

B.Sc. DEGREE (C.B.C.S.S.) EXAMINATION, OCTOBER 2014**Third Semester**

Complementary Course—Physics—QUANTUM MECHANICS, SPECTROSCOPY, NUCLEAR PHYSICS, BASIC ELECTRONICS AND DIGITAL ELECTRONICS

(For Mathematics and Statistics)

[2013 admissions]

Time : Three Hours

Maximum : 60 Marks

Part A (Short Answer Questions)

Answer all questions.

1 mark each.

1. State Heisenberg's uncertainty principle.
2. Bring out the features of matter waves.
3. Explain Thomson's model of atom.
4. What is the principle of microwave oven ?
5. What is meant by packing fraction ?
6. Draw the forward and reverse characteristics of a PN junction.
7. Give the truth table of a XOR gate.
8. NAND gate is known as a Universal gate. Why ?

(8 × 1 = 8)

Part B (Brief Answer Questions)

Answer any six questions.

2 marks each.

9. Explain the physical significance of wave function.
10. Briefly explain the Plancks quantum hypothesis.
11. Give the quantum theory of Raman Effect.
12. Explain the features of vector atom model.
13. What is meant by binding energy per nucleon ? State its importance.
14. Briefly explain the method of radioactive carbon dating.

Turn over

15. How can a zener diode, be used as a voltage regulator ?
16. Explain the amplifying action of a transistor.
17. Explain the use of feedback in amplifiers.
18. State and explain De Morgan's second theorem.

(6 × 2 = 12)

Part C (Problems/Derivations)

Answer any **four** questions.

4 marks each.

19. Obtain the expression for the energy eigenvalues of a particle trapped in a box with infinitely hard walls.
20. An electron has a De-Broglie wavelength of 2 pm. Find its kinetic energy and velocity. The rest energy of the electron is 511KeV.
21. The CO molecule has a bond length of 0.113 nm and the masses of the ^{12}C and ^{16}O atoms are 1.99×10^{-26} kg and 2.66×10^{-26} kg respectively. Find the energy of the lowest rotational state of the CO molecule.
22. Uranium ores on the earth at the present time typically have a composition of 99.3% of the isotope $^{92}\text{U}^{238}$ and 0.7% of the isotope $^{92}\text{U}^{235}$. The half lives of these isotopes are 4.47×10^9 years and 7.04×10^8 years respectively. If these isotopes were equally abundant when the earth was formed, estimate the age of the earth.
23. A transistor is connected in CE configuration, in which collector supply is 8V and the voltage drop across the collector load resistor 800Ω is 0.5 V. If $\alpha = 0.96$, determine (a) collector emitter voltage (b) base current.
24. Using uncertainty principle, show that electrons can exist in an atom.

(4 × 4 = 16)

Part D (Long Answer /Problem Questions)

Answer any **two** questions.

2 marks each.

25. What is photoelectric effect ? What are the experimental results observed with the photoelectric effect ? How did Einstein explain these results ?
26. Discuss the vibrational spectra of a rigid diatomic molecule.
27. Explain the rectifying action of a full wave bridge rectifier with neat diagram. Obtain the expressions for ripple factor and efficiency.
28. Discuss in detail the properties of nuclei. Why some combinations of neutrons and protons are more stable than others ?

(2 × 12 = 24)