NALANDA OPEN UNIVERSITY

M.Sc. Physics

PART–I, PAPER–I

(Mathematical Physics)

Annual Examination, 2012

Time : 3 Hours. **Full Marks : 80**

Answer any Five Questions. All questions carry equal marks.

1. Distinguish between the Largrangian and Hamiltorian formulations of mechanical systems. Using Hamiltorian formulation, find equations of motion of (a) Compound pendulum and (b) Linear harmonic oscillator.

2. Show that the transformations defined by the following :—

   (a) $Q = \frac{1}{P}$ *and* $P = qp^2$

   (b) $q = \sqrt{2P}\, SinQ$ *and* $p = \sqrt{2P}\, CosQ$

   are both canonical transformations.

3. If a matrix C is given as $C = \begin{bmatrix} 4 & 6 & 2 \\ 6 & 0 & 3 \\ 2 & 3 & -1 \end{bmatrix}$ then find (a) $\frac{1}{2}C^2 - C$ and (b) $C\left(\frac{1}{2}C - 1\right)$.

4. (a) Show that all the eigenvalues of a Hermitian matrix are real.

   (b) Find the eigenvalues and eigenvectors of the following matrix $\begin{bmatrix} 3 & 0 & 0 \\ 0 & -8 & 0 \\ 0 & 0 & 4 \end{bmatrix}$.

5. Solve the differental equation :— $x^2y'' + xy' + \left(x^2 - 1\right)y = 0$.

6. Describe Bensel function and its properties. Find values of $J_{\pm\frac{1}{2}}(x)$.

7. Derive the following recurrence formulae for Hermite polynomials :—

   (a) $H_n''(x) = 4n(n-1)\, H_{n-2}(x)$

   (b) $2x\, H_n(x) - H_{n+1}(x) = H_n'(x)$

8. Describe Laguerre's equation and show that. $L_3(x) = 1 - 3x + \frac{3}{2}x^2 + \frac{x^3}{6}$.

9. Obtain Fourier transform of δ–function.

10. Determine the conjugate metric tensor in (a) Cylindrical and (b) Spherical Coordinates.

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Examination Programme-2012

M.Sc. Physics, Part–I

Date	*Papers*	*Time*	*Examination Centre*
09.05.2012	Paper–I	8.00 AM to 11.00 AM	Nalanda Open University, Patna
11.05.2012	Paper–II	8.00 AM to 11.00 AM	Nalanda Open University, Patna
15.05.2012	Paper–III	8.00 AM to 11.00 AM	Nalanda Open University, Patna
17.05.2012	Paper–IV	8.00 AM to 11.00 AM	Nalanda Open University, Patna
19.05.2012	Paper–V	8.00 AM to 11.00 AM	Nalanda Open University, Patna
21.05.2012	Paper–VI	8.00 AM to 11.00 AM	Nalanda Open University, Patna
23.05.2012	Paper–VII	8.00 AM to 11.00 AM	Nalanda Open University, Patna
25.05.2012	Paper–VIII	8.00 AM to 11.00 AM	Nalanda Open University, Patna

NALANDA OPEN UNIVERSITY

M.Sc. Physics

PART–I, PAPER–II

(Quantum Mechanics)

Annual Examination, 2012

Time : 3 Hours. **Full Marks : 80**

Answer any Five Questions. All questions carry equal marks.

1. State and explain the meaning of expectation value of a dynamical quantity. Write down the expectation values of energy, momentum and angular momentum of a particle.

2. Consider a square well potential given by

   $V(x) = -V_0, \quad 0 < x < L$

   $= \quad 0 \ , \quad x < 0 \ and \ x < L$

   Calculate the reflection and transmission coefficients when particle is incident from left with energy E > 0. At what energies of the electron will there be no reflection.

3. State and prove Heisenberg's uncertainty relations. What are its consequences ?

4. Show that,

   (a) $L^2 = \frac{1}{2}\left(L_+ L_- + L_- L_+\right) + L_z^2$ where $L_+ = L_x + iLy$ and $L_- = L_x - iLy$ are called ladder operators.

   (b) $\left[L_+, L_-\right] = 2\hbar \, L_z$

5. Find the energy eigenvalues and energy eigenfunctions in the case of a plane rotator.

6. Find energy levels and energy eigenfunctions of the matrix $H = \begin{pmatrix} 1+\in & \in \\ \in & -1+\in \end{pmatrix}, \in << |$ corrected upto 1st order in $\in$ using penturbation theory compare the above energy eigenvalues with the exact one (i.e. by diagonalizing the matrix H).

7. Find the total scattering cross-section, for the scattering by a square well potential, in terms of reff. & a.

8. State and explain Fermi's golden rule. What do you understand by adiabatic and sudden approximation.

9. State and explain the fundamental postulates of Wave Mechanics.

10. Write short notes on any ***Two*** of the following :—
    (a) Ehrenfest's Theorem
    (b) Differential Scattering Cross-Section
    (c) Symmetry of Wave Functions.

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NALANDA OPEN UNIVERSITY

M.Sc. Physics

Part–I, Paper–III

(Electrodynamics & Plasma Physics)

Annual Examination, 2012

Time : 3 Hours. **Full Marks : 80**

Answer any Five Questions. Selecting at least two questions from each group. All questions carry equal marks.

GROUP 'A'

1. Find the transformation equations of electric field $\vec{E}$ and magnetic field $\vec{B}$ under Lorentz transformation and hence show that $\vec{E} \cdot \vec{B}$ is lorentz in variant.

2. Explain the following :—
   (a) Fom vectors under Lorentz transformation
   (b) Energy momentum tensor
   (c) Electromagnetic field tensor

3. What do you mean by Lienarl-Weichert potential ? Obtain an expression for L-W potential due to uniformly moving point change.

4. Deduce Larmor's formula for a non-relativistic accelerated change.

5. Discuss the motion of changed particle in the presence of non-uniform electric field.

6. Discuss the motion of charged particles in oscillating e.m. fields.

GROUP 'B'

7. Describe a distribution function, and also obtain on expression for the mean density of a plasma medium.

8. Find an expression for plasma frequency from the mass conservation equation of Continuity.

9. What is plasma confinement ? Describe a tokomak device for plasma confinement.

10. Obtain an expression for the Alfven speed. Explain the nature of Alfven wave and the requisite condition for its formation.

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—: आवश्यक सूचना :—

M.Sc. Physics, Part–I के सभी परीक्षार्थियों को सूचित किया जाता है कि पटना नगर निगम चुनाव के कारण दिनांक 17.05.2012 को होने वाली Paper–IV की परीक्षा अब दिनांक 18.05.2012 को प्रातः 8 बजे से 11 बजे के बीच आयोजित की जायेगी । अन्य पत्रों की परीक्षा अपने पूर्व निर्धारित तिथि, समय एवं स्थान पर आयोजित होगी ।

NALANDA OPEN UNIVERSITY

M.Sc. Physics

Part–I, Paper–IV

(Statistical Physics)

Annual Examination, 2012

Time : 3 Hours. **Full Marks : 80**

Answer any Five Questions. All questions carry equal marks.

1. Deduce the entropy of a monatomic gas using Boltzmann theorem of entropy.

   Show that the mean energy of a gas is given by $U = -\left(\frac{\partial}{\partial p}\right)(l\,nZ)$ where Z is the partition function.

2. What is Gibb's paradox ? Give suitable explanation for resolving it.

3. Deduce an expression for the partition function of an ideal monatomic gas. Using this expression, find the internal energy C_v, P, F *and* S of the above gas.

4. Define 'ensembles'. What are the three types of ensembles ? Describe 'micro canonical ensemble' and give its properties.

5. Prove that the pressure exerted by a Fermi-Dirac gas at T = 0 is $P_F = \frac{2}{5}\left(\frac{N}{V}\right)E_F$ where E_F is Fermi energy.

6. What is Bose-Einstein condensation ? Give an account of the theory of Bose-Einstein condensation.

7. Describe two dimensional Ising model and show how does it explain the phenomenon of spontaneous magnetization.

8. Derive the virial equation of state and evaluate the virial coefficients.

9. What are critical indices ? Explain the different scaling relations among the critical indices.

10. Write short notes on any ***Two*** of the following :—
    (a) Bose Einstein Condensation
    (b) Fermi-Dirac distribution law
    (c) Phase space, trajectory and density of states

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NALANDA OPEN UNIVERSITY

M.Sc. Physics

Part–I, Paper–V

(Nuclear and Particle Physics)

Annual Examination, 2012

Time : 3 Hours. **Full Marks : 80**

Answer any Five Questions. All questions carry equal marks.

1. Discuss the theory of ground state of deuteron. Use graphical solution of the necessary transcendental equation to obtain energy eigenvalue and eigenfunctions.

2. Give a critical analysis of the spin dependence of nuclear forces. Justify your answer with substantive experimental facts.

3. Describe the basic ideas in YuKaWa's meson exchange theory of the nuclear force.

4. What are the different types of nuclear reactions ? Classify them giving suitable examples.

5. Describe the compound nucleus theory of nuclear reactions. Give the experimental evidences in support of this theory.

6. Distinguish between the three forms of β-decay giving suitable examples for each of them. Also, discuss the shape of the β-spectrum.

7. What are allowed and forbidden β-transitions ? Discuss Fermi and Gamow-Teller selection rules in the context of Fermi's theory of β-disintegration.

8. What are electric and magnetic transitions in γ-ray emission. Explain what is meant by multiple order of transition and show how is it related with the change of parity and spin.

9. Discuss the nature and properties of π-mesons. Show that the parity of π-mesons is negative.

10. Give an account of classification of hadrons. Explain SU(3) symmetry and discuss octet and decuplet multiplets for baryons as well as octet multiplets for mesons.

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NALANDA OPEN UNIVERSITY

M.Sc. Physics

Part–I, Paper–VI

(Atomic and Molecular Physics)

Annual Examination, 2012

Time : 3 Hours. **Full Marks : 80**

Answer Five Questions in all, selecting atleast two questions from each group. All questions carry equal marks.

GROUP 'A'

1. Write down the Schrödinger equation of one electron atom and use separation of variables method to solve this equation and explain physical meaning of all the quantum numbers that appear.

2. What are normal and anomalous Zeeman effects ? How are they explained ?

3. Describe the general feature of the spectra of alkali-like atoms. How are they explained ?

4. Describe and explain the different types of couplings in atoms. Give illustrative examples.

5. Discuss briefly the various factors which contribute broadening in a spectral time.

GROUP 'B'

6. Describe the principal features of the rotational band spectrum of a diatomic molecule. Estimate the energy difference between the rotational levels $J = 0$ and $J = 1$ of HCL if its moment of inertia is 2.66×10^{-47} Kg-m².

7. What are *P, G* and *R* branches in vibration-rotation spectra ? Explain their origin.

8. Discuss Raman Spectra of a diatomic molecule and point out the similarities and differences of this with infra-red Raman Spectra.

9. State Franck-Condon principle and give its wave mechanical interpretation. How does it help in understanding the intensity distribution in the vibrational structure of the electronic transitions of a diatomic molecule ?

10. What do you mean by ESR ? Explain the basis principles of interaction of electron spin and applied magnetic field.

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NALANDA OPEN UNIVERSITY

M.Sc. Physics

Part–I, Paper–VII

(Condensed Matter Physics)

Annual Examination, 2012

Time : 3 Hours. **Full Marks : 80**

Answer any Five Questions. All questions carry equal marks.

1. What are symmetry operations ? Describe the principal symmetry operation applicable to a three dimensional lattice. Show that the five-fold rotation axis is not permissible in case of lattices.

2. Show that for a cubic lattice, the lattice constant 'a' is given by $a = (nM/PN)^{Y_3}$, where n is the no. of atoms per unit cell, M is the atomic weight, P is the density of the Crystalline material & N is Avogadro's number.

3. (a) Show that the interplanar spacing of *(hkl)* plane in an orthorhombic lattice with constants a, b, c, is $d_{hkl} = \left[\frac{h^2}{a^2} + \frac{k^2}{b^2} + \frac{l^2}{c^2}\right]^{Y_2}$.

   (b) Prove that for a crystal of cubic symmetry, the direction *[hkl]* is perpendicular to the plane *(hkl)*.

4. Show that the intensity of an x-ray beam passing through a given material decreases exponentially as $I(x) = I(o)\, e^{-\mu x}$ where μ is the absorption coefficient and x is the thickness of the material through which X-ray beam has travelled. Discuss the various types of absorption coefficients.

5. What are Brillouin Zones ? How are Brillouin Zones Constructed ? Describe and give the sketches of the first Brillouin Zones of *bcc* and *fcc* lattices. Mention their importance in crystal analysis.

6. Discuss the various types of dislocations in a crystal and indicate the manner in which the Burgers vector differs for different dislocation.

7. (a) State and prove Bloch theorem.
   (b) Explain the significance of the effective mass of the electron.

8. Describe the Cellular method for studying the band structure of solids. What are the problems encountered in this method ?

9. What is quantum Hall effect ? Give an account of its relevant theory.

10. What is a superconductor ? How do the properties of superconductors differ from those of normal conductors ? mention some applications of superconductors.

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NALANDA OPEN UNIVERSITY

M.Sc. Physics

Part–I, Paper–VIII

(Electronic Devices)

Annual Examination, 2012

Time : 3 Hours. **Full Marks : 80**

Answer any Five Questions. All questions carry equal marks.

1. Describe the design and operating characteristics of UJT. How are there characteristics explained ? What are the 5 parameters defined for UJT ?
2. Describe the design and working of IMPATT Diode.
3. What is meant by Pinch off ? How does it take place in JFET ?
4. How can NMOS device be used to implement memory device ? Give the proper explanation.
5. What do you understand by Electrogyration ? Explain it on the basis of symmetry approach.
6. What do you understand by acoustooptic effect ? Explain.
   Mention the areas of its applications.
7. Explain large Bragg angle diffraction with special reference to codirectional and contradirectional coupling.
8. Explain transmissive and reflective type LCDs.
9. What do you mean by piezoelectricity ? Discuss the application of piezoelectric materials in Sensors and actuators.
10. Write short notes on any ***Two*** of the following :—
    (a) Surface Wave Sensors.
    (b) Liquid Crystal Display.
    (c) Acoustooptic Spectrum Analyser.
    (d) Small Bragg Angle Diffraction.

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For Practical Counselling Class & Practical Examination Programme Please See on Back Page.

NALANDA OPEN UNIVERSITY

M.Sc. Physics

PART–II, PAPER–IX

(Computational Mathematics)

Annual Examination, 2012

Time : 3 Hours. **Full Marks : 80**

Answer any Five Questions. All questions carry equal marks.

1. Using Lin-Bairstow's method, obtain the quadratic factor of the polynomial given by $f(x) = x^3 - 2x^2 + 5x - 2$.

2. For the system of equations, $x + 2y + z = 8;\ 2x - y + 2z = 6;\ 3x + 2y - z = 4$ an approximate solution is given by $x = 1$, $y = 1.8$ and $z = 2.8$. Improve this solution by the method of iteration.

3. Find the eigen values and eigenvectors of the given matrix and show that $n \times n$ matrix may have n linearly independent eigenvectors, or it may have fewer than n :—

$$A = \begin{vmatrix} -2\lambda & 2 & -3 \\ 2 & 1-\lambda & 0 \\ -1 & -2 & 0-\lambda \end{vmatrix}$$

4. State and prove Stirling's formula for interpolation.

5. From the following table of values of x and y, obtain $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ for $x = 1.2$.

x	1.0	1.2	1.4	1.6	1.8	2.0	2.2
y	2.7183	3.3201	4.0552	4.9530	6.0496	7.3891	9.0250

6. Evaluate the following integral using Euler-Maclaurin formula :—

$$I = \int_0^{\pi/2} Sin\, x \cdot dx$$

7. Derive Simpson's $1/3$–rule using the method of undetermined coefficients.

8. Solve, by Euler's method, the equation

$$\frac{dy}{dx} = x + y, \qquad y(0) = 0$$

Choose $\lambda = 0.2$ and Compute $y(0.4)$ and $y(0.6)$.

9. Use the spline method to solve the initial value problem,

$$y'' + 2y' + y = 0$$

$$y(0) = 0 \quad and \quad y(1) = 0$$

10. Solve the equation, $\nabla^2 f = F(x, y)$ with $F(x, y) = xy$ and $f = 0$ on boundary. The domain is a square with corners at (0, 0) and (4, 4). Use $h = 1$.

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NALANDA OPEN UNIVERSITY

M.Sc. Physics

PART–II, PAPER–X

(Programming with Fortran C++)

Annual Examination, 2012

Time : 3 Hours. **Full Marks : 80**

Answer any Five Questions. All questions carry equal marks.

1. What are the executable and nonexecutable statements in Fortran Programming ? Distinguish clearly between them. Write a program to calculate the sum and product of three given integers l, n & m.

2. What is a computer programme ? Explain the terms : Machine Language, Compiler, Interpreter and Assembler. What is the difference between a hardware & a software ?

3. Explain integer and real data types representation in the Fortran Language with examples.

4. Write a programme which reads in an integer K > Z and determines if K is a prime number and exhibit a nontrivial divisor of K if not a prime number.

5. Define Arrays. Explain the declaration of arrays with example in Fortran Language.

6. What is meant by the comparison and logical operators ? How are they different from the arithmetic and assignment operators ? List out all C++ operators alongwith their ASSOCIATIVITY.

7. Write a programme in C++ to perform the following :—
   (i) Area of a Circle
   (ii) Area of a triangle
   (iii) Area of a rectangle.

8. (a) Write a function in C++ to generate a Fibonacci series of 'n' numbers, where n is defined by a programmer.
   (b) Write a programme to define the Pascal syntax in a C++ programme.

9. Write a programme to initialize a few members of an array of structure and to display the contents of all the structures.

10. What is the relationship between a pointer and an array ? Explain how a pointer to function can be declared in C++.

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NALANDA OPEN UNIVERSITY

M.Sc. Physics

PART–II, PAPER–XI

(Physics of Nanomaterials)

Annual Examination, 2012

Time : 3 Hours. **Full Marks : 80**

Answer any Five Questions. All questions carry equal marks.

1. What is the density of states in a metal ? Derive an expression for the density of energy sates and hence, obtain the Fermi energy of a metal.

2. What do you understand by the term 'density of states' in a metal ? Derive an expression for the density of states for electrons in metals.

3. Write short notes on the following :—
   (a) Quantum Well
   (b) Superlattice

4. What is a quantum dot ? Discuss the structure and characteristics of various types of quantum dots.

5. What do you mean by single electron transistor ? Discuss the theory of coulomb oscillation.

6. Discuss the optical properties of quantum wires. Describe the various quantum wire devices.

7. Explain the phenomena of photoluminescence, phosphorescence and chemiluminescence. How do you account for the shift in peaks of PL-spectra ?

8. What is the difference between the "Bottom up" and "Bottom down" methods of preparing nonoparticles ? Describe, in detail, the sol-gel method of preparation of nanoparticles.

9. What is multiferroic magnetoelectric material ? Discuss the applications of such materials.

10. Write short notes on any ***Two*** of the following :—
    (a) Raman spectra of nanomaterials.
    (b) Electron Miscroscope.
    (c) Quantum dots as electronc devices.

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NALANDA OPEN UNIVERSITY

M.Sc. Physics

PART–II, PAPER–XII

(Science and Technology of Renewable Energy)

Annual Examination, 2012

Time : 3 Hours. **Full Marks : 80**

Answer any Five Questions. All questions carry equal marks.

1. (a) "Solar energy is the mother of renewable energy sources"—justify this statement by giving suitable examples.
   (b) Derive expression for Radiant Power Density.

2. Explain Minority Carrier life time and diffusion length in Simple Semiconductor Crystal.

3. Derive expression for the total current in (a) Wide Base Diode and (b) Narrow Base Diode.

4. Explain 'quantum efficiency' and 'spectral response'. How will you calculate quantum efficiency from spectral response.

5. (a) What are the resistive effects in solar cell ? Explain, in brief.
   (b) Distinguish between, 'characteristic resistance' and 'parasitic resistance'.

6. What do you understand by anti reflection coating and how is it used to minimize optical loss in solar cells ? How is antireflection coating measured ?

7. (a) Explain the chemical and mechanical application of solar energy.
   (b) How can solar energy be used for cooling ? Explain.

8. Explain the perspectives of hydrogen energy in the World ? Give an account of the pilot programmes. What are the safety risks involved with application of hydrogen fuel ?

9. Compare hydroelectric generation with other sources of energy and discuss its positive and negative aspects. What are its limitations.

10. Write short notes on the following :—
    (a) Ideal Solar Cell.
    (b) Wind Energy.

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NALANDA OPEN UNIVERSITY

M.Sc. Physics

PART–II, PAPER–XIII

(Environmental Physics)

Annual Examination, 2012

Time : 3 Hours. **Full Marks : 80**

Answer any Five Questions. All questions carry equal marks.

1. Discuss the composition and structure of atmosphere and explain their temperature, radiation and pressure.

2. Discuss, in detail, the 'Atmospheric Stratification' and find expressions for potential density and stratification frequency. Explain saturated and adiabatic lapse rates.

3. Explain Einstein's A & B coefficients of absorption, stimulated emission and spontaneous emission. Hence, deduce Lambert-Beer's law.

4. What is LIDAR ? Explain its principle, physical and technical aspects with applications.

5. (a) Explain the zero dimensional greenhouse gas model.
   (b) Discuss weather and climactic effect on earth in nuclear explosion occurs and sum becomes cool.

6. Discuss the equations of motion for a fluid and hence obtain the Navier-Stokes Equation for fluids.

7. What is an Urban Heat Island ? Explain the causes of Heat Island.

8. What do you mean by End-of-Year Cost and Rest Value. What is 'building times' and 'break-even points' with reference to conventional energy sources.

9. Discuss the working principle and properties of the Gratzel Cell.

10. Discuss the power from (i) Nuclear Fission and (ii) Nuclear Fusion.
    How will you optimize the reactor size based on fission ?

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NALANDA OPEN UNIVERSITY

M.Sc. Physics

PART–II, PAPER–XIV

(Photonics)

Annual Examination, 2012

Time : 3 Hours. **Full Marks : 80**

Answer any Five Questions. All questions carry equal marks.

1. Describe a double heterojunction LED. Why this system has be light emitting efficiency than p-n junction LED ?

2. Describe band gap and fill factor of a p-n cell. How does Fill Factor (FF) depend on the normalized open circuit voltage ?

3. What do you mean by 'stimulated emission' and 'population inversion' ? How is the population inversion accomplished in semiconductor and non-semiconductor laser ?

4. Describe the principles of Nd-Yag laser. What are its applications ?

5. Describe an injection laser. What is double heterojunction injection laser ? Explain the origin of the term 'injection'.

6. What do you mean by core and cladding ? Describe the structures of different types of optical fibers with ray paths.

7. What are the devices used for detecting optical signal after it comes out of the fiber ? Compare their characteristics. An optical fiber in air has a numerical aperture of 0.4. Calculate the acceptance angle for meridional rays and also for a skew ray which changes direction by 120° at each reflection.

8. What do you mean by beats ? Extend the concept of beats from acoustic to optical region. How does the beat formation help in deciding the changes in phase of the laser source ?

9. How plasma screen is different from LCD screen ? What is the future of LCD screen ?

10. Show experimental set-up to obtain ultra fast laser. What are the uses of these ultrafast lasers ?

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NALANDA OPEN UNIVERSITY

M.Sc. Physics

PART–II, PAPER–XV

(Advanced Condensed Matter Physics)

Annual Examination, 2012

Time : 3 Hours. **Full Marks : 80**

Answer any Five Questions. All questions carry equal marks.

1. (a) Describe the covalent bonding process between a pair of hydrogen atoms. What is the driving energy for the formation of a diatomic molecule ?
   (b) What is Madelung constant ? Show that the value of this constant for an infinite linear chain of alternating unit charge is $2ln2$.

2. Obtain dispersion relation for a one-dimensional crystal with two types of atoms and hence discuss the nature of optical and acoustic modes. Extend the results to 3-dimensional crystal.

3. What are Normal and Umkalpp phonon processes ? Give the importance of U-process in explaining the thermal conductivity in non-metallic solids.

4. What is the importance of inelastic scattering of Light Waves with phonons ? Describe, in detail, the (i) Brillouin Scattering and (ii) Raman scattering. Give the applications of these process.

5. Write an essay on Mössbauer effect and its applications.

6. What is Debye-Waller factor ? What is its origin ? Discuss the temperature dependence of the Bragg reflection.

7. Derive the equation of state for solids and obtain the Gruneisen law.

8. Give the theory of interaction of electrons with acoustic phonons.

9. Give a quantitative treatment of BCS ground state. Obtain an expression for the energy gap at OK.

10. Write notes on the following :—
    (a) Lyddane-Sachs-Teller Relation.
    (b) DC Josepson effect.

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NALANDA OPEN UNIVERSITY

M.Sc. Physics

PART–II, PAPER–XVI

(Advanced Electronics)

Annual Examination, 2012

Time : 3 Hours. **Full Marks : 80**

Answer any Five Questions. All questions carry equal marks.

1. Find the expression for (a) voltage gain, (b) differential input resistance and (c) output resistance for a single-input, balanced output amplifier.

2. Give reasons why an open-loop op-amp is unsuitable for linear applications. What is a feedback ? What are different negative feedback configurations ? Explain with the help of circuit diagrams.

3. (a) Explain the use of op-amp as an integrator.
   (b) What is a logarithmic amplifier ? Show that is a logarithmic amplifier, output voltage changes as the logarithm of the input voltage.

4. Derive an expression for frequency of oscillation of phase shift oscillator. Following specifications are given for a particular phase shift oscillator :—
   C = 0.1 μF , R = 3.9kr and $\left| Rf \right| Ri \left|\right.$ = 29. Determine the frequency of oscillation.

5. What is a Comparator ? Explain the working of a Comparator. What are its important characteristics ?

6. What is a flip-flop ? Explain the functioning of NOR and NAND latch.

7. What is the difference between a counter and a shift register ? Discuss the various kinds of shift registers.

8. (a) What is a decoder ? Design a 3-time-to-8-time decoder.
   (b) What is a encoder ? Draw the logic circuit of 8-time-to-3-time encoder.

9. Draw the block diagram of ROM and explain its operation.

10. What are the five basic hardware blocks of a digital computer ? Draw the block diagram of a digital computer and explain the working of each block.

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M.Sc. Physics, Part–II के प्रायोगिक कक्षा एवं प्रायोगिक परीक्षा का कार्यक्रम, सभी विद्यार्थियों को डाक के माध्यम से भेजा जायेगा ।