momentum in quantum mechanics ? Derive following commutation relations :　　**15**

   　　(i)　$\left[\hat{L}x, \hat{L}y\right] = i\hbar \hat{L}z$

   　　(ii)　$\left[\hat{L}y, \hat{L}z\right] = i\hbar Lx$

   　　(iii)　$\left[\hat{L}z, \hat{L}x\right] = i\hbar \hat{L}y$

   　　(iv)　$\left[\hat{L}^2, \hat{L}z\right] = 0$

Marks

5. Answer the following sub-questions :

   (a) How is the wave nature of electron demonstrated experimentally by Davisson   **10**
   and Germer ? Explain.

   (b) Write the Schrondinger's equation for the particle in a box and solve it to obtain   **15**
   eigen values and eigen function.

   (c) Write a note on "Quantum Numbers".   **15**

SECTION - C

6. Answer the following sub-questions :

   (a) State the postulates of Bohr's theory of Hydrogen spectra and deduce an expression   **10**
   for the energy of nth orbit of Hydrogen atom. What interpretation do you give to
   the negative sign of the energy value ?

   (b) Explain in detail Raman effect. State its importance.   **10**

   (c) What are Nuclear forces ? What are their characteristics ?   **10**

   (d) Give the names of various Nuclear models. Write a note on :   **10**

   'Liquid drop model' of the nucleus.

7. Answer the following sub-questions :

   (a) What are normal and anomalous Zeeman effects ? Describe the experimental   **10**
   arrangement for studying the Zeeman effect.

   (b) Obtain an expression for the eigen values of rotating rigid diatomic molecule.   **10**

   (c) Define :   **10**

      (i)   Binding energy

      (ii) Parity

      (iii) Packing fraction

      (iv) Mass defect

   (d) Write down any ten applications of Radio activity.   **10**

P.T.O.

Marks

SECTION - D

8. Answer the following sub-questions :

(a) Deduce Bragg's law in X-ray diffraction. Describe Bragg's spectrometer and explain how it is used to determine the wavelength of X-rays ? **15**

(b) What is Hall effect ? How the Hall voltage is related to Hall coefficient ? What is the importance of Hall effect ? **10**

(c) What do you mean by Rectification, Avalanche breakdown and Zener breakdown ? With neat diagram, explain working of Zener diode. **15**

9. Answer the following sub-questions :

(a) (i) Distinguish between Insulator and Semiconductor. **9**

(ii) What do you understand by Magnetic susceptibility, Diamagnetic and Paramagnetic substances ? **6**

(b) With neat diagram, explain construction and principle of working of Solar Cell. Draw current-voltage characteristics of a Solar Cell. **10**

(c) Write down any five types of logic gates used in digital electronics. Draw their symbols. Give their truth table. **15**

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