NALANDA OPEN UNIVERSITY

M.Sc. Physics, Part-I

PAPER–I

(Mathematical Physics)

Annual Examination, 2020

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

Answer any Five Questions.
All questions carry equal marks.

1. Find the equation of motion for a charged particle in an electromagnetic field using the Hamiltonian of the particle.

2. Find the general solution of the equation $y'' - 5y' + 6y = 2e^x + 6x - 5$.

3. Write notes on orthonormality of column and row vectors. Prove that eigenvectors of a symmetric matrix corresponding to different eigenvectors are orthogonal.

4. Find the solution of harmonic oscillator by Hamilton Jacobi Method.

5. Find the value of $J_{\pm\frac{1}{2}}(x)$ *and* $J_{\pm\frac{3}{2}}(x)$.

6. Show that $(2n+1-x)\,L_n(x) = (n+1)\,L_{n+1}(x) - nL_{n-1}(x)$

7. Obtain the expression for normal frequencies of a double pendulum.

8. A covariant tensor has components xy, 2y – z^2, xz in rectangular coordinates. Find its covariant components in spherical coordinates.

9. State and prove (a) Parseval's theorem (b) Convolution theorem of Fourier-transforms.

10. If $A^k = g^{jK}$ Aj ; Show that $A_j = g_{jk}A^k$.

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EXAMINATION PROGRAMME-2020
M.Sc. Physics, Part-I

Date	Papers	Time	Examination Centre
06.04.2021	Paper–I	2.30 PM to 5.30 PM	A. N. College, Boring Road, Patna-800013
08.04.2021	Paper–II	2.30 PM to 5.30 PM	A. N. College, Boring Road, Patna-800013
10.04.2021	Paper–III	2.30 PM to 5.30 PM	A. N. College, Boring Road, Patna-800013
13.04.2021	Paper–IV	2.30 PM to 5.30 PM	A. N. College, Boring Road, Patna-800013
16.04.2021	Paper–V	2.30 PM to 5.30 PM	A. N. College, Boring Road, Patna-800013
19.04.2021	Paper–VI	2.30 PM to 5.30 PM	A. N. College, Boring Road, Patna-800013
24.04.2021	Paper–VII	2.30 PM to 5.30 PM	A. N. College, Boring Road, Patna-800013
27.04.2021	Paper–VIII	2.30 PM to 5.30 PM	A. N. College, Boring Road, Patna-800013

NALANDA OPEN UNIVERSITY

M.Sc. Physics, Part-I

PAPER–II

(Quantum Mechanics)

Annual Examination, 2020

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

Answer any Five Questions.
All questions carry equal marks.

1. State the postulates of Schrödinger formulation of quantum mechanics.

2. Find the value of,
   (i) $\left[L^2, L_{\pm}\right] = 0$ (ii) $\left[L_+, L_-\right]$
   (iii) $\left[L_z, L_+\right]$ (iv) $\left[L_z, L_-\right]$

3. Establish Schrödinger equation. What is the meaning of wave function. Explain stationary states.

4. Starting with momentum-position uncertainty obtain (a) $\Delta\phi \cdot \Delta\ell \geq \frac{\hbar}{2}$ and (b) $\Delta E \cdot \Delta t \geq \frac{\hbar}{2}$.

5. Give a brief account of quantum mechanical theory of Stark effect for splitting of energy of hydrogen atom.

6. Using the method of partial waves for the study of scattering problems, show that scattering cross section is given by $\sigma = \frac{4\pi}{k^2} \sum_{l=0}^{\infty} (2l+1)\, Sin^2 \delta l$.

7. Calculate the coefficient of reflection and transmission when a particle with energy $E > V_o$ is incident on a potential step defined by
   $V_{(x)} = 0 \quad for \quad x < 0$
   $= V_0 \quad for \quad x > 0$

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. Set up Schrödinger equation for one dimensional harmonic oscillator and solve it for energy eigenvalues and eigenfunctions.

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

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NALANDA OPEN UNIVERSITY

M.Sc. Physics, Part-I

PAPER–III

(Electrodynamics and Plasma Physics)

Annual Examination, 2020

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

Answer any Five Questions.
All questions carry equal marks.

1. Calculate vector potential of a current loop.
2. Discuss the motion of a charged in an oscillating electromagnetic field.
3. Give Saha theory of thermal ionisation and explain the determination of plasma ionisation on its basis.
4. Discuss Debye length, Debye shielding and the plasma parameter in detail.
5. What do you mean by Lienard and Weichert potential ? Obtain expression for Lienard-Weichart potential for uniformly moving point charge.
6. While discussing the behaviour of plasma particles in static magnetic field, deduce and discuss Larmor frequency.
7. Show that the scalar product $\vec{E} \cdot \vec{B}$ is unchanged under Lorentz transformation and show the same for $E^2 - C^2B^2$.
8. Discuss Larmor's formula for a non-relativistic accelerated charge.
9. Write Maxwell's equations in tensor form and show that they are covariant under its basis.
10. Derive Boltzmann's equation. What is Boltzmann-Vlasov equation.

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NALANDA OPEN UNIVERSITY

M.Sc. Physics, Part-I

PAPER–IV

(Statistical Mechanics)

Annual Examination, 2020

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

Answer any Five Questions.
All questions carry equal marks.

1. 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 ?
2. State and prove Boltzmann theorem of entropy. Obtain expression for the entropy of a monoatomic gas.
3. Derive Fermi-Dirac distribution law.
4. State and explain the fundamental assumptions of statistical mechanics. Explain phase space and density of states.
5. State and prove Liouville theorem. How is it analogous to the equation of continuity of an incompressible fluid ?
6. What are Critical Indices ? Explain the different kinds of Critical Indices.
7. What is phase transition ? Explain the first order and the second order phase transitions. Discuss Landau theory of phase transition.
8. Derive the virial equation of state and evaluate the virial coefficients.
9. What do you mean by cluster expansion ? Discuss the theory of cluster expansion.
10. Explain : ensembles, microcanonical and the grand canonical ensembles. Derive Sackur equation for a perfect gas.

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NALANDA OPEN UNIVERSITY

M.Sc. Physics, Part-I

PAPER–V

(Nuclear and Particle Physics)

Annual Examination, 2020

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

Answer any Five Questions.
All questions carry equal marks.

1. 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 ?

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. Write the classification chart of elementary particles. Give in details the electromagnetic interaction between elementary particles.

4. 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.

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

6. Discuss the quark model in detail. How does this model explain baryons and mesons ?

7. Define the Q-value of a nuclear reaction. Establish the Q-equation of the nuclear reaction.

8. What are electric and magnetic transitions in Gamma-ray emission ? Explain multipolarity in the Gamma transition.

9. What are stripping and pickup reactions ? Obtain an expression for reaction amplitude using Born approximation for the above reactions.

10. Describe Wu's experiment and give its interpretation to explain the non-conservation of parity in weak interaction.

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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–VI

(Atomic and molecular Physics)

Annual Examination, 2020

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 stark effect. Show that splitting increases with the increase of principal quantum number.
2. Discuss the hyperfine structure of Spectral lines. What light does this throw on the spin and magnetic moment of atomic nuclei ?
3. What are normal and anomalous Zeeman effects ? How are they explained ?
4. Describe the general feature of the spectra of alkali-like atoms. How are they explained.
5. 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.

GROUP 'B'

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

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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, 2020

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

Answer any Five Questions. All questions carry equal marks.

1. (a) State and prove Bloch theorem.
   (b) Explain the significance of the effective mass of the electron.
2. 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 $(a,\ 2b,\ \alpha)$.
3. 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.
4. 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.
5. Discuss the quantization of electron orbits in magnetic field.
6. How are Brillouin Zones constructed ? Describe and sketch the first Brillouin Zones of bcc and fcc lattices. Mention their importance in crystal analysis.
7. Explain the difference between Type I and Type II superconductors. Prove that Meissner effect and the disappearance of resistinity in a superconductor are mutually consistant.
8. What is atomic scattering factor ? Derive the general expression for the atomic scattering factor using spherical polar coordinates.
9. Discuss Kronig-Penny model for a linear lattice. How does it lead to the formation of bands in solids.
10. Explain the Schottky and the Frenkel defects. Calculate the equilibrium concentration defects and indicate the order of their magnitude.

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NALANDA OPEN UNIVERSITY

M.Sc. Physics, Part-I

PAPER–VIII

(Electronic Devices)

Annual Examination, 2020

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

Answer any Five Questions. All questions carry equal marks.

1. Explain piezoelectricity and discuss the application of piezoelectric material in sensors and actuators.
2. Give the basic design of Change-Coupled-Device (CCD) and explain its working.
3. Describe the mechanism of current flow in a properly biased BJT. Define the various parameters of BJT.
4. State and explain (i) Electrostrictive effect and (ii) Magnetostrictive effect.
5. Describe the construction and the working of Uni junction transistor. Discuss its characteristics. Explain intrinsic stand off ratio.
6. What is Raman-Nath diffraction ? Give its theory. How can it be observed ?
7. Explain large angle diffraction with special reference to co-directional and contra directional.
8. Give an account of the theoretical treatment of liquid crystals.
9. What do you understand by electrogyration ? Explain it on the basis of symmetry approach.
10. What is Pockels effect ? What is a Pockels Cell ? Explain the dynamics within the cell and discuss the applications of Pockel Cells.

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M.SC. PHYSICS, PART–I

REVISED PRACTICAL EXAMINATION PROGRAMME, 2020

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

For Enrollment No. : All Old Batch Students & 190280001 to 190280009		
Date	**Paper**	**Time**
06.09.2021	VI	8.00 AM to 11.00 AM
06.09.2021	VII	11.00 AM to 2.00 PM
06.09.2021	VIII	2.00 PM to 5.00 PM

For Enrollment No. : 190280010 to 190280070		
Date	**Paper**	**Time**
07.09.2021	VI	8.00 AM to 11.00 AM
07.09.2021	VII	11.00 AM to 2.00 PM
07.09.2021	VIII	2.00 PM to 5.00 PM

For Enrollment No. : 190280071 to 190280125		
Date	**Paper**	**Time**
08.09.2021	VI	8.00 AM to 11.00 AM
08.09.2021	VII	11.00 AM to 2.00 PM
08.09.2021	VIII	2.00 PM to 5.00 PM

For Enrollment No. : 190280126 to 190280220		
Date	**Paper**	**Time**
09.09.2021	VI	8.00 AM to 11.00 AM
09.09.2021	VII	11.00 AM to 2.00 PM
09.09.2021	VIII	2.00 PM to 5.00 PM

For Enrollment No. : 190280221 to 190280270		
Date	**Paper**	**Time**
10.09.2021	VI	8.00 AM to 11.00 AM
10.09.2021	VII	11.00 AM to 2.00 PM
10.09.2021	VIII	2.00 PM to 5.00 PM

For Enrollment No. : 190280271 to 190280310		
Date	**Paper**	**Time**
11.09.2021	VI	8.00 AM to 11.00 AM
11.09.2021	VII	11.00 AM to 2.00 PM
11.09.2021	VIII	2.00 PM to 5.00 PM

For Enrollment No. : 190280311 to 190280380		
Date	**Paper**	**Time**
13.09.2021	VI	8.00 AM to 11.00 AM
13.09.2021	VII	11.00 AM to 2.00 PM
13.09.2021	VIII	2.00 PM to 5.00 PM

For Enrollment No. : 190280381 to 190280440		
Date	**Paper**	**Time**
14.09.2021	VI	8.00 AM to 11.00 AM
14.09.2021	VII	11.00 AM to 2.00 PM
14.09.2021	VIII	2.00 PM to 5.00 PM

For Enrollment No. : 190280441 to 190280515		
Date	**Paper**	**Time**
15.09.2021	VI	8.00 AM to 11.00 AM
15.09.2021	VII	11.00 AM to 2.00 PM
15.09.2021	VIII	2.00 PM to 5.00 PM

For Enrollment No. : 190280516 to 190280595		
Date	**Paper**	**Time**
16.09.2021	VI	8.00 AM to 11.00 AM
16.09.2021	VII	11.00 AM to 2.00 PM
16.09.2021	VIII	2.00 PM to 5.00 PM

For Enrollment No. : 190280596 to 190280650		
Date	**Paper**	**Time**
18.09.2021	VI	8.00 AM to 11.00 AM
18.09.2021	VII	11.00 AM to 2.00 PM
18.09.2021	VIII	2.00 PM to 5.00 PM

For Enrollment No. : 190280651 to 190280730		
Date	**Paper**	**Time**
20.09.2021	VI	8.00 AM to 11.00 AM
20.09.2021	VII	11.00 AM to 2.00 PM
20.09.2021	VIII	2.00 PM to 5.00 PM

For Enrollment No. : 190280731 to 190280800		
Date	**Paper**	**Time**
21.09.2021	VI	8.00 AM to 11.00 AM
21.09.2021	VII	11.00 AM to 2.00 PM
21.09.2021	VIII	2.00 PM to 5.00 PM

For Enrollment No. : 190280801 to 190280900		
Date	**Paper**	**Time**
22.09.2021	VI	8.00 AM to 11.00 AM
22.09.2021	VII	11.00 AM to 2.00 PM
22.09.2021	VIII	2.00 PM to 5.00 PM

NALANDA OPEN UNIVERSITY

M.Sc. Physics, Part-II

PAPER–IX

(Computational Mathematics)

Annual Examination, 2020

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

Answer any Five Questions.
All questions carry equal marks.

1. Find the root of the equation $x \sin x + \cos x = 0$ using Newton-Raphson formula.
2. Solve the following systems by Gauss-Seidel method,

$$10x + 2y + z = 9$$
$$2x + 20y + z = -44$$
$$-2x + 3y + 10z = 22$$

3. State and prove Stirling's formula for interpolation.
4. From the Taylor's series for *y(x)*, find *y(0, 1)*, correct to three decimal places if *y(x)* satisfies $y' = x - y^2$ and *y(0) = 1*.
5. What is Euler-Maclaurin formula for numerical integration ? Evaluate $I = \int_0^{\pi/2} Cosx\, dx$ using this formula.
6. Give the theory of Crank-Nicolson Method to solve the parabolic partial differential equation. Explain it with a suitable solved example.
7. Solve the equation $y'' + y + 1 = 0$ with boundary conditions y = 0, when x = 0 and y = 0 when x = 1.
8. Using finite difference method, solve the following differential equation $\frac{d^2y}{dx^2} = y$ with $y(0) = 0,\ y(2) = 3.627$.
9. Use spin method to solve the initial value problem $y'' + 2y' + y = 0,\ \ y(0) = 0$ and $y(1) = 0$.
10. Find the eigenvalues and eigenvectors of the given matrix. Show that n×n matrix may have n linearly independent eigenvectors.

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EXAMINATION PROGRAMME-2020

M.Sc. Physics, Part-II

Date	Papers	Time	Examination Centre
28.01.2021	Paper–IX	2.30 PM to 5.30 PM	Nalanda Open University, 2nd Floor, Biscomaun Bhawan, Patna
30.01.2021	Paper–X	2.30 PM to 5.30 PM	Nalanda Open University, 2nd Floor, Biscomaun Bhawan, Patna
02.02.2021	Paper–XI	2.30 PM to 5.30 PM	Nalanda Open University, 2nd Floor, Biscomaun Bhawan, Patna
04.02.2021	Paper–XII	2.30 PM to 5.30 PM	Nalanda Open University, 2nd Floor, Biscomaun Bhawan, Patna
06.02.2021	Paper–XIII	2.30 PM to 5.30 PM	Nalanda Open University, 2nd Floor, Biscomaun Bhawan, Patna
09.02.2021	Paper–XIV	2.30 PM to 5.30 PM	Nalanda Open University, 2nd Floor, Biscomaun Bhawan, Patna
11.02.2021	Paper–XV	2.30 PM to 5.30 PM	Nalanda Open University, 2nd Floor, Biscomaun Bhawan, Patna
13.02.2021	Paper–XVI	2.30 PM to 5.30 PM	Nalanda Open University, 2nd Floor, Biscomaun Bhawan, Patna

NALANDA OPEN UNIVERSITY
M.Sc. Physics, Part-II
PAPER–X
(Programming with Fortran and C^{++})

Annual Examination, 2020

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

Answer any Five Questions. All questions carry equal marks.

1. What are executable and non-executable statements and what is difference between them ?
2. Write Fortran program which counts the number of positive numbers and the number of negative numbers.
3. Discuss the following three ways of writing $X2$ in Fortran; (a) X*X, (b) X**2, (c) X**2.0.
4. Write a program segment or subroutine to plot a graph between specified limit with its argument.
5. Write a SUBROUTINE subprogram which does not have any (a) argument (b) RETURN statement.
6. Discuss the characteristics of OPEN, REAL END FILE and close FILE used in file format of Fortran.
7. Write a function in C^{++} to generate a Fibonacci series of n numbers, where n is defined by a program.
8. Write a program in C^{++} to perform the following, (a) Area of a triangle (b) Area of a rectangle.
9. What is a function ? List out the advantages and disadvantages of using functions in C^{++}.
10. What is a relationship between a pointer and an array ? How is a pointer variable declared in C^{++}.

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M.Sc. Physics, Part-II
Practical Counseling and Practical Examination Programme, 2020

Practical Programme for Paper-X of All Students

Counselling Class Programme		***Practical Examination Programme***		
Date	***Time***	***Paper***	***Date***	***Time***
17.02.2021 to 19.02.2021	12.00 Noon to 4.00 PM	X	20.02.2021	12:00 Noon to 3:00 PM
Venue : School of Computer Education & IT, Nalanda Open University, 12th Floor, Biscomaun Tower, Patna-800001				

For Enrollment No. 150280001 to 150280320, 160280001 to 160280700 & 170280001 to 170280320

Counselling Class Programme		***Practical Examination Programme***		
Date	***Time***	***Paper***	***Date***	***Time***
22.02.2021 & 23.02.2021	11.00 AM to 5.00 PM	XII	24.02.2021	11:30 AM to 2:30 PM
		XIV	24.02.2021	2:45 PM to 5:45 PM
		XV	25.02.2021	11:30 AM to 2:30 PM
		XVI	25.02.2021	2:45 PM to 5:45 PM
Venue : Physics Lab, 1st Floor Biscomaun Tower, Patna-800001				

For Enrollment No. 170280321 to 170280750 & 180280001 to 180280140

Counselling Class Programme		***Practical Examination Programme***		
Date	***Time***	***Paper***	***Date***	***Time***
01.03.2021 & 02.03.2021	11.00 AM to 5.00 PM	XII	03.03.2021	11:30 AM to 2:30 PM
		XIV	03.03.2021	2:45 PM to 5:45 PM
		XV	04.03.2021	11:30 AM to 2:30 PM
		XVI	04.03.2021	2:45 PM to 5:45 PM
Venue : Physics Lab, 1st Floor Biscomaun Tower, Patna-800001				

For Enrollment No. 180280141 to 180280450

Counselling Class Programme		***Practical Examination Programme***		
Date	***Time***	***Paper***	***Date***	***Time***
05.03.2021 & 06.03.2021	11.00 AM to 5.00 PM	XII	08.03.2021	11:30 AM to 2:30 PM
		XIV	08.03.2021	2:45 PM to 5:45 PM
		XV	09.03.2021	11:30 AM to 2:30 PM
		XVI	09.03.2021	2:45 PM to 5:45 PM
Venue : Physics Lab, 1st Floor Biscomaun Tower, Patna-800001				

NALANDA OPEN UNIVERSITY

M.Sc. Physics, Part-II

PAPER–XI

(Physics of Nano Materials)

Annual Examination, 2020

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

Answer any Five Questions. All questions carry equal marks.

1. What are Nanoparticles ? What are quantum dots ? Give short notes on their applications.
2. What is a quantum wire ? Discuss the optical properties of quantum wire. Describe various quantum wire devices.
3. Discuss the motion of electrons in two dimensional potential well and obtain expression for density of states.
4. Write note on, (i) Quantum Well (ii) Superlattice.
5. Enumerate the basic steps involved in construction of electron microscope. Give brief notes on Transmission Electron Microscope (TEM) Scanning Electron Microscope (SEM).
6. What is multiferroic material ? Describe the application of such materials.
7. What is difference between 'Bottom up' and 'bottom down' methods of producing nanoparticles ? Describe, in detail, the Sol-Gel method of preparation of nanoparticles.
8. What is Raman effect ? Discuss the variations in Raman Spectra of nanomaterials.
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, 2020

Practical Programme for Paper-X of All Students

Counselling Class Programme		***Practical Examination Programme***		
Date	***Time***	***Paper***	***Date***	***Time***
17.02.2021 to 19.02.2021	12.00 Noon to 4.00 PM	X	20.02.2021	12:00 Noon to 3:00 PM
Venue : School of Computer Education & IT, Nalanda Open University, 12th Floor, Biscomaun Tower, Patna-800001				

For Enrollment No. 150280001 to 150280320, 160280001 to 160280700 & 170280001 to 170280320

Counselling Class Programme		***Practical Examination Programme***		
Date	***Time***	***Paper***	***Date***	***Time***
22.02.2021 & 23.02.2021	11.00 AM to 5.00 PM	XII	24.02.2021	11:30 AM to 2:30 PM
		XIV	24.02.2021	2:45 PM to 5:45 PM
		XV	25.02.2021	11:30 AM to 2:30 PM
		XVI	25.02.2021	2:45 PM to 5:45 PM
Venue : Physics Lab, 1st Floor Biscomaun Tower, Patna-800001				

For Enrollment No. 170280321 to 170280750 & 180280001 to 180280140

Counselling Class Programme		***Practical Examination Programme***		
Date	***Time***	***Paper***	***Date***	***Time***
01.03.2021 & 02.03.2021	11.00 AM to 5.00 PM	XII	03.03.2021	11:30 AM to 2:30 PM
		XIV	03.03.2021	2:45 PM to 5:45 PM
		XV	04.03.2021	11:30 AM to 2:30 PM
		XVI	04.03.2021	2:45 PM to 5:45 PM
Venue : Physics Lab, 1st Floor Biscomaun Tower, Patna-800001				

For Enrollment No. 180280141 to 180280450

Counselling Class Programme		***Practical Examination Programme***		
Date	***Time***	***Paper***	***Date***	***Time***
05.03.2021 & 06.03.2021	11.00 AM to 5.00 PM	XII	08.03.2021	11:30 AM to 2:30 PM
		XIV	08.03.2021	2:45 PM to 5:45 PM
		XV	09.03.2021	11:30 AM to 2:30 PM
		XVI	09.03.2021	2:45 PM to 5:45 PM
Venue : Physics Lab, 1st Floor Biscomaun Tower, Patna-800001				

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

Annual Examination, 2020

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

Answer any Five Questions. All questions carry equal marks.

1. What are environmental impacts of harnessing the geothermal, the wave and the tidal energy ? What are the methods employed in harnessing the tidal energy ?
2. Derive expression for Radiant Power Density.
3. Explain 'quantum efficiency' and 'spectral response'. How will you calculate quantum efficiency from spectral response ?
4. Compare hydroelectric generation with other sources of energy and discuss its positive and negative aspects. What are its limitations ?
5. What do you understand by first, second and third generation of solar cells ? What efficiency they can achieve ?
6. What are advantages and disadvantages of hydrogen energy applications ?
7. Explain series and shunt resistances and their effects on 'Fill Factor' (FF) in solar cells. Distinguish between characteristics and parasitic resistances.
8. Can solar energy be used for cooling ? How ?
9. Derive Betz's law and show that maximum efficiency of rotors can't exceed 60%. What are the factors that limit the use of wind energy ?
10. Write notes on the following :—
    (a) Wave energy generation.
    (b) Ideal solar cell.

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M.Sc. Physics, Part-II

Practical Counseling and Practical Examination Programme, 2020

Practical Programme for Paper-X of All Students

Counselling Class Programme		***Practical Examination Programme***		
Date	***Time***	***Paper***	***Date***	***Time***
17.02.2021 to 19.02.2021	12.00 Noon to 4.00 PM	X	20.02.2021	12:00 Noon to 3:00 PM
Venue : School of Computer Education & IT, Nalanda Open University, 12th Floor, Biscomaun Tower, Patna-800001				

For Enrollment No. 150280001 to 150280320, 160280001 to 160280700 & 170280001 to 170280320

Counselling Class Programme		***Practical Examination Programme***		
Date	***Time***	***Paper***	***Date***	***Time***
22.02.2021 & 23.02.2021	11.00 AM to 5.00 PM	XII	24.02.2021	11:30 AM to 2:30 PM
		XIV	24.02.2021	2:45 PM to 5:45 PM
		XV	25.02.2021	11:30 AM to 2:30 PM
		XVI	25.02.2021	2:45 PM to 5:45 PM
Venue : Physics Lab, 1st Floor Biscomaun Tower, Patna-800001				

For Enrollment No. 170280321 to 170280750 & 180280001 to 180280140

Counselling Class Programme		***Practical Examination Programme***		
Date	***Time***	***Paper***	***Date***	***Time***
01.03.2021 & 02.03.2021	11.00 AM to 5.00 PM	XII	03.03.2021	11:30 AM to 2:30 PM
		XIV	03.03.2021	2:45 PM to 5:45 PM
		XV	04.03.2021	11:30 AM to 2:30 PM
		XVI	04.03.2021	2:45 PM to 5:45 PM
Venue : Physics Lab, 1st Floor Biscomaun Tower, Patna-800001				

For Enrollment No. 180280141 to 180280450

Counselling Class Programme		***Practical Examination Programme***		
Date	***Time***	***Paper***	***Date***	***Time***
05.03.2021 & 06.03.2021	11.00 AM to 5.00 PM	XII	08.03.2021	11:30 AM to 2:30 PM
		XIV	08.03.2021	2:45 PM to 5:45 PM
		XV	09.03.2021	11:30 AM to 2:30 PM
		XVI	09.03.2021	2:45 PM to 5:45 PM
Venue : Physics Lab, 1st Floor Biscomaun Tower, Patna-800001				

NALANDA OPEN UNIVERSITY

M.Sc. Physics, Part-II

PAPER–XIII

(Environmental Physics)

Annual Examination, 2020

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

Answer any Five Questions. All questions carry equal marks.

1. Discuss equation of motion for fluid and hence obtain the Navier-Stoke's equation for fluids.
2. 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).
3. 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.
4. Derive Fick law and explain its analogy with heat transfer equation.
5. Why Bifuels are called renewable energy source ? Explain briefly, the four generations of Bifuesl.
6. What is LIDAR ? Explain its principle, physical and technical aspects with applications.
7. Discuss improvements in diffusion equations to predict the transport of pollutants to a fair accuracy. What is Drupuit Approximation ? Discuss.
8. What is atmospheric stratification ? Explain its importance. What do you mean by 'The Froude Number' ?
9. Explain Einstein's A and B coefficients of absorption, stimulated emission and spontaneous emission. Hence deduce Lambert-Beer's Law.
10. Explain the principle of solar collectors which absorb solar radiation. Find the expression for the net heat flux entering the collector.

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M.Sc. Physics, Part-II

Practical Counseling and Practical Examination Programme, 2020

Practical Programme for Paper-X of All Students

Counselling Class Programme		***Practical Examination Programme***		
Date	***Time***	***Paper***	***Date***	***Time***
17.02.2021 to 19.02.2021	12.00 Noon to 4.00 PM	X	20.02.2021	12:00 Noon to 3:00 PM
Venue : School of Computer Education & IT, Nalanda Open University, 12th Floor, Biscomaun Tower, Patna-800001				

For Enrollment No. 150280001 to 150280320, 160280001 to 160280700 & 170280001 to 170280320

Counselling Class Programme		***Practical Examination Programme***		
Date	***Time***	***Paper***	***Date***	***Time***
22.02.2021 & 23.02.2021	11.00 AM to 5.00 PM	XII	24.02.2021	11:30 AM to 2:30 PM
		XIV	24.02.2021	2:45 PM to 5:45 PM
		XV	25.02.2021	11:30 AM to 2:30 PM
		XVI	25.02.2021	2:45 PM to 5:45 PM
Venue : Physics Lab, 1st Floor Biscomaun Tower, Patna-800001				

For Enrollment No. 170280321 to 170280750 & 180280001 to 180280140

Counselling Class Programme		***Practical Examination Programme***		
Date	***Time***	***Paper***	***Date***	***Time***
01.03.2021 & 02.03.2021	11.00 AM to 5.00 PM	XII	03.03.2021	11:30 AM to 2:30 PM
		XIV	03.03.2021	2:45 PM to 5:45 PM
		XV	04.03.2021	11:30 AM to 2:30 PM
		XVI	04.03.2021	2:45 PM to 5:45 PM
Venue : Physics Lab, 1st Floor Biscomaun Tower, Patna-800001				

For Enrollment No. 180280141 to 180280450

Counselling Class Programme		***Practical Examination Programme***		
Date	***Time***	***Paper***	***Date***	***Time***
05.03.2021 & 06.03.2021	11.00 AM to 5.00 PM	XII	08.03.2021	11:30 AM to 2:30 PM
		XIV	08.03.2021	2:45 PM to 5:45 PM
		XV	09.03.2021	11:30 AM to 2:30 PM
		XVI	09.03.2021	2:45 PM to 5:45 PM
Venue : Physics Lab, 1st Floor Biscomaun Tower, Patna-800001				

NALANDA OPEN UNIVERSITY

M.Sc. Physics, Part-II

PAPER–XIV

(Photonics)

Annual Examination, 2020

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

Answer any Five Questions. All questions carry equal marks.

1. How plasma screen in different from LCD screen ? What is the future of LCD screen ?
2. Describe intrinsic semiconductor laser and doped semiconductor laser. What is limitation for these lasers to operate continuously.
3. Explain the difference between analog and digital communication. Why digital communication is more suitable with modern day requirements ?
4. Obtain a relation between divergence and Waist Rise of of the beam for a Gaussian distribution of wave energy.
5. Describe with a neat diagram the operation of Ruby laser. Explain the origin of spiking in laser emission.
6. What is LED ? Describe its design and explain its working.
7. What do you mean by 'Core and Cladding' ? Describe the structures of different types of optical fibers with ray path.
8. What is optical fiber flow sensor ? Describe optical fiber gyroscope.
9. What do you mean by 'stimulated emission' and 'population inversion' ? How is the population inversion accomplished in semiconductor and non-semiconductor laser ?
10. Write notes on the following :—
    (a) Ultrafast laser and its uses
    (b) Holography
    (c) Optical transmitters and receivers

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M.Sc. Physics, Part-II

Practical Counseling and Practical Examination Programme, 2020

Practical Programme for Paper-X of All Students

Counselling Class Programme		***Practical Examination Programme***		
Date	***Time***	***Paper***	***Date***	***Time***
17.02.2021 to 19.02.2021	12.00 Noon to 4.00 PM	X	20.02.2021	12:00 Noon to 3:00 PM
Venue : School of Computer Education & IT, Nalanda Open University, 12th Floor, Biscomaun Tower, Patna-800001				

For Enrollment No. 150280001 to 150280320, 160280001 to 160280700 & 170280001 to 170280320

Counselling Class Programme		***Practical Examination Programme***		
Date	***Time***	***Paper***	***Date***	***Time***
22.02.2021 & 23.02.2021	11.00 AM to 5.00 PM	XII	24.02.2021	11:30 AM to 2:30 PM
		XIV	24.02.2021	2:45 PM to 5:45 PM
		XV	25.02.2021	11:30 AM to 2:30 PM
		XVI	25.02.2021	2:45 PM to 5:45 PM
Venue : Physics Lab, 1st Floor Biscomaun Tower, Patna-800001				

For Enrollment No. 170280321 to 170280750 & 180280001 to 180280140

Counselling Class Programme		***Practical Examination Programme***		
Date	***Time***	***Paper***	***Date***	***Time***
01.03.2021 & 02.03.2021	11.00 AM to 5.00 PM	XII	03.03.2021	11:30 AM to 2:30 PM
		XIV	03.03.2021	2:45 PM to 5:45 PM
		XV	04.03.2021	11:30 AM to 2:30 PM
		XVI	04.03.2021	2:45 PM to 5:45 PM
Venue : Physics Lab, 1st Floor Biscomaun Tower, Patna-800001				

For Enrollment No. 180280141 to 180280450

Counselling Class Programme		***Practical Examination Programme***		
Date	***Time***	***Paper***	***Date***	***Time***
05.03.2021 & 06.03.2021	11.00 AM to 5.00 PM	XII	08.03.2021	11:30 AM to 2:30 PM
		XIV	08.03.2021	2:45 PM to 5:45 PM
		XV	09.03.2021	11:30 AM to 2:30 PM
		XVI	09.03.2021	2:45 PM to 5:45 PM
Venue : Physics Lab, 1st Floor Biscomaun Tower, Patna-800001				

NALANDA OPEN UNIVERSITY

M.Sc. Physics, Part-II

PAPER–XV

(Advanced Condensed Matter Physics)

Annual Examination, 2020

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

Answer any Five Questions. All questions carry equal marks.

1. Derive an expression for electrical conductivity of metal on Drone Model. Explain the effect on conductivity if an alternatives electric field is applied to the system.
2. State Gruneisen law. Derive equation of state and gruneisen parameter for solids.
3. Give a quantitative treatment of BCS ground state. Obtain an expression for the energy gap at 0K.
4. Derive Clausius-Mossotti formula relating the dielectric constant and the polarisability for a composite dielectric material.
5. What do you understand by direct transition and indirect transition ? Calculate the absorption coefficient in case of direct transition.
6. What is skin effect ? Distinguish between normal and anamalous skin effect. Give the mathematical theory of anomalous skin effect. How do you get information about Fermi structure with the help of this effect ?
7. What is Debye-Waller factor ? What is its origin ? Discuss the temperature dependence of the Bragg reflection.
8. What are ionic crystals ? Explain the formation of an ionic crystal and obtain, in short, an expression for its cohesive energy.
9. What is Mösbauer effect ? Explain Doppler broadening through intensity-frequency graphs for gamma emission and absorption by identical nuclei.
10. What is polariton ? Obtain polariton dispersion relation. How does it stand with the experiment test ?

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M.Sc. Physics, Part-II

Practical Counseling and Practical Examination Programme, 2020

Practical Programme for Paper-X of All Students

Counselling Class Programme		***Practical Examination Programme***		
Date	***Time***	***Paper***	***Date***	***Time***
17.02.2021 to 19.02.2021	12.00 Noon to 4.00 PM	X	20.02.2021	12:00 Noon to 3:00 PM
Venue : School of Computer Education & IT, Nalanda Open University, 12th Floor, Biscomaun Tower, Patna-800001				

For Enrollment No. 150280001 to 150280320, 160280001 to 160280700 & 170280001 to 170280320

Counselling Class Programme		***Practical Examination Programme***		
Date	***Time***	***Paper***	***Date***	***Time***
22.02.2021 & 23.02.2021	11.00 AM to 5.00 PM	XII	24.02.2021	11:30 AM to 2:30 PM
		XIV	24.02.2021	2:45 PM to 5:45 PM
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		XVI	25.02.2021	2:45 PM to 5:45 PM
Venue : Physics Lab, 1st Floor Biscomaun Tower, Patna-800001				

For Enrollment No. 170280321 to 170280750 & 180280001 to 180280140

Counselling Class Programme		***Practical Examination Programme***		
Date	***Time***	***Paper***	***Date***	***Time***
01.03.2021 & 02.03.2021	11.00 AM to 5.00 PM	XII	03.03.2021	11:30 AM to 2:30 PM
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For Enrollment No. 180280141 to 180280450

Counselling Class Programme		***Practical Examination Programme***		
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		XV	09.03.2021	11:30 AM to 2:30 PM
		XVI	09.03.2021	2:45 PM to 5:45 PM
Venue : Physics Lab, 1st Floor Biscomaun Tower, Patna-800001				

NALANDA OPEN UNIVERSITY

M.Sc. Physics, Part-II

PAPER–XVI

(Advanced Electronics)

Annual Examination, 2020

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

Answer any Five Questions. All questions carry equal marks.

1. What is a multiplexer ? Draw the logic circuit for a 4-to-1 multiplexer. Write the Boolean equation and describe the truth table.
2. What is a level transistor circuit ? Why it is used with the cascaded differential amplifier ?
3. What is an op-amp ? What are the characteristics of an ideal op-amp ? Draw the block diagram of an op-amp ?
4. What is a decoder ? Describe seven segment displays for an LED circuit.
5. What is encoder. Draw the logic circuit of 8-time-to-3 time encoder.
6. What is Read Only Memory (ROM) ? Distinguish between PROM and EPROM. Give some of the important applications of ROM.
7. What is a comparator ? Explain the working of a comparator. What are its important characteristics ?
8. What is a flip-flop ? Explain the functioning of NOR and NAND latch.
9. 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.
10. Explain the architecture of 8086 microprocessor.

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M.Sc. Physics, Part-II

Practical Counseling and Practical Examination Programme, 2020

Practical Programme for Paper-X of All Students

Counselling Class Programme		***Practical Examination Programme***		
Date	***Time***	***Paper***	***Date***	***Time***
17.02.2021 to 19.02.2021	12.00 Noon to 4.00 PM	X	20.02.2021	12:00 Noon to 3:00 PM
Venue : School of Computer Education & IT, Nalanda Open University, 12th Floor, Biscomaun Tower, Patna-800001				

For Enrollment No. 150280001 to 150280320, 160280001 to 160280700 & 170280001 to 170280320

Counselling Class Programme		***Practical Examination Programme***		
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22.02.2021 & 23.02.2021	11.00 AM to 5.00 PM	XII	24.02.2021	11:30 AM to 2:30 PM
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Venue : Physics Lab, 1st Floor Biscomaun Tower, Patna-800001				

For Enrollment No. 170280321 to 170280750 & 180280001 to 180280140

Counselling Class Programme		***Practical Examination Programme***		
Date	***Time***	***Paper***	***Date***	***Time***
01.03.2021 & 02.03.2021	11.00 AM to 5.00 PM	XII	03.03.2021	11:30 AM to 2:30 PM
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For Enrollment No. 180280141 to 180280450

Counselling Class Programme		***Practical Examination Programme***		
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