

# DRAFT SYLLABUS UNDER AUTONOMY

## PHYSICS

**SEMESTER I**

**COURSE : S.PHY.1.01**

**MECHANICS AND SOUND**

**[ 45 LECTURES]**

### Learning Objectives :

To understand properties of matter :

- (1) Dynamics of rigid bodies
- (2) Motion in fluids
- (3) Propagation of Sound

### Unit I:

[15 Lectures]

1. Newton's laws of motion, Inertial and non-inertial frames, limitations of Newtonian mechanics.

- References : (1) Physics by Resnick and Halliday 1966 : 5-1 to 5-6, 5-10, 6-5  
(2) Concepts of Physics-I : H.C. Verma ch.5 worked examples 1-11.

2. Work done by variable force, conservative and non-conservative forces, Potential energy, work-K.E. theorem.

- References : (1) Concepts of Physics-I : H.C. Verma: 8.1-8.11  
(2) Physics by Resnick and Halliday 1966 : Ch. 7

3. Mechanics of single particle: falling body with air resistance, projectile with air resistance. Composition of 2 SHM's in mutually perpendicular directions.

- Reference : Concepts of Physics-I : H.C. Verma 12.11

### Unit II:

[15 Lectures]

1. Fluid mechanics, continuity equation, Bernoulli's principle, Poiseuille's equation.

- Reference : Concepts of Physics-I H. C. Verma 13.7 to 13.12

2. Elasticity, Bending moments, Cantilever, Poisson's ratio, couple per unit twist in a wire, relations connecting elastic constants.

- References : Elements of properties of matter, D.S. Mathur: 8.8 to 8.18, 8.22, 8.24, 8.29, 8.30

3. Centre of mass and moment of inertia for some regular solids (wire bent into an arc, hemisphere, cone). Compound pendulum, centre of percussion, (derivation of periodic time).

- Reference : Elements of properties of matter, D.S. Mathur 3.6

**Unit III:**

[15 Lectures]

1. Wave motion in one dimension .General solution of wave equation(no derivation) , Classification of waves, Examples of one dimensional waves : Transverse wave in a string , Longitudinal waves on rod , Pressure waves in a gas (concepts only).  
Reference : Fundamentals of vibration and waves – S.P. Puri (TMH) 6.1, 6.2, 6.5, 6.5.1,6.5.2 , 6.5.3
2. Ultrasonics : Piezoelectric effect, Production of Ultrasonic waves : Piezoelectric Crystal method , Magnetostriction method . Detection , Properties and applications of Ultrasonic waves .
3. Acoustics of Buildings : Reverberation , Sabine’s formula (without derivation ) Absorption coefficient , Acoustics of Buildings , factors affecting Acoustics of Buildings , Sound distribution in an auditorium .

**References :**

Properties of matter and Acoustics – R.Murugation and K. Shivprasath ,S.Chand & Co. Ltd.

- Additional References : (1) University Physics –Young and Freedman .  
(2) Physics for Scientist and Engineers – R.A. Serway .  
(3) Mechanics by Hans & Puri-2<sup>nd</sup> edition.

**C.I.A. Problem Solving****SEMESTER I****COURSE : S.PHY.1.02****ELECTRICITY AND ATOMIC PHYSICS****[ 45 LECTURES]****Learning Objectives :**

- (1) To study the working of D.C. and A.C. circuits with applications
- (2) To review atomic structure and atomic spectra
- (3) To understand the generation of X-Rays and Scattering

**Unit –I : D.C.Circuits**

[15Lectures]

1. Network Theorems : Superposition Theorem, Thevenin’s Theorem, Norton’s Theorem and Maximum Power Transfer Theorem(single power supply).  
C.R.:7.7 TO 7.11

2. Transient Response : LR, CR and LCR circuits

C.R.: 14.1 TO 14.3

3. Electromagnetic Measuring Instruments : Moving Coil Galvanometer and Ballistic Galvanometer.

C.R.: 12.1, 12.2, 12.4, 12.5

### **Unit II - A.C.Circuits**

[15 Lectures]

1. Alternating Current Theory : Phasor Diagrams ( j operator method) of LR, CR and LCR series and parallel circuits ,series and parallel resonance

Application: Working of Fan & Choke.

C.R.: 15.1 TO 15.10.

2. A.C. Bridge Circuits : General A.C. Bridge Circuit, Maxwell, deSauty and Wien Bridge circuits

C.R.: 15.14

### **Unit- III -Atomic Physics**

[15 Lectures]

1. Bohr atom model:-Atomic structure, electron orbits, energy structure, atomic excitation , absorption and emission spectra, correspondence Principle, effect of nuclear motion.

A.B.: 4.1 to 4.8

2. X-rays: production, continuous & characteristic spectra, Diffraction, Bragg's law

A.B. : 2.4 to 2.6

3. Compton effect , Pair production , Gravitational red shift .

A.B.: 2.7 to 2.9

### **References :**

(1) Electricity and Magnetism: By Chattopadhyay and Rakshit( C.R.)

(2) Waves and Oscillations by A.P. French (for AC theory)

(3) Concepts of Modern Physics –A. Beiser (6<sup>th</sup> Ed) Tata McGraw Hill . (A.B.)

(4) Atomic and Nuclear Physics – Gupta and Ghosh

### **C.I.A. Problem Solving**

## **SEMESTER II**

**COURSE : S.PHY.2.01**

## **HEAT AND OPTICS**

**[ 45 LECTURES]**

### **Learning Objectives :**

- (1) To study the fundamentals of Heat and Thermodynamics
- (2) To learn the difference between Geometrical, Physical and Quantum Optics

### **Unit I-** Heat

[15 Lectures]

1. Kinetic theory of gases , Mean free path , degrees of freedom , Variations of  $C_V$  with temperature , critical phenomena , Vander waal's equation ,  $RT_C/P_CV_C = 8/3$ .
2. Work done in isothermal and adiabatic processes , Adiabatic Relations I law of thermodynamics , Experimental verification of I law of thermodynamics .

**References:** (1) Basic thermodynamics –Evylen Guha (Narosa Publications )  
(2) Heat & thermodynamics by N.Subramaniam & Brij Lal

### **UNIT II**

[15 Lectures]

1. Geometrical Optics: Refraction through lenses, Comparison of thin lenses and thick lenses (Qualitative only) , Lens combination (In contact , Out of contact)
2. Aberrations :-a) Monochromatic aberration , Spherical aberration , Distortion  
b) Chromatic aberration
3. Interference of light : Interference of light in thin films , Fringes in Wedge shaped film , Newton's Rings

**Reference :** A text book of Optics – N. Subramaniam and Brij Lal , S. Chand and Co.  
2.1 to 2.11 , 2.14 , 2.15 , 3.5 to 3.11 , 3.25 to 3.28 , 4.36 , 4.37 , 8.15 to 8.25

### **UNIT III**

[15 Lectures]

1. Laser : Introduction, Principle of Laser , Properties of Laser , He –Ne Laser , Ruby Laser, Holography, Application of Lasers in medicine & industry.

Reference: A text book of Optics – N. Subramaniam and Brig Lal , S. Chand and Co.  
*Additional Ref. : Modern Physics concepts & applications – Sanjeev Puri ,  
Narosa Pub. 9.1 to 9.6, 9.10 , 9.11*

2. Fiber Optics :-Light propagation through fibers , Fiber geometry , Total Internal reflection , Numerical aperture , Step –Index and Graded index Fibers.  
Application in communication systems & Medicine .

**Reference :** Modern Physics concepts and applications – Sanjeev Puri , Narosa Pub.  
13.3 , 13.5 , 13.9

Additional Ref.: (1) Heat and Thermodynamics- Mathur  
(2) Lasers -Ghatak

### **C.I.A. Problem Solving**

## **SEMESTER II**

## **COURSE : S.PHY.2.02**

### **ELECTRONICS AND NUCLEAR PHYSICS**

**[ 45 LECTURES]**

#### **Learning Objectives :**

- (1) To learn about Semiconductor devices and their applications in analog and digital circuits
- (2) To understand Nuclear Structure and Radioactivity

#### **Unit- I** -*Analog electronics*

[15 Lectures]

1. Rectifiers:- Half wave Rectifier, Full wave Rectifier and Bridge Rectifier, Their efficiencies. Ripple factor, Load regulation.
2. Filters:- Capacitor filter, Inductor filter (choke),  $\pi$  filter.
3. Voltage stabilization:-Zener diode as a voltage stabilizer, Regulated power supply.
4. Transistor:-Transistor as an amplifier, CB,CE ,CC modes, Definition of  $\alpha$  and  $\beta$  (Both ac and dc), Input impedance, Output impedance.

V.K.M.: -CHAPTERS 9 & 11.

#### **Unit II** -*Digital electronics*

[15 Lectures]

1. Number systems: Binary, Octal, Hexadecimal number system, BCD code, Inter conversion between various number systems, Binary arithmetic.
2. Logic gates : De Morgan's theorem, NAND, NOR as a universal building block. Ex-OR, Ex-NOR gates and their implementation using basic gates,
3. Digital Circuits : Controlled inverter, Half adder and full adder.

V.K.M.: - CHAPTER 28.

### **Unit III Nuclear Physics**

[15 Lectures]

1. Nuclear composition, nuclear size, stability, binding energy, packing fraction, Meson theory.
2. Radioactivity:- five types of decay , Half life , disintegration constant , average life , successive disintegration ,types of equilibrium , radioactive series, Radiation hazards, radiometric dating , applications of radioactivity in other fields .  
A.B.:- 11.1 to 11.4, 11.7, 12.1, 12.2,12.3.

#### **References :**

- (1) Electronic Principles 6<sup>th</sup> Ed. –A.P. Malvino TMH
- (2) Principles of Electronics -V.K. Mehta & Rohit Mehta S. Chand &co.(V.K.M.)
- (3) Digital principles and applications 6<sup>th</sup> Ed. Malvino and Leach ,TMH
- (4) Modern Digital electronics 4<sup>th</sup> Ed. R.P. Jain , TMH
- (5) Concepts of Modern Physics –A. Beiser (6<sup>th</sup> Ed) Tata McGraw Hill . (A.B.)
- (6) Atomic and Nuclear Physics – Gupta and Ghosh

#### **C.I.A. Problem Solving**

#### **PRACTICALS**

#### **Regular Experiments**

#### **SEMESTER I**

#### **COURSE : S.PHY.PR.1**

#### **PRACTICAL 1**

#### **Mechanics , Sound , Heat, Light**

1. Flywheel
2. Torsional Oscillations
3. Bifilar Pendulum
4. Viscosity by Poiseuille's method
5. Bar Pendulum
6. Y by Vibration

#### **PRACTICAL 2**

#### **Electricity , Atomic Physics, Electronics, Nuclear Physics**

1. Thevenin's theorem
2. Maximum Power transfer theorem
3. Superposition theorem
4. LR circuit
5. CR circuit
6. LCR series resonance
7. Frequency of AC mains

## **SEMESTER II**

## **COURSE : S.PHY.PR.2**

### **PRACTICAL 1** **Mechanics ,Sound ,Heat, Light**

1. Spectrometer ( determination of angle of prism)
2. Spectrometer ( determination of refractive index of material of prism)
3. Combination of lenses
4. Newtons rings
5. Wedge Shaped Film
6. Viscosity by Stokes method

### **PRACTICAL 2** **Electricity , Atomic Physics,Electronics,Nuclear Physics**

1. LDR Characteristics
2. Bridge Rectifier (to study load regulation )
3. Zener as a regulator
4. Transistor (CE) Characteristics
5. Verification of NAND , NOR , EXOR gates and DeMorgans theorem

### **DEMONSTRATION EXPERIMENTS**

#### **COURSE : S.PHY.PR.1** **PRACTICAL 1 AND 2. SEMESTER –I**

1. Angular momentum conservation (Rotating platform)
2. Charging and discharging of a capacitor
3. Use of PC for graphs, demonstration experiments

#### **COURSE : S.PHY.PR.2** **PRACTICAL 1. AND 2. SEMESTER II**

1. Single slit Fraunhofer diffraction
2. Brewsters law
3. Laser beam divergence, intensity
4. Use of Oscilloscope

### **SKILL EXPERIMENTS**

**COURSE : S.PHY.PR.1**  
**PRACTICAL 1. AND 2. SEMESTER-I**

1. Use of Vernier Callipers , Micrometer Screw Gauge and Travelling Microscope
2. Graph plotting  
(Exponential , Straight line with intercept , Resonance curve etc.)

**COURSE : S.PHY.PR.2**  
**PRACTICAL 1. AND 2. SEMESTER II**

1. Spectrometer : Schuster's Method
2. Use of DMM

**REFERENCES:**

1. Advanced Practical Physics – Worsnop & Flint
2. Advanced course in Practical Physics D. Chattopadhyya , P.C. Rakshit & B. Saha
3. B. Sc. Practical Physics –C. L. Arora

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Note: Minimum eight experiments from each paper, four demos and all the skills have to be performed and written in the journal to appear for the practical examination