

- (e) Calculate in units of B, the frequency of the rotational lines of H_2 resulting from the transitions to the excited state characterized by the quantum number $J = 4$. If the bond length of H_2 is 0.07417 nm, determine the spacing between the lines. The mass of hydrogen atom is 1.673×10^{-27} kg. 10
5. (a) What is solar cell ? Explain the design requirements, construction and working of solar cell. 30
- (b) What is the energy of the characteristics X-ray (K_β) emitted from a tungsten target when an electron drops from M shell to a vacancy in K-shell ? 20

OR

- (c) What is Zener diode ? How a Zener diode works as a voltage regulator ? Draw its I-V characteristic curve. 15
- (d) Explain the working of OR, NOT, NAND and X-OR gates using diodes and truth tables. 15
- (e) Explain the working of half-adder and full-adder using appropriate logic circuits and truth tables. 20
6. (a) What is super conductivity ? Write the characteristics of superconductors. 15
- (b) Explain the differences between superconductors and conductors. 20
- (c) Explain the three configurations of a transistor. Describe how a transistor works as an amplifier and an oscillator. 15

OR

- (d) What are elementary particles and how they are classified ? 20
- (e) Explain the working of a transmitter, receiver in television with a block diagram. 30

Total No. of Printed Pages : 4

Roll No.

1[CCE.M]1

Physics–II

(18)

Time : Three Hours

Maximum Marks : 300

INSTRUCTIONS

- (i) Answers must be written in English.
- (ii) The number of marks carried by each question is indicated at the end of the question.
- (iii) The answer to each question or part thereof should begin on a fresh page.
- (iv) Your answers should be precise and coherent.
- (v) The part/parts of the same question must be answered together and should not be interposed between answers to other questions.
- (vi) Candidates should attempt **all** questions.
- (vii) If you encounter any typographical error, please read it as it appears in the text book.
- (viii) Candidates are in their own interest advised to go through the General Instructions on the back side of the title page of the Answer Script for strict adherence.
- (ix) No continuation sheets shall be provided to any candidate under any circumstances.

- (x) Candidates shall put a cross (X) on blank pages of Answer Script.
- (xi) No blank page be left in between answer to various questions.
1. (a) State and explain the Coulomb's law and Gauss's law of electrostatics. 10
- (b) Deduce Coulomb's law from Gauss's law. 20
- (c) Derive an expression for the electric field due to uniformly charged sphere. 20

OR

- (d) What feature of atomic structure determines the dia or paramagnetic nature of an element ? Explain the domain theory of ferromagnetism. 30
- (e) Distinguish between dia, para and ferromagnetic substances. 20
2. (a) What is meant by dielectric ? Deduce Poisson's and Laplace's equations for a homogeneous dielectric. 20
- (b) An uncharged conducting sphere of radius 'a' is placed in a uniform electric field E_0 . If the sphere carries a charge 'q', then deduce an expression for potential at any point at a distance 'r' from its centre. 30

OR

- (c) State the laws of Faraday's and Lenz's which deals with the production of induced emf. 15
- (d) Describe the theory of LCR parallel resonant circuit and obtain an expression for resonant frequency. 20
- (e) A rectangular coil of dimensions 10×18 cm having 600 turns is rotated in a magnetic field of $200 \times 10^{-4} \text{ Wb m}^{-2}$ at 1200 rpm. Find the emf induced when it makes an angle of 60° with the field. 15

3. (a) Explain the phenomenon of radioactivity. Distinguish between natural and artificial radioactivity. 20
- (b) Obtain an expression for mean lifetime of a radioactivity element in terms of half lifetime. 15
- (c) A radioactive source, in the form of metallic sphere of radius 10^{-2} m emits β particle at the rate of 10^{11} particles per second. The source is electrical insulated. What will be the time required for its potential to be raised by 4 volts assuming 60% of emitted β particles escape from the source ? 15

OR

- (d) Explain the construction, theory and working of cyclotron. 20
- (e) How do the relativistic effects limit the acceleration of electrons to high energies in cyclotron ? 15
- (f) An electron accelerated by a potential difference of 2 kV moves in a uniform magnetic field at an angle $\theta = 30^\circ$ to the vector B whose magnitude is 30 mT. Calculate the pitch of the helical trajectory. 15
4. (a) Explain the Zeeman effect using classical ideas. Distinguish between normal and anomalous Zeeman effects. 30
- (b) Find the minimum magnetic field needed for the normal Zeeman effect to be observed in a spectral line of 400 nm wavelength when a spectrometer whose resolution is 0.001 nm is used. 20

OR

- (c) What is Raman effect ? Explain theoretically the observed characteristics of Raman spectrum of a diatomic molecule. 20
- (d) How Raman spectrum is used to explain the structure of a molecule ? 20