E 4245 (Pages : 3) Reg. No.....

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# B.Sc. DEGREE (C.B.C.S.S.) EXAMINATION, OCTOBER 2012

## Third Semester

Complementary Course : QUANTUM MECHANICS, SPECTROSCOPY, NUCLEAR PHYSICS AND ELECTRONICS

(Common for B.Sc. Chemistry and B.Sc. Geology)

Time : Three Hours Maximum Weight : 25

## Part A (Objective Type Questions)

*Answer* **all** *questions.*
*Weight* 1 *for each bunch.*

Bunch I

1. The minimum frequency of radiation at which the emission of photoelectrons begins is called :
   (a) Doppler frequency. (b) Threshold frequency.
   (c) Resonance frequency. (d) None of these.
2. The electrons revolve around the nucleus like planets around the sun. This is due to :
   (a) Bohr. (b) Thomson.
   (c) Rutherford. (d) Chadwick.
3. The mass defect per nucleus is :
   (a) The binding energy. (b) The packing fraction.
   (c) The nuclear energy. (d) None of these.
4. A small amount of gallium to a pure semiconductor yields to :
   (a) *p*-type. (b) *n*-type.
   (c) np junction. (d) none of these.

Bunch II

5. The minimum energy required to liberate an electron from a metal surface is :
   (a) Work function. (b) Eigen value.
   (c) Eigen function. (d) None of these.
6. The spectra in the UV region of hydrogen atom is :
   (a) Paschen series. (b) Pfund series.
   (c) Balmer series. (d) Lyman series.
7. Every radionuclide has a characteristic :
   (a) Nature. (b) Stability.
   (c) Half life. (d) All the above.

**Turn over**

8. The applied reverse bias appears as forward bias to :
   (a) Majority carriers. (b) Holes.
   (c) Electrons. (d) Minority carriers.

Bunch III

9. The wave length of an electron accelerated through a potential difference of 100 volts in vacuum is :
   (a) 0.123 nm. (b) 12.3 nm.
   (c) 1.23 nm. (d) 123 nm.
10. Raman lines are strongly :
   (a) Scattreed. (b) Polarised.
   (c) Intense. (d) None of these.
11. Of the following which can be used as a moderator :
   (a) Graphite. (b) Ilminite.
   (c) Monazite. (d) None of these.
12. A npn transistor transfers signal from a low resistance region to a :
   (a) Low resistance region. (b) high resistance region.
   (c) no resistance region. (d) None of these.

Bunch IV

13. Wave function is a function of :
   (a) Space and time. (b) Space only.
   (c) Time only. (d) None of these.
14. The size of nucleus is of the order of :
   (a) $10^{-9}$. (b) $10^{-10}$m.
   (c) $10^{-12}$ m. (d) $10^{-15}$ m.
15. The charge of a nucleus is due to :
   (a) Electrons. (b) Protons.
   (c) Both neutrons and protons. (d) All the above.
16. Which of the following is applicable to base of a transistor ?
   (a) Lightly doped. (b) Heavily doped.
   (c) Moderately doped. (d) All of these.

$(4 \times 1 = 4)$

## Part B (Short Answer Questions)

*Answer any* **five** *questions.*
*Each question carries a weight of* 1.

17. State and explain Planck's quantum hypothesis.
18. What is photoelectric threshold ? Explain.

19. Briefly narrate Somerfiled's relativistic atom model.
20. What is Bhor magneton ?
21. Explain carbon dating.
22. What is a breeder reactor ?
23. Write down diode equation.
24. What is the purpose of feedback in amplifiers ? Explain.

(5 × 1 = 5)

## Part C (Short Essay/Problems)

*Answer any* **four** *questions.*
*Each question carries a weight of* 2.

25. The threshold wavelength of photoelectric emission in tungsten is 230 nm. What wavelength of light must be used in order for electrons with a maximum energy of 1.5 ev to be ejected.
26. Determine the wavelength associated with an electron moving with a velocity $1.6 \times 10^6$ $ms^{-1}$.
27. The life time of an excited state of an atom is about $10^{-9}$ seconds. Calculate the uncertainty in the determination of the energy in the excited state.
28. Calculate the shortest wavelength of the spectral line which can be obtained from hydrogen spectrum. $R = 1.099 \times 10^7$ $m^{-1}$.
29. Find the atomic mass of $^{10}Ne_{20}$ if the binding energy of neon is 160.64 MeV.
30. A power supply provides 100 mA at 20 V dc. It uses a capacitive filtering and is driven from a 50 Hz source. If C = 1000 μF, find the ripple factor for full wave rectification.

(4 × 2 = 8)

## Part D (Essay)

*Answer* **two** *questions.*
*Each question carries a weight of* 4.

31. Discuss vector atom model. Bring out the salient features of vector atom model.
32. Describe the construction and working of a fusion nuclear reactor.
33. Explain the working of a bridge rectifier and derive expressions for efficiency and ripple factor.

(2 × 4 = 8)