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 2019-20

Syllabus for B.Sc. Physics(Theory&Practical)
Aspercreditbasedsystem
FirstYearB.Sc.2019–2020.

The revised syllabus in Physics as per credit based system for the First Year B.Sc. Course will be implemented from the academic year **2019–2020.**

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		
ASPUSPHY101	Classical Physics, Optics and Thermodynamics	2
ASPUSPHY 102	Modern Physics and Digital Electronics	2
ASPUSPHYP 1	Practical I	2
		Total= 06
Semester II		
ASPUSPHY 201	Mathematical Physics, Optics and Wave Mechanics	2
ASPUSPHY 202	Electronics, Modern Physics and Electrostatics	2
ASPUSPHYP 2	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	
ASPUSPHY101	Classical Physics, Optics and Thermodynamics	2for USPH101	

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.Kinematical Equations, Moment of Inertia , Torque

2. Elasticity:

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

3. Fluid Dynamics:

Equation of continuity, Bernoulli's equation, applications of Bernoulli's equation, streamline and turbulent flow, lines of flow in airfoil, Poiseuille's equation(formulae only).

Unit II **15 Lectures**

1.Lens Maker's Formula (Review), magnification-lateral, longitudinal and angular. image formation in thin lens f and 2f.

2. Equivalent focal length of two thin lenses, cardinal points of thick lens, Ramsden and Huygens eyepiece.

Unit III 15 lectures

1. Photoelectric effect, Black Body (definition), black body spectrum, Wien's displacement law

2. X-Rays production and properties. Continuous and characteristic X-Ray spectra, X-Ray Diffraction, Bragg's Law, Applications of X-Rays.

3. Compton Effect, Pair production,

References:

1. Kaplan: Nuclear Physics, Irving Kaplan, 2nd Ed. Narosa Publishing House

2. SBP: Dr. S. B. Patel, Nuclear Physics Reprint 2009, New Age International

3.BSS: N Subrahmanyam, Brijlal and Seshan, Atomic and Nuclear Physics Revised Ed. Reprint 2012, S. Chand

4. Arthur Beiser, Perspectives ofModernPhysics : Tata McGraw Hill

Additional References:

1 S N Ghosal, Atomic Physics S Chand

2 S N Ghosal, Nuclear Physics 2nd ed. S Chand

Semester I: Practical I

Name of the Programme	Duration	Semester	Subject
B.Sc. in Physics	Six semesters	I	Physics
Course Code	Title	Credits	
ASPUSPHYP 1	Practical I	2for ASPUSPHYP 1	

Leaning Outcome:

On successful completion of this course students will be able to:

i) To demonstrate their practical skills.

ii) To understand and practice the skills while doing physics practical.

iii) To understand the use of apparatus and their use without fear.

iv) To correlate their physics theory concepts through practical.

v) Understand the concepts of errors and their estimation.

Semester I: Paper II

Name of the Programme	Duration	Semester	Subject
B.Sc. in Physics	Six semesters	I	Physics
Course Code	Title	Credits	
ASPUSPHY102	Modern Physics and Digital Electronics	2for USPH102	

Learning Outcomes:

After successful completion of this course students will be able to

1. Understand nuclear properties and nuclear behavior.
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 15lectures

1. Structure of Nuclei:Basic properties of nuclei, Composition, Charge, Size, Rutherford's expt. for estimation of nuclear size, density of nucleus, Mass defect and Binding energy, Packing fraction, BE/A vs A plot, stability of nuclei (N Vs Z plot) and problems.
2. Radioactivity: Radioactive disintegration concept of natural and artificial radioactivity, Properties of α, β, γ-rays, laws of radioactive decay, half-life, mean life (derivation not required), units of radioactivity, successive disintegration and equilibriums, radioisotopes. Numerical Problems.

Unit II **15 lectures**

1.DC power supply:Half wave rectifier , Full wave rectifier, Bridge rectifier, PIV and Ripple factor of full wave rectifier, Clipper and Clampers(Basic circuits only), Capacitor Filter. Zener diode as voltage stabilizer.

2.Digital electronics : Logic gates(Review), NAND and NOR as universal building blocks. EXOR gate: logic expression, logic symbol, truth table, Implementation using basic gates and its applications, Boolean algebra, Boolean theorems. De-Morgan theorems, Half adder and Full adder

3. Transistors: Basic consturctions, action, configuration CE and CB mode

3. Aberration: Spherical Aberration, Chromatic aberration

4.Interference: Interference in thin films, Fringes in Wedge shaped films, Newton's Rings

5.Diffraction

Concept of diffraction, single slit and straight edge, difference between Fresnel and Fraunhofer diffraction

Unit III **15 Lectures**

1. Behaviour of real gases and real gas equation, Van der Waal equation
2. Thermodynamic Systems, Zeroth law of thermodynamics, Concept of Heat, The first law, Non Adiabatic process and Heat as a path function, Internal energy, , Heat Capacity and specific heat, Applications of first law to simple processes, general relations from the first law, Indicator diagrams, Work done during isothermal and adiabatic processes, Worked examples, Problems

Note: A good number of numerical examples are expected to be covered during the prescribed lectures.

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. Iradov
4. Brijlal,Subramanyam and Avadhanulu A Textbook of Optics, 25th revised ed.(2012) S. Chand
5. Brijlal, Subramanyam and Hemne, Heat Thermodynamics and Statistical Physics, S Chand, Revised, Multi-coloured,2007 Ed.
6. Jenkins and White, Fundamentals of Optics by (4th Ed.), McGraw Hill International.

Additional References :

1. Thornton and Marion, Classical Dynamics – (5th Ed)
2. D S Mathur, Element of Properties of Matter, S Chand & Co.
3. R Murugeshan and K Shivprasath, Properties of Matter and Acoustics S Chand.
4. M W Zemansky and R H Dittman, Heat and Thermodynamics, McGraw Hill.
5. D K Chakrabarti, Theory and Experiments on Thermal Physics, (2006 Ed) Central books.
6. C L Arora, Optics, S Chand.
7. Hans and Puri, Mechanics –, 2nd Ed. Tata McGraw Hill

A. Regular experiments:

Sr. no	Name of the experiment
1	J by Electrical Method: To determine mechanical equivalent of heat (Radiation correction by graph method)
2	Bifilar Pendulum
3	Spectrometer: To determine of angle of Prism.
4	Y by vibrations: To determine Y Young's Modulus of a wire material by method of vibrations- Flat spiral Spring
5	To determine Coefficient of Viscosity (ç) of a given liquid by Poisseuli's Method
6	Combination of Lenses To determine equivalent focal length of a lens system by magnification method.
7	Newton's Rings To determine radius of curvature of a given convex lens using Newton's rings.
8	To study NAND and NOR gates as Universal Building Blocks
9	To study EX-OR Gate, half adder and full adder and verify their truth tables
10	To verify De Morgan's Theorems
11	To study Zener Diode as Regulator
12	To study load regulation of a Bridge Rectifier

B. Skill Experiments:

1. Use of Verniercalipers, Micrometer Screw Gauge, Travelling Microscope

2. Graph Plotting : Experimental, Straight Line with intercept, Resonance Curve etc.

3. Spectrometer: Schuster's Method

4. Use of DMM

5 Absolute and relative errors calculation

Semester II: Paper I

Name of the Programme	Duration	Semester	Subject
B.Sc. in Physics	Six semesters	II	Physics
Course Code	Title	Credits	
ASPUSPHY201	Mathematical Physics, Optics and Wave Mechanics	2for USPH201	

Learning Outcomes:

On successful completion of this course students will be able to:

1. Understand the basic mathematical concepts and applications of them in physical situations.

2. Demonstrate quantitative problem solving skills in all the topics covered.

3. Understanding optics and their applications.

Unit I **15 lectures**

1. Vector Algebra :

Vectors, Scalars, Vector algebra, Laws of Vector algebra, Unit vector, Rectangular unit vectors, Components of a vector, Scalar fields, Vector fields, Problems based on Vector algebra.

Dot or Scalar product, Cross or Vector product, Commutative and Distributive Laws, Scalar Triple product, Vector Triple product (Omit proofs). Problems and applications based on Dot, Cross and Triple products.

2. Gradient, divergence and curl:

The • Þ operator, Definitions and physical significance of Gradient, Divergence and Curl; Distributive Laws for Gradient, Divergence and Curl (Omit proofs); Problems based on Gradient, Divergence and Curl.

Unit: II **15lectures**

1. Laser : Introduction, transition between Atomic energy states (without derivation), Principle of Laser, Properties of Laser, Helium–Neon Laser, Application of Laser, Holography

2)FibreOptics : Light propagation through Fibres, Fibre Geometry, Internal reflection, Numerical Aperture, Step-Index and Graded-Index Fibres, Applications of Fibres.

Unit:III **15lectures**

1. Superposition of Collinear Harmonic oscillations: Linearity and Superposition Principle. Superposition of two collinear oscillations having (1) equal frequencies and (2) different frequencies (Beats).
2. Superposition of two perpendicular Harmonic Oscillations: Graphical and Analytical Methods. Lissajous Figures with equal an unequal frequency and their uses
3. Wave Motion: Transverse waves on string, Travelling and standing waves on a string. Normal modes of a string, Group velocity, Phase velocity, Plane waves, Spherical waves, Wave intensity.

References:

1.MS:Murray R Spiegel, Schaum's outline of Theory and problems of Vector Analysis, Asian Student Edition
2. Waves: Berkeley Physics Course, vol. 3, Francis Crawford, 2007, Tata McGraw-Hill.
3. The Physics of Vibrations and Waves, H. J. Pain, 2013, John Wiley and Sons.
4. The Physics of Waves and Oscillations, N.K. Bajaj, 1998, Tata McGraw Hill.
5. Brijlal,Subramanyam and Avadhanulu A Textbook of Optics, 25th revised ed.(2012) S. Chand

Additional References:

1. BrijLal,**N. Subrahmanyam , JivanSeshan**, Mechanics and Electrodynamics, , (S. Chand) (Revised & Enlarged ED. 2005)
2. A K Ghatak, Chua, Mathematical Physics, 1995, Macmillan India Ltd.
3. Ken Riley, **Michael Hobson and Stephen Bence, Mathematical Methods for Physics and Engineering, Cambridge (Indian edition).**
4. H. K. Dass, Mathematical Physics, S. Chand & Co.
5. Jon Mathews & R. L. Walker, Mathematical Methods of Physics: W A Benjamin Inc.

Semester II: Paper II

Name of the Programme	Duration	Semester	Subject
B.Sc. in Physics	Six semesters	II	Physics
Course Code	Title	Credits	
ASPUSPHY202	Electronics, Modern Physics and Electrostatics	2for USPH202	

Unit I : **15 lectures**

1. Alternating current theory:(Concept of L, R, and C: Review)

AC circuit containing pure R, pure L and pure C, representation of sinusoids by complex numbers, Series L-R, C-R and LCR circuits. Resonance in LCR circuit (both series and parallel), Power in ac circuit. Q-factor.

3. AC bridges: AC-bridges: General AC bridge, Maxwell,de-Sauty, Wien Bridge , Hay Bridge.

Unit II : **15 lectures**

Wave nature of particle

1 .Origin of Quantum theory, Black body (definition), , Matter waves, wave particle duality, Heisenberg's uncertainty Principle. Davisson-Germer experiment, G. P. Thompson experiment.

2. Bohr's theory in detail, correspondence, introduction of four quantum numbers

Unit III: Electrostatics and Magnetostatics **15 lectures**

1. The Electric Field : Introduction, Coulomb's Law, The Electric Field, Continuous charge Distribution, Electric Potential, Introduction to Potential, Comments on Potential, The Potential of a Localized Charge Distribution

2. Work and Energy in Electrostatics: The Work Done to Move a charge, The Energy of a Point Charge Distribution

3. Magnetostatics: Magnetic Fields

4. The Biot Savart Law: Steady Currents, The Magnetic Field of a Steady Current Helmholtz coil and solenoid.

References :

CR: D. Chattopadhyay, P C Rakshit , Electricity and Magnetism 7th Ed. New Central Book agency.

TT :B.L. Theraja and A.K. Theraja , A Textbook of Electrical Technology Vol. I , S. Chand Publication

BN :Boylestad and Nashelsky, Electronic devices and Circuit Theory: 7th edition, Prentice Hall of India.

David J. Griffiths : Introduction to Electrodynamics, Prentice Hall India (EEE) 3rd Ed.

SEMESTER II : Practical II

Name of the	Duration	Semester	Subject

Programme			
B.Sc. in Physics	Six semesters	II	Physics
Course Code	Title	Credits	
ASPUSPHYP 2	Practical II	2	

Leaning Outcome:

i) To understand and practice the skills while doing physics practical.

ii) To understand the use of apparatus and their use without fear.

iii) To correlate their physics theory concepts through practical.

iv) Understand the concepts of errors and their estimation.

A) Regular experiments:

Sr. No	Name of Experiments
1	Flywheel
2	Torsional Oscillation: To determine modulus of rigidity ç of a material of wire by torsional oscillations
3	Spectrometer: To determine refractive index ì of the material of prism
4	To study Thermistor characteristic Resistance vs Temperature
5	Wedge Shaped Film
6	LR Circuit: To determine the value of given inductance and phase angle
7	CR Circuit: To determine value of given capacitor and Phase angle
8	Frequency of AC Mains: To determine frequency of AC mains
9	LCR series Resonance: To determine resonance frequency of LCR series circuit.
10	LDR Characteristics: To study the dependence of LDR resistance on intensity of light.
11	Surface Tension/ Angle of contact
12	Constant volume/constant pressure

B) List of Demo-experiments: (Min. four)

1. Angular Momentum conservation (Rotating Platform)
2. Light dependent switch
3. Laser beam divergence, Intensity
4. Use of Oscilloscope
5. Charging and discharging of a capacitor