

Name:- Ms. Supriya
Assistant Professor (Physics)

Teaching Plan Report (Syllabus-wise)

Course Details

- **Programme:** B.Sc. (Physics) – Pass Course
 - **Year / Semester:** 2nd Semester/ 1st year
 - **Course Title:** Electronic Devices and Applications
 - **Course Code:** 24PHYS402DS02
 - **Programme Code:** USPHY4
 - **University:** M.D. University, Rohtak (Haryana)
 - **Teaching Hours:** 06 Hours per week (Theory 4 + Practical 2)
 - **Credits:** 04 (2+2)
 - **Maximum Marks:**
 - Theory: 50 (Internal: 15 + External: 35)
 - Practical: 50
 - **Total:** 100
 - **Time of Examination:**
 - Theory: 03 Hours
 - Practical: 03 Hours
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Course Learning Outcomes (CLOs)

- **CLO 1:** Students will gain knowledge of P–N junction diode and related semiconductor devices.
 - **CLO 2:** Students will acquire conceptual and practical understanding of transistors as amplifiers.
 - **CLO 3:** Students will be able to design and analyze half-wave and full-wave rectifier circuits using P–N junction diodes.
 - **CLO 4:** Students will understand the principles and working of different types of oscillators.
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Unit-wise Teaching Plan

Unit I: Semiconductors

- Energy bands in solids
- Intrinsic and extrinsic semiconductors
- Carrier mobility and electrical resistivity
- P–N junction diode and its characteristics
- Zener and avalanche breakdown
- Zener diode and its use as a voltage regulator
- Light Emitting Diode (LED)
- Photoconduction in semiconductors
- Photodiode and Solar Cell

Outcome: Students will understand basic semiconductor physics and the working principles of commonly used semiconductor devices.

Unit II: Transistors

- Junction transistors
- Working of NPN and PNP transistors
- Transistor configurations: CB, CE and CC
- Characteristics of transistors
- Transistor constants and their relations
- Advantages and disadvantages of CE configuration
- D.C. load line
- Transistor biasing: methods of biasing and stabilization

Outcome: Students will gain a clear understanding of transistor operation and biasing techniques used in electronic circuits.

Unit III: Transistor Amplifiers

- Basic concept of amplifiers
- Common base and common emitter amplifiers
- Coupling of amplifiers
- Types of coupling methods
- RC coupled amplifier (two-stage)
- Concept of bandwidth (no derivation)
- Feedback in amplifiers
- Advantages of negative feedback
- Emitter follower

Outcome: Students will be able to explain amplifier action and analyze basic amplifier circuits.

Unit IV: Rectifiers, Filters and Oscillators

- P–N junction diode as a rectifier
- Half-wave and full-wave rectifiers (with derivation)
- Filters: series inductor, shunt capacitor, L-section and choke filter
- Oscillators: definition and principle of oscillation
- Classification of oscillators
- Condition for self-sustained oscillation (Barkhausen criterion)
- Tuned collector common emitter oscillator
- Hartley oscillator

Outcome: Students will understand rectification, filtering processes and working principles of oscillator circuits.

Practical (Laboratory Work)

Students will perform at least **eight (08)** experiments from the following list:

1. Study of I–V characteristics of P–N junction diode.
2. Study of series inductor, shunt capacitance and L-section (choke) filters.
3. Study of Zener diode voltage regulation characteristics.
4. Study of half-wave and full-wave rectifiers.
5. Verification of inverse square law using a photocell.
6. Drawing common base and common emitter characteristics of a transistor and calculation of transistor parameters.
7. Study of transistor as a CB amplifier.
8. Study of transistor as a CE amplifier.
9. Study of ripple factor in a D.C. power supply.
10. Study of Hartley oscillator.

Outcome: Practical work will enhance students' experimental skills and help them correlate theoretical concepts with real electronic circuits.

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Syllabus Implementation Report

General Information

- **Name of Program:** B.Sc. (Physics)
 - **Semester:** IV (Second Year)
 - **Course Title:** Atomic, Molecular and Laser Physics
 - **Program Code:** USPHY4
 - **Course Code:** 25PHYS404DS02
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 - **Hours per Week:** 06 (Theory: 2, Practical: 4)
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Course Learning Outcomes (CLOs)

- **CLO1:** To understand atomic spectra of one- and two-electron atoms.
 - **CLO2:** To study the behavior of atoms in externally applied electric and magnetic fields.
 - **CLO3:** To understand diatomic molecules and their rotational, vibrational and rotational-vibrational spectra.
 - **CLO4:** To understand energy levels and spectra in diatomic molecules and basics of laser physics.
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Unit-wise Teaching Plan (Theory)

Unit I: Atomic Spectra and Atomic Structure

- Atomic spectra and atomic number
- Hydrogen atom spectrum and its explanation
- Atoms in electric and magnetic fields
- Electron spin and Stern–Gerlach experiment

- Orbital angular momentum, magnetic dipole moment
- Vector atom model for two-valence electron atoms
- Coupling schemes: LS (Russell–Saunders) coupling and JJ coupling
- Interaction energy in LS coupling (sp, pd configurations)
- Lande interval rule
- Pauli exclusion principle and periodic classification of elements

Unit II: Many Electron Atoms and Fine Structure

- Equivalent and non-equivalent electrons
- Doublet structure of alkali spectra
- Empirical evidence of multiplets
- Selection rules and total angular momentum
- Pauli exclusion principle
- Many particles in one-dimensional box
- Symmetric and antisymmetric wave functions
- Atomic shell model and periodic table
- Spectral notations for atomic states
- Hyperfine structure of spectral lines
- Isotope effect and nuclear spin

Unit III: Atoms and Molecules in External Fields

- Zeeman effect: Normal and anomalous
- Experimental setup for Zeeman effect
- Classical and quantum mechanical explanation of normal Zeeman effect
- Explanation of anomalous Zeeman effect (Lande g-factor)
- Zeeman pattern of D1 and D2 lines of sodium atom
- Paschen–Back effect for a single valence electron system
- Weak field Stark effect for hydrogen atom
- Discrete and electronic energy levels of molecules
- Quantization of vibrational and rotational energies
- Raman effect (quantitative description)
- Stokes and anti-Stokes lines

Unit IV: Laser Physics

- Basic features of lasers: directionality, high intensity, coherence
- Spatial and temporal coherence
- Einstein coefficients and optical amplification
- Momentum transfer and lifetime of energy levels
- Kinetics of optical absorption
- Threshold condition for laser emission
- Laser pumping mechanisms

- He–Ne laser: principle, construction and working
 - Ruby laser: principle, construction and working
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Practical (Laboratory Work)

Students are required to perform **at least eight (08)** experiments from the following list:

1. Determination of wavelength of H-alpha emission line of hydrogen atom.
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 6. Study of interference fringes and measurement of coherence length using He–Ne laser.
 7. Determination of wavelength of He–Ne laser using a ruler.
 8. Determination of size of lycopodium particles using diode laser.
 9. Determination of diameter of fine wire using He–Ne laser.
 10. Determination of angular spread of He–Ne laser using plane diffraction grating.
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Teaching Methodology

- Classroom lectures using blackboard
 - Numerical problem-solving sessions
 - Conceptual discussions and unit-wise tests
 - Laboratory demonstrations and hands-on practical training
 - Continuous internal assessment through assignments and viva-voce
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