

- (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  $1.673 \times 10^{-27}$  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 ( $K_\beta$ ) 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  $10 \times 18$  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  $60^\circ$  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  $\beta$  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  $\beta$  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