

STATE MODEL SYLLABUS FOR
UNDER GRADUATE COURSE IN
PHYSICS
(Bachelor of Science Examination)

Approved & Recommended

S. K. Patra
24/7/19

P. Mishra
24/7/19

H. K. Tol
24.7.19

R. S. Bels
24/7/19
(CHAIRMAN)

R.
24.07.19

UNDER
CHOICE BASED CREDIT SYSTEM

Course structure of UG Physics Honors

SEMESTER	COURSE OPTED	COURSE NAME	Credit
I 4 Papers (400 Marks)	Ability Enhancement Compulsory Course-I	AECC-1	4
	Core course-I	Mathematical Physics-I	4
	Core Course-I Practical/Tutorial	Mathematical Physics-I Lab	2
	Core course-II	Mechanics	4
	Core Course-II Practical/Tutorial	Mechanics Lab	2
	Generic Elective -1	GE-1	4/5
	Generic Elective -1	Practical/Tutorial	2/1
II 4 Papers (400 Marks)	Ability Enhancement Compulsory Course-II	AECC-II	4
	Core course-III	Electricity and Magnetism	4
	Core Course-III Practical/Tutorial	Electricity and Magnetism Lab	2
	Core course-IV	Waves and Optics	4
	Core Course-IV Practical/Tutorial	Waves and Optics Lab	2
	Generic Elective -2	GE-2	4/5
	Generic Elective -2	Practical/Tutorial	2/1
III 5 Papers (500 Marks)	Core course-V	Mathematical Physics-II	4
	Core Course-V Practical/Tutorial	Mathematical Physics-II Lab	2
	Core course-VI	Thermal Physics	4
	Core Course-VI Practical/Tutorial	Thermal Physics Lab	2
	Core course-VII	Analog Systems and Applications	4
	Core Course-VII Practical/Tutorial	Analog Systems & Applications Lab	2
	Skill Enhancement Compulsory Course -1	SECC-1	4
	Generic Elective -3	GE-3	4/5
	Generic Elective -3	Practical/Tutorial	2/1

P. Mishra
24/7/19

P. Mishra
24/7/19

S. Patra
24/7/19

H. K. Tole
24.7.19

P. Mishra
24.07.19

V 5 Papers (500 Marks)	Core course-VIII	Mathematical Physics III	4
	Core Course-VII Practical/Tutorial	Mathematical Physics-III Lab	2
	Core course-IX	Elements of Modern Physics	4
	Core Course-IX Practical/Tutorial	Elements of Modern Physics Lab	2
	Core course-X	Digital Systems and Applications	4
	Core Course-X Practical/Tutorial	Digital Systems & Applications Lab	2
	Skill Enhancement Compulsory Course -2	SECC -2	4
	Generic Elective -4	GE-4	4/5
	Generic Elective -4	Practical/Tutorial	2/1
V 4 Papers (400 Marks)	Core course-XI	Quantum Mechanics & Applications	4
	Core Course-XI Practical/Tutorial	Quantum Mechanics Lab	2
	Core course-XII	Solid State Physics	4
	Core Course-XII Practical/Tutorial	Solid State Physics Lab	2
	Discipline Specific Elective -1	DSE-1	4/5
	Discipline Specific Elective -1	Practical/Tutorial	2/1
	Discipline Specific Elective -2	DSE-2	4/5
	Discipline Specific Elective- 2	Practical/Tutorial	2/1
VI 4 Papers (400 Marks)	Core course-XIII	Electro-magnetic Theory	4
	Core Course-XIII Practical/Tutorial	Electro-magnetic Theory Lab	2
	Core course-XIV	Statistical Mechanics	4
	Core Course-XIV Practical/Tutorial	Statistical Mechanics Lab	2
	Discipline Specific Elective4	DSE-4	4/5
	Discipline Specific Elective -4	Practical/Tutorial	2/1
	Or Discipline Specific Elective-4	(Eligible Students may do a Project in DSE-IV)	6
		Total Credits	148

P. Mishra
24/7/19

P. Mishra
24/7/19

S. K. Patra
24/7/19

H. K. Tola
24.7.19

A. K. Saha
24.07.19

Generic Elective Papers (GE) (Minor-Physics) for other Departments/Disciplines: (Credit: 06 each)

Depending on their requirements, Universities may choose 2 (two) GE subjects with 2 papers from each subject or only one GE subject with 4 papers from it.

Two papers GE subject will be :

- ✓ 1. **GE-I** (Mechanics & Properties of matter, Oscillation & Waves, Thermal Physics, Electricity and Magnetism & Electronics) + Lab
- ✓ 2. **GE-II** (Optics, Special Theory of Relativity, Atomic Physics, Quantum Mechanics and Nuclear Physics)+ Lab

A student who chooses to read only Physics subject GE will take 4 DSC papers of the Pass Course as below

1. **GE-I** as **DSC-1**(Mechanics)+ Lab
2. **GE-II** as **DSC-2**,(Electricity, Magnetism & Emt))+ Lab
3. **GE-III** as **DSC-3**, (Thermal Physics & Stastical Mechanics))+ Lab
4. **GE-IV** as **DSC-4** (Waves And Optics))+ Lab

(GE-I same paper as DSC-1, GE-II same as DSC-2 ,GE-III same as DSC-3, GE-IV same as DSC-4)

P. Pachera
24/7/19

H. K. Toke
24/7/19

Sulatra
24/7/19

P. S. S. S.
24/7/19

PHYSICS

HONOURS PAPERS:

Core course – 14 papers

Discipline Specific Elective – 4 papers (out of the 5 papers suggested)

Generic Elective for Non Physics students – 4 papers. In case University offers 2 subjects as GE, then papers 1 and 2 will be the GE paper.

Marks per paper –

For practical paper: Midterm : 15 marks, End term : 60 marks, Practical- 25 marks

For non practical paper: Midterm : 20 marks, End term : 80 marks

Total – 100 marks Credit per paper – 6

Teaching hours per paper –

Practical paper-40 hours theory classes + 20 hours Practical classes

Non Practical paper-50 hours theory classes + 10 hours tutorial

CORE PAPER-1

MATHEMATICAL PHYSICS-I

The emphasis of course is on applications in solving problems of interest to physicists. The students are to be examined entirely on the basis of problems, seen and unseen.

UNIT-I

Calculus -I: Plotting of functions, Intuitive ideas of continuous, differentiable functions and plotting of curves, Approximation: Taylor and binomial series (statements only), First Order Differential Equations and Integrating Factor, Second Order Differential equations: Homogeneous Equations with constant coefficients, Wronskian and general solution, Statement of existence and Uniqueness Theorem for Initial Value Problems, Particular Integral.

P. Saha
24/7/19

Su. Patra
24/7/19

H. K. Toke
24.7.19

P. B. B. B.
24/7/19

P. Saha
24.07.19

UNIT-II

Calculus-II: Calculus of functions of more than one variable: Partial derivatives, exact and inexact differentials. Integrating factor, with simple illustration, Constrained Maximization using Lagrange Multipliers,

Vector algebra: Recapitulation of vectors: Properties of vectors under rotations. Scalar product and its invariance under rotations, Vector product, Scalar triple product and their interpretation in terms of area and volume respectively, Scalar and Vector fields.

UNIT-III

Orthogonal Curvilinear Coordinates: Orthogonal Curvilinear Coordinates, Derivation of Gradient, Divergence, Curl and Laplacian in Cartesian, Spherical and Cylindrical Coordinate Systems, Comparison of velocity and acceleration in cylindrical and spherical coordinate system

Dirac Delta function and its properties: Definition of Dirac delta function. Representation as limit of a Gaussian function and rectangular Function, Properties of Dirac delta function.

UNIT-IV

Vector Differentiation: Directional derivatives and normal derivative, Gradient of a scalar field and its geometrical interpretation, Divergence and curl of a vector field, Del and Laplacian operators, Vector identities

Vector Integration: Ordinary Integrals of Vectors, Multiple integrals, Jacobian, Notion of infinitesimal line, surface and volume elements, Line, surface and volume integrals of Vector fields, Flux of a vector field, Gauss' divergence theorem, Green's and Stokes Theorems and their applications (no rigorous proofs)

Text Books:

1. Mathematical Methods for Physicists, G.B. Arfken, H.J. Weber, F.E. Harris (2013, 7th Edn., Elsevier)
2. Advanced Engineering Mathematics, Erwin Kreyszig (Wiley India)

Reference books:

1. Mathematical Physics C. Harper (Prentice Hall India)

P. Palena
24/7/19

S. K. Patra
24/7/19

H. K. Talle
24.7.19

K. S. Sub
24/7/19

2. Complex Variable: Schaum's Outlines Series M. Spiegel (2nd Edition , McGraw Hill Education)
3. Complex variables and applications, J. W. Brown and R.V.Churchill
Mathematical Physics, Satya Prakash (SultanChand)
4. Mathematical Physics, B. D. Gupta (4th edition, Vikas Publication)
Mathematical Physics and Special Relativity, M. Das, P.K. Jena and B.K.Dash (Srikrishna Prakashan)
5. Mathematical Physics–H.K.Dass, Dr. Rama Verma (S. ChandPublishing)

CORE PAPER I LAB:

The aim of this Lab is not just to teach computer programming and numerical analysis but to emphasize its role in solving problems in Physics.

- Highlights the use of computational methods to solve physical problems
- The course will consist of lectures (both theory and practical) in the Lab
- Evaluation done not on the programming but on the basis of formulating the problem
- Aim at teaching students to construct the computational problem to be solved
- Students can use any one operating system Linux or Microsoft Windows

Introduction and Overview: Computer architecture and organization, memory and Input/output devices.

Basics of scientific computing: Binary and decimal arithmetic, Floating point numbers, algorithms, Sequence, Selection and Repetition, single and double precision arithmetic, underflow and overflow emphasize the importance of making equations in terms of dimensionless variables, Iterative methods. Algorithm

Errors and error Analysis: Truncation and round off errors, Absolute and relative errors, Floating point computations. Systematic and Random Errors, Propagation of Errors, Normal Law of Errors, Standard and Probable Error.

Review of C and C++ Programming: Introduction to Programming, constants,

P. Patra
24/7/19

S. K. Patra
24/7/19

H. K. Toke
24.7.19

A. Das
24.07.19

R. S. Das
24/7/19

variables and Fundamentals data types, operators and Expressions, I/O statements, scanf and printf, c in and c out, Manipulators for data formatting, Control statements (decision making and looping statements) (If Statement, IfelseStatement, NestedIfstructure, ElseIfStatement, Ternaryoperator, Goto Statement. Switch Statement. Unconditional and Conditional Looping. While Loop. Do-While Loop. FOR Loop. Break and Continue Statements. Nested Loops), Arrays (1D and 2D) and strings, user defined functions, Structures and Unions, Idea of classes and objects

Programs: Sum and average of a list of numbers, largest of a given list of numbers and its location in the list, sorting of numbers in ascending descending order, Binary search

Random number generation: Area of circle, area of square, volume of sphere, value of π .

Reference Books:

1. Introduction to Numerical Analysis, S.S. Sastry, 5th Edn., 2012, PHI Learning Pvt. Ltd.
2. Schaum's Outline of Programming with C++. J. Hubbard, 2000, McGraw-Hill Pub.
3. Numerical Recipes in C: The Art of Scientific Computing, W.H. Press et al, 3rd Edn. 2007, Cambridge University Press.
4. A first course in Numerical Methods, U.M. Ascher and C. Greif, 2012, PHI Learning.
5. Elementary Numerical Analysis, K.E. Atkinson, 3rd Edn., 2007, Wiley India Edition.
6. Numerical Methods for Scientists and Engineers, R.W. Hamming, 1973, Courier Dover Pub.
7. An Introduction to computational Physics, T. Pang, 2nd Edn., 2006, Cambridge Univ. Press.

P. Pachera
24/7/19

S. K. Patra
24/7/19

H. K. Patra
24.7.19

R. B. Patra
24/7/19

CORE PAPER-II
MECHANICS

UNIT-I

Rotational Dynamics: Centre of Mass, Motion of CoM, Centre of Mass and Laboratory frames, Angular momentum of a particle and system of particles, Principle of conservation of angular momentum, Rotation about a fixed axis, Moment of Inertia, Perpendicular and Parallel Axis Theorems, Routh Rule, Calculation of moment of inertia for cylindrical and spherical bodies, Kinetic energy of rotation, Eulers Equations of Rigid Body motion, Motion involving both translation and rotation. Moment of Inertia of a Flywheel.

Non-Inertial Systems: Non-inertial frames and fictitious forces, Uniformly rotating frame, Laws of Physics in rotating coordinate systems, Centrifugal force, Coriolis force and its applications.

UNIT-II Elasticity: Relation between Elastic constants, Twisting torque on a Cylinder or Wire, Bending of beams, External bending moment, Flexural rigidity, Single and double cantilever

Fluid Motion: Kinematics of Moving Fluids: Poiseuilles Equation for Flow of a Liquid through a Capillary Tube, Surface tension, Gravity waves and ripple

Viscosity: Poiseuilles Equation for Flow of a Liquid with corrections.

UNIT-III Gravitation and Central Force Motion: Law of gravitation, Gravitational potential energy, Inertial and gravitational mass, Potential and field due to spherical shell and solid sphere, Motion of a particle under a central force field, Two-body problem and its reduction to one-body problem and its solution, Differential Equation of motion with central force and its solution, The first Integrals (two), Concept of power Law Potentials, Keplers Laws of Planetary motion, Satellites: Geosynchronous orbits, Weightlessness, Basic idea of global positioning system (GPS), Physiological effects on astronauts.

P. Acharya
24/7/19

S. K. Patra
24/7/19

H. K. Tole
24.7.19

A. K. Patra
24.07.19

P. K. Bala
24/7/19

UNIT-IV

Oscillations: Simple Harmonic Oscillations. Kinetic energy, potential energy, total energy and their time-average values. Damped oscillation. Equation of motion and solution (cases of oscillatory, critically damped and overdamped) Forced oscillations: Transient and steady states; Resonance, sharpness of resonance; power dissipation and Quality Factor, Bar Pendulum, Kater's Pendulum

Special Theory of Relativity: Michelson-Morley Experiment and its outcome, Postulates of Special Theory of Relativity, Lorentz Transformations, Simultaneity and order of events, Lorentz contraction, Time dilation, Relativistic transformation of velocity, Frequency and wave number, Relativistic addition of velocities, Variation of mass with velocity, Massless Particles, Mass-energy Equivalence, Relativistic Doppler effect, Relativistic Kinematics, Transformation of Energy and Momentum.

Text Books:

1. Mechanics, D.S. Mathur (S. Chand Publishing)
2. Introduction to Special Relativity, R. Resnick (John Wiley)

Reference Books:

1. Introduction to Mechanics Daniel Klapner and Robert Kolenkow, McGrawHill.
2. Mechanics by K.R Simon
3. Mechanics, Berkeley Physics, vol.1, C.Kittel, W. Knight, et al (Tata McGraw-Hill)
4. Physics, Resnick, Halliday and Walker (8/e.2008, Wiley)
5. Theoretical Mechanics-M.R. Spiegel (Tata McGrawHill).
6. Feynman Lectures, Vol. I, R.P.Feynman, R.B.Leighton, M.Sands (Pearson)
7. Mechanics-M.Das, P.K.Jena and R.N. Mishra (Srikrishna Publications)

P. Pradhan
24/7/19

S. K. Patra
24/7/19

J. K. Saha
24.7.19

A. B. Saha
24/7/19

CORE PAPER-II LAB

(minimum 5 experiments are to be done):

1. To study surface tension by capillary rise method
2. To determine the height of a building using a Sextant.
3. To study the Motion of Spring and calculate (a) Spring constant, (b) g and (c) Modulus of rigidity.
4. To determine the Moment of Inertia of a Flywheel.
5. To determine Coefficient of Viscosity of water by Capillary Flow Method (Poiseuilles method).
6. To determine the Modulus of Rigidity of a Wire by Maxwellsneedle.
7. To determine the value of g using BarPendulum.
8. To determine the value of g using KatersPendulum

Reference Books:

1. Advanced Practical Physics for students, B. L. Flint and H.T. Worsnop, 1971, AsiaPublishing House
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
3. A Text Book of Practical Physics, I.Prakash and Ramakrishna, 11thEdn, 2011, Kitab Mahal

CORE PAPER-III

ELECTRICITY AND MAGNETISM

UNIT-I

Electric Field and Electric Potential

Electric field: Electric field lines, Electric flux, Gauss Law with applications to charge distributions with spherical, cylindrical and planar symmetry, Conservative nature of Electrostatic Field. Electrostatic Potential, Potential and Electric Field of a dipole, Force and Torque on a dipole, Potential calculation in different simple cases, Laplace and Poisson equations, The Uniqueness Theorem,

P. Mahera
24/7/19

R. K. Patra
24/7/19

A. K.
24.07.19

H. K. Tol
24.7.19

M. B. B. B.
24/7/19

Method of Images and its application to (1) Plane Infinite Sheet and (2) Sphere.

Electrostatic energy of system of charges, Electrostatic energy of a charged sphere, Conductors in an electrostatic field, Surface charge and force on a conductor.

UNIT-II

Magnetic Field: Magnetic Force, Lorentz Force, Biot Savarts Law, Current Loop as a Magnetic Dipole and its Dipole Moment (analogy with Electric Dipole), Amperes Circuital Law and its application to (1) Solenoid (2) Toroid (3) Helmholtz coil, Properties of B : curl and divergence, Vector Potential, Ballistic Galvanometer: Torque on a current Loop, Current and Charge Sensitivity, Electromagnetic damping, Logarithmic damping, CDR.

UNIT-III

Dielectric Properties of Matter: Electric Field in matter, Polarization, Polarization Charges, Electrical Susceptibility and Dielectric Constant, Capacitor (parallel plate, spherical, cylindrical) filled with dielectric, Displacement vector D , Relations between E , P and D , Gauss Law in dielectrics. Magnetic Properties of Matter: Magnetization vector (M), Magnetic Intensity (H), Magnetic Susceptibility and permeability, Relation between B , H , M , Ferromagnetism, B - H curve and hysteresis.

Electromagnetic Induction: Faradays Law, Lenzs Law, Self Inductance and Mutual Inductance, Reciprocity Theorem, Energy stored in a Magnetic Field, Introduction to Maxwells Equations

UNIT-IV

Electrical Circuits: AC Circuits: Kirchhoffs laws for AC circuits, Complex Reactance and Impedance, Series LCR Circuit: (1) Resonance (2) Power Dissipation (3) Quality Factor, (4) Band Width, Parallel LCR Circuit.

Network theorems: Ideal Constant-voltage and Constant-current Sources,

P. Pachera
24/7/19

Su. Patra
24/7/19

Air Toke
24-7-19

K. D. Saha
24/7/19

Network Theorems: Thevenin theorem, Norton theorem, Superposition theorem, Reciprocity theorem, Maximum Power Transfer theorem, Applications to DC circuits. Transient Currents Growth and decay of current in RC and LR circuits.

Text Books:

1. Introduction to Electrodynamics – D.J. Griffiths (Pearson, 4th edition, 2015)
2. Foundations of Electromagnetic Theory-Ritz and Milford (Pearson)

Reference Books:

1. Classical Electrodynamics, J. D. Jackson (Wiley).
2. Electricity and Magnetism D. C. Tayal (Himalaya Publishing house)
3. Electricity, Magnetism and Electromagnetic Theory- S. Mahajan and Choudhury (Tata McGraw Hill)
4. Feynman Lectures Vol.2, R. P. Feynman, R. B. Leighton, M. Sands (Pearson)
5. Electricity and Magnetism, J. H. Fewkes and J. Yarwood. Vol. I (Oxford Univ. Press)

CORE PAPER-III

LAB (minimum of 6 experiments are to be done)

Use a Multimeter for measuring (a) Resistances, (b) AC and DC Voltages, c)DC Current, (d) Capacitances, and (e) Checking electricalfuses.

1. To study the characteristics of a series RCCircuit.
2. To determine an unknown Low Resistance using Potentiometer.
3. To determine an unknown Low Resistance using Carey Fosters Bridge. To compare capacitances using DeSautysbridge.
4. Measurement of field strength B and its variation in a solenoid (determine dB/dx)
5. To verify the Thevenin and Norton theorems.

P. Acharya
24/7/19

R. K. Patra
24/7/19

R. B.
24.07.19

H. K. Toki
24.7.19

S. K. Das
24/7/19

6. To determine self inductance of a coil by Andersons bridge.
7. To study response curve of a Series LCR circuit and determine its (a) Resonant frequency, (b) Impedance at resonance, (c) Quality factor Q, and (d) Band width.
8. To study the response curve of a parallel LCR circuit and determine its (a) Antiresonance frequency and (b) Quality factor Q.

Reference Books:

1. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House
2. A Text Book of Practical Physics, I. Prakash and Ramakrishna, 11th Ed., 2011, Kitab Mahal
3. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
4. A Laboratory Manual of Physics for undergraduate classes, D.P. Khandelwal, 1985, Vani Pub.

CORE PAPER-IV: WAVES AND OPTICS

UNIT - I

Geometrical optics : Fermats principle, reflection and refraction at plane interface, Matrix formulation of geometrical Optics, Cardinal points and Cardinal planes of an optical system, Idea of dispersion, Application to thick Lens and thin Lens, Ramsden and Huygens eyepiece. **Wave Optics :** Electromagnetic nature of light. Definition and properties of wave front Huygens Principle. Temporal and Spatial Coherence.

UNIT - II

Wave Motion : Plane and Spherical Waves, Longitudinal and Transverse Waves, Plane Progressive (Traveling) Waves, Wave Equation, Particle and Wave Velocities, Differential Equation, Pressure of a Longitudinal Wave, Energy Transport, Intensity of Wave. Superposition of two perpendicular Harmonic Oscillations : Graphical and

Prakasha
24/7/19

Su Patra
24/7/19

AK Te
24.7.19

AK Te
24/7/19

Analytical Methods, Lissajous Figures (1:1 and 1:2) and their uses, Superposition of N harmonic waves.

UNIT- III

Interference : Division of amplitude and wave front, Youngs double slit experiment, Lloyds Mirror and Fresnels Bi-prism, Phase change on reflection: Stokes treatment, Interference in Thin Films: parallel and wedge-shaped films, Fringes of equal inclination (Haidinger Fringes), Fringes of equal thickness (Fizeau Fringes), Newtons Rings: Measurement of wavelength and refractive index. Interferometer : Michelsons Interferometer-(1) Idea of form of fringes (No theory required), (2) Determination of Wavelength, (3) Wavelength Difference, (4) Refractive Index, and (5) Visibility of Fringes, Fabry-Perot interferometer.

UNIT - IV

Fraunhofer diffraction: Single slit, Circular aperture, Resolving Power of a telescope, Double slit, Multiple slits, Diffraction grating, Resolving power of grating. Fresnel Diffraction: Fresnels Assumptions, Fresnels Half-Period Zones for Plane Wave, Explanation of Rectilinear Propagation of Light, Theory of a Zone Plate: Multiple Foci of a Zone Plate, Fresnels Integral, Fresnel diffraction pattern of a straight edge, a slit and a wire.

Text Books:

1. A text book of Optics N. Subrahmanyam and Brij Lal (S. Chand Publishing)
2. Optics - Ajoy Ghatak (McGraw Hill)

Reference Books:

1. Optics-E. Hecht (Pearson)
2. Fundamentals of Optics-F. A. Jenkins and H. E. White (McGraw-Hill)
3. Geometrical and Physical Optics R. S. Longhurst (Orient Blackswan)
4. The Physics of Vibrations and Waves-H. J. Pain (John Wiley)
5. Optics P. K. Chakrabarty

P. Acharya
24/7/19

S. K. Patra
24/7/19

H. K. Tole
24.7.19

Ar
24.07.19

A. S. Datta
24/7/19

6. Principles of Optics - Max Born and Emil Wolf (Pergamon Press)
7. The Physics of Waves and Oscillations - N.K. Bajaj (McGraw Hill)

CORE PAPER-IV LAB

(minimum 5 experiments are to be done)

1. To determine the frequency of a tuning fork by Melde's experiment and verify $2 T \lambda w$.
2. To plot the I-D curve and to determine the refractive index of a prism
3. To determine refractive index of the material of a prism using sodium source.
4. To determine the dispersive power and Cauchy constants of the material of a prism using mercury source.
5. To determine wavelength of sodium light using Newton's Rings.
6. To determine wavelength of (1) Na source and (2) spectral lines of Hg source using plane diffraction grating.
7. To determine dispersive power and resolving power of a plane diffraction grating.

Reference Books:

1. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House
2. A Text Book of Practical Physics, I. Prakash and Ramakrishna, 11th Ed., 2011, Kitab Mahal
3. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
4. A Laboratory Manual of Physics for undergraduate classes, D. P. Khandelwal, 1985, Vani

CORE PAPER-V

MATHEMATICAL PHYSICS-II

P. Prakash
24/7/19

S.K. Patra
24/7/19

H.K. Tolak
24.7.19

A.P. Bhatnagar
24/7/19

GENERIC ELECTIVE (GE)

Generic Elective Paper I

(Mechanics and Properties of matter, Oscillation and Waves, Thermal Physics, Electricity and Magnetism and Electronics)

UNIT-I

Mechanics and Properties of Matter

Moment of Inertia Parallel axis and perpendicular axis theorem, M.I. of a Solid sphere and Solid cylinder, Gravitational potential and field due to a thin spherical shell and a solid sphere at external points and internal points, Relation among elastic constants, depression at free end of a light cantilever, Surface tension, pressure, difference across a curved membrane, viscous flow, Poiseuille's formula.

UNIT-II

Oscillation and Waves

Simple harmonic motion, damped harmonic motion, under damped, over damped and critically damped motion, Forced vibration, Resonance, Wave equation in a medium, Velocity of Longitudinal waves in an elastic medium and velocity of transverse wave in a stretched string, Composition of SHM, Lissajous figures for superposition of two orthogonal simple harmonic vibrations (a) with same frequency, (b) frequency with 2:1.

UNIT-III

Thermal Physics

Entropy, change in entropy in reversible and irreversible process, Carnot engine and its efficiency. Carnot Theorem, Second law of thermodynamics, Kelvin-Planck,

P. Pachera
24/7/19

S. K. Patra
24/7/19

J. K. Tale
24.7.19

Bev
24.07.19

Aluq
24/7

Clausius formula. Thermal conductivity, differential equation for heat flow in one dimension, Maxwell thermodynamic relation (statement only), Clausius Clapeyron equation, Black body radiation, Planck radiation formula (Noderivation).

UNIT-IV

Electricity and Magnetism

Gauss law of electrostatics, use of Gauss law to compute electrostatic field due to a linear charge distribution, Magnetic induction B, Lorentz force law, Biot Savarts law, Magnetic induction due to long straight current carrying conductor, and in the axis of a current carrying circular coil, Amperes Circuital law, its differential form, The law of electromagneticequations, its differential and integral form, Maxwells electro-magnetic equations and their physical significance, Growth and decay of currents in LR and RC circuits, time constant, alternating currents in RC, RL and LCR circuits, impedance, power factor, resonance.

P-type and N-type semiconductors, PN-Junction as rectifier, Half wave and Full wave rectifiers (Bridge type), efficiency, ripple factor, use of RC, LC, and filters, working of PNP and NPN transistors, transistor configurations in CE and CB circuits and relation between α and β . JFET, its operation and characteristics of V-I curve.

Text Books:

1. Properties of Matter D.S. Mathur (S. ChandPublication).
2. Heat and Thermodynamics A.B. Gupta and H.B. Ray (New Central BookAgency).
3. A Text Books book of oscillations, waves and acoustics(5thed.)M. Ghosh and D. Bhattacharya (S. ChandPublication).
4. Electricity and magnetism- R. Murugesan (S.ChandPublishing)
5. Fundamentals of Electronics-Raskhit and Chattopadhyay (New age InternationalPublication)

Reference Books:

Sk Patra
24/7/19

H. K. Tola
24.7.19

Poojara
24/7/19

1000
24/7/19

- in one
ron
1. Physics of Degree students Vol.I M. Das, P.K. Jena etal (Sri krishna Prakashan).
 2. Physics of Degree students Vol.II M. Das, P.K. Jena etal (Sri krishna Prakashan).
 3. Waves and Oscillations (2nd ed) N. Subramaniam and Brij Lal (Vikas Publications)
 4. A Text Books book of Sound (2nd ed) - N. Subramaniam and Brij Lal (S. ChandPublications)

Generic Elective Paper I Lab-

(minimum 6 experiments are to be done)

1. To determine the moment of inertia of a flywheel.
2. To determine the Young's modulus Y of a wire by Searl's method.
3. To determine the modulus of rigidity of a wire by Maxwell's needle/Torsion Pendulum (Dynamic method).
4. To determine g by bar pendulum.
5. To determine the value of Y of a rubber by using travelling microscope.
6. To determine the Rigidity of modulus by static method.
7. To determine the frequency of a telescope by using Sonometer.
8. Verification of Laws of Vibration of a string by using Sonometer.

TEXT BOOKS:

1. To compare capacitances using DeSauty bridge.
2. To determine the Law of resistance by using Foster bridge.
3. Compare the specific heat of two liquids by method of Cooling.

Reference Books:

1. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House
2. A Laboratory Manual of Physics for Undergraduate Classes, D.P. Khandelwal (1985), Vani Publication
3. A Text Books book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition (2011), Kitab Mahal, New Delhi

P. Patra
24/7/19

S. Patra
24/7/19

H.K. Tola
24.7.19

R. Patra
24.07.19

R. Patra
24/7/19

Generic Elective Paper -II

(Optics, Special Theory of Relativity, Atomic Physics, Quantum Mechanics and Nuclear Physics)

UNIT-I

Optics-I: Elementary ideas of monochromatic aberrations and their minimization, chromatic aberration, achromatic combination, Theory of formation of primary and secondary rainbow, condition of interference, coherent sources, Youngs double slit experiment, biprism and measurement of wave length of light of by it, color of thin films and Newtons rings, Fresnel and Fraunhofer diffraction, diffraction by single slit plane transmission grating.

Optics-II : Electromagnetic nature of light, polarized and unpolarized light, polarization by reflection and refraction, Brewsters Law, Maules Law, Double refraction, Ordinary and extraordinary rays.

UNIT-II Atomic Physics

Inadequacy of classical physics, brief outline of Rayleigh Jeans theory and Plancks quantum theory of radiation, particle nature of electromagnetic radiation photo electric effect, Compton effect, dual nature of radiation, wave nature of particles, de-Broglie hypothesis, matter wave, wave-particle duality, Davisson-Germer experiment.

Bohrs theory of Hydrogen atom, explanation of Hydrogen Spectra, correction for finite mass of the nucleus, Bohrs correspondence principle, limitations of Bohrs theory, Discrete energy, exchange by atom Frank Hertz experiment.

UNIT-III

Quantum Mechanics : Heisenbergs Uncertainty relation, Time dependent Schrodingers wave equation in one dimension and three dimensions, The physical interpretation of the wave function, Probability density and probability current

S. K. Patra
24/7/19

A. K. Tolak
24.7.19

P. Prakash
24/7/19

1980
24/7

density, Equation of continuity, Normalization of the Wave function, Expectation value of an observable, Ehrenfests theorem. Time independent Schrodingers wave equation in one dimension particle in a box, energy eigen values and eigenfunctions.

UNIT-IV

Nuclear Physics : Properties of the nucleus Charge, Size, Spin, Magnetic Moment, Mass, Mass defect, Binding energy, Packing fraction, Nuclear force and its characteristics features, Radioactive decay laws, average life, half life, nuclear fission, nuclear fusion, Linear accelerators, and cyclotron.

Relativity: Galilean transformation, Newtonian relativity and its limitation, MichelsonMorleyexperimentanditsconsequence,postulatesofspecialtheory of relativity. Lorentz transformation, length contraction, time dilation, relativistic mass and momentum, mass energyrelation.

Text Books:

1. University Physics, H. D. Young, R. A. Freedman(Person)
2. Fundamentals of Physics, Resnick, Halliday, Walker(Wiley)

Reference Books :

1. A Text Books book of Optics N.Subrahmanyam and Brij Lal (S.Chand Publishing)
2. Introduction to Special Relativity-R. Resnick (JohnWiley)
3. ConceptsofModernPhysics ArthurBeiser(McGrawHill)
4. Modern Physics H.S. Mani and G.K.Mehta

Generic Elective Paper II LAB

(minimum6experimentsaretobedone):

1. Determiration of E.C.E. of a Copper by taking 3 readings.
2. DetermirationofRefractiveindexofthematierialofaprismusingSodium light.
3. Todeterminethewavelengthoflightusingplanediffractiongrating.

P. Prachara
24/7/19

S. K. Patra
24/7/19

H. K. Toke
24.7.19

Rev
24.07.19

(Signature)
24/7/19

4. To determine the wavelength of light using Newton's ring.
5. Determination of refractive index of (a) glass and (b) liquid by using travelling microscope.
6. To plot the I-D curve and to determine the refractive index of a prism
7. Determination of radius of curvature of a convex/concave mirror by using Kohlrausch's method.
8. To determine the magnifying power of a given telescope.
9. To obtain the static characteristics of a P-N-P/N-P-N transistor/ Triode Valve.
10. To determine the reduction factor of a tangent Galvanometer.
11. To study the Variation of magnetic field along the axis of a circular coil carrying current.

Reference Books:

1. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House
2. A Laboratory Manual of Physics for Undergraduate Classes, D.P. Khandelwal (1985), Vani Publication
3. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition (2011), Kitab Mahal, New Delhi

Su Parth
24/7/19

Hir Toke
24.7.19

P. Parth
24/7/19

(S) on
24/7/19