Maharaja Surajmal Brij University, Bharatpur

Syllabus

(From Session 2017-18)

B.Sc.Physics

(Part I, II & III)

अकादमिक प्रभारी

B.Sc. Part I
Physics

Scheme

Paper I	Exam. 3 Hours Duration	Max. Marks 33	Min. Pass Marks 12
Paper II	Exam. 3 Hours Duration	Max. Marks 33	Min. Pass Marks 12
Paper III	Exam. 3 Hours Duration	Max. Marks 34	Min. Pass Marks 12
Practical	Exam. 5 Hours Duration	Max. Marks 50	Min. Pass Marks 18

Paper-I (Mechanics)

Work Load: Two hours lecture per week
Examination Duration: 3 Hrs.
Scheme of Examination: Five questions shall be set and all are compulsory. First question shall contain 12 short answer type questions (3 questions from each unit) of one mark each with answer to each question not exceeding 50 words. Candidates have to attempt any nine questions out of these 12 questions. Remaining four questions will be of 6 marks each and will be set with one question from each unit. Second to fifth questions will have 100% internal choice.

Unit – I

Physical Law and frame of Reference:

Inertial and non-inertial frames: Transformation of displacement, velocity, acceleration between different frames of reference involving translation, Galilean transformation and invariance of Newton's laws.

Special theory of Relativity: Postulates of Special theory of relativity, Lorentz transformation, transformation of velocity and acceleration, Length contraction and time dilation with experimental verification

Coriolis Force: Transformation of displacement, velocity and acceleration between rotating frame, Pseudo forces, Coriolis force, Motion relative to earth, Focult's pendulum.

Unit – II

Centre of Mass:

Introduction about Centre of Mass, Centre of Mass Frame; Collision of two particles in one and two dimensions (elastic and inelastic), Slowing down of neutrons in a moderator, Motion of a system with varying mass, Angular momentum concept, conservation and charge particle scattering by a nucleus.

Rigid body

Equation of a motion of a rotating body, Inertial coefficient, Case of J not parallel to w, Kinetic energy of rotation and idea of principal axes, Determination of moment of inertia of symmetric bodies using inertial coefficients, Precessional motion of a spinning top.

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Unit –III

Motion under Central Forces:

Introduction about Central Forces, Motion under central forces, Gravitational interaction, Inertial and gravitational mass, General solution under gravitational interaction, Keplers Laws, Discussion of trajectories, Cases of elliptical and circular orbits, Rutherford scattering.

Elastic Properties of Matter

Elastic constants and relations among them, Elastic theorems, Bending of beams and cantilever, Torsion of a cylinder, Experimental determination of Y by bending of beam; η by Maxwell's needle; Y, η and σ by Searle's method & η by static method

Unit – IV

Damped Harmonic Oscillations:

Introduction about oscillations in a potential well, Damped force and motion under damping, Damped Simple Harmonic Oscillator, Power dissipation, Anharmonic oscillator and simple pendulum as an example.

Driven Harmonic Oscillations

Driven harmonic oscillator with damping, Frequency response, Phase relation, Quality factor, Resonance, Series and parallel of LCR circuit, Electromechanical system-Ballistic Galvanometer.

Coupled Oscillations

Equation of motion of two coupled Simple Harmonic Oscillators, Normal modes, motion in mixed modes, Transient behaviour, Dynamics of a number of oscillators with neighbour interactions.

Reference Books:

1. Mechanics: Berkeley Physics Course Vol- I, Charles Kittel
2. Mechanics: H S Hans S P Puri, Tata McGraw-Hill
3. The Physics of Waves & Oscillations. N.K. Bajaj, Tata McGraw-Hill
4. Analytical Mechanics L.N. Hand, J.D. Finch (Cambridge University Press).

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Paper - II (Electromagnetism)

Work Load: Two hours lecture per week

Examination Duration: Three hours

Scheme of Examination: Five questions shall be set and all are compulsory. First question shall contain 12 short answer type questions (3 questions from each unit) of one mark each with answer to each question not exceeding 50 words. Candidates have to attempt any nine questions out of these 12 questions. Remaining four questions will be of 6 marks each and will be set with one question from each unit. Second to fifth questions will have 100% internal choice.

Unit I

Scalar and Vector Fields

Concept of Field, Scalar and Vector Fields, Gradient of scalar field, Physical significance and formulism of Gradient, Divergence and Curl of a vector field in Cartesian co-ordinates system, Problems based on Gradient, Divergence and curl operators.

Concept of Solid angle, Gauss's divergence and Stokes theorem, Differential and integral form of Gauss's law, Ampere's law and Faraday's law.

Unit II

Fields of stationary and moving charges

Potential energy of system of (i) Discrete N-charges (ii) Continuous charge distribution. Energy required to build a uniformly charged sphere, classical radius of electron, Electric field due to a short electric dipole, Interaction of electric dipole with external uniform and non-uniform electric field, potential due to a uniformly charged spherical shell.

Poisson's and Laplace equations in Cartesian co-ordinates and their applications to solve the one dimensional problems of electrostatics.

Invariance of charge, Electric field measured in moving frames, Electric field of a point charge moving with constant velocity.

Unit III

Electric field in matter

Multipole expansion, definition of moments of charge distribution, Dielectrics, Induced dipole moments, polar & non polar molecules, Free and bound charges, Polarization, Atomic polarizabilty, electric displacement vector, electric susceptibility, dielectric constant, relation between them.

Electric potential and electric field due to a uniformly polarized sphere (i) outside the sphere (ii) at the surface of the sphere (iii) inside the sphere, Electric field due to a dielectric sphere placed in a uniform electric field (a) outside the sphere (b) inside the sphere, Electric field

due to a charge placed in dielectric medium and Gauss law, Clausius-Mossotti relation in dielectrics, Transient behaviour of series R-C Circuit with a DC Source.

Unit IV

Magnetostatics and magnetic field in matter

Lorentz force, properties of magnetic field, Ampere's law, magnetic field due to a current carrying solid conducting cylinder (i) outside (ii) at the surface and (iii) inside the cylinder, Ampere's law in differential form, Introduction of Magnetic Vector potential, Poisson's equation for vector potential, Deduction of Bio-Savart law using Magnetic Vector potentials, Differential form of Ampere's law, Transient behaviour of series L-R Circuit with a DC Source.

Atomic magnet, Gyromagnetic ratio, Bohr-magneton, Larmor frequency, induced magnetic moment and dia-magnetism, spin magnetic moment, para and ferro magnetism, Intensity of Magnetization, Magnetic permeability and Susceptibility, free and bound current densities, Magnetic field due to a uniformly magnetized material and Non-uniformly magnetized material.

Reference Books:

1. Electricity & Magnetism; AS Mahajan & Abbas A Rangwala, Tata McGraw-Hill
2. Introduction to electrodynamics; David J. Griffith. Prentice Hall
3. Berkley Physics Course. Vol II
4. Fundamental University Physics Vol II: Fields and Waves. M. Alonso and EJ Finn: Addrson-Wesley Publishing Company.

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Paper III OPTICS

Work Load: Two hours lecture per week

Examination Duration: Three hours

Scheme of Examination: Five questions shall be set and all are compulsory. First question shall contain 12 short answer type questions (3 questions from each unit) of one mark each with answer to each question not exceeding 50 words. Candidates have to attempt any **ten** questions out of these 12 questions. Remaining four questions will be of 6 marks each and will be set with one question from each unit. Second to fifth question will have 100% internal choice.

Unit-I

Interference:

Concept of Spatial and Temporal Coherence, coherence length, coherence time, Types of interference, interference by division of wave fronts: Fresnel's Biprism, Measurement of wavelength λ and thickness of a thin transparent sheet, Interference by division of amplitude: Interference in thin films of constant thickness in transmitted and reflected waves. Interference produced by a wedge shaped film, Newton's rings, Determination of wavelength λ and refractive index μ by Newton's Rings: fringes of equal inclination (Haidinger fringes) and equal thickness (Fizeau fringes), Michelson's Interferometer, shape of fringes, Measurement of wavelength, difference between two spectral lines and thickness of a thin transparent sheet.

Unit - 2

Diffraction:

Fresnel's diffraction, Half period zones, Fresnel's diffraction at a circular aperture, straight edge and a rectangular slit, Zone plate, Multiple foci of zone plate, comparison between zone plate and convexlens, Fraunhofer diffraction by single slit and a circular aperture, Fraunhofer diffraction by N parallel slits with two slits as a special case, Missing order, Plane diffraction grating and its use in determining wavelength, Dispersion by a grating, Rayleigh's criterion of resolution, Resolving power of a Telescope and a Grating.

Unit - 3

Polarization:

Polarization, Plane, Circular and Elliptically Polarized light, Polarization by reflection, Double refraction and Huygens explanation of double refraction, Production and detection of Plane, Circular and Elliptically Polarized light; Quarter wave and Half wave plates, optical activity. Specific rotation, Biquartz and half shade Polarmeters and their comparison.

(i) **Laser:** Spontaneous and Stimulated emission Einstein's A&B coefficients. Energy density of radiation as a result of stimulated emission and absorption, population Inversion. Methods of Optical pumping, Energy level schemes. He-Ne, Ruby, CO_2 lasers.

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(ii) **Holography:** Basic concepts of holography, Principle, Theory. Construction and reconstruction of image. Application of holography.

Unit -4

Wave motion:

1D and 3D wave equation, Transverse waves in a stretched string. Elastic waves in solids. Pressure waves in a gas column, spherical waves. Fourier's Theorem and its application to square and saw-tooth waves, Phase and group velocities, Dispersion of waves. Electromagnetic waves, Energy density of Electromagnetic waves, Electromagnetic waves in an Isotropic and Dispersive medium, Spectrum of Electromagnetic waves

Reference Books:

1. Optics by Brij Lal & Subramanium, S. Chand.
2. Optics by D. P. Khandelwal.
3. Principles of optics by B. K. Mathur.
4. Introduction to Modem Optics by A. K. Ghatak.
5. An introduction to Modem Optics by G. R. Fowels.
6. Essentials of Lasers by Allen.

Practical

Work Load: Four hours laboratory work per week

Examination Duration: Four hours

Minimum Experiments: Total sixteen taking eight from each section.

Section A

1. To study the variation of power transfer by two different loads by a DC source and to verify maximum power transfer theorem.
2. To study the variation of charge and current in a R-C circuit with a different time constant (using a DC source).
3. To study the behaviour of a R-C circuit with varying resistance and capacitance using at mains as a power Source and also to determine the impedance and phase relations.
4. To study the rise and decay of current in an L-R circuit with a source of constant emf.
5. To study the voltage and current behaviour of an L-R circuit with an AC power source. Also determine power factor, impedance and phase relations.
6. To study the characteristics of a semi- conductor junction diode and determine forward and reverse resistances
7. To study the magnetic field along the axis of a current carrying circular coil, Plot the necessary graph and hence find radius of the circular coil.
8. To determine the specific resistance of a material and determine difference between two small resistance using Carey Fosters Bridge
9. To convert a galvanometer into an ammeter of a given range
10. To convert a galvanometer into a voltmeter of a given range.

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Section B

1. To study the random decay and determine the decay constant using the statistical board,
2. Using compound pendulum study the variation of time period with amplitude in large angle Oscillations.
3. To study the damping using compound pendulum.
4. To study the excitation of normal modes and measure frequency splitting using two coupled oscillators.
5. To study the frequency of energy transfer as a function of coupling strength using coupled oscillators,
6. To study the viscous fluid damping of a compound pendulum and determining damping coefficient and Q of the oscillator.
7. To study the electromagnetic damping of a compound pendulum and to find the variation of damping coefficients with the assistance of a conducting lamina.
8. To find J by Calendar and Barne's Method
9. To determine Youngs modulus by bending of beam.
10. To determine Y, σ and η by Searle's method.
11. To ensure Curie temperature of Monel alloy.
12. To determine modulus of rigidity of a wire using Maxwell's needle.
13. Study of normal modes of a coupled pendulum system, Study of oscillations in mixed modes and find the period of energy exchange between the two oscillators,
14. To study variation of surface tension with temperature using Jaegger s method.
15. To study the specific-rotation of sugar solution by polarimeter

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Blueprint for setting question *paper I & II* for B.Sc. part I Physics Examination - 2018

First question is compulsory and is of 9 marks. This question contains 12 short answer type questions of one mark each. Candidates have to attempt any 9 questions with answer not more than 50 words. Second to fifth questions are of six marks each with internal choice.

प्रथम प्रश्न अनिवार्य है और यह 9 अंक का है। इस प्रश्न के अन्तर्गत 12 लघुत्तरात्मक प्रश्न हैं, जिनमें से कोई भी 9 प्रश्न हलं करने है, जिनका उत्तर 50 शब्दों से अधिक न हो। प्रश्न संख्या 2 से 5 तक प्रत्येक प्रश्न 6 अंक का है, जिसमें आन्तरिक विकल्प है।

1. पचास शब्द सीमा में नौ भागों के उत्तर दीजिए।

(i)	(ii)	(iii)	(iv)
(v)	(vi)	(vii)	(viii)
(ix)	(x)	(xi)	(xii)

Unit – I प्रथम इकाई

2 (a)
(b)

Or / अथवा

(a)
(b)

Unit – II द्वितीय इकाई

3 (a)
(b)

Or / अथवा

(a)
(b)

Unit – III तृतीय इकाई

4 (a)
(b)

Or/ अथवा

(a)
(b)

Unit – IV चतुर्थ इकाई

5 (a)
(b)

Or/ अथवा

(a)
(b)

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Blueprint for setting question *paper III* for B.Sc. part I Physics Examination - 2018

First question is compulsory and is of ten marks. This question contains 12 short answer type questions of one mark each. Candidates have to attempt any 10 questions with answer not more than 50 words. Second to fifth questions are of six marks each with internal choice.

प्रथम प्रश्न अनिवार्य है और यह 10 अंक का है। इस प्रश्न के अन्तर्गत 12 लघुत्तरात्मक प्रश्न है, जिनमें से कोई भी 10 प्रश्न हल करने है, जिनका उत्तर 50 शब्दों से अधिक न हो। प्रश्न संख्या 2 से 5 तक प्रत्येक प्रश्न 6 अंक का है, जिसमें आन्तरिक विकल्प है।

1. पचास शब्द सीमा में दस भागों के उत्तर दीजिए।

(i)	(ii)	(iii)	(iv)
(v)	(vi)	(vii)	(viii)
(ix)	(x)	(xi)	(xii)

Unit – I प्रथम इकाई

2 (a)
(b)

Or / अथवा

(a)
(b)

Unit – II द्वितीय इकाई

3 (a)
(b)

Or / अथवा

(a)
(b)

Unit – III तृतीय इकाई

4 (a)
(b)

Or/ अथवा

(a)
(b)

Unit – IV चतुर्थ इकाई

5 (a)
(b)

Or/ अथवा

(a)
(b)

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