E 2091 (Pages : 3) Reg. No.....

Name.....

B.Sc. DEGREE (C.B.C.S.S.) EXAMINATION, OCTOBER 2011

Third Semester

Complementary Course—QUANTUM MECHANICS, SPECTROSCOPY, NUCLEAR PHYSICS, BASIC ELECTRONICS AND DIGITAL ELECTRONICS

(For Mathematics and Statistics)

Time : Three Hours Maximum Weight : 25

Part A (Objective Type Questions)

Answer all *questions.*
Each bunch of four questions carries a weight of 1.

Bunch I

1. The momentum of a photon is given by :

   (a) $h\gamma$. (b) $h\gamma/c$.
   (c) $h\gamma\lambda$. (d) $h\gamma$.

2. Raman lines are strongly :

   (a) Polarized. (b) Intense.
   (c) Optically active. (d) Fluorescent.

3. The resistance of a *pn* junction depends on :

   (a) The magnitude of the current flowing in it.
   (b) The magntiude of the voltage across it.
   (c) The direction of current flowing in it.
   (d) None of these.

4. A lightly doped diode has a :

   (a) Lower breakdown voltage. (b) Higher breakdown voltage.
   (c) Lower reverse voltage. (d) None of these.

Bunch II

5. When visible light is used instead of UV radiation, the photoelectric work function of the metal :

   (a) Becomes zero. (b) Increases.
   (c) Remains unchanged. (d) Decreases.

6. The beta rays are electrons :

   (a) Orbiting around the nucleus. (b) Emitted by radioactive nucleus.
   (c) With EM radiations. (d) None of these.

Turn over

7. *npn* transistors are preferred to *pnp*, because they have :

(a) Low cost. (b) Low dissipation energy.

(c) High mobility of energy. (d) All the above.

8. A transistor biasing circuit ensures proper zero signal :

(a) Emitter current. (b) Base current.

(c) Collector current. (d) None of these.

Bunch III

9. The blue color of the sky is due to :

(a) Red light absorbed. (b) Blue light scattered.

(c) Red light scattered. (d) None of these.

10. All nuclai have nearly :

(a) The same density. (b) Constant density.

(c) Same volume. (d) Same mass.

11. In a half wave rectifier, the rectifier conducts current only during the :

(a) Positive half cycles of input a.c. (b) Negative half cycles of input a.c.

(c) Negative half cycles of output a.c. (d) None of these.

12. The binary equivalent of decimal number 25 is :

(a) 10001. (b) 11001.

(c) 10011. (d) 10101.

Bunch IV

13. The angular speed of electron in the nth Bohr orbit is proportional to :

(a) n. (b) $n^{1/2}$.

(c) n^2. (d) n^3.

14. The binding energy is the energy equivalent of :

(a) Packing fraction. (b) Mass defect.

(c) One amu. (d) None of these.

15. For the conversionof a.c into d.c which of the following is preferred ?

(a) Half-wave rectifier.

(b) Full-wave rectifier.

(c) Both half-wave rectifier and full-wave rectifier.

(d) All the above.

16. Which of the following represents De Morgan's first theorem ?

(a) $X + Y = \overline{X} \cdot \overline{Y}$. (b) $\overline{X} + \overline{Y} = \overline{X}\,\overline{Y}$.

(c) $\overline{X}\,\overline{Y} = \overline{X} \cdot \overline{Y}$. (d) None of these.

(4 × 1 = 4)

Part B (Short Answer Questions)

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

17. What are matter waves ? Explain.
18. Briefly explain quantum theory of Raman Effect.
19. List the salient features of Bohr atom model.
20. Write down the time independent Schrödinger equation.
21. Explain biasing of a transistor.
22. Distinguish between mean life and half life.
23. What is doping ? Explain.
24. What is a NOT gate ? Give the truth table.

$(5 \times 1 = 5)$

Part C (Short Essay/Problem)

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

25. Light of wavelength 200 nm falls on aluminium surface with work function 4.2 eV. Calculate threshold wavelength.
26. The energy of a state of hydrogen atom is 5.36 eV and the energy of another state is 3.45 eV. Determine the wavelength of light emitted when the atom makes a transition from one state to another.
27. For HCl, the successive separation of the lines in the far infra red is 20.68 $cm.^{-1}$ Calculate the rotational constant B.
28. One gram of radioactive material having a half life of 2 years is kept in store for a duration of 4 years. Calculate how much of the material remains unchanged.
29. In a silicon transistor, a change of 7.89 mA in the emitter current produces a change of 7.8 mA in the collector current. What change in the base current is needed to produce an equivalent change in the collector current ?
30. Illustrate the use of NAND gate as digital building blocks for NOT gate and NOR gate.

$(4 \times 2 = 8)$

Part D (Essay)

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

31. What are Planck's hypothesis ? Derive an expression for Planck's law of radiation.
32. How does the Bohrs theory of hydrogen atom, explain the different series of spectral lines of hydrogen ?
33. Describe the action of a transistor. What is the common transistor configuration to be used as an amplifier ? Deduce an expression for voltage gain.

$(2 \times 4 = 8)$