(2013 – 17 Admn)

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(Pages : 3) **N – 7750**

Reg. No. : .....

Name : .....

Fourth Semester B.Sc. Degree Examination, August 2022

First Degree Programme under CBCSS

Physics

Complementary Course for Mathematics and Statistics

PY 1431.1/PY 1431.3 : MODERN PHYSICS AND ELECTRONICS

(2013 – 2017 Admission)

Time : 3 Hours Max. Marks : 80

SECTION – A

Very short answer type questions (Answer all **ten** questions of **1** mark each).

1. Give Paul's exclusion principle.
2. Name any two nuclear detectors.
3. Radioactivity was discovered by ———
4. Write time independent time Schrodinger equation.
5. The current amplification t-factor is always ———
6. Is the frequency content of the output of a half-wave rectifier and a full-wave rectifier the same?
7. What is the base in octal number system?
8. Write the number 15 in binary number system.
9. What are the operations in Boolean algebra?
10. $\overline{AB} = ?$

(10 × 1 = 10 Marks)

P.T.O.

SECTION – B

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

11. Give the basic features of Bohr model.
12. State Bohr correspondence principle.
13. What are the properties of a nucleus?
14. Discuss spin orbit coupling.
15. What are the properties of wave functions?
16. Explain probability density.
17. Differentiate forward and reverse bias.
18. Distinguish a Zener diode from an ordinary junction diode.
19. Distinguish emitter. base and collector.
20. Explain why CE configuration is widely used in amplifier circuits.
21. Convert binary 1011.011 to decimal.
22. State De Morgan's theorem.

(8 × 2 = 16 Marks)

SECTION – C

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

23. Calculate the radius and energy of the electron in the nth orbit in hydrogen from the following data.
    $e = 1.6 \times 10^{-19}$ 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 $c = 3 / 10^{8}$ ms^{-1}.
24. Calculate the binding energy of an a-particle and express the result both in MeV and joules.
25. The half-value period of radium is 1590 years. In how many years will one gram of pure element lose one centigram?

26. Consider a particle moving inside a box along the x-direction. The particle is bouncing back and forth between the walls of the box. The box has insurmountable potential barriers at $x = 0$ and $x = L$. i.e., the box is supposed to have walls of infinite height at $x = 0$ and $x = L$. The particle has a mass m and its position x at any instant is given by $0 < x < L$. The potential energy V of the particle is infinite on both sides of the box. The potential energy V of the particle can be assumed to be zero between $x = 0$ and $x = L$. Deduce expression for energy of the particle.

27. Discuss Common Emitter input characteristics of a Transistor.

28. A transistor is connected in the CE configuration. The collector supply voltage is 10V and the voltage drop across the 500Ω connected in the collector circuit is 0.6 V. If $\alpha = 0.96$, find he

    (a) collector-emitter voltage

    (b) base current, and

    (c) the emitter current.

29. With a neat diagram, explain the working of a bridge rectifier.

30. Using truth table, prove that the complement of the sum of two variables is equal to the product of complements of the variables.

31. Convert decimal 25 to binary number. Find its 1's and 2's compliment.

(6 × 4 = 24 Marks)

SECTION – D

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

32. (a) Briefly discuss the vector atom model.

    (b) Discuss the quantum numbers associated with the vector atom model.

33. Derive time dependent Schrodinger equation. What is its significance.

34. Discuss the construction, working and mathematical analysis of a p-n junction diode as half wave rectifier.

35. What are logic gates? Briefly discuss NOT, OR, AND, NOR and NAND gates.

(2 × 15 = 30 Marks)
