Total No. of Questions : 7]

SEAT No. :

P-2395

[Total No. of Pages : 3

[6062]-111
M.Sc.
PHYSICS
PHCT-111 : Mathematical Methods in Physics
(2020 Pattern) (Semester - I) (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 calculator is allowed.*

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

a) Find real and imaginary part of $\sin z$.

b) Find the characteristic polynomial of the matrix $A = \begin{bmatrix} 1 & 3 \\ 4 & 5 \end{bmatrix}$.

c) Prove that $H_n(-x) = (-1)^n H_n(x)$.

d) Find Laplace transform of $\cos^3 t$

e) Rodrigue's Formula for Laguerre polynomials is $Ln(x) = \frac{e^x}{n!}\frac{d^n}{dx^n}(x^n e^{-x})$, find out $L_0(x)$ & $L_1(x)$.

f) Define linear combination of vectors and linear span of the set of vectors.

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 $f(x) = e^{-a|x|}$ where $a > 0$ and x belongs to $(-\omega, \omega)$. **[5]**

P.T.O.

Q3) a) i) Prove that $zJ'n(z) = z\,J_{n-1}(z) - n\,J_n(z)$. **[4]**

ii) Find first three terms of the Taylor's series expansion of

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

b) If $f(p)$ and $g(p)$ are complex Fourier transforms of $F(x)$ and $G(x)$ respectively then : **[5]**

i) $$\frac{1}{2\pi}\int_{-\omega}^{\omega} f(p)\overline{g(p)}\,dp = \int_{-\omega}^{\omega} F(x)\overline{G(x)}\,dx$$

ii) $$\frac{1}{2\pi}\int_{-\omega}^{\omega} |f(p)|^2\,dp = \int_{-\omega}^{\omega} |F(x)|^2\,dx$$

Q4) a) i) Find the eigenvalues of the matrix $A = \begin{bmatrix} 2 & 1 & 1 \\ 2 & 3 & 4 \\ -1 & -1 & -2 \end{bmatrix}$. **[4]**

ii) Prove that, $nP_n = xP_n' - P_{n-1}'$. **[3]**

b) Evaluate by contour integration $\int_C \frac{5z-2}{z(z-1)}\,dz$ where C is a circle $|z| = 3$ taken counter clockwise. **[5]**

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

b) Prove the orthogonal property for $H_n(x)$ **[6]**

$$\int_{-\omega}^{\omega} \exp(x^2) H_n(x) H_m(x)\,dx = 0;\ \text{if } m \neq n,$$

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

Q7) Solve any three of the following : **[12]**

a) State and prove Cauchy - Riemann equations in carlehan co-ordinate system. **[4]**

b) Determine whether the set B= {(3, 1, –4), (2, 5, 6), (1, 4, 8)} is basis for R^3. **[4]**

c) Prove that $L_{n+1}(x) = (2n + 1 - x)\, L_n(x) - n^2\, L_{n-1}(x)$. **[4]**

d) Using Laplace transform, solve $\frac{dy}{dt}+2y=e^{-3t},\ y(0)=1$. **[4]**

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Total No. of Questions : 7]

SEAT No. :

P-2397

[Total No. of Pages : 2

[6062]-113
M.Sc.
PHYSICS
PHCT-113 : Electronics
(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 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 ncessary.***

Q1) Solve any Five of the following :

a) Define latching current and firing angle of SCR. **[2]**

b) A 4 bit DAC has step size of 10 m^{v}. Determine full scale output voltage and resolution in%. **[2]**

c) List the applications of k-map. **[2]**

d) How many flip-flops are required to construct each of the following counter.

i) Mod 12

ii) Mod 19 **[2]**

e) State the role of junction temperature in SCR. **[2]**

f) State the applications of phase locked loop circuit. **[2]**

Q2) a) Explain the working of TRIAC. Draw its IV characteristics. **[4]**

b) State advantages and disadvantages of SMPS. **[3]**

c) Explain the counter type ADC. Draw D/A output staircase wave form for 3 bit counting ADC. **[5]**

P.T.O.

Q3) a) Explain the working of voltage controlled oscillator (VCO) using IC 566. **[4]**

b) Explain R-2R ladder DAC. **[3]**

c) Compute free running frequency f_o, lock in range and capture range of PLL 565. **[5]**

[Given : $R_T = 20k\Omega$, $C_T = 0.01\mu F$, $C = 1\mu F$,$V_{cc} = 6v$]

Q4) a) Explain the working of monostable multivibrator using IC 714. Draw it's waveforms. **[4]**

b) Explain the working of half wave precision rectifier. Draw it's waveform. **[3]**

c) Describe FSK generator using IC 555. State it's limitations. **[5]**

Q5) a) Explain Dual slope ADC. **[4]**

b) A dual slope ADC uses a 16 bit counter and a 4 MHz clock rate. The maximum input voltage is + 10v. The maximum integrator output voltage should be – 8v when counter has cycled through 2^n counts. Find the value of the register. [Given : C = 0.1 μF] **[3]**

c) Design a binary - to Gray code converter. **[5]**

Q6) a) Explain successive approximation converter. State it's advantages and disadvantages. **[4]**

b) State the features of an Instrumentation amplifier with three op-Amp. **[3]**

c) Design the square wave oscillator at f_o = 1KHz. (Given C = 0.05 μF, $V_{cc} = \pm 15V$) **[5]**

Q7) Write short notes on any three of the following :

a) SCR. **[4]**

b) Counter. **[4]**

c) Specifications of ADC. **[4]**

d) Pulse Amplitude Modulation. **[4]**

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Total No. of Questions : 7]

SEAT No. :

P-2398

[Total No. of Pages : 3

[6062]-211

F.Y. M.Sc. - I

PHYSICS

PHCT - 121 : Electrodynamics

(2020 Pattern) (Semester - 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-tables or non-programmable electronic calculator is allowed.***
6) ***Neat figures must be drawn where necessary.***

Q1) **Solve any five of the following :**

a) Write Maxwell's equations in differential form. **[2]**

b) Caluclate the magnitude of Poynting vector at the surface of the sun. Given that the power radiated by the sun = 3.8×10^6 watt and radius of the sun = 7×10^8 m. **[2]**

c) State two postulates of Einstein's theory of relativity. **[2]**

d) Two point charges, 2q and –q are separated by a distance ‘a’. Find the monopole moment. **[2]**

e) Explain the significance of $\nabla \cdot J + \frac{d\rho}{dt} = 0$. **[2]**

f) Determine the depth of penetration of copper at 1MHz. **[2]**

Given : $\mu = \mu_0 = 4\pi \times 10^{-7}$ wb/A–m

$\sigma = 5.8 \times 10^7$ mho/m

P.T.O.

Q2) a) Obtain Faraday's law of induction in differential form for a stationary medium and show how it can be modified if the medium is moving. **[7]**

b) The rest mass of an electron is 9.1×10^{-28}g. What will be its mass if it were moving with $4/5^{th}$ the speed of light. **[5]**

Q3) a) What is a linear quadrupole? Derive an expression for potential at a distant point due to a small linear quadrupole. **[7]**

b) Starting from Maxwell's equation, derive inhomogeneous wave equation in terms of scalar potential (ϕ) and vector potential $(\overline{\mathrm{A}})$. **[5]**

Q4) a) Obtain an expression for Fresnel's equation if the electric field vectors are perpendicular to the plane of incidence. **[7]**

b) Describe the Michelson - Morley experiment and discuss the results obtained by them. **[5]**

Q5) a) Show that Maxwell's equations in a charge free region lead to : **[7]**

$$\nabla^2 \overline{\mathrm{E}} - \mu\sigma \frac{\partial \overline{\mathrm{E}}}{\partial t} - \frac{KK_m}{\mathrm{C}^2} \frac{\partial^2 \mathrm{E}}{\partial t^2} = 0$$

Explain which term is ignored in a non-conducting medium.

b) Obtain an expression for electromagnetic field tensor $\mathrm{F}_{\mu\gamma}$. **[5]**

Q6) a) Explain the term Hertz potential and show that it obeys the in homogeneous wave equation. Obtain the electric and magnetic fields in terms of Hertz potential expressed as **[7]**

$$E = \bar{\nabla} \times \left(\bar{\nabla} \times \bar{Z}\right) \frac{-\rho}{E_0} \ \& \ B = \frac{1}{C^z} \frac{\partial}{\partial t} \left(\bar{\nabla} \times \bar{Z}\right).$$

where $\bar{Z}$ is the Hertz potential.

b) Describe Lorentz force on a charged particle. **[5]**

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

a) Four Vector Potential. **[4]**

b) Lorentz and Coulomb Gauge. **[4]**

c) Minkowski's space - time diagram . **[4]**

d) Lorentz relativistic transformation equations. **[4]**

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Total No. of Questions : 7]

SEAT No. :

P 2399

[Total No. of Pages : 2

[6062]-212
F.Y.M.Sc.
PHYSICS
PHCT - 122:Atoms and Molecules
(2020 Pattern) (CBCS) (Semester - 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 indicates full marks.***
5) ***Use of logtable or non-programmable electronic calculater is allowed.***
6) ***Neat diagram must be drawn wherever necessary.***

Q1) Solve any five questions of the following. **[10]**

a) Explain the selection rules of L,S,J in case of Spectroscopic transition. **[2]**

b) What is Hunds rule. Explain with its signeficance. **[2]**

c) What is Dissociation energy? Explain its significance. **[2]**

d) Explain Intrared spectroscopy. **[2]**

e) Obtain the total number of electrons, if the magnitude of principle quantum number, n=5. **[2]**

Q2) a) Obtain the different spectroscopic term symbols for p-d configuration. Hence draw the energy level diagram using Γ_1 Γ_2 and $\Gamma_3 +$ Γ_4. **[7]**

b) What is bremsstrablung in continous X-ray production. Explain the properties of continous and Characteristic X-ray. **[5]**

Q3) a) What is paschen Back effect. prove that the frequency shift for strong field is given by **[7]**

$$\Delta\nu = \frac{lH}{4\pi m}\Delta(m_l + 2m_s)$$

b) Explain the vibrational energy levels of diatomic molecules with the help of morse curve. **[5]**

Q4) a) Explain the construction and working of microwave spectrometer. **[7]**

b) The fundamental and first overtone transition of ^{14}N ^{16}O are Centred at 1,876.06 cm^{-1} and 3724.20cm^{-1} respectively. calculate the equilibrium vibration frequency if mass of ^{14}N= 23.25×10^{-27}kg and mass of ^{16}O=26.56×10^{-27}kg. **[5]**

P.T.O.

Q5) a) Define polarizability. What is Raman effect? How to distingwish stokes and antistokes lines. Draw and explain the schematics of Raman spectrometen. **[7]**

b) It the radiation having wavelength 4358 Å irradiate carbon tetrachloride. it gives Raman lines at 4400Å, 4419Å and 4447Å Calculate the Raman shift for each of these lines in cm^{-1}. **[5]**

Q6) a) What is electron spin resonance? Explain the construction and working of ESR spectrometer. **[7]**

b) What is the nuclear ^{9}N factor for ^{19}F nucleus which has a magnetic moment of $2.6273\,\mu_N$.Nuclear spin quantum number. I= ½. **[5]**

Q7) Write short note on any three of the following.

a) Electronic spectrum of sodium triplet. **[4]**

b) Zeeman effect and its significance. **[4]**

c) Difference between electronic spectroscopy and X-ray spectroscopy. **[4]**

d) Chemical shift in nuclear Magnetic Resonance. **[4]**

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Total No. of Questions : 7]

SEAT No. :

P-2400

[Total No. of Pages : 2

[6062]-213

F.Y. 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-tables or non-programmable electronic calculator is allowed.*
6) *Neat diagrams must be drawn wherever necessary.*

Q1) **Solve any five of the following :**

a) Show that the momentum operator $\hat{p}$ is self adjoint. **[2]**

b) For pauli spin matrices show that $\sigma_x \sigma_y = i\sigma_z$. **[2]**

c) Explain unitary operator. **[2]**

d) For $\mathrm{H} = \frac{p^2}{2m} + \frac{1}{2} m w^2 x^2$ show that $x\mathrm{H} - \mathrm{H}x = -\frac{i\hbar}{m} p$. **[2]**

e) Show that $[\mathrm{L}^2, \mathrm{L}_x] = 0$. **[2]**

f) What is meant by Harmonic perturbation. **[2]**

Q2) a) Using ladder operators; obtain the energy eigen values and eigen functions for 1-D harmonic oscillator. **[7]**

b) Show that operator equations remain unchanged in form under unitary transformation. **[5]**

P.T.O.

Q3) a) Obtain Clebsch-Gordan coefficients by adding the angular momenta of two non-interacting electrons with $j_1 = \frac{1}{2}$ and $j_2 = \frac{1}{2}$. **[7]**

b) Discuss postulates of quantum mechanics. **[5]**

Q4) a) i) Define Hilbert space. Write the expression for norm and scalar product in this space. **[4]**

ii) Prove $\left[L_x, L_y\right] = i\hbar L_z$. **[3]**

b) Show that the variational method gives an upper bound to the ground state energy. **[5]**

Q5) a) Consider a linear operator F and vectors $|\psi\rangle$ and $|\chi\rangle$ such that $F|\psi\rangle = |\chi\rangle$. Represent F as a matrix element in A representation. **[7]**

b) Obtain first order energy eigen value for time independent perturbation. **[5]**

Q6) a) State and prove Fermi Golden rule for the rate of the transition induced by constant perturbation. **[7]**

b) Explain completeness & closure property. **[5]**

Q7) **Write short notes on <u>any three</u> of the following :**

a) Explain wave packet and Heisenberg's uncertainty. **[4]**

b) Explain Dirac's bra and ket notations. **[4]**

c) Obtain eigen values for L^2 operator. **[4]**

d) Explain Zeeman effect in brief. **[4]**

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Total No. of Questions : 7]

SEAT No. :

P-2401

[Total No. of Pages : 3

[6062]-214
M.Sc.
PHYSICS
PHOT - 234G4 : ACOUSTICS - I
(2020 Pattern) (Semester - III) (CBCS) (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 side indicate full marks.***
5) ***Use of log-table or non-programmable electronic calculator is allowed.***
6) ***Neat diagrams must be drawn wherever necessary.***

Q1) Solve any Five of the following.

a) What do you mean by standing wave Ratio? **[2]**

b) Find Sound Power Level in an enclosure which emits low of acoustic power [$W_0=10^{-12}W$]. **[2]**

c) Write formula and unit for energy density and effective pressure. **[2]**

d) Define Acoustic compliance with its formula and unit. **[2]**

e) Give formula for characteristics frequency corresponding to allowed room modes. **[2]**

f) What do you mean by live and dead room. **[2]**

Q2) a) i) Write a note on Haas Effect. Why is straight delay for speaker placement around 1 millisecond per foot? **[4]**

ii) In case of "Reflection at the surface of a solid", the SWR is 2.0 and the first node is locate at a distance of $\frac{3}{8}\lambda$ from the reflecting surface. Determine the magnitude of normal specific acoustic impedance of the solid. **[3]**

P.T.O.

b) The resonator frequency of flanged Helmholtz resonator is 256Hz. Determine its volume if length and radii are 0.006m and 0.0155m respectively. Also find effective stiffness constant, Quality factor and inertance [C=343m/s.] **[5]**

Q3) a) i) Discuss the term velocity of sound in fluids. **[4]**

ii) Determine the acoustic intensity level at a distance of 10m from a source that radiates 1w of power assuming spherical propagation of sound in case of following reference intensities. **[3]**

1) 10^{12}W/m^2 2) 10^{-12}W/m^2

3) 10^{-13}W/m^2

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

Q4) a) Derive the expression for growth of sound intensity in a live room. **[7]**

b) A small reverberation chamber is used to measure the effective sound absorption of particular material. The volume of chamber is 8×9×10 cubic ft. The observed Reverberation time reduces from 5sec to 1 sec when 40 sq.ft. of acoustic material is used to cover part of a wall of this chamber. Find effecgive sound absorption coefficient of material. **[5]**

Q5) a) Derive the expression for sound power reflection coefficient in case of "Transmission from one fluid medium to another" at normal incidence. Hence compare limiting cases for $\rho_2 C_2 \rho_1 C_1 \rightarrow \infty$ and 0. **[7]**

b) Determine the room modes (8 0 0), (3 0 2), (1 2 2) (2 2 2) for a seminar hall 54×36×15 cubic ft. What do you conclude? [C=1130ft.sec] **[5]**

Q6) a) Explain the analogies between electrical, mechanical and acoustical systems. Give acoustical and equivalent electrical circuit for Helmholtz resonator. **[6]**

b) Explain Sound Transmission class (STC) in detail. **[6]**

Q7) Write short note on <u>any three</u> of the following.

a) Hearing mechanism. **[4]**

b) Sound absorption coefficient **[4]**

c) Relation between Phon and Sone with definition **[4]**

d) Decibel scales. **[4]**

Total No. of Questions : 7]

SEAT No. :

P-2402

[Total No. of Pages : 2

[6062]-215
M.Sc. (Semester - III)
PHYSICS
PHOT-234H4 : Energy Studies - I
(2020 Pattern) (CBCS) (4 Credits)

Time : 3 Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Q1 is compulsory.***
2) ***Solve any five questions from Q2 to Q7.***
3) ***Figures to the right indicate full marks.***
4) ***Use of log-table and non-programmable electronic calculator is allowed.***
5) ***Neat diagram must be drawn where ncessary.***

Q1) Attempt any Five of the following.

a) What are non-renewable energy sources? **[2]**

b) What is latent heat storage? **[2]**

c) What is green house effect? **[2]**

d) What is biomass energy? **[2]**

e) Give at least 2 characteristics of sun. **[2]**

f) Calculate air mass if zenith angle is 60°. **[2]**

Q2) a) i) Explain Fourier's law and Stefans - Boltzman relation. **[4]**

ii) Define beam, diffused and global radiation. **[3]**

b) Explain construction, working principle of sunshine recoder with neat diagram. **[5]**

P.T.O.

Q3) a) i) Explain 1st and 2nd law of thermodynamics. **[4]**

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

b) Explain with suitable diagram, the structure of sun. **[5]**

Q4) a) Explain the working, principle, construction of pyrhelimeter with neat diagram. **[6]**

b) Explain with neat diagram, the spectral distributon of extra terrostrial solar radiations. **[6]**

Q5) a) What is global warming? Explain in brief about essential factors for sustainable development. **[7]**

b) Explain sensible and latent heat storage systems. **[5]**

Q6) a) With neat diagram, describe Hydrostorage system. **[6]**

b) Explain the different types heat transfer. **[6]**

Q7) Write short note on any three of the following.

a) Electrical energy storage. **[4]**

b) Harmful effects of acid rain. **[4]**

c) Solar Pond as energy storage. **[4]**

d) Geothermal energy and its application. **[4]**

Total No. of Questions : 7]

SEAT No. :

P-2403

[Total No. of Pages : 2

[6062]-216

M.Sc.

PHYSICS

PHOT-234I4: Electronic Instrumentation - I (Group - II) (2020 Pattern) (Semester - III) (CBCS) (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) What is thermoelectric effect? **[2]**

b) Define the term accuracy and precision. **[2]**

c) What do you understand by static characteristics? **[2]**

d) What is signal conditioner? **[2]**

e) What is the rate of input scan of modern scanners of data logger? **[2]**

f) What is the purpose of error detector in a recorder? **[2]**

Q2) a) Explain in details the use of microprocessor in improving Fuel efficiency of petrol engine. **[7]**

b) What are main advantages of electrical transducer? **[5]**

Q3) a) Give detailed classification of measuring instruments. Explain each type in brief. **[7]**

b) Explain unbounded strain gauge as displacement transducer with the help of suitable diagram. **[5]**

Q4) a) With suitable block diagram, explain ultrasonic flow meter in detail. **[7]**

b) Derive an expression for gauge factor for bonded resistance wire strain gauge. **[5]**

Q5) a) State the significance of performance characteristics of instrument. Distinguish between static and dynamic characteristics of instruments. **[7]**

b) Define principle operation of thermocouple and explain types of thermocouple. **[5]**

Q6) a) Explain the principle and operation of inkjet printers. **[7]**

b) Compare LCD and LED display for their advantage and limitations. **[5]**

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

a) Instrumentation Amplifier. **[4]**

b) Zero order instrument. **[4]**

c) Data logger. **[4]**

d) Laser printer. **[4]**

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Total No. of Questions : 7]

SEAT No. :

P 2404

[Total No. of Pages : 2

[6062]-220
S.Y. M.Sc.
PHYSICS
PHOT - 234 M4 : Materials Science - I
(2020 Pattern) (Semester - III) (CBCS) (Credit - II)

Time : 3 Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Q.1 is compulsory.***
2) ***Attempt any five from Q.2 to Q.7.***
3) ***Use of log table or non-programmable electronic calculater is allowed.***
4) ***Neat diagrams must be drawn wherever necessary.***

Q1) Solve any five questions of the following. **[10]**

a) State Rault's law and Riehard's rule.

b) Give different factors governing diffusien.

c) What do you understand by volume defect.

d) What is regular solution behavior.

e) Define Miscibility gap.

f) Give three optical properties of solvels.

Q2) a) Derive clausius - clapeyron equation. **[7]**

b) At the surface of steel bar there is one carbon atom per 20 unitcell of iron. At a depth 1mm from the surface there is one carbon atom per 30 UC. If different diffusion of C in iron at 1000 °C is 3×10^{-11} m^2 /s. Find the no. of carbon atoms diffusming through each UC/min. The structure of iron of 1000 °C is fcc with a =3.65 Å. **[5]**

P.T.O.

Q3) a) Considering the mixing of N_A atoms of solid A and N_B of solid B as the process. **[7]**

State 1 $\rightarrow$ State 2

i.e. unmixed A & B $\rightarrow$ mixed A and B

prove: $\Delta G^M = RT\,(XAInX_A + A_B InX_B)$

b) Give a brief account of atonic size and size factor in solid solution. **[5]**

Q4) a) Considering water - gas reaction. **[7]**

$$H_2O_{(g)} + CO_{(g)} = H_{2(g)} + CO_2$$

Obtain an equation for equilibrium constant.

$k_p = k_x\, p^{c+d-a-b}$

b) Describe in detail Dislocation generator. **[5]**

Q5) a) Describe various factors governing solid solubility. **[6]**

b) Derive the equation for number of schottky defect in equilibrium at temp.T. **[6]**

Q6) a) Classify defects according to dimensieonality. and enlist the various sub-classed for each of them. **[6]**

b) Explain the thermodynamic origin of phase diagram and sketch a well labelled diagram illustrating ideal free energy of mixing Carves for a system A- B at temp. T. **[6]**

Q7) Write short - note on Any three **[12]**

a) Type I phase diagram.

b) Minima and maxima in two- plase region.

c) Carburization of steel.

d) Thermal properties of materials.

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Total No. of Questions : 4]

SEAT No. :

P 2405

[Total No. of Pages : 2

[6062]-223
S.Y. M.Sc.
PHYSICS
PHOT - 234H2 : Energy Studies - I
(2020 Pattern) (CBCS) (Semester - III) (Group - II) (Credits - 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 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) What is latent heat storage? **[2]**

ii) What is biomass energy? **[2]**

iii) What is the Stefans Boltzman relation for conductive heat transfer? **[2]**

iv) What is meant by non - renewable energy sources? **[2]**

v) What is sunshine recorder? **[2]**

b) Explain the wind energy as a renewable energy source. **[3]**

Q2) a) i) Discuss the concept of biomass and solar as renewable energy sources. **[4]**

ii) Calculate the sensible heat stored per unit volume for methyl alcohol as a heat storage medium, when the temperature is increased by 10° C. Given : for methyl alcohol. **[3]**

($Ps = 810\ kg/m^3$, $Cp = 2512\ J/kg\ °C$)

b) Explain the process of heat transfer due to wind. **[5]**

P.T.O.

Q3) a) Draw the systematic diagram of pryhelimeter and explain its construction and working principles. **[6]**

b) Explain the conduction, convection and radiation in terms of their mechanisms of heat transfer. **[6]**

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

a) Sun as a fusion reactor. **[4]**

b) Green house as energy storage. **[4]**

c) Beam and diffuse radiation. **[4]**

d) Nature of solar radiation. **[4]**

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Total No. of Questions : 4]

SEAT No. :

P2406

[Total No. of Pages : 2

[6062]-224

M.Sc. - II

PHYSICS

PHOT - 234I2 : Electronic Instrumentation - I

(2020 CBCS Pattern) (2 Credits) (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 indicates full marks.***
5) ***Use of log table or non-programmable electric calculator is allowed.***
6) ***Neat diagram must be drawn wherever necessary.***

Q1) A) Solve any four questions of the following.

a) Define active transducer and passive transducer. **[2]**

b) Write advantage of electrical transducer. **[2]**

c) Define hysteresis and drift. **[2]**

d) What are advantages of Instrumentation amplifier. **[2]**

e) What is signal conditioner? **[2]**

B) Explain basic requirement of transducer. **[3]**

Q2) a) Draw block diagram of functional element of a measurement system and explain each block in short. **[7]**

b) Derive an expression for gauge factor for bonded resistance wire strain gauge. **[5]**

P.T.O.

Q3) a) Explain phase sensitive detector with neat circuit diagram. **[7]**

b) Explain microcontroller based data acquisition system. **[5]**

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

a) Thermocouple's Law **[6]**

b) First order system **[6]**

c) Logarithmic compression & Ratiomatric conversion **[6]**

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Total No. of Questions : 4]

SEAT No. :

P2407

[Total No. of Pages : 2

[6062]-225
S.Y.M.Sc.
PHYSICS
PHOT - 234J2T : Biomedical Instrumentation - 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) ***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 side 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.

i) What is circulatory system of human body? **[2]**

ii) What do you mean by bioelectric signals? **[2]**

iii) What are active, passive and digital transducers? **[2]**

iv) What is invitro and invivo measurement? **[2]**

v) What are the types of leakage current? **[2]**

b) The intracellular k^+ concentration of a group of cells averages 160×10^{-6} moles/cm^3. The extracellular concentration of k^+ averages 6.5×10^{-6} moles/cm^3. **[3]**

calculate

i) Concentration ratio

ii) Diffusion potential for k^+

Q2) a) Explain the specifications of medical instrumentation system. **[7]**

b) Draw block diagram of ECG machine & explain each block. **[5]**

P.T.O.

Q3) a) What is pulse oximetry? Explain the construction & working of pulse oximeter. **[7]**

b) Explain the origin of biopotential. **[5]**

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

a) Difference between external and internal pacemaker. **[6]**

b) Microshock and Macroshock. **[6]**

c) Basic Recording system. **[6]**

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Total No. of Questions : 4]

SEAT No. :

P2408

[Total No. of Pages : 2

[6062]-228
S.Y. M.Sc.
PHYSICS
PHOT - 234M2 : Material Science - I
(2020 Pattern) (Semester - III) (CBCS) (Credits - 2) (Group - II)

Time : 2 Hours] ***[Max. Marks : 35***

Instructions to the candidates:

1) ***Question 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 calculater 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 solid solution?

iii) What is dislocation?

iv) State twin boundary.

v) Define the term vacancies and interstitials.

b) Find the equilibrium concentration of vacancies in Nickel at 0 k and 300k (E_{Ni} = 1.74ev) **[3]**

Q2) a) Describe Frank- Read generator for the multiplication of dislocation. **[7]**

b) Draw a flow chart of defects. **[5]**

P.T.O.

Q3) a) What is Frankel defect? Obtain an expression for equilibrium concentration of Frankel defect in Crystals. **[7]**

b) Explain Hume - Rothery rule with examples.. **[5]**

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

a) Thermal Properties.

b) Frank - Read source

c) Volume defect

d) Solid solubility with few examples.

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Total No. of Questions : 7]

SEAT No. :

P-2409

[Total No. of Pages : 2

[6062]-311
M.Sc.
PHYSICS
PHCT - 231 : Statistical Mechanics
(2020 Pattern) (CBCS) (Semester - III) (4 Credits)

Time : 3 Hours] ***[Max. Marks : 70***

Instructions to the candidates :

1) *Question 1 is compulsory.*
2) *Attempt 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 diagrams must be drawn where necessary.*

Constants :

1. *Boltzmann constant* $k_B = 1.38 \times 10^{-23} J/k$
2. *Planck's constant* $h = 6.623 \times 10^{-34}/J.Sec$
3. *Avogadro's number* $N = 6.023 \times 10^{23}/gm\text{-}mole$
4. *Mass of electron* $Me = 9.1 \times 10^{-31} kg$
5. *Velocity of light* $C = 3 \times 10^{8} m/s$
6. *Charge on electron* $e = 1.6 \times 10^{-19} c$

Q1) Attempt any Five of the following :

a) Define mu-space and gamma space. **[2]**

b) What is meant by ensemble? Discuss canonical ensemble. **[2]**

c) Explain postulate of equal priori probability. **[2]**

d) Calculate mean value $\overline{E}$ for canonical ensemble interms of partition function. **[2]**

e) 4 molecules are to be distributed in 2 cells. Find possible number of macrostates and corresponding number of microstates. **[2]**

f) Find out average number of photons in an enclosure of 22.4 litres at 273°k. **[2]**

Q2) a) State and prove Maxwells Third and Fourth thermodynamic relations. **[7]**

b) On the basis of canonical distribution, obtain the curie law of paramagnetism. **[5]**

Q3) a) Show that Fermi energy of fermions is $E_f = \frac{\hbar^2}{2m}\left(\frac{3\pi^2 N}{V}\right)^{2/3}$. **[7]**

b) Obtain an expression for vibrational specific heat at constant volume for a diatomic molecule. **[5]**

Q4) a) Show that, Maxwell distribution of speed is given by

$$F(v)dv = 4\pi n\left[\frac{m}{2\pi kT}\right]^{3/2} V^3 e^{-\frac{mv^2}{2kT}} dv.$$ **[6]**

b) Discuss the distribution of energy between two systems in thermal contact and obtain the condition at thermal equilibrium. **[6]**

Q5) a) Show that entropy in canonical ensemble can be represented as $S = -k\sum \Pr \ln \Pr$. **[6]**

b) The molar mass of lithium is 0.00694 and its density is $0.53 \times 10^3 kg/m^3$. Calculate Fermi energy and Fermi temperature of the electron. **[6]**

Q6) a) State and prove Liouville's theorem. **[6]**

b) In case of Grand Canonical ensemble show that $Z = \sum_r e^{-\beta E_r - \alpha N r}$. **[6]**

Q7) Write short note on any <u>Three</u> :

a) Compare B.E. Statistics and F.D. Statistics. **[4]**

b) White - Dwarf. **[4]**

c) Gibb's paradox. **[4]**

d) Boltzmann limit of Boson and Fermion gases. **[4]**

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Total No. of Questions : 7]

SEAT No. :

P-2410

[Total No. of Pages : 2

[6062]-312
S.Y. 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.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) ***Draw neat labelled diagram wherevere ncessary.***
6) ***Use of log table or calculator is allowed.***

Given :

Planck's constant h = 6.626×10^{-34}J.s

Mass of electron $m_e = 9.1 \times 10^{-31}$ kg

Boltzman constant $K_B = 1.38 \times 10^{-23}$J/K

Avogadro's number $N_A = 6.023 \times 10^{26}$/Kmol

Permeability of free space $\mu_0 = 4\pi \times 10^{-7}$ Henry/m

Charge of electron(e) = 1.6×10^{-19} C

Permittivity of free space $\in_0 = 8.85 \times 10^{-12}$ C^2/Nm^2

Bohr magneton $\mu_B = 9.27 \times 10^{-24}$ Am^2

Q1) Solve any Five of the following :

a) What is cyclotron resonance? **[2]**

b) What are Type I and Type II superconductor? **[2]**

c) Sketch the variation of magnetic susceptibility with temperature for paramagnetic substance. **[2]**

d) Identify the crystal structure of metal showing [1, 1, 1], [2, 2, 2] and [2, 0, 0] hkl miller indices reflections in x-ray diffraction pattern. **[2]**

e) Calculate the paramagnetic susceptibility (χ) at 300 k of a substance having 5×10^{28} m^{-3} number of atoms. **[2]**

f) What piezoelectricity? Give its example. **[2]**

P.T.O.

Q2) a) Discuss the origin of paramagnetism in free atom. Obtain zangevin's paramagnetic equation for paramagnetic susceptibility. **[7]**

b) The energy near the valence band edge of a crystal is given by $E = -Ak^2$, where $A = 10^{-39} Jm^2$. An electron with wave vector $K = 10^{10} k_x$ m^{-1} is removed from an orbital in the completely filled valence band. Determine the effective mass, velocity, momentum and energy of the hole. **[5]**

Q3) a) What is ferromagnetism? Explain in detail with the help of Weiss molecular theory. **[7]**

b) Calculate the effective magneton number for Gd^{3+} having outermost electron configuration ($4f^7\ 5s^2\ 5p^6$). **[5]**

Q4) a) State and prove Bloch theorem. **[7]**

b) What is Meissner effect? Explain with neat labelled diagram. **[5]**

Q5) a) What is structure factor? Calculate the structure factor for Body Centered Cubic (BCC) lattice. **[7]**

b) The critical temperature T_C for mercury with isotopic mass 199.5 is 4.185 k. Calculate its critical temperature when its isotopic mass changes to 203.4. **[5]**

Q6) a) On the basis of band theory of solids distinguish between a metal, semiconductor and insulator. **[7]**

b) Show that for a super conductor on the basis of meissner effect and maxwell's eq^n magnetic susceptibility is $\chi = -1$. **[5]**

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

a) What are free electrons and nearly free electron? **[4]**

b) Explain the concept of Bloch wall and ferromagnetic domain. **[4]**

c) Explain the dielectric behaviour in $BaTiO_3$. **[4]**

d) Explain superconductivity on the basis of BCS theory. **[4]**

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Total No. of Questions : 7]

SEAT No. :

P2411

[Total No. of Pages : 2

[6062]-313

M.Sc.-II

PHYSICS

PHCT-233 : EXPERIMENTAL TECHNIQUES IN PHYSICS-I

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

Time : 3 Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Question 1 is compulsory.***
2) ***Attempt /slove 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. **[5×2=10]**

a) Define the terms impingement rate and mean free path of gas molecules.

b) Why Helium is the most suitable gas for leak detection test?

c) State any four characteristics that must be possessed by a fluid used in oil diffusion pump.

d) State any four types of signals.

e) Define the terms

i) Pump down time

ii) Through put.

f) Define the term 'vacuum'. State any two units used for measurement of vacuum.

Q2) a) i) Describe any two methods of data fitting techniques. **[4]**

ii) If mean free path of nitrogen molecule is 64 mm at 10^{-3} mbar. What will be it at 0-2 mbar. **[3]**

b) With the help of neat diagram explain the working of titanium sublimation pump. **[5]**

P.T.O.

Q3) a) Explain the expansion of gases (Throttling process) as a low temperature technique. With the help of suitable diagram explain the refrigeration cycle. **[7]**

b) What is the principle of operation of vacuum gauges based on thermal conduction. Explain the working of Pirani gauge. **[5]**

Q4) a) i) What is cryosorption and cryocondensation? Explain the working of cryopump. **[4]**

ii) A vessel of volume 4 m^3 has to be evacuated from 1000 mbar to 1 mbar in 20 minute. **[3]**

b) Discuss the various types of errors in measurement system. **[5]**

Q5) a) Discuss the transport properties of gases and describe how they are related to the vacuum techniques. **[7]**

b) Explain the working of hot cathode ionization guage (triode type) for vacuum measurement. **[5]**

Q6) a) Describe the characteristics of sensors in details. **[6]**

b) What is the principle of operation of momentum transfer type of vacuum pumps. Explain the working of turbomolecular pump. **[6]**

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

a) Write a short note on pressure rise and pressure drop leak detection test. **[4]**

b) Write a short note on applications of vacuum. **[4]**

c) Write a short note on orbitron pump. **[4]**

d) Write a short note on classification of sensors. **[4]**

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Total No. of Questions : 7]

SEAT No. :

P-3145

[Total No. of Pages : 2

[6062]-411A
M.Sc.
PHYSICS
PHCT - 241 : Nuclear Physics
(2020 Pattern) (Semester - IV) (CBCS) (4 Credits)

Time : 3 Hours] *[Max. Marks : 70*

Instructions to the candidates :

1) ***Question 1 is compulsory.***
2) ***Attempt/Solve any five questions from Q.2 to Q.7.***
3) ***Questions Q2 to Q7 carry equal marks.***
4) ***Figure to the indicate full marks.***
5) ***Use of log-table or non-programmable electronic calculator is allowed.***
6) ***Neat diagrams must be drawn where necessary.***

Q1) Solve any five of the following.

a) Calculate the mass defect of ^{238}U. **[2]**

b) Write down the assumptions of the liquid Drop Model. **[2]**

c) Using the shell model Calculate the spin parity of $^{16}_{8}O$. **[2]**

d) What are magic numbers? What is their significance? **[2]**

e) What are elementary particles? **[2]**

f) Define mirror nuclei. **[2]**

Q2) a) Explain the construction and working of Betatron. Prove that the betatron condition $\frac{d\phi}{dt} = 2\pi R^2 \frac{dB}{dt}$. **[7]**

b) Discuss the shell model of the nucleus. What are it's merits and demerits? **[5]**

P.T.O.

Q3) a) What are quarks? Do they exists in nature? Explain how quarks are treated as building blocks of hydrons and mesons? **[7]**

b) Calculate the binding energy per nucleon of ^{7}Li and ^{56}Fe (M_{Li} = 7.016 amu; M_{Fe}=55.935amu). **[5]**

Q4) a) Discuss in details of the evidences for the existence of magic numbers in the shell model. **[7]**

b) With the helf of orbital quantum number, explain spin-orbit coupling. **[5]**

Q5) a) Describe fermi-gas model and obtain an expression for energy of proton. **[7]**

b) Explain why experimentally the study of P.P scattering is capuble of much higher accuracy than n-p scattering. **[5]**

Q6) a) States the law of Radioactive Disintegration. The half life of a radon is 3.82 days. What fraction of freshly prepared sample of radon will disintegrate in 10 days? **[7]**

b) A cyclotron has a magnetic field of 1.5ub/m^2. The extraction radius is 0.5m. Calculate the Frequency of the of oscillator necessary for accelerating deutrons and the energy of the extracted beam. (mass of proton = 1.67×10^{-27}kg). **[5]**

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

a) Cloud chamber **[4]**

b) Four factor formula **[4]**

c) Internal conversion & pair production/Creation. **[4]**

d) Classification of elementary particles. **[4]**

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Total No. of Questions : 7]

SEAT No. :

P 2413

[Total No. of Pages : 2

[6062]-412
M.Sc. - II
PHYSICS
PHCT - 242:Experimental Techniques in physics - II
(2020 Pattern) (CBSC) (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 indicates full marks.***
5) ***Use of logtable or non-programmable electronic calculator is allowed.***
6) ***Neat diagram must be drawn wherever necessary.***

Q1) Solve any five of the following. **[10]**

a) State basic mechanism of microwave process.

b) State the characteristic of thermogravimetric analysis (TGA) curve.

c) What is role of filter in x-ray production?

d) State the principle of electron microscopy.

e) State different types of microscopes.

f) What is the most commonly used wavelengths for Raman spectroscopy?

Q2) a) i) State the Bragg's diffraction condition and working principle of x-ray diffraction. **[4]**

ii) Explain the principle of diffused reflectance spectroscopy. **[3]**

b) Explain construction and working of optical microscope. **[5]**

Q3) a) i) What are advantages and limitations of TEM. **[4]**

ii) An x-ray tube operated at 30kv emits a continuous x-ray spectrum, then calculate wavelength of emitting radiations. **[3]**

b) State different types of source of radiations for y-rays, x-rays, and IR. **[5]**

Q4) a) i) What are different advantages of FESEM? **[4]**

ii) Why some peaks in XRD have higher intensity than others. **[3]**

b) Explain the instrumentation and working of XPS. **[5]**

P.T.O.

Q5) a) Write range of wavelengths and corresponding energies for all the electromagnetic radiations. **[6]**

b) Explain the principle, construction and working of Fourier transform infra-red spectrometer (FTIR). **[6]**

Q6) a) Write principle, instrumentation and working of Differential Thermal Analysis (DTA). **[6]**

b) With neat labelled diagram explain principle, construction and working of Transmission Electron Microscope (TEM). **[6]**

Q7) Answer any three of the following.

a) Write short note on Neutron diffraction. **[4]**

b) Write short note on advantages of TEM over XRD. **[4]**

c) Write short note on applications, advantages and disadvantages of Scanning Electron Microscope (SEM). **[4]**

d) State different applications, advanatages and disadvantages of optical microscope. **[4]**

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Total No. of Questions : 7]

SEAT No. :

P2414

[Total No. of Pages : 2

[6062]-413

M.Sc-I/II

PHYSICS

(PHOT-XXX A4) (CBOP-I) (PHOT-114/124 A4) (CBOP-I)

(PHOT-243A4) : Physics of Thin Films

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

Time : 3 Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Question 1 is compulsory.***
2) ***Attempt 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) Solve any five questions of the following.

a) What is mean by island layer. **[2]**

b) Define DIP coating and steps involved in it. **[2]**

c) Define super saturation growth mechanism. **[2]**

d) Write four applications of thin films. **[2]**

e) Define principle of photolithography. **[2]**

f) Compare thin and thick films. **[2]**

Q2) a) Explain spray pyrolysis method with it's construction and working? **[7]**

b) Explain optical coating and its types. **[5]**

Q3) a) Explain capillary and atomistic models for thin films. **[7]**

b) Explain Hall effect in thin films. **[5]**

P.T.O.

Q4) a) i) Explain application of thin films as resistor. **[4]**

ii) Write a short note on absorption of optical properties. **[3]**

b) Explain principle and mechanism of solar cells and it's types. **[5]**

Q5) a) Explain chemical vapour deposition method. Give various chemical reactions involved in it. **[7]**

b) Define sputtering. Explain any one type of sputtering with neat diagram. **[5]**

Q6) a) Explain construction and working of molecular beam Epitaxy. **[7]**

b) Explain tolansky technique with it's applications. **[5]**

Q7) Write a short notes on the following. (any three)

a) Nucleation and condensation. **[4]**

b) Electron-beam deposition. **[4]**

c) Humidity sensor. **[4]**

d) Various stages in growth of thin films. **[4]**

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Total No. of Questions : 7]

SEAT No. :

P2415

[Total No. of Pages : 2

[6062]-414

M.Sc. - I/II

PHYSICS

PHOT - XXXB4 (CBOP-I) (PHOT-114/124B4) (CBOP -I)
(PHOT - 243B4) : Physics of Nanomaterials

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

Time : 3 Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Q.1 is compulsory.***
2) ***Attempt 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) ***Use of log-table or non-programmable electronic calculator is allowed.***
6) ***Neat diagrams must be drawn wherever necessary.***

Q1) Solve any five of the following: **[5×2=10]**

a) Define nanotechnology.

b) What is the significance of nanosize materials?

c) What is Bottom-up approach?

d) What is the main benefit of Sol-gel processing?

e) Enlist the various fields of applications of nanotechnology.

f) List application of physical vapour deposition.

Q2) a) i) Explain Biological method for nanomaterials. **[4]**

ii) Calculate the optical energy band gap of wavelength 400 nm. **[3]**

b) Explain various challenges in nanotechnology. **[5]**

P.T.O.

Q3) a) Describe synthesis of nanomaterials using physical vapour deposition with suitable diagram. **[7]**

b) Write short note on graphene. **[5]**

Q4) a) Explain Mechanical and Biomedical application of nanomaterials. **[6]**

b) What is the mechanism at hydrothermal method. **[6]**

Q5) a) Describe synthesis of nanomaterials using Sol-gel method. **[6]**

b) Describe nanomaterials synthesis by chemical both deposition. **[6]**

Q6) a) Explain Nucleation and Growth Phenomenon for nanomaterials synthesis. **[6]**

b) Explain top-down and bottom-up approach for nanomaterials synthesis. **[6]**

Q7) Write short notes on any three out of four questions: **[3×4=12]**

a) Aerogel.

b) Nano-composites.

c) Carbon nanotubes.

d) Thermal Properties.

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Total No. of Questions : 7]

SEAT No. :

P-2416

[Total No. of Pages : 2

[6062]-415
M.Sc.
PHYSICS (Group - I)
CBOP-1 (PHOT-124C4) : Lasers & Applications
(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 electronic calculator is allowed.*
6) *Neat diagrams must be drawn where ncessary.*

Q1) Solve any Five of the following :

a) Explain stimulated emission of radiation. **[2]**

b) What is optical resonator? What is its need? **[2]**

c) What do you mean by threshold gain? **[2]**

d) What is metastable state? How it is useful in lasers? **[2]**

e) Define pumping & state its types. **[2]**

f) Calculate the intensity of the He-Ne laser beam of wavelength 6328 A°. If the power radiated by the laser is 1 mW. **[2]**

Q2) a) i) Describe construction & working of He-Ne Laser. **[4]**

ii) Define the term laser & state its important characteristics. **[3]**

b) Explain stability curve for laser cavity on the basis of g-parameters. **[5]**

Q3) a) Describe construction & working of semiconductor laser. **[7]**

b) Find the relative population of the two states in a ruby laser that produces a light beam of wavelength 6943 A° at 500k. **[5]**

P.T.O.

Q4) a) Derive an expression for the necessary condition for laser in three level system. Write the expression for threshold pump power of the laser. **[6]**

b) Describe construction & working of Nd-YAG laser. **[6]**

Q5) a) What are laser cavity modes? Explain longitudinal & transverse modes in details. **[6]**

b) Derive an expression for threshold condition for lasers. **[6]**

Q6) a) Explain principle & working of nitrogen laser. **[6]**

b) The wavelength of emission is 6000 A° & the lifetime τsp is 10^{-6}sec. Determine the three Einstein's coefficients. **[6]**

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

a) Industrial Applications of lasers. **[4]**

b) Doppler broadening. **[4]**

c) Biological Applications of lasers. **[4]**

d) Ordinary light & lasers. **[4]**

□□□

Total No. of Questions : 7]

SEAT No. :

P2417

[Total No. of Pages : 2

[6062]-416

M.Sc. - I/II

PHYSICS

CBOT - I (PHOT - 124 E4) / CBOT - I (PHOT - 243 E4)

Physics of Semiconductor Devices

(2020 CBCS Pattern) (Semester - 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 right indicate full marks.*
5) *Use of log-table or non-programable electronic calculator is allowed.*
6) *Neat labelled diagrams must be drawn wherever necessary.*

Q1) Solve any FIVE of the following :

a) Draw the I-V characteristics of SCR. **[2]**

b) How can we make semiconductors n-type an p-type? **[2]**

c) Define the common base current gain. **[2]**

d) Give the device structure of IMPATT diode. **[2]**

e) How many ways we can inject carries in the semiconductor? **[2]**

f) What is the junction breakdown? Give its type. **[2]**

Q2) a) Draw a neat labelled diagram of n-p-n transistor and explain the current components in the transistors. **[4]**

b) Explain the quasi-saturation and second breakdown of power transistor. **[4]**

c) Define : **[4]**

i) Emitter injection efficiency

ii) Base transport factor

iii) Common emitter current gain

P.T.O.

Q3) a) Derive an expression for drain current in linear, Non-linear and saturation regions of JFET output characteristics. **[4]**

b) Find the equation of intrinsic carrier density at thermal equilibrium. **[4]**

c) What will be Hall coefficient and the electron density for a n-type semiconductor, if it is placed in an electric field of 100v/cm and a magnetic field of 0.5 wb/m^2, having current density 3×10^3 A/m^2. (Given : $e = 1.6 \times 10^{-19}c$) **[4]**

Q4) a) What is the Hall effect? Derive expressions for Hall voltage. Hall coefficient and Hall mobility. **[4]**

b) Find the doping density from the depletion layer capacitance of one-sided abrupt junction. **[4]**

c) What is the schottkey effect? Draw a neat labelled diagram of indicating barrier height. **[4]**

Q5) a) Define generation and recombination current density also find the total forward current density (TF). **[4]**

b) Explain the avalanche and second breakdown of the power transistor. **[4]**

c) Compare the rectifying and ohmic contact. **[4]**

Q6) a) Consider the assumptions of thermionic emission theory and derive the expression for total current denisty. **[6]**

b) Derive shockely equation for ideal diode. **[6]**

Q7) Write short note on any THREE of the following :

a) Direct and indirect band gap. **[4]**

b) Formation of transistor (BJT). **[4]**

c) Resistivity, mobility and charge carrier concentration of a semiconductor. **[4]**

d) Linearly graded p-n junction. **[4]**

e) Metal-semiconductor contact. **[4]**

☯☯☯☯

Total No. of Questions : 5]

SEAT No. :

P2418

[Total No. of Pages : 2

[6062]-419
M.Sc.-I/II
PHYSICS
(PHOT-XXX A2) (CBOP-I) (PHOT-114/124 A2)
(CBOP-I) (PHOT-243A2) Physics of Thin Films
(2020 Pattern) (CBCS) (Group I) (Semester-I,II & IV) (2 Credits)

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 indicates full marks.***
5) ***Use of log-rable or non-programmable electronic calculator is allowed.***
6) ***Neat diagrams must be drawn where necessary.***

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

i) What is spin coating? **[2]**

ii) What is mean by Island layer? **[2]**

iii) Write thin film resistance properties. **[2]**

iv) Write the difference between thin film and thick film. **[2]**

v) Write the application of thin film. (any 4) **[2]**

b) What is difference between dip coating and spin coating. **[3]**

Q2) a) Draw the diagram Molecular Beam Epitaxy and explain its construction and working. **[7]**

b) Explain solar cells with its application. **[5]**

Q3) a) Explain the statistical or Atomistic theory with nucleation rate. **[7]**

b) Explain quartz crystal microbalance of measurement of thickness of thin films. **[5]**

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

a) Dip coating **[4]**

b) Humidity sensor **[4]**

c) Thin film resistor **[4]**

d) Photolithography. **[4]**

e) Chemical vapour deposition. **[4]**

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Total No. of Questions : 4]

SEAT No. :

P2419

[Total No. of Pages : 2

[6062]-420

M.Sc. - I/II

PHYSICS

PHOT - XXXB2 (CBOP - I) (PHOT -114/243B2) (CBOP - I) (PHOT-124B2) : Physics of Nanomaterials

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

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 side 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 of the following: **[4×2=8]**

i) What are the steps involved in physical vapour diposition?

ii) What is the meaning of sol-gel?

iii) Enlist the various structure of nanotubes.

iv) State any two application of nanomaterials.

v) Define term ‘Nanoscience.

b) Draw a neat labelled diagram of Hydrothermal method of nanomaterials. **[3]**

Q2) a) i) Write short note on graphene. **[4]**

ii) Calculate the optical energy band gap of wavelength 400 nm. **[3]**

b) Explain the significance of nanosize materials. **[5]**

Q3) a) Describe step by step the chemical both Deposition method with suitable diagram. **[7]**

b) Explain Optoelectronic Application of nanomaterials. **[5]**

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

a) Biological Method.

b) Carbon nanotube.

c) Effect of Reduction of Dimension.

d) Magnetic Properties.

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Total No. of Questions : 5]

SEAT No. :

P-2420

[Total No. of Pages : 2

[6062]-421
M.Sc.
PHYSICS
CBOP - 1 (PHOT - 114C2) : Lasers & Applications
(2020 Pattern) (CBCS) (Semester - I) (Group - I) (2 Credits)

Time : 2 Hours] *[Max. Marks : 35*

Instructions to the candidates :

1) *Question 1 is compulsory.*
2) *Attempt /solve any two questions from Q. 2 to Q. 4.*
3) *Question No. 2 to Question No. 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 where necessary.*

Q1) A) **Solve any four of the following :**

i) Explain stimulated emission of radiation. **[2]**

ii) Define population Inversion. **[2]**

iii) What do you mean by threshold gain. **[2]**

iv) What is metastable state. How it is useful in lasers. **[2]**

v) Write any four aplications of lasers. **[2]**

B) Calculate the intensity of the He - Ne laser beam of wavelength 6328 A°. If the power radiatd by the laser is 1 m W. **[3]**

Q2) a) i) Describe construction and working of He-Ne lasers. **[4]**

ii) Define the term laser & state its important characteristics. **[3]**

b) Define absorption coefficient & show that intensity of light decreases exponentially with distance in the medium. **[5]**

P.T.O.

Q3) a) Describe construction & working of semiconductor laser. **[7]**

b) Find the relative population of the two states in ruby laser that produces a light beam of wavelength 6943 A° at 500 K. **[5]**

Q4) Write short notes on Any three of the following :

a) Excimer lasers. **[4]**

b) Gas lasers. **[4]**

c) Pumping & its types. **[4]**

d) Various vibrational modes in CO_2 molecule. **[4]**

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Total No. of Questions : 4]

SEAT No. :

P2421

[Total No. of Pages : 2

[6062]-422

M.Sc. - I/II

PHYSICS

CBOP-I (PHOT-243D2)/CBOP-I (PHOT-124 D2)

Physics of Semiconductor Devices

(2020 CBCS Pattern) (Semester - I/IV) (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 right indicate full marks.*
5) *Use of log-table or non-programable electronic calculator is allowed.*
6) *Neat labelled diagrams must be drawn wherever necessary.*

Q1) a) Solve any four of the following :

i) Draw ideal diode I-V characteristics and name the different regions of it. **[2]**

ii) Give the device configuration of IMPATT diode. **[2]**

iii) Write the charge balance equation of electrostatically neutral semiconductor. **[2]**

iv) Define the generation & recombination of carries in semiconductor. **[2]**

v) What is schottky diode? **[2]**

b) N-type semiconductor has a minority carrier lifetime 10^{-6} sec. Find the diffusion length of minority carrier at 300K. Given $\mu p = 250 cm^2/v.s$ & $\frac{KT}{q} = 0.0259\,v$. **[3]**

Q2) a) i) Define : **[4]**

1) Emitter injection efficiency
2) Base transport factor,
3) Common base current gain
4) Common emitter current gain of p-n-p transistor

ii) Explain ON and OFF states of BJT. **[3]**

b) What is the junction breakdown? Explain its types in brief. **[5]**

P.T.O.

Q3) a) Derive shockely equation and give its significance. **[6]**

b) Describe junction formation of JFET. What is the pinch-off and saturation mechanisms of JFET? **[6]**

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

a) Barrier height of metal - semiconductor contact. **[4]**

b) Carrier concentration of intrinsic semiconductor at thermal equilibrium. **[4]**

c) Zener diode and its characteristics. **[4]**

d) Current transport process in thermionic emission theory. **[4]**

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Total No. of Questions : 4]

SEAT No. :

P2422

[Total No. of Pages : 1

[6062]-423

M.Sc. - I/II

PHYSICS

CBOP - I (PHOT - 243E2)/CBOP-I (PHOT-124E2)/

CBOP-1(PHOT-114E2)

Communication Electronics

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

Time : 2 Hours] *[Max. Marks : 35*

Instructions to the candidates:

1) *Q.1 is Compulsory.*
2) *Q.2 to Q.4 carry equal marks.*
3) *Solve any two questions from Q.2 to Q.4.*

Q1) a) Solve any FOUR of the following.

i) Draw the block diagram of digital communication system. **[2]**

ii) State shannon-Hartley theorem. **[2]**

iii) What is the role of E-relay in telephone set? **[2]**

iv) Give the principle of facsimile. **[2]**

v) What is the path length if minimum path length in the attenuating medium is 100 km and $\beta = 5$ degrees? **[2]**

b) Calculate the capacity of a standard 4-kHz telephone channel has 3100 Hz bandwidth with a 30 dB signal to noise ratio. **[3]**

Q2) a) i) Describe Error detection & correction. **[4]**

ii) Explain the Echo suppressors characteristics of data transmission.**[3]**

b) Draw the circuit diagram of telephone subseviber loop circuit. Also explain the role of DC battery in telephone system. **[5]**

Q3) a) Derive the basic radar range equation, as governed by minimum receivable echo power p_{min}. **[7]**

d) Define transmission path in satellite communication. Explain the impotency of it in communication. **[5]**

Q4) Write short note on any two of the following.

a) Different codes used for data transmission. **[6]**

b) Network organization. **[6]**

c) Orbital aspects in satellite communication system. **[6]**

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Total No. of Questions : 7]

SEAT No. :

P-2423

[Total No. of Pages : 3

[6062]-425
S.Y. M.Sc.
PHYSICS
PHOT-244G4: Acoustics - II (Group - II)
(2020 Pattern) (Semester - IV) (CBCS) (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 side indicate full marks.***
5) ***Use of log table/non-programmable electronic calculator is allowed.***
6) ***Neat diagram must be drawn wherever necessary.***

Q1) Solve any Five of the following :

a) Give the expression for efficiency and acoustic power for a direct radiator loudspeaker. **[2]**

b) Give assumptions required for deriving wave equation for horn loudspeaker. **[2]**

c) Draw a diagram showing cross-section of a moving coil microphone. **[2]**

d) Draw circuit diagram for a three way first and second order crossover network. **[2]**

e) What is volume limiter? How is it different from volume compressor. **[2]**

f) Define Directivity factor and Directivity index. **[2]**

Q2) a) Give steps involved in the reciprocity calibration of a microphone. Hence derive expression for open circuit voltage response. Also state advantages of this method. **[7]**

b) Write a note on Dolby Noise reduction. **[5]**

Q3) a) With a neat diagram showing cross-section of a condenser microphone, derive the expression for its sensitivity. **[7]**

b) A direct radiator loud speaker has total mass of l0 gm and operated in magnetic field of 2 Wb/m^2. The radius of the speaker is 0.1 m. The mechanical resistance is 1 kg/sec, radiation resistance and radiation reactance each are 2 kg/sec. The stiffness of the cone system is 2500 N/m, the voice coil is 380 cm long has a resistance of 10 ohm. Calculate following quantities at 200 Hz frequency – i) f_0 ii) η iii) Acoustic power for an input current of 3A. **[5]**

Q4) a) i) With a neat diagram derive expression for pressure response of loudspeaker. **[4]**

ii) Discuss the effect of voice coil parameters on efficiency. **[3]**

b) Determine the phase velocity of a 350 Hz plane wave progressing through an exponential horn of flare constant of 5.0 at a temperature of 35°C. **[5]**

Q5) a) Explain theory of Pressure Gradient microphone. **[7]**

b) A velocity ribbon microphone has an aluminium strip of width 2×10^{-3}m, length 3×10^{-2}m and mass 1.5×10^{-6} kg. The strip moves in a magnetic field of flux density 0.2 Wb/m^2 inside a circular baffle of radius 0.04m. If a plane acoustic wave of frequency 200 Hz and pressure 3 N/m^2 is incident normally on the face of the ribbon. Calculate i) Voltage generated in the ribbon ii) Sensitivity iii) Velocity amplitude and displacement amplitude . [Take C = 330 m/s]. **[5]**

Q6) a) Define Sound Reproducing Systems (SRS). Discuss its types with a neat diagram. **[7]**

b) The equation for plane waves in an exponential horn is $\frac{\partial^2 \xi}{\partial t^2} = c^2 \left[\frac{\partial^2 \xi}{\partial x^2} + m \frac{\partial \xi}{\partial x} \right]$. Show that, for $\xi = Ae^{j(wt+\gamma x)}$ to be a solution to the equation, γ must satisfy the relation $\gamma^2 - jm\gamma - k^2 = 0$ where $k = \frac{\omega}{c}$. **[5]**

Q7) Write a short note on <u>any three</u> of the following :

a) Audio CD parameters. **[4]**

b) Audio file format. **[4]**

c) MIDI (Musical Instruments Digital Interface). **[4]**

d) Ultrasonic cleaning and ultrasonic range finding. **[4]**

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Total No. of Questions : 7]

SEAT No. :

P-2424

[Total No. Of Pages : 2

[6062]-426
S.Y. M.Sc.
PHYSICS
PHOT- 244H4: Energy Studies - II (Group-II)
(2020 Pattern) (CBCS) (Semester-IV) (4 Credits)

Time : 3 Hours] *[Max. Marks : 70*

Instructions to the candidates :

1) ***Q.No.1 is compulsory.***
2) ***Solve any five questions from Q.No.2 to Q.No 7.***
3) ***figures to the right indicate full marks.***
4) ***Use of logtables and non-progrommable electronic calculator is allowed.***

Q1) **Attempt any Five of the following:**

a) What is fill factor of solarcell? **[2]**

b) What is biomass? **[2]**

c) What is energy balance equation for collector? **[2]**

d) What is basic principle of wind energy conversion? **[2]**

e) What is gasification? **[2]**

f) Give the different types solar cells & their material. **[2]**

Q2) a) i) What are limitations of wind energy conversion. **[4]**

ii) Give the applications SPV system. **[3]**

b) What are the advantages and disadvantages of solar concentrators? **[5]**

Q3) a) i) What are the different types of biofules? Give their applications. **[4]**

ii) If efficiency of solar cell is 15% having Isc = 500mA, Voc = 0.5v and fill factor = 0.6, then calculate the input power pin. **[3]**

b) Explain any method of hydrogen production with neat diagram. **[5]**

P.T.O

Q4) a) Explain the different types of selective coatings and material used for it. **[7]**

b) Explain the utilization of hydrogen as fuel cell. **[5]**

Q5) a) Explain with block diagram, SPV conversion system. Give their characteristics. **[7]**

b) Explain the different sources of hydrogen. **[5]**

Q6) a) Explain with neat diagram, box type solar cooker. **[6]**

b) Explain the important factors of designing of digester **[6]**

Q7) **Write short note on any Three of the following:**

a) Solar dryer **[4]**

b) Biomass gasifier and their types. **[4]**

c) Aerobic and anaerobic biconversion. **[4]**

d) Types of wind mills. **[4]**

Total No. of Questions : 7]

SEAT No. :

P-2425

[Total No. of Pages : 2

[6062]-427

S.Y. M.Sc.

PHYSICS

PHOT - 244I4 : Electronics Instrumentation - II (Group - II)

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

Time : 3 Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Q.1 is compulsory.***
2) ***Answer/Solve any five questions from Q.2 to Q.7.***
3) ***Q.2 to Q.7 carry equal marks.***
4) ***Figures to the right side 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) Define ladder diagram. Draw circuit symbol for NC and NO type of physical limit switch. **[2]**

b) What is process control principle? **[2]**

c) Explain in short "Cyclic response" criteria evaluation of controller system performance. **[2]**

d) Why derivative controller mode is never use alone? **[2]**

e) What is script file? Write purpose of command window in mat lab. **[2]**

f) Write the equation for integral and proportional controller model. **[2]**

Q2) a) What is process control loop? Explain control system evaluation criteria in detail. **[7]**

b) What is script file in mat lab? Write rule for defining scalar variable in mat lab. **[5]**

P.T.O.

Q3) a) Draw circuit diagram using operational amplifiers for a two position controller. Explain how it works. Give one application of two position controller along with on advantage and limitation of this type of controller. **[7]**

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

Q4) a) With neat circuit diagram explain PI controller mode. Derive output voltage equation. **[7]**

b) Design a proportional integral controller with a proportional band of 30% and an integration gain of 0.1% (%–5). The 4 to 2 mA input converts to a 0.4 to 2V signal and output is to be 0-10V. calculate values of G_p, G_1, R_2, R_1 and C respectively. **[5]**

Q5) a) Draw block diagram for a PLC. Explain its operation in details with special reference to input module and output module and applications. **[7]**

b) Explain process characteristics with special reference to process equation with suitable example draw necessary diagram. **[5]**

Q6) a) Draw a ladder diagram for elevators system. The global objective is to take load in upword direction if start or up switch pressed. Down ward motion is to be initiated by pressing down switch provided up motion of platform is not in progress, vice versa for up motion. **[7]**

b) Level measurement in sump tank is provided by transducer scaled as 0.2V/m. A pump is to be turned on by application of +5V when the sump level exceeds 2.0 m. The pump is to be turned back off when the sump level drop to 1.5m develop two position controller. **[5]**

Q7) Write a short note on <u>any two</u> of the following :

a) Control system objectives. **[6]**

b) Second order sensor time response. **[6]**

c) P-I-D controller. **[6]**

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Total No. of Questions : 7]

SEAT No. :

P-2426

[Total No. of Pages : 2

[6062]-431
M.Sc.
PHYSICS
PHOT-244M4 : Material Science - II
(2020 Pattern) (CBCS) (4 Credits) (Semester - IV)

Time : 3 Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Q1 is compulsory.***
2) ***Attempt any five questions from Q2 to Q7.***
3) ***Q2 to Q7 carry equal marks.***
4) ***Figures to the right indicate full marks.***
5) ***Use of log-table or non-programmable electronic.***
6) ***Neat diagram must be drawn where ncessary.***

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

a) Give the chemical formula for Montmorillonite.

b) What are magnetic bubbles.

c) What is the electron density on the electrodes of charge 0.24×10^{-10}C.

d) The resistivity of pure silicon at room temperature is 3000Ωm. Calculate intrinsic carrier density.

e) What do you understand by pyroelectric material.

f) Explain hysteresis in magnetic materials.

Q2) a) With a labelled diagram discuss subclasses of silicates, (any four). **[7]**

b) Explain ferromagnetic and ferrimagnetic materials. **[5]**

Q3) a) Derive the relation for built-in potential in p-n junction. **[7]**

b) List various applications of High T_C materials. **[5]**

P.T.O.

Q4) a) i) Calculate the density of FeO which has NaCl - type structure. $r_{Fe^{2+}} = 0.074$nm, $R_{O^{2-}} = 0.140$nm Atomic mass : Fe = 55.8 a.m.u, O - 16 a.m.u. **[4]**

ii) An electrical glass has a working range of 870°C ($\eta = 10^6$ Pa.s or 10^7 poises) to 1300°C ($\eta = 10^{2.5}$ Pa.s to $10^{3.5}$ poises). Estimate the annealing point for ($\eta = 10^{12}$ Pa.s or 10^{13} poises) **[4]**

b) With a labelled diagram give an account of magnetization characteristic and hysteresis loop caused by domain action. **[4]**

Q5) a) Derive the equation for equilibrium electron and hole concentrations. **[6]**

b) Draw crystal structure of YBCO, Yttrium barium cuparate High T_C superconductor and explain it. **[6]**

Q6) a) Discuss in detail AX-type and AX_2-type ceramic materials. **[6]**

b) Explain in detail Zener and Avalanche breakdown. **[6]**

Q7) Write short note on any three. **[12]**

a) Notch sensitivity

b) Compensated semiconductors

c) Ferroelectric materials

d) Hard and soft magnets

Total No. of Questions : 4]

SEAT No. : [ ]

P-2427

[Total No. of Pages : 2

[6062]-434

S.Y. M.Sc.

PHYSICS

PHOT - 244H2 : Energy Studies - II

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

Time : 2 Hours] *[Max. Marks : 35*

Instructions to the candidates:

1) ***Q.1 is compulsory.***
2) ***Answer/Solve any two questions 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-tables or non-programmable electronic calculator is allowed.***
6) ***Neat diagrams must be drawn where necessary.***

Q1) a) Attempt any four of the following :

i) What is selective coating? **[2]**

ii) Define the Biomass. **[2]**

iii) What is aerobic bioconversion? **[2]**

iv) What is meant by solar cell? **[2]**

v) Define solar concentrator. **[2]**

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

Q2) a) i) Discuss the merits and demerits of vertical axis wind mill. **[4]**

ii) Explain the street light as application of SPV system. **[3]**

b) Explain the solar still with a suitable diagram. **[5]**

Q3) a) Explain with neat diagram, the construction and working of Evacuated Tube collector. **[6]**

b) Explain the process of hydrogen production by direct electrolysis of water with a suitable diagram. **[6]**

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

a) Solar Dryer. **[4]**

b) Parabolic concentrator cooker. **[4]**

c) Fermentation process. **[4]**

d) Horizontal axis wind mill. **[4]**

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Total No. of Questions : 4]

SEAT No. :

P-2428

[Total No. of Pages : 2

[6062]-435
M.Sc.
PHYSICS
PHOT - 244I2 : Electronics Instrumentation - II
(2020 Pattern) (Semester - IV) (CBCS) (2 Credits)

Time : 2 Hours] *[Max. Marks : 35*

Instructions to the candidates :

1) *Question 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 indicate full marks.*
5) *Use of log-table or non-programmable electronic calculator is allowed.*
6) *Neat diagrams must be drawn where necessary.*

Q1) A) Solve any four of the following.

a) Define Scan time in PLC. What is maximum scan time? **[2]**

b) What is integral control mode? Mention advantage and application. **[2]**

c) Derivative control mode is not used along. Comment. **[2]**

d) Explain the role of process control specialist and industry expert. **[2]**

e) What is servomechanism? **[2]**

B) Draw circuit symbol for Nc and No types of following switches used in ladder diagram. **[3]**

i) Pressure limit switch

ii) Level limit switch

iii) Physical limit switch

Q2) a) Construct the ladder diagram that will provide a solution to the discrete state control problem of automatic bottle filling machine. Assume that when the level control system is commanded off, the input value is closed and a 1-min prefill is required for intialization. **[7]**

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

P.T.O.

Q3) a) Explain an op-amp propotional integral (PI) and propotional derivative (PD) mode control with help of neat circuit diagram. **[7]**

b) In propotional controller, 0-10V corresponds to a 0-100% output. If R_2 is 10kΩ and full scale error range is 10V. Find the values of V_0 and R_1 to support a 20% propotional band about 50% zero error controller output. **[5]**

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

a) Control system evalution criteria. **[6]**

b) Integral mode control. **[6]**

c) Continous and discrete state control. **[6]**

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Total No. of Questions : 4]

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M.Sc. (Semester-IV)
PHYSICS
PHOT244J2T: Biomedical Instrumentation - II
(CBCS) (2020 Pattern) (2 Credits) (Group-II)

Time : 2 Hours] *[Max. Marks : 35*

Instructions to the candidates :

1) ***Q.No.1 is compulsory.***
2) ***Attempt / Solve any Two questions from Q.No.2 to Q.No 4.***
3) ***Q.2 to Q.4 carry equal marks.***
4) ***Figures to the right side indicate full marks.***
5) ***Use of logtable and non-porgramble electronic calculator is allowed.***
6) ***Neat diagrams must be drawn wherever necessary.***

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

i) State different types of brain waves with their frequency values. **[2]**

ii) What are the limitations of EEG? **[2]**

iii) What are the types of EMG? **[2]**

iv) What is ultrasound? State its use in biomedical instrumentation? **[2]**

v) What are pneumograph and pneumogram? **[2]**

b) Find the energy of xray in eV, when wavelength of diagnostic X-ray is $1A^o$, **[3]**

Q2) a) What is nervous system? Explain divisions of nervous system? What are the basic functions of nervous system? **[7]**

b) Explain the semiconductor memories in detail. **[5]**

P. T. O

Q3) a) Why ultrasonic waves are preferred for imaging? What are its characteristics? **[7]**

b) Explain Physiology of respiratory system. **[5]**

Q4) **Write short note on any two of the following.**

a) Lung volume and Lung capacities. **[6]**

b) Characteristics of ultrasound. **[6]**

c) Spirometer **[6]**

Total No. of Questions : 4]

SEAT No. :

P-2430

[Total No. of Pages : 2

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M.Sc.

PHYSICS

PHOT - 244M2 : Material Science - II

(2020 Pattern) (CBCS) (2 Credits) (Semester - 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 side indicate full marks.***
5) ***Use of log-tables or non-programmable electronic calculator is allowed.***
6) ***Neat diagrams must be drawn wherever necessary.***

Q1) a) Solve <u>any four</u> of the following : **[4 × 2 = 8]**

i) Derive maxwell's first hermodynamic relation.

ii) State Richard's and Troaton's rule.

iii) Define binary phase diagram.

iv) State second law of thermodynamics.

v) Explain activity coefficient.

b) What are the degree of freedom of system of two components when the number of phase is two. **[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 the following thermodynamic function. Internal Energy, Enthalpy, Gibb's free energy. **[6]**

b) Describe any one experimental technique for determination of phase diagram. **[6]**

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

a) Type - II phase diagram.

b) Chemical reaction equilibrium.

c) Miscibility gap.

d) Regular solution (Henry's law)

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