

Nalanda Open University
Annual Examination - 2019
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. Describe Cartesian, spherical polar and cylindrical coordinate systems and show the position coordinates in each of them and establish their inter relations. Write expressions for infinitesimal volume element in each of them.
2. Explain generalised coordinates, degrees of freedom and constraints.
3. State and explain the principle of least action. Use this to derive Lagrange's equations of motion.
4. Deduce equation of motion of a compound pendulum by writing the Lagrangian of the same.
5. Obtain expression for the force acting on a particle in a rotating frame and explain centripetal & centrifugal forces.

Group - B

6. Establish the relation $E^2 = p^2 c^2 + m_0^2 c^4$ for a relativistic system and discuss it.
7. Using four dimensional formulations in relativity, obtain the equation for variation of mass with velocity.
8. Write down Einstein's postulates of the special theory of relativity and hence derive Lorentz transformations. equations.

Group - C

9. Obtain the equation of stationary waves and find the positions of nodes and antinodes.
10. Explain the following :-
 (a) D' Alembert's principle. (b) Curl, divergence of a vector and grad of a scalar.



B.Sc. Part-I Physics (Hons.), Practical Counselling and Examination 2019
Venue : 1st Floor, Physics Lab, Biscomaun Tower, Patna

(A) Practical Counselling Class

Date	Paper	Time	Roll No.
26.06.2019	I & II	11:00 AM to 05:00 PM	160500001 to 160500250
			170500001 to 170500210
			180500001 to 180500020
27.06.2019	I & II	11:00 AM to 05:00 PM	180500021 to 180500050
28.06.2019	I & II	11:00 AM to 05:00 PM	180500051 to 180500100

(B) Practical Examination

Date	Time		Roll No.
	Paper I	Paper II	
29.06.2019	11:30 AM to 02:30 PM	02:45 PM to 05:45 PM	160500001 to 160500250
			170500001 to 170500210
			180500001 to 180500020
01.07.2019	11:30 AM to 02:30 PM	02:45 PM to 05:45 PM	180500021 to 180500050
02.07.2019	11:30 AM to 02:30 PM	02:45 PM to 05:45 PM	180500051 to 180500100

Examination Programme, 2019 B.Sc (Part – I) All Honours Subjects

Except Geography, Home Science & Yoga Honours

(गृह विज्ञान, भूगोल और योग ऑनर्स को छोड़कर)

Date	Papers.	Time	Examination Centre
29/5/2019	(Hons) P-I	3.30 to 6.30 pm	Nalanda Open University, Patna
31/5/2019	(Hons) P-II	3.30 to 6.30 pm	Nalanda Open University, Patna
03/6/2019	Home Science (Sub)-P I	12 to 3 pm	Nalanda Open University, Patna
04/6/2019	Physics (Sub) P-I	12 to 3 pm	Nalanda Open University, Patna
07/6/2019	Rastrabhsha-100 or Hindi+Urdu or Eng	3.30 to 6.30 pm	Nalanda Open University, Patna
10/6/2019	Math (Sub) P-I	12 to 3 pm	Nalanda Open University, Patna
11/6/2019	Geography (Sub) P-I	12 to 3 pm	Nalanda Open University, Patna
12/6/2019	Zoology (Sub) P-I	12 to 3 pm	Nalanda Open University, Patna
14/6/2019	Chemistry (Sub) P-I	12 to 3 pm	Nalanda Open University, Patna
15/6/2019	Botany (Sub) P-I	12 to 3 pm	Nalanda Open University, Patna

Nalanda Open University
Annual Examination - 2019
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. Deduce Maxwell's law of velocity distribution amongst the molecules of an ideal gas. Use this law to find an expression for the most probable velocity.
2. State the principle of equipartition of energy and derive the result that the mean energy of a system of gases is $1/2KT$ per degree of freedom.
3. Give the Einstein's theory of Brownian motion.
4. Deduce an expression for steady state temperature distribution along a uniform metal rod heated at one end.
5. Use Debye theory to find the formula for specific heat of a solid.

Group - B

6. Derive Maxwell's thermodynamics relations. On their basis solve at least two simple physical problems.
7. What is first order phase transition? Derive the Clausius-Clapeyron equation for these transitions. Also explain triple point with the help of suitable diagram.
8. Describe porous plug experiment and discuss Joule-Thomson effect.
9. Derive the expression for efficiency of a Carnot engine using the second law of thermodynamics. Define Carnot's refrigerator.
10. Write brief notes on any two of the following:-
 - (a) Adiabatic and isothermal changes
 - (b) Chemical potential
 - (c) Reversible & irreversible process
 - (d) Triple point.



Nalanda Open University
Annual Examination - 2019
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. Fixing one end of a metal wire, deduce an expression for torsional torque to produce a twist at its second end. Derive expression for time period of torsional oscillation of this wire.
2. Derive relativistic mass energy equation, $E = mc^2$.
3. Describe the arrangement of Michelson-Morley experiment with the help of a neat diagram. Discuss the theory of this experiment and describe the result so obtained.
4. Explain generalized coordinates and momenta. Differentiate between holonomic and non-holonomic constraints.
5. Define and deduce expression for the elastic constants Y, K, η and σ and establish relation between them.
6. Derive Vander Wall's equation of state for real gases. Evaluate 'a' & 'b' in terms of P_c, V_c and T_c .
7. What is Carnot's cycle? Find efficiency of Carnot's engine.
8. What do you mean by ultrasonics and supersonics? Discuss the production and applications of ultrasonics.
9. State and explain the first law of thermodynamics and hence obtain expression for $(C_p - C_v)$.
10. Discuss Planck's quantum theory of radiation. Show that Wien's displacement law may be derived from this theory.



Programme of B.Sc. Part-I Physics (Subsidiary)
Practical Counselling and Examination 2019
Venue : 1st Floor, Physics Lab, Biscomaun Tower, Patna
Practical Counselling

<u>Date</u>	<u>Time</u>	
	11:00 AM to 02:00 PM	02:00 PM to 05:00 PM
03.07.2019	Chemistry (H) All Old Students & Chemistry (H) 180470001 to 180470035	180470036 to 180470064
04.07.2019	Botany (H), Geography (H), Home Sc. (H), Yoga (H) Statistics (H) All Students	All Zoology (H) Students
05.07.2019	Math (H) All Old Students	Math (H) 180490001 to 180490030
06.07.2019	Math (H) 180490031 to 180490060	Math (H) 180490061 to 180490090
08.07.2019	Math (H) 180490091 to 180490130	

(B) Practical Examination

<u>Date</u>	<u>Time</u>	
	11:00 AM to 02:00 PM	02:00 PM to 05:00 PM
09.07.2019	Chemistry (H) All Old Students & Chemistry (H) 180470001 to 180470035	180470036 to 180470064
10.07.2019	Botany (H), Geography (H), Home Sc. (H), Yoga (H) Statistics (H) All Students	All Zoology (H) Students
11.07.2019	Math (H) All Old Students	Math (H) 180490001 to 180490030
12.07.2019	Math (H) 180490031 to 180490060	Math (H) 180490061 to 180490090
13.07.2019	Math (H) 180490091 to 180490130	

Nalanda Open University
Annual Examination - 2019
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 Michelson's interferometer. Explain the theory of its working. How will you measure the difference in wavelength of D-lines of sodium light ?
2. 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.
3. Give the construction of a Nicol prism and the theory of its working. How it is used as a polarizer and as an analyser.
4. Give the theory of determination of wavelength of monochromatic light by measuring the diameters of Newton's ring.
5. What is Brewster's Law? show that when a ray is incident at the Brewster's angle, the reflected ray is perpendicular to the refracted ray.
6. Give the construction and working of a Babinet's compensator.
7. Describe the construction of a diffraction grating and give the theory of its working. Derive an expression for its resolving power.

Group - B

8. State Maxwell's equations and deduce the equation of a plane e.m. wave in free space. Show that the velocity of the wave is equal to C , the velocity of light.
9. Discuss the theory of Thomson's scattering of e.m. wave.
10. What is Poynting's vector and Poynting theorem? Deduce Poynting theorem.

or

Deduce the laws of reflection and refraction of e.m. wave.



*Programme of B.Sc. Part-II Physics (Hons.),
 Practical Class and Practical Examination, 2019*

Venue:- 1st Floor, Biscomaun Tower, Patna

(A) Practical Counselling Class

<i>Date</i>	<i>Paper</i>	<i>Time</i>	<i>Roll No.</i>
11.06.2019 & 12.06.2019	III & IV	11:30 AM to 4:30 PM	150500001 to 150500125 160500001 to 160500213
13.06.2019 & 14.06.2019	III & IV	11:30 AM to 4:30 PM	170500001 to 170500225

(B) Practical Examination

<i>Date</i>	<i>Paper</i>	<i>Time</i>	<i>Roll No.</i>
15.06.2019	III	11:30 AM to 2:30 PM	150500001 to 150500125 160500001 to 160500213
	IV	2:45 PM to 5:45 PM	
18.06.2019	III	11:30 AM to 2:30 PM	170500001 to 170500225
	IV	2:45 PM to 5:45 PM	

Nalanda Open University

Annual Examination - 2019

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. Define a quadrupole. Calculate the field and potential at a point far away from a linear quadrupole.
2. What is hysteresis loss? Show that the energy loss per unit volume per cycle of magnetisation is equal to μ_0 times the area of the hysteresis loop
3. Define Peltier coefficient (π) and Thomson's coefficient (σ) and making use of thermodynamic laws, derive the ne/ns.
(a) $\pi = T \frac{dE}{dT}$ (b) $\sigma = -T \frac{d^2E}{dT^2}$
4. Describe the theory of Thomson's method to determine the value of e/m.
5. Investigate the growth of current in an LCR circuit subjected to a steady e.m.f.
6. Give the theory of Anderson's a.c. bridge. Give its relevant vector diagram.
7. Describe a Geiger Muller Counter and explain its working and theory.
8. Explain Compton effect and find expression for change in wavelength of light.
9. Describe construction and the theory of working of a cyclotron. Obtain an expression for energy of the particle accelerated by it.
10. Obtain the resonance frequency of a series resonant circuit. Discuss the sharpness of resonance of the circuit.



*Programme of B.Sc. Part-II Physics (Hons.),
Practical Class and Practical Examination, 2019*

Venue:- 1st Floor, Biscomaun Tower, Patna

(A) Practical Counselling Class

<i>Date</i>	<i>Paper</i>	<i>Time</i>	<i>Roll No.</i>
11.06.2019 & 12.06.2019	III & IV	11:30 AM to 4:30 PM	150500001 to 150500125 160500001 to 160500250
13.06.2019 & 14.06.2019	III & IV	11:30 AM to 4:30 PM	170500001 to 170500225

(B) Practical Examination

<i>Date</i>	<i>Paper</i>	<i>Time</i>	<i>Roll No.</i>
15.06.2019	III	11:30 AM to 2:30 PM	150500001 to 150500125
	IV	2:45 PM to 5:45 PM	160500001 to 160500250
18.06.2019	III	11:30 AM to 2:30 PM	170500001 to 170500225
	IV	2:45 PM to 5:45 PM	

Nalanda Open University
Annual Examination - 2019
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. What is ferromagnetism? Explain ferromagnetism on the basis of domain theory. What is Curie's law?
2. Define \vec{E} , \vec{P} , and \vec{D} . Establish the relation between them.
3. Explain the concept of an 'electrical image'. Find the field due to a point charge on an infinite grounded conducting plane.
4. Set up the equation for discharge of a capacitor through a pure inductor and solve it. Discuss the results so obtained.
5. Explain Seebeck effect and Thomson effect. Also explain inversion temperature, thermoelectric power and Thomson coefficient.
6. Discuss the theory of Anderson's a.c. bridge. What is the merit of this bridge?
7. Discuss Rutherford-Soddy's theory of radioactive decay and obtain an expression for half-life.
8. What is meant by resolving power of an optical instrument? Derive an expression for resolving power of a telescope.
9. Give the theory of determination of wavelength of sodium light by measuring the diameters of Newton's ring.
10. Discuss Fresnel's diffraction due to a straight edge. How is the wavelength of light determined from these diffraction fringes?



Nalanda Open University

Annual Examination - 2019

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. Explain analytic function. Derive Cauchy-Riemann conditions for such function.
2. State and prove Cauchy's integral theorem.
3. Following the rules of Vector differentiation, show that $\vec{\nabla} r^n = nr^{n-2} \vec{r}$.
4. Solve the problem of motion of harmonic oscillator by using the Hamiltonian-Jacobi method.
5. On the basis of d' Alembert's principle of Virtual Work. Obtain Hamilton's equation of least action.
6. On the basis of the theory of motion under central force obtain Kepler's laws of planetary motion.
7. Discuss the motion of symmetric top moving under gravity.
8. Solve Legendre's differential equation and obtain the recurrence formula $nP_n = xP'_{n+1} - P'_{n-1}$.
9. What are Poisson's brackets ? State and prove some of its properties.
10. (a) Show that energy tensor can be expressed as the sum of two tensors, one of which symmetric and the other skew symmetric.
(b) Show that by contraction, The rank of a tensor is reduced by Two.



Examination Programme-2019 B.Sc (Part-III) Physics Honours

Date	Papers	Time	Examination Centre
09/4/2019	Honours Paper-V	8 to 11 AM	Nalanda Open University, Patna
12/4/2019	Honours Paper-VI	8 to 11 AM	Nalanda Open University, Patna
13/4/2019	Honours Paper-VII	8 to 11 AM	Nalanda Open University, Patna
15/4/2019	Honours Paper-VIII	8 to 11 AM	Nalanda Open University, Patna
17/4/2019	Paper -XV (General Studies)	8 to 11 AM	Nalanda Open University, Patna

Programme of B.Sc. Part-III Physics (Hons.) Annual Practical Counselling & Practical Examination - 2019

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

Practical Counselling

Date	Time	Paper	Roll No.
18.04.2019	09:00 AM to 5:00 PM	VII & VIII	140500023 to 140500113 150500001 to 150500127 160500001 to 160500036
20.04.2019	09:00 AM to 5:00 PM	VII & VIII	160500037 to 160500250

Practical Examination

Date	Time		Roll No.
	Paper-VII	Paper-VIII	
22.04.2019	11:00 AM to 2:00 PM	2:30 PM to 5:30 PM	140500023 to 140500113 150500001 to 150500127 160500001 to 160500036
24.04.2019	11:00 AM to 2:00 PM	2:30 PM to 5:30 PM	160500037 to 160500250

Nalanda Open University

Annual Examination - 2019

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. What are basic postulates of quantum mechanics? Explain correspondence principle in quantum mechanics.
2. Give the physical interpretation of wave function. Derive Schrodinger equation in both (i) time independent and (ii) time dependent cases.
3. Define angular momentum (\vec{L}) in quantum mechanics. Show that L_x , L_y and L_z commute with L^2 when they do not commute with each other.
4. Define expectation value of a quantum mechanical operator and show that it corresponds to a classical observable.
5. What are symmetric and antisymmetric wave functions? Discuss their important properties.
6. Write down the fundamental assumptions 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. Deduce Bose-Einstein statistics for Bose and obtain Planck's radiation formula.
9. State and prove Liouville's theorem.
10. Give the possible states of the He-atom and its Hamiltonian. Also, find ground state of the He-atom and its energy.



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

Annual Practical Counselling & Practical Examination - 2019

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

Practical Counselling

Date	Time	Paper	Roll No.
18.04.2019	09:00 AM to 5:00 PM	VII & VIII	140500023 to 140500113 150500001 to 150500127 160500001 to 160500036
20.04.2019	09:00 AM to 5:00 PM	VII & VIII	160500037 to 160500250

Practical Examination

Date	Time		Roll No.
	Paper-VII	Paper-VIII	
22.04.2019	11:00 AM to 2:00 PM	2:30 PM to 5:30 PM	140500023 to 140500113 150500001 to 150500127 160500001 to 160500036
24.04.2019	11:00 AM to 2:00 PM	2:30 PM to 5:30 PM	160500037 to 160500250

Nalanda Open University
Annual Examination - 2019
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. Explain Lienard-wiechert potential. Calculate the intensities of electric and magnetic field due to a uniformly moving charge making use of this potential.
2. Explain plasma state and describe plasma parameters. Discuss collective collective behaviours of plasma and explain concept of temperature in plasma.
3. Establish the covariance of Maxwell's equations under Lorentz transformation.
4. Give quantum mechanical treatment of Paschen-Back effect.
5. Explain spin magnetic moment and electric quadrupole magnetic moment associated with atomic nucleus.
6. Give a brief account of the liquid drop model of nucleus. Explain magnetic number of nuclei.
7. Explain the theory of molecular spectra of diatomic molecule treated as a harmonic vibrator. What are the short comings of this model?
8. Describe the construction and the principle of working of a He-Ne laser.
9. Describe the Stern-Gerlach experiment and explain how does it explain the existence of spin magnetic moment of nucleus.
10. What do you mean by NMR spectroscopy? Describe with diagram the continuous wave NMR spectrometer.



Programme of B.Sc. Part-III Physics (Hons.)
Annual Practical Counselling & Practical Examination - 2019

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

Practical Counselling

Date	Time	Paper	Roll No.
18.04.2019	09:00 AM to 5:00 PM	VII & VIII	140500023 to 140500113 150500001 to 150500127 160500001 to 160500036
20.04.2019	09:00 AM to 5:00 PM	VII & VIII	160500037 to 160500250

Practical Examination

Date	Time		Roll No.
	Paper-VII	Paper-VIII	
22.04.2019	11:00 AM to 2:00 PM	2:30 PM to 5:30 PM	140500023 to 140500113 150500001 to 150500127 160500001 to 160500036
24.04.2019	11:00 AM to 2:00 PM	2:30 PM to 5:30 PM	160500037 to 160500250

Nalanda Open University
Annual Examination - 2019
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 lattice energy? Calculate the lattice energy of an ionic crystal. Define Madlung constant and show that for an infinite line of ions its values is $2\ln 2$.
2. Explain Hall effect. Define Hall coefficient and give its importance. How are they determined in the laboratory?
3. Deduce Laue's equation of diffraction of x-rays by a crystal and obtain Bragg's diffraction condition from them.
4. Explain the nuclear shell model. How this model is used to explain the angular momentum of ground state of the nucleus.
5. State and prove:
 (a) Norton's theorem and (b) Reciprocity theorem.
6. What is a zener diode? Explain its working. How can it be used as a voltage stabilizer?
7. What is an amplifier? Discuss the working of an R. C. Coupled amplifier with a circuit diagram. Obtain expression for voltage gain.
8. What is a photodiode? Discuss its working and uses with the help of its characteristics curve.
9. Explain the principle of frequency modulation. Define frequency deviation and the modulation index for frequency modulated carrier.
10. Distinguish between Einstein's theory and Debye theory of specific heat of solids. Discuss Debye theory and explain why this theory is most successful.



Programme of B.Sc. Part-III Physics (Hons.)
Annual Practical Counselling & Practical Examination - 2019

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

Practical Counselling

Date	Time	Paper	Roll No.
18.04.2019	09:00 AM to 5:00 PM	VII & VIII	140500023 to 140500113 150500001 to 150500127 160500001 to 160500036
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Practical Examination

Date	Time		Roll No.
	Paper-VII	Paper-VIII	
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24.04.2019	11:00 AM to 2:00 PM	2:30 PM to 5:30 PM	160500037 to 160500250