UG (CBCS) IInd Year Annual Examination

2089

B.Sc. PHYSICS

(Waves and Optics)

(DSC ID)/Core

Paper : PHYS 202 TH

Time : 3 Hours]　　　　　　　　　　**[Maximum Marks : 50**

Note :– Attempt *five* questions in all. The question paper consists of five Sections. Section A is compulsory. Sections, B, C, D and E consist of *two* questions each. Select *one* question from each Section.

Section–A

1. Compulsory question :

   (i)　What are the factors on which the natural frequency of an oscillator depend ?

   (ii)　What is the difference between positive and negative crystals ?

   (iii)　What is relaxation time and how is it related to damping coefficient ?

CH–808　　　　　　　(1)　　　　　　　**Turn Over**

(iv) What do you mean by induction coupling ?

(v) What is a figure of merit of vibration ?

(vi) Show that $y = x^2 + c^2 t^2$ is a solution of one dimensional wave equation.

(vii) What is the difference between normal dispersion and anomalous dispersion ? $2 \times 7 = 14$

Section–B

2. (a) Write the equation of motion of a damped simple harmonic system. What are the solutions of the equation ?

   (b) Deduce the frequency and quality factor of a circuit with :

   $$L = 10 \, \mu H, \ C = 5 \, \mu F \ \text{and} \ R = 2 \, \Omega.$$ 5,4

3. (a) Derive the expression for the time period of oscillation of two spring connected in :

   (i) Parallel combination

   (ii) Series combination

   (b) If the displacement equation of SHM be

   $$x = A \sin(\omega t + \phi),$$

   show that the velocity v and acceleration a satisfy the equation $\omega^2 v^2 + a^2 = A^2 \omega^4$.   5,4

CH–808

(2)

Section–C

4. (a) Show that the maximum displacement of a forced damped oscillator by a force $F = F_0 \cos \omega t$ and having damping constant r is given by :

$$A_{max} = \frac{F_0}{\omega' r}, \text{ where } \omega' = \sqrt{\frac{s}{m} - \frac{r^2}{4m^2}}$$

(b) The voltage of 200 V is applied to a series LCR circuit, having R = 20 Ω, L = 10 μH and C = 0.01 μF. Calculate :

(i) Natural frequency

(ii) Q value of circuit at resonance

(iii) Bandwidth of the circuit   5,4

5. (a) Define and explain normal co-ordinates and normal modes of vibration in coupled oscillators.

(b) What is the difference between in phase and out of phase modes ?   5,4

Section–D

6. (a) Discuss how transverse waves are reflected and transmitted at the boundary. Find refraction and transmission coefficients.

(b) Define phase and group velocity. Find the relation between them.   5,4

CH–808   (3)   Turn Over

7. (a) Derive laws of refraction from Huygen's principle.

(b) A soap film 6×10^{-5} cm thick is viewed at an angle of $30°$ to the normal. Find the wevelengths of the light in the visible spectrum which will be absent from the reflected light ($n = 1.33$). 5,4

Section-E

8. (a) Distinguish between Fresnel and Fraunhoffer type diffraction. Discuss Fraunhoffer diffraction at a double slit and the position of maxima and minima.

(b) A narrow slit illuminated by light of wavelength 6.4×10^{-5} cm is placed at a distance 3 metres from a straight edge. If the distance between the straight edge and screen is 5 m, calculate the distance between first and fourth dark band. 5,4

9. (a) Describe the construction and working of a Nicol prism. How is it used as a polarizer and analyser ?

(b) What is double refraction ? How will you get circularly and elliptically polarized light ? 5,4

Total No. of Questions : **9**]   [Total No. of Printed Pages : **4**

(2042)

UG (CBCS) Ist Year Annual Examination
2008
B.Sc. PHYSICS
(Electricity, Magnetism and EMT)
(Core)
Paper : PHYS 102

Time : 3 Hours]   **[Maximum Marks : 50**

Note :– Attempt *five* questions in all, selecting *one* question each from Sections B, C, D and E and *seven* sub-questions from Section A. Question No. **1** (Section A) is compulsory.

Section–A

(Compulsory Question)

1. (i) Show that :

$$\vec{A} = 3y^2 z^2 \,\hat{i} + 3x^3 z^2 \,\hat{j} - 3x^2 y^2 \,\hat{k}$$

is a solenoidal vector field.

(ii) Ohm's law fails in some cases; why ?

CH–727   (1)   Turn Over

(iii) If the electric field near the earth's surface be 300 V/m directed downwards, then find the surface charge density on the earth surface.

(iv) What is Ampere's circuital law ?

(v) When a current is passed in a solenoid having loose windings, the solenoid slightly contracts; why ?

(vi) Can we give any desired charge to a capacitor filled with some dielectric substance ? Explain it.

(vii) Why is ferromagnetism not found in liquids and gases ?

(viii) What is Skin Depth ? What is its value for a perfect conductor ?

(ix) What is the phase difference between electric field and magnetic field of EM waves travelling in a conducting medium ? $7 \times 2 = 14$

Section–B

2. (a) State and prove Gauss-Divergence theorem.

(b) If $\vec{A} = -y\hat{i} + x\hat{j}$, find $\text{curl} \vec{A}$ and $\oint_C \vec{A} . \vec{dl}$ for a closed curve $x^2 + y^2 = r^2$, $z = 0$ and verify Stokes' theorem. 5,4

CH–727 (2)

3. (a) Apply Gauss theorem of electrostatics to find the electric field at a point lying outside, on the surface and inside a uniformly charged non-conducting solid sphere.

   (b) Find the microscopic form of Ohm's law $\left(\vec{J} = \sigma \vec{E}\right)$; where $\vec{J}$, σ and $\vec{E}$ are respectively current density, conductivity of the conductor and electric field. 6,3

Section–C

4. (a) Find the expression for electric field of a point charge moving with constant velocity.

   (b) The vector potential at a point P(x, y, z) is given by $\vec{A} = 5(x^2 + y^2 + z^2)\hat{i}$. Evaluate the magnetic field at a point (1, 2, 3). 6,3

5. (a) Derive Claussius-Mossotti equation.

   (b) What is Hall effect ? Find the expression for Hall constant. 6,3

CH–727 (3) Turn Over

Section–D

6. (a) Explain diamagnetism and paramagnetism on the basis of orbital motion and spin of the electrons.

   (b) Establish the relation $\vec{\nabla}.\vec{D} = \rho_{free}$. 6,3

7. (a) What is atomic polarizability ? Derive its expression. What are its dimensions ?

   (b) What are Ferrites ? How are they useful for us ? 6,3

Section–E

8. (a) What is Poynting vector ? State and prove Poynting theorem.

   (b) What are Maxwell's equation for EM waves ? Give their physical interpretation. 6,3

9. (a) What is the impedance of a medium to EM waves ? Find the expression for the impedance of a dielectric medium to EM waves.

   (b) Show that the equation of continuity is contained in Maxwell's equations for EM waves. 6,3

CH–727 (4)

UG (CBCS) Ist Year Annual Examination

2007

B.Sc. PHYSICS

(Mechanics)

(Core)

Paper : PHYS 101 TH

Time : 3 Hours]   [Maximum Marks : 50

Note :– Attempt *five* questions in all, selecting *one* question each from Sections B, C, D and E. Question No. 1 (Section A) is compulsory.

Section–A

(Compulsory Question)

1. (i) Differentiate between linear and non-linear differential equations.

(ii) What are left handed and right handed co-ordinate systems ?

(iii) What do you mean by homogeneity of space ?

(iv) What is non-inertial frame of reference ?

(v) What is a turning point of a body moving under central force field ?

(vi) What is angular momentum ? Give its S.I. unit.

(vii) What is the final result of Michelson-Morley experiment ?   2×7=14

Section–B

2. (a) Derive an expression for the velocity of a particle moving in a plane in polar co-ordinates.

   (b) Motion of a particle is described by the equation $x = 4 \sin 2t$, $y = 4 \cos 2t$, $z = 6t$. Find velocity and acceleration of the particle.   5,4

3. (a) What is Coriolis Force ? Derive an expression for it.

   (b) Prove that homogeneity of time leads to law of conservation of energy.   5,4

CH–726   (2)

Section–C

4. (a) Obtain equation of motion for equivalent one body problem for two masses. Also explain the concept of reduced mass.

   (b) State and explain Kepler's first law of planetary motion.   5,4

5. (a) What do you understand by central and non-central forces ? Establish the differential equation of motion under central force and deduce its solution.

   (b) Show that the angular momentum of a particle moving under a central force is constant.   5,4

Section–D

6. (a) What do you mean by Torque ? Derive its expression along three axes. What is the physical meaning of torque ?

   (b) Derive the relation between torque and angular momentum.   5,4

CH–726 (3)

7. (a) Explain the laboratory and centre of mass system. Discuss the elastic collision between two particles in the lab system.

(b) Prove that the kinetic energy of the system in centre of mass frame is always less than kinetic energy in the laboratory frame. 5,4

Section–E

8. (a) What was the essential aim of Michelson-Morely experiment ? Discuss the significance of the result obtained.

(b) Discuss the postulates of Einstein's special theory of relativity. 5,4

9. (a) Derive the formula for relativistic variation of mass with velocity.

(b) At what speed a particle is moving, if its mass is equal to four times its rest mass ? 5,4

Total No. of Questions : **9**]　　[Total No. of Printed Pages : **4**

(2042)

UG (CBCS) IInd Year Annual Examination

2088

B.Sc. PHYSICS

(Statistical and Thermal Physics)

(DSC 1C)/Core

Paper : PHYS 201 TH

Time : 3 Hours]　　　　　　　　**[Maximum Marks : 50**

Note :– Attempt *five* questions in all, selecting *one* question from each Section–B, C, D and E and seven sub-questions from Section–A. Question No. **1** is compulsory.

Section–A

(Compulsory Question)

1. Attempt all the seven sub-questions :

(a) A pair of six faced dice with faces marked 1 to 6 is thrown simultaneously. What is the probability that the sum of numbers which show up is 10 ?

CH–807　　　　　(1)　　　　　Turn Over

(b) In which of the following statistics, no phase space can have more than one particle :

   (i)   M–B

   (ii) B–E

   (iii) F–D

   (iv) All of these

(c) What are bosons ? State the statistics followed by them.

(d) State Clausius's statement of second law of thermodynamics.

(e) The combined entropy of the mixture of two systems with entropies S_1 and S_2 :

   (i) $S_1 \times S_2$

   (ii) $S_1 - S_2$

   (iii) $S_1 + S_2$

   (iv) S_1/S_2

(f) Define critical temperature.

(g) The unit of entropy is ....   2×7=14

Section–B

2. Show that the probability $P(r, n - r)$ of a macrostate $(r, n - r)$ is maximum when $r = \dfrac{n}{2}$ where :

$$P(r, n - r) = \frac{n!}{r!(n-r)!\,2^n}$$

9

3. (a) Write down in tabular form, the various microstates and macrostates of a system of 4 distinguishable particles arranged in 3 compartments.

   (b) Calculate the percentage error in using Stirling formula for $n = 7$.

6,3

Section–C

4. (a) Derive Planck's law for energy distribution of black body using Bose-Einstein distribution law.

   (b) Obtain Wein's displacement law and Stefan's law from Planck's law.

5,4

5. Using Maxwell-Boltzmann expression for distribution of velocity for an ideal gas :

$$n_v\,dv = \sqrt{2}\,\pi n \sqrt[3]{m/\pi kT}\, v_e^{2-mv^2/2kT}\,dv$$

CH–807   (3)   Turn Over

Obtain expression for :

(a) Root mean square speed

(b) Most probable speed
9

Section–D

6. (a) The second law of thermodynamics and law of increase of entropy are equivalent. Comment.

(b) Write a short note on death of the universe.
5,4

7. (a) What do you mean by entropy ? Obtain change in entropy in a reversible and irreversible process.

(b) Calculate change in entropy when 10 g of ice at 0°C is converted into water at the same temperature.
6,3

Section–E

8. What is Joule-Thomson effect ? Discuss it for liquefaction of Helium. Obtain an expression for change in temperature.
9

9. (a) Obtain TdS equations for isobaric, isochoric and isothermal processes.

(b) Obtain Clausius-Clapeyron equation from Maxwell's second thermodynamic relation :

$$\left(\frac{\partial S}{\partial V}\right)_T = \left(\frac{\partial P}{\partial T}\right)_V$$
5,4

CH–807

(4)

UG (CBCS) IIIrd Year (Annual) Examination

3226

B.Sc. PHYSICS

(Elements of Modern Physics)
(DSE-1A)
Paper : PHYS 301 TH

Time : 3 Hours]   **[Maximum Marks : 50**

Note :– Attempt *five* questions in all, selecting *one* question from each Section–B, C, D and E. Question No. **1** (Section–A) is compulsory.

Section–A

(Compulsory Question)   2 each

1. (a) Why Compton Shift is not observed with visible light ?

    (b) Why retarding potential applied to plate in Franck-Hertz Experiment ?

    (c) What is an Operator ?

(d) Give *two* reasons that electron cannot exist inside the Nucleous.

(e) What is Internal Conversion ?

(f) What is relation between activity and half life of radioactive substance ?

(g) What are properties of a good moderator ?

Section–B

2. (a) Deduce relation between angle of scattering of a photon and direction of recoil electron in Compton scattering.

   (b) A photon of wavelength 1.02 Å is scattered through 90° by free electron. Calculate change in wavelength of photon. 6,3

3. (a) Describe Franck-Hertz Experiment. How does this experiment shows discrete energy levels in an atom ?

   (b) State and prove Bohr's correspondence principle. 6,3

Section–C

4. (a) What is Heisenberg's uncertainty principle ? Apply this principle to calculate minimum energy of harmonic oscillator.

   (b) Using uncertainty principle calculate energy of particle confined to region of space. 5,4

5. (a) Derive time independent Schrödinger equation.

   (b) Normalize the wave function given by :

$$\psi(x) = \begin{cases} A \sin \dfrac{\pi x}{a}, & \text{for } 0 < x < a \\ 0, & \text{outside} \end{cases}$$

5,4

Section–D

6. What do you mean by particle in a box ? Determine energy levels and normalized wave functions for particle in a box. 9

7. (a) What is binding energy ? Explain variation of binding energy per nucleon with mass number (A).

   (b) What are magic numbers ? Give experimental evidence for their existance. 5,4

CH–26 (3) Turn Over

Section–E

8. (a) What are different modes of β-decay ? Under what conditions do they occur ?

   (b) Explain Geiger-Nuttal Law. Discuss its importance. 5,4

9. (a) What is a chain reaction ? What are factors on which escape of neutrons depends ?

   (b) Discuss construction and working of a nuclear reactor. 5,4

UGC (CBCS) VIth Semester (New) Examination

242

B.Sc. PHYSICS

(Nuclear and Particle Physics)
(DSE)
Paper : PHYS 601

Time : 3 Hours]   [Maximum Marks : 70

Note :– Attempt *five* questions in all *i.e.* Section–A is compulsory and select *one* question from each of the Sections B, C, D and E.

Section–A

(Compulsory Question)

1. (i)   During emission of β particle from a nucleus its .... changes.

   (a)   Atomic number

   (b)   Mass number

   (c)   Both (a) and (b)

   (d)   None of these

(ii) Two protons attract each other, when the distance between them is of the order of :

(a) 10^{-1} m

(b) 10^{-5} m

(c) 10^{-15} m

(d) None of these

(iii) The neutrino hypothesis was put forward by :

(a) Einstein

(b) Rutherford

(c) Pauli

(d) Dirac

(iv) Which of the following can be deflected by magnetic field ?

(a) X-rays

(b) γ-rays

(c) uv-rays

(d) β-rays

CH–442

(v)   Which physical quantity measures the deviation of a nucleus from the state of spherical symmetry ?

   (a)   Dipole moment

   (b)   Magnetic moment

   (c)   Quadrupole moment

   (d)   Moment of inertia

(vi)   The weakest interaction in nature is .... interaction.

   (a)   Weak

   (b)   Strong

   (c)   Electromagnetic

   (d)   Gravitational

(vii)   The nuclear cross-section has dimensions of :

   (a)   Area

   (b)   Volume

   (c)   Length

   (d)   Angle

CH–442　　　　　　　(3)

(viii) Which of the following combinations of quarks represents a proton ?

    (a)   uud

    (b)   udd

    (c)   dds

    (d)   uds

(ix) What do you mean by even-even nuclei ?

(x) What is the difference between fermions and bosons ?

(xi) What do you mean by threshold frequency in photoelectric effect ?

$2\times11=22$

Section–B

2. (a) What do you mean by binding energy of the nucleus ? Draw a graph between the binding energy per nucleon and mass number. What conclusions can be drawn from the curve ?

  (b) Calculate the energy in MeV equivalent to 1 a.m.u.

8,4

CH–442

(4)

3. (a) Discuss the assumptions, achievements and drawbacks of Nuclear shell model.

(b) Discuss the properties of nuclear forces. 6,6

Section-C

4. (a) Discuss the various possible ways in which a nucleus can decay to attain stability.

(b) Explain why the classical theory fails to explain the process of α decay and what are the assumptions of Gamow theory. 7,5

5. (a) What quantities are conserved in a nuclear reaction ? Define Q value of a nuclear reaction and discuss its physical significance.

(b) In a nuclear reaction :

$$_7N^{14} + {_0}n^1 \rightarrow {_6}C^{14} + {_1}H^1 + Q$$

Calculate the mass of $_6C^{14}$ in a.m.u.

(Given that the mass of $_7N^{14} = 14.00755$ a.m.u., $_1H^1 = 1.00815$ a.m.u., $_0n^1 = 1.00899$ a.m.u. and $Q = 0.55$ MeV.) 8,4

CH–442 (5)

Section–D

6. (a) Derive Bohr's formula for the energy loss of heavy charged particle through matter and explain the modification by Bethe and Block.

   (b) Find change in wavelength of an X-ray photon when it is scattered through an angle of 60°.   8,4

7. (a) Describe principle, construction and working of a GM counter. Why internal quenching is required in a GM tube ?

   (b) What are the advantages of scintillation counters ?   8,4

Section–E

8. (a) Describe the principle, construction and working of a cyclotron. Derive the expression for the maximum kinetic energy.

   (b) Why cyclotron cannot be used to accelerate electrons ?   8,4

CH–442   (6)

9. (a) Discuss the quantum numbers associated with elementary particles. Give the corresponding conservation laws.

(b) What are Quarks ? Discuss their properties. 8,4

CH–442 (7)

(2032)

UG (CBCS) IIIrd Year (Annual) Examination

3230

B.Sc. PHYSICS

(Quantum Mechanics)

(DSE–1B)

Paper : PHYS 305 TH

Time : 3 Hours]   [Maximum Marks : 50

Note :– Attempt *five* questions in all, selecting *one* question from each of the Sections B, C, D and E respectively. Question No. **1** (Section–A) is compulsory.

Section–A

(Compulsory Question)

1. (i) Which of the following is the condition for two wave functions Ψ_i and Ψ_j to be orthogonal ?

   (a) $\int \Psi_i \Psi_i^* d\tau = 1$

   (b) $\int \Psi_j \Psi_j^* d\tau = 1$

   (c) $\int \Psi_i \Psi_j^* d\tau = 1; \, i \neq j$

   (d) $\int \Psi_i \Psi_j^* d\tau = 0; \, i \neq j$

(ii) Which of the following is the correct description of uncertainty principle ?

(a) $\Delta x \cdot \Delta p_x \geq \hbar$ (b) $\Delta y \cdot \Delta p_x \geq \hbar$

(c) $\Delta z \cdot \Delta p_x \geq \hbar$ (d) All of these

(iii) What is the zero-point energy of a Harmonic Oscillator ?

(a) 0   (b) $h\nu$

(c) $\dfrac{1}{2}\hbar\omega$ (d) $\dfrac{3}{2}\hbar\omega$

(iv) What do you mean by degenerate eigen functions ?

(v) For $l = 0$, the possible value of 'j' is :

(a) $j = 0$ (b) $j = \dfrac{1}{2}$

(c) $j = \dfrac{3}{2}$ (d) $j = \dfrac{-1}{2}$

(vi) What do you mean by symmetric and antisymmetric wave functions ?

(vii) For a well behaved wave function which of the following is correct ?

(a) Wave function must be continuous

(b) Wave function must be single valued at every point of space

(c) Wave function must be finite

(d) All of these

2×7=14

CH–30   (2)

Section–B

2. (a) Develop time dependent one-dimensional Schrödinger equation for a particle under some force.

(b) A particle in one dimension has a wave function :

$$\Psi(x) = x^2; \qquad 0 < x < 1$$

$$\Psi(x) = 0; \qquad \text{All other regions}$$

Find the probability of finding the particle in

$$0 < x < \frac{1}{5}.$$ 5,4

3. Write short notes on the following :

(i) Eigen values

(ii) Energy and momentum operators

(iii) Zero-point energy 3×3=9

Section–C

4. What is Tunnel effect in quantum mechanics ? Derive an expression for the transmission co-efficient for the effect. Cite an example in Nuclear Physics where it is used to explain a phenomenon. 2,6,1

5. What is a Harmonic Oscillator ? Derive an expression for its energy levels. Also underline its importance. 9

CH–30 (3) Turn Over

Section–D

6. (a) Derive Schrödinger equation in spherical polar coordinates.

   (b) Explain the concepts of magnetic quantum number and space quantization. 5,4

7. What are Normal and Annomalous Zeeman effects ? Explain in detail on the basis of quantum mechanical treatment. 9

Section–E

8. What is fine structure of atomic spectra ? Explain it by spin-orbit interaction for the hydrogen atom. 9

9. (a) For a two-electron system, each with $l = 1$, $s = \dfrac{1}{2}$, find the possible values of 'J'.

   (b) Write down quantum numbers l, s, j for the following one-electron terms :

   $$^2S_{1/2}, \ ^2P_{3/2}, \ ^2F_{5/2}$$

   (c) What is the difference between a singlet and a triplet state ? Explain.

   3,3,3

CH–30 (4)

UG (CBCS) IIIrd Year (Annual) Examination

3232

B.Sc. PHYSICS

(Radiation Safety)

(SEC–3)

Paper : PHYS 307 TH

Time : 3 Hours]   **[Maximum Marks : 50**

Note :– Attempt any *five* questions.

1. (a) What is Q-value of a nuclear reaction ? Derive an expression for Q-value of a nuclear reaction in terms of masses and kinetic energies of incident particle, product particle and nuclei.

    (b) Calculate mass defect, binding energy and binding energy per nucleon for nickel nuclei Given : Mass of $_{28}Ni^{64}$ nucleus = 63.9126 a.m.u. m_p = 1.007285 a.m.u. m_n = 1.008665 a.m.u. 1 a.m.u. = 931 MeV.   7,3

2. What is Einstein's photoelectric equation ? Explain the experimental observation of photoelectric effect on the basis of this equation.　　　　10

3. (a) Explain the terms absorbed dose, effective dose and equivalent dose.

　　(b) Explain different natural sources of radiations in reference to exposure.　　　　6,4

4. (a) Explain principle, construction and working of ionization chamber.

　　(b) Differentiate between ionization chamber and G.M. counter.　　　　7,3

5. (a) What do you mean by biological effects of ionizing radiations ? Discuss them in detail.

　　(b) What is ICRP ? Explain its different principles.　7,3

6. (a) Explain principle, construction and working of Positron Emission Tomography (PET).

　　(b) What is Radiation Therapy ?　　　　7,3

CH–32　　　　(2)

7. Write short notes on the following :

   (i)   Bremsstrahlung

   (ii) Effects of nuclear radiations on human body   5,5

(2032)

UG (CBCS) IIIrd Year (Annual) Examination

3235

B.Sc. PHYSICS

(Renewable Energy and Energy Harvesting)
(SEC–4)
Paper : PHYS 310 TH

Time : 3 Hours]　　　　　　　**[Maximum Marks : 50**

Note :– Attempt *five* questions in all. All questions carry equal marks (10 marks each).

1. What do you mean by renewable energy ? Discuss the need of renewable energy. Give a brief account of various renewable energy sources.　10

2. What is Solar Energy ? Discuss in detail various practical applications of solar energy.　10

3. Write short notes on the following :

   (a) Wind farm

   (b) OTEC

(c) Tidal Barrage

(d) Tidal Lagoon

(e) Osmotic power   2×5=10

4. (a) What is Geothermal Energy ? Discuss Geothermal drilling.

(b) What is Hydroelectric power ? Discuss the environmental impacts of hydropower sources.   5,5

5. (a) Explain Piezoelectric effect and write its practical applications.

(b) Discuss Electromagnetic energy harvesting.   5,5

6. (a) What is Wind Energy ? Explain the principle of wind energy conversion and wind power generation.

(b) Discuss the major challenges and issues for exploiting wind energy.   5,5

7. (a) What are fossil fuels ? Discuss the environmental impacts of burning them.

(b) What is Nuclear Energy ? Discuss the advantages and disadvantages of nuclear energy. 5,5

CH–35   (2)

UGC (CBCS) IInd Semester (New) Examination

104

B.Sc. PHYSICS

(Electricity and Magnetism/Electricity Magnetism and EMT)

(Core)

Paper : PHYS201

Time : 3 Hours]　　　　　　**[Maximum Marks : 50**

Note :– Attempt *five* questions in all, selecting *one* question from each of the Sections-B, C, D, E. Question No. **1** of Section-A is compulsory.

Section–A

1. (a) What is the relation between electric field and electric potential ?

   (b) What is displacement vector ?

   (c) Define irrotational field.

   (d) What are the characteristics of conservative field ?

(e) What is the net charge on a charged capacitor ?

(f) What is vector potential ?

(g) On what factors does the magnetic flux linked with a coil depend ?   2×7=14

Section–B

2. (a) State and prove Gauss's Divergence Theorem.

   (b) Prove that if $\vec{C}$ is a constant vector, then $\vec{\nabla}(\vec{C}.\vec{r}) = \vec{C}$.   5,4

3. (a) What do you mean by divergence of a vector field ? Find its expression in Cartesian co-ordinates.

   (b) Prove that $\vec{\nabla}.\vec{\nabla}\,U = \nabla^2 U$.   5,4

Section–C

4. (a) Using Gauss's law, find the electric field due to uniformly charged sphere at a point which lies :

   (i)   inside the sphere

   (ii) on the sphere

   (iii) outside the sphere

   (b) Find the expression for capacitance for parallel plate capacitor.   5,4

CH-304   (2)

5. (a) Find an expression for the electric potential due to a point charge located at the origin.

(b) Show that in an electrostatic field $curl \ \vec{E} = 0$. 5,4

Section–D

6. (a) State and explain Biot-Savart's law.

(b) Using Ampere's law find the magnetic field due to an infinite hollow cylinder carrying current. 5,4

7. (a) Outline various properties of a magnet. Distinguish between diamagnetic, paramagnetic and ferromagnetic materials.

(b) Derive the relation between magnetic permeability and magnetic susceptibility. 5,4

Section–E

8. (a) Find the expression for energy stored in magnetic field.

(b) State and explain Faraday's laws of electromagnetic induction. 5,4

9. Deduce Maxwell's equations of electromagnetism. 9

CH–304 (3)

UGC (CBCS) VIth Semester (New) Examination

245

B.Sc. PHYSICS

(Renewable Energy and Energy Harvesting)
(SEC)
Paper : PHYS 607

Time : 3 Hours]   [Maximum Marks : 50

Note :– Attempt any *five* questions. Each question carries 10 marks.

1. Explain in brief :

   (a) Fossil fuels

   (b) Depletion of Ozone Layer

   (c) Global Warming

   (d) Nuclear Energy

   (e) Energy Audit   2×5=10

2. (a) What is Solar Energy ? Give some of its applications.

   (b) How is Solar Energy responsible for fossil fuels ? Explain it.

   (c) What are solar thermal hot water systems ?   5,3,2

3. (a) What is a wind turbine ? How does it work ? Differentiate between horizontal and vertical axis turbines.

   (b) Why is wind energy called green power ? Write down advantages and disadvantages of wind energy.   6,4

4. (a) What is wave energy ? Discuss the various wave energy devices.

   (b) What are the advantages of ocean energy ?   6,4

5. (a) What is Geothermal energy ? Discuss the various geothermal energy sources.

   (b) Differentiate between geothermal power plant and geothermal heat pump technology.   6,4

6. What is Piezoelectricity ? Explain :

   (a) Direct piezoelectric effect,

   (b) Converse piezoelectric effect. What are the applications of piezoelectric energy harvesting ? 10

7. What is Hydroenergy ? Classify hydropower plants on the basis of their capacity. Discuss in detail the impact of hydropower sources on the environment. 10

Total No. of Questions : 7]   [Total No. of Printed Pages : 2

(2042)

UGC (CBCS) VIth Semester (New) Examination

244

B.Sc. PHYSICS

(Weather Forecasting)

(SEC)

Paper : PHYS 606

Time : 3 Hours]   **[Maximum Marks : 50**

Note :– Attempt any *five* questions. Each question carries 10 marks.

1. (a) What is Atmosphere ? Discuss its composition and different layers.

    (b) How is temperature measured ? Discuss working of different thermometers in short.   6,4

2. (a) What are different forces responsible for Production of Wind ?

    (b) Discuss variation of pressure with latitude.   6,4

CH–444   (1)   Turn Over

3. (a) Discuss the various modes of heating and cooling of Atmosphere.

   (b) State Wien's displacement law.   6,4

4. (a) Classify the clouds, according to their height and further on the basis of their shapes.

   (b) Define atmospheric humidity. What are different methods to measure humidity ?   6,4

5. (a) What are air masses and their source regions ? Classify them depending upon latitude and nature of surface of the source region.

   (b) What is Thunderstorm ? Classify different types of thunderstorm.   6,4

6. (a) Discuss the term air pollution with its important categorizations.

   (b) Main causes of Acid rain.   6,4

7. (a) What is weather forecasting and what are different steps involved in weather forecasting ?

   (b) Discuss criteria to choose a weather map.   6,4

CH–444   (2)

Total No. of Questions : 7|　　　|Total No. of Printed Pages : **2**

(2032)

UG (CBCS) IIIrd Year (Annual) Examination

3233

B.Sc. PHYSICS

(Applied Optics)
(SEC-3)
Paper : PHYS 308 TH

Time : 3 Hours]　　　　　**[Maximum Marks : 50**

Note :– Attempt any *five* questions. All questions carry equal marks.

1. (a) Explain in detail the process of spontaneous emission and stimulated emission of radiations.

   (b) Find the number of photons emitted per second by a laser having wavelength 630 nm and output power 2 mW.　　　　6+4=10

2. What is population inversion ? Discuss the working of a semiconductor laser with the help of energy band diagram.

10

CH–33　　　　　(1)　　　　　Turn Over

3. What is Fourier transform spectroscopy ? Discuss in detail its applications in NMR spectroscopy. 10

4. (a) Discuss the basic principle and theory of a hologram.

   (b) Explain in detail the terms spatial and temporal coherence. 6+4=10

5. Discuss in detail applications of holography in interferometry. 10

6. What is an Optical Fibre ? Derive an expression for numerical aperture of an optical fibre. 10

7. (a) What is the difference between a single mode and multimode optical fibre ?

   (b) Explain the term total internal reflection. 6+4=10

Total No. of Questions : 7] |Total No. of Printed Pages : 4

(2042)

UGC (CBCS) IVth Semester (New) Examination

148

B.Sc. PHYSICS

(Electrical Circuits and Network Skills)
(SEC)
Paper : PHYS 402

Time : 3 Hours]   [Maximum Marks : 50

Note :– Attempt *five* questions in all. Question No. **1** is compulsory.

1. Attempt any *five* parts :

   (i)   What are active and passive elements in an electrical circuit ?

   (ii) What is the use of fuse in a circuit ?

   (iii) Define the term self-induction and mutual-induction.

CH–348   (1)   Turn Over

(iv) How can we convert galvanometer into a voltmeter and an ammeter ?

(v) What are Kirchoff's laws ?

(vi) What is the function of a Multimeter ?

(vii) What are different parts of a cable ?   2×5=10

2. (a) Describe the principle, construction and working of a moving coil galvanometer.

(b) Three resistances 75 Ω, 60 Ω and 20 Ω are connected in parallel. The total current is 1A. Determine the applied voltage and current in each branch.   6,4

3. (a) What is the meaning of circuit analysis ? Differentiate between mesh and loop. A 1000W heating element is connected to a 250 V AC supply voltage. Calculate the resistance of the element when it is hot.

(b) Discuss the star connection and delta connection in three phase system.   6,4

4. (a) What is a Control Circuit ? Explain the main components of it.

(b) What is a Power Circuit ? Explain it with a suitable diagram. 6,4

5. (a) What is a Transformer ? Discuss its construction, working and efficiency.

(b) Draw the symbols of :

(i) Battery

(ii) Resistor

(iii) Indicator

(iv) Switch 6,4

6. (a) Explain the response of a capacitor to AC with Phase diagram.

(b) A coil of inductance 150 mH and zero resistance is connected across a 100V, 50 Hz supply. Calculate the inductive reactance of the coil and the current flowing through it. 6,4

CH–348 (3) Turn Over

7. (a) Give detail of different types of electrical wires and cables.

(b) Draw the schematic diagram of single and three phase wiring. 6,4

CH–348 (4)

Total No. of Questions : **7**]   [Total No. of Printed Pages : **2**

(2042)

UGC (CBCS) IVth Semester (New) Examination

149

B.Sc. PHYSICS

(Basic Instrumentation Skills)

(SEC)

Paper : PHYS 403

Time : 3 Hours]   [**Maximum Marks : 50**

Note :– Attempt any *five* questions.

1. (a) Explain accuracy, precision and resolution of an instrument.

   (b) Four voltage measurements were recorded as 77.01V, 77.04V, 77.1V and 77.08V.

   Calculate average voltage and average deviation. 5,5

2. Discuss working of electronic voltmeter. Discuss different types of electronic voltmeters. 10

3. Discuss working of a CRO in detail. Explain how voltage can be measured with CRO. 10

4. (a) What is a wave analyzer ? Explain with the help of a diagram.

   (b) Discuss function generator with the help of block diagram. 5,5

5. With the help of diagram, discuss working and principle of Q meter. Explain its operation and write equation for Q meter. 10

6. Discuss working principle of different digital voltmeters. 10

7. Discuss time base stability, accuracy and resolution in frequency counter. 10

UG (CBCS) IIIrd Year (Annual) Examination

3229

B.Sc. PHYSICS

(Nuclear and Particle Physics)

(DSE-1B)

Paper : PHYS 304 TH

Time : 3 Hours]   **[Maximum Marks : 70**

Note :– Attempt *five* questions in all, selecting *one* question from each Section. Question No. **1** is compulsory.

Section–A

(Compulsory Question)

1. (i)   Magnetic moment of neutron is :

   (a)   Positive   (b)   Negative

   (c)   Zero   (d)   Infinite

   (ii)   Which has the highest penetrating power ?

   (a) α particles

   (b) β particles

   (c) γ rays

   (d)   All have the same penetrating power

CH–29

(iii) The decay constant of the end product of natural radioactive series is :

(a) Zero

(b) One

(c) Infinite

(d) π

(iv) A meson is a bound state of :

(a) 3 quarks

(b) 2 quarks

(c) 1 quark and 1 anti-quark

(d) 3 anti-quarks

(v) The values of Baryon number, Lepton number, Iso-spin, Strangeness number of neutron are :

(a) $1, 0, \dfrac{1}{2}, 0$

(b) $1, 1, \dfrac{1}{2}, 0$

(c) $0, 1, \dfrac{1}{2}, 1$

(d) $1, 0, 0, 1$

(vi) Nuclear forces are saturated forces. Explain.

(vii) What are Thermal Neutrons ?

(viii) What are the processes by which a γ-ray may lose its energy ?

(ix) What are Cerenkov radiations ?

(x) What is a Cyclotron ? How does it differ from a betatron ?

(xi) Give an example of each : Fermion, Boson, Baryon, Lepton.

$11 \times 2 = 22$

CH–29

(2)

Section–B

2. (a) Why electron cannot be a constituent part of the nucleus ? Explain in detail.

   (b) What is Binding Energy (BE) per nucleon ? What inferences can be drawn from BE per nucleon curve ?

   (c) Assuming that average mass of a nucleon is 1.67×10^{-27} kg and radius of a nucleus to be given $R = R_o A^{1/3}$, calculate the density of the nucleus ($R_o = 1.5 \times 10^{-15}$ m).   6,3,3

3. Describe the nuclear shell model. Show how 'magic numbers' are obtained in nuclear shell model. Describe limitations of nuclear shell model.   12

Section–C

4. Discuss Gamow's theory of α-decay and derive the expression for transmission coefficient for α-decay.   12

5. (a) Derive the expression for half life and mean life time of radioactive substance. What is the relation between these two ?

   (b) Explain neutrino hypothesis of β-decay.

   (c) Explain inverse β-decay.   6,3,3

Section–D

6. (a) What is Compton Effect ? Derive an expression for the change in wavelength of a scattered photon.

   (b) Why a photon cannot transfer its entire energy to the electron in Compton process ?

   (c) Explain why visible light cannot demonstrate Compton effect ?

   6,3,3

7. Describe the construction and working of Geiger-Muller (GM) counter. What do you mean by dead time and recovery time of GM counter ? Explain the differences between GM counter and proportional counter.

   12

Section–E

8. What are Quarks ? Discuss qualitative aspects of quark model. On the basis of quark model discuss quark content of mesons and baryons.

   12

9. (a) For each of the following decays state the conservation law that forbids it :

   (i) $n \to p + e^-$

   (ii) $n \to p + \gamma$

   (iii) $n \to \pi^+ + e^-$

   (b) Write a short note on composition of cosmic rays.

   (c) Write a short note on variation of cosmic rays intensity with latitude and altitude.

   6,3,3

CH–29 (4)

UGC (CBCS) IVth Semester (New) Examination

147

B.Sc. PHYSICS

(Waves and Optics)

(Core)

Paper : PHYS 401

Time : 3 Hours]   [Maximum Marks : 50

Note :— Attempt *five* questions in all. Select *one* question each from Sections B, C, D and E. Question No. 1 (Section–A) is compulsory.

Section–A

(Compulsory Question)

1. Attempt any *seven* parts :

    (i)   When two collinear harmonic oscillations of same amplitude (A), same frequency (ν) and

having zero phase difference superimpose then the resultant amplitude and frequency will be :

(a) 2A, v

(b) A, 2v

(c) 2A, 2v

(d) $\dfrac{A}{2}, \dfrac{v}{2}$

(ii) Which mode of light does the Newton rings experiment support ?

(a) Particle

(b) Wave

(c) Both of these

(d) None of these

(iii) Extra phase difference of .... radians is introduced in a wave reflected from optically denser medium.

(a) $\dfrac{\pi}{2}$

(b) π

(c) λ

(d) $\dfrac{\lambda}{2}$

CH–347

(2)

(iv) If a quarter wave plate is introduced between analyser and source of light and there is no transmission of light for one particular orientation then the light is :

   (a)   Unpolarised

   (b)   Circularly polarised

   (c)   Plane polarised

   (d)   Elliptically polarised

(v)   What are 'Beats' ? How are they produced ?

(vi)   What do you mean by normal and anomalous dispersion of waves ?

(vii)   The radius of the fourth half period zone is .... times the radius of the first half period zone.

(viii)   Write down the S.I. units of coefficient of viscosity.

(ix)   Differentiate between musical sound and noise.

$7 \times 2 = 14$

Section–B

2. (a) Discuss the superposition of two simple harmonic oscillations perpendicular to each other with different amplitudes and frequencies in the ratio of 2 : 1.

(b) Two simple harmonic oscillations having frequencies 60 Hz and 65 Hz are superimposed. Calculate the number of beats produced per second.

6+3=9

3. (a) What are stationary waves ? Discuss analytically the formation of stationary wave in a string of fixed length.

(b) A progressive wave travelling in a string is :

$$y = 50 \cos(0.2x - 5t)$$

Calculate the wavelength, frequency and the velocity of the wave.

5+4=9

CH–347

4. (a) What is viscosity ? How is it different from friction ? Discuss the Poiseuille's method for the determination of coefficient of viscosity using Poiseuille's formula.

(b) Water rises in a capillary tube, whereas mercury falls in the same tube. Explain. 6+3=9

5. (a) What is Fourier series ? Evaluate the coefficients of a Fourier series.

(b) What do you mean by Persistence of hearing and Threshold of hearing ? Explain. 6+3=9

Section–D

6. (a) Discuss the theory of interference by division of amplitude in thin films due to reflected light.

(b) What is Fresnel's biprism ? Draw the ray diagram to show how this prism can produce two coherent sources. 5+4=9

7. (a) When the movable mirror of Michelson interferrometer is shifted through 600×10^{-6} m a shift of 200 fringes is observed. Find the wavelength of light used.

(b) Why two independent sources of light cannot produce sustained interference pattern ? Explain.

(c) Why we need an extended source of light for interference by division of amplitude?   3+3+3=9

Section–E

8. (a) Discuss the Fraunhofer diffraction at a single slit. Hence deduce width of central fringe in its diffraction pattern.

(b) Find the highest order of Principal Maxima when a diffraction grating of grating element 1.5×10^{-6} m is illuminated by a light of wavelength 550 nm.   5+4=9

CH–347   (6)

9. (a) What do you mean by a quarter wave plate, half wave plate and full wave plate ? Which one of them can be used to produce circularly polarised light ?

(b) How a zone plate is different from a convex lens ? Explain.   6+3=9

Total No. of Questions : **9**]   [Total No. of Printed Pages : **4**

(2042)

UGC (CBCS) VIth Semester (New) Examination

243

B.Sc. PHYSICS

(Quantum Mechanics)

(DSE)

Paper : PHYS 602

Time : 3 Hours]   **[Maximum Marks : 50**

Note :– Attempt *five* questions in all, selecting *one* question from each Section. Question No. **1** (Section–A) is compulsory.

Section–A

(Compulsory Question)

1. (i) Which of the following represents probability of finding the particle in space ?

   (a) $\psi\psi^*$ (b) $\psi\psi d\tau$

   (c) $\psi^*\psi^* d\tau$ (d) $\psi\psi^* d\tau$

CH–443   (1)   Turn Over

(ii) The energy operator is :

(a) $i\hbar \dfrac{\partial}{\partial x}$ (b) $-i\hbar \dfrac{\partial}{\partial t}$

(c) $i\hbar \dfrac{\partial^2}{\partial t^2}$ (d) $i\hbar \dfrac{\partial}{\partial t}$

(iii) The energy of one-dimensional harmonic oscillator in second excited state is :

(a) Zero (b) $2\hbar\omega$

(c) $\dfrac{3}{2}\hbar\omega$ (d) $\dfrac{5}{2}\hbar\omega$

(iv) The maximum value of magnetic quantum number (m_l) for a given value of orbital quantum number (l) is :

(a) $l - 1$ (b) $2l - 1$

(c) $2l + 1$ (d) $l + 1$

(v) What is Bohr magnetron ? Give its value.

(vi) Differentiate between symmetric and antisymmetric wave functions.

(vii) Show that a hydrogen atom for a given value of n is n^2-fold degenerate.

$2 \times 7 = 14$

CH–443 (2)

Section–B

2. (a) What do you mean by expectation value ? Derive an expression for expectation value of momentum and energy.

(b) Prove that :

$$[x, p] = i\hbar \qquad 5,4$$

3. (a) Derive the differential equation for time independent Schrödinger equation.

(b) What is meant by momentum space-wave function ? 6,3

Section–C

4. (a) A particle incident on a potential step of height V_0 with energy $E > V_0$. Calculate the reflection and transmission coefficient.

(b) Calculate the minimum energy of an electron confined to a box 1Å across. 6,3

5. What is quantum mechanical tunneling ? An electron of mass m and total energy E is incident on a rectangular potential barrier of height V and width b. Derive an expression for the transmission probability. 9

CH–443 (3) Turn Over

Section–D

6. (a) Discuss the probability density of electron and shapes of hydrogen atom orbitals.

   (b) What are quantum numbers ? Discuss the physical significance of orbital quantum number. 5,4

7. (a) What do you mean by orbital magnetic dipole moment ? Derive an expression for it.

   (b) What is space quantization ? Explain 5,4

Section–E

8. (a) What is Zeeman effect ? Discuss the anomalous Zeeman patterns of sodium lines.

   (b) Find out the possible values of j and m_j for states in which $l = 3$. 6,3

9. (a) What is spin-orbit coupling ? How does it help in understanding fine structure ?

   (b) Find S, L and J values to the following states :
   $1D_2$, $3P_2$, $3F_4$, $2D_{3/2}$. 5,4

Total No. of Questions : 7]   [Total No. of Printed Pages : 3

(2032)

UG (CBCS) IIIrd Year (Annual) Examination

3234

B.Sc. PHYSICS

(Weather Forecasting)

(SEC–4)

Paper : PHYS 309 TH

Time : 3 Hours]   **[Maximum Marks : 50**

Note :– Attempt any *five* questions. Each question carries 10 marks.

1. (a) What do you understand by atmosphere ? Explain the different layers of the atmosphere, emphasizing the significance of each layer.

   (b) Derive an expression for Barometric Formula.   6,4

2. (a) What are the five horizontal forces that help to control and accelerate horizontal winds ? Give a brief account of each force.

   (b) What is SODAR ? Explain its principle, construction and working.   6,4

CH–34   (1)   Turn Over

3. (a) What are Tropical Cyclones ? How are they created ? Explain its main characteristics.

(b) Give a brief description of local thunderstorms in India.

6,4

4. (a) What is Global Warming ? Explain its main outcomes.

(b) What is the difference between :

(i) Weather and climate

(ii) Climate and climate change

(iii) Climate change and global warming

(iv) Primary and secondary pollutants ?

6,4

5. (a) What is Weather Forecasting ? Explain different methods of weather forecasting.

(b) Why do weather forecasts sometimes go wrong ?

6,4

6. (a) Explain the meaning of the terms 'site' and 'exposure'. What are the different kinds of general considerations while choosing an area for a site ?

(b) Draw different symbols used to illustrate the following meteorological phenomenon on weather maps :

(i) Wind Speed

(ii) Cloud Cover

(iii) Weather Fronts ·

(iv) Precipitation

6,4

7. (a) What is ozone layer depletion ? Explain its main causes, effects and control measures.

(b) Describe Koppen's classification of climate. 6,4

Total No. of Questions : **9**]

(2032)

[Total No. of Printed Pages : **4**

UG (CBCS) IIIrd Year (Annual) Examination

3227

B.Sc. PHYSICS

(Solid State Physics and Electronics)

(DSE-1A)

Paper : PHYS 302 TH

Time : 3 Hours]   **[Maximum Marks : 50**

Note :– Attempt *five* questions in all, selecting *one* question from each Section–B, C, D and E. Section–A is compulsory. Use of log table and non-programmable calculator is allowed.

Section–A

(Compulsory Question)

1. (i) Which of the following waves are used to study the crystal structure ?

    (a) X-rays

    (b) γ-rays

    (c) Infrared waves

    (d) None of these

CH–27   (1)   Turn Over

(ii) $\dfrac{h\nu}{k}$ has the dimension of (where k is Boltzmann constant and ν is the frequency) :

(a) Wavelength   (b) Velocity

(c) Energy   (d) Temperature

(iii) The feedback used in oscillators is .... feedback.

(a) Positive

(b) Negative

(c) Positive or Negative

(d) None of these

(iv) In common base configuration of a transistor the input resistance is always .... the output resistance.

(a) Greater than   (b) Less than

(c) Equal to   (d) None of these

(v) The approximate values of energy gap for semiconductors and insulators respectively are :

(a) 1 eV and 0.1 eV

(b) 0.2 keV and 0.4 eV

(c) 1 eV and 10 eV

(d) 100 MeV and 500 eV

(vi) What do you mean by ripple factor ?

(vii) Differentiate between photons and phonons. 2×7=14

CH–27

(2)

Section–B

2. (a) What are Miller Indices ? Derive an expression for the distance between two adjacent planes of a simple cubic crystal.

   (b) The primitive transnational vectors of the hexagonal space lattice are :
   $$\vec{a} = 2i + j, \quad \vec{b} = 2j, \quad \vec{c} = k$$
   Find the primitive translation vectors of the reciprocal lattice. 5,4

3. (a) Discuss the Debye model of specific heat of solids. What are its successes and failures ?

   (b) Explain Dulong and Petit's Law. What are the drawbacks of this law ? 6,3

Section–C

4. (a) Derive expression for the Fermi energy and density of states for a free electron gas in one dimension.

   (b) Find the Fermi velocity of electrons if the number density of electrons in sodium is 2.52×10^{28} m^{-3} at room temperature. 5,4

5. (a) On the basis of band theory of solids distinguish between metals, insulators and semiconductors.

   (b) What is Meissner effect of superconductivity ? How does it help in classifying different types of superconductors ? 5,4

Section–D

6. (a) Explain the use of p-n junction diode as a full-wave rectifier. Hence evaluate its ripple factor.

   (b) Discuss the VI characteristics of a p-n junction diode by drawing a circuit diagram for the reverse and forward biased diode. 5,4

7. (a) Draw the circuit diagram of a common emitter amplifier and its equivalent circuit in terms of h-parameters. Derive the expression for current and voltage gain.

   (b) For JFET, the values of amplification factor and transconductance are 40 and 160 mho respectively. Calculate the dynamic drain resistance. 7,2

Section–E

8. (a) Explain the working of a transformer coupled amplifier by drawing its circuit diagram.

   (b) Discuss the advantages and disadvantages of negative feedback in amplifiers. 6,3

9. (a) Explain the working of a tuned collector oscillator by drawing the circuit diagram.

   (b) What is an operational amplifier ? Discuss any *one* application of it. 6,3