

Reg. No. :

Name :

Fourth Semester B.Sc. Degree Examination, May 2021

First Degree Programme under CBCSS

Physics

Complementary Course

PY 1431.1 : MODERN PHYSICS AND ELECTRONICS

(For Mathematics)

(2019 Admission Regular)

Time : 3 Hours

Max. Marks : 80

PART – A

Answer **all** questions. Each question carries **1** mark.

1. State Bohr's correspondence principle.
2. Name the essential elements that characterize the vector atom model.
3. What is an α particle?
4. Write the expression for the de Broglie wavelength for matter waves.
5. Give the significance of the wave function.
6. What is a *depletion region* with reference to a PN junction diode?
7. "Once in breakdown, a zener diode keeps its voltage practically constant". True or False?

8. What is a "rectifier"?
9. What is "binary system"?
10. The number D_{16} in decimal is:

(10 × 1 = 10 Marks)

PART – B

Answer any **eight** questions, not exceeding **one** paragraph. Each question carries **2** marks.

11. Write the postulates of Bohr atom model.
12. Explain spinning electron hypothesis with reference to the vector atom model.
13. State Pauli's exclusion principle.
14. Explain spin angular momentum.
15. Define atomic binding energy.
16. Define mean life of a radio active element.
17. What is the unit of radio activity?
18. Write the time dependent Schrödinger equation.
19. Explain avalanche breakdown.
20. Explain the working of a half-wave rectifier.
21. What is meant by a quiescent point in the transistor characteristics?
22. Explain the need for biasing a transistor.
23. Explain voltage divider bias.
24. Convert: (a) 11001_2 to equivalent decimal number (b) 345_{10} to equivalent binary.

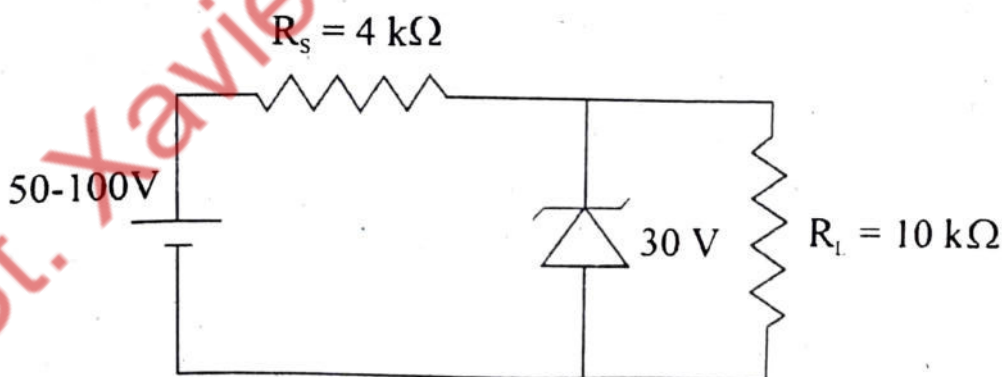
25. Explain the operation of a two input NAND gate with truth table.
26. Write De Morgan's theorems.

(8 × 2 = 16 Marks)

PART – C

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

27. Using the vector atom model, determine the possible values of the total angular momentum of an f - electron.
28. Find the series limit of Balmer series, given $R_H = 1.097 \times 10^7 \text{ m}^{-1}$.
29. A radio active sample has its half-life equal to 60 days. Calculate its: (a) dis-integration constant (b) average life (c) time for $2/3$ of the original number of atoms to disintegrate.
30. If the age of earth is taken to be 10^{10} years, what fraction of the original amount of U-238 is still in existence on the earth? Given that half-life (T) of U-238 = 4.5×10^9 years.
31. Find the maximum and minimum values of zener diode current for the following circuit. What will be its power rating?



32. In a half wave rectifier, the load resistance is $R_L = 1 \text{ k}\Omega$, forward resistance of the diode is $r_d = 100 \Omega$ and the input alternating voltage is 325 V (peak value). Calculate: (a) peak, average and rms value of the output current (b) Efficiency of the rectifier.

33. In a fixed bias circuit, $V_{CC} = 10V$, $R_C = 2k\Omega$, $R_B = 300k\Omega$, $\beta = 75$ and $V_{BE} = 1V$. Find the operating point and also check whether it is in the active region or not.
34. Locate the operating point for a voltage divider bias circuit with values: $V_{CC} = 10V$, $R_1 = 14k\Omega$, $R_2 = 6k\Omega$, $R_C = 2k\Omega$, $R_E = 3k\Omega$.
35. Write down the laws of Boolean algebra.
36. Explain the process of finding the 1's and 2's complement of a binary number with a suitable example.
37. Write down the truth table of a 4 input OR gate.
38. Prove the Boolean identity: $A + \bar{A}B = A + B$.

(6 × 4 = 24 Marks)

PART – D

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

39. Write a note on: (a) Spectral series of Hydrogen atom (b) L-S and J-J coupling.
40. Explain the salient features and quantum numbers associated with vector atom model.
41. Explain the operation and draw the output wave forms of a bridge rectifier. What is its efficiency?
42. Explain: (a) the construction and operation of a bipolar junction transistor (b) how DC load lines are drawn and quiescent points located.
43. Explain the working of a single stage transistor amplifier. Obtain expressions for current, voltage and power gains.
44. Explain decimal, binary, octal, hexadecimal and BCD number systems.

(2 × 15 = 30 Marks)