Exam Code: 171806   Paper Code: 6180

(20)

Programme: Bachelor of Science (Honours) Physics

Semester-VI

Course Title: Radiation and Particle Physics

Course Code: BOPL-6391

Time Allowed: 3 Hours   **Max Marks: 60**

Note: Attempt FIVE questions, selecting at least one question from each section. The FIFTH question may be attempted from any Section. Each question carries 12 marks. Students can use scientific calculator or logarithmic table.

SECTION A

1. Write a Short note on each of the following:

    (i) Pair production

    (ii) Bragg Curve

    (iii) Bremsstrahlung radiation   (4+4+4)

2. (a) Describe the process of photoelectric effect and pair production.   (8)

    (b) Why does photoelectric effect occur for bound electrons only?   (4)

SECTION B

3. Discuss scintillation detector in detail. Why NaI detector is activated with thallium (Tl) (12)

4. Explain the principle and Working of a G.M. counter. What is the function of quenching gas in GM tube?
(12)

SECTION C

5. Describe the principle, construction and Working of a cyclotron. What is the limitation of a cyclotron for a relativistic particle? (12)

6. Discuss in detail the process of particle acceleration in a linear accelerator. (12)

SECTION D

7. Discuss the four fundamental forces of nature. Why the range of strong force is short despite the mass of gluon is zero? (12)

8. (a) Discuss with an example the conservation law of baryon number, strangeness and linear momentum.
(9)

(b) Which conservation law is violated in the following interaction?

(i) $e^+ + e^+ \longrightarrow \mu^+ + \mu^+$

(ii) $\Lambda^0 \longrightarrow \pi^0 + \pi^0$

(iii) $n \longrightarrow p + \gamma$ (3)

Exam Code: 171806   Paper Code: 6181
                    (20)

Programme: Bachelor of Science (Honours) Physics
Semester-VI

Course Title: Condensed Matter Physics – II

Course Code: BOPL-6392

Time Allowed: 3 Hours   Max Marks: 60

NOTE: Attempt five question in all selecting at least one from each section. Fifth question can be attempted from any section. Each question carries 12 marks. Use of log tables and scientific calculator is allowed.

SECTION A

1. What is the difference between photons and phonons? Discuss the inelastic scattering of photons by phonons and obtain an expression for the frequency of phonons emitted in the process.   12

2. Discuss the Debye's theory of specific heat of solids and explain that it is able to explain correct behaviour of solids at low temperatures. What are its limitations?

                                                    12

SECTION B

3. a) What is superconductivity? What is Meissner's effect in superconductors?   6

b) What do you mean by Critical magnetic field? Distinguish between type I and Type II superconductors? 6

4. a) Show that flux is quantised in a superconducting ring. 6

b) How does specific heat and thermal conductivity of superconductor varies as compared to normal conductor? 6

SECTION C

5. What are various sources of polarization? Derive the relevant expressions for each contribution. 12

6. a) Derive the Clausius-Mossotti relation between polarizability and dielectric constant of a dielectric. 6

b) What are ferroelectric and piezoelectric materials? Explain them in brief. 6

SECTION D

7. How nanomaterials are classified? Discuss in brief the following
   i) Fullerenes
   ii) Graphene
   iii) Carbon nanotubes 12

8. What is scanning electron microscope? Give its principle, construction and working. 12

Programme: Bachelor of Science (Honours) Physics
Semester-VI

Course Title: Molecular Spectroscopy and Laser

Course Code: BOPL-6393

Time Allowed: 3 Hours   **Max Marks: 60**

Note: Attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any section. Each question carries 12 marks. Students can use scientific calculator or logarithmic table.

Section A

1. (a) Explain technique and instrumentation of microwave
    spectroscopy.   (6)
    (b) What are the different types of molecular spectra
    and explain Born Oppenheimer Approximation.
                                                           (6)

2. a) Explain the effect of isotropic substitution and
    diatomic molecule as non rigid rotator.   (10)
    b) The force constant of HF^{19} molecule is 966N/m. Find
    the frequency of vibration of the molecule.   (2)

Section B

3. What is Raman Effect? How is it explained quantum mechanically? Show that frequency difference in Ramn lines is twice the frequency difference between successive lines in a pure rotational spectrum of a molecule. (12)

4. a) Explain the principle features of the electronic band spectrum of a diatomic molecule. Explain the rule of mutual exclusion. (9)

   b) A substance shows a Raman line at 4567Å when exciting line 4358 Å is used. Deduce the positions of stokes and antistokes lines for that substance when exciting line 4047 Å is used. (3)

Section C

5. (a) Discuss the components of laser and lasing action by explaining three and four level lasing techniques.
   (6)

   (b) Derive Schawloe-Townes condition for laser oscillations. (6)

6. Explain with suitable graphs and expression, the variation of absorption co-efficient with frequency of incident light in optical absorption. Derive the fauchber lendenberg formula (12)

Section-D

7. (a) What is Q-switching? Explain the various Q-switching systems (8)

   (b) The laser beams are highly directional and laser is essentially a converter of energy. explain. (4)

8. Explain the principle, construction, working and laser beam characteristics of CO_2 and Dye laser.

   (12)

Programme: Bachelor of Science (Honours) Physics
Semester-VI

Course Title: Digital Electronics and Applications

Course Code: BOPL-6394

Time Allowed: 3 Hours   Max Marks: 60

Note: Attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any section. Each question carries 12 marks. Students can use scientific calculator or logarithmic table.

Section A

1. (a) Convert the following decimal numbers to BCD numbers
    (i)   4
    (ii)   24
    (iii)   907
    (iv)   5361   (6)

    (b) Write a note on analog and digital signals. List its application and advantages of digital signals

                                                          (6)

2. (a) Discuss in detail about A/D Conversion method

    (6)

    (b) Convert the following
    (i) $(11011)_2$ to an equivalent decimal number
    (ii) $(735)_8$ to an equivalent decimal number
    (iii) $(2A5B)_{16}$ to a decimal equivalent   (6)

Section B

3. Write a note on each of the following
    (i)   AND and NOT Gates using transistors
    (ii)   DeMorgan's theorem
    (iii)   four variable K map   (12)

4. Simplify the following function using K maps
    (i) $F(ABC) = \sum m(1,3,4,5,7)$
    (ii) $f(wxy) = \sum(3,5,6,7)$
    (iii) $Y(ABCD) = \sum(0,2,4,5,6,7,8,10,12,14)$

    (12)

Section C

5. Explain the following with logic circuit
    (a) Half Subtractor
    (b) Full Adder
    (c) Comparator circuit

    (12)

6. Discuss in detail each of the following
    (a) R S Flip Flop and De Multiplexer
    (b) JK Flip Flops
    (c) Edge triggered Flip Flops.

    (12)

Section D

7. (a) Explain the working of Monostable Multivibrator

    (6)

    (b) Explain each of the following   (6)
    (i) Ring Counter
    (ii) Decade Counter

8. Explain the working of the following   (6)
    (i) Synchroncus Counter
    (ii) Astable Multi Vibrator
    (b) Discuss in detail each of the following   (6)
    (i) R.O.M
    (ii) R.A.M
    (iii) E.P.R.O.M