

**B. Sc. DEGREE END SEMESTER EXAMINATION - OCTOBER 2018****SEMESTER – 3: PHYSICS (COMPLEMENTARY FOR B.Sc. MATHEMATICS)****COURSE: 15U3CPPHY5: – QUANTUM MECHANICS, SPECTROSCOPY, NUCLEAR PHYSICS,  
BASIC ELECTRONICS AND DIGITAL ELECTRONICS***(For Regular - 2017 Admission and Supplementary / Improvement 2016 & 2015 & 2014 Admissions)*

Time: Three Hours

Max. Marks: 60

**PART - A (Very short answer questions)**(Answer **all** questions. Each question carries 1 Mark)

1. State Planck's quantum hypothesis.
2. What is the physical significance of a wave function?
3. What are the main features of vector atom model?
4. Explain zero point energy of a simple harmonic oscillator.
5. Define packing fraction.
6. What is meant by quadrupole moment of a nucleus?
7. Write diode equation and explain the parameters.
8. Define current gain for a transistor in the CE configuration.
9. Give the truth table of a NOR gate.
10. Convert  $(2C4)_{16}$  into its binary equivalent. (1 x 10 = 10)

**PART - B (Short Answer)**(Answer any **seven** questions. Each question carries 2 Marks)

11. Explain de Broglie's concept of wave function.
12. Distinguish between L-S and j-j coupling schemes.
13. Explain orbital and magnetic orbital quantum numbers in vector atom model.
14. Normalize the wave function  $\Psi = A \sin(n\pi x/L)$  of a particle in a one dimensional box of length L.
15. Give the features of nuclear forces.
16. Explain carbon dating.
17. Derive an expression for the gain of a negative feedback amplifier.
18. Convert  $(1011.011)_2$  into its decimal equivalent.
19. State and prove De-Morgan's theorem. (2 x 7 = 14)

**PART - C (Problem/Derivations)**(Answer any **four** questions. Each question carries 4 Marks)

20. The threshold wavelength of a metal is 5600 Å. Find the kinetic energy of an electron emitted from its surface when a radiation of wavelength 3500 Å. (Planck's constant is  $6.6 \times 10^{-34}$  Js)
21. Explain fine structure of hydrogen atom.

22. An electron is confined to move in a cubical box of side  $1 \text{ \AA}$ . Calculate the minimum uncertainty in its velocity. Given mass of electron =  $9.1 \times 10^{-31} \text{ kg}$  and  $h = 6.625 \times 10^{-34} \text{ Js}$ .
23. The atomic mass of  ${}^8\text{O}^{16}$  is 16.000 u. Calculate its binding energy per nucleon. Mass of proton = 1.007825 u and mass of neutron = 1.008665 u.
24. A transistor with  $\alpha = 0.98$  is connected in the CE configuration. If the collector current is 1.5mA find its base current.
25. Convert the following numbers: (a)  $(276.77)_8$  into decimal. (b)  $(926.223)_{10}$  into binary.

(4 x 4 = 16)

**PART D (Essay)**(Answer **two** questions. Each question carries 10 Marks)

26. Explain Davisson Germer experiment. Discuss the results.
27. Derive the exponential law of radioactive disintegration. Hence deduce the expression for half-life and mean life.
28. What is a zener diode? Draw its characteristics and mention the main features. With the help of a circuit diagram explain the working of a zener diode as an voltage regulator.
29. What is a full adder? Write its logic expression and truth table. Design a full adder using XOR, AND and OR gates.

(10 x 2 = 20)

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