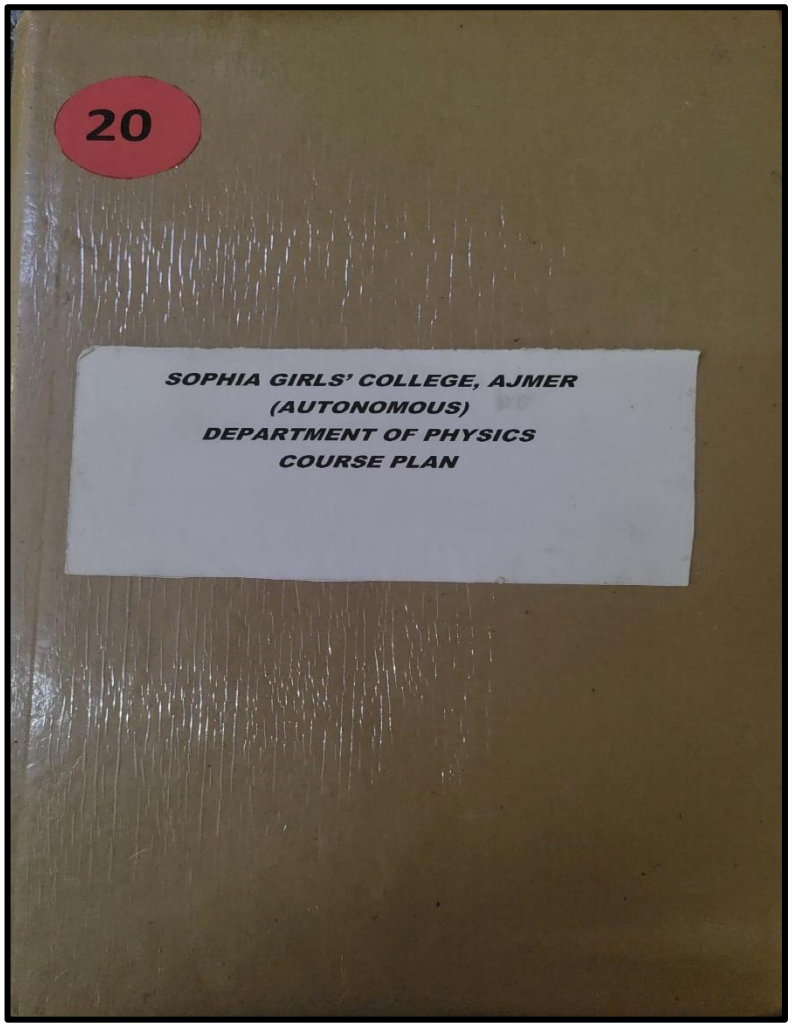
# SOPHIA GIRLS' COLLEGE(AUTONOMOUS), AJMER




COURSE_PLAN_2022-23_MS_MERIL_KURAIN

# COURSE PLAN (PHYSICS)

# U.G Programs

## 2022-23

# SOPHIA GIRLS' COLLEGE (AUTONOMOUS), AJMER
## B. Sc. I (SEMESTER I)
## ELECTROMAGNETISM (PHY-102)

Max. Marks: 75 (50 External; 25 Internal) Min. Marks: 30 (20 External; 10 Internal) Credit: 03

## COURSE PLAN

| SEM I Month | UNIT/TOPIC | Concepts/facts | Teaching Pedagogy | Learning Outcomes | Questions | Marks Weightage (%) |
|---|---|---|---|---|---|---|
| AUGUST | **UNIT I**<br><br>Scalars and Vectors: dot products, vector product, triple vector product, gradient of scalar field and its geometrical interpretation, divergence and curl of a vector field. Flux of vector field | • Scalar and vector fields.<br>• Addition and Multiplication of vector field. | Lecture method, problem solving method, numerical solving method | ✓ Tabulate scalar and vector properties and theorems related to it.<br>✓ Solve numerical based on STP and VTP | *Knowledge Based*<br><br>-What is vector field?<br>-State the Stokes theorem.<br>-State the Green's theorem.<br>- State the Gauss Divergence theorem. | Knowledge--60<br>Understanding-30<br>Higher Order-10 |
| AUGUST | Gauss's divergence theorem, Stokes theorem. Gauss's Law and its integral and differential form. Coulomb's law in vacuum expressed in vector form. | • Theorems related to scalar and vector fields<br>• Coulomb's law and it's vector form | Lecture method, teacher guided learning, numerical solving method | | | |

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| SEPTEMBER | **UNIT II**<br><br>Electric field in matter: atomic and molecular dipoles, permanent dipole moment. Capacity of parallel plate capacitor with partially or completely filled dielectric, electric displacement, Lorentz local field and Clausius Mossotti equation. | • Electrostatic properties of conductor<br><br>• Concept of Capacitance | Lecture Method, numerical solving method, Demonstration method | ✓ Classify Electrostatic properties of conductor and various boundary conditions. | *Understanding Based*<br><br>- Capacity of parallel plate capacitor with partially or completely filled dielectric.<br><br>-Illustrate the electromagnetic induction. | |
| OCTOBER | Electrostatic field – conductors in electric field, Boundary conditions for potential and field at dielectric surface, Poisson's and Laplace's equations in Cartesian cylindrical and spherical polar coordinates (without derivation). | • Various boundary conditions.<br><br>• Poisson's and Laplace's equations in various forms | Lecture Method, quiz, numerical solving method, teacher guided learning. | ✓ Solve numerical on Poisson's and Laplace's equations | *Higher Order Thinking Skills Based*<br><br>- Estimate equations for the growth and decay of current in LR circuit. | |
| OCTOBER | **UNIT III**<br><br>Concept of magnetic field B and magnetic flux, Biot-Savart's law, B due to a straight current carrying conductor. Ampere circuital law (integral and differential form). Force on a current carrying wire and torque on a current loop in a magnetic field, Maxwell's | • Magnetic flux and intensity of magnetic field<br>• Maxwell's equations<br>• Ampere circuital law | Group Discussion, Demonstration method, numerical solving method | ✓ Explains the Magnetic field due to current in a circuit<br>✓ Analysis | - Express the Maxwell's equation in their differential and integral forms and discuss them. | |

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| | equations (integral and differential form) and displacement current. | | | ✓ of AC circuits, LCR circuit<br>✓ Solve problems related to Biot-Savart's law | -Explain Charging, discharging of condenser through resistance. | |
| NOVEMBER | Electromagnetic induction, Faraday law (its integral and differential form) Lenz's law, mutual & self inductance, Charging, discharging of condenser through resistance, rise and decay of current in LR circuit, decay constant, transient in LCR circuit | • Electromagnetic Induction<br>• Charging, discharging of condenser | Demonstration through examples, Experimental methods | | | |

Deepmala.
Head
Department of Physics
Sophia Girls' College
(Autonomous), Ajmer

Meril

Sr. Pearl
PRINCIPAL
SOPHIA GIRLS' COLLEGE
(AUTONOMOUS)
AJMER

# SOPHIA GIRLS' COLLEGE (AUTONOMOUS), AJMER

## B. Sc. I (SEMESTER II)

## Kinetic Theory of Gases and Theory of Relativity (PHY-201)

Max. Marks: 75 (50 External; 25 Internal) Min. Marks: 30 (20 External; 10 Internal) Credit: 03

## COURSE PLAN

| SEM II Month | UNIT/TOPIC | Concepts/facts | Teaching Pedagogy | Learning Outcomes | Questions | Marks Weightage (%) |
|---|---|---|---|---|---|---|
| JANUARY | **UNIT II**<br><br>Inertial frames, Galilean transformation, Non-Inertial frames, fictious forces, Displacement, velocity and acceleration in rotating co-ordinate system, Coriolis force and its application, Effect of Coriolis force on a particle moving Horizontally on Earth | • Describe the types of Frame of References.<br>• Fictious forces | Group Discussion, Lecture method, Animations | ✓ Explains the coriolis force,<br>✓ Classifies frame of reference and galilean transformation | *Knowledge Based*<br><br>- what are Inertial frames ?<br><br>-What is law of equipartition of energy?<br><br>-what is the RMS speed? | Knowledge—50<br>Understanding-40<br>Higher Order-10 |
| JANUARY | Effect of Coriolis force on pendulum and Foucault pendulum,<br>Effect of Coriolis force on Bodies falling Vertically downward on Earth,<br>Effect of Coriolis force on Bodies thrown Vertically upward on Earth. | • Effect of Coriolis force on a body in various forms | Demonstration through examples, Lecture method, | | | |

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| FEBRUARY | **UNIT I**<br><br>Assumption of kinetic theory of gases, law of equipartition of energy and it's applications of specific heats of gases, Maxwell distribution of speed and velocities. | • Kinetic Theory of Gases. | Blackboard teaching, Lecture method, problem solving method, quiz | ✓ Describes the Maxwell's distribution of speed and velocities.<br><br>✓ Explains the Law of equipartition of energy. | *Understanding Based*<br><br>Calculate equation for Galilean Transformation.<br><br>-Derive the effect of coriolis force on pendulum.<br><br>*Higher Order Thinking Skills Based*<br><br>- Estimate the formula for displacement, velocity and acceleration in rotating coordinate system.<br><br>Calculate the result for Length contraction and time dilation. | |
| FEBRUARY | Experimental verification of Maxwell's law of speed distribution, most probable speed, average speed, r.m.s. speed, mean free path. | • Verification of Maxwell's law | Lecture method, problem solving method | | | |
| MARCH | **UNIT III**<br><br>Application of special theory of relativity, Lorentz co-ordinate and physical significance of Lorentz invariance, Length contraction, Time dilation, Velocity addition theorem. | • To understand special theory of relativity<br><br>• To calculate length contraction and time dilation. | Lecture Method, PPT, quiz, numerical solving method, Flipped learning | ✓ Calculate the variation of mass with velocity and also the mass energy equivalence.<br><br>✓ Constructs relation between momentum and energy. | | |
| MARCH | Variation of mass with velocity, Mass energy equivalence, relation between momentum and energy, Mass, velocity, momentum, mass energy of zero rest mass. | • Special theory of relativity | Lecture Method, PPT, quiz, numerical solving method | | | |

Head
Department of Physics
Sophia Girls' College
(Autonomous), Ajmer

PRINCIPAL
SOPHIA GIRLS' COLLEGE
(AUTONOMOUS)
AJMER

# SOPHIA GIRLS' COLLEGE (AUTONOMOUS), AJMER
## B.Sc. II (SEMESTER - III)
## ELECTRONICS (PHY-301)

Max. Marks: 75 (50 External; 25 Internal) Min. Marks: 30 (20 External; 10 Internal) Credit: 03

## COURSE PLAN

| SEM III Month | UNIT/TOPIC | Concepts/facts | Teaching Pedagogy | Learning Outcomes | Questions | Marks Weightage (%) |
|---|---|---|---|---|---|---|
| JULY | **UNIT I**<br>Energy bands in solids, Intrinsic and extrinsic semiconductors, carrier mobility and electrical resistivity of semiconductors, , solar cell, p-n junction diode and their characteristics, Zener and Avalanche Breakdown, Zener diode ,Zener diode as voltage regulator | • Energy bands in solids, Semiconductors<br>• p-n junction diode | PPT, Quiz, Lecture method, Problem solving method, Heuristic method | ✓ Understanding of semiconductor<br>✓ Describe Zener diode and its function as a voltage regulator | *Knowledge Based*<br>- what is intrinsic and extrinsic semiconductors? Give example of both.<br>-what are filters? Explain them with their types.<br>what are rectifiers? Explain them with their types. | Knowledge--40<br>Understanding-40<br>Higher Order-20 |
| JULY-AUGUST | Light emitting diode(LED), photoconduction in semiconductors, Photodiode, Solar cell, p-n junction as a rectifier, half wave and full wave rectifiers (with derivation), Filters (series inductor, Shunt capacitance, L-section or choke, pie | • Application of diode as a rectifier.<br>• LED | Lecture method, problem solving method, Quiz, Animation Based teaching, PPT | ✓ Understanding about use and application of rectifiers<br>✓ Understanding about use and | | |

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| | and RC filter circuits.(No derivation). | • Solar Cell<br>• Filters | | application of filters. | *Understanding Based*<br>-Describe three types of configuration of Transistor.<br>- Describe the working of JFET.<br>*Higher Order Thinking Skills Based*<br>- Explain different types of Amplifiers<br>-Discuss feedback in Amplifiers.<br>- Explain RC coupled amplifier | |
| AUGUST | **UNIT II**<br>Junction transistor, Working of NPN and PNP transistors, Three configuration of transistor( C-B , C-E, C-C modes), Common base, common emitter, and common collector characteristics of transistor. | • Transistor in different configurations. | PPT, Quiz, Lecture method, Problem solving method, demonstration method | ✓ Compares the Transistors, parameters and biasing of transistors.<br>✓ Explains D. C. load line.<br>✓ Describes JFET | | |
| SEPTEMBER | Parameters of a transistor and their relation, D.C. load line, Transistor biasing; various method of transistor biasing and stabilization. Junction Field Effect Transistor (JFET), volt ampere relations. | • Transistor biasing<br>• Operating point of JFET. | Demonstration through examples, Lecture method, PPT | | | |
| OCTOBER | **UNIT III**<br>Amplifier, Classification of Amplifiers, common base and common emitter amplifiers, RC coupled amplifier – Two Stage concept of band width (no | • Amplifiers.<br>• CB & CE amplifiers | Lecture Method, PPT, quiz, Observation method, Demonstration through | ✓ Classifies about the Amplifiers<br>✓ Explains R-C coupled amplifier. | | |

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| | derivation). | | examples. | | | |
| NOVEMBER | Concept of feedback, positive and negative feedback, advantages of negative feedback, Stabilization of gain, reduction of non linear distortion. | • Positive and negative Feedback.<br>• Stabilization of gain | Heuristic method, PPT, quiz, numerical solving method | ✓ Understands the concept of feedback | | |

Deepmala

Head
Department of Physics
Sophia Girls' College
(Autonomous), Ajmer

Meril

Sr. Pearl

PRINCIPAL
SOPHIA GIRLS' COLLEGE
(AUTONOMOUS)
AJMER

# SOPHIA GIRLS' COLLEGE (AUTONOMOUS), AJMER
## B.Sc. II (SEMESTER - IV)
## Optics (PHY - 402)

Max. Marks : 75 (50Ext; 25 Internal)

Min. Marks: 30(20 Ext; 10 Internal)

Credit: 03

## COURSE PLAN

| SEM IV Month | UNIT/TOPIC | Concepts/facts | Teaching Pedagogy | Learning Outcomes | Questions | Marks Weightage (%) |
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| JANUARY | **UNIT – II**<br><br>Polarization of light: Meaning of polarization, polarization by reflection: Brewster law, polarization by refraction through "Pile of plates", Laws of Malus, Phenomenon of double refraction, uniaxial and biaxial crystals, Huygens theory of double refraction, the ordinary and extra ordinary refractive indices. | • Meaning polarisation of light and its applications<br><br>• Phenomenon of double refraction | Class test, assignments, project work, class teaching on board, PPT | ✓ Explains the Polarization phenomenon.<br><br>✓ Understand the use of Polaroid.<br><br>✓ Applies concept of double refraction | *Knowledge Based*<br><br>-Define Coherent sources.<br><br>-What is the principle of Interference?<br><br>-What is Law of Malus?<br><br>- What is principle of superposition? | Knowledge--60<br>Understanding-30<br>Higher Order-10 |
| JANUARY | Production and Analysis of Polarized Light : production of plane polarized light, the Polaroid, Nicol prism, analyser and polarizer, double image | • Production of plane polarized light<br><br>• Double image | Observation method, Lecture method, Examples, Heuristic method | | | |

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| | prisms, quarter and half wave plates | prisms | | | | |
| FEBRUARY | **UNIT I**<br><br>Interference of a light: The principle of superposition, two slit interference, coherence requirements of the sources. Newton's ring and it's application to find wavelength of light and refractive index of medium. | • Knowledge of Interference,<br><br>• Newton rings and it's application | White board teaching for derivation, PPT, Examples, group discussion | ✓ Summarize Interference and its application in Michelson interferometer<br><br>✓ Describes Fringes of equal inclination. | *Understanding Based*<br>-Write application of Newton Rings.<br><br>-Compare uniaxial and biaxial crystals. | |
| FEBRUARY | Haidinger fringes: Fringes of equal inclination. Michelson interferometer it's application for precision determination of wavelength, Wavelength difference and the width of spectral lines. | • Haidinger fringes<br><br>• Michelson interferometer and it's application | Quiz, PPT, Observation method, Project method | ✓ Observes wavelength difference | *Higher Order Thinking Skills Based*<br>- Explain Working of Michelson interferometer.<br><br>-Explain Diffraction due to Double slits. | |
| MARCH-APRIL | **UNIT – III**<br><br>Fresnel diffraction : Half periods zones, Fraunhoffer diffraction : Single slit, double slit, n slit, Intensity distribution, Plane diffraction grating, Dispersive power of a grating, Resolving power, Reyleigh criterion, resolving power : telescope, grating, prism. | • Fresnel diffraction<br><br>• Fraunhoffer diffraction<br><br>• Resolving power | Basic concepts of diffraction by practical. Theoretical concept by PPT, White board teaching for derivation, Examples, group discussion | ✓ Compares the Fresnel and Fraunhoffer Diffraction and their application in grating.<br><br>✓ Understands the Resolving Power | - Explain resolving power of prism. | |

Head
Department of Physics
Sophia Girls' College
(Autonomous), Ajmer

Sr. Pearl
PRINCIPAL
SOPHIA GIRLS' COLLEGE
(AUTONOMOUS)
AJMER

# SOPHIA GIRLS' COLLEGE (AUTONOMOUS), AJMER

## B. Sc. III (SEMESTER - V)

## SOLID STATE PHYSICS (PHY-501)

Max. Marks: 75 (50 External; 25 Internal)

Min. Marks: 30 (20 External; 10 Internal)

Credit: 03

## COURSE PLAN

| SEM V Month | UNIT/TOPIC | Concepts/facts | Teaching Pedagogy | Learning Outcomes | Questions | Marks Weightage (%) |
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| JULY | **UNIT I**<br><br>Crystal binding and crystal structure: Crystal bonding, Ionic bonding, binding energy of ionic crystal, determination of repulsive exponent, covalent bonding, metallic bonding, molecular and vanderwaal's bonding, hydrogen bonding. | • Types of bonding<br>• Binding energy of Ionic crystal | Lecture method, problem solving method, quiz, PPT, Animation | ✓ Summarise different bonding between atoms.<br>✓ Describes different bonding in solids. | *Knowledge Based*<br><br>-What is Crystal bonding?<br><br>-What is binding energy of ionic crystal?<br><br>- differentiate between Covalent bonding and metallic bonding. | Knowledge--30<br>Understanding-50<br>Higher Order-20 |
| JULY | Space lattice and crystal structure, Bravis lattice, Miller indices and crystal structure, spacing of planes in crystal lattice, atomic packing, simple cubical lattice structure, face centered cubic lattice structure, | • Lattice structure<br>• Miller indices | Lecture method, problem solving method, Examples, PPT, Observation method | | | |

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| | body centered cubic lattice structure, construction of ventilatior (Covid – 19) | | | | *Understanding Based*<br>-Discuss Bloch theorem.<br>-what is Effective Mass of electron?<br>-Explain cooper pair.<br>-What is Flux Quantization? | |
| AUGUST-SEPTEMBER | **UNIT III**<br>Superconductivity: Introduction, experimental features of superconductivity, the isotope effect, electron phonon interaction, the effect of superconducting transition of properties of superconductors, special features of superconducting materials, Theoretical survey ( basic idea), Flux quantization, BCS theory of superconductivity: cooper pairs ,high temperature superconductors( basic ideas), | • Superconductivity.<br>• Flux quantization<br>• Transition of properties of superconductors | Lecture Method, PPT, quiz, Heuristic method, Demonstration method, Group discussion | ✓ Explains the concept of superconductivity.<br>✓ Explains the BCS theory of superconductivity.<br>✓ Classifies magnetic properties for a Solid.<br>✓ Discuss about magnetic susceptibility. | | |
| SEPTEMBER | Magnetic properties: classification of magnetic materials, origin of atomic magnetism, magnetic susceptibility, phenomenon of diamagnetism, paramagnetic susceptibility of ionic crystal, ferromagnetism. | • Magnetic properties of materials.<br>• Concept of diamagnetism, paramagnetic, ferromagnetism. | Lecture Method, PPT, quiz, numerical solving method | | *Higher Order Thinking Skills Based*<br>- Estimate the special features of superconducting materials.<br>- Explain magnetic susceptibility. | |

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| OCTOBER | **UNIT II**<br><br>Thermal properties of solids: concepts of thermal energy and phonons, internal energy and specific heat, the various theories of lattice specific heat of solids: the Einstein model, vibrational modes of continuous medium, Debye model, electronic configuration of the internal energy hence to the specific heat of metals, Thermal conductivity of Lattice. | • Basic concept of Einstein and Debye model.<br><br>• Thermal conductivity of Lattice. | Group Discussion, Lecture method, Quiz, PPT, Examples | ✓ Explains the vibrational modes of continuous medium of Einstein model.<br><br>✓ Classifies thermal conductivity of Lattice. | -differentiate between diamagnetism, paramagnetic, ferromagnetism. | |
| OCTOBER | Band theory of solids: formation of bands, periodic potential of solid, wave function in periodic lattice and bloch theorem, The distinction between metals, insulators, and intrinsic semiconductors. | • Bloch theorem<br><br>• Formation of bands | Demonstration through examples, PPT, Quiz. | ✓ Distinguish between metals, insulators, and intrinsic semiconductors. | | |

Deepmala

**Head**
**Department of Physics**
**Sophia Girls' College**
**(Autonomous), Ajmer**

Meril

Sr. Pearl

PRINCIPAL
SOPHIA GIRLS' COLLEGE
(AUTONOMOUS)
AJMER

# SOPHIA GIRLS' COLLEGE (AUTONOMOUS), AJMER
## B. Sc. III (SEMESTER - VI)
## NUCLEAR PHYSICS (PHY- 601)

Max. Marks: 75 (50 External; 25 Internal) Min. Marks: 30 (20 External; 10 Internal) Credit: 03

## COURSE PLAN

| SEM VI Month | UNIT/TOPIC | Concepts/facts | Teaching Pedagogy | Learning Outcomes | Questions | Marks Weightage (%) |
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| JANUARY | **UNIT I**<br><br>Nuclear properties: Rutherford's theory of particle scattering, properties of nuclei, quadrupole moment and nuclear ellipticity, Quadrupole moment and nuclear spin, parity and orbital angular momentum, parity and its conservation. | • Nuclear properties.<br>• Rutherford theory of particle scattering<br>• Parity and its conservation. | Lecture Method, PPT, quiz, numerical solving method, demonstration method. | ✓ Explains the Rutherford theory of particle scattering.<br>✓ Distinguishes between quadrupole moment and orbital angular momentum<br>✓ Explains Cosmic rays | *Knowledge Based*<br><br>-What is Nuclear fission?<br>-What is the principle of nuclear reactors?<br>-What is _quadrupole moment | Knowledge--30<br>Understanding-50<br>Higher Order-20 |
| JANUARY | Cosmic rays: Discovery of cosmic rays, nature of cosmic rays, soft and hard , components, variation in cosmic rays –<br>(1) Lattitude effect.<br>(2) East-West asymmetry and directional effect.<br>(3) Altitude effect. | • Cosmic rays.<br>• Effects of cosmic rays | Lecture Method, PPT, quiz, numerical solving method, PPT, Project method | | | |

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| FEBURARY | **UNIT II**<br><br>Nuclear fission: The discovery of nuclear fission, the energy release in the fission, the fission products, mass distribution of fission products, fission cross section and threshold, neutron emission in fission, the prompt neutrons and delayed neutrons, energy of fission neutrons, theory of nuclear fission and liquid drop model. | • Fission and fusion.<br>• Energy of fission neutrons | Lecture method, problem solving method, quiz, PPT, Heuristic method | ✓ Summarise the discovery of Nuclear fission.<br>✓ Applies theory of spontaneous fission.<br>✓ Classifies the type of reactors | *Understanding Based*<br>-Discuss Plasma as the fourth state of matter.<br>-what are elementary particles?<br>-explain barrier penetration.<br>-write nuclear reaction.<br>-what is Breeder reactors? | |
| FEBURARY | Barrier penetration- theory of spontaneous fission, nuclear energy sources, nuclear fission as a source of energy, the nuclear chain reaction, condition of controlled chain reaction, the principle of nuclear reactors, classification of reactors, typical reactors, power of nuclear reactors, the Breeder reactors, | • Nuclear reactors.<br>• Condition of controlled chain reaction<br>• Power of nuclear reactors | Lecture method, problem solving method, Animation, PPT | | | |
| MARCH | **UNIT III**<br><br>Nuclear fusion: the sources of | • Lawson criteria. | Group Discussion, Lecture method, | ✓ Explains the elementary | | |

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| | stellar energy, the plasma: the fourth state of matter, fusion reaction, energy balance and Lawson criteria, magnetic confinement of plasma, classical plasma losses from the magnetic container, anomalous losses, turbulence and plasma instabilities. | • magnetic confinement of plasma<br>• Plasma instabilities | Quiz, Observation method | particles.<br>✓ Explains fusion reaction<br>✓ Applies Quarks models<br>✓ Implies Lawson criteria | *Higher Order Thinking Skills Based*<br>- Estimate nuclear spin, parity and angular momentum.<br>- Explain Lattitude effect.<br>-Differentiate charmed and coloured quarks. | |
| MARCH | Elementary particles: classification of elementary particles, fundamental interactions, unified approach (basic ideas), the conservation laws, Quarks (basic ideas), charmed and coloured quarks. | • Elementary particles.<br>• Quarks | Demonstration through examples, PPT, Quiz, Lecture method | | | |

Head
Department of Physics
Sophia Girls' College
(Autonomous), Ajmer

PRINCIPAL
SOPHIA GIRLS' COLLEGE
(AUTONOMOUS)
AJMER