- (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.
- (e) Explain the working of half-adder and full-adder using appropriate logic circuits and truth tables. 20
- (a) What is super conductivity ? Write the characteristics of superconductors.
 - (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.

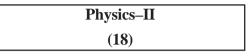
OR

- (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



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.

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- (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 200×10^{-4} Wb m⁻² at 1200 rpm. Find the emf induced when it makes an angle of 60° with the field.
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Contd.

- 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 ?
- (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

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