

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

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

(For Chemistry and Geology)

[2013 admissions]

Time : Three Hours

Maximum : 60 Marks

Candidates can use Clark's tables and scientific non-programmable calculators.

Part A (Short Answer Questions)

Answer all questions.

1 mark each.

1. State the conditions to be satisfied by a wave function to be well behaved one.
2. Give the statement of Heisenberg's uncertainty principle.
3. What is meant by spatial quantization ?
4. Diatomic molecules such as CO, HF will show a rotational spectrum where as N_2 , O_2 , H_2 will not. Why ?
5. What are the limitations of Bohr atom model ?
6. Define binding energy per nucleon. What is its significance ?
7. What is the principle of atom bomb ?
8. What are the two biasing modes of PNI junction ?

(8 × 1 = 8)

Part B (Brief Answer Questions)

Answer any six questions.

2 marks each.

9. The photoelectric effect cannot be explained on the basis of electromagnetic wave theory. Why ?
10. What do you understand by the term eigenvalue and eigenfunction ?
11. How is the fine structure of spectral lines accounted ?
12. Give the quantum theory of Raman Effect.
13. What is electric quadrupole moment ?
14. What is meant by radioactive carbon dating ?

Turn over

15. Explain the features of liquid drop model.
16. Briefly explain the production of energy in stars.
17. How the potential divider method helps in the biasing of a transistor ?
18. How can a zener diode be used in a voltage stabilizer circuit ?

(6 × 2 = 12)

Part C (Problems /Derivations)

Answer any **four** questions.
4 marks each.

19. Find the kinetic energy of a proton whose Broglie wavelength is 1 fm.
20. The ground state energy of Hydrogen atom is -13.6 eV. Find the orbital radius and velocity of the electron in a Hydrogen atom.
21. Find the energy release, if two, H^2 nuclei can fuse together to form He^4 nucleus. The binding energy per nucleon of ${}^1_1\text{H}^2$ and ${}^4_2\text{He}^4$ is 1.1 MeV and 7.0 MeV respectively.
22. Calculate the fission rate for U^{235} required producing 2W and the amount of energy that is released in the complete fissioning of 0.5 kg of U^{235} . 200 MeV energy is released per fission of U^{235} .
23. In a negative feedback amplifier the open loop gain is 100, $\beta = 0.04$ and input voltage = 50 mV. Find (a) Gain with feedback ; (b) Output voltage ; (c) Feedback factor ; (d) Feedback voltage.
24. Obtain the mutual relationship between the current amplification factors α , β and γ of a transistor.

(4 × 4 = 16)

Part D (Long Answer /Problem Questions)

Answer any **two** questions.
12 marks each.

25. Discuss in detail the Davisson-Germer experiment.
26. Explain the rotational spectra of a rigid diatomic molecule.
27. Describe the properties of the nucleus.
28. What is a full wave bridge rectifier ? Explain the working of it with a neat diagram. Obtain the expression for its efficiency.

(2 × 12 = 24)