

TB153480A

Reg. No: .....

Name: .....

**B. Sc. DEGREE (C. B. C. S. S.) EXAMINATION, OCTOBER 2016**  
**SEMESTER III – COMPLEMENTARY COURSE (PHYSICS)**  
**PH3CC3TB – QUANTUM MECHANICS, SPECTROSCOPY,**  
**NUCLEAR PHYSICS AND ELECTRONICS**

**(For Chemistry)**

**Time: Three Hours**

**Maximum Marks: 60**

**PART A**

**Short answer questions**

**I. Answer all questions. Each question carries 1 mark**

1. What do you mean by matter waves? Write down the equation for the de Broglie wavelength of matter waves.
2. List out four shortcomings of Bohr atom model.
3. What do you mean by transuranic elements? Give two examples.
4. State Soddy-Fajan's displacement law in radioactivity.
5. Write down the diode equation. Name the diode parameters.

**(5x1 = 5)**

**PART B**

**Brief answer questions**

**II. Answer any five questions. Each question carries 2 marks**

6. Briefly point out four reasons which led to the evolution of quantum mechanics.
7. What is the physical significance of a wave function? What do you mean by normalization of a wave function?
8. Explain briefly how Sommerfeld's relativistic correction explained the fine structure of spectral lines, with the help of  $H_{\alpha}$  fine structure diagram.
9. Write down the four general properties of a nucleus.
10. Define half life and mean life of a radioactive element. The disintegration constant of a radioactive element is 0.00231 per day. Calculate its half life and mean life.
11. Write a short note on radioactive dating.
12. Differentiate between intrinsic and extrinsic semiconductors with one example for each.
13. What do you mean by thermal runaway?

**(5x2= 10)**

**PART C**

**Descriptive Short essay questions**

**III. Answer any five questions. Each question carries 5 marks**

14. An electron has a velocity of  $6.6 \times 10^4$  m/s with an accuracy of 0.01%. Calculate the uncertainty in the position of the electron.
15. Show that the electrons accelerated through a potential difference of V volts will have a wave of wavelength  $\frac{12.27}{\sqrt{V}}$  Å associated with them. What voltage must be applied to an electron microscope to produce electrons of wavelength 0.5 Å.
16. The first member of Balmer series of Hydrogen atom has wavelength of 6563 Å. Calculate the wavelength of the second member of Balmer series.
17. A nucleus with mass number  $A = 235$ , splits into two nuclei, whose mass numbers are in the ratio 2:1. Find the radii of the new nuclei.
18. A reactor generates energy at the rate of  $32 \times 10^6$  watts. How many atoms of  $U^{235}$  undergo fission per second. Assume that on the average, an energy of 200 MeV is released per fission.
19. A certain radioactive element disintegrates for an interval of time equal to its mean life. What fraction of element remains? What fraction has been disintegrated?
20. Define current amplification factor. In a common base connection, current amplification factor is 0.9. If the emitter current is 1 mA, determine the value of base current.
21. A power supply A delivers 10V dc with a ripple of 0.5 V<sub>rms</sub> while the power supply B delivers 25V dc with a ripple of 1 mV. Which one is a better power supply? Justify your answer.

**(5x5 = 25)**

## PART D

### Long essay type questions

#### IV. Answer any two questions. Each question carries 10 marks

22. What is the significance of Schrodinger equation in Quantum Mechanics? Derive the time independent Schrodinger equation in three dimensions.
23. Explain the postulates of Vector atom model. Briefly explain the quantum numbers associated with vector atom model.
24. Differentiate between natural and artificial radioactivity with examples. Write down four properties each for alpha, beta and gamma rays.
25. Explain the function of a rectifier circuit. Define ripple factor. Derive expressions for the ripple factor and efficiency of a half wave rectifier.

**(2x10 = 20)**