

Nalanda Open University

Annual Examination - 2017

B.Sc. Physics (Honours), Part-I

Paper-I

Time: 3.00 Hrs.

Full Marks: 80

Answer any Five questions, selecting at least one from each group. All questions carry equal marks.

Group - A

1. Write position Co-ordinate of a particle in Cartesian, spherical polar and cylindrical polar co-ordinate systems and give their inter relations. also write expression for infinitesimal volume element in each of them.
2. Explain divergence and curl of a vector. Write their expressions in Cartesian and spherical polar co-ordinates.
3. State and explain the principle of least action. On its basis deduce Lagrange's equation of motion.
4. Obtain expression for the force acting on a particle in a rotating frame and explain centripetal and centrifugal forces.
5. Deduce equation of motion of a compound pendulum by writing the Lagrangian of the same.

Group - B

6. State and explain Newton's postulates of special theory of relativity and hence deduce Lorentz transformations.
7. Use Lorentz transformations to explain Doppler Effect and aberration of light.
8. Obtain expression for variation of mass of a particle with its velocity.

Group - C

9. Deduce differential equation of damped motion and discuss its solutions.
10. Write notes on any Two of the following :-
 - (a) Generalised Co-ordinates and of momenta.
 - (b) D' Alembert's principle
 - (c) Length contraction & time dilation
 - (d) Kepler's laws of planetary motion.



Examination Programme, 2017 (Revised)

B.Sc (Part – I) All Honours Subjects

Except Home Science, Geography & Statistics Honours

(गृह विज्ञान, भूगोल और सांख्यिकी ऑनर्स को छोड़कर)

Date	Papers.	Time	Examination Centre
20/3/2017	(Hons) P-I	3.30 to 6.30 pm	Nalanda Open University, Patna
22/3/2017	(Hons) P-II	3.30 to 6.30 pm	Nalanda Open University, Patna
24/3/2017	Rastrabhsha-100 or Hindi+Urdu 100	3.30 to 6.30 pm	Nalanda Open University, Patna
27/3/2017	Math (Sub) P-I	8.00 to 11.00 am	Nalanda Open University, Patna
28/3/2017	Geography (Sub) P-I	8.00 to 11.00 am	Nalanda Open University, Patna
29/3/2017	Chemistry (Sub) P-I	8.00 to 11.00 am	Nalanda Open University, Patna
30/3/2017	Home Science (Sub)-P I	8.00 to 11.00 am	Nalanda Open University, Patna
31/3/2017	Zoology (Sub) P-I	8.00 to 11.00 am	Nalanda Open University, Patna
03/4/2017	Physics (Sub) P-I	8.00 to 11.00 am	Nalanda Open University, Patna
04/4/2017	Botany (Sub) P-I	8.00 to 11.00 am	Nalanda Open University, Patna
05/4/2017	Statistics (Sub) P-I	8.00 to 11.00 am	Nalanda Open University, Patna

Nalanda Open University
Annual Examination - 2017
B.Sc. Physics (Honours), Part-I
Paper-II

Time: 3.00 Hrs.

Full Marks: 80

Answer any Five questions, selecting at least Two from each group. All questions carry equal marks.

Group - A

1. Explain the principle of equipartition of energy. Deduce the expression for the mean energy per degree of freedom for a system of gases $\left(= \frac{1}{2} kT \right)$
2. Give Einstein's theory of Brownian motion and obtain an expression for the average square displacement of particles under this motion.
3. Explain steady state of a metal rod being heated continuously at one end and deduce an expression for temperature distribution on it in this state.
4. Give Maxwell's theory of velocity distribution in a perfect gas and hence discuss mean velocity and most probable velocity.
5. On the basis of virial theory deduce Van-der Waal's equation of state of a real gas.

Group - B

6. Describe porous plug experiment and discuss Joule Thomson effect.
7. Explain statistical basis of thermodynamics and explain the second law of thermodynamics on its basis.
8. Derive Clausius Clapeyron equation for first order phase transition.
9. Derive Maxwell's thermodynamic relations. Apply them to explain at least two thermodynamical problems.
10. Write notes on any Two of the following:-
 - (a) Reversible and irreversible thermal processes.
 - (b) Chemical potential
 - (c) Thermodynamical probability
 - (d) Triple point.



Programme of B.Sc. Part-I Physics (Hons.)
Practical Counselling and Examination 2017
Venue : 1st Floor, Physics Lab, Biscomaun Tower, Patna
(A) Practical Counselling Class

<i>Date</i>	<i>Paper</i>	<i>Time</i>	<i>Roll No.</i>
06.04.2017 & 07.04.2017	I & II	11:30 AM to 04:00 PM	All Old Students & 160500001 to 160500020
08.04.2017 & 11.04.2017	I & II	11:30 AM to 04:00 PM	160500021 to 160500060
12.04.2017 & 13.04.2017	I & II	11:30 AM to 04:00 PM	160500061 to 160500100
19.04.2017 & 20.04.2017	I & II	11:30 AM to 04:00 PM	160500101 to 160500140
21.04.2017 & 22.04.2017	I & II	11:30 AM to 04:00 PM	160500141 to 160500180
22.04.2017 & 24.04.2017	I & II	11:30 AM to 04:00 PM	160500181 to 160500220
25.04.2017 & 26.04.2017	I & II	11:30 AM to 04:00 PM	160500221 to 160500260

(B) Practical Examination

<i>Date</i>	<i>Papers</i>	<i>Time</i>	<i>Enrollment No.</i>
27.04.2017	I	11.30 AM to 02.30 PM	All Old Students 160500001 to 160500020
	II	02.45 PM to 05.45 PM	
28.04.2017	I	11.30 AM to 02.30 PM	160500021 to 160500060
	II	02.45 PM to 05.45 PM	
29.04.2017	I	11.30 AM to 02.30 PM	160500061 to 160500100
	II	02.45 PM to 05.45 PM	
02.05.2017	I	11.30 AM to 02.30 PM	160500101 to 160500140
	II	02.45 PM to 05.45 PM	
03.05.2017	I	11.30 AM to 02.30 PM	160500141 to 160500180
	II	02.45 PM to 05.45 PM	
05.05.2017	I	11.30 AM to 02.30 PM	160500181 to 160500220
	II	02.45 PM to 05.45 PM	
06.05.2017	I	11.30 AM to 02.30 PM	160500221 to 160500260
	II	02.45 PM to 05.45 PM	

Nalanda Open University
Annual Examination - 2017
B.Sc. Physics (Subsidiary), Part-I
Paper-I

Time: 3.00 Hrs.

Full Marks: 80

Answer any Five questions. All questions carry equal marks.

1. A metal wire is fixed at its upper end. Deduce an expression for torsional torque to produce a twist θ at its lower end. Derive expression for time period of torsional oscillation of this wire.
2. Explain generalised co-ordinates and momenta. Differentiate between holonomic and non-holonomic constraints.
3. Write Fourier series and discuss the method of evaluation of its coefficients. Apply it to the case of vibration of a plucked string.
4. Discuss Planck's quantum theory of radiation. Show that Wien's displacement law may be derived from this theory.
5. Give the different kinds of statement of the second law of thermodynamics and discuss their different respective aspects.
6. State and explain the Einstein's postulates of the special theory of relativity. Deduce Lorentz transformation equations on their basis.
7. Define and deduce expression for the elastic constants Y , k , n and σ and establish relations between them.
8. Give the theory of Michelson-Morley experiment. Discuss the results of this experiment.
9. What do you mean by ultrasonics and supersonics? Discuss the production and applications of ultrasonics.
10. Derive Van der Waal's equation of state for a real gas. Evaluate its coefficients a and b in terms of critical pressure P_c , critical volume V_c and critical temperature T_c .



Nalanda Open University
Annual Examination - 2017
B.Sc. Physics (Honours), Part-II
Paper-III (Optics & Electromagnetic Theory)

Time: 3.00 Hrs.

Full Marks: 80

*Answer any Three questions from group 'A' and Two Questions from group 'B'.
 All questions carry equal marks.*

Group - A

1. Describe the construction of a zone plate and show that it has a number of Focii. Enumerate the difference between a zone plate and a convex lens.
2. Describe the construction of a diffraction grating and give the theory of its working. Derive an expression for its resolving power.
3. Describe the construction of a Michelson's interferometer. Discuss the theory of its working.
4. Give the construction of a Nicol prism and the theory of its working. How it is it used as a polarizer and as an analyser.
5. What is Rayleigh criterion of resolution ? Deduce expression for resolving power of a microscope.
6. Give the construction and explain the working of a Babinet's compensator.

Group - B

7. Discuss laws of reflection and refraction on the basis of e.m. waves.
8. Write down Maxwell's equations and on their basis deduce the equation of plane e.m. wave in vacuum, Show that velocity of this wave is equal to that of light.
9. Discuss the theory of Thomson's scattering of e.m. waves.
10. Write notes on any Two of the following:-
 - (a) Dispersion in gases
 - (b) Scattering of e.m. waves
 - (c) Maxwell stress tensors
 - (d) Poyating's vector.



Nalanda Open University, Patna
*Programme of B.Sc. Part-II Physics (Hons.),
 Practical Class and Practical Examination, 2017*
 Venue:- 1st Floor, Biscomaun Tower, Patna

(A) Practical Counselling Class

Date	Paper	Time	Roll No.
16.03.2017 to 17.03.2017	III & IV	11:30 AM to 4:00 PM	<i>All Old Students & Roll No- 150500001 to 150500010</i>
18.03.2017 & 20.03.2017	III & IV	11:30 AM to 4:00 PM	<i>150500011 to 150500060</i>
21.03.2017 & 23.03.2017	III & IV	11:30 AM to 4:00 PM	<i>150500061 to 150500161</i>

(B) Practical Examination

Date	Paper	Time	Roll No.
24.03.2017	III	11:30 AM to 2:30 PM	<i>All Old Students & Roll No-150500001 to 150500010</i>
	IV	2:45 PM to 5:45 PM	
25.03.2017	III	11:30 AM to 2:30 PM	<i>150500011 to 150500060</i>
	IV	2:45 PM to 5:45 PM	
27.03.2017	III	11:30 AM to 2:30 PM	<i>150500061 to 150500161</i>
	IV	2:45 PM to 5:45 PM	

Nalanda Open University

Annual Examination - 2017

B.Sc. Physics (Honours), Part-II

Paper-IV (Electrostatics, Magnetism current Electricity and Modern Physics)

Time: 3.00 Hrs.

Full Marks: 80

Answer any five questions. All questions carry equal marks.

1. Obtain the electric potential and field due to a linear quadripole at a point for way from it.
2. Discuss Langevin's theory of paramagnetism. What are its shortcomings.
3. Define Paltier coefficient (π) and Thomson's coefficient (σ). Applying the laws of thermodynamics to a thermocouple circuit, establish the relations
(a) $\pi = T \cdot \frac{dE}{dT}$ (b) $\sigma = -T \cdot \frac{d^2E}{dT^2}$
4. Give the theory of Anderson's a.c. bridge. Give its relevant vector diagram.
5. Describe the theory of Thomson's method to determining the value of $\frac{e}{m}$.
6. Describe a cyclotron and give the theory of its working. Obtain expression for energy of the particle accelerated by it.
7. Obtain the resonance frequency of a series resonant circuit. Discuss the sharpness of resonance of the circuit.
8. Explain Compton effect and find expression for change in wave length of light.
9. Give Einstein's quantum hypothesis and hence write down the famous photoelectric equation. Explain work function and threshold frequency.
10. Describe a Geiger Muller counter and explain the theory of its working.



Nalanda Open University, Patna
Programme of B.Sc. Part-II Physics (Hons.),
Practical Class and Practical Examination, 2017
Venue:- 1st Floor, Biscamaun Tower, Patna
(A) Practical Counselling Class

Date	Paper	Time	Roll No.
16.03.2017 to 17.03.2017	III & IV	11:30 AM to 4:00 PM	All Old Students & Roll No- 150500001 to 150500010
18.03.2017 & 20.03.2017	III & IV	11:30 AM to 4:00 PM	150500011 to 150500060
21.03.2017 & 23.03.2017	III & IV	11:30 AM to 4:00 PM	150500061 to 150500161

(B) Practical Examination

Date	Paper	Time	Roll No.
24.03.2017	III	11:30 AM to 2:30 PM	All Old Students & Roll No-150500001 to 150500010
	IV	2:45 PM to 5:45 PM	
25.03.2017	III	11:30 AM to 2:30 PM	150500011 to 150500060
	IV	2:45 PM to 5:45 PM	
27.03.2017	III	11:30 AM to 2:30 PM	150500061 to 150500161
	IV	2:45 PM to 5:45 PM	

Nalanda Open University
Annual Examination - 2017
B.Sc. Physics (Subsidiary), Part-II
Paper-II

Time: 3.00 Hrs.

Full Marks: 80

Answer any five questions. All questions carry equal marks.

1. Explain magnetic vector potential and give its unit. Explain the importance of vector potential.
2. Define E , P and D . Establish the relation between them.
3. Discuss Langevin's theory of paramagnetism.
4. Explain Seebeck effect and Thomson's effect. Also explain inversion temperature, thermoelectric power and Thomson Co efficient.
5. Discuss the growth of charge in a d c circuit having resistance, induct and capacitance all connected in series.
6. What is photoelectric effect. Derive Einstein's photoelectric equation.
7. Describe a plane diffraction grating and explain the theory of its working.
8. What is LASER ? Describe construction and working of Ruby laser.
9. Discuss Rutherford-Soddy's theory of radioactive decay and obtain expression for half-life.
10. Give the circuit diagram of common emitter amplifier and explain its working.



Nalanda Open University

Annual Examination - 2017

B.Sc. Physics (Honours), Part-III

Paper-V (Mathematical Physics and Classical Mechanics)

Time: 3.00 Hrs.

Full Marks: 80

Answer any five questions. All questions carry equal marks.

1. Following the rules of Vector differentiation, show that $\vec{\nabla} r^n = n r^{n-2} \vec{r}$
2. Solve the problem of motion of harmonic oscillator by using the Hamilton-Jacobi method.
3. On the basis of d'Alembert's principle of virtual work, obtain Hamilton's equation of least action.
4. Explain analytic function. Discuss Cauchy-Riemann conditions.
5. State and prove Cauchy's integral theorem.
6. Solve Legendre's differential equation and obtain the recurrence formula $nP_n = xP'_{n+1} - P'_{n-1}$
7. Show that the set of tensor equations $\sum_{\nu=1}^4 \frac{\partial F_{\mu\nu}}{\partial x^\nu} = \mu_0 J_\mu$, where $F_{\mu\nu}$ and J_μ are the components of electromagnetic field tensor and four-vector current density, respectively, reduce to Maxwell's first and fourth equations.
8. On the basis of the theory of motion under central force obtain Kepler's laws of planetary motion.
9. What is Dirac delta function? Give all its properties. Also, prove the $x.\delta(x)=0$
10. Discuss the motion of symmetric top moving under gravity.



Programme of B.Sc. Part-III Physics (Hons.)

Annual Practical Counselling & Practical Examination - 2017

Venue : 1st Floor Biscomaun Tower, Patna - 800 001

Practical Counselling

Date	Time	Paper
23.02.2017 to 25.02.2017	11:30 AM to 4:00 PM	VII & VIII

Practical Examination

Date	Time	
	11:30 AM to 2:30 PM	2:45 AM to 5:45 PM
27.02.2017	Paper-VII	Paper-VIII

Nalanda Open University

Annual Examination - 2017

B.Sc. Physics (Honours), Part-III

Paper-VI (Quantum Mechanics and Statistical Mechanics)

Time: 3.00 Hrs.

Full Marks: 80

Answer any five questions. All questions carry equal marks.

1. Derive Schrödinger's equation in both (i) time independent and (ii) time dependent cases.
2. Discuss the wave equation of a particle in a potential well. Find eigen values and eigen functions.
3. What is uncertainty principle? Derive Heisenberg's uncertainty relation for position and momentum variables. Show that an electron cannot exist inside the nucleus.
4. Define angular momentum (L) in quantum mechanics. Show that components of L commute with L^2 whereas they do not commute with each other.
5. Give the possible states of the H-atom and its Hamiltonian. Also, find ground state of the He-atom and its energy.
6. Write down the fundamental assumption of statistical mechanics. Define and explain the three types of statistical ensembles.
7. What do you mean by statistical entropy? Obtain expression for entropy of an ideal gas. What is Gibb's paradox and how is it explained?
8. State and prove Liouville's theorem.
9. What are symmetric and antisymmetric wave functions? Discuss their important properties.
10. Deduce Bose-Einstein statistics for Bosons and obtain Planck's radiation formula.



Programme of B.Sc. Part-III Physics (Hons.)

Annual Practical Counselling & Practical Examination - 2017

Venue : 1st Floor Biscomaun Tower, Patna - 800 001

Practical Counselling

Date	Time	Paper
23.02.2017 to 25.02.2017	11:30 AM to 4:00 PM	VII & VIII

Practical Examination

Date	Time	
	11:30 AM to 2:30 PM	2:45 AM to 5:45 PM
27.02.2017	Paper-VII	Paper-VIII

Nalanda Open University
Annual Examination - 2017
B.Sc. Physics (Honours), Part-III
Paper-VII (Classical Electrodynamics, Plasma Physics, Physics of Atoms, Molecules and Nuclei)

Time: 3.00 Hrs.

Full Marks: 80

Answer any five questions. All questions carry equal marks.

1. What do you mean by electromagnetic field tensor? Write all its components in terms of components of the electric and magnetic fields.
2. Explain Lienard. Wiechert potential. Calculate the intensities of electric and magnetic field due to a uniformly moving charge making use of this potential.
3. Explain plasma state and describe plasma parameters. Discuss collective behaviours of plasma and explain concept of temperature in plasma.
4. Write Maxwell's field equations and discuss their covariance under Lorentz transformations.
5. Give quantum mechanical treatment of Paschen-Back effect.
6. Explain spin magnetic moment and electric quadrupole magnetic moment associated with atomic nucleus.
7. Give a brief account of the liquid drop model of nucleus. Explain magnetic number of nuclei.
8. Explain the theory of molecular spectra of diatomic molecule treated as a harmonic vibrator. What are the shortcomings of this model?
9. Describe the construction and the principle of working of a He-Ne laser.
10. Describe the Stern-Gerlach experiment and explain how does it explain the existence of spin magnetic moment of nucleus.



Programme of B.Sc. Part-III Physics (Hons.)
Annual Practical Counselling & Practical Examination - 2017

Venue : 1st Floor Biscomaun Tower, Patna - 800 001

Practical Counselling

Date	Time	Paper
23.02.2017 to 25.02.2017	11:30 AM to 4:00 PM	VII & VIII

Practical Examination

Date	Time	
	27.02.2017	11:30 AM to 2:30 PM Paper-VII

Nalanda Open University
Annual Examination - 2017
B.Sc. Physics (Honours), Part-III
Paper-VIII (Condensed Matter Physics & Electronics)

Time: 3.00 Hrs.

Full Marks: 80

Answer any five questions. All questions carry equal marks.

1. What is space lattice? Describe various types of lattices in the cubic system. Show that for a simple cubic lattice, $d_{100}:d_{110}:d_{111} = \sqrt{6}:\sqrt{3}:\sqrt{2}$
2. Explain Hall Effect. Define Hall coefficient and give its importance. How are they determined in the laboratory?
3. State and prove (i) Narton's theorem and (ii) Reciprocity theorem
4. Deduce Laue's equation of diffraction of x-rays by a crystal show how Bragg's Law follows from that equation.
5. Discuss Kronig-Penny model of energy bands structure of solids. Distinguish clearly between metal, semiconductor and insulators on the basis of energy bands in solids.
6. Describe a R.c. Coupled amplifier, explain its functioning. Obtain expression for voltage gain in this amplifier.
7. What is a Zener diode? Explain its working. How can it be used as a voltage stabilizer?
8. Define Madlung constant and show that for an infinite line of ions, its value is $2 \ln 2$.
9. What is a photodiode? Discuss its working and uses with the help of its characteristic curves.
10. Explain the nuclear shell model. How this model is used to explain the angular momentum of ground state of the nucleus?



Programme of B.Sc. Part-III Physics (Hons.)
Annual Practical Counselling & Practical Examination - 2017
 Venue : 1st Floor Biscomaun Tower, Patna - 800 001

Practical Counselling

Date	Time	Paper
23.02.2017 to 25.02.2017	11:30 AM to 4:00 PM	VII & VIII

Practical Examination

Date	Time	
	11:30 AM to 2:30 PM	2:45 AM to 5:45 PM
27.02.2017	Paper-VII	Paper-VIII