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Name.................................

Reg. No.................................

FIFTH SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2018

(CUCBCSS—UG)

Physics/Applied Physics

PHY 5B 07/APY 5B 08—QUANTUM MECHANICS

Time : Three Hours

Maximum : 80 Marks

Section A

Answer all *questions.*

1. Write down Rayleigh-Jeans formula.

2. Average energy of Planck's oscillator is —————.

3. Write down uncertainty principle.

4. Write down energy time uncertainty relation.

5. Write the expression for Balmer series.

6. The spectral series of Hydrogen in ultra violet regions.

7. Write down the expression for orbital radius of Hydrogen atom in terms of Bohr radius.

8. Write down the condition for normalization of the wave function.

9. Orbital angular momentum quantum number can have the values —————.

10. Operator correspondence of energy is —————.

(10 × 1 = 10 marks)

Section B

Answer all *questions.*

11. What is photoelectric effect.

12. Explain pair production.

13. Explain Schwarzschild radius.

14. Distinguish between phase and group velocity.

15. Write down the Bohr Postulates.

16. Write down the admissibility condition for a function to become wave function.

17. Distinguish between are 'classical state' with 'Quantum state'.

(7 × 2 = 14 marks)

Turn over

Section C

Answer any five questions.

18. Derive the expression for gravitational red sift.

19. Explain the working of electron microscope using a diagram.

20. Explain Frank-Hertz experiment

21. Derive the steady state Schrodinger equation from time dependent Schrodinger equation.

22. Write a short note on scanning tunneling microscope.

23. Give the idea of allowed transition and forbidden transition.

24. Explain Zeeman effect.

$(5 \times 4 = 20 \text{ marks})$

Section D

Answer any four questions.

25. What potential difference must be applied to stop fastest photoelectrons emitted by a surface when electromagnetic radiation of frequency 1.5×10^{15} Hz is allowed to fall on it. The work function of the surface is 5eV.

26. X-rays of wave length 80pm are scattered 120° by a largest. Find out the scattered wave length.

27. Calculate the de-Broglie wave length of an electron having kinetic energy of 1000eV. Compare the result with the wave lengths of X-rays having same energy.

28. The average life time of an excited atomic state is 10^{-9}s. If the spectral line associated with the decay of this state is 6000A°, estimate the width of the line.

29. Calculate the maximum wave length that Hydrogen in its ground state can absorb.

30. Find the expectation value <x> of the position of a particle trapped in a box L wide.

31. Find out the normalization constant 'A' of the azimuthal wave function for Hydrogen atom, with $\Phi = Ae^{im\Phi}$.

$(4 \times 4 = 16 \text{ marks})$

Section E

Answer any two questions.

32. What is Compton effect ? Derive the expression for shift in the wave length ? Write the salient features of Compton effect.

33. Derive the energy eigen values and eigen function of partied confined in a box.

34. Obtain the Schrodinger equation for Hydrogen atom in spherical polar co-ordinates and obtain the differential equation for r, θ, φ by using separation of variable method.

35. What are matter waves ? Derive the expression for wavelength of matter waves. Describe Davisson- Germer experiment to establish the wave nature of particle.

$(2 \times 10 = 20 \text{ marks})$