

Total No. of Questions : 7]

SEAT No. :

PD-2999

[Total No. of Pages : 2

[6475]-11

M.Sc. - I

PHYSICS

**PHCT - 111 : Mathematical Method in Physics
(2020 Pattern) (Semester - I) (4 Credits)**

Time : 3 Hours]

[Max. Marks : 70

Instructions to the candidates :

- 1) *Q.1 is compulsory.*
- 2) *Attempt / Solve any five questions from Q.2 to Q.7.*
- 3) *Q.2 to Q.7 carry equal marks.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of log- table and non programmable electronic calculator is allowed.*
- 6) *Neat must be drawn where necessary.*

Q1) Solve any Five of the following :

- a) Find Laplace transform of $\sinh(a^t)$. [2]
- b) Define eigen value and eigen vector. [2]
- c) State Cauchy - Riemann conditions. [2]
- d) For what value of k is $(1, k, 5)$ a linear combination of $u = (1, -3, 2)$ and $v = (2, -1, 1)$. [2]
- e) Define linear combination of vector and linear span of the set of vectors.[2]
- f) Prove that $H_n(-x) = (-1)^n H_n(x)$. [2]

Q2) a) i) State and prove Cauchy - Schwarz inequality. [4]

ii) Find an analytic function whose real part is $u = y^3 - 3x^2y$. [3]

b) Find complex Fourier transform of $f(x) = e^{-2|x|}$ where $a > 0$ and x belongs to $(-w, w)$. [5]

P.T.O.

- Q3) a) i)** Prove that $xJ^n(x) = xJ_{n-1}'(x) - nJ_n(x)$. [4]
ii) Find first three terms of the Taylor's series expansion of

$$f(z) = \frac{1}{z^2 + 4} \text{ about } z = -i. \quad [3]$$

- b)** State Residue theorem. Explain how the Cauchy's theorem and integral formulas are special cases of residue theorem. [5]

- Q4) a) i)** Prove that : $L_{n+1}(x) = 2(n+1-x)L_n(x) - n^2L_{n-1}(x)$. [4]

ii) Prove that if $L\{f(t)\} = F(s)$ then $L\{f(at)\} = \left(\frac{1}{a}\right)F\left(\frac{s}{a}\right)$ [3]

- b)** Define Basis and Dimension of a vector space with one example. [5]

- Q5) a)** Find fourier series of $f(x) = x$ in $(0, \pi)$. [6]

- b)** Prove the orthogonal property for $H_n(x) \int_{-\infty}^{\infty} \exp(-x^2) H_n(x) H_m(x) dx = 0$;
 if $m \neq n$. [6]

- Q6) a)** Apply the Gram-Schmidt orthogonalization process to find out an orthogonal basis then an orthonormal basis for the subspace U of R^4 spanned by $U_1 = (1, 1, 1, 1)$ $U_2 = (1, 2, 4, 5)$ and $U_3 = (1, -3, -4, -2)$. [6]

- b)** Evaluate by contour integration

$$\int_0^{2\pi} \frac{d\theta}{5 + 3\cos\theta} \quad [6]$$

- Q7) Solve any Three of the following :**

- a)** State and explain the Dirichlet conditions. [4]
b) Prove that the Laplace transform operator L is linear. [4]
c) Determine whether the set $B = \{(3, 1, -4), (2, 5, 6), (1, 4, 8)\}$ is basis for R^3 . [4]
d) Verify that the following is an inner product in R^2 [4]

$$\langle u, v \rangle = x_1y_1 - x_1y_2 - x_2y_1 + 3x_2y_2$$

$$\text{where } u = (x_1, x_2), v = (y_1, y_2)$$



Total No. of Questions : 7]

SEAT No. :

PD-3000

[Total No. of Pages : 2

[6475]-12

M.Sc. - I

PHYSICS

PHCT-112 : Classical Mechanics

(2020 Pattern) (CBCS) (Semester - I) (4 Credits)

Time : 3 Hours]

[Max. Marks : 70

Instructions to the candidates :

- 1) Q. 1 is compulsory.
- 2) Attempt any five equations from Q.2 to Q.7.
- 3) Q.2 to Q.7 carry equal marks.
- 4) Use of log table or non programmable electronic calculator is allowed.
- 5) Figures to the right indicate full marks.
- 6) Neat diagram must be drawn wherever necessary.

Q1) Solve any five of the following :

- a) State Kepler's second law. [2]
- b) What do you mean by Inertial frame of reference. [2]
- c) Write the type of constraints for pendulum with variable length. [2]
- d) Write lagrangian for free particle in cartesian co-ordinate system. [2]
- e) Find the relation between angular momentum vector, the inertia tensor and the angular velocity vector. [2]
- f) What are cyclic coordinates? [2]

Q2) a) Derive the equation for two body problem into equivalent one body problem. Hence Discuss concept of Reduced Mass. [7]

- b) Write a note on symmetric top. [5]

P.T.O.

- Q3)** a) Show that poisson bracket is invariant under Canonical transformation. [7]
 b) Write a note on Foucault's pendulum. [5]
- Q4)** a) Describe Hamiltonian and Hamilton's equation of motion for charged particle in an electromagnetic field. [7]
 b) State and prove virial theorem. [5]
- Q5)** a) Derive an expression for Euler-lagrange's equation for variational principle. [6]
 b) Obtain the Lagrangian and equation of motion for simple Pendulum. [6]
- Q6)** a) Show that the transformation.

$$Q = \frac{1}{p} \text{ \& } p = qp^2 \text{ is Canonical.} \quad [6]$$

 b) Show that the path followed by a particle in sliding from one point to another in the absence of friction in the shortest time is Cycloid. [6]
- Q7)** Solve any three of the following :
- a) In case of poisson Bracket solve $[L_x, L_y]$ [4]
 b) Consider a particle falling freely from height 'h' at attitude α . Find horizontal deflection of particle. [4]
 c) State the condition for stability and closure of the orbit. [4]
 d) The distance between sun and earth is suddenly reduced to half of its present distance. What will be duration of year? [4]



Total No. of Questions : 7]

SEAT No. :

PD-3001

[Total No. of Pages : 2

[6475]-13
M.Sc. (Part - I)
PHYSICS
PHCT - 113 : Electronics
(2020 Pattern) (Semester - I) (CBCS) (4 Credits)

Time : 3 Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) *Q. 1 is compulsory.*
- 2) *Attempt any five questions from Q. 2 to Q.7.*
- 3) *Questions 2 to 7 carry equal marks.*
- 4) *Use of non-programmable calculator and log table is allowed.*
- 5) *Figures to the right indicate full marks.*

Q1) Answer any Five of the following :

- a) What is forward blocking mode in SCR? [2]
- b) State Boolean laws. [2]
- c) An 8 bit DAC (R-2R) produces output voltage of 2V for a binary input of 0110 0100. What will be the output voltage for a binary input of 1011 0011? [2]
- d) List the various applications of PLL. [2]
- e) Convert $(1101\ 0111)_2$ into gray code. [2]
- f) Define shift register and give its different types. [2]

- Q2)**
- a) Distinguish between DIAC and TRIAC. [4]
 - b) Define flip-flop. How many flip-flops are required to construct each of the following counters : i) mod-3, ii) mode-11. [3]
 - c) $f = \overline{A}\overline{B}\overline{C}D + \overline{A}\overline{B}C\overline{D} + \overline{A}BCD$. Place the given function on the truth table and map the function and obtain reduced expression. Draw an equivalent diagram. [5]

P.T.O.

- Q3)** a) Design a FSK generator of frequencies 120 KHz and 90 KHz for bit 1 and bit 0 respectively. Find the appropriate values of R_1 , R_2 and R_3 while assuming $C_1 = 1nF$. [5]
- b) How does the Up/Down counter count a clock pulse in it? Explain with the help of schematic circuit diagram. [4]
- c) What are advantages of dual slope ADC over single slope ADC? [3]
- Q4)** a) With the help of block diagram, explain the working principle of VCO using IC 566. [4]
- b) Calculate the free running frequency and duty cycle for IC 555 of Astable multivibrator. (Given : $R_A = 6.8k\Omega$, $R_B = 3.3 k\Omega$ and $C = 0.1\mu F$). [5]
- c) Which shift registers are the fastest in operation? Why? [3]
- Q5)** a) Which type of ADC is the fastest in operation? Explain the working principle of it. [6]
- b) Explain the working of counter ramp type A to D converter. [3]
- c) What are the applications of shift registers. [3]
- Q6)** a) With the help of block diagram, explain the construction and working principle of instrumentation amplifier using op-amp. Obtain an expression for gain. [6]
- b) Explain the V-I characteristics of SCR. [6]
- Q7)** Write a short note on Any Three of the following.
- a) SMPs. [4]
- b) Astable multivibrator [4]
- c) Four variable K-map. [4]
- d) Dual slope A to D converter. [4]



Total No. of Questions : 7]

SEAT No. :

PD-3002

[Total No. of Pages : 2

[6475]-21

M.Sc. (Part - I)

PHYSICS

PHCT-121 : Electrodynamics

(2020 Pattern) (CBCS) (Semester - II) (4 Credits)

Time : 3 Hours]

[Max. Marks : 70

Instructions to the candidates :

- 1) Q. 1 is compulsory.
- 2) Attempt / Solve any five questions from Q.2 to Q.7.
- 3) Q.2 to Q.7 carry equal marks.
- 4) Use of logarithmic or non programmable electronic calculator is allowed.
- 5) Figures to the right indicate full marks.

Q1) Solve any five of the following :

[5 × 2 = 10]

- a) State Faraday's law of electromagnetic induction.
- b) Calculate skin depth of copper at 1 MHz.

Given : $\sigma = 5.81 \times 10^7$ mho/m

$$\mu = \mu_0 = 4\pi \times 10^{-7} \text{ Wb/A-m.}$$

- c) Write Lorentz relativistic transformation equations.
- d) Explain scalar and vector potential.
- e) Define Poynting vector and give its physical significance.
- f) Describe D'Alembertian operator.

Q2) a) Explain Minkowski's space-time in detail.

[7]

b) Discuss Gauge transformation.

[5]

P.T.O.

- Q3)** a) State and prove Poynting theorem. Give the physical interpretation of each term of Poynting theorem equation. [7]
 b) Obtain integral form of Maxwell's equations. [5]
- Q4)** a) Obtain an expression of Lorentz force on charge particle. [7]
 b) What is meant by Hertz potential? Discuss its uses in computation of radiation fields. [5]
- Q5)** a) Write and explain the boundary conditions at the interface of a dielectric. [7]
 b) Discuss the electromagnetic plane wave in stationary medium. [5]
- Q6)** a) Using Maxwell's equations in free space prove that $C = \frac{1}{\sqrt{\mu_0 \epsilon_0}}$, C is speed of light. ϵ_0 & μ_0 are permittivity & permeability of free space. [6]
 b) Describe Michelson - Morley experiment. [6]
- Q7) Attempt any Three of the following :** [12]
 a) Discuss Lorentz gauge.
 b) Explain Maxwell's displacement current.
 c) Write wave equations in terms of electromagnetic potential.
 d) Describe four vector potential.
 e) Explain postulates of theory of relativity.



Total No. of Questions : 7]

SEAT No. :

PD-3003

[Total No. of Pages : 2

[6475]-22

M.Sc.

PHYSICS

PHCT - 122 : Atoms and Molecules
(2020 Pattern) (CBCS) (Semester - II) (4 Credits)

Time : 3 Hours]

[Max. Marks : 70

Instructions to the candidates :

- 1) Q.1 is compulsory.
- 2) Attempt / Solve any five questions from Q.2 to Q.7.
- 3) Q.2 to Q.7 carry equal marks.
- 4) Figures to the right indicates full marks.
- 5) Use of logarithmic table and non programmable electronic calculator is allowed.

Given :-

Rest mass of electron	$= 9.10 \times 10^{-31} \text{ kg}$
Charge on electron	$= 1.602 \times 10^{-19} \text{ Coulomb}$
Plank's constant	$= 6.626 \times 10^{-34} \text{ Joule - Sec}$
Boltzman constant	$= 1.381 \times 10^{-23} \text{ Joule / } ^\circ\text{k}$
Avagadro's number	$= 6.023 \times 10^{23} \text{ atoms / mole}$
1 e.v	$= 1.602 \times 10^{-19} \text{ Joule}$
Bohr magnetron μ_B	$= 9.274 \times 10^{-24} \text{ Joule / Tesla}$

Q1) Solve any Five of the following :

- a) State Pauli exclusion principle for electronic configuration. [2]
- b) State selection rule for L, J and S. [2]
- c) Explain Normal Zeeman effect. [2]
- d) Explain four quantum numbers and Their allowed values. [2]
- e) Determine lande Factor (g) for $3_{d_{\frac{5}{2}}}$. [2]
- f) Detemine spectral notation for Al (z = 13) atom. [2]

P.T.O.

- Q2)** a) State and explain Frank - Condon principle. [4]
 b) Write a note on Vibrational coarse structure. [3]
 c) Draw a block diagram of ESR spectrometer and explain it's working. [5]
- Q3)** a) Explain LS coupling scheme for 'pd' configuration? [4]
 b) A free electron is placed in a magnetic field of strength 1.3T. Calculate the Resonance frequency. If $g = 2.0023$. [3]
 c) Explain Anamalous Zeeman effect and hence derive a formula for wave number shift in spectral line. [5]
- Q4)** a) State principle of NMR spectroscopy. Explain it's construction and working. [7]
 b) Explain experimental arrangements and working of IR spectrometer. [5]
- Q5)** a) What is Paschen - Back effect. Explain Paschen Back effect in case of sodium atom. [6]
 b) Discuss vibrational analysis of band system. [6]
- Q6)** a) Explain band origin and band head in relation to rotational fine structure of electronic vibrational spectra. [6]
 b) Explain the Laue Theory of x-ray diffraction and obtain the condition for diffraction maxima. [6]
- Q7)** Write a short note on any Three of the following :
- a) Fourier Transform Infrared Spectroscopy (FTIR). [4]
 b) Relaxation process in NMR. [4]
 c) Applization of Raman Spectroscopy. [4]
 d) Origin of Spectral line. [4]



Total No. of Questions : 7]

SEAT No. :

PD-3004

[Total No. of Pages : 2

[6475]-23

M.Sc.

PHYSICS

PHCT-123 : Quantum Mechanics

(2020 Pattern) (CBCS) (Semester - II) (4 Credits)

Time : 3 Hours]

[Max. Marks : 70

Instructions to the candidates :

- 1) Q. 1 is compulsory.
- 2) Attempt / Solve any five questions from Q.2 to Q.7.
- 3) Q.2 to Q.7 carry equal marks.
- 4) Figures to the right indicate full marks.
- 5) Use of log table or non programmable calculator is allowed.
- 6) Neat diagram must be drawn wherever necessary.

Q1) Attempt any Five of the following :

[10]

- a) What is Fermi Golden rule?
- b) Write the Pauli spin matrices for spin angular momentum operator S_x and S_y for spin half particle.
- c) What is unit operator?
- d) Explain Dirac delta function.
- e) Write the physical interpretation of eigen value and eigen function.
- f) Discuss the Heisenberg's uncertainty relation.

Q2) a) Find the first order correction to the energy of a system using Perturbation time independent theory in weak field Zeeman effect. [7]

- b) Obtain matrix representation of spin angular momentum operator S^2 and S_z for spin half particle system. [5]

P.T.O.

- Q3) a)** Explain bra and ket vectors. Also discuss their properties. [7]
- b)** The wave function for a particle in an infinite potential well is given by
- $$\psi_n(x) = \sqrt{\frac{2}{a}} \sin\left(\frac{n\pi x}{a}\right) \text{ where } 0 \leq x \leq a \text{ find } \langle x \rangle \text{ and } \langle p_x \rangle. \quad [5]$$
- Q4) a)** Find Clebsch - Gordan coefficient for a system of two particles with total angular momentum operator $j_1 = \frac{1}{2}$ and $j_2 = \frac{1}{2}$. [7]
- b)** Obtain the ground state energy of one dimensional harmonic oscillator using variational method. [5]
- Q5) a)** What are observables? Explain completeness and closure property in detail. [6]
- b)** Find Hamiltonian operator in terms of ladder operator a_+ and a_- for one dimensional simple harmonic oscillator. Discuss the eigen function and eigen value of simple harmonic oscillator. [6]
- Q6) a)** Derive an expression for first order correction to time dependent perturbation system. [6]
- b)** Obtain angular momentum operator L^2 in spherical polar co-ordinate system. [6]
- Q7) Attempt any Three of the following :** [12]
- a)** Discuss the WKB approximation in potential well with two vertical walls.
- b)** Explain postulates of quantum mechanics.
- c)** Explain unitary transformation with its properties.
- d)** What is probability density function? Give its physical interpretation.



Total No. of Questions : 7]

SEAT No. :

PD-3005

[Total No. of Pages : 3

[6475]-31

M.Sc. - II

PHYSICS

PHCT-231 : Statistical Mechanics

(2020 Pattern) (CBCS) (Semester - III) (4 Credits)

Time : 3 Hours]

[Max. Marks : 70

Instructions to the candidates :

- 1) Q. 1 is compulsory.
- 2) Attempt / Solve any five questions from Q.2 to Q.7.
- 3) Q.2 to Q.7 carry equal marks.
- 4) Figures to the right indicate full marks.
- 5) Use of log-table or non programmable electronic calculator is allowed.
- 6) Neat diagram must be drawn wherever necessary.

Q1) Solve any five of the following :

- a) Find the most probable state for the distribution of five particles in three cells. [2]
- b) Define mu space and Gamma space. [2]
- c) Write the partition function for N - distinguishable and indistinguishable particles in Maxwell - Boltzmann distribution. [2]
- d) Find the partition function for two identical particles (a, a) obeying Fermi - Dirac statistics are distributed in the energy levels with energy $\epsilon_n = n\epsilon$, where $n = 0, 1, 2$. [2]
- e) What are Bosons? [2]
- f) State the law of equipartition energy. [2]

P.T.O.

- Q2) a)** For a phase space representing the single particle of Mass 'M' in volume 'V', show that the number of phase cells in the energy range 0 to E is given by $\phi = \frac{4\pi V}{3h^3} (2mE)^{3/2}$, where h^3 is volume of phase cells in μ -space. [7]
- b)** A damped harmonic oscillator is described by the equation $\frac{d^2x}{dt^2} + R \frac{dx}{dt} + kx = 0$. Determine the phase space trajectory of oscillator. [5]
- Q3) a)** State and prove Liouville's theorem. [7]
- b)** Show that the entropy of canonical ensemble can be represented as $S = -k \sum_r p_r \ln p_r$. [5]
- Q4) a)** For grand Canonical ensemble, show that the probability of finding the system in a particular microstate r, having energy E_r is given by $P_r = \frac{e^{-\beta E_r - \alpha N_r}}{\sum_r e^{-\beta E_r - \alpha N_r}}$. [7]
- b)** Show that the entropy of the composite system is equal to the sum of entropies of all the subsystems $S = S_1 + S_2 + S_3 + \dots$. [5]
- Q5) a)** State and prove Equipartition theorem. [7]
- b)** The rms velocity of molecules of H_2 gas at certain temperature is 1600 m/s, what will be the rms velocity of molecule of oxygen at the same temperature.
(Given : Molecular weight of $H_2 = 2$ a.m.u. and molecular weight of $O_2 = 32$ a.m.u.) [5]
- Q6) a)** Show that the relation $PV = \frac{2}{3}E$ is satisfied by a free monoatomic particles in quantum statistics (BE and FD statistics) [7]
- b)** On the basis of Canonical distribution, obtain the law of atmosphere. [5]

Q7) Write a note on any Three of the following :

- a) Phase space and phase trajectory [4]
- b) Gibb's paradox [4]
- c) Distinguish between macrostate and microstate [4]
- d) Boltzmann limit of Boson and Fermion gas. [4]



Total No. of Questions : 7]

SEAT No. :

PD-3006

[Total No. of Pages : 2

[6475]-32

M.Sc.

PHYSICS

PHCT 232 : Solid State Physics

(2020 Pattern) (CBCS) (Semester - III) (4 Credits)

Time : 3 Hours]

[Max. Marks : 70

Instructions to the candidates :

- 1) Q. No. 1 is compulsory
- 2) Attempt/Solve any five questions from Q.2 to Q.7.
- 3) Q. 2 to Q. 7 carry equal marks.
- 4) Figures to right indicate full marks.
- 5) Use of log-table or non-programmable electronic calculator is allowed.
- 6) Neat Diagram must be drawn where necessary.

Give :

Planck's constant	=	$6.626 \times 10^{-34} \text{ JS}$
Mass of electron	=	$9.1 \times 10^{-31} \text{ kg}$
Boltzmann constant	=	$1.38 \times 10^{-23} \text{ J/K}$
Avogadro's Number	=	$6.023 \times 10^{26} \text{ /K.mole}$
Permeability of free space	=	$4\pi \times 10^{-7} \text{ Henry/m}$
Charge of electron	=	$1.6 \times 10^{-19} \text{ C}$
Permittivity of free space	=	$8.85 \times 10^{-12} \text{ C}^2/\text{Nm}^2$
Bohr magneton	=	$9.27 \times 10^{-24} \text{ A M}^2$

Q1) Solve any Five of the following (2 marks each) :

[10]

- a) Explain the cause of paramagnetism in a material.
- b) State the difference between diamagnetism and ferromagnetism.
- c) A super conducting tin has a critical temperature of 2.7 k at zero magnetic field & a critical field of 0.0418 Tesla at 0k. Find the critical field at 2 k.
- d) What are type I & type II super conductors?
- e) Define the following term's :
 - i) Fermi energy
 - ii) Fermi velocity
- f) What is cyclotron resonance?

P.T.O.

- Q2) a)** Derive London equation for superconducting state and obtain expression for the penetration depth. [7]
- b) A paramagnetic salt contains 10^{28} ion's/m³ with magnetic moment of one Bohr magneton. Calculate the paramagnetic susceptibility and magnetisation produced in a uniform magnetic field of 10^6 A/m at room temperature. [5]
- Q3) a)** Describe the motion of electron in a one dimensional periodic potential. Hence, explain the concept of effective mass m^* . Explain the meaning of negative mass (effective) with the help of $m^* k$ - curve. [7]
- b) Distinguish between metal's, semiconductor's and insulator's on the basis of band theory of solids. [5]
- Q4) a) i)** Describe the assumptions of BCS theory [4]
- ii) Explain with neat diagrams, reduced, periodic and extended zone schemes. [3]
- b) Explain the formation of energy gap on the basis of nearly free electron model. [5]
- Q5) a)** Explain the term's anisotropy energy & Bloch wall with reference to magnetization. [7]
- b) Explain Josephson effect in super conductor's. [5]
- Q6) a)** State the assumptions of the Kronig - Penney model. Show that the energy spectrum of an electron consist of allowed & forbidden energy. [7]
- b) A magnetic material has a magnetization of 3300 A/m & flux density of 0.0044 wb/m² calculate the magnetizing force and the relative permeability of the material. [5]
- Q7) Write short notes on any three of the following.** [12]
- a) Hysterisis curve (B - H curve) [4]
- b) Cooper pairs [4]
- c) Meissner effect [4]
- d) Critical field and critical temperature in superconductor [4]



Total No. of Questions : 7]

SEAT No. :

PD-3007

[Total No. of Pages : 2

[6475]-33

M.Sc. (Part - II)

PHYSICS

**PHCT-233 : Experimental Techniques in Physics - I
(2020 Pattern) (CBCS) (Semester - III) (4 Credits)**

Time : 3 Hours]

[Max. Marks : 70

Instructions to the candidates :

- 1) Q. 1 is compulsory.
- 2) Attempt / Solve any five questions from Q.2 to Q.7.
- 3) Q.2 to Q.7 carry equal marks.
- 4) Figures to the right indicate full marks.
- 5) Use of log-tables or non programmable electronic calculator is allowed.
- 6) Neat diagrams must be drawn wherever necessary.

Q1) Solve any five of the following :

- a) What is mean by signal? Write any two characteristics of signal? [2]
- b) Give the sources of uncertainty and experimental error. [2]
- c) What are the applications of vacuum? [2]
- d) An ideal gas in a cylinder fitted with piston is held at fixed pressure. If the temperature of the gas increases from 50°C to 100°C, by what factor does the volume change? [2]
- e) State any four characteristics that must be possessed by a fluid used in oil diffusion pump. [2]
- f) Which of the principle is used for pumping? [2]
- g) Define ultimate pressure and degassing. [2]

- Q2) a)**
- i) How is elementary data fitting achieved? [4]
 - ii) Calculate the mean free path of a nitrogen molecule at 1 torr at 298K. (Given $K = 1.38 \times 10^{-23}$ J/k, 1Torr = 133.2N/m² diameter of nitrogen molecule = 3.7Å) [3]
- b) With the help of a neat diagram, explain the principle, construction and working of McLeod gauge. [5]

P.T.O.

- Q3)** a) i) Derive the expression for pump down time. [4]
 ii) Give the properties of fluid used in diffusion pump. [3]
 b) Discuss the applications of vacuum pumps for various experimental techniques in physics. [5]

- Q4)** a) i) Explain the construction and working of Rotary pump. [4]
 ii) Discuss working mechanism of pressure sensors. Also write it's application. [3]
 b) What is throttling process? What are the different throttling devices? [5]

- Q5)** a) Explain in details, the characteristics of sensors. [6]
 b) Explain the working of rotary - vane pump. Describe the concept of roughing and backing pump. [6]

- Q6)** a) Derive the relation for the effective pumping speed of the vacuum pump. [6]
 b) Explain construction and working of Bayard - Alpert gauge using suitable diagram. [6]

Q7) Answer any three of the following :

- a) The energy of a system as a function of time t is given as $E(t) = A^2 \exp(-\beta t)$ where $\beta = 0.1 \text{ s}^{-1}$. The measurement of A has an error of 1.25%. If the error in measurement of time is 1.5%. Calculate percentage error in the value of $E(t)$ at 4s. [4]
 b) Write short note on Penning gauges. [4]
 c) Write a short note on impingement rate of molecules on a surface. [4]
 d) Write a short note on [4]
 i) Fourier transform
 ii) Discrete Fourier transform.



Total No. of Questions : 7]

SEAT No. :

PD-3008

[Total No. of Pages : 2

[6475]-34

M.Sc.

PHYSICS

PHOT-234 G4 : Acoustics - I

(2020 Pattern) (CBCS) (Semester - III) (4 Credits) (Group - I)

Time : 3 Hours]

[Max. Marks : 70

Instructions to the candidates :

- 1) Q. 1 is compulsory.
- 2) Attempt / Solve any five questions from Q.2 to Q.7.
- 3) Q.2 to Q.7 carry equal marks.
- 4) Figures to the right indicate full marks.
- 5) Use of log-table and non-programmable electronic calculator is allowed.
- 6) Neat diagrams must be drawn wherever necessary.

Q1) Solve any five of the following :

- a) Define Acoustic Intensity. Give its unit. [2]
- b) What is Sabine's formula for reverberation time? [2]
- c) Find sound power level in an enclosure which emits 10W of acoustic power. [$w_0 = 10^{-12}w$] [2]
- d) Define specific acoustic impedance. Give its units. [2]
- e) What do you mean by Standing Wave Ratio (SWR)? [2]
- f) Give formula and unit for Sound Power Level. [2]

Q2) a) Derive expression for growth of sound intensity in a live room. [7]

- b) Determine the room modes (800), (302), (122) and (222) for a seminar hall $56 \times 36 \times 15$ cubit ft. What do you conclude? [$c = 1130$ ft/sec] [5]

P.T.O.

- Q3)** a) i) Discuss the term velocity of sound in fluids. [4]
 ii) The decrease in intensity level of a plane wave passing from medium A to medium B is 35 dB. Determine the corresponding power Reflection coefficient. [3]
 b) Explain Sound Transmission Class (STC). [5]
- Q4)** a) Write a note on human voice mechanism. [7]
 b) Determine the energy density and effective pressure of a plane wave in air of 70 dB intensity level. Determine the energy density and effective pressure of a plane wave in water, if its sound pressure level is 70 dB re / microbar. [5]
- Q5)** a) i) Discuss the conditions under which one should use Eyring's or Millington's equations rather than Sabine's equation for reverberation time estimation. [4]
 ii) In case of 'Reflection at the surface of a solid', the Standing Wave Ratio (SWR) is 2.0 and the first node is located at a distance of $3/8\lambda$ from the reflecting surface. Determine the magnitude of normal specific acoustic impedance of the solid. [3]
 b) Discuss types of room modes in detail. [5]
- Q6)** a) Explain the analogies between electrical, mechanical and acoustical systems. Give acoustical equivalent electrical circuit for Helmholtz resonator. [6]
 b) With the help of a neat diagram, explain working of an expansion chamber muffler. [6]
- Q7) Write short notes on any three of the following :**
- a) Audiometry [4]
 b) Decibel scale [4]
 c) Hass Effect [4]
 d) Decay of sound in dead rooms [4]



Total No. of Questions : 7]

SEAT No. :

PD-3009

[Total No. of Pages : 2

[6475]-35

M.Sc. - II

PHYSICS

PHOT-234 H4 : Energy Studies - I

(2020 Pattern) (CBCS) (Semester - III) (4 Credits) (Group - II)

Time : 3 Hours]

[Max. Marks : 70

Instructions to the candidates :

- 1) Q. 1 is compulsory.
- 2) Solve any five questions from Q.2 to Q.7.
- 3) Q.2 to Q.7 carry equal marks.
- 4) Use of log tables and non programmable electronic calculator is allowed.
- 5) Figures to the right indicate full marks.
- 6) Neat diagrams must be drawn wherever necessary.

Q1) Attempt any five of the following :

- a) What is meant by conservation of energy? [2]
- b) What is latent heat? [2]
- c) What is air mass? [2]
- d) What is biomass energy? [2]
- e) What is wind energy? [2]
- f) What is sensible heat storage system? [2]

- Q2) a) i) Explain 1st and 2nd law of thermodynamics. [4]**
- ii) Define the terms Zenith angle, Hour angle and inclination angle. [3]
- b) Describe structure of sun with suitable diagram. [5]

P.T.O.

- Q3)** a) i) Explain Fourier's law and Stefan's - Boltzmann relation. [4]
ii) Describe electrical energy storage systems. [3]
b) Explain working principle and construction of sunshine recorder with neat diagram. [5]
- Q4)** a) What is global warming? Explain in brief about essential factors for sustainable development. [7]
b) Explain chemical storage systems. [5]
- Q5)** a) Describe the Hydro storage system with neat diagram. [6]
b) What are the different types of heat transfer? Define each type Explain the basic units of heat. [6]
- Q6)** a) Explain the working principle and construction of pyr heliometer with neat diagram. [6]
b) Write the difference between terrestrial and extra-terrestrial solar radiation. Explain sun as a fusion reactor. [6]
- Q7)** Write short note on any three of the following :
- a) Laws of thermodynamics. [4]
b) Types of heat transfer. [4]
c) Potential solutions to environmental problems. [4]
d) Conventional energy and non-conventional energy. [4]



Total No. of Questions : 7]

SEAT No. :

PD-3010

[Total No. of Pages : 2

[6475]-36

M.Sc.

PHYSICS

**PHOT 234 I4 : Electronics Instrumentation - I
(2020 Pattern) (Semester - III) (4 Credits) (Group - II)**

Time : 3 Hours]

[Max. Marks : 70

Instructions to the candidates :

- 1) Q. No. 1 is compulsory.
- 2) Solve any five questions from Q.2 to Q.7.
- 3) Q. 2 to 7 carry equal marks.
- 4) Figures to the right indicate full marks.
- 5) Use of log table or non-programmable electronic calculator is allowed.
- 6) Neat labelled diagrams must be drawn whenever necessary.

Q1) Solve any Five of the following :

- a) Define the terms: Accuracy and Precision. [2]
- b) State different types of thermocouples. [2]
- c) A strain gauge has a gauge factor of 2.5. If the resistance changes by 0.1Ω for a strain of 0.001, find the original resistance. [2]
- d) Distinguish between active and passive type of transducers. [2]
- e) What are main advantages of electrical transducer? [2]
- f) What is the rate of input scan of modern scanners of data logger? [2]

Q2) a) Explain unbound strain gauge or displacement transducer with the help of suitable diagram. [7]

b) Discuss zero order system with suitable example. [5]

Q3) a) Draw a block diagram of instrumentation amplifier using three op-amp. Derive equation for it's output. [7]

b) Explain static performance characteristics of measuring system. [5]

Q4) a) Explain data logger with necessary block diagram. [7]

b) Explain methods of corrections for interfering and modifying inputs. [5]

P.T.O.

- Q5)** a) With suitable block diagram, explain ultrasonic flow meter in detail. [7]
b) Explain thermocouple laws. [5]
- Q6)** a) Explain the principle and operation of Laser printers. [7]
b) Explain with neat diagram optical pyrometer. [5]
- Q7) Write a short note on any three of following :**
- a) Data Acquisition system. [4]
b) Orifice meter. [4]
c) Capacitive displacement Transducer. [4]
d) Pitot tube. [4]



Total No. of Questions : 7]

SEAT No. :

PD-3011

[Total No. of Pages : 2

[6475]-37

M.Sc.

PHYSICS

PHOT 234J4 : Biomedical Instrumentation - I
(2020 Pattern) (CBCS) (Semester - III) (4 Credits)
(Group - II)

Time : 3 Hours]

[Max. Marks : 70

Instructions to the candidates :

- 1) *Q. No. 1 is compulsory.*
- 2) *Attempt any five questions from Q.2 to Q.7.*
- 3) *Q. No. 2 to 7 carry equal marks.*
- 4) *Figures to the right side indicate full marks.*
- 5) *Draw neat labelled diagrams wherever necessary.*

Q1) Solve any Five of the following :

- a) Define biosignals. [2]
- b) Define leads. [2]
- c) Define biosensors. [2]
- d) What is an action potential? [2]
- e) What is biomedical instrumentation? [2]
- f) What are the types of Pacemaker? [2]

- Q2)** a) Describe the different lead system used in ECG recording. [7]
b) Explain the function and types of pacemaker. [5]

- Q3)** a) Explain the working principle and applications of Phonocardiograph.[7]
b) How do artefacts effect ECG recording? Describe methods to minimize them. [5]

P.T.O.

- Q4)** a) Describe safety measures while handling biomedical instruments. [7]
b) Describe different types of electrodes used in biomedical application.[5]

- Q5)** a) Explain the importance of patient safety in biomedical instrumentation.[7]
b) Explain the block diagram of ECG machine and its components. [5]

- Q6)** a) Describe different types of bioelectrodes used for ECG and EEG. [6]
b) Explain the function of transducers & its types. [6]

Q7) Write a short note on any three of the following :

- a) Motion transducer [4]
b) Pulse oximeter [4]
c) Amplifier in biomedical instrumentation [4]
d) Active and Passive conductions in nerve signals [4]



Total No. of Questions : 7]

SEAT No. :

PD-3012

[Total No. of Pages : 2

[6475]-38

M.Sc.

PHYSICS

**PHOT - 234 K4 : Nuclear Techniques - I
(2020 Pattern) (Semester - III) (CBCS) (4 Credits)**

Time : 3 Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) *Q.1 is compulsory.*
- 2) *Solve any five questions from Q.2 to Q.7.*
- 3) *Q.2 to Q.7 carry equal marks.*
- 4) *Figures to right indicate full marks.*
- 5) *Use of log table and non-programmable electronic calculator is allowed.*
- 6) *Neat diagram must be drawn wherever necessary.*

Q1) Solve any Five of the following :

- a) Define Roentgen (R) in terms of radiation measurement. [2]
- b) What is ionization of gases and how does it occur? [2]
- c) What is the main advantages of proportional counter over an ionization chamber? [2]
- d) What is the purpose of using delay lines in nuclear electronics? [2]
- e) Define the linear attenuation coefficient. [2]
- f) What is the practical use of cema in medical physics? [2]

- Q2)**
- a) Explain the concept of energy transfer in radiation interactions. How does energy transfer differ for direct and indirect ionizing radiation? [7]
 - b) Describe how electrons, protons and ions interact with matter. Explain the factors that influence their interactions. [5]

P.T.O.

- Q3)** a) Explain the working principle and advantages of HPGe detectors in gamma - ray spectroscopy. [7]
b) The paralysis time of a G.M tube is 400 μ sec. What is the true count rate for measured count rate of 1000 counts per min. [5]
- Q4)** a) Describe the function of a Single - Channel Analyzer (SCA). [7]
b) Explain the working principle of a preamplifier and discuss its role in signal processing. [5]
- Q5)** a) Describe the biological effect of radiation exposure on the human body. How does radiation impact different on tissues and organs? [6]
b) Define absorbed dose and explain its significance in radiation protection and medical application. [6]
- Q6)** a) Explain the working principle and advantages of semiconductor detectors. [6]
b) Write a short note on effective dose equivalent effects. [6]
- Q7)** Write short note on any Three of the following :
- a) Linear energy transfer [4]
 - b) Quality factor [4]
 - c) Pulse shaping [4]
 - d) Stopping power [4]



Total No. of Questions : 7]

SEAT No. :

PD-3013

[Total No. of Pages : 2

[6475]-39

M.Sc.

PHYSICS

**PHOT-234 L4 : Microcontroller Based Instrumentation
System - I**

(2020 Pattern) (CBCS) (Semester - III) (4 Credits)

Time : 3 Hours]

[Max. Marks : 70

Instructions to the candidates :

- 1) Q. 1 is compulsory.
- 2) Solve any five questions from Q.2 to Q.7.
- 3) Q.2 to Q.7 carry equal marks.
- 4) Figures to the right indicate full marks.
- 5) Use of log table and non programmable electronic calculator is allowed.
- 6) Neat diagram must be drawn wherever necessary.

Q1) Solve any five of the following :

- a) What is the role of the stack in the 8051 microcontroller? [2]
- b) What is the function of the Timer in the 8051 microcontroller. [2]
- c) What is the difference between BCD and binary representation? [2]
- d) Define ASCII and mention its significance in data conversion. [2]
- e) Explain the Basic working principle of ADC 0809. [2]
- f) What are the key difference between ADC and DAC? [2]

Q2) a) Draw functional block diagram of microcontroller 8051 and explain its different sections. [7]

- b) Explain the interrupt structure of microcontroller 8051 in details. [5]

P.T.O.

- Q3)** a) Explain various addressing modes in micro-controller 8051. [7]
b) Explain parallel port structure in 8051. [5]
- Q4)** a) Explain the complete process of programming the 8051 microcontroller using C with an example. [7]
b) How do you handle multiple interrupt in 8051 C programming? Explain with an example. [5]
- Q5)** a) Explain the hardware connections and programming involved in traffic signal control using the 8051. [6]
b) Write an assembly language program for code conversion in the 8051 microcontroller. [6]
- Q6)** a) Explain the dual role of port0 and port2 in the 8051 microcontroller. [6]
b) Discuss the bit-addressable feature of the I/P ports in the 8051 microcontroller. [6]
- Q7) Attempt any three of the following :**
- a) Compare RISC and CISC architectures with examples. [4]
b) Explain how interrupt priority works in 8051 microcontroller. [4]
c) Describe how the interrupt vector table is used in 8051 C programming. [4]
d) Write a short note on the 8051 serial port and its role in data transmission. [4]



Total No. of Questions : 7]

SEAT No. :

PD-3014

[Total No. of Pages : 2

[6475]-40

M.Sc. (Part - II)

PHYSICS

PHOT-234 M4 : Material Science - I

(2020 Pattern) (CBCS) (Semester - III) (4 Credits)

Time : 3 Hours]

[Max. Marks : 70

Instructions to the candidates :

- 1) *Q. 1 is compulsory.*
- 2) *Attempt / Solve any five questions from Q.2 to Q.7.*
- 3) *Q.2 to Q.7 carry equal marks.*
- 4) *Use of log table or non programmable calculator is allowed.*
- 5) *Figures to the right indicate full marks.*
- 6) *Neat diagrams must be drawn wherever necessary.*

Q1) Solve any five of the following :

[10]

- a) Explain eutectic and peritectic point of phase diagram.
- b) State laws of thermodynamics.
- c) Write magnetic properties of the material.
- d) Explain Hume-Rothery rule of solid solubility.
- e) Discuss type II phase diagram.
- f) Discuss Rault's law of thermodynamic solution.

Q2) a) Explain thermodynamic properties of solution in detail.

[7]

b) Explain Schottky and Frankel defects.

[5]

P.T.O.

- Q3)** a) Discuss solid solubility. Explain the types of solid solution with suitable diagram. [7]
b) Explain type-I phase diagram using Cu-Ni example. [5]
- Q4)** a) What do you mean by line dislocation? Discuss its types and properties in detail. [7]
b) Discuss the following terms used in phase diagram.
i) Lever rule
ii) Extension rule
iii) Syntactic reaction. [5]
- Q5)** a) Explain Fick's first and second law of diffusion. [6]
b) Explain Gibb's phase rule in thermodynamics. Explain it for single component and binary phase diagram. [6]
- Q6)** a) Explain in detail phase diagram of Pb-Sn. [6]
b) Explain grain boundaries with explanation of high angle, low angle, tilt and twist boundaries. [6]
- Q7)** Write a short note on any three of the following : [12]
a) Write a note on stacking fault.
b) Give applications of phase diagram.
c) Explain Vegard's law of solid solution.
d) Write a note on auxiliary thermodynamic function.



Total No. of Questions : 4]

SEAT No. :

PD-3015

[Total No. of Pages : 2

[6475]-42

M.Sc.

PHYSICS

PHOT - 234 G2 : Acoustics - I

(2020 Pattern) (CBCS) (2 Credits) (Semester - III) (Group - II)

Time : 2 Hours]

[Max. Marks : 35

Instructions to the candidates :

- 1) Q.1 is compulsory.
- 2) Attempt/solve any two questions from Q.2 to Q.4.
- 3) Q.2 to Q.4 carry equal marks.
- 4) Figures to the right indicate full marks
- 5) Use of log tables and non-programmable electronic calculator is allowed.
- 6) Neat diagrams must be drawn wherever necessary.

Q1) a) Attempt any four of the following :

- i) Define acoustic impedance and give its unit. [2]
 - ii) Find Sound Power Level in an acoustic enclosure which emits 1 W of acoustic power. [$W_0 = 10^{-12}W$]. [2]
 - iii) What do you mean by Standing Wave Ratio (SWR)? [2]
 - iv) Give formula and unit for sound intensity level. [2]
 - v) Define phon and sone. [2]
- b) Write a note on sound absorption coefficient. [3]

Q2) a) i) Draw a diagram showing longitudinal displacements in a plane sound

wave. Derive expression for equation of continuity $S = - \frac{\partial \zeta}{\partial x}$. [4]

- ii) A rectangular hall has dimensions 10 ft $\times$ 15 ft $\times$ 30 ft having interior boundaries with average absorption coefficient $\bar{\alpha} = 0.1$. What is reverberation time of the hall? [3]

b) Discuss types of room modes in detail. [5]

P.T.O.

- Q3)** a) Explain the analogies between electrical, mechanical and acoustical systems. Give acoustical equivalent electrical circuit for Helmholtz resonator. [7]
- b) A small reverberation chamber is used to measure the effective sound absorption of a particular material. The volume of chamber is $8 \times 9 \times 10$ cubic feet. The observed reverberation time reduces from 5 sec to 1 sec when 40 sq. ft. of acoustical material is used cover part of a wall of this chamber. Find effective sound absorption coefficient of material. [5]

Q4) Write short notes on any three of the following : [12]

- a) Hass effect
- b) Helmholtz resonator
- c) Decibel scales
- d) Significance of standing wave ratios.



Total No. of Questions : 4]

SEAT No. :

PD-3016

[Total No. of Pages : 2

[6475]-43

M.Sc. (Part - II)

PHYSICS

PHOT - 234H2 : Energy Studies - I

(2020 Pattern) (CBCS) (Semester -III) (Group - II)

(2 Credits)

Time : 2 Hours]

[Max. Marks : 35

Instructions to the candidates :

- 1) *Q. 1 is compulsory.*
- 2) *Solve any two questions from Q.2 to Q.4.*
- 3) *Q.2 to Q.4 carry equal marks.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of log table or non-programmable electronic calculator is allowed.*
- 6) *Neat diagrams must be drawn wherever necessary.*

Q1) a) Attempt any four of the following:

- i) State the 1st and 2nd law of thermodynamics. [2]
- ii) What is latent heat storage? [2]
- iii) What is radiation heat transfer coefficient? [2]
- iv) What is biomass energy? [2]
- v) What is air mass? [2]
- b) Explain electrical energy storage systems. [3]

Q2) a) i) Explain the spectral distribution of extra-terrestrial radiation. [4]

ii) Define the terms : Hour angle, Zenith angle and Altitude angle. [3]

b) What are the different types of heat transfer? Explain them in brief. [5]

P.T.O.

Q3) a) What are the different types energy storage systems? Explain with neat diagram, the working of solar pond as an energy storage. [7]

b) Explain with neat diagram, the measurement of solar radiations by pyranometer. [5]

Q4) Write a short note on any three of following:

a) Sun as fusion reactor. [4]

b) Solar as renewable energy source. [4]

c) Importance of solar energy. [4]

d) Non-renewable energy sources and their disadvantages. [4]



Total No. of Questions : 4]

SEAT No. :

PD-3017

[Total No. of Pages : 2

[6475]-44

M.Sc.

PHYSICS

PHOT 234 I2 : Electronic Instrumentation - I
(2020 Pattern) (CBCS) (Semester - III) (2 Credit) (Group - II)

Time : 2 Hours]

[Max. Marks : 35

Instructions to the candidates:

- 1) *Q. 1 is compulsory.*
- 2) *Attempt any two questions from Q.2 to Q.4.*
- 3) *Q.2 to Q.4 carry equal marks.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of log table and non-programmable calculator is allowed.*
- 6) *Neat diagram must be drawn wherever necessary.*

Q1) a) Attempt any four of the following :

- i) Define the terms : Accuracy and Precision. [2]
- ii) State different types of thermocouple. [2]
- iii) A resistance strain gauge with a gauge factor of 2 is cemented to a steel member which is subjected to a strain of 1×10^{-6} . If the original resistance value of the gauge is 130Ω calculate the change in resistance. [2]
- iv) What is signal conditioner? [2]
- v) What is logarithmic compression? [2]
- b) What are the ideal characteristics of operational amplifier. [3]

Q2) a) i) Explain unbounded strain gauge as displacement transducer with the help of suitable diagram. [4]

ii) Explain principle construction and working of platinum resistance thermometer. [3]

b) Draw the block diagram for multichannel DAS and explain it in detail. [5]

Q3) a) Explain the role of microprocessor in improving fuel efficiency of petrol engine with suitable diagram [6]

b) Explain step response of first order instrument in brief. [6]

P.T.O.

Q4) Attempt any three of the following :

- a) Explain capacitive type of displacement transducer with suitable diagram. **[4]**
- b) Write a note on data loggers **[4]**
- c) The power radiated from a hot piece of metal was measured by the radiation pyrometer and the temperature was determined as 820°C assuming a surface emissivity of 0.75 later it was found that the accurate value of emissivity was 0.69. Find the error in the temperature determination. **[4]**
- d) Draw the circuit diagram for phase detection using LVDT and explain it. **[4]**



Total No. of Questions : 4]

SEAT No. :

PD-3018

[Total No. of Pages : 2

[6475]-45

M.Sc.

PHYSICS

PHOT-234 J2: Biomedical Instrumentation - I

(2020 CBCS Pattern) (2 Credit) (Semester - III) (Group II)

Time : 2 Hours]

[Max. Marks : 35

Instructions to the candidate:

- 1) Q. 1 is compulsory.
- 2) Attempt any two questions from Q. 2 to Q.4.
- 3) Q. 2 to Q.4. carry equal marks.
- 4) Neat diagrams must be drawn wherever necessary.

Q1) a) Solve any four of the following :

- i) Define active and passive transducer. [2]
- ii) Define leads. [2]
- iii) State any two types of leakage current. [2]
- iv) Why right leg (RL) is used of ground potential. [2]
- v) What is in-vitro and in-vivo measurement? [2]

b) State any three physiological effects of electric current on human body. [3]

Q2) a) What are the different types of electrodes used for ECG recording. Explain them. [7]

b) Discuss basic recording system [5]

P.T.O.

Q3) a) What are biosignals? Explain various sources of biosignals. **[7]**

b) State the difference between external and Internal pacemaker. **[5]**

Q4) Write a short note on any two of the following:

a) Objectives of instrumentation system **[6]**

b) Structure and working of heart. **[6]**

c) Microshock and macroshock **[6]**



Total No. of Questions : 4]

SEAT No. :

PD-3019

[Total No. of Pages : 2

[6475]-46

M.Sc.

PHYSICS

**PHOT - 234K2 : Nuclear Techniques - I
(2020 Pattern) (Semester - III) (CBCS) (2 Credits)**

Time : 2 Hours]

[Max. Marks : 35

Instructions to the candidates :

- 1) *Q.1 is compulsory.*
- 2) *Attempt/Solve any two questions from 2 to 4.*
- 3) *Q.2 to Q.4 carry equal marks.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of log tables table and non-programmable electronic calculator is allowed.*
- 6) *Neat diagrams must be drawn wherever necessary.*

Q1) a) Attempt any four of the following :

- i) Define stopping power and explain its significance. [2]
 - ii) What is dose equivalent? How does it differ from the absorbed dose? [2]
 - iii) Define the unit Sievert (SV) and explain its use in expressing dose equivalent. How is it related to the unit Gray? [2]
 - iv) What is the function of multichannel analyzer (MCA) in radiation spectroscopy? [2]
 - v) What is the working principle of an Ionization chamber. [2]
- b) An experiment involves measuring the activity of a radioactive sample using a G.M. counter. If the counter records an average of 200 counts in 1 minute, calculate the activity of the sample in Becquerels. [3]

- Q2) a)**
- i) Discuss the principle & working of semiconductor detectors like Si(Li) and Ge(Li). [4]
 - ii) A proton with an energy of 10 MeV enters a material with a stopping power of 0.1 MeV-cm^{-1} . Calculate the proton's range in the material. [3]
- b) Discuss the construction and working of HPGe detector in gamma-ray spectroscopy. [5]

P.T.O.

- Q3)** a) Describe the interaction of gamma radiation with matter in detail. [7]
b) Explain the principle of operation of a G.M. counter. Give its advantages. [5]

Q4) Write a short note on any three of the following :

- a) Effects of radiation on the human body. [4]
b) NaI-(Tl) scintillation detector. [4]
c) Explain the differences between RAD, REM and Sievert in radiation dosimetry. [4]
d) What are the general characteristics of organic scintillators? [4]



Total No. of Questions : 4]

SEAT No. :

PD-3020

[Total No. of Pages : 2

[6475]-47

M.Sc.

PHYSICS

**PHOT-234 L2 : Microcontroller Based Instrumentation
System - I**

(2020 Pattern) (CBCS) (Semester - III) (2 Credits) (Group - I)

Time : 2 Hours]

[Max. Marks : 35

Instructions to the candidates :

- 1) Q. 1 is compulsory.
- 2) Attempt / Solve any two questions from Q.2 to Q.4.
- 3) Q.2 to Q.4 carry equal marks.
- 4) Figures to the right indicate full marks.
- 5) Use of log-tables non programmable calculator is allowed.
- 6) Neat diagrams must be drawn wherever necessary.

Q1) a) Solve any four the following :

- i) What is an 8-bit microprocessor? Give an example. [2]
- ii) Define assembler directives in the 8051 microcontroller. [2]
- iii) What is stack pointer? [2]
- iv) What is PSW register? Draw its format. [2]
- v) Define an Interrupt Service Routine (ISR). [2]
- b) List the six types of interrupts available in the 8051 microcontroller. [3]

Q2) a) Explain with one example & one advantage any three addressing methods used in 8051 programs. [7]

- b) Discuss the role of Loops in 8051 programming with an example. [5]

P.T.O.

- Q3)** a) Draw functional block diagram of microcontroller 8051 and explain it's different sections. [7]
- b) Explain parallel port structure in 8051 ul. [5]

Q4) Attempt any two of the following :

- a) What are times? Explain it's mode of operation. [6]
- b) Explain 'JMOD' and 'JCOH' registers in microcontroller 8051 with examples. [6]
- c) Explain with one example the instructions. [6]
- i) SWAP A
 - ii) XCH A, data address
 - iii) JBC bit address, code address



Total No. of Questions : 4]

SEAT No. :

PD-3021

[Total No. of Pages : 2

[6475]-48

M.Sc. - II

PHYSICS

PHOT-234 M2 : Material Science - I

(2020 Pattern) (CBCS) (Semester - III) (2 Credits)

Time : 2 Hours]

[Max. Marks : 35

Instructions to the candidates :

- 1) Q. 1 is compulsory.
- 2) Attempt / Solve any two questions from Q.2 to Q.4.
- 3) Q.2 to Q.4 carry equal marks.
- 4) Figures to the right indicate full marks.
- 5) Use of log table or non-programmable electronic calculator is allowed.
- 6) Neat diagrams must be drawn wherever necessary.

Q1) a) Solve any four questions of the following :

[4 × 2 = 8]

- i) Define defect in solids.
 - ii) What is dislocation
 - iii) Define the term substitutional solid solution?
 - iv) State twin boundary?
 - v) Define Atomic diffusion?
- b) The resistivity of an aluminium alloy is $2.8 \times 10^{-6} \Omega \cdot \text{cm}$. What would be the resistance of an aluminium wire 101.6 cm long and 0.01 cm^2 in cross-section? [3]

Q2) a) What are the types of phase diagrams? Explain Lens type Cu-Ni phase diagram. [7]

b) Derive an equation for the force present on dislocation. [5]

P.T.O.

-
- Q3)** a) What is Frenkel defect? Obtain an expression for equilibrium concentration of Frenkel defect in crystals. [7]
b) Explain Schottky defect and Grain boundaries. [5]

Q4) Write a short note on any three of the following : [3 × 4 = 12]

- a) Thermal properties.
- b) Volume defect
- c) Diffusion mechanism
- d) Solid solubility with few examples.



Total No. of Questions : 4]

SEAT No. :

PD3022

[Total No. of Pages : 1

[6475]-49

S.Y.M.Sc.

PHYSICS

**PHOT-234N2: Medical Physics - I
(2020 Pattern) (CBCS) (Semester - III) (2 Credit)**

Time : 2 Hours]

[Max. Marks : 35

Instructions to the candidates:

- 1) *Q.1 is compulsory.*
- 2) *Attempt / solve any two questions from Q.2 to Q.4.*
- 3) *Q. 2 to Q.4 carry equal marks.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of log table and programmable electronic calculator is allowed.*
- 6) *Neat diagrams must be draw whenever necessary.*

Q1) a) Attempt any four of the following.

- i) Define audibility. [2]
- ii) Define sound pollution. [2]
- iii) What a short mechanical properties of bone? [2]
- iv) Explain role of friction in walking and running. [2]
- v) Define static equilibrium in biomechanics. [2]
- b) Explain the physic of the ear in brief. [3]

Q2) a) Describe the factors affecting the mechanics of joints. [7]

b) Discuss the importance of sound in medical diagnosis and treatment.[5]

Q3) a) Compare and contrast the nernst and Goldmann equations with examples. [7]

b) Explain the working of an ECG and its clinical significance. [5]

Q4) Write a short note on any three of the following.

- a) Pressure in the body [4]
- b) MCG, MEG [4]
- c) Photoreceptors [4]
- d) Physical properties of bone [4]



Total No. of Questions : 7]

SEAT No. :

PD-3023

[Total No. of Pages : 2

[6475]-51
M.Sc. (Part-II)
PHYSICS
PHCT-241: Nuclear Physics
(2020 Pattern) (4 Credits) (Semester - IV) (CBCS)

Time : 3 Hours]

[Max. Marks : 70

Instructions to the candidate:

- 1) *Q. 1 is compulsory.*
- 2) *Q. 2 to 7 carry equal marks.*
- 3) *Attempt/Solve any five questions from Q. 2 to Q. 7.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of log tables or non-programmable electronic calculator is allowed.*
- 6) *Neat diagram must be drawn wherever necessary.*

Q1) Solve any five of the following :

- a) Draw the decay scheme of ^{60}Co Nuclei. [2]
- b) What do you mean by Radiation Detector? [2]
- c) Find the radius of Pb^{206} . ($R_0 = 1.2 \times 10^{-15}\text{m}$) [2]
- d) Define the terms nuclear fission and Nuclear Fusion. [2]
- e) Define Q-value of Nuclear Reaction. [2]
- f) What is elementary particles? [2]

Q2) a) What are leptons? Name any three leptons and their anti - particles. Discuss the properties of leptons. [7]

- b) Calculate the binding energy and binding energy per nucleon in the case of helium.

(Given: $M_p = 1.007825 \text{ amu}$; $M_n = 1.008665 \text{ amu}$ and $M_{\text{He}} = 4.00387 \text{ amu}$)

[5]

P.T.O.

- Q3)** a) What is semi-empirical mass formula? Derive the semi empirical binding energy (E_B) with the help of volume energy, surface energy, coulomb energy, asymmetry energy and pairing energy. [7]
- b) What fraction of the freshly prepared radon of half-life 3.82 days decay at the end of 3 days. [5]
- Q4)** a) Discuss the shell model of the nucleus. What are its merits and demerits?[7]
- b) Explain why experimentally the study of p-p scattering is capable of much higher accuracy than n-p scattering. [5]
- Q5)** a) Describe the principle, construction, working and uses of van de graff accelerator. [7]
- b) Give the list of nuclear power plants in India-operational. [5]
- Q6)** a) What is β -decay? Describe neutrino hypothesis of β -decay. What is the evidence for existence of neutrino? [7]
- b) What are elementary particles? Write down its classification of elementary particles. [5]
- Q7)** Write a short note on any three of the following:
- a) Mass spectrograph [4]
- b) High purity germanium detector. [4]
- c) Light Hydron Collidor (LHC) [4]
- d) Geiger-Nuttal Law [4]



Total No. of Questions : 7]

SEAT No. :

PD-3024

[Total No. of Pages : 2

[6475]-52

M.Sc. - II

PHYSICS

**PHCT - 242 : Experimental Techniques in Physics - II
(2020 Pattern) (CBCS) (Semester - IV) (4 Credits)**

Time : 3 Hours]

[Max. Marks : 70

Instructions to the candidates :

- 1) *Q.1 is compulsory.*
- 2) *Attempt / Solve any five questions from Q.2 to Q.7.*
- 3) *Q.2 to Q.7 carry equal marks.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of log-table and non programmable electronic calculator is allowed.*
- 6) *Neat diagrams must be drawn where necessary.*

Q1) Solve any Five of the following : **[10]**

- a) State the wavelength ranges for different types of electromagnetic radiations. **[2]**
- b) State different types of detectors used for detection of infra-red radiation. **[2]**
- c) Draw a neat and labelled diagram of Bragg's diffraction condition. **[2]**
- d) Sketch and label thermogravimetric graph. **[2]**
- e) Draw neat labelled diagram for Field Emission Scanning Electron Microscope (FESEM). **[2]**
- f) What is the principle of electron microscopy? **[2]**

- Q2)**
- a)
 - i) Explain in brief the detectors used for y-rays, x-rays, UV-visible and microwaves. **[4]**
 - ii) Why do microwave ovens heat up food. **[3]**
 - b) State different sources of radiations for y-rays, x-rays IR, UV-visible and microwave. **[5]**

P.T.O.

- Q3)** a) i) Derive Bragg's diffraction condition. [4]
ii) What are the factors affecting the intensity of x-ray diffraction peaks. [3]
b) Explain differential thermal analysis (DTA) using neat diagram. [5]
- Q4)** a) i) What are advantages and limitations of TEM. [4]
ii) State the limitations of scanning electron microscope over the transmission electron microscope. [3]
b) Explain principle, construction and working of the Vibrating Sample Magnetometer (VSM). [5]
- Q5)** a) Write range of wavelengths and corresponding energies for all the electromagnetic radiations. [6]
b) Derive the Scherrer formula for size determination of nanoparticles. [6]
- Q6)** a) Explain the principle, construction and working of scanning electron microscope (SEM) with the help of neat diagram. [6]
b) Explain the principle, construction and working of Fourier Transform Infra-red Spectrometer (FTIR). [6]
- Q7)** Answer any Three of the following :
- a) Write a short note on X-ray production. [4]
b) Write short note on Thermo gravimetric Analysis (TGA). [4]
c) Write short note on applications, advantages and disadvantages of Scanning Electron Microscope (SEM). [4]
d) What is Raman Spectroscopy? [4]



Total No. of Questions : 7]

SEAT No. :

PD-3025

[Total No. of Pages : 2

[6475]-53

M.Sc.

PHYSICS

PHOT -244 G4 : Acoustics - II

(2020 Pattern) (Semester -IV) (4 Credits) (Group - II)

Time : 3 Hours]

[Max. Marks : 70

Instructions to the candidates :

- 1) *Q.1 is compulsory.*
- 2) *Attempt / Solve any five questions from Q.2 to Q.7.*
- 3) *Q.2 to Q.7 carry equal marks.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of log table and non-programmable electronic calculator is allowed.*
- 6) *Neat diagrams must be drawn wherever necessary.*

Q1) Answer any five of the following:

-

- a) What is volume limiter? [2]
- b) Define phase velocity C^1 of exponential horn. [2]
- c) State any four parameters of digital audio CD. [2]
- d) Draw circuit diagram of Ist order three way crossover network. [2]
- e) Define Directivity factor and Directivity index. [2]
- f) What is monaural SRS? [2]

Q2) a) i) Derive an expression for sensitivity of carbon microphones. [4]

- ii) An infinite exponential horn of length 0.75m has radius of 0.02m at the throat and a radius of 0.2 m at its mouth. Determine its flare constant and cut-off frequency. [3]

b) Write a note on different types of loudspeaker cabinets. [5]

P.T.O.

- Q3)** a) i) With the help of a neat diagram explain construction and working of a moving coil microphone. [4]
 ii) Write a note on applications of ultrasound. [3]
 b) Determine the phase velocity of a 354 Hz plane wave progressing through an exponential horn of flare constant 5.1 at a temperature of 38°C. [5]
- Q4)** a) i) Derive an expression for pressure response of a loudspeaker. Draw a neat diagram. [4]
 ii) Write a note on Audio File Format. [3]
 b) Write a note on stereophonic sound recording system. Draw a neat diagram. [5]
- Q5)** a) With the help of neat diagrams explain polar patterns of microphones. [7]
 b) Discuss the effect of voice coil parameters on the acoustic output of direct radiator loudspeakers. [5]
- Q6)** a) i) Derive the expression for motional impedance Z_m of direct radiator loudspeaker. [4]
 ii) Write a note on ultrasonic cleaning and ultrasonic range finding. [3]
 b) With the help of a neat diagram, explain construction and working of a horn loudspeaker. [5]
- Q7)** Answer any three of the following.
- a) Dolby noise reduction [4]
 b) Graphic Equalizer [4]
 c) Anechoic chamber [4]
 d) Musical Instruments Digital Interface (MIDI) [4]



Total No. of Questions : 7]

SEAT No. :

PD-3026

[Total No. of Pages : 2

[6475]-54

M.Sc.

PHYSICS

PHOT-244H4 : Energy Studies II

(2020 CBCS Pattern) (Semester - IV) (Group II) (4 Credits)

Time : 3 Hours]

[Max. Marks : 70

Instructions to the candidates :

- 1) Q.1 is compulsory.
- 2) Answer/Solve any five from Q2 to Q7.
- 3) Q2 to Q7 carry equal marks.
- 4) Figures to the right side indicate full marks.
- 5) Use of calculator is allowed.
- 6) Neat diagram must be drawn wherever necessary.

Q1) Solve any five.

- a) What are the sources of Hydrogen? [2]
- b) Define Solar Cell. Give its types. [2]
- c) State the difference between direct and indirect band gap. [2]
- d) What is open circuit voltage and short circuit current. [2]
- e) What do you mean by energy farming? [2]
- f) What is selective coating? [2]

Q2) a) What are the various Hydrogen production method? Explain any one of them. [7]

b) Define Biomass and explain its use to produce electric power. [5]

Q3) a) What do you mean by Biomass gassification? Describe various Biomass gasifiers. [7]

b) How are metals, insulators and semiconductors classified? Give examples of each. [5]

P.T.O.

- Q4)** a) Explain wind turbine types and their construction. [7]
b) Explain working principle of solar Dryer with a neat suitable diagram. [5]
- Q5)** a) Explain with neat diagram, box type solar cooker. [6]
b) What are the major applications of wind power and explain them in detail. [6]
- Q6)** a) Explain the performance of a flat plate collector based on solar irradiance (I), inlet temperature (T_i) and air temperature (T_a) [7]
b) State the advantages and disadvantages of vertical axis wind mills. [5]
- Q7)** Write short notes on any three of the following.
- a) Origin of wind. [4]
 - b) Factors affecting the distribution of wind energy on the surface of the Earth. [4]
 - c) Aerobic and Anaerobic bioconversion processes. [4]
 - d) Solar pond [4]



Total No. of Questions : 7]

SEAT No. :

PD-3027

[Total No. of Pages : 2

[6475]-55

M.Sc.

PHYSICS

PHOT-244I4 : Electronics Instrumentation - II
(2020 Pattern) (Semester - IV) (4 Credits) (Group - II)

Time : 3 Hours]

[Max. Marks : 70

Instructions to the candidates :

- 1) *Q. 1 is compulsory.*
- 2) *Solve any five questions from Q.2 to Q.7.*
- 3) *Q.2 to Q.7 carry equal marks.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of log table or non-programmable electronic calculator is allowed.*
- 6) *Neat labelled diagrams must be drawn wherever necessary.*

Q1) Solve any five of the following :

- a) Why derivative controller mode is never use alone? [2]
- b) Which controllers are also called as Reset type controllers? Why? Explain. [2]
- c) Write a purpose of command window and figure window. [2]
- d) Define ladder diagram. Draw circuit symbol for NC and NO type of physical limit switch. [2]
- e) Define total scan time of PLC. [2]
- f) What is process control loop? [2]

- Q2) a)** With neat circuit diagram explain PI controller mode. Derive output voltage equation. [7]
- b) Explain process characteristics with special reference to process equation with suitable examples draw necessary diagram. [5]

P.T.O.

- Q3) a)** Explain in details the colon (:) operator used in matlab. Give at least two distinct use of this operator. Give the use of (;) semicolon (%) percentage symbol in matlab. Give list of predefine variable in matlab. [7]
- b) Design a proportional integral controller with a proportional band of 30% and an integration gain of 0.1% (–5%). The 4 to 2mA input converts to a 0.4 V to 2V signal and output is to be 0-10V. Calculate values of G_p , G_i , R_2 , R_1 and C respectively. [5]
- Q4) a)** With neat circuit diagram explain PD controller mode. Derive output voltage equation. [7]
- b) What is script file in matlab? Write rule for defining scaler variable in matlab. [5]
- Q5) a)** Draw a neat circuit diagram for proportional controller using operational amplifiers. Explain the working and significance of proportional band and proportional gain. What limitation of proportional controllers process? Give area of application of these controllers. [7]
- b) A controller is used to control speed of motor from 140 rpm to 600 rpm by Controlling current in the range of 4-20 MA flowing in the motor coil. Calculate current corresponding to 310 rpm and express the value of current as the present of control output. [5]
- Q6) a)** Draw block diagram for a PLC. Explain it's operations in details with special reference to input mode, output mode and application. [7]
- b) What is a "MATLAB" List important windows for a "MATLAB" Describe any two of them in brief specify maximum length of characters in defining a variable name in Matlab. [5]
- Q7) Write short note on any two of the following :**
- a) Control system Evaluation. [6]
- b) Two position controller mode. [6]
- c) First order sensor time response. [6]



Total No. of Questions : 7]

SEAT No. :

PD-3028

[Total No. of Pages : 2

[6475]-59

M.Sc. (Part - II)

PHYSICS

PHOT-244M4 : Material Science - II

(2020 Pattern) (CBCS) (Semester - IV) (4 Credits)

Time : 3 Hours]

[Max. Marks : 70

Instructions to the candidates :

- 1) Q. 1 is compulsory.
- 2) Attempt any five questions from Q.2 to Q.7.
- 3) Q.2 to Q.7 carry equal marks.
- 4) Use of log table or non programmable electronic is allowed.
- 5) Figures to the right indicate full marks.
- 6) Neat diagram must be drawn where necessary.

Q1) Solve any five of the following : [10]

- a) What are multiple compounds? Explain. [2]
- b) Describe in short field effect transistor. [2]
- c) The electron concentration in an n-type semiconductor is $5 \times 10^{17}/\text{m}^3$. Calculate the conductivity of the material if drift velocity of electron is 350 m/s in a field of 1000 v/m. [2]
- d) What is the electron density on the electrodes of charge 0.24×10^{-10} c. [2]
- e) Differentiate between ferro - magnetic and ferrimagnetic materials. [2]
- f) The resistivity of pure silicon of room temperature is $3000\Omega \text{ m}$. Calculate intrinsic carrier density. [2]

Q2) a) Derive the relation for built-in potential in p-n junction. [7]

- b) List various applications of High T_e materials. [5]

P.T.O.

- Q3) a)** With a labelled diagram discuss subclasses of silicates. (any four). [7]
b) Explain in detail processing of ceramic materials. [5]
 i) Sintering process.
 ii) Single crystal preparation.
- Q4) a)** Draw a well labelled diagram of garnets structure unit and explain in detail contribution of spin. [7]
b) A rod of p - type Germanium 10mm long and 1mm diameter has a resistance of 100Ω . What is the concentration of impurity in this rod. ($\mu_e = 0.39 \text{ m}^2/\text{Vs}$, $\mu_n = 0.19 \text{ m}^2/\text{Vs}$) [5]
- Q5) a)** Sketch diagrams depicting temperature dependence of inverse susceptibility in paramagnetic regime of : [6]
 i) Paramagnetic
 ii) Ferromagnetic
 iii) Ferrimagnetic
 iv) Anti - ferromagnetic
b) Explain in detail intrinsic and extrinsic semiconductor with diagram and examples. [6]
- Q6) a)** Explain in detail about quasi - crystals which can be formed by 'Penrose Rhombus'? [6]
b) Explain in detail Intrinsic & Extrinsic semiconductor with well labelled diagrams. [6]
- Q7) Write short note on any three :** [12]
 a) Type - II phase diagram [4]
 b) Chemical reaction equilibrium [4]
 c) Optical materials [4]
 d) Giant Magneto - Resistance (GMR) [4]



Total No. of Questions : 4]

SEAT No. :

PD-3029

[Total No. of Pages : 2

[6475]-62

M.Sc.

PHYSICS

PHOT-244 H2: Energy Studies - II

(2020 Pattern) (CBCS) (2 Credits) (Semester - IV)

Time : 2 Hours]

[Max. Marks : 35

Instructions to the candidate:

- 1) Q. 1 is compulsory.
- 2) Attempt/solve any two questions from Q. 2 to Q.4.
- 3) Q. 2 to Q.4. carry equal marks.
- 4) Figures to the right indicate full marks.
- 5) Use of calculator is allowed.
- 6) Neat diagrams must be drawn wherever necessary.

Q1) a) Attempt any four of the following : [8]

i) What is biomass [2]

ii) What is selective coating [2]

iii) How wind mills are classified [2]

iv) What is selective coating? [2]

v) What is solar distillation? [2]

b) What are the applications of flat plate collector. [3]

Q2) a) Explain in details different types of wind mills. [7]

b) Explain with neat diagram, the power generation SPV system. [5]

P.T.O.

Q3) a) Explain with neat diagram, a basic photovoltaic system integrated with power grid. [7]

b) Explain the process of pyrolysis and gasification. [5]

Q4) Write a short note on any three of the following: [12]

a) Solar box type cooker [4]

b) Parabolic concentrator cooker [4]

c) Digestor Design [4]

d) Energy balance equation of steady state [4]



Total No. of Questions : 4]

SEAT No. :

PD-3030

[Total No. of Pages : 2

[6475]-63

M.Sc. (Part-II)

PHYSICS

PHOT-244 I2: Electronics Instrumentation - II
(2020 Pattern) (CBCS) (2 Credits) (Semester - IV)

Time : 2 Hours]

[Max. Marks : 35

Instructions to the candidate:

- 1) Q. 1 is compulsory.
- 2) Attempt/solve any two questions from Q. 2 to Q.4.
- 3) Q. 2 to Q.4. carry equal marks.
- 4) Figures to the right indicate full marks.
- 5) Use of log table of non-programmable electronic calculator is allowed.
- 6) Neat diagrams must be drawn where necessary.

Q1) a) Solve any four of the following :

- i) What is process control principle? [2]
- ii) Define total scan time of PLC. [2]
- iii) Derivative control mode is not used along. Comment. [2]
- iv) List the composite controller mode. [2]
- v) What is servomechanism? [2]

b) With neat circuit diagram explain PI controller mode. [3]

Q2) a) Explain derivative mode op-amp controller with the help of neat circuit diagram. [7]

b) List the advantages of computer-based controller over relay logic controller. [5]

P.T.O.

Q3) a) What is process control loop? Explain control system evaluation criteria in detail. [7]

b) Explain first and second order sensor response. [5]

Q4) Write a short note on any two of the following:

a) Proportional control mode [6]

b) Process control block diagram [6]

c) Sensor time response [6]



Total No. of Questions : 4]

SEAT No. :

PD-3031

[Total No. of Pages : 2

[6475]-64

M.Sc.

PHYSICS

PHOT - 244 J2 : Biomedical Instrumentation - II
(2020 Pattern) (Semester - IV) (2 Credits)

Time : 2 Hours]

[Max. Marks : 35

Instructions to the candidates :

- 1) *Q.1 is compulsory.*
- 2) *Attempt any two question from Q.2 to Q.4.*
- 3) *Q.2 to Q.4 carry equal marks.*
- 4) *Figures to the right side indicate full marks.*
- 5) *Use of log table and non programmable electronic calculator is allowed.*
- 6) *Neat diagrams must be drawn wherever necessary.*

Q1) a) Solve any four of the following :

- i) What is electroencephalogram? What is its typical amplitude? [2]
- ii) What are pneumograph and pneumogram? [2]
- iii) Define the term hypoventilation and hyperventilation. [2]
- iv) What are the types of EMG? [2]
- v) What is ultrasound? State its use in biomedical instrumentation.[2]

b) Calculate the wavelength of a 2MHz ultrasound beam.

(Velocity of tissues = 1540 m/s) [3]

Q2) a) Explain basic pulse echo apparatus with block diagram. [7]

b) What is computer? Explain digital computer system in detail. [5]

Q3) a) Explain with neat labelled diagram, block diagram of EEG machine. [7]

b) Explain the generation and detection of ultrasound. [5]

P.T.O.

Q4) Write a short note on any three of the following :

- a) Computer software [4]
- b) Procedure to perform EMG [4]
- c) Neuromascular transmission [4]
- d) Describe properties of ultrasound [4]



Total No. of Questions : 4]

SEAT No. :

[Total No. of Pages : 2

PD-3032

[6475]-67

M.Sc. -II

PHYSICS

PHOT -244 M2 : Material Science - II

(2020 Pattern) (CBCS) (Semester -IV) (2 Credits)

Time : 2 Hours]

[Max. Marks : 35

Instruction to the candidates :

- 1) *Q.1 is compulsory.*
- 2) *Attempt / Solve any two questions from Q.2 to Q.4.*
- 3) *Q.2 to Q.4 carry equal marks.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of log table and non-programmable electronic calculator is allowed.*
- 6) *Neat diagrams must be drawn wherever necessary.*

Q1) Solve any four of the following :

[4 × 2 = 8]

- a)
 - i) Define binary phase diagram.
 - ii) State lever rule.
 - iii) State Richard's and Troaton's rule.
 - iv) Explain activity co-efficient.
 - v) Explain change in enthalpy.
- b) What are the degrees of freedom of a system of two components when the numbers of phase is one. **[3]**

Q2) a) Derive an expression for Gibb's phase rule. Hence write invariance for unary and binary component system. **[7]**

- b) With the help of neat diagram explain minima in two-phase regions. **[5]**

P.T.O.

- Q3)** a) Explain with the help of free energy diagram the thermodynamic origin of equilibrium lens shape phase diagram. [7]
- b) Describe any one experimental technique for determination of phase diagram. [5]

Q4) Write a short note on any three of the following: [3 × 4 = 12]

- a) Chemical reaction equilibrium.
- b) Regular solution (Henry's law)
- c) Limited mutual solid solubility
- d) Change in entropy.



Total No. of Questions : 7]

SEAT No. :

PD3033

[Total No. of Pages : 2

[6475]-69

S.Y.M.Sc.

PHYSICS

**CBOP-I (PHOT-243A4): Physics of Thin Films
(2020 Pattern) (Semester - IV) (4 Credit)**

Time : 3 Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) *Q.1 is compulsory.*
- 2) *Solve any five questions form Q.2 to Q.7.*
- 3) *Q. 2 to Q.7 carry equal marks.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of log tables and non-programmable calculator is allowed.*
- 6) *Neat diagrams must be drawn wherever necessary.*

Q1) Solve any FIVE of the following.

- a) Enlist the difference between PVD and CVN. [2]
- b) Define super saturation growth mechanism. [2]
- c) What is magnetoresistance in thin film. [2]
- d) Write the principle of phorolithography. [2]
- e) Write the advantages of thin film resistor. [2]
- f) Define nucleation. [2]

Q2) a) What is interference? How this phenomena is utilized in the thin film thickness measurement? Explain with the help of schematic diagram.[7]

- b) Write a note on thin film capacitor. [5]

Q3) a) Explain how the shortcoming in Thomson model for scattering of electron are overcome by fuchs- Sondheimer theory from thin film surface? [7]

- b) Explain in brief pulsed Laser Ablation. [5]

Q4) a) i) Why it is important to understand gas transport nature during CVD growth mechanism? Explain. [4]

- ii) Explain the term: Thin film solar cells. [3]

- b) With the help of schematic diagram, explain the working principle of quartz crystal microbalance. [5]

P.T.O.

- Q5)** a) State the different techniques of thin film coatings. Explain the construction and working principle of spray pyrolysis technique. [6]
b) What is capillary model and Atomistic model? Write difference between capillarity and Atomistic model. [6]
- Q6)** a) What are the uses and applications of thin films in information storage, electro-acoustics and telecommunication. [6]
b) Define sputtering. Explain any one type of sputtering in detail. [6]
- Q7)** Write a short note on Any Three of the following.
- a) Pulse Laser Deposition. [4]
 - b) Difference between thin and thick films. [4]
 - c) Molecular beam epitaxy. [4]
 - d) Residual resistivity in metallic conductors. [4]



Total No. of Questions : 7]

SEAT No. :

PD-3034

[Total No. of Pages : 2

[6475]-70

M.Sc. (Part - II)

PHYSICS

**CBOP-I (PHOT-243XXB4) : Physics of Nanomaterials
(Common Paper)
(2020 Pattern) (CBCS) (4 Credits)**

Time : 3 Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) *Q.1 is compulsory.*
- 2) *Attempt / Solve any 5 questions from Q.2 to Q.7.*
- 3) *Q.2 to Q.7 carry equal marks.*
- 4) *Figures to the right indicate full marks.*
- 5) *Neat diagram must be drawn wherever necessary.*
- 6) *Use of log-table or non-programmable electronic calculator is allowed.*

Q1) Solve any Five of the following :

[10]

- a) State significance of nanomaterials.
- b) What are applications of PVD?
- c) What factor affect on chemical bath deposition method?
- d) Enlist the various structures of nanotubes.
- e) What is the main benefit of sol-gel processing?
- f) Explain electrical properties of nanomaterials.
- g) What is top-down approach?

Q2) a) Describe step by step chemical bath deposition method with suitable diagram. **[7]**

- b) Explain nucleation and growth phenomenon for nanomaterial's synthesis. **[5]**

P.T.O.

- Q3)** a) Explain in brief physical vapour deposition method with neat diagram. Write its advantages and disadvantages. [7]
b) Explain optical and electric properties of nanomaterial's in brief. [5]
- Q4)** a) Describe quantum confinement effect in metal nanoparticles. [7]
b) Write a short note on graphene. [5]
- Q5)** a) What is Aerogel? Explain it's properties and application. [7]
b) Explain step by step the metal reduction method. [5]
- Q6)** a) Explain in details the high energy ball milling method for synthesis of nanomaterial's and give it's disadvantages. [7]
b) Explain the significance of nanosize material's. [5]
- Q7)** Write short note on any three of the following : [12]
a) Write short note on fullerene.
b) Applications of nanomaterial's in defence field.
c) Biological method of nanomaterial's.
d) Magnetic properties of nanomaterial's.



Total No. of Questions : 7]

SEAT No. :

PD-3035

[Total No. of Pages : 2

[6475]-71

M.Sc. - II

PHYSICS

**CBOP-I(PHOT-243XXXC4) : Lasers & Applications
(CBCS) (2020 Pattern) (4 Credits) (Semester - I, II & IV)**

Time : 3 Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) *Q.1 is compulsory.*
- 2) *Attempt / Solve any five questions from Q.2 to Q.7.*
- 3) *Q.2 to Q.7 carry equal marks.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of log-table or non-programmable calculator is allowed.*
- 6) *Neat diagrams must be drawn wherever necessary.*

Q1) Solve any Five of the following :

[10]

- a) Define the term spontaneous emission & stimulated emission.
- b) Explain the threshold gain & round trip gain.
- c) Write any two scientific applications of lasers.
- d) Define metastable state. How it is useful in lasers?
- e) What is Pumping in lasers?
- f) Define active medium. What is the active medium used in Ruby laser?

Q2) a) Explain the construction & working of He-Ne laser.

[7]

b) Derive the relation between Einstein coefficients.

[5]

Q3) a) Explain the condition of large stimulated emission in lasers.

[6]

b) Explain the applications of lasers in industry.

[6]

P.T.O.

- Q4)** a) What will be the reflectivity of first cavity mirror, if the reflectance of second mirror is 95%? The length of cavity is 20 cm & gain factor of laser material is 0.003 per cm. [7]
- b) Explain the characteristics of laser light in detail. [5]
- Q5)** a) With neat diagrams explain the construction & working of Nd-YAG laser. [6]
- b) Find the relative population inversion of the two states in Ruby laser that produces a light beam of wavelength $6943\text{\AA}$, at 400°K [6]
- Q6)** a) Explain the principle, construction & working of semiconductor laser.[6]
- b) What is divergence? Explain the divergence of laser beam. [6]
- Q7)** Write short note on any three of the following :
- a) Applications of lasers in medical field. [4]
- b) Laser light & ordinary light. [4]
- c) Gas lasers [4]
- d) Population inversion [4]



Total No. of Questions : 7]

SEAT No. :

PD-3036

[Total No. of Pages : 2

[6475]-72

M.Sc.

PHYSICS

**CBOP-I (PHOT 234xxx D4) : Physics of Semiconductor Devices
(2020 Pattern) (CBCS) (Semester - I, II & IV) (4 Credits) (Group - I)**

Time : 3 Hours]

[Max. Marks : 70

Instructions to the candidates :

- 1) *Q. No. 1 is compulsory.*
- 2) *Attempt any five questions from Q.2 to Q.7.*
- 3) *Q. No. 2 to 7 carry equal marks.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of calculator is allowed.*
- 6) *Neat diagrams must be drawn whenever necessary.*

Q1) Solve any Five of the following :

- a) What is depletion layer capacitance? [2]
- b) What is Schottky contact? [2]
- c) Write current density equations for electrons and holes. [2]
- d) Draw connection and current component in common base configuration. [2]
- e) Obtain carrier concentration of holes P_o . [2]
(Given $n_i = 1.5 \times 10^{10}/\text{cc}$; $n_0 = 1 \times 10^{16} \text{ cc}$)
- f) Explain Thermal Breakdown of PN junction. [2]

Q2) a) What are the different types of junction breakdown? Explain any two junction breakdowns. [7]

b) Explain the working of junction field effect transistor. [5]

Q3) a) What do you ment by recombination of carries? Explain any two recombination of carriers. [7]

b) Describe direct and indirect band gap semiconductors using suitable diagram. [5]

P.T.O.

- Q4)** a) Draw neat labelled diagram of common base configuration for N.P.N. transistors. Explain input and output characteristics of common base configuration for N*P*N transistors. [7]
b) With suitable diagram explain energy band relation for metal semiconductors. [5]
- Q5)** a) Explain Schottky effect. Also explain how to obtain Schottky barrier height? [7]
b) Describe carrier concentrations of resistivity and obtain expression for resistivity of n-type and p-type semiconductor. [5]
- Q6)** a) Explain carrier diffusion and obtain Einstein's relation. [6]
b) Explain construction and working of metal semiconductors. [6]
- Q7) Write a short note on any three :**
- a) Unijunction transistor [4]
b) Construction of transistor [4]
c) High injection condition [4]
d) Diffusion junction method [4]



Total No. of Questions : 7]

SEAT No. :

PD-3037

[Total No. of Pages : 2

[6475]-73

M.Sc.

PHYSICS

**CBOP-I(PHOT-243E4) : Communication Electronics
(2020 Pattern) (CBCS) (Semester - I, II & IV) (4 Credits)**

Time : 3 Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) *Q.1 is compulsory.*
- 2) *Solve any five questions from Q.2 to Q.7*
- 3) *Q.2 to Q.7 carry equal marks.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of log-table and non-programmable electronic calculator is allowed.*
- 6) *Neat diagram must be drawn wherever necessary.*

Q1) Solve any five of the following :

- a) What is digital communication? [2]
- b) Define Signal to Noise Ratio (SNR). [2]
- c) What is a two-wire repeater? [2]
- d) What is multiplexing? [2]
- e) Differentiating between FDM and TDM? [2]
- f) Defination geostationary orbit. [2]

Q2) a) Explain Network organization. Determine the number of links required between 6 pcs. [7]

- b) Explain the working principle of an echo suppressor and its importance. [5]

Q3) a) Explain in detail the various types of light source used in fiber optics communication. [7]

- b) What is Facsimile? Give the principle of Fascimile. Explain its use in telecommunication. [5]

P.T.O.

- Q4)** a) Explain the fundamentals of a digital communication system and its importance. [7]
b) Explain the working of a basic pulsed radar system with a block diagram. [5]
- Q5)** a) Explain how satellite orbits are selected based on their applications. [6]
b) Compare different digital codes like Baudot, ASCII, EBCDIC and Hollerith code. [6]
- Q6)** a) Compare the working principle of wire telephone and mobile telephone system. [6]
b) Discuss different type of losses in optical fibers and method to minimize them. [6]
- Q7)** Write short note on any three of the following :
- a) Telephone subscribe loop circuit. [4]
b) Fiber communication system. [4]
c) Characteristics of data transmission. [4]
d) Basic pulse radar. [4]



Total No. of Questions : 7]

SEAT No. :

PD3038

[Total No. of Pages : 2

[6475]-74

M.Sc.

PHYSICS (Common Paper)

CBOP-I (PHOT-243F4): Microwave Physics and Applications

Time : 3 Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) *Q.1 is compulsory.*
- 2) *Solve any five questions from Q.2 to Q.7.*
- 3) *Q. 2 to Q.7 carry equal marks.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of log tables and non programmable electronic calculator is allowed.*
- 6) *Neat diagrams must be drawn wherever necessary.*

Q1) Solve any five of the following.

- a) Define transmission line in microwave communication. [2]
- b) Define standing wave Ratio (SWR). [2]
- c) What are TE and TM modes in wave guides? [2]
- d) Define the bunching process in a klystron. [2]
- e) What is the role of a Gunn diode in microwave applications? [2]
- f) What are TR and ATR switches? [2]

Q2) a) Discuss various application of microwaves in industries, medicine and defense. [7]

- b) Explain how the SWR is calculated and its importance in transmission lines. [5]

Q3) a) Explain how waveguide components like bends, corners and twists influence microwave signal transmission. [7]

- b) Describe the working of a Magnetron with a diagram. [5]

Q4) a) Explain different methods of microwave power measurement including the use of bolometers. [7]

- b) Explain how impedance is measured in microwave systems using the smith chart. [5]

P.T.O.

- Q5)** a) Explain different methods to minimize reflections in a transmission line.[6]
b) Discuss the importance of attenuators in microwave circuits and their types. [6]
- Q6)** a) Compare the working principles and applications of MOSFET and PIN diode. [6]
b) Discuss the importance of Q-factor measurement in cavity resonators and microwave circuits. [6]
- Q7)** Solve any three of the following:
- a) Use of microwaves in communication and radar system. [4]
b) What is the role of a hybrid ring (Rat - Race) in microwave communication. [4]
c) Explain how the bunching process improves microwave amplification.[4]
d) What is the Q-factor, and how is it measured in microwave systems?[4]



Total No. of Questions : 4]

SEAT No. :

PD3039

[Total No. of Pages : 1

[6475]-75

M.Sc.-PHYSICS

**PHY-243A2: Physics of Thin Films
(Semester-I,II &IV)**

Time : 2 Hours]

[Max. Marks : 35

Instructions to the candidates:

- 1) *Q.1 is compulsory.*
- 2) *Attempt / solve any two questions from Q.2 to Q.4.*
- 3) *Q. 2 to Q.4 carry equal marks.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of log tables and non-programmable electronic calculator is allowed.*
- 6) *Neat diagrams must be drawn wherever necessary.*

- Q1)** a) Solve any four of the following.
- i) Define Nucleation. [2]
 - ii) State the working principle in capillarity model. [2]
 - iii) Write the applications of thin film in solar cells. [2]
 - iv) State the working of quartz microbalance. [2]
 - v) List the different steps involved in Talystep method. [2]
- b) Explain the working of pulsed Laser Ablation method. [3]
- Q2)** a) Define interference. How this phenomenon is used in the measurement of thickness of thin film by Tolansky method. [7]
- b) Distinguish between capillarity model and Atomistic model. [5]
- Q3)** a) State the working principle in dip coating. Discuss the importance of dip coating. [7]
- b) Explain optical coating with it's properties and applications. [5]
- Q4)** Write a short note on any three of the following.
- a) Chemical vapour deposition. [4]
 - b) Junction devices (metal-semiconductor junction). [4]
 - c) Difference between thin and thick films. [4]
 - d) Applications of thin films in sensors. [4]



Total No. of Questions : 4]

SEAT No. :

PD-3040

[Total No. of Pages : 2

[6475]-76

M.Sc.

PHYSICS

**(Group-I) : CBOP-I (PHOT-XXXB2T) : Physics of
Nanomaterials**

(2020 Pattern) (CBCS) (Semester - I & II & IV) (2 Credits)

Time : 2 Hours]

[Max. Marks : 35

Instructions to the candidates :

- 1) Q. 1 is compulsory.
- 2) Attempt / Solve any Two questions from Q.2 to Q.4.
- 3) Q.2 to Q.4 carry equal marks.
- 4) Use of log table or non - programmable electronic calculator is allowed.
- 5) Figures to the right indicate full marks.
- 6) Neat diagrams must be drawn where necessary.

Q1) a) Solve any four of the following :

- i) What is meant by Sol-gel? [2]
 - ii) Define Nanoscience and Nanotechnology. [2]
 - iii) Name any two chemical method of synthesis of Nano particles. [2]
 - iv) List application of physical vapour deposition. [2]
 - v) What are different type of carbon nano tube. [2]
- b) Draw a neat labelled diagram of Hydrothermal method of nano materials. [3]

Q2) a) i) Explain mechanical properties of nano materials. [4]

ii) Calculate Energy in eV of a wave length is 400 nm. [3]

b) Explain the effect of reduction of dimension of nanosize of materials. [5]

P.T.O.

- Q3)** a) Describe step by step the Chemical Bath deposition method with suitable diagram. [7]
- b) Describe the synthesis, properties and applications of Carbon nanotubes. [5]

Q4) Write a short notes on any three of the following:

- a) Optoelectronic Application. [4]
- b) Physical vapour deposition. [4]
- c) Biomedical Application. [4]
- d) Graphene and their Application. [4]



Total No. of Questions : 4]

SEAT No. :

PD-3041

[Total No. of Pages : 2

[6475]-77

M.Sc. (Part - II)

PHYSICS

PHOT-243XXXC2T : Lasers & Applications

(CBCS) (2020 Pattern) (2 Credits) (Semester - I, II & IV)

Time : 2 Hours]

[Max. Marks : 35

Instructions to the candidates:

- 1) Q.1 is compulsory.
- 2) Attempt / Solve any two questions from Q.2 to Q.4.
- 3) Q.2 to Q.4 carry equal marks.
- 4) Figures to the right indicate full marks.
- 5) Use of log-table or non-programmable calculator is allowed.
- 6) Neat diagram must be drawn wherever necessary.

Q1) a) Attempt any four of the following :

- i) What do you mean by spontaneous emission? [2]
- ii) What do you mean by pumping? [2]
- iii) Define the term of metastable state. [2]
- iv) What do you mean by active medium with example. [2]
- v) Explain principle of solid state laser. [2]
- b) Distinguish between 3-level & 4 level lasers. [3]

Q2) a) With neat diagram explain the construction & working of semiconductor lasers. [7]

b) Derivation of relation between Einstein coefficients. [5]

Q3) a) Explain the construction, working and energy level diagram for He-Ne laser. State any four application. [7]

b) What is mean by population inversion? Why it is important in layers. Explain the method at activiting it. [5]

P.T.O.

Q4) Write short note on any three of the following :

- a) Gas lasers [4]
- b) Properties of laser [4]
- c) Stimulates Emission [4]
- d) Light amplification [4]



Total No. of Questions : 4]

SEAT No. :

PD-3042

[Total No. of Pages : 2

[6475]-78

M.Sc. - II

PHYSICS

**CBOP-1(PHOT-243XXD2) : Physics of Semiconductor
Devices**

(CBCS) (2020 Pattern) (2 Credits) (Semester - I & II & IV)

Time : 2 Hours]

[Max. Marks : 35

Instructions to the candidates:

- 1) *Q.1 is compulsory.*
- 2) *Attempt any two questions from Q.2 to Q.4.*
- 3) *Q2 to Q4 carry equal marks.*
- 4) *Use of calculator is allowed.*
- 5) *Neat diagrams must be drawn wherever necessary.*

- Q1)** a) Solve any four of the following : [8]
- i) What is IMPATT diode? [2]
 - ii) State Hall effect. [2]
 - iii) State Fick's law. [2]
 - iv) Explain the inversion stage of heterojunction. [2]
 - v) Write note on diffusion method of junction formation. [2]
- b) What is the pinch-off of JFET? [3]
- Q2)** a) Explain the static characteristics of SCR. [7]
- b) Explain the working of JFET. [5]
- Q3)** a) i) Explain basic device technology of PN junction. [4]
- ii) What is inversion stage and depletion stage in the heterojunction. [3]
- b) Explain BJT with neat diagram. [5]

P.T.O.

Q4) Write short note on any three : **[12]**

- a) Junction breakdown **[4]**
- b) Excess carriers in semiconductors **[4]**
- c) Barrier heights and its different measurement methods. **[4]**
- d) Diffusion capacitance of P-N junction. **[4]**



Total No. of Questions : 4]

SEAT No. :

PD-3043

[Total No. of Pages : 2

[6475]-79

M.Sc.

PHYSICS

**CBOP-I(PHOT-243 E2) : Communication Electronics
(2020 Pattern) (CBCS) (Semester - I, II & IV) (2 Credit)**

Time : 2 Hours]

[Max. Marks : 35

Instructions to the candidates :

- 1) *Q. 1 is compulsory.*
- 2) *Write any 2 from 2 to 4.*
- 3) *Figures to the right indicate full marks.*

Q1) a) Solve any four of the following :

- i) What is digital communication ? [2]
- ii) Define crosstalk in digital communication. [2]
- iii) What is a four-wire terminating set? [2]
- iv) What is a pulsed radar? [2]
- v) Define satellite attitude. [2]
- b) Draw the block diagram of basic pulsed radar set. [3]

Q2) a) Explain in detail different digital codes used for data representation. [7]

- b) Describe various satellite frequency band and their uses. [5]

Q3) a) Compare different digital codes like Baudot, ASCII, EBCDIC, and Hollerith codes. [7]

- b) Calculate the capacity of a standard 4 KHz telephone channel has 3100 Hz bandwidth with a 30 dB signal to noise ratio. [5]

P.T.O.

—

Q4) Write short note on any three of the following :

- a) Network organization. [4]
- b) Farsimile transmission. [4]
- c) Basic pulsed radar. [4]
- d) Synchronous orbit in satellite communication system. [4]



Total No. of Questions : 4]

SEAT No. :

PD3044

[Total No. of Pages : 1

[6475]-80

M.Sc.

PHYSICS (Common Paper)

PHOT-243F2: Microwave Physics and Applications

Time : 2 Hours]

[Max. Marks : 35

Instructions to the candidates:

- 1) *Q.1 is compulsory.*
- 2) *Attempt any two questions from Q.2 to Q.4.*
- 3) *Q.2 to Q.4 carry equal marks.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of log tables and non programmable electronic calculator is allowed.*
- 6) *Neat diagrams must be drawn wherever necessary.*

Q1) a) Attempt any four of the following.

- i) What is a microwave? [2]
 - ii) What is the difference between TE and TM modes in waveguides? [2]
 - iii) List two applications of microwaves. [2]
 - iv) What is the principle diagram. [2]
 - v) Define the Applegate diagram. [2]
- b) Describe the working of a rectangular waveguide with suitable diagrams. [3]

Q2) a) i) How does a Magnetron generate microwave energy? [4]
ii) What are Johnson's four equations? [3]

b) Explain the transmission line theory with mathematical equations and solution. [5]

Q3) a) Explain the role of MOSFETs in microwave application. [7]
b) Explain the working and applications of circular waveguides. [5]

Q4) Write a short note on any three of the following.

- a) Concept of single stub and double stub matching. [4]
- b) Working of a Reflex klystron with a diagram. [4]
- c) Explain the significance of the Q-factor in cavity resonators. [4]
- d) Explain the role of a Gunn diode in microwave applications. [4]

