

NALANDA OPEN UNIVERSITY

M.Sc. Physics, Part-I

PAPER-I

(Mathematical Physics)

Annual Examination, 2022

Time : 3 Hours.

Full Marks : 80

*Answer any Five Questions.
All questions carry equal marks.*

1. Find the solution of the harmonic oscillator by Hamilton Jacobi Method.
2. Obtain the expression for normal frequencies of a double pendulum.
3. Find the Eigen values and eigen vectors of the following matrix and show that $n \times n$ matrix may have n linearly independent eigenvectors, or it may have fewer than n .

$$A = \begin{vmatrix} -2 & 3 & -2 \\ 2 & 1 & -6 \\ -1 & -2 & -0 \end{vmatrix}$$

4. Find the general solution of the equation $y'' - 5y' + 6y = 2e^x + 6x - 5$.
5. Prove that : $(1 - x^2) P_n'(x) = -\frac{n(n+1)}{2n+1} [P_{n+1}(x) - P_{n-1}(x)]$.
6. Find the value of $J_{\pm \frac{1}{2}}(x)$ and $J_{\pm \frac{3}{2}}(x)$.
7. Describe the following recurrence formulae for Hermite Polynomials :
 - (a) $H_n''(x) = 4n(n-1)H_{n-2}(x)$
 - (b) $2xH_n(x) - H_{n+1}(x) = H_n'(x)$
8. Show that $(2n+1-x)L_n(x) = (n+1)L_{n+1}(x) - nL_{n-1}(x)$.
9. A covariant tensor has components $xy, 2y - z^2, xz$ in rectangular coordinates. Find its covariant components in spherical coordinates.
10. If $A^k = g^{jk} A_j$; Show that $A_j = g_{jk} A^k$.

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EXAMINATION PROGRAMME-2022 M.Sc. Physics & Botany, Part-I

| Date | Papers | Time | Examination Centre |
|------------|------------|--------------------|--|
| 10.11.2022 | Paper-I | 2.30 PM to 5.30 PM | Nalanda Open University, 2 nd Floor, Biscomaun Bhawan, Patna |
| 12.11.2022 | Paper-II | 2.30 PM to 5.30 PM | Nalanda Open University, 2 nd Floor, Biscomaun Bhawan, Patna |
| 15.11.2022 | Paper-III | 2.30 PM to 5.30 PM | Nalanda Open University, 2 nd Floor, Biscomaun Bhawan, Patna |
| 17.11.2022 | Paper-IV | 2.30 PM to 5.30 PM | Nalanda Open University, 2 nd Floor, Biscomaun Bhawan, Patna |
| 19.11.2022 | Paper-V | 2.30 PM to 5.30 PM | Nalanda Open University, 2 nd Floor, Biscomaun Bhawan, Patna |
| 22.11.2022 | Paper-VI | 2.30 PM to 5.30 PM | Nalanda Open University, 2 nd Floor, Biscomaun Bhawan, Patna |
| 24.11.2022 | Paper-VII | 2.30 PM to 5.30 PM | Nalanda Open University, 2 nd Floor, Biscomaun Bhawan, Patna |
| 26.11.2022 | Paper-VIII | 2.30 PM to 5.30 PM | Nalanda Open University, 2 nd Floor, Biscomaun Bhawan, Patna |

NALANDA OPEN UNIVERSITY
M.Sc. Physics, Part-I
PAPER-II
(Quantum Mechanics)
Annual Examination, 2022

Time : 3 Hours.

Full Marks : 80

Answer any Five Questions.
All questions carry equal marks.

1. Derive Schrödinger (i) time independent and (ii) time dependent equations for matter wave. Give physical interpretation of the wave function. Define the stationary state of a particle.
2. State and prove Heisenberg uncertainty principle. What are its consequences ?
3. Calculate the reflection and the transmission coefficients when a particle with energy $E > V_0$ is incident on a potential step defined by

$$V_{(x)} = 0 \quad \text{for } x < 0 \\ = V_0 \quad \text{for } x > 0$$

4. State the postulates of Schrödinger formulation of quantum mechanics.
5. Set up Schrödinger equation for an one dimensional harmonic oscillator and solve it for energy eigenvalues and eigenfunctions.
6. Show that, (i) $[L^2, L_{\pm}] = 0$, (ii) $[L_+, L_-] = 2\hbar L_z$, (iii) $[L_z, L_{\pm}] = \pm \hbar L_{\pm}$ and $[L_z, L_z] = 0$.
7. Using the method of partial waves for the study of scattering problems, show that scattering cross section is given by $\sigma = \frac{4\pi}{k^2} \sum_{l=0}^{\infty} (2l+1) \sin^2 \delta_l$
8. Write down Schrödinger's equation for hydrogen atom and apply the separation of variables method to obtain the radial wave function for the system.
9. Give a brief account of quantum mechanical theory of Stark effect for splitting of energy of hydrogen atom.
10. Write short notes on any **Two** of the following :—
 - (a) de-Broglie hypothesis
 - (b) Operator form of K.E. & momentum.
 - (c) Degeneracy.
 - (d) Dirac δ -function.

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NALANDA OPEN UNIVERSITY
M.Sc. Physics, Part-I
PAPER–III

(Electrodynamics and Plasma Physics)
Annual Examination, 2022

Time : 3 Hours.

Full Marks : 80

Answer any Five Questions.
All questions carry equal marks.

1. Show that the scalar product $\vec{E} \cdot \vec{B}$ is unchanged under Lorentz transformation and show that the same for $E^2 - C^2 B^2$.
2. What do you mean by Lienard and Weichert potential ? Obtain expression for Lienard-Weichert potential for uniformly moving point charge.
3. Obtain the electric and magnetic field due to acceleration parallel and perpendicular to the velocity of charged particle.
4. Discuss Larmor's formula for a non-relativistic accelerated charge.
5. Discuss the motion of a charged particle in an oscillating electromagnetic field.
6. Write Maxwell's equations in tensor form and show that they are covariant under transformations.
7. Give Saha theory of thermal ionisation and explain the determination of plasma ionisation on its basis.
8. Discuss Debye length, Debye shielding and the plasma parameter in detail.
9. Derive Boltzmann's equation. What is Boltzmann-Vlasov equation.
10. Discuss in details :—
 - (a) Pulsed plasma Nitriding.
 - (b) Plasma enhanced chemical vapour deposition.
 - (c) Plasma pyrolysis of medical waste.
 - (d) Space plasma.

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EXAMINATION PROGRAMME-2022
M.Sc. Physics & Botany, Part-I

| Date | Papers | Time | Examination Centre |
|------------|------------|--------------------|--|
| 10.11.2022 | Paper-I | 2.30 PM to 5.30 PM | Nalanda Open University, 2 nd Floor, Biscomaun Bhawan, Patna |
| 12.11.2022 | Paper-II | 2.30 PM to 5.30 PM | Nalanda Open University, 2 nd Floor, Biscomaun Bhawan, Patna |
| 15.11.2022 | Paper-III | 2.30 PM to 5.30 PM | Nalanda Open University, 2 nd Floor, Biscomaun Bhawan, Patna |
| 17.11.2022 | Paper-IV | 2.30 PM to 5.30 PM | Nalanda Open University, 2 nd Floor, Biscomaun Bhawan, Patna |
| 19.11.2022 | Paper-V | 2.30 PM to 5.30 PM | Nalanda Open University, 2 nd Floor, Biscomaun Bhawan, Patna |
| 22.11.2022 | Paper-VI | 2.30 PM to 5.30 PM | Nalanda Open University, 2 nd Floor, Biscomaun Bhawan, Patna |
| 24.11.2022 | Paper-VII | 2.30 PM to 5.30 PM | Nalanda Open University, 2 nd Floor, Biscomaun Bhawan, Patna |
| 26.11.2022 | Paper-VIII | 2.30 PM to 5.30 PM | Nalanda Open University, 2 nd Floor, Biscomaun Bhawan, Patna |

NALANDA OPEN UNIVERSITY
M.Sc. Physics, Part-I
PAPER-IV
(Statistical Mechanics)
Annual Examination, 2022

Time : 3 Hours.

Full Marks : 80

Answer any Five Questions.
All questions carry equal marks.

1. What is entropy ? Show that, (a) $S = K \ln z + \frac{U}{T}$, (b) $U = -\frac{\partial}{\partial \beta} (\ln z)$, Where notations have their usual meaning in this chapter.
2. Explain partition function. Deduce expression for partition function of a monoatomic gas.
3. Prove that the one dimensional Ising model does not explain the spontaneous magnetization. How does the solution of the two dimensional Ising model overcome these difficulties ?
4. State and prove Liouville theorem. How does it analogous to the equation of continuity of an incompressible fluid ?
5. Explain : ensemble, microcanonical and the grand canonical ensembles. Derive Sackur-Tetrode equation for a perfect gas.
6. Explain Cluster Expansion. Discuss the classical approach towards the theory of cluster expansion.
7. Explain the first and the second order phase transitions. Give the Landau theory of transition.
8. Derive virial equation of state and evaluate the virial coefficients.
9. Derive Fermi-Dirac distribution law or, Bose-Einstein distribution law.
10. What are critical indices ? Explain the different kinds of critical indices.

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NALANDA OPEN UNIVERSITY
M.Sc. Physics, Part-I
PAPER-V
(Nuclear and Particle Physics)
Annual Examination, 2022

Time : 3 Hours.

Full Marks : 80

Answer any Five Questions. All questions carry equal marks.

1. Explain clearly nuclear quadrupole moment and discuss the ground state of deuteron in the light of the fact that it has small but definite quadrupole moment.
2. What is β -decay ? Give Fermi theory of β -decay. Discuss Fermi and Gamow-Teller selection rules in the context of Fermi's theory of β -disintegration.
3. Discuss the nature and properties of π -mesons. How does it account for the charge independence of nuclear forces ? Show that the parity of π -mesons is negative.
4. What is majorana force ? Explain why a neutron-proton pair forms bound nucleus, while a bi-neutron and a di-proton pair does not. How this exchange force gives rise to saturation in binding energy ?
5. Discuss the quark model in detail. How does this model explain baryons and mesons ?
6. What are electric and magnetic transitions in Gamma-ray emission ? Explain multipolarity in the Gamma transition.
7. Define Q-value of a nuclear reaction. Establish the Q-equation of the nuclear reaction.
8. What are stripping and pickup reactions ? Obtain an expression for reaction amplitude using Born approximation for stripping and pickup reaction.
9. Describe the compound nucleus theory of nuclear reactions. Give experimental evidences in support of this theory.
10. Give an account of classification of hadrons. Explain SU(3) symmetry and discuss octet and decuplet multiplets for hadrons and 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, 2022

Time : 3 Hours.

Full Marks : 80

*Answer Five Questions in all, selecting at least Two Questions from each group.
All questions carry equal marks.*

GROUP 'A'

1. Discuss the hyperfine structure of Spectral lines. What light does this throw on the spin and magnetic moment of atomic nuclei ?
2. Describe the general feature of the spectra of alkali-like atoms. How are they explained.
3. Deduce an expression for the series spectra of a hydrogen-like atom, taking into account the finite mass of the nucleus. Calculate the energy required to remove the electron from singly-ionized helium atom.
4. What are normal and anomalous Zeeman effects ? How are they explained ?
5. Discuss stark effect. Show that splitting increases with the increase of principal quantum number n .

GROUP 'B'

6. Describe the principal features of the rotational band spectrum of a diatomic molecule.
7. Give the theory of a vibrational-rotational spectrum of a diatomic molecule.
8. Discuss the Raman spectra of a diatomic molecule and point out the similarities and differences with infra-red Raman spectra.
9. Explain the important features of electronic spectra. How electronic spectra differ from atomic spectra.
10. Explain with calculation of frequency for ESR and VMR.

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प्रायोगिक परामर्श कक्षा एवं प्रायोगिक परीक्षा का कार्यक्रम पार पृष्ठ पर देखें ।

NALANDA OPEN UNIVERSITY

M.Sc. Physics, Part-I

PAPER-VII

(Condensed Matter Physics)

Annual Examination, 2022

Time : 3 Hours.

Full Marks : 80

Answer any Five Questions. All questions carry equal marks.

1. What are Miller indices ? How the orientation of a plane is specified by Miller indices ? Explain their importance. Write down the Miller indices for planes with intercepts $(a, 2b, \alpha)$.
2. Derive the Laue equations for diffraction of X-rays by a crystalline solid. Show that the Bragg's equation in a special case of the Laue equations.
3. How are Brillouin Zones constructed ? Describe and sketch the first Brillouin Zones of bcc and fcc lattices. Mention their importance in crystal analysis.
4. What is atomic scattering factor ? Derive the general expression for the atomic scattering factor using spherical polar coordinates.
5. Discuss Kronig-Penny model for a linear lattice. How does it lead to the formation of bands in solids.
6. (a) State and prove Bloch theorem.
(b) Explain the significance of the effective mass of the electron.
7. Explain the Schottky and the Frenkel defects. Calculate the equilibrium concentration defects and indicate the order of their magnitude.
8. Describe the tight binding approximation for calculating the energy states of an electron in a solid. How can this method be compared with the nearby free electron model in the case of a metal.
9. Discuss the quantization of electron orbits in magnetic field.
10. Explain the difference between Type I and Type II superconductors. Prove that Meissner effect and the disappearance of resistivity in a superconductor are mutually consistent.

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प्रायोगिक परामर्श कक्षा एवं प्रायोगिक परीक्षा का कार्यक्रम पार पृष्ठ पर देखें ।

NALANDA OPEN UNIVERSITY
M.Sc. Physics, Part-I
PAPER–VIII
(Electronic Devices)
Annual Examination, 2022

Time : 3 Hours.

Full Marks : 80

Answer any Five Questions.
All questions carry equal marks.

1. Describe the construction and the working of Uni junction transistor. Discuss its characteristics. Explain intrinsic stand off ratio.
2. Describe construction of a JFET. Discuss its characteristics. What is pinch off and how it takes place ?
3. Explain large angle diffraction with special reference to co-directional and contra directional coupling.
4. Explain piezoelectricity and discuss the application of the piezoelectric material in sensors and actuators.
5. Give the full name of SAW. Discuss its use in surface wave sensors.
6. What is Raman-Nath diffraction ? Give its theory. How can it be observed ?
7. Describe the mechanism of current flow in a properly biased BJT. Define the various parameters.
8. Give the basic design of a Charged Coupled-Device (CCD) and explain its working.
9. Distinguish between RAM & ROM. What are static and dynamic RAMS ? How it can be obtained ?
10. What is Pockels effect ? What is a Pockel's Cell ? Explain the dynamics within the cell and discuss the applications of Pockel Cells.

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प्रायोगिक परामर्श कक्षा एवं प्रायोगिक परीक्षा का कार्यक्रम पार पृष्ठ पर देखें ।

NALANDA OPEN UNIVERSITY

M.Sc. Physics, Part-II

PAPER-IX

(Computational Mathematics)

Annual Examination, 2022

Time : 3 Hours.

Full Marks : 80

Answer any Five Questions.
All questions carry equal marks.

- Find the root of the equation $x \sin x + \cos x = 0$ using Newton-Raphson formula.
- Using the matrix inversion method, find the solution of the following set of equations
$$\left. \begin{aligned} 3x + y + 2z &= 3 \\ 2x - 3y - z &= -3 \\ x + 2y + z &= 4 \end{aligned} \right\}.$$
- Using Newton's Backward Difference Interpolation Formula estimate $f(7.5)$ from following data :—

| x | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|--------|---|---|----|----|-----|-----|-----|-----|
| $f(x)$ | 1 | 8 | 27 | 64 | 125 | 216 | 343 | 512 |

- State and prove Sterling's formula for interpolation.
- From the Taylor's series for $y(x)$, find $y(0, 1)$, correct to three decimal places if $y(x)$ satisfies $y' = x - y''$ and $y(0) = 1$.
- What the help of Euler-Maclaurin formula, evaluate the integral $I = \int_0^{5/2} \sin x \, dx$.
- Give the theory of Crank-Nicolson Method to solve the parabolic partial differential equation. Explain it with a suitable solved example.
- Use Splin method to solve the initial value problem $y'' + 2y' + y = 0$, $y(0) = 0$ and $y(1) = 0$.
- Solve the equation $y'' + y + 1 = 0$, with boundary condition $y = 0$, when $x = 0$ and $y = 0$ when $x = 1$.
- Find the eigenvalues and eigenvectors of the given matrix. Show that $n \times n$ matrix may have n linearly independent eigenvectors.

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EXAMINATION PROGRAMME-2022

M.Sc. Physics, Part-II

| Date | Papers | Time | Examination Centre |
|------------|------------|--------------------|---|
| 27.01.2023 | Paper-IX | 2.30 PM to 5.30 PM | Nalanda Open University, 2 nd Floor, Biscomaun Bhawan, Patna |
| 31.01.2023 | Paper-X | 2.30 PM to 5.30 PM | Nalanda Open University, 2 nd Floor, Biscomaun Bhawan, Patna |
| 02.02.2023 | Paper-XI | 2.30 PM to 5.30 PM | Nalanda Open University, 2 nd Floor, Biscomaun Bhawan, Patna |
| 04.02.2023 | Paper-XII | 2.30 PM to 5.30 PM | Nalanda Open University, 2 nd Floor, Biscomaun Bhawan, Patna |
| 06.02.2023 | Paper-XIII | 2.30 PM to 5.30 PM | Nalanda Open University, 2 nd Floor, Biscomaun Bhawan, Patna |
| 08.02.2023 | Paper-XIV | 2.30 PM to 5.30 PM | Nalanda Open University, 2 nd Floor, Biscomaun Bhawan, Patna |
| 10.02.2023 | Paper-XV | 2.30 PM to 5.30 PM | Nalanda Open University, 2 nd Floor, Biscomaun Bhawan, Patna |
| 14.02.2023 | Paper-XVI | 2.30 PM to 5.30 PM | Nalanda Open University, 2 nd Floor, Biscomaun Bhawan, Patna |

NALANDA OPEN UNIVERSITY

M.Sc. Physics, Part-II

PAPER-X

(Programming with Fortran and C++)

Annual Examination, 2022

Time : 3 Hours.

Full Marks : 80

Answer any Five Questions. All questions carry equal marks.

1. Write short notes on (a) Machine Language, (b) Assembly Language and (c) High Level Programming.
2. What are executable and non-executable statements ? Explain the difference between them.
3. Discuss the following three ways of writing X^2 in Fortran; (a) $X*X$, (b) $X**2$, (c) $X**2.0$.
4. Write Fortran program which counts the number of positive numbers and the number of negative numbers.
5. Write a SUBROUTINE subprogram which does not have any (a) argument (b) RETURN statement.
6. Write a program in C++ to perform the following, (a) Area of a triangle (b) Area of a rectangle.
7. Write a function in C++ to generate a Fibonacci series of n numbers, where n is defined by a program.
8. What is a function ? List out the advantages and disadvantages of using functions in C++. What do you mean by local and global variables ?
9. Write a program to initialize the number of a union and to display the contents of the union.
10. Explain the various functions involved in opening and closing sequential file in C++.

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M.SC. PHYSICS, PART-II

Practical Counseling and Practical Examination Programme, 2022

Practical Programme for Paper-X of All Students

Venue : School of Computer Education & IT, Nalanda Open University, 12th Floor, Biscomaun Tower, Patna-800001

| Enrollment No. | Date of Counselling | Time | Enrollment No. | Date of Exam | Time |
|---|--------------------------------|--------------------|---|--------------|----------------------|
| All Old Students & 200280001 to 200280180 | 15, 16, 17 & 20 February, 2023 | 3.00 PM to 4.30 PM | All Old Students & 200280001 to 200280070 | 21.02.2023 | 10.30 AM to 12.30 PM |
| 200280181 to 200281300 | 15, 16, 17 & 20 February, 2023 | 4.30 AM to 6.00 PM | 200280071 to 200280330 | 21.02.2023 | 1.00 PM to 3.00 PM |
| | | | 200280331 to 200281300 | 21.02.2023 | 3.00 PM to 5.00 PM |

Practical Programme for Paper-XII, XIV, XV & XVI

Venue : Physics Lab, 1st Floor Biscomaun Tower, Patna-800001

For Enrollment No. 170280001 to 190280600

| Counselling Class Programme | | Practical Examination Programme | | | | |
|-----------------------------|---------------------|---------------------------------|------------|-------|------------|---------------------|
| Date | Time | Paper | Date | Paper | Date | Time |
| 22.02.2023 & 23.02.2023 | 11.00 AM to 5.00 PM | XII | 24.02.2023 | XV | 25.02.2023 | 10:00 AM to 1:00 PM |
| | | XIV | 24.02.2023 | XVI | 25.02.2023 | 1:30 PM to 4:30 PM |

For Enrollment No. 190280601 to 190280900 & 200280001 to 200280100

| Counselling Class Programme | | Practical Examination Programme | | | | |
|-----------------------------|---------------------|---------------------------------|------------|-------|------------|---------------------|
| Date | Time | Paper | Date | Paper | Date | Time |
| 27.02.2023 & 28.02.2023 | 11.00 AM to 5.00 PM | XII | 01.03.2023 | XV | 02.03.2023 | 10:00 AM to 1:00 PM |
| | | XIV | 01.03.2023 | XVI | 02.03.2023 | 1:30 PM to 4:30 PM |

For Enrollment No. 200280101 to 200280300

| Counselling Class Programme | | Practical Examination Programme | | | | |
|-----------------------------|---------------------|---------------------------------|------------|-------|------------|---------------------|
| Date | Time | Paper | Date | Paper | Date | Time |
| 03.03.2023 & 04.03.2023 | 11.00 AM to 5.00 PM | XII | 05.03.2023 | XV | 06.03.2023 | 10:00 AM to 1:00 PM |
| | | XIV | 05.03.2023 | XVI | 06.03.2023 | 1:30 PM to 4:30 PM |

For Enrollment No. 200280301 to 200280600

| Counselling Class Programme | | Practical Examination Programme | | | | |
|-----------------------------|---------------------|---------------------------------|------------|-------|------------|---------------------|
| Date | Time | Paper | Date | Paper | Date | Time |
| 13.03.2023 & 14.03.2023 | 11.00 AM to 5.00 PM | XII | 15.03.2023 | XV | 16.03.2023 | 10:00 AM to 1:00 PM |
| | | XIV | 15.03.2023 | XVI | 16.03.2023 | 1:30 PM to 4:30 PM |

For Enrollment No. 200280601 to 200281300

| Counselling Class Programme | | Practical Examination Programme | | | | |
|-----------------------------|---------------------|---------------------------------|------------|-------|------------|---------------------|
| Date | Time | Paper | Date | Paper | Date | Time |
| 17.03.2023 & 18.03.2023 | 11.00 AM to 5.00 PM | XII | 20.03.2023 | XV | 21.03.2023 | 10:00 AM to 1:00 PM |
| | | XIV | 20.03.2023 | XVI | 21.03.2023 | 1:30 PM to 4:30 PM |

NALANDA OPEN UNIVERSITY

M.Sc. Physics, Part-II

PAPER–XI

(Physics of Nano Materials)

Annual Examination, 2022

Time : 3 Hours.

Full Marks : 80

Answer any Five Questions. All questions carry equal marks.

1. Derive an expression for the electrical conductivity of a free electron gas using the collision time concept. Does this result explain the experimental value of resistivity of a metal ?
2. Discuss the motion of electrons in two dimensional potential well and obtain expression for density of states.
3. What is a quantum wire ? Discuss the optical properties of quantum wire. Describe various quantum wire devices.
4. What is difference between 'bottom up' and 'bottom down' methods of producing nanoparticles ? Describe, in detail, the 'Sol-Gel method' of preparation of nanoparticles.
5. What is multiferroic magnetoelectric material ? Describe the applications of such materials.
6. What is Raman effect ? Discuss variations in Raman Spectra of nanomaterials.
7. Describe the Hartree-Fock approximation of the coulomb interaction between 3D confined electrons. Mention the application of Hund's rule in quantum dots.
8. Name the six widely known methods to produce nanomaterials. Describe, briefly, at least three of them.
9. Explain the phenomenon of photoluminescence, phosphorescence and chemiluminescence. How do you account for the shift in the peaks of PL-Spectra ?
10. Write notes on (a) Plasma Arcing (b) Hund's rule in quantum dot.

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M.SC. PHYSICS, PART-II

Practical Counseling and Practical Examination Programme, 2022

Practical Programme for Paper-X of All Students

Venue : School of Computer Education & IT, Nalanda Open University, 12th Floor, Biscomaun Tower, Patna-800001

| Enrollment No. | Date of Counselling | Time | Enrollment No. | Date of Exam | Time |
|---|--------------------------------|--------------------|---|--------------|----------------------|
| All Old Students & 200280001 to 200280180 | 15, 16, 17 & 20 February, 2023 | 3.00 PM to 4.30 PM | All Old Students & 200280001 to 200280070 | 21.02.2023 | 10.30 AM to 12.30 PM |
| 200280181 to 200281300 | 15, 16, 17 & 20 February, 2023 | 4.30 AM to 6.00 PM | 200280071 to 200280330 | 21.02.2023 | 1.00 PM to 3.00 PM |
| | | | 200280331 to 200281300 | 21.02.2023 | 3.00 PM to 5.00 PM |

Practical Programme for Paper-XII, XIV, XV & XVI

Venue : Physics Lab, 1st Floor Biscomaun Tower, Patna-800001

For Enrollment No. 170280001 to 190280600

| Counselling Class Programme | | Practical Examination Programme | | | | |
|-----------------------------|---------------------|---------------------------------|------------|-------|------------|---------------------|
| Date | Time | Paper | Date | Paper | Date | Time |
| 22.02.2023 & 23.02.2023 | 11.00 AM to 5.00 PM | XII | 24.02.2023 | XV | 25.02.2023 | 10:00 AM to 1:00 PM |
| | | XIV | 24.02.2023 | XVI | 25.02.2023 | 1:30 PM to 4:30 PM |

For Enrollment No. 190280601 to 190280900 & 200280001 to 200280100

| Counselling Class Programme | | Practical Examination Programme | | | | |
|-----------------------------|---------------------|---------------------------------|------------|-------|------------|---------------------|
| Date | Time | Paper | Date | Paper | Date | Time |
| 27.02.2023 & 28.02.2023 | 11.00 AM to 5.00 PM | XII | 01.03.2023 | XV | 02.03.2023 | 10:00 AM to 1:00 PM |
| | | XIV | 01.03.2023 | XVI | 02.03.2023 | 1:30 PM to 4:30 PM |

For Enrollment No. 200280101 to 200280300

| Counselling Class Programme | | Practical Examination Programme | | | | |
|-----------------------------|---------------------|---------------------------------|------------|-------|------------|---------------------|
| Date | Time | Paper | Date | Paper | Date | Time |
| 03.03.2023 & 04.03.2023 | 11.00 AM to 5.00 PM | XII | 05.03.2023 | XV | 06.03.2023 | 10:00 AM to 1:00 PM |
| | | XIV | 05.03.2023 | XVI | 06.03.2023 | 1:30 PM to 4:30 PM |

For Enrollment No. 200280301 to 200280600

| Counselling Class Programme | | Practical Examination Programme | | | | |
|-----------------------------|---------------------|---------------------------------|------------|-------|------------|---------------------|
| Date | Time | Paper | Date | Paper | Date | Time |
| 13.03.2023 & 14.03.2023 | 11.00 AM to 5.00 PM | XII | 15.03.2023 | XV | 16.03.2023 | 10:00 AM to 1:00 PM |
| | | XIV | 15.03.2023 | XVI | 16.03.2023 | 1:30 PM to 4:30 PM |

For Enrollment No. 200280601 to 200281300

| Counselling Class Programme | | Practical Examination Programme | | | | |
|-----------------------------|---------------------|---------------------------------|------------|-------|------------|---------------------|
| Date | Time | Paper | Date | Paper | Date | Time |
| 17.03.2023 & 18.03.2023 | 11.00 AM to 5.00 PM | XII | 20.03.2023 | XV | 21.03.2023 | 10:00 AM to 1:00 PM |
| | | XIV | 20.03.2023 | XVI | 21.03.2023 | 1:30 PM to 4:30 PM |

NALANDA OPEN UNIVERSITY
M.Sc. Physics, Part-II
PAPER–XII
 (Science and Technology of Renewable Energy)
Annual Examination, 2022

Time : 3 Hours.

Full Marks : 80

Answer any Five Questions. All questions carry equal marks.

1. Explain spectral response. How will you calculate quantum efficiency from spectral response ?
2. What do you understand by first, second and third generation of solar cells ? What efficiency they can achieve ?
3. State and explain the Diode equation for non-ideal and ideal diodes. Illustrate the Diode law graphically and explain the importance of dark current. Explain depletion approximation.
4. Explain importance of Fill Factor (FF) in a solar cell and derive its expression. Also, discuss, in details, the efficiency of the solar cell.
5. Derive Betz's law and show that maximum efficiency of the rotors can't exceed 60%. What are the factors that limit the wind energy ?
6. What are environmental impacts of harnessing the geothermal, the wave and the tidal energy ? What are the methods employed in harnessing the tidal energy ?
7. Explain minority carrier life time and diffusion length in simple semi conductor crystals.
8. Explain series and shunt resistances and their effects on 'Fill Factor' (FF) in solar cells. Distinguish between characteristics and parasitic resistances.
9. Explain the perspectives of hydrogen energy in the World. Give an account of the pilot programmes. What are safety risks involved with application of hydrogen fuel ?
10. Write notes on (a) Ideal Solar Cell (b) Wind Energy.

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M.SC. PHYSICS, PART-II
Practical Counseling and Practical Examination Programme, 2022
Practical Programme for Paper-X of All Students

Venue : School of Computer Education & IT, Nalanda Open University, 12th Floor, Biscomaun Tower, Patna-800001

| Enrollment No. | Date of Counselling | Time | Enrollment No. | Date of Exam | Time |
|---|--------------------------------|--------------------|---|--------------|----------------------|
| All Old Students & 200280001 to 200280180 | 15, 16, 17 & 20 February, 2023 | 3.00 PM to 4.30 PM | All Old Students & 200280001 to 200280070 | 21.02.2023 | 10.30 AM to 12.30 PM |
| 200280181 to 200281300 | 15, 16, 17 & 20 February, 2023 | 4.30 AM to 6.00 PM | 200280071 to 200280330 | 21.02.2023 | 1.00 PM to 3.00 PM |
| | | | 200280331 to 200281300 | 21.02.2023 | 3.00 PM to 5.00 PM |

Practical Programme for Paper-XII, XIV, XV & XVI
 Venue : Physics Lab, 1st Floor Biscomaun Tower, Patna-800001

For Enrollment No. 170280001 to 190280600

| Counselling Class Programme | | Practical Examination Programme | | | | |
|------------------------------------|---------------------|--|-------------|--------------|-------------|---------------------|
| Date | Time | Paper | Date | Paper | Date | Time |
| 22.02.2023 & 23.02.2023 | 11.00 AM to 5.00 PM | XII | 24.02.2023 | XV | 25.02.2023 | 10:00 AM to 1:00 PM |
| | | XIV | 24.02.2023 | XVI | 25.02.2023 | 1:30 PM to 4:30 PM |

For Enrollment No. 190280601 to 190280900 & 200280001 to 200280100

| Counselling Class Programme | | Practical Examination Programme | | | | |
|------------------------------------|---------------------|--|-------------|--------------|-------------|---------------------|
| Date | Time | Paper | Date | Paper | Date | Time |
| 27.02.2023 & 28.02.2023 | 11.00 AM to 5.00 PM | XII | 01.03.2023 | XV | 02.03.2023 | 10:00 AM to 1:00 PM |
| | | XIV | 01.03.2023 | XVI | 02.03.2023 | 1:30 PM to 4:30 PM |

For Enrollment No. 200280101 to 200280300

| Counselling Class Programme | | Practical Examination Programme | | | | |
|------------------------------------|---------------------|--|-------------|--------------|-------------|---------------------|
| Date | Time | Paper | Date | Paper | Date | Time |
| 03.03.2023 & 04.03.2023 | 11.00 AM to 5.00 PM | XII | 05.03.2023 | XV | 06.03.2023 | 10:00 AM to 1:00 PM |
| | | XIV | 05.03.2023 | XVI | 06.03.2023 | 1:30 PM to 4:30 PM |

For Enrollment No. 200280301 to 200280600

| Counselling Class Programme | | Practical Examination Programme | | | | |
|------------------------------------|---------------------|--|-------------|--------------|-------------|---------------------|
| Date | Time | Paper | Date | Paper | Date | Time |
| 13.03.2023 & 14.03.2023 | 11.00 AM to 5.00 PM | XII | 15.03.2023 | XV | 16.03.2023 | 10:00 AM to 1:00 PM |
| | | XIV | 15.03.2023 | XVI | 16.03.2023 | 1:30 PM to 4:30 PM |

For Enrollment No. 200280601 to 200281300

| Counselling Class Programme | | Practical Examination Programme | | | | |
|------------------------------------|---------------------|--|-------------|--------------|-------------|---------------------|
| Date | Time | Paper | Date | Paper | Date | Time |
| 17.03.2023 & 18.03.2023 | 11.00 AM to 5.00 PM | XII | 20.03.2023 | XV | 21.03.2023 | 10:00 AM to 1:00 PM |
| | | XIV | 20.03.2023 | XVI | 21.03.2023 | 1:30 PM to 4:30 PM |

NALANDA OPEN UNIVERSITY

M.Sc. Physics, Part-II

PAPER–XIII

(Environmental Physics)

Annual Examination, 2022

Time : 3 Hours.

Full Marks : 80

Answer any Five Questions. All questions carry equal marks.

1. What is LIDAR ? Explain its principle, physical and technical aspects with applications.
2. Explain Einstein's A and B coefficients of absorption, stimulated emission and spontaneous emission. Hence deduce Lambert-Beer's Law.
3. Discuss equations of motion for fluid and hence obtain the Navier-Stoke's equation for fluids.
4. 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.
5. Enumerate the basic atmospheric forces to study laws of motion in atmosphere. Explain what do you mean by 'Baroclinic Model' and 'Renold's Number' (Re).
6. Discuss improvements in diffusion equations to predict the transport of pollutants to a fair accuracy. What is Dupuit Approximation ? Discuss.
7. Why Bifuels are called renewable energy source ? Explain, briefly, the four generations of Bifuels.
8. Derive Fick's law and explain its analogy with heat transfer equation.
9. Show that efficiency (η) of a real heat engine is always smaller than that of an ideal carnot engine

(η_C) by a factor $\left[1 + \sqrt{\frac{T_C}{T_H}} \right]$. The smaller efficiency implies that entropy ΔS is not produced while

operating the engine. Show that $\Delta S = \frac{(\eta_C - \eta)_{QH}}{T_C}$.

10. Write short notes on any **Two** of the following :
 - (a) Photovoltaic Effect
 - (b) Green House Gas Model
 - (c) Black Body Radiation
 - (d) Solar Pond.

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M.SC. PHYSICS, PART-II Practical Counseling and Practical Examination Programme, 2022

Practical Programme for Paper-X of All Students

Venue : School of Computer Education & IT, Nalanda Open University, 12th Floor, Biscomaun Tower, Patna-800001

| Enrollment No. | Date of Counselling | Time | Enrollment No. | Date of Exam | Time |
|---|--------------------------------|--------------------|---|--------------|----------------------|
| All Old Students & 200280001 to 200280180 | 15, 16, 17 & 20 February, 2023 | 3.00 PM to 4.30 PM | All Old Students & 200280001 to 200280070 | 21.02.2023 | 10.30 AM to 12.30 PM |
| 200280181 to 200281300 | 15, 16, 17 & 20 February, 2023 | 4.30 AM to 6.00 PM | 200280071 to 200280330 | 21.02.2023 | 1.00 PM to 3.00 PM |
| | | | 200280331 to 200281300 | 21.02.2023 | 3.00 PM to 5.00 PM |

Practical Programme for Paper-XII, XIV, XV & XVI

Venue : Physics Lab, 1st Floor Biscomaun Tower, Patna-800001

For Enrollment No. 170280001 to 190280600

| Counselling Class Programme | | Practical Examination Programme | | | |
|-----------------------------|---------------------|---------------------------------|------------|-------|---------------------|
| Date | Time | Paper | Date | Paper | Time |
| 22.02.2023 & 23.02.2023 | 11.00 AM to 5.00 PM | XII | 24.02.2023 | XV | 10:00 AM to 1:00 PM |
| | | XIV | 24.02.2023 | XVI | 1:30 PM to 4:30 PM |

For Enrollment No. 190280601 to 190280900 & 200280001 to 200280100

| Counselling Class Programme | | Practical Examination Programme | | | |
|-----------------------------|---------------------|---------------------------------|------------|-------|---------------------|
| Date | Time | Paper | Date | Paper | Time |
| 27.02.2023 & 28.02.2023 | 11.00 AM to 5.00 PM | XII | 01.03.2023 | XV | 10:00 AM to 1:00 PM |
| | | XIV | 01.03.2023 | XVI | 1:30 PM to 4:30 PM |

For Enrollment No. 200280101 to 200280300

| Counselling Class Programme | | Practical Examination Programme | | | |
|-----------------------------|---------------------|---------------------------------|------------|-------|---------------------|
| Date | Time | Paper | Date | Paper | Time |
| 03.03.2023 & 04.03.2023 | 11.00 AM to 5.00 PM | XII | 05.03.2023 | XV | 10:00 AM to 1:00 PM |
| | | XIV | 05.03.2023 | XVI | 1:30 PM to 4:30 PM |

For Enrollment No. 200280301 to 200280600

| Counselling Class Programme | | Practical Examination Programme | | | |
|-----------------------------|---------------------|---------------------------------|------------|-------|---------------------|
| Date | Time | Paper | Date | Paper | Time |
| 13.03.2023 & 14.03.2023 | 11.00 AM to 5.00 PM | XII | 15.03.2023 | XV | 10:00 AM to 1:00 PM |
| | | XIV | 15.03.2023 | XVI | 1:30 PM to 4:30 PM |

For Enrollment No. 200280601 to 200281300

| Counselling Class Programme | | Practical Examination Programme | | | |
|-----------------------------|---------------------|---------------------------------|------------|-------|---------------------|
| Date | Time | Paper | Date | Paper | Time |
| 17.03.2023 & 18.03.2023 | 11.00 AM to 5.00 PM | XII | 20.03.2023 | XV | 10:00 AM to 1:00 PM |
| | | XIV | 20.03.2023 | XVI | 1:30 PM to 4:30 PM |

NALANDA OPEN UNIVERSITY
M.Sc. Physics, Part-II
PAPER-XIV
 (Photonics)
 Annual Examination, 2022

Time : 3 Hours.

Full Marks : 80

Answer any Five Questions. All questions carry equal marks.

1. What is LED ? Describe its design and explain its working.
2. Derive relation between Einstein's A and B coefficients. Give the weak points in Einstein's theory.
3. What do you mean by 'Core and Cladding' ? Describe the structures of different types of optical fibers with ray path.
4. Describe Avalanche Photodiode (APD). Illustrate its advantages.
5. How plasma screen is different from LCD screen ? What is the future of LCD screen ?
6. Explain the difference between analog and digital communication. Why digital communication is more suitable with modern day requirements ?
7. Describe the principles of Nd-Yag Laser. What are its applications.
8. What is optical fibre flow sensor ? Describe optical fibre gyroscope.
9. Describe intrinsic semiconductor laser and doped semiconductor laser. What is the limitation for these lasers to operate continuously ?
10. Obtain a relation between divergence and waist size of the beam for a Gaussian distribution of wave energy.

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M.SC. PHYSICS, PART-II
Practical Counseling and Practical Examination Programme, 2022
Practical Programme for Paper-X of All Students

Venue : School of Computer Education & IT, Nalanda Open University, 12th Floor, Biscomaun Tower, Patna-800001

| Enrollment No. | Date of Counselling | Time | Enrollment No. | Date of Exam | Time |
|---|--------------------------------|--------------------|---|--------------|----------------------|
| All Old Students & 200280001 to 200280180 | 15, 16, 17 & 20 February, 2023 | 3.00 PM to 4.30 PM | All Old Students & 200280001 to 200280070 | 21.02.2023 | 10.30 AM to 12.30 PM |
| 200280181 to 200281300 | 15, 16, 17 & 20 February, 2023 | 4.30 AM to 6.00 PM | 200280071 to 200280330 | 21.02.2023 | 1.00 PM to 3.00 PM |
| | | | 200280331 to 200281300 | 21.02.2023 | 3.00 PM to 5.00 PM |

Practical Programme for Paper-XII, XIV, XV & XVI
 Venue : Physics Lab, 1st Floor Biscomaun Tower, Patna-800001

For Enrollment No. 170280001 to 190280600

| Counselling Class Programme | | Practical Examination Programme | | | | |
|-----------------------------|---------------------|---------------------------------|------------|-------|------------|---------------------|
| Date | Time | Paper | Date | Paper | Date | Time |
| 22.02.2023 & 23.02.2023 | 11.00 AM to 5.00 PM | XII | 24.02.2023 | XV | 25.02.2023 | 10:00 AM to 1:00 PM |
| | | XIV | 24.02.2023 | XVI | 25.02.2023 | 1:30 PM to 4:30 PM |

For Enrollment No. 190280601 to 190280900 & 200280001 to 200280100

| Counselling Class Programme | | Practical Examination Programme | | | | |
|-----------------------------|---------------------|---------------------------------|------------|-------|------------|---------------------|
| Date | Time | Paper | Date | Paper | Date | Time |
| 27.02.2023 & 28.02.2023 | 11.00 AM to 5.00 PM | XII | 01.03.2023 | XV | 02.03.2023 | 10:00 AM to 1:00 PM |
| | | XIV | 01.03.2023 | XVI | 02.03.2023 | 1:30 PM to 4:30 PM |

For Enrollment No. 200280101 to 200280300

| Counselling Class Programme | | Practical Examination Programme | | | | |
|-----------------------------|---------------------|---------------------------------|------------|-------|------------|---------------------|
| Date | Time | Paper | Date | Paper | Date | Time |
| 03.03.2023 & 04.03.2023 | 11.00 AM to 5.00 PM | XII | 05.03.2023 | XV | 06.03.2023 | 10:00 AM to 1:00 PM |
| | | XIV | 05.03.2023 | XVI | 06.03.2023 | 1:30 PM to 4:30 PM |

For Enrollment No. 200280301 to 200280600

| Counselling Class Programme | | Practical Examination Programme | | | | |
|-----------------------------|---------------------|---------------------------------|------------|-------|------------|---------------------|
| Date | Time | Paper | Date | Paper | Date | Time |
| 13.03.2023 & 14.03.2023 | 11.00 AM to 5.00 PM | XII | 15.03.2023 | XV | 16.03.2023 | 10:00 AM to 1:00 PM |
| | | XIV | 15.03.2023 | XVI | 16.03.2023 | 1:30 PM to 4:30 PM |

For Enrollment No. 200280601 to 200281300

| Counselling Class Programme | | Practical Examination Programme | | | | |
|-----------------------------|---------------------|---------------------------------|------------|-------|------------|---------------------|
| Date | Time | Paper | Date | Paper | Date | Time |
| 17.03.2023 & 18.03.2023 | 11.00 AM to 5.00 PM | XII | 20.03.2023 | XV | 21.03.2023 | 10:00 AM to 1:00 PM |
| | | XIV | 20.03.2023 | XVI | 21.03.2023 | 1:30 PM to 4:30 PM |

NALANDA OPEN UNIVERSITY
M.Sc. Physics, Part-II
PAPER–XV
(Advanced Condensed Matter Physics)
Annual Examination, 2022

Time : 3 Hours.

Full Marks : 80

Answer any Five Questions. All questions carry equal marks.

- Describe Clausius-Mosotti formula relating the dielectric constant and the polarisability for a composite dielectric material.
- What is Mössbauer effect ? Explain Doppler broadening through intensity-frequency graphs for gamma emission and absorption by identical nuclei.
- State Gruneisen Law. Derive equation of state and gruneisen parameter for solid.
- Establish Lydden-Sach-Teller relation between the static dielectric constant and that at optical frequencies.
- What is skin effect ? Distinguish between normal and anomalous skin effect. Give the mathematical theory of anomalous skin effect. How do you get information about Fermi structure with the help of this effect ?
- Discuss A. C. Josephson effect. Show that the current oscillates with the frequency $\omega = \frac{2eV}{\hbar}$.
- What is Debye-Waller factor ? What is its origin ? Discuss the temperature dependence of the reflection.
- Give a quantitative treatment of BCS ground state. Obtain an expression for the energy gap at 0K.
- What is Polariton ? Obtain Polariton dispersion relation. How does it stand the experiment test ?
- Give an account of Ginzberg-Landon theory of the phenomenology of the super conducting state. How do you get coherence length ?

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M.SC. PHYSICS, PART-II
Practical Counseling and Practical Examination Programme, 2022

Practical Programme for Paper-X of All Students

Venue : School of Computer Education & IT, Nalanda Open University, 12th Floor, Biscomaun Tower, Patna-800001

| Enrollment No. | Date of Counselling | Time | Enrollment No. | Date of Exam | Time |
|---|--------------------------------|--------------------|---|--------------|----------------------|
| All Old Students & 200280001 to 200280180 | 15, 16, 17 & 20 February, 2023 | 3.00 PM to 4.30 PM | All Old Students & 200280001 to 200280070 | 21.02.2023 | 10.30 AM to 12.30 PM |
| 200280181 to 200281300 | 15, 16, 17 & 20 February, 2023 | 4.30 AM to 6.00 PM | 200280071 to 200280330 | 21.02.2023 | 1.00 PM to 3.00 PM |
| | | | 200280331 to 200281300 | 21.02.2023 | 3.00 PM to 5.00 PM |

Practical Programme for Paper-XII, XIV, XV & XVI

Venue : Physics Lab, 1st Floor Biscomaun Tower, Patna-800001

For Enrollment No. 170280001 to 190280600

| Counselling Class Programme | | Practical Examination Programme | | | | |
|-----------------------------|---------------------|---------------------------------|------------|-------|------------|---------------------|
| Date | Time | Paper | Date | Paper | Date | Time |
| 22.02.2023 & 23.02.2023 | 11.00 AM to 5.00 PM | XII | 24.02.2023 | XV | 25.02.2023 | 10:00 AM to 1:00 PM |
| | | XIV | 24.02.2023 | XVI | 25.02.2023 | 1:30 PM to 4:30 PM |

For Enrollment No. 190280601 to 190280900 & 200280001 to 200280100

| Counselling Class Programme | | Practical Examination Programme | | | | |
|-----------------------------|---------------------|---------------------------------|------------|-------|------------|---------------------|
| Date | Time | Paper | Date | Paper | Date | Time |
| 27.02.2023 & 28.02.2023 | 11.00 AM to 5.00 PM | XII | 01.03.2023 | XV | 02.03.2023 | 10:00 AM to 1:00 PM |
| | | XIV | 01.03.2023 | XVI | 02.03.2023 | 1:30 PM to 4:30 PM |

For Enrollment No. 200280101 to 200280300

| Counselling Class Programme | | Practical Examination Programme | | | | |
|-----------------------------|---------------------|---------------------------------|------------|-------|------------|---------------------|
| Date | Time | Paper | Date | Paper | Date | Time |
| 03.03.2023 & 04.03.2023 | 11.00 AM to 5.00 PM | XII | 05.03.2023 | XV | 06.03.2023 | 10:00 AM to 1:00 PM |
| | | XIV | 05.03.2023 | XVI | 06.03.2023 | 1:30 PM to 4:30 PM |

For Enrollment No. 200280301 to 200280600

| Counselling Class Programme | | Practical Examination Programme | | | | |
|-----------------------------|---------------------|---------------------------------|------------|-------|------------|---------------------|
| Date | Time | Paper | Date | Paper | Date | Time |
| 13.03.2023 & 14.03.2023 | 11.00 AM to 5.00 PM | XII | 15.03.2023 | XV | 16.03.2023 | 10:00 AM to 1:00 PM |
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For Enrollment No. 200280601 to 200281300

| Counselling Class Programme | | Practical Examination Programme | | | | |
|-----------------------------|---------------------|---------------------------------|------------|-------|------------|---------------------|
| Date | Time | Paper | Date | Paper | Date | Time |
| 17.03.2023 & 18.03.2023 | 11.00 AM to 5.00 PM | XII | 20.03.2023 | XV | 21.03.2023 | 10:00 AM to 1:00 PM |
| | | XIV | 20.03.2023 | XVI | 21.03.2023 | 1:30 PM to 4:30 PM |

NALANDA OPEN UNIVERSITY
M.Sc. Physics, Part-II
PAPER-XVI
(Advanced Electronics)
Annual Examination, 2022

Time : 3 Hours.

Full Marks : 80

Answer any Five Questions. All questions carry equal marks.

- Describe D.C. equivalent circuit and A.C. equivalent circuit of a dual-input, balanced output differential amplifier.
- What is a multiplexer ? Draw the logic circuit for a 4-to-1 multiplexer. Write the Boolean equation and describe the truth table.
- How can op-amp be used as a voltage-to-current and current-to-voltage converters ? What is a logarithmic amplifier ?
- What is a decoder ? Describe seven segment displays for an LED circuit.
- What is Read Only Memory (ROM) ? Distinguish between PROM and EPROM. Give some of the important applications of ROM.
- What is an encoder ? Draw the logic circuit of 8-time-to-3 encoder.
- What is a flip-flop ? Explain the functioning of NOR and NAND latch.
- What is a comparator ? Explain the working of a comparator. What are its important characteristics ?
- Derive an expression for frequency of oscillation of phase shift oscillator. Following specifications are given for a particular phase shift oscillator $C = 0.1 \mu F$, $R = 3.9 K\Omega$ and $\left| \frac{R_f}{R_i} \right| = 29$. Determine the frequency of oscillation.
- Explain the architecture of 8086 microprocessor.

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M.SC. PHYSICS, PART-II
Practical Counselling and Practical Examination Programme, 2022

Practical Programme for Paper-X of All Students

Venue : School of Computer Education & IT, Nalanda Open University, 12th Floor, Biscomaun Tower, Patna-800001

| Enrollment No. | Date of Counselling | Time | Enrollment No. | Date of Exam | Time |
|---|--------------------------------|--------------------|---|--------------|----------------------|
| All Old Students & 200280001 to 200280180 | 15, 16, 17 & 20 February, 2023 | 3.00 PM to 4.30 PM | All Old Students & 200280001 to 200280070 | 21.02.2023 | 10.30 AM to 12.30 PM |
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| | | | 200280331 to 200281300 | 21.02.2023 | 3.00 PM to 5.00 PM |

Practical Programme for Paper-XII, XIV, XV & XVI

Venue : Physics Lab, 1st Floor Biscomaun Tower, Patna-800001

For Enrollment No. 170280001 to 190280600

| Counselling Class Programme | | Practical Examination Programme | | | | |
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| | | XIV | 24.02.2023 | XVI | 25.02.2023 | 1:30 PM to 4:30 PM |

For Enrollment No. 190280601 to 190280900 & 200280001 to 200280100

| Counselling Class Programme | | Practical Examination Programme | | | | |
|-----------------------------|---------------------|---------------------------------|------------|-------|------------|---------------------|
| Date | Time | Paper | Date | Paper | Date | Time |
| 27.02.2023 & 28.02.2023 | 11.00 AM to 5.00 PM | XII | 01.03.2023 | XV | 02.03.2023 | 10:00 AM to 1:00 PM |
| | | XIV | 01.03.2023 | XVI | 02.03.2023 | 1:30 PM to 4:30 PM |

For Enrollment No. 200280101 to 200280300

| Counselling Class Programme | | Practical Examination Programme | | | | |
|-----------------------------|---------------------|---------------------------------|------------|-------|------------|---------------------|
| Date | Time | Paper | Date | Paper | Date | Time |
| 03.03.2023 & 04.03.2023 | 11.00 AM to 5.00 PM | XII | 05.03.2023 | XV | 06.03.2023 | 10:00 AM to 1:00 PM |
| | | XIV | 05.03.2023 | XVI | 06.03.2023 | 1:30 PM to 4:30 PM |

For Enrollment No. 200280301 to 200280600

| Counselling Class Programme | | Practical Examination Programme | | | | |
|-----------------------------|---------------------|---------------------------------|------------|-------|------------|---------------------|
| Date | Time | Paper | Date | Paper | Date | Time |
| 13.03.2023 & 14.03.2023 | 11.00 AM to 5.00 PM | XII | 15.03.2023 | XV | 16.03.2023 | 10:00 AM to 1:00 PM |
| | | XIV | 15.03.2023 | XVI | 16.03.2023 | 1:30 PM to 4:30 PM |

For Enrollment No. 200280601 to 200281300

| Counselling Class Programme | | Practical Examination Programme | | | | |
|-----------------------------|---------------------|---------------------------------|------------|-------|------------|---------------------|
| Date | Time | Paper | Date | Paper | Date | Time |
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