E 9006

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

Third Semester

Physics

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

(For Mathematics Model I and Statistics)

[Prior to 2013 admissions]

Time : Three Hours   Maximum Weight : 25

Part A (Objective Type Questions)

Answer all questions.
Each bunch carries 1 weight. Choose the correct answer)

BUNCH I

1. The ability of a body to radiate is closely related to its ability to :

    (a) Reflect radiation.   (b) Absorb radiation.

    (c) Emit radiation.   (d) Transmit radiation.

2. According to Thomson's atom model electrons are :

    (a) Situated inside the tiny sphere.

    (b) Situated outside the tiny sphere.

    (c) Posted on the surface of the tiny sphere.

    (d) Situated inside the sphere in various positions.

3. The size of a nucleus is of the order of :

    (a) Nanometer.   (b) Angstrom.

    (c) Fermi.   (d) Micro meter.

4. The current conductivity in *n* type semiconductor is predominated by :

    (a) Positive charges.   (b) Negative charges.

    (c) Positive and negative charges. (d) All the above.

BUNCH II

5. Photoelectric current is directly proportional to :

    (a) Frequency of incident radiation.   (b) Threshold for frequency.

    (c) Intensity of incident radiation.   (d) Photoelectric emission.

Turn over

6. Bohr atom model is based on :

   (a) Quantum theory.

   (b) Wave theory.

   (c) Orbital theory.

   (d) Wave theory and quantum theory.

7. The energy equivalent of the missing mass of a nucleus is called :

   (a) Nuclear energy.

   (b) Binding energy.

   (c) Packing fraction energy.

   (d) Nucleus energy.

8. The ac component in the rectified output is known as :

   (a) Efficiency factor.

   (b) Ripple factor.

   (c) Ripple.

   (d) Efficiency.

BUNCH III

9. The dual nature of matter was suggested by :

   (a) Erwin Schrödinger.

   (b) De Broglie.

   (c) Einstein.

   (d) Planck.

10. The Balmer series of hydrogen spectrum is due to jumping of electron from :

    (a) Third orbit to higher orbits.

    (b) Second orbit to higher orbits.

    (c) Fourth orbit to higher orbits.

    (d) First orbit to higher orbits.

11. Nuclear forces are :

    (a) Long range forces.

    (b) Variable forces.

    (c) Short range forces.

    (d) Medium range forces.

12. The most widely used method for transistor biasing is :

    (a) Base resistor method.

    (b) Voltage divider method.

    (c) Feedback resistor method.

    (d) None of the above.

BUNCH IV

13. The Davisson and Germer experiment established :

    (a) Dual nature of matter.

    (b) wave nature of matter.

    (c) Particle nature of electron.

    (d) Scattering due to electrons.

14. The vibration-rotation spectra are in the :

    (a) Near ultraviolet region.

    (b) Visible region.

    (c) Near infra red region.

    (d) Near microwave region.

15. The decay constant of the radio nuclide whose half life is 300 minutes is :

    (a) $3.85 \times 10^{-5}\ s^{-1}$.   (b) $3.85 \times 10^{+5}\ s^{-1}$.

    (c) $3.85 \times 10^{-6}\ s^{-1}$.   (d) $3.85 \times 10^{-9}\ s^{-1}$.

16. The decimal equivalent of the binary member 101110 is :

    (a) 48.   (b) 46.

    (c) 64.   (d) 84.

                                                                              $(4 \times 1 = 4)$

Part B

*Answer any **five** questions.*
Each question carries 1 weight.

17. Give the Rayleigh-Jeans formula. What is ultra violet catastrophe ?

18. Briefly explain the de Broglie concept of matter waves.

19. Write down the expression for orbital radius in Bohr atom model and explain.

20. Write a short account on the quantum theory of Raman effect.

21. Explain mass effect and binding energy. Illustrate your answer.

22. What happens to the atomic number and mass number of a nucleus when it units an alpha particle.

23. Give an account of the band structure in semiconductors.

24. How logical addition is realised by an OR gate with two inputs ?

                                                                              $(5 \times 1 = 5)$

Part C

*Answer any **four** questions.*
Each carries 2 weight.

25. The work function of an element is 5.68×10^{-19} J and the photo electric threnshold is 450 nm. Calculate the Planck's constant.

26. Determine the wavelength of the H_L line of hydrogen spectrum.

27. Calculate the binding energy of last neutron in U^{236} nuclear.

28. Find out the activity of one milligram of Radon whose atomic mass in 222 u.

29. In a common base connection $\alpha = 0.95$. The voltage drop across $2k\Omega$ resistance connected in the collector circuit is 2 volt. Calculate the base current.

30. Simplify the expression $(A + B)\ (B + C)\ (A + C)$ and draw the block diagram.

                                                                              $(4 \times 2 = 8)$

Part D

*Answer any **two** questions.*
Each question carries 4 weight.

31. Describe with theory the Davisson–Germer experiment.

32. Discuss the theory of the origin of pure rotational spectrum of a diatomic molecule.

33. Explain the working of a bridge rectifier and derive expressions for efficiency and ripple factor.

$$(2 \times 4 = 8)$$