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Reg. No. : .....

Name : .....

Fourth Semester B.Sc. Degree Examination, March 2020

First Degree Programme Under CBCSS

Complementary Course

PY 1431.1 : MODERN PHYSICS AND ELECTRONICS

(For Mathematics)

(2018 Admission)

Time : 3 Hours Max. Marks : 80

SECTION – A

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

1. Name the spectral series of hydrogen atom in the visible region.
2. Write the Schrodinger equation in time independent form.
3. Define packing fraction.
4. Write Plank's law of black body radiation.
5. What is the origin of leakage current in a pn junction diode.
6. Define current amplification factor in common emitter configuration.
7. What is ripple factor?
8. Write down the truth table of NAND gate.

9. The BCD equivalent for 37_{10} is ————————.

10. What is De Morgan's theorem?

(10 × 1 = 10 Marks)

SECTION – B

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

11. Draw the input and output characteristics of Common emitter transistor configuration. What do you infer from these characteristics?

12. The mass of nucleus is always less than the sum of the masses of its nucleons. Why?

13. Sketch construction and working of half wave rectifier. Sketch its output wave form.

14. What is Zener diode? How its characteristics differ from an ordinary diode.

15. Which of the following wave functions cannot be a solutions of Schrodinger's equation for all positive values of x? Why not (a) $\psi = Ae^{x^2}$ (b) $\psi = Ae^{-x}$.

16. Briefly explain any two inadequacies of classical mechanics.

17. Explain ac and dc load line.

18. Write a short note on nuclear spin and nuclear magnetic moment.

19. What are various quantum numbers in vector atom model?

20. Explain the laws of Boolean Algebra.

21. Using 2's complement subtract 11011 from 10101.

22. Draw logic implementation of an AND gate and OR gate using NAND gates.

(8 × 2 = 16 Marks)

SECTION – C

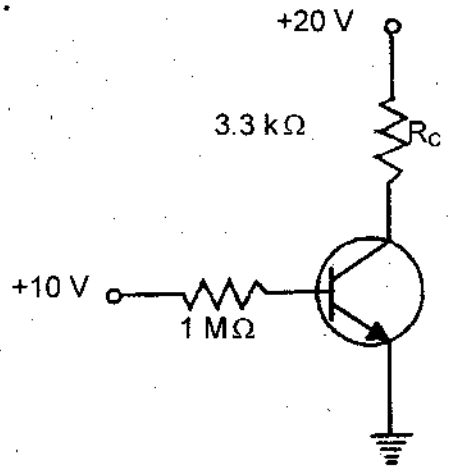
Answer any **six** questions. Each question carries **4** marks.

23. An electron is contained in a one-dimensional box of width 1.0 nm. Calculate energy of electrons for the level up to n = 4.

24. Write a short note on Radioactive equilibrium.

25. Find the binary and decimal equivalent of (a) $(17E)_{16}$ (b) $(762)_8$

26. Draw dc load line. Calculate operating point if V_{BE} = 0.7 V and $\beta = 500$.



27. The four semiconductor diodes used in a bridge rectifier circuit have forward resistance which can be considered constant at 0.1 Ω and infinite reverse resistance. They supply a mean current of 100 mA to a resistive load from a sinusoidally varying alternating supply of 20 V rms. Determine resistance of the load and efficiency of the circuit.

28. In a transistor employed in common emitter configuration, the base current is 68 μA and current gain is 440.Find Collector current and Emitter Current. Also find the current gain in common base configuration.

29. Calculate the binding energy of an α particle in Joules. Mass of α particle = 4.03188 u and Mass of proton = 1.00728 u, Mass of neutron = 1.00866 u.

30. Simplify the following Boolean expressions

(a) $\overline{A}\,\overline{B}C + A\overline{B}C + AB\overline{C} + ABC$

(b) AB + AC + B

31. A 9 volts stabilized voltage supply is required to run a car stereo system from the car's 12 volt battery. A zener diode with V_z = 9 V with P_{max} = 0.27 V is used as a voltage regulator. Find the value of the series resistor if the load resistance is 450 Ω.

(6 × 4 = 24 Marks)

SECTION – D

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

32. What are the essential features of Bohr atom model? Derive expressions for the radii of stationary orbits for electrons and the total energy of electron in the orbit. Discuss the origin of the spectral series of hydrogen.

33. What are the basic laws of radio activity? Derive an expression for mean life and half life of a radioactive element.

34. With the help of neat diagram explain construction and working of a single stage transistor amplifier. Hence explain frequency response curve, gain and band width.

35. Discuss the normalization and probability interpretation of a wave function. Give physical interpretation of wave function. Obtain Schrodinger steady state equation.

(2 × 15 = 30 Marks)