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Reg. No. : .....

Name : .....

TRIVANDRUM

Fourth Semester B.Sc. Degree Examination, August 2022

First Degree Programme under CBCSS

Physics

Complementary Course for Mathematics

PY 1431.1 : MODERN PHYSICS AND ELECTRONICS

(2019 Admission onwards)

Time : 3 Hours Max. Marks : 80

PART – A

Answer **all** questions in one or two sentences. Each question carries **1** mark.

1. State Bohr correspondence principle.
2. What do you mean by probability density?
3. Define nuclear magnetron.
4. Define packing fraction.
5. State Pauli's exclusion principle
6. What is the peak inverse voltage of a rectifier?
7. Define operating point.
8. Define knee voltage.

9. What is an octal number?

10. 2's compliment of 0111 is _____.

(10 × 1 = 10 Marks)

PART – B

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

11. Explain how quantum numbers are defined in vector atom model.

12. What are the inadequacies of classical physics?

13. What is nuclear binding energy? Draw the binding energy per nucleon graph.

14. What is the significance of wave function in quantum mechanics?

15. Write any four characteristics of nuclear force.

16. What percentage of a given mass of a radioactive substance will left after four half-lives?

17. What are the types of radioactive equilibrium? Write down the conditions for them.

18. What is mean life of an element? Derive the expression for mean life.

19. Draw the circuit diagram and explain the working of a Zener diode voltage regulator voltage.

20. Draw the frequency response curve of a single stage CE amplifier and mention all the regions.

21. Draw the characteristics of a Common base configuration and explain.

22. Derive the relationship between the current amplification factor α and β.

23. Draw the AC load line in a transistor circuit.

24. How will you convert a decimal fraction to the equivalent binary number? Give suitable example.

25. Write down the logic symbol and truth table of a NOR Gate.

26. Explain binary coded decimal system.

(8 × 2 = 16 Marks)

PART – C

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

27. Calculate the radii of the first, second and third permitted electron Bohr-orbits in a hydrogen atom.

28. Calculate the permitted energy level of an electron, in a box of 1 Å wide.

29. Calculate the probability density for the wave function $\psi(x) = u(x)\exp[i\phi(x)]$, where u, Φ are real.

30. Calculate the binding energy of an alpha particle and express the result both in MeV and Joules. Given mass of proton 1.007276u, mass of neutron 1.008665u, mass of alpha particle is 4.001506u.

31. A Zener diode has 7.5V across it and a current of 30mA passes through it. Find the power dissipation.

32. An ac supply voltage of 240V is applied to a half-wave rectifier through a step-down transformer of turns ratio 40:1. Find the d.c. output voltage. Neglect the forward resistance of the diode.

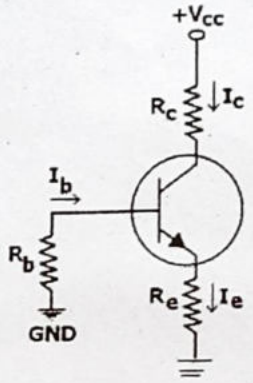
33. Explain NAND gate.

34. Subtract the decimal number 60 from 78 in 2's complement form.

35. Convert the following numbers in to decimal; (a) 673_8 (b) $AB9_{16}$

36. A Transistor is connected in CE configuration. The voltage drops across $5K\Omega$ resistance which is connected in the collector circuit is 5 volts. Find the base current. The current gain α of the amplifier is 0.98.

37. Determine the Q point of the transistor circuit shown in figure. Also draw the d.c. load line. Given $R_C = 2K\Omega, R_B = 50K\Omega, R_E = 3.7K\Omega$, $V_{CC} = 12V$, $\beta = 100$ and $V_{BE} = 0.7V$.



38. A Simplify the Boolean expression: $X = \overline{A}\overline{B}C + A\overline{B}C + AB\overline{C} + ABC$.

(6 × 4 = 24 Marks)

PART – D

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

39. What are quantum numbers? Explain all the numbers associated with vector atom model.

40. State and explain the law of radioactive disintegration. Show that number of atoms of a radioactive element decreases exponentially with time.

41. Derive Schrodinger's time independent wave equation. Hence derive the expression for energy of a particle in a box.

42. What is full wave rectifier? Explain the working with necessary theory. Also derive the expression for ripple factor and rectification efficiency.

43. What is biasing in transistors? What the need for biasing and also draw the circuit diagram of a voltage divider arrangement and mention its working.

44. Derive the expression for the energy and normatized wave function of a particle in a box.

(2 × 15 = 30 Marks)
