Academic Council
Item No: _____

Devrukh Shikshan Prasarak Mandal's

Nya. TATYASAHEB ATHALYE ARTS, Ved. S.R. SAPRE COMMERCE & Vid. DADASAHEB PITRE SCIENCE COLLEGE, DEVRUKH [AUTONOMOUS]

Syllabus for F.Y. B.Sc.
Program: B.Sc.
Course: Physics
Credit Based Semester and Grading System with the Effect from
Academic Year 2020-21

Syllabus for B.Sc. Physics (Theory & Practical)
As per credit based system
First Year B.Sc. 2020–21

The revised syllabus in Physics as per credit based system for the First Year B.Sc. Course will be implemented from the academic year **2020–21**

Preamble:
The systematic and planned curricula from these courses shall motivate and encourage learners to understand basic concepts of Physics.

Objectives:
• To develop analytical abilities towards real world problems
• To familiarize with current and recent scientific and technological developments
• To enrich knowledge through problem solving, hands on activities, study visits, projects etc.

Course code	Title	Credits
Semester I		
USPHT11		2
USPHT12		2
USPHP1	Practical I	2
		Total – 06
Semester II		
USPHT21		2
USPHT22		2
USPHP2	Practical II	2
		Total - 06

Semester I: Paper I

Name of the Programme	Duration	Semester	Subject
B.Sc. In Physics	Six Semesters	I	Physics
Course Code	**Title**	**Credits**	
USPHT11		2 for USPHT11	

Learning Outcomes:-

On successful completion of this course students will be able to:
1. Understand kinematical equations
2. Understand the concepts of friction and the concepts of elasticity, fluid mechanics and be able to perform calculations using them.
3. Understand the concepts of lens system, diffraction and interference.
4. Apply the laws of thermodynamics to formulate the relations necessary to analyse a thermodynamic process.
5. Demonstrate quantitative problem solving skills in all the topics covered

Unit - I **15 Lectures**

1. Physical quantities – Definitions and units

2. Functions and graphs - Graphs of linear, sin, cos, tan, and values for important angles, exponential, power, logarithmic, shfting of graph, using calculator

3. Determinants – evaluation, important properties.

4. Complex Numbers - Basics, conjugate, Euler Identity, polar representation, Division of complex numbers

5. Simple Harmonic Motion, Composition of two collinear SHMs of same period, Composition of two perpendicular SHMs of same period

Unit - II **15 Lectures**

1. Newton’s Laws of motion.

Newton’s Laws of motion, concept of inertia, momentum, Kinematical Equations.

2. Fluid Dynamics:

Equation of continuity, Bernoulli's Equation, Applications of Bernoulli's equation, streamline and turbulent flow, Concept of viscocity and coefficient of viscocity, Poiseuille's equation (without derivation)

3. Thermodynamics:

Thermodynamic systems, zeroth law, concept of heat, first law of thermodynamics, concept of ideal gas and ideal gas equation, internal energy, thermodynamic processes – relations between P, V, and T, work done, specific heats.

Unit - III **15 Lectures**

1. Electromagnetic Spectrum and Electromagnetic nature of light.

2. Refraction:

Basics of reflection, refraction, refractive index, deviation, dispersion, dispersive power, lensmaker equation, lens formula, importance of F and 2F in image formation, thick lens and cardinal points, equivalent focal length of coaxial combination of two thin lenses.

3. Lens Aberrations:

Spherical Aberration and ways to minimize it, Chromatic aberration – Axial chromatic aberration and conditions for achromatism in lenses, Ramsden eyepiece.

4. Interference of light:

Concept of division of wavefront and division of amplitude, Interference of light reflected from thin films, Wedge shaped film, Newton's Rings.

References:

1. Halliday, Resnick and Walker, Fundamental of Physics (extended) – (6th Ed.), John Wiley and Sons.
2. H. C. Verma, Concepts of Physics – (Part–I), 2002 Ed. BharatiBhavan Publishers.
3. Brijlal,Subramanyam and Avadhanulu A Textbook of Optics, 25th revised ed.(2012) S. Chand
4. Brijlal, Subramanyam and Hemne, Heat Thermodynamics and Statistical Physics, S Chand, Revised, Multi-coloured,2007 Ed.
5. Jenkins and White, Fundamentals of Optics by (4th Ed.), McGraw Hill International.
6. D S Mathur, Element of Properties of Matter, S Chand & Co.
7. C L Arora, Optics, S Chand.
8. Hans and Puri, Mechanics –, 2nd Ed. Tata McGraw Hill

Semester I: Paper II

Name of the Programme	Duration	Semester	Subject
B.Sc. In Physics	Six Semesters	I	Physics
Course Code	**Title**	**Credits**	
USPHT12		2 for USPHT12	

Learning Outcomes:
After successful completion of this course students will be able to
1. Understand nuclear properties and nuclear behaviour.
2. Understand the type isotopes and their applications.
3. Understand in detail basics of electronics and digital electronics
4. Demonstrate and understand the quantum mechanical concepts.
5. Demonstrate quantitative problem solving skills in all the topics covered.

Unit I **15 lectures**

1. Electrostatics: Coulomb's Law, electric lines of force, Electric Field, Electric Potential, Energy stored in a discrete charge distribution, Problems based on discrete charge distribution.
2. Magnetostatics: Biot Savart's Law, magnetic lines of force, Lorentz force, applications

3. Faraday's law

Unit II **15 lectures**

Basic concepts – electron volt, energy/velocity gained by a charged particle accelerated by a PD, X-rays – production, X-ray spectrum, properties and Applications of X-Rays.

Concept of photon, photoelectric effect

Rutherford experiment, concept of nucleus, isotope, isobar, isotone, amu, Basic properties of nuclei, Composition, Charge, Size, density of nucleus, Mass defect and Binding energy, Packing fraction. Concept of natural radioactivity, properties of α, β, γ-rays, law of radioactive decay, nuclear reactions.

Unit III **15 lectures**

1. Digital electronics : Logic gates, Voltage levels of logic gates, NAND / NOR as universal building blocks. EX-OR gate: logic expression, symbol, truth table, implementation using basic gates, Boolean algebra, De-Morgan laws, Sum-of-products (SOP) and product-of-sums (POS) methods and its realization, parity generator/checker
2. Binary, Decimal and Hexadecimal number system and interconversion (without fractional numbers), Binary addition/subtraction

References:

1. D. Chattopadhyay, P C Rakshit , Electricity and Magnetism 7th Ed. New Central Book agency
2. David J. Griffiths : Introduction to Electrodynamics, Prentice Hall India (EEE) 3rd Ed.
3. BSS: N Subrahmanyam, Brijlal and Seshan, Atomic and Nuclear Physics Revised Ed. Reprint 2012, S. Chand
4. Arthur Beiser, Perspectives of Modern Physics : Tata McGraw Hill
5. A P Malvino, Digital Principles and Applications: Tata McGraw Hill.
6. VKM: V K Mehta and R Mehta Electronics Principals, MulticolouredRevised 11th Ed. reprint in 2012 ,S Chand.
7. Tokhiem, Digital electronics, 4thed, McGraw Hill International Edition

Experiments

1. Plotting of graphs – bell shaped curve, simple straight line, Y/X-intercept, polar graphs
2. Vernier, micrometer, Travelling Microscope, angle measurement
3. DMM, Basic devices, components and values
4. Density of various liquids
5. Torsional Oscillations
6. Poiseulle's Method
7. Image formation by a lens
8. Newton's Rings
9. Frequency of AC mains
10. Basic logic gates
11. Universal building blocks
12. CVAT

Demonstrations

1. Use of scientific calculator
2. f by Autocollimation, pendulum time period
3. study of optical instruments – telescope, microscope and prism
4. laser experiments – reflection, refraction, TIR
5. Light experiments - Dispersion of light, biprism, Thin film colours

Semester II: Paper I

Name of the Programme	Duration	Semester	Subject
B.Sc. In Physics	Six Semesters	II	Physics
Course Code	**Title**	**Credits**	
USPHT21		2 for USPHT21	

Unit I **15 lectures**

1. Scalars, Vectors, Vector algebra, Magnitude, Rectangular unit vectors, resolution / components of a vector, Unit vector, Problems based on Vector algebra.

2. Scalar, Vector, scalar triple and vector triple products and their properties, Projection of a vector onto another vector, concept of torque, Problems and applications based on Scalar, Vector and Triple products.

Unit II **15 lectures**

Elasticity: Review of Elastic constants Y, K, η and σ; Equivalence of shear strain to compression and extension strains. Relations between elastic constants, Couple for twist in cylinder.

Behavior of real gases and real gas equation, Van der Waal equation, Latent heat, methods of cooling – freezing mixer, Cooling by evaporation, cooling by adiabatic expansion, Concept of refrigerator

Unit III **15 lectures**

Laser : Introduction, transition between Atomic energy states (without derivation), Population Inversion, Pumping, Principle of Laser, Properties of Laser, He-Ne Laser, Application of Laser

Fibre Optics : Fibre construction, Geometry. Total Internal Reflection, Light propagation through fibres, numerical aperture. Applications of optical fibres.

Wave Motion: Definition, Wave equation and its solution (without derivation), wavelength, period, frequency, wave number, propagation constant. Types and properties of waves, Group velocity, Phase velocity, Wave intensity. Transverse waves on string.

References

1. MS:Murray R Spiegel, Schaum's outline of Theory and problems of Vector Analysis, Asian Student Edition.
2. CH**:** Charlie Harper, Introduction to Mathematical Physics , 2009 (EEE) PHI Learning Pvt. Ltd.
3. H. C. Verma, Concepts of Physics – (Part–I), 2002 Ed. Bharati Bhavan Publishers.
4. Brijlal,Subramanyam and Avadhanulu A Textbook of Optics, 25th revised ed.(2012) S. Chand
5. Modern Physics Concept and Applications – SanjeevPuri, Narosa Publication.

6. The Physics of Vibrations and Waves, H. J. Pain, 2013, John Wiley and Sons.
7.The Physics of Waves and Oscillations, N.K. Bajaj, 1998, Tata McGraw Hill.

Semester II: Paper II

Name of the Programme	Duration	Semester	Subject
B.Sc. In Physics	Six Semesters	II	Physics
Course Code	**Title**	**Credits**	
USPHT22		2 for USPHT22	

Unit I **15 lectures**

1. Basics related to electrical circuits – Ohm's law, KCL, KVL, series and parallel arrangement of resistances, etc.

2. Network Theorems – Thevenin's, Norton's, superposition and maximum power transfer theorem and related problems.

3. Transient response of circuits – Behaviour and equations of capacitor and inductor. Step responses of CR, LR circuits, time constant and its significance.

Unit II **15 lectures**

1. Radioactivity: half-life, mean life, units of radioactivity, successive disintegration and equilibriums. Carbon dating, other applications of radioisotopes (Agricultural, Medical, Industrial, Archaeological).

2. Atom models – Thomson, Rutherford and Bohr's postulates of H atom, velocity, radius and Energy of electron in nth bohr orbit, hydrogen spectrum.

3. Compton Effect, Pair production.

Matter waves, wave particle duality, Davisson-Germer.

Unit III **15 lectures**

1. Semiconductors: Semiconductors, bond structure in silicon, Intrinsic semiconductor, p and n types, temperature dependence, pn junction, depletion layer, forward and reverse bias, drift and diffusion currents.

2. Diode characteristics, Half wave, Full wave and Bridge rectifiers, Rectification efficiency and ripple, Capacitor Filter, Zener diode as voltage stabilizer.

3. BJT: Construction, doping levels and sizes of E, B and C, types and symbols, working of transistor. CB, CE and CC Configurations, Characteristics – CB and CE, current gains.

References:

1. CR: D. Chattopadhyay, P C Rakshit , Electricity and Magnetism 7th Ed. New Central Book agency.
2. TT :B.L. Theraja and A.K. Theraja , A Textbook of Electrical Technology Vol. I , S. Chand Publication.
3. VKM: V K Mehta and R Mehta Electronics Principals, MulticolouredRevised 11th Ed. reprint in 2012 ,S Chand.
4. Arthur Beiser, Perspectives of Modern Physics : Tata McGraw Hill.
5.

Experiments

1) Helmholtz Resonator
2) Flywheel
3) Y by Bending
4) Total Internal Reflection
5) Transistor CE characteristics
6) Diode Characteristics
7) Lens Combination
8) Wedge shaped film
9) Charging and Discharging of capacitor
10) De-Morgan laws
11) Thevenin's Theorem
12) Maximum Power Transfer Theorem

Demonstrations

1) Faraday's laws
2) Fiber optics
3) Transformer demo
4) Use and handling of Signal Generator
5) Use of CRO and charging discharging
6) Use of speaker as a mike
7) Demo of mutual induction
8) Magnetic lines of force
9) Demo of Mutual inductance
10) Laser beam profile