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Reg. No. : .....

Name : .....

Fourth Semester B.Sc. Degree Examination, February 2022

First Degree Programme under CBCSS

Physics

Complementary Course for Chemistry

PY 1431.2 : ATOMIC PHYSICS, QUANTUM MECHANICS AND ELECTRONICS

(2019 Admission)

Special Examination

Time : 3 Hours Max. Marks : 80

SECTION – A

Very short answer type questions. Answer **all** 10 questions of **1** mark each.

1. Find the 2's complement of 1101.
2. State Pauli's exclusion principle.
3. What do you mean by ionization potential of an atom.
4. What is the de Broglie wavelength for a charged particle q and mass m. accelerated through a potential difference of V volts?
5. What is superconductivity?
6. Draw the V-I characteristic of a p-n junction diode.
7. Convert the hexadecimal number $(3C8)_{16}$ to its decimal equivalent.

P.T.O.

8. What are the regions of the electromagnetic spectrum.

9. Define ripple factor.

10. What is a DC load line?

(10 × 1 = 10 Marks)

SECTION – B

Short answer type questions. Answer any **eight** questions of **2** marks each.

11. State Bohr's correspondence principle.

12. Distinguish between a Zener diode and an ordinary junction diode.

13. State De Morgan's Theorems.

14. Construct truth tables for NOR and NAND gates.

15. Draw the circuit diagram of a full wave rectifier.

16. Draw the circuit diagram of a voltage divider bias circuit.

17. Draw the output characteristics of a transistor connected in the common base configuration.

18. What are matter waves?

19. What is meant by spin-orbit coupling?

20. Discuss space quantisation.

21. What do you mean by absorption spectroscopy?

22. Reduce $AB + ABC + \overline{A}B + A\overline{B}C$ using laws of Boolean algebra.

23. Draw the circuit of two-input OR gate using two diodes.

24. Explain briefly the working of a grating spectrograph employed in infra-red spectroscopy.

25. Discuss isotope effect in superconductors.

26. Find the decimal equivalent of 0.1101

(8 × 2 = 16 Marks)

SECTION – C

Answer any **six** questions. **Each** question carries **4** marks.

27. List any four applications of superconductors.

28. With the help of necessary diagrams discuss the input characteristics of a transistor connected in the common base configuration.

29. A transistor is connected in the CE configuration. The collector supply voltage is 10 V and the voltage drop across the 500 Ω connected in the collector circuit is 0.6 V. If α = 0.96, find the (a) collector-emitter voltage, (b) base current, and (c) the emitter current.

30. A microscope, using photons, is employed to locate an electron in an atom to within a distance of 0.2 Å. What is the uncertainty in the momentum of the electron located in this way.

31. Distinguish between Raman spectra and IR spectra.

32. Find the wavelength of the spectral line that corresponds to a transition in hydrogen from the n = 10 state to the ground state.

33. Calculate the radius and energy of the electron in the n^{th} orbit in hydrogen from the following data: e = 1.6 x 10^{-19} coulomb; m = 9.1 $\times 10^{-31}$ kg; h = 6.6 $\times 10^{34}$ joule second; $\varepsilon_0 = 8.85 \times 10^{-12}$ farad/metre and $c = 3 \times 10^8$ m/s.

34. Calculate the value of Rydberg constant, assuming that wavelength of H_α line is 6563 Å.

35. Calculate the wavelength associated with an electron subjected to a potential difference of 1.25 kV.

36. How can an AND gate and OR gate be realized using a NAND gate?

37. What are the techniques used for stabilization of the operating point of a transistor?

38. The critical temperature for Hg with isotopic mass 199.5 is 4.185 K. Calculate its critical temperature when its isotopic mass changes to 203.4

(6 × 4 = 24 Marks)

SECTION – D

Answer any **two** questions. **Each** question carries **15** marks.

39. Discuss particle in a box problem and obtain expressions for normalized wave function and energy of the particle.

40. State the postulates of Bohr regarding his atom model. Obtain expressions for the radius and electron energy of the n^{th} orbit. Explain how Bohr's atom model successfully accounts for the hydrogen spectrum.

41. Discuss the spectroscopic technique employed in the visible region of the electromagnetic spectrum.

42. Explain Planck's hypothesis and obtain Planck's radiation law.

43. Discuss the various transistor biasing techniques.

44. With a neat circuit diagram explain the working of a half wave rectifier and obtain expressions for D.C. (average) value of output current, D.C. power output, R.M.S. value of output current, A.C. power input, rectifier efficiency, ripple factor.

(2 × 15 = 30 Marks)