1(CCEM)0

Physics

(18)

Paper—II

Time : Three Hours]   [Maximum Marks : 300

Note :— (i) Answers must be written in English.

(ii) Number of marks carried by each question are indicated at the end of the question.

(iii) Part/Parts of the same question must be answered together and should not be interposed between answers to other questions.

(iv) The answer to each question or Part thereof should begin on a fresh page.

(v) Your answers should be precise and coherent.

(vi) Answer all questions. All questions carry equal marks.

(vii) If you encounter any typographical error, please read it as it appears in the text-book.

1. (a) Show that the electrostatic potential satisfies Poisson's equation.

20

(b) A conducting uncharged sphere is placed in a uniform electric field, determine the surface distribution of charge induced on the sphere.

30

OR

What is the equivalence between magnetic shell and an electric circuit ? Obtain an expression for the field due to a magnetic shell.

50

2. What is a series resonance circuit ? Derive the expression for the resonant frequency of the circuit. What will be the effect on resonant circuit if resistance, R is replaced by 2R ? Will there be any effect on resonant frequency ? 50

OR

State Maxwell's equations in differential and integral forms. With the help of Maxwell's equations show that electromagnetic waves are transverse in nature. 50

3. Explain how the idea of space quantisation is useful. Describe the Stern-Gerlach experiment. Discuss the important results of the experiment. 50

OR

What is photoelectric effect ? Describe the experimental setup with which the photoelectric effect has been investigated.

In an experiment of photoelectric effect measuring the energy and number of photoelectrons, what happens if :

(i) the target material is changed, frequency and intensity of light being kept constant.

(ii) the frequency of incident light is changed, target material and intensity of light being constant.

(iii) the intensity of light is changed, frequency of light and target material being constant. 50

4. Derive Schrodinger wave equation and apply it to obtain the expression for the energy of a particle in one dimensional potential well. 50

OR

What are nuclear reactions ? Write different types of nuclear reactions. What are conservation laws obeyed by a nuclear reaction ? What is Q-value ? 50

5. (a) Distinguish between insulators, semiconductors and conductors based on band theory. 20

(b) With the help of energy band diagram, explain the distinction between intrinsic and extrinsic semiconductors. Give examples. 20

(c) Write briefly on diffusion process in semiconductors. 10

OR

What is a potential barrier and how it develops at the junction of the diode ? Draw the energy level diagram for a p-n junction under zero bias. How does it change when Forward bias and Reverse bias is applied ? 50

6. What is operating point ? Explain biasing, load line analysis and thermal runway with regard to amplifiers. 50

OR

Explain what we understand by 'modulation'. What is the necessity and importance of having modulation for radio communication ? Explain the essential features of the process of "Amplitude modulation". 50