# Department of Physics

## Scheme of Examination and Syllabus for
## Under Graduate Programme
## (For Affiliated Colleges as per Scheme C)

### Under Multiple Entry and Exit, Internship and
### CBCS-LOCF as per NEP-2020
### For session 2025-26 (in phased manner)

## Subject: Physics

**Guru Jambheshwar University of Science &Technology**
**Hisar-125001, Haryana**

**(A+ NAAC Accredited State Govt. University)**

| Program Outcomes | |
|---|---|
| PO1 | Apply the basic principles of Physics to the events occurring around us. |
| PO2 | Collaborate effectively on team-oriented projects/practical. |
| PO3 | Analyze scientific reasoning for various things and improve programming skills. |
| PO4 | Develop scientific and logical thinking among the students. |
| PO5 | Build effective communication skills through viva-voce or seminar. |
| PO6 | Develop experimental skills and independent work culture through a series of experiments that compliment theories and projects. |
| PO7 | Understand and solve problems of relevance to society to meet the specified needs using the knowledge, skills and attitudes acquired from physics. |

# Guru Jambheshwar University of Science and Technology

## Hisar-125001, Haryana

## ('A+' NAAC Accredited State Govt. University)

Examination Scheme and Syllabus for B. Sc. with major in Physics as per scheme C for the session 2025-26
(For Affiliated Colleges according to National Education Policy-2020)

**Subject-Physics**

## FIRST YEAR

| SEMESTER-I | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Type of Course** | **Course Code** | **Nomenclature of Paper/Course** | **Credits** | **Contact Hours** | **Internal Marks** | **External Marks** | **Total Marks** | **Duration of Exam (Hrs)** |
| **Discipline Specific Course (DSC-A1)** | C24PHY101T/ C24MIN101T | Mechanics | 3 | 3 | 20 | 50 | 70 | 2.5 |
| | C24PHY101P/ C24MIN101P | Mechanics Lab | 1 | 2 | 10 | 20 | 30 | 3 |
| **Discipline Specific Course (DSC-A2)** | C24PHY102T | Introductory Mathematical Physics -I | 4 | 4 | 30 | 70 | 100 | 3 |
| **Minor Course (MIC-1) #** | C24MIN101T/ C24PHY101T | Mechanics | 3 | 3 | 20 | 50 | 70 | 2.5 |
| | C24MIN101P/ C24PHY101P | Mechanics Lab | 1 | 2 | 10 | 20 | 30 | 3 |
| **Multidisciplinary Course (MDC-1)** | C24MDC123T | Fundamental of Physics-I | 2 | 2 | 15 | 35 | 50 | 2 |
| | C24MDC123P | Fundamental of Physics-I Lab | 1 | 2 | 10 | 15 | 25 | 3 |
| **Skill Enhancement Course (SEC-1)** | C24SEC130T | Instrumentation-I | 2 | 2 | 15 | 35 | 50 | 2 |
| | C24SEC130P | Instrumentation-I Lab | 1 | 2 | 10 | 15 | 25 | 3 |
| **Value Added Course (VAC-1/ VAC-2)** | C24VAC119T | Electronic Components and Measuring Instruments | 2 | 2 | 15 | 35 | 50 | 2 |
| **SEMESTER-II** | | | | | | | | |
| **Type of Course** | **Course Code** | **Nomenclature of Paper/Course** | **Credits** | **Contact Hours** | **Internal Marks** | **External Marks** | **Total Marks** | **Duration of Exam (Hrs)** |
| **Discipline Specific Course (DSC-A3)** | C24PHY201T/ C24MIN201T | Electricity and Magnetism | 3 | 3 | 20 | 50 | 70 | 2.5 |
| | C24PHY201P/ C24MIN201P | Electricity and Magnetism Lab | 1 | 2 | 10 | 20 | 30 | 3 |
| **Discipline Specific Course (DSC-A4)** | C24PHY202T | Introductory Mathematical Physics -II | 4 | 4 | 30 | 70 | 100 | 3 |
| **Minor Course (MIC-2) #** | C24MIN201T/ C24PHY201T | Electricity and Magnetism | 3 | 3 | 20 | 50 | 70 | 2.5 |
| | C24MIN201P/ C24PHY201P | Electricity and Magnetism Lab | 1 | 2 | 10 | 20 | 30 | 3 |
| **Multidisciplinary Course (MDC-2)** | C24MDC223T | Fundamental of Physics-II | 2 | 3 | 15 | 35 | 50 | 2 |
| | C24MDC223P | Fundamental of Physics-II Lab | 1 | 3 | 10 | 15 | 25 | 3 |
| **Skill Enhancement Course (SEC-2)** | C24SEC230T | Instrumentation-II | 2 | 2 | 15 | 35 | 50 | 2 |
| | C24SEC230P | Instrumentation-II Lab | 1 | 2 | 10 | 15 | 25 | 3 |

**Notes: Internship of 4 credits of 4 weeks duration after 2nd semester may be done in summer vacation.**

## SECOND YEAR

| SEMESTER-III | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Type of Course** | **Course Code** | **Nomenclature of Paper/Course** | **Credits** | **Contact Hours** | **Internal Marks** | **External Marks** | **Total Marks** | **Duration of Exam (Hrs)** |
| **Discipline Specific Course (DSC-A5)** | C24PHY301T/ C24MIC333T | Thermodynamics and Statistical Physics | 3 | 3 | 20 | 50 | 70 | 2.5 |
| | C24PHY301P/ C24MIC333P | Thermodynamics and Statistical Physics Lab | 1 | 2 | 10 | 20 | 30 | 3 |
| **Discipline Specific Course (DSC-A6)** | C24PHY302T | Waves and Oscillations | 4 | 4 | 30 | 70 | 100 | 3 |
| **Minor Course (MIC-3) #** | C24MIC333T/ C24PHY301T | Thermodynamics and Statistical Physics | 3 | 3 | 20 | 50 | 70 | 2.5 |
| | C24MIC333P/ C24PHY301P | Thermodynamics and Statistical Physics Lab | 1 | 2 | 10 | 20 | 30 | 3 |
| **Multidisciplinary Course (MDC-3)** | C24MDC323T | Introductory Modern Physics | 2 | 2 | 15 | 35 | 50 | 2 |
| | C24MDC323P | Introductory Modern Physics Lab | 1 | 2 | 10 | 15 | 25 | 3 |
| **Skill Enhancement Course (SEC-3)** | C24SEC330T | Numerical Techniques | 2 | 2 | 15 | 35 | 50 | 2 |
| | C24SEC330P | Numerical Techniques Lab | 1 | 2 | 10 | 15 | 25 | 3 |
| **Value Added Course (VAC-3)** | C24VAC304T | Renewable Energy | 2 | 2 | 15 | 35 | 50 | 2 |

| SEMESTER-IV | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Type of Course** | **Course Code** | **Nomenclature of Paper/Course** | **Credits** | **Contact Hours** | **Internal Marks** | **External Marks** | **Total Marks** | **Duration of Exam (Hrs)** |
| **Discipline Specific Course (DSC-A7)** | C24PHY401T | Optics | 3 | 3 | 20 | 50 | 70 | 2.5 |
| | C24PHY401P | Optics Lab | 1 | 2 | 10 | 20 | 30 | 3 |
| **Discipline Specific Course (DSC-A8)** | C24PHY402T | Physics of Semiconductor Devices | 3 | 3 | 20 | 50 | 70 | 2.5 |
| | C24PHY402P | Physics of Semiconductor Devices Practical | 1 | 2 | 10 | 20 | 30 | 3 |
| **Discipline Specific Course (DSC-A9)** | C24PHY403T | Astronomy and Astrophysics | 4 | 4 | 30 | 70 | 100 | 3 |
| **Discipline Specific Course (DSC-A10) Elective** | C24PHY404T | Electromagnetic Theory | 4 | 4 | 30 | 70 | 100 | 3 |
| **Minor Course (MIC-4 /Vocational)#** | C24VOC433T | Introduction to Optics | 2 | 2 | 15 | 35 | 50 | 2 |
| | C24VOC433P | Introduction to Optics Lab | 2 | 4 | 15 | 35 | 50 | 3 |
| **Value Added Course (VAC-4)** | C24VAC408T | Introduction to Satellites | 2 | 2 | 15 | 35 | 50 | 2 |

**# To be taken by the students of the other department i.e., for scheme C.**

**Notes: Internship of 4 credits of 4 weeks duration after 4th semester (if not done after 2nd semester). Four credit of internship completed by a student during summer after 2nd or 4th semester, will be taken into account in 5th semester who pursue 3-year UG Programme without taking exit option.**

# Semester-I

**Discipline Specific Course (DSC-A1)**
**C24PHY101T: Mechanics**

**Paper Code: C24PHY101T/C24MIN101T**
**45 Hrs (3Hrs /week)** **External Marks: 50**
**Credits: 3** **Internal Marks: 20**
**Time: 2.5 Hrs** **Total Marks: 70**

**Note**: The examiner is required to set nine questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 2 marks each. In addition to this, eight more questions (each question may be of 2-3 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt five questions in all selecting one from each unit in addition to the compulsory Question No.1. All questions carry equal marks. 20% numerical problems are to be set and use of scientific calculator (nonprogrammable) is allowed.

**Unit-I**

**Fundamentals of Dynamics**: Rigid body, Moment of Inertia, Radius of Gyration, Theorems of perpendicular and parallel axis (with proof), Moment of Inertia of ring, Disc, Angular Disc, Solid cylinder, Solid sphere, Hollow sphere, Torque, Rotational Kinetic Energy, Angular momentum, Law of conservation of angular momentum, rolling motion, condition for pure rolling, acceleration of body rolling down an inclined plane, Fly wheel, Moment of Inertia of an irregular body.

**Unit-II**

**Elasticity:** Deforming force, Elastic limit, stress, strain and their types, Hooke's law, Modulus of rigidity, Relation between shear angle and angle of twist, elastic energy stored/volume in an elastic body, Elongation produced in heavy rod due to its own weight and elastic potential energy stored in it, Tension in rotating rod, Poisson's ratio and its limiting value, Elastic Constants, and their relations. Torque required for twisting cylinder, bending of beam, bending moment and its magnitude, determination of elastic constants for material of wire by Searle's method.

**Unit-III**

**Gravitation and central force motion:** Law of gravitation, Gravitational potential energy, Inertial and gravitational mass, Potential and field due to spherical shell and solid sphere, Motion of a particle under a central force field, Two-body problem and its reduction to one-body problem and its solution, Differential Equation of motion with central force and its solution, Concept of power Law Potentials, Kepler's Laws of Planetary motion.

**Unit-IV**

**Special Theory of Relativity:** Michelson's Morley experiment and its outcomes, Postulates of special theory of relativity, Lorentz Transformations, Simultaneity and order of events, Lorentz contraction, Time dilation, Relativistic transformation of velocity, relativistic addition of velocities, variation of mass-energy equivalence, relativistic Doppler effect, relativistic kinematics, transformation of energy and momentum, transformation of force.

**C24PHY101P: Mechanics Lab**

**Paper Code: C24PHY101P/ C24MIN101P**

**30 Hrs (2 Hrs /week)** **External Marks: 20**

**Credit: 1** **Internal Marks: 10**

**Time: 3 Hrs** **Total Marks: 30**

**Practical**

1. Measurement of length (or diameter) using Vernier Caliper, screw gauge and travelling microscope.
2. To study the random error in observations.
3. To determine the area of window using a sextant.
4. Moment of Inertia of a Fly Wheel
5. Moment of Inertia of irregular body using a Torsion Pendulum.
6. Young's Modulus by Bending of Beam.
7. Modulus of rigidity of material of wire by Maxwell's Needle.
8. Elastic constants by Searle's method.
9. To determine the value of 'g' by using Bar pendulum.
10. To compare Moment of Inertia of a solid Sphere, Hollow Sphere, and solid Disc of same mass with the help of Torsion Pendulum.
11. To determine the bending moment of a cantilever beam with uniformly distributed load, uniformly varying load and point load.

**Note: The list of experiments may vary. Student will perform at least six experiments. The examiner will allot one practical at the time of end term examination. Students are required to get minimum pass marks separately as per university rules in theory and practical components of the course.**

**Suggested Books:**


1. Mechanics "Berkeley Physics Course Vol. I", Charles Kittel, Tata McGraw-Hill
2. Mechanics, D.S. Mathur, S. Chand and Company Limited, 2000
3. Elements of Properties of Matter, D.S. Mathur, S. Chand & Com. Pt. Ltd., New Delhi
4. Physics, Resnick, Halliday & Walker, Wiley
5. An introduction to mechanics, D. Kleppner, R.J. Kolenkow, 1973, McGraw-Hill.
6. B.Sc. Practical Physics, C.L. Arora, S. Chand Publisher, New Delhi


Course Outcomes (COs)

After completing this course, the student will be able to:

CO1. Understand the motion of rigid object along the surface, so that they can calculate moment of inertia, velocity, acceleration, total kinetic energy of an object that undergoing both translational and rotational motion and apply energy conservation in analyzing such motion.

CO2. Know about the basic concepts of elasticity, bending moment, torsional oscillations, and modulus of rigidity

CO3. Understand postulates of Special theory of relativity and its consequences such as length contraction, time dilation, relativistic mass and mass-energy equivalence.

CO4. Comprehend the general characteristics of central forces and the application of Kepler's laws to describe the motion of planets and satellite in circular orbit through the study of law of Gravitation.

CO5. Perform experiments on Properties of matter such as the determination of moduli of elasticity viz., Young's modulus, Rigidity modulus of certain materials; Sextant, Moment of inertia of some regular bodies by different methods and compare the experimental values with the standard values

**Mapping of COs with POs**

**C24PHY101T/ C24MIN101T and C24PHY101P/ C24MIN101P**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|---|---|---|---|---|---|---|---|
| CO1 | S | M | M | M | M | S | S |
| CO2 | S | M | M | M | M | S | S |
| CO3 | S | M | M | M | M | S | S |
| CO4 | S | M | S | M | M | S | S |
| CO5 | S | M | S | S | S | S | S |

S= Strong, M = Medium, W= Weak

**Discipline Specific Course (DSC-A2)**

**C24PHY102T: Introductory Mathematical Physics – I**

**Paper Code: C24PHY102T**
**60 Hrs (4Hrs /week)** **External Marks: 70**
**Credits: 4** **Internal Marks: 30**
**Time: 3 Hrs** **Total Marks: 100**

Note: Paper setter is to set nine questions in all. Question no. 1 (compulsory based on the entire syllabus) will consist of seven short answer type questions, each of two marks. Rest of Eight questions is to be set uniformly selecting two questions from each Unit. A student is required to attempt five questions in all selecting one from each Unit and a compulsory question 1.

**UNIT-I**

**Vector Calculus:** Properties of vectors under rotations, Scalar product and its invariance under rotations, Vector product, Scalar triple product and their interpretation in terms of area and volume respectively.
**Vector Differentiation:-** Scalar and Vector Fields. Ordinary and Partial Derivative of a Vector w.r.t. Coordinates. Space Curves. Unit Tangent Vector and Unit Normal Vector (without Frenet - Serret Formulae). Directional Derivatives and Normal Derivative. Gradient of a Scalar Field and its Geometrical Interpretation. Divergence and Curl of a Vector Field. Del and Laplacian Operators. Vector Identities.

**UNIT-II**

**Vector Integration:** Ordinary Integral of Vectors. Line, Surface and Volume Integrals. Flux of a Vector Field. Gauss' Divergence Theorem, Green's Theorem and Stokes Theorem and their applications.
**Double and Triple Integrals**: Change of Order of Integration. Change of Variables and Jacobian. Applications of Multiple Integrals : (1) Area Enclosed by Plane Curves, (2) Area of a Curved Surface, (3) Volumes of Solids.

**UNIT-III**

**Some Special Integrals:** Beta and Gamma Functions and its Relation, Expression of Integrals in terms of Gamma Functions, Error Function (Probability Integral).

**Dirac Delta function and its properties:** Definition of Dirac delta function, Representation as limit of a Gaussian function and rectangular function, Properties of Dirac delta function.

**Theory of Errors:** Systematic and Random Errors, Propagation of Errors, Normal Law of Errors, Standard and Probable Error, Least-squares fit, Error on the slope and intercept of a fitted line.

**UNIT-IV**

**Introduction to probability:** Independent random variables, Probability distribution functions; Binomial, Gaussian, and Poisson distributions (with examples), mean and variance, Dependent events: Conditional Probability, Bayes' Theorem and the idea of hypothesis testing.

**Suggested Books:**


1. Mathematical Methods for Physicists, G.B. Arfken, H.J. Weber, F.E. Harris, 2013, 7th Edn., Elsevier.
2. Advanced Engineering Mathematics, Erwin Kreyszig, 2008, Wiley India.
3. Mathematical Physics, H K Das, S Chand

**Course Outcomes (COs)**

After completing this course, the students will be able to:

CO1. Understand the Vector algebra and the vector differentiation for their applications in various branch of physics.
CO2. Understand the vector integration and various important theorems such as Gauss divergence theorem, Stokes theorem and Green's theorem.
CO3. Learn about the some special integral, Dirac Delta function and their applications to various branch of physics.
CO4. Develop an understanding on the theory and types of errors involved in various calculations used in physics.
CO5. Know about the concept of probability and its types that play the important role in microphysics.

**Mapping of COs with POs**

**C24PHY102T**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|---|---|---|---|---|---|---|---|
| CO1 | M | S | M | M | M | M | S |
| CO2 | M | S | S | M | M | M | S |
| CO3 | M | S | M | S | M | M | S |
| CO4 | M | S | S | M | M | M | S |
| CO5 | M | S | S | S | M | M | S |

S= Strong, M = Medium, W= Weak

**Physics**
**Minor Course (MIC-1 / DSC-A1)**
**C24MIN101T: Mechanics**

**Paper Code: C24MIN101T/C24PHY101T**
**45 Hrs (3 Hrs /week)** **External Marks: 50**
**Credits: 3** **Internal Marks: 20**
**Time: 2.5 Hrs** **Total Marks: 70**

**Note**: The examiner is required to set nine questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 2 marks each. In addition to this, eight more questions (each question may be of 2-3 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt five questions in all selecting one from each unit in addition to the compulsory Question No.1. All questions carry equal marks. 20% numerical problems are to be set and use of scientific calculator (nonprogrammable) is allowed.

**Unit-I**

**Fundamentals of Dynamics**: Rigid body, Moment of Inertia, Radius of Gyration, Theorems of perpendicular and parallel axis (with proof), Moment of Inertia of ring, Disc, Angular Disc, Solid cylinder, Solid sphere, Hollow sphere, Torque, Rotational Kinetic Energy, Angular momentum, Law of conservation of angular momentum, rolling motion, condition for pure rolling, acceleration of body rolling down an inclined plane, Fly wheel, Moment of Inertia of an irregular body.

**Unit-II**

**Elasticity:** Deforming force, Elastic limit, stress, strain and their types, Hooke's law, Modulus of rigidity, Relation between shear angle and angle of twist, elastic energy stored/volume in an elastic body, Elongation produced in heavy rod due to its own weight and elastic potential energy stored in it, Tension in rotating rod, Poisson's ratio and its limiting value, Elastic Constants, and their relations. Torque required for twisting cylinder, bending of beam, bending moment and its magnitude, determination of elastic constants for material of wire by Searle's method.

**Unit-III**

**Gravitation and central force motion:** Law of gravitation, Gravitational potential energy, Inertial and gravitational mass, Potential and field due to spherical shell and solid sphere, Motion of a particle under a central force field, Two-body problem and its reduction to one-body problem and its solution, Differential Equation of motion with central force and its solution, Concept of power Law Potentials, Kepler's Laws of Planetary motion.

**Unit-IV**

**Special Theory of Relativity:** Michelson's Morley experiment and its outcomes, Postulates of special theory of relativity, Lorentz Transformations, Simultaneity and order of events, Lorentz contraction, Time dilation, Relativistic transformation of velocity, relativistic addition of velocities, variation of mass-energy equivalence, relativistic Doppler effect, relativistic kinematics, transformation of energy and momentum, transformation of force.

**C24MIN101P: Mechanics Lab**

**Paper Code: C24MIN101P/ C24PHY101P**
**30 Hrs (2 Hrs /week)** **External Marks: 20**
**Credit: 1** **Internal Marks: 10**
**Time: 3 Hrs** **Total Marks: 30**

**Practical**

1. Measurement of length (or diameter) using Vernier Caliper, screw gauge and travelling microscope.
2. To study the random error in observations.
3. To determine the area of window using a sextant.
4. Moment of Inertia of a Fly Wheel
5. Moment of Inertia of irregular body using a Torsion Pendulum.
6. Young's Modulus by Bending of Beam.
7. Modulus of rigidity of material of wire by Maxwell's Needle.
8. Elastic constants by Searle's method.
9. To determine the value of 'g' by using Bar pendulum.
10. To compare Moment of Inertia of a solid Sphere, Hollow Sphere, and solid Disc of same mass with the help of Torsion Pendulum.
11. To determine the bending moment of a cantilever beam with uniformly distributed load, uniformly varying load and point load.

**Note: The list of experiments may vary. Student will perform at least six experiments. The examiner will allot one practical at the time of end term examination. Students are required to get minimum pass marks separately as per university rules in theory and practical components of the course.**

**Suggested Books:**


1. Mechanics "Berkeley Physics Course Vol. I", Charles Kittel, Tata McGraw-Hill
2. Mechanics, D.S. Mathur, S. Chand and Company Limited, 2000
3. Elements of Properties of Matter, D.S. Mathur, S. Chand & Com. Pt. Ltd., New Delhi
4. Physics, Resnick, Halliday & Walker, Wiley
5. An introduction to mechanics, D. Kleppner, R.J. Kolenkow, 1973, McGraw-Hill.
6. B.Sc. Practical Physics, C.L. Arora, S. Chand Publisher, New Delhi


Course Outcomes (CO)

After completing this course, the student will be able to:

CO1. Understand the motion of rigid object along the surface, so that they can calculate moment of inertia, velocity, acceleration, total kinetic energy of an object that undergoing both translational and rotational motion and apply energy conservation in analyzing such motion.

CO2. Know about the basic concepts of elasticity, bending moment, torsional oscillations, and modulus of rigidity

CO3. Understand postulates of Special theory of relativity and its consequences such as length contraction, time dilation, relativistic mass and mass-energy equivalence.

CO4. Comprehend the general characteristics of central forces and the application of Kepler's laws to describe the motion of planets and satellite in circular orbit through the study of law of Gravitation.

CO5. Perform experiments on Properties of matter such as the determination of moduli of elasticity viz., Young's modulus, Rigidity modulus of certain materials; Sextant, Moment of inertia of some regular bodies by different methods and compare the experimental values with the standard values

**Mapping of CO with PO**
**C24MIN101T/C24PHY101T and C24MIN101P/ C24PHY101P**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|---|---|---|---|---|---|---|---|
| CO1 | S | M | M | M | M | S | S |
| CO2 | S | M | M | M | M | S | S |
| CO3 | S | M | M | M | M | S | S |
| CO4 | S | M | S | M | M | S | S |
| CO5 | S | M | S | S | S | S | S |

S= Strong, M = Medium, W= Weak

**Physics**
**Multidisciplinary Course (MDC-1)**
**C24MDC123T: Fundamental of Physics-I**

**Paper Code: C24MDC123T**
**30 Hrs (2 Hrs /week)** **External Marks: 35**
**Credits: 2** **Internal Marks: 15**
**Time: 2 Hrs** **Total Marks: 50**

**Note**: The examiner is required to set five questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 3 marks each. In addition to this, four more questions (each question may be of 2-3 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt three questions in all selecting one from each unit in consisting of 10 marks in addition to the compulsory Question No.1.

**Unit-I**

**Fundamental of Physics:** System of Measuring Units-Need for measurement, measuring process, concept of mass, length, time; Fundamental and derive units, system of units, concepts of error, types of error (only definition), Accuracy and precision in measurement, least count and applications of measuring instruments -Vernier caliper, Screw Gauge. Scalar and Vector quantities.

**Unit-II**

**Laws of motion:** Description of motion along a straight line- distance and displacement, uniform motion and non-uniform motion, average and instantaneous speed, average and instantaneous velocity, acceleration; graphical analysis of straight-line motion- distance- time graph, velocity-time graph, equation of motions and their applications.
Causes of motion- concept of force, Newton's Ist law of motion, inertia, and mass; Newton's $2^{nd}$ law of motion, momentum, and force; $3^{rd}$ law of motion, daily life applications of Newton's laws of motion.
Universal law of gravitation and its importance, acceleration due to gravity and free fall of a body; mass and weight of an object on earth and moon, concept of thrust and pressure and importance in daily life.

**C24MDC123P: Fundamental of Physics-I Lab**

**Paper Code: C24MDC123P**
**30 Hrs (2 Hrs /week)** **External Marks: 15**
**Credit: 1** **Internal Marks: 10**
**Time: 3 Hrs** **Total Marks: 25**

**Practical**

1. To measure the diameter of a small spherical / cylindrical body.
2. To measure the length, width and height of the given rectangular block using vernier calipers.
3. To measure the internal diameter and depth of a given beaker/calorimeter and hence find its volume.
4. Use of screw gauge to measure diameter of a given wire.
5. Use of screw gauge to measure thickness of a given sheet
6. Diameter of thin wire using Screw gauge

**Note: The list of experiments may vary. The examiner will allot one practical at the time of end term examination. Students are required to get minimum pass marks separately as per university rules in theory and practical components of the course.**

**Suggested Books:**


1. Essential University Physics, Vol.-1 &2 by Richard Wolfson, Pearson Education, Patparganj, Delhi, India.
2. Concept of Physics by H.C. Verma, Bharti Bhawan, Ansari Road, Daryaganj, New Delhi, India.
3. Modern Physics (2nd edition), by S.L. Kakani and Shubhra Kakani, Viva Books, New Delhi.
4. Physics for Scientists and Engineers with Modern Physics, 7th edition, by Raymond A. Serway and John W. Jewett, Jr., Thomson Higher Education 10 Davis Drive Belmont, CA 94002-3098 USA.
5. Physics For You, Fifth Edition, by Keith Johnson, OUP Oxford.


**Course Outcomes (COs)**

After completing this course, the student will be able to:

CO1. Understand the system of Measuring Units-Need for measurement, measuring process, concept of mass, length, time; and applications of measuring instruments -Vernier caliper, Screw Gauge.

CO2. Know about the description of motion along a straight line- distance and displacement, uniform motion and non-uniform motion, and about universal law of gravitation and its importance.

CO3. Perform experiments on measuring the diameter of a small spherical / cylindrical body; use of screw gauge to measure diameter of a given wire and compare the experimental values with the standard values.

**Mapping of COs with POs**
**C24MDC123T & C24MDC123P**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|---|---|---|---|---|---|---|---|
| CO1 | M | M | S | S | M | S | S |
| CO2 | M | M | S | S | M | S | S |
| CO3 | M | M | S | S | M | S | S |

S= Strong, M = Medium, W= Weak

**Physics**
**Skill Enhancement Course (SEC-1)**
**C24SEC130T: Instrumentation-I**

**Paper Code: C24SEC130T**
**30 Hrs (2 Hrs /week)** **External Marks: 35**
**Credits: 2** **Internal Marks: 15**
**Time: 2 Hrs** **Total Marks: 50**

**Note**: The examiner is required to set five questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 3 marks each. In addition to this, four more questions (each question may be of 2-3 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt three questions in all selecting one from each unit in consisting of 10 marks in addition to the compulsory Question No.1.

**Unit-I**

Error in measurement, Types of error, Ohm's law, Kirchhoff's current law, Kirchhoff's voltage law, Wheatstone bridge, Potentiometer, Measurement of emf of a cell using potentiometer, Multimeter: Principles of measurement of dc voltage and dc current, ac voltage, ac current and resistance. Specifications of a multimeter and their significance. Electronic Voltmeter: Advantage over conventional multimeter for voltage measurement with respect to input impedance and sensitivity. Principles of voltage measurement (block diagram only).

**Unit-II**

Cathode Ray Oscilloscope: Block diagram of basic CRO. Construction of CRT, Electron gun, electrostatic focusing and acceleration (Explanation only– no mathematical treatment), brief discussion on screen phosphor, visual persistence & chemical composition. Time base operation, synchronization. Front panel controls. Specifications of a CRO and their significance. Use of CRO for the measurement of voltage (dc and ac frequency, time period. Special features of dual trace.

**C24SEC130P: Instrumentation-I Lab**

**Paper Code: C24SEC130P**
**30 Hrs (2 Hrs /week)** **External Marks: 15**
**Credit: 1** **Internal Marks: 10**
**Time: 3 Hrs** **Total Marks: 25**

**Practical**

1. To study different types of measuring tools such as Vernier Calipers, Screw Gauge and determine their least count.
2. Verification of ohm's law from unknown resistance.
3. To determine value of unknown resistance using Wheatstone bridge.
4. Measurement of voltage, frequency, time period and phase angle using CRO.
5. To observe the loading effect of a multimeter while measuring voltage across a low resistance and high resistance.
6. Electronic Voltmeter measurement of peak, average and R.M.S. value of signal.
7. To observe the limitations of a multimeter for measuring high frequency voltage and currents.

**Note: The list of experiments may vary. The examiner will allot one practical at the time of end term examination. Students are required to get minimum pass marks separately as per university rules in theory and practical components of the course.**

**Suggested Books:**


1. Essential University Physics, Vol.-1 &2 by Richard Wolfson, Pearson Education, Patparganj, Delhi, India.
2. Electronic Devices and circuits, S. Salivahanan & N. S.Kumar, 3rd Ed., 2012, Tata Mc-Graw Hill.
3. Fundamental of Physics by Resnick, Halliday and Walker, WILEY student edition.
4. Advanced Practical Physics for students, B.L.Flint and H.T.Worsnop, 1971, Asia Publishing House.


**Course Outcomes (CO)**

After completing this course, the students will be able to:
CO1. Understand the error involved in measurements and different techniques used in resistance measurements.
CO2. Know about the functioning of CRO and its use in electronic circuits.
CO3. Perform experiments related resistance measurement; use of CRO in various experiments.

**Mapping of COs with POs**
**C24SEC130T & C24SEC130P**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|---|---|---|---|---|---|---|---|
| CO1 | M | M | M | S | M | S | S |
| CO2 | M | M | S | S | M | S | M |
| CO3 | M | M | S | S | M | S | S |

S= Strong, M = Medium, W= Weak

**Physics**
**Value Added Course (VAC-1/VAC-2)**
**C24VAC119T: Electronic Components and Measuring Instruments**

**Paper Code: C24VAC119T**
**30 Hrs (2 Hrs /week)** **External Marks: 35**
**Credits: 2** **Internal Marks: 15**
**Time: 2 Hrs** **Total Marks: 50**

**Note**: The examiner is required to set five questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 3 marks each. In addition to this, four more questions (each question may be of 2-3 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt three questions in all selecting one from each unit in consisting of 10 marks in addition to the compulsory Question No.1.

**Unit-I**

**Introduction to electronics:** basic electronic concept; charge, Millikan's oil drop experiment, voltage, current and power concepts, electronic components: resistors, capacitors and inductors, their series, and parallel combinations, colour coding of resistors, ohm's law and Kirchhoff's law of voltage and current.

Basic concepts of conductors, insulators and semi-conductors, energy band in conductors, insulators and semiconductor, types of semi-conductors.

**Unit-II**

**p-n junction:** p-n diode and its forward and reverse characteristics. Applications of diode; Diode as a rectifier, LED, Solar cell, Zener diode and its characteristics.

**Transistors:** Transistors and its configurations and characteristics (CB, CE, CC), DC load line analysis, Q point, Application of transistor: as an amplifier, oscillator. Types of oscillators: Colpit's oscillator and Hartley oscillator

**Suggested Books:**


1. Physics of Semiconductor Devices, S. M. Sze, Willey Publisher.
2. Integrated Electronics, Jacob Millman and C C Halkias, TATA McGraw-Hill Edition.
3. A text book in Electrical Technology- B L Theraja – S Chand & Co.
4. Basic Electronics and Linear Circuits, N N Bhargava, McGraw-Hill Edition.


**Course Outcomes (CO)**
After completing this course, the student will be able to:
CO1. Understand the basics of electronic components such as resistor, capacitor, and inductor.
CO2. Know about the p-n junction, Zener diode and applications of diode as LED and solar cell
CO3. Understand the transistor configuration and various application in electronics

**Mapping of CO with PO C24VAC119T**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|---|---|---|---|---|---|---|---|
| CO1 | M | M | S | S | M | S | S |
| CO2 | M | M | S | M | M | S | S |
| CO3 | M | M | S | M | M | S | M |

S= Strong, M = Medium, W= Weak

# Semester-II

**Discipline Specific Course (DSC-A3)**
**C24PHY201T: Electricity and Magnetism**

**Paper Code: C24PHY201T/C24MIN201T**
**45 Hrs (3 Hrs /week)** **External Marks: 50**
**Credits: 3** **Internal Marks: 20**
**Time: 2.5 Hrs** **Total Marks: 70**

**Note:** The examiner is required to set nine questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 2 marks each. In addition to this, eight more questions (each question may be of 2-3 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt five questions in all selecting one from each unit in addition to the compulsory Question No.1. All questions carry equal marks. 20% numerical problems are to be set. Use of scientific calculator (nonprogrammable) is allowed.

**Unit-I**

**Vector Background** a**nd Electric Field**: Gradient of a scalar and its physical significance, Line, Surface and Volume integrals of a vector and their physical significance, Flux of a vector field, Divergence and curl of a vector and their physical significance, Gauss's divergence theorem, Stoke's theorem. Conservative nature of Electrostatic Field, Electrostatic Potential, Potential as line integral of field, potential difference Derivation of electric field E from potential as gradient. Derivation of Laplace and Poisson equations. Electric flux, Gauss's Law, Differential form of Gauss's law and applications of Gauss's law.

**Unit-II**

**Magnetic Field:** Biot-Savart law and its applications: straight wire and circular loop, Current Loop as a Magnetic Dipole and its Dipole Moment, Ampere's Circuital Law, and its applications to (1) Solenoid and (2) Toroid,

**Magnetic Properties of Matter:** Force on a dipole in an external field, Electric currents in Atoms, Electron spin and Magnetic moment, types of magnetic materials, Magnetization vector (M), Magnetic Intensity (H), Magnetic Susceptibility and permeability, Relation between B, H and M, Electronic theory of dia and paramagnetism, Domain theory of ferromagnetism (Langevin's theory), B-H curve and hysteresis loop, importance of Hysteresis loop.

**Unit-III**

**Time varying electromagnetic fields:** Electromagnetic induction, Faraday's laws of induction and Lenz's Law, Self-inductance, Mutual inductance, Energy stored in a Magnetic field, Derivation of Maxwell's equations, Displacement current, Maxwell's equations in differential and integral form and their physical significance.

**Electromagnetic Waves:** Electromagnetic waves, Transverse nature of electromagnetic wave, energy transported by electromagnetic waves, Poynting vector, Poynting's theorem. Propagation of Plane electromagnetic waves in free space & Dielectrics.

**Unit-IV**

**DC current Circuits:** Electric current and current density, Electrical conductivity, and Ohm's law, Kirchhoff's laws for D.C. networks, Network theorems: Thevenin's theorem, Norton theorem, Superposition theorem.

**Alternating Current Circuits:** A resonance circuit, Phasor, Complex Reactance and Impedance, Analysis for RL, RC and LC Circuits, Series LCR Circuit: (1) Resonance, (2) Power Dissipation (3) Quality Factor and (4) Band Width, Parallel LCR Circuit.

**C24PHY201P: Electricity and Magnetism Lab**

**Paper Code: C24PHY201P/C24MIN201P**
**30 Hrs (2 Hrs /week)** **External Marks: 20**
**Credit: 1** **Internal Marks: 10**
**Time: 3 Hrs** **Total Marks: 30**

**Practical**

1. Use of Multimeter for measuring Resistance, A.C. and D.C. Voltage and Current, checking of electrical fuses.
2. Determination of Impedance of an A.C. circuit and its verification.
3. Frequency of A.C. mains using an electromagnet.
4. Frequency of A.C. mains Electrical vibrator.
5. High resistance by substitution method.
6. To study the Characteristics of a Series RC Circuit.
7. To study a series LCR circuit and determine its (a) Resonant frequency, (b) Quality factor.
8. To study a parallel LCR circuit and determine its (a) Anti-resonant frequency and (b) Quality factor.
9. To verify the Thevenin and Norton theorems.
10. To verify the Superposition and Maximum Power Transfer Theorems.

**Note: The list of experiments may vary. Student will perform at least six experiments. The examiner will allot one practical at the time of end term examination. Students are required to get minimum pass marks separately as per university rules in theory and practical components of the course.**

## Suggested Books:


1. Electricity and Magnetism (Berkley, Phys. Course 2), Edward M. Purcell, 1986 McGraw-Hill Education
2. Introduction to Electrodynamics, D.J. Griffiths, 3rd Edn., 1998, Benjamin Cummings.
3. Feynman Lectures Vol.2, R.P. Feynman, R.B. Leighton, M. Sands, 2008, Pearson Education
4. Electricity and Magnetism, J.H.Fewkes & J.Yarwood. Vol. I, 1991, Oxford Univ. Press.
5. Field and Wave Electromagnetics (2nd Edn.), David K. Cheng, Addison-Wesley Publishing Company.
6. B.Sc. Practical Physics, C.L. Arora, S. Chand Publisher, New Delhi.
7. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, Asia Publishing House.


**Course Outcomes (COs)**

After completing this course, the students will be able to:

- CO1. Understand the Gauss law and its application to obtain electric field in different cases.
- CO2. Understand Biot and Savart's law and Ampere's circuital law to describe and explain the generation of magnetic fields by electrical currents.
- CO3. Distinguish between the magnetic effect of electric current and electromagnetic induction and apply the related laws in appropriate circumstances.
- CO4. Develop an understanding on the unification of electric and magnetic fields and Maxwell's equations governing electromagnetic waves.
- CO5. Phenomenon of resonance in LCR AC-circuits, sharpness of resonance, Q- factor, Power factor and the comparative study of series and parallel resonant circuits.
- CO6. Learn to present observations, results analysis and different concepts related to experiments of Electricity and Magnetism

**Mapping of COs with POs**
**C24PHY201T/C24MIN201T and C24PHY201P/C24MIN201P**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|---|---|---|---|---|---|---|---|
| CO1 | M | S | M | M | M | S | M |
| CO2 | M | S | M | M | M | S | M |
| CO3 | M | S | M | M | M | S | M |
| CO4 | M | S | S | M | M | S | S |
| CO5 | M | S | S | S | M | S | S |
| CO6 | M | S | S | S | M | S | S |

S= Strong, M = Medium, W= Weak

**Discipline Specific Course (DSC-A4)**

**C24PHY202T: Introductory Mathematical Physics-II**

**Paper Code: C24PHY202T**
**60 Hrs (4 Hrs /week)** **External Marks: 70**
**Credits: 4** **Internal Marks: 30**
**Time: 3 Hrs** **Total Marks: 100**

Note: Paper setter is to set nine questions in all. Question no. 1 (compulsory based on the entire syllabus) will consist of seven short answer type questions, each of two marks. Rest of Eight questions is to be set uniformly selecting two questions from each Unit. A student is required to attempt five questions in all selecting one from each Unit and a compulsory question 1.

**UNIT – I**

**Calculus:** Plotting of functions. Approximation: Taylor and binomial series (statements only).
**Differential Equations Classification:** Ordinary and Partial, Order and Degree, Linear and Nonlinear, Homogeneous and Non-homogeneous. Solution: Explicit and Implicit, Number of Arbitrary Constants.
**Linear Ordinary Differential Equations First order :-** (1) Separable Equations. Initial Value Problem. (2) Exact Equations. Integrating Factor. (3) Linear Equations. Lagrange's Method of Variation of Parameters.

**UNIT – II**

**Linear Ordinary Differential Equations Second order:-** Homogeneous Equations with Constant Coefficients. Wronskian and General Solution. Statement of Existence and Uniqueness Theorem for Initial Value Problems. Solution of Non-homogeneous Equations by D Operator Method. Particular Integral. Methods of Undetermined Coefficients and Variation of Parameters. Equations Reducible to those with Constant Coefficients. Bernoulli and Euler Equations.
**Coupled Differential Equations:-** Solution by Method of Elimination.

**UNIT-III**

**Partial Differential Equations:** Solutions to partial differential equations, using separation of variables: Laplace's Equation in problems of rectangular, cylindrical spherical symmetry. Wave equation and its solution for vibrational modes of a stretched string, rectangular and circular membranes, Diffusion Equation.

**UNIT – IV**

**Fourier series:** Periodic functions, Orthogonally of sine and cosine functions, Dirichlet Conditions (Statement only). Expansion of periodic functions in a series of sine and cosine functions and determination of Fourier coefficients, Complex representation of Fourier series, Expansion of functions with arbitrary period, Expansion of non-periodic functions over an interval, Even and odd functions and their Fourier expansions Application, Summing of Infinite Series, Term-by-Term differentiation and integration of Fourier Series, Parseval Identity.

**Suggeted Books:**

1. Mathematical Methods for Physicists: Arfken, Weber, 2005, Harris, Elsevier.
2. Fourier Analysis by M.R. Spiegel, 2004, Tata McGraw-Hill.
3. Mathematics for Physicists, Susan M. Lea, 2004, Thomson Brooks/Cole.

**Course Outcomes (COs)**

After completing this course, the students will be able to:

CO1. Learn about the calculus and types of equations for their applications in various branch of physics.
CO2. Understand the first and second order ordinary differential equations involves various field of science.
CO3. Analyse the use of partial differential equations in physics.
CO4. Develop an understanding about the use of various physical equations i.e., wave equation and diffusion equation..
CO5. Know about the concept of Fourier series and its types that play the important role in physics.

**Mapping of COs with POs**

**C24PHY202T**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|---|---|---|---|---|---|---|---|
| CO1 | M | S | M | M | M | M | S |
| CO2 | M | S | S | M | M | M | S |
| CO3 | M | S | M | S | M | M | S |
| CO4 | M | S | S | M | M | M | S |
| CO5 | M | S | S | S | M | M | S |

S= Strong, M = Medium, W= Weak

**Physics**
**Minor Course (MIC-2 / DSC-A3)**
**C24MIN201T: Electricity and Magnetism**

**Paper Code: C24MIN201T/C24PHY201T**
**45 Hrs (3 Hrs /week)** **External Marks: 50**
**Credits: 3** **Internal Marks: 20**
**Time: 2.5 Hrs** **Total Marks: 70**

**Note:** The examiner is required to set nine questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 2 marks each. In addition to this, eight more questions (each question may be of 2-3 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt five questions in all selecting one from each unit in addition to the compulsory Question No.1. All questions carry equal marks. 20% numerical problems are to be set. Use of scientific calculator (nonprogrammable) is allowed.

**Unit-I**

**Vector Background** a**nd Electric Field**: Gradient of a scalar and its physical significance, Line, Surface and Volume integrals of a vector and their physical significance, Flux of a vector field, Divergence and curl of a vector and their physical significance, Gauss's divergence theorem, Stoke's theorem. Conservative nature of Electrostatic Field, Electrostatic Potential, Potential as line integral of field, potential difference Derivation of electric field E from potential as gradient. Derivation of Laplace and Poisson equations. Electric flux, Gauss's Law, Differential form of Gauss's law and applications of Gauss's law.

**Unit-II**

**Magnetic Field:** Biot-Savart law and its applications: straight wire and circular loop, Current Loop as a Magnetic Dipole and its Dipole Moment, Ampere's Circuital Law, and its applications to (1) Solenoid and (2) Toroid,

**Magnetic Properties of Matter:** Force on a dipole in an external field, Electric currents in Atoms, Electron spin and Magnetic moment, types of magnetic materials, Magnetization vector (M), Magnetic Intensity (H), Magnetic Susceptibility and permeability, Relation between B, H and M, Electronic theory of dia and paramagnetism, Domain theory of ferromagnetism (Langevin's theory), B-H curve and hysteresis loop, importance of Hysteresis loop.

**Unit-III**

**Time varying electromagnetic fields:** Electromagnetic induction, Faraday's laws of induction and Lenz's Law, Self-inductance, Mutual inductance, Energy stored in a Magnetic field, Derivation of Maxwell's equations, Displacement current, Maxwell's equations in differential and integral form and their physical significance.

**Electromagnetic Waves:** Electromagnetic waves, Transverse nature of electromagnetic wave, energy transported by electromagnetic waves, Poynting vector, Poynting's theorem. Propagation of Plane electromagnetic waves in free space & Dielectrics.

**Unit-IV**

**DC current Circuits:** Electric current and current density, Electrical conductivity, and Ohm's law, Kirchhoff's laws for D.C. networks, Network theorems: Thevenin's theorem, Norton theorem, Superposition theorem.

**Alternating Current Circuits:** A resonance circuit, Phasor, Complex Reactance and Impedance, Analysis for RL, RC and LC Circuits, Series LCR Circuit: (1) Resonance, (2) Power Dissipation (3) Quality Factor and (4) Band Width, Parallel LCR Circuit.

## C24MIN201P: Electricity and Magnetism Lab

**Paper Code: C24MIN201P/C24PHY201P**
**30 Hrs (2 Hrs /week)** **External Marks: 20**
**Credit: 1** **Internal Marks: 10**
**Time: 3 Hrs** **Total Marks: 30**

**Practical**

1. Use of Multimeter for measuring Resistance, A.C. and D.C. Voltage and Current, checking of electrical fuses.
2. Determination of Impedance of an A.C. circuit and its verification.
3. Frequency of A.C. mains using an electromagnet.
4. Frequency of A.C. mains Electrical vibrator.
5. High resistance by substitution method.
6. To study the Characteristics of a Series RC Circuit.
7. To study a series LCR circuit and determine its (a) Resonant frequency, (b) Quality factor.
8. To study a parallel LCR circuit and determine its (a) Anti-resonant frequency and (b) Quality factor.
9. To verify the Thevenin and Norton theorems.
10. To verify the Superposition and Maximum Power Transfer Theorems.

**Note: The list of experiments may vary. Student will perform at least six experiments. The examiner will allot one practical at the time of end term examination. Students are required to get minimum pass marks separately as per university rules in theory and practical components of the course.**

### Suggested Books:


1. Electricity and Magnetism (Berkley, Phys. Course 2), Edward M. Purcell, 1986 McGraw-Hill Education
2. Introduction to Electrodynamics, D.J. Griffiths, 3rd Edn., 1998, Benjamin Cummings.
3. Feynman Lectures Vol.2, R.P. Feynman, R.B. Leighton, M. Sands, 2008, Pearson Education
4. Electricity and Magnetism, J.H.Fewkes & J.Yarwood. Vol. I, 1991, Oxford Univ. Press.
5. Field and Wave Electromagnetics (2nd Edn.), David K. Cheng, Addison-Wesley Publishing Company.
6. B.Sc. Practical Physics, C.L. Arora, S. Chand Publisher, New Delhi.
7. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, Asia Publishing House.


**Course Outcomes (COs)**

After completing this course, the students will be able to:

CO1. Understand the Gauss law and its application to obtain electric field in different cases.
CO2. Understand Biot and Savart's law and Ampere's circuital law to describe and explain the generation of magnetic fields by electrical currents.
CO3. Distinguish between the magnetic effect of electric current and electromagnetic induction and apply the related laws in appropriate circumstances.
CO4. Develop an understanding on the unification of electric and magnetic fields and Maxwell's equations governing electromagnetic waves.
CO5. Phenomenon of resonance in LCR AC-circuits, sharpness of resonance, Q- factor, Power factor and the comparative study of series and parallel resonant circuits.
CO6. Learn to present observations, results analysis and different concepts related to experiments of Electricity and Magnetism

**Mapping of COs with POs**
**C24MIN201T/C24PHY201T and C24MIN201P/C24PHY201P**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|---|---|---|---|---|---|---|---|
| CO1 | M | S | M | M | M | S | M |
| CO2 | M | S | M | M | M | S | M |
| CO3 | M | S | M | M | M | S | M |
| CO4 | M | S | S | M | M | S | S |
| CO5 | M | S | S | S | M | S | S |
| CO6 | M | S | S | S | M | S | S |

S= Strong, M = Medium, W= Weak

**Physics**
**Multidisciplinary Course (MDC-2)**
**Fundamental of Physics-II**

**Paper Code: C24MDC223T**
**30 Hrs (2 Hrs /week)** **External Marks: 35**
**Credits: 2** **Internal Marks: 15**
**Time: 2 Hrs** **Total Marks: 50**

**Note**: The examiner is required to set five questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 3 marks each. In addition to this, four more questions (each question may be of 2-3 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt three questions in all selecting one from each unit in consisting of 10 marks in addition to the compulsory Question No.1.

**Unit-I**

**Light and Optics**-Nature and properties of light, its speed, frequency, and wavelength; Reflection of light-types of reflection and their importance in daily life, laws of reflection, multiple reflection by mirrors and their applications.
Refraction of light- laws of refraction, refractive index, refraction of light through prism (dispersion of light), formation Rainbow, twinkling of stars, advance Sunrise, and delayed Sunset; Scattering of light and blue colour of the sky; apparent depth, total internal reflection, and its important applications.

**Unit-II**

**Electricity**- electric charge, types of charges, unit of charge, frictional electricity, electricity by conduction and electric current, units of electric current, measurement of current, conductors and insulators; resistance, resistivity and Ohm's law, electric potential and potential difference, emf; Electric circuit- resistor, capacitor, battery, ammeter and voltmeter; Series and parallel combinations of resistors, electrical wiring in houses and electrical safety (fuse, hot wire, neutral, ground and short circuit), electric power and electric power transmission; Heating effect of current and its practical applications.

**C24MDC223P: Fundamental of Physics-II Lab**

**Paper Code: C24MDC223P**
**30 Hrs (2 Hrs /week)** **External Marks: 15**
**Credit: 1** **Internal Marks: 10**
**Time: 3 Hrs** **Total Marks: 25**

**Practical**

1. To determine radius of curvature of a given spherical surface by a spherometer.
2. To study the reflection of light.
3. To study the dispersion of light.
4. To find the current and voltage in electronic circuit.
5. To determine the least count of ammeter, voltmeter, travelling microscope and spectrometer.
6. To study the total internal reflection of light.

**Note: The list of experiments may vary. The examiner will allot one practical at the time of end term examination. Students are required to get minimum pass marks separately as per university rules in theory and practical components of the course**

**Suggested Books:**


1. Essential University Physics, Vol.-1 &2 by Richard Wolfson, Pearson Education, Patparganj, Delhi, India.
2. Concept of Physics by H.C. Verma, Bharti Bhawan, Ansari Road, Daryaganj, New Delhi, India.
3. Modern Physics (2nd edition), by S.L. Kakani and Shubhra Kakani, Viva Books, New Delhi.
4. Physics for Scientists and Engineers with Modern Physics, 7th edition, by Raymond A. Serway and John W. Jewett, Jr., Thomson Higher Education 10 Davis Drive Belmont, CA 94002-3098 USA.
5. Physics For You, Fifth Edition, by Keith Johnson, OUP Oxford.


**Course Outcomes (COs)**

After completing this course, the students will be able to:

CO1. Understand the light behavior such as reflection, refraction, dispersion and scattering and various applications.
CO2. Know about the electric charge, conductors, insulators, resistance, electric current and various laws that describe their applications in various fields.
CO3. Perform experiments using light, to measure the resistance and current in a circuit; use of ammeter and voltmeter in electric circuit and various experiments

**Mapping of COs with POs**
**C24MDC223T and C24MDC223P**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|---|---|---|---|---|---|---|---|
| CO1 | M | M | M | M | M | S | M |
| CO2 | M | S | S | S | M | S | S |
| CO3 | M | S | S | S | M | S | S |

S= Strong, M = Medium, W= Weak

**Physics**
**Skill Enhancement Course (SEC-2)**
**C24SEC230T: Instrumentation-II**

**Paper Code: C24SEC230T**
**30 Hrs (2 Hrs /week)** **External Marks: 35**
**Credits: 2** **Internal Marks: 15**
**Time: 2 Hrs** **Total Marks: 50**

**Note**: The examiner is required to set five questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 3 marks each. In addition to this, four more questions (each question may be of 2-3 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt three questions in all selecting one from each unit in consisting of 10 marks in addition to the compulsory Question No.1.

**Unit-I**

Self-induction, Coefficient of self-induction of solenoid, Mutual induction, Coefficient of mutual induction of solenoid, B-H curve, Hysteresis loop, Permanent magnets, Transformers. Efficiency of transformers, Losses in transformers.

Introduction to semiconductors, Intrinsic and Extrinsic semiconductors (n and p-type semiconductors), p-n junction, Forward bias, Reverse bias, Zener breakdown, Different types of diode, Half-wave and Full-wave rectifier, Zener diode as voltage regulator.

**Unit-II**

Bipolar Junction Transistors: n-p-n and p-n-p, Biasing of transistor in active, cut-off and saturation modes, Circuit configuration and characteristics of Common Base, Common Emitter, Common Collector Transistors, Current gains $\alpha$ and $\beta$.

## C24SEC230P: Instrumentation-II Lab

**Paper Code: C24SEC230P**
**30 Hrs (2 Hrs /week)** **External Marks: 15**
**Credit: 1** **Internal Marks: 10**
**Time: 3 Hrs** **Total Marks: 25**

**Practical**

1. Forward and Reverse Bias characteristics of p-n junction diode.
2. Zener Diode as Voltage Regulator.
3. To draw Common Base characteristics of a transistor and calculate transistor characteristics parameters.
4. To draw Common Emitter characteristics of a transistor and calculate transistor characteristics parameters.
5. Study the BH curve using Oscilloscope.
6. Frequency of A.C. mains using Sonometer.
7. Frequency of A.C. mains using Electric Vibrator.

**Note: The list of experiments may vary. The examiner will allot one practical at the time of end term examination. Students are required to get minimum pass marks separately as per university rules in theory and practical components of the course.**

**Suggested Books:**


1. Essential University Physics, Vol.-1 &2 by Richard Wolfson, Pearson Education, Patparganj, Delhi, India.
2. Concept of Physics by H.C. Verma, Bharti Bhawan, Ansari Road, Daryaganj, New Delhi, India.
3. Fundamental of Physics by Resnick, Halliday and Walker, WILEY student edition.
4. Physics of Semiconductor Devices, S. M. Sze, Willey Publisher.
5. Integrated Electronics, Jacob Millman and C C Halkias, TATA McGraw-Hill Edition.


**Course Outcomes (COs)**

After completing this course, the students will be able to:

CO1. Understand the concept of induction, B-H curve and functioning of transformer.
CO2. Know about the basics of p-n junction, transistors, and their use in devices.
CO3. Perform experiments related to Zener diode, transistors configuration, B-H curve and to calculate the frequency of alternating current

**Mapping of COs with POs**
**C24SEC230T and C24SEC230P**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|---|---|---|---|---|---|---|---|
| CO1 | M | S | M | S | M | S | S |
| CO2 | M | M | S | S | M | S | S |
| CO3 | M | M | S | S | M | S | S |

S= Strong, M = Medium, W= Weak

# Semester-III

**Discipline Specific Course (DSC-A5)**
**C24PHY301T: Thermodynamics and Statistical Physics**

**Paper Code: C24PHY301T/C24MIC333T**
**45 Hrs (3Hrs /week)** **External Marks: 50**
**Credits: 3** **Internal Marks: 20**
**Time: 2.5 Hrs** **Total Marks: 70**

**Note**: The examiner is required to set nine questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 2 marks each. In addition to this, eight more questions (each question may be of 2-3 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt five questions in all selecting one from each unit in addition to the compulsory Question No.1. All questions carry equal marks. 20% numerical problems are to be set and use of scientific calculator (nonprogrammable) is allowed.

**Unit-I**

**Thermodynamics-I:** Thermodynamics systems, variables and equation of state, thermal equilibrium, Zeroth law of thermodynamics; Concept of heat, work and its sign(work done by the system on the system), First law of thermodynamics- its significance and limitations, different types of process-isochoric process, isobaric process, adiabatic process, isothermal process, cyclic process, Reversible and irreversible process, First law and cyclic process; Second law of thermodynamics and its significance, Carnot theorem; Absolute scale of temperature, Absolute Zero, Joule's free expansion, Joule Thomson effect, Entropy, calculations of entropy of reversible and irreversible process, T-S diagram, entropy of a perfect gas, Nernst heat law (third law of thermodynamics).

**Unit-II**

**Thermodynamics-II:** Derivation of Clausius-Clapeyron and Clausius latent heat equations and their significance, phase diagram and triple point of a substance, Thermodynamics functions: Internal energy (U), Helmholtz function (F), Enthalpy (H), Gibbs function (G) and the relations between them, derivation of Maxwell thermodynamics relations from thermodynamics functions, Application of Maxwell relations: relations between two specific heats of gas.

**Unit-III**

**Statistical Physics-I:** Distribution of N (for N= 2, 3, 4) distinguishable and indistinguishable particles in two boxes of equal size, microstates and microstate's, thermodynamically probability, constraints and accessible states, statistical fluctuations, general distribution of distinguishable particles in compartments of different size, postulates of statistical mechanics

**Unit-IV**

**Statistical Physics-II:** Classical statistics, basic approach to these statistics, Maxwell-Boltzmann statistics applied to an ideal gas in equilibrium-energy and speed distribution law, most probable speed, average and r.m.s. speed., Need of Quantum statistics- classical versus quantum statistics, Bose-Einstein energy distribution Law, Fermi Dirac energy distribution Law.

. **C24PHY301P: Thermodynamics and Statistical Physics Lab**

**Paper Code: C24PHY301P/C24MIC333P**
**30 Hrs (2 Hrs /week)** **External Marks: 20**
**Credit: 1** **Internal Marks: 10**
**Time: 3 Hrs** **Total Marks: 30**

**Practical**

1. To determine Mechanical Equivalent of Heat, J, by Callender and Barne's constant flow method.
2. Measurement of Planck's constant using black body radiation.
3. To determine Stefan's Constant.
4. To determine the coefficient of thermal conductivity of copper by Searle's Apparatus.
5. To determine the Coefficient of Thermal Conductivity of Cu by Angstrom's Method.
6. To determine the coefficient of thermal conductivity of a bad conductor by Lee and Charlton's disc method.
7. To determine the temperature co-efficient of resistance by Platinum resistance thermometer.
8. To study the variation of thermo emf across two junctions of a thermocouple with temperature.
9. To record and analyze the cooling temperature of an hot object as a function of time using a thermocouple and suitable data acquisition system
10. To calibrate Resistance Temperature Device (RTD) using Null Method/Off-Balance Bridge
11. To prove the law of probability by using one coin, two coins and 10 or more coins.
12. To determine the coefficient of increase of volume of air at constant pressure.
13. To determine the coefficient of increase of pressure of air at constant volume.
14. Computer simulation of Maxwell-Boltzmann distribution, Fermi- Dirac & Bose-Einstein
15. Study of statistical distribution from the given data and to find most probable, average, and rms value
16. Mechanical Equivalent of heat (J) by Joule's calorimeter.

**Note: The list of experiments may vary. Student will perform at least six experiments. The examiner will allot one practical at the time of end term examination. Students are required to get minimum pass marks separately as per university rules in theory and practical components of the course.**

**Suggested Books:**


1. Thermal Physics and Statistical Mechanics, S.K. Roy, New Age International Publishers, New Delhi
2. Thermodynamics and Statistical Physics, J.K. Sharma and K.K. Sarkar, Himalaya Publishing House, Bombay
3. Introduction to Thermodynamics and its Applications, Stowe Keith, University Press (India) Pvt. Ltd, Hyderabad
4. Introductory Thermodynamics, Pierre Infelta, BrownWalker Press, Boca Ratan, Florida
5. Fundamentals of Thermodynamics, J. K. Johnson, University of Pittsburgh 2009
6. Thermodynamics and Its Applications, Jefferson Tester, Michael Modell, 3rd Edition
7. Thermodynamics, Statistical Thermodynamics & Kinetics, Thomas Engel, Philip Reid, 2nd Edition
8. Advanced Practical Physics for students, B.L.Flint & H.T.Worsnop, 1971, Asia Publishing House.


Course Outcomes (COs)

After completing this course, the student will be able to:

CO1. Understand the thermodynamics systems, laws of thermodynamics and their significance, Joule-Thomson effect and entropy.
CO2. Know about the Clausius-Clapeyron and Clausius latent heat equations, Internal energy (U), Helmholtz function (F), Enthalpy (H), Gibbs function (G) of rigidity, Application of Maxwell relations: relations between two specific heats of gas.
CO3. Understand the basics of statistical physics, Classical and quantum statistics, and Maxwell's distribution of speed & velocity.
CO4. Know about the Dulong and Petit Law, B. E. condensation and the F. D. energy distribution Law for electron gas.
CO5. Perform experiments on thermodynamics and statistical physics by different methods and compare the experimental values with the standard values

**Mapping of COs with POs**
**C24PHY301T and C24PHY301P**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|---|---|---|---|---|---|---|---|
| CO1 | M | S | M | S | M | S | S |
| CO2 | M | S | M | S | M | S | M |
| CO3 | M | S | M | S | M | S | M |
| CO4 | M | S | S | S | M | S | S |
| CO5 | M | S | S | S | S | S | S |

S= Strong, M = Medium, W= Weak

**Discipline Specific Course (DSC-A6)**

**C24PHY302T: Waves and Oscillations**

**Paper Code: C24PHY302T**
**60 Hrs (4Hrs /week)** **External Marks: 70**
**Credits: 4** **Internal Marks: 30**
**Time: 3 Hrs** **Total Marks: 100**

Note: Paper setter is to set nine questions in all. Question no. 1 (compulsory based on the entire syllabus) will consist of seven short answer type questions, each of two marks. Rest of Eight questions is to be set uniformly selecting two questions from each Unit. A student is required to attempt five questions in all selecting one from each Unit and a compulsory question 1. The question paper shall contain 20% numerical problems.

**UNIT-I**

**Oscillations: SHM**: Simple Harmonic Oscillations, Differential equation of SHM and its solution. Simple pendulum and compound pendulum, Superposition of Collinear Harmonic oscillations: Linearity and Superposition Principle, Superposition of two collinear oscillations having (1) equal frequencies and (2) different frequencies (Beats), Superposition of N collinear Harmonic Oscillations with (1) equal phase differences and (2) equal frequency differences.

Superposition of two perpendicular Harmonic Oscillations: Graphical and Analytical Methods, Lissajous Figures with equal and unequal frequency and their uses.

**UNIT-III**

**Damped Oscillations**: Differential equation of a damped oscillator and its solutions, heavy damping, critical damping, weak damping; characterizing weak damping: logarithmic decrement; relaxation time, quality factor; differential equation of an undamped oscillator and its solution;
**Forced Oscillations and Resonance**: differential equation of a weakly damped forced harmonic oscillator and its solutions, steady state solution, resonance. Examples of forced vibrations and resonance, power absorbed by a forced oscillator, quality factor.

**UNIT-II**

**Wave Motion:** Wave Equation, Solution of wave equation, Particle and Wave Velocities, Intensity of Wave.
**Transverse Waves:** The string as a force oscillator**,** Velocity of Transverse Vibrations of Stretched Strings, Reflections and transmission of waves on a string at a boundary, Reflections and transmission of Energy.
**Longitudinal Waves:** Velocity of Longitudinal Waves in a Fluid in a Pipe, Newton's Formula for Velocity of Sound, Laplace's Correction, Reflections and transmission of sound waves at a boundary, Reflections and transmission of sound intensity, Energy distribution in sound waves, Phase and Group Velocities

**UNIT-IV**

**The Doppler Effect:** Source in Motion and Observer Stationary, Source Stationary and Observer in Motion, Source and Observer both in Motion; Shock Waves,
**Principle of Superposition and types of waves:** Principle of Superposition of Waves; Stationary Waves, Properties of stationary waves, Velocity of a Particle at any Point in a Stationary Wave, Harmonics in Stationary Waves.

**Suggested Books:**


1. Optics, Ajoy Ghatak, 2008, Tata McGraw Hill
2. The Physics of Vibrations and Waves, H. J. Pain, 2013, John Wiley and Sons.
3. The Physics of Waves and Oscillations, N.K. Bajaj, 1998, Tata McGraw Hill.

Course Outcomes (COs)

After completing this course, the student will be able to:

CO1. Understand the oscillations, simple harmonic motion of waves and various oscillations types.
CO2. Know about the damped oscillations, forced oscillations and resonance.
CO3. Analyse the wave motions, transverse and longitudinal waves.
CO4. Know about the Doppler Effect, principle of superposition of waves and wave types.

**Mapping of COs with POs**
**C24PHY302T**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|---|---|---|---|---|---|---|---|
| CO1 | M | S | M | S | M | S | M |
| CO2 | M | S | M | S | M | S | M |
| CO3 | M | S | M | S | M | S | M |
| CO4 | M | S | S | S | M | S | M |

S= Strong, M = Medium, W= Weak

**Physics**
**Minor Course (MIC-3/ DSC-A5)**
**C24MIC333T: Thermodynamics and Statistical Physics**

**Paper Code: C24MIC333T / C24PHY301T**
**45 Hrs (3Hrs /week)** **External Marks: 50**
**Credits: 3** **Internal Marks: 20**
**Time: 2.5 Hrs** **Total Marks: 70**

**Note**: The examiner is required to set nine questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 2 marks each. In addition to this, eight more questions (each question may be of 2-3 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt five questions in all selecting one from each unit in addition to the compulsory Question No.1. All questions carry equal marks. 20% numerical problems are to be set and use of scientific calculator (nonprogrammable) is allowed.

**Unit-I**

**Thermodynamics-I:** Thermodynamics systems, variables and equation of state, thermal equilibrium, Zeroth law of thermodynamics; Concept of heat, work and its sign(work done by the system on the system), First law of thermodynamics- its significance and limitations, different types of process-isochoric process, isobaric process, adiabatic process, isothermal process, cyclic process, Reversible and irreversible process, First law and cyclic process; Second law of thermodynamics and its significance, Carnot theorem; Absolute scale of temperature, Absolute Zero, Joule's free expansion, Joule Thomson effect, Entropy, calculations of entropy of reversible and irreversible process, T-S diagram, entropy of a perfect gas, Nernst heat law (third law of thermodynamics).

**Unit-II**

**Thermodynamics-II:** Derivation of Clausius-Clapeyron and Clausius latent heat equations and their significance, phase diagram and triple point of a substance, Thermodynamics functions: Internal energy (U), Helmholtz function (F), Enthalpy (H), Gibbs function (G) and the relations between them, derivation of Maxwell thermodynamics relations from thermodynamics functions, Application of Maxwell relations: relations between two specific heats of gas.

**Unit-III**

**Statistical Physics-I:** Distribution of N (for N= 2, 3, 4) distinguishable and indistinguishable particles in two boxes of equal size, microstates and microstate's, thermodynamically probability, constraints and accessible states, statistical fluctuations, general distribution of distinguishable particles in compartments of different size, postulates of statistical mechanics

**Unit-IV**

**Statistical Physics-II:** Classical statistics, basic approach to these statistics, Maxwell-Boltzmann statistics applied to an ideal gas in equilibrium-energy and speed distribution law, most probable speed, average and r.m.s. speed., Need of Quantum statistics- classical versus quantum statistics, Bose-Einstein energy distribution Law, Fermi Dirac energy distribution Law.

. **C24MIC333P: Thermodynamics and Statistical Physics Lab**

**Paper Code: C24MIC333P/C24PHY301P**
**30 Hrs (2 Hrs /week)** **External Marks: 20**
**Credit: 1** **Internal Marks: 10**
**Time: 3 Hrs** **Total Marks: 30**

**Practical**

1. To determine Mechanical Equivalent of Heat, J, by Callender and Barne's constant flow method.
2. Measurement of Planck's constant using black body radiation.
3. To determine Stefan's Constant.
4. To determine the coefficient of thermal conductivity of copper by Searle's Apparatus.
5. To determine the Coefficient of Thermal Conductivity of Cu by Angstrom's Method.
6. To determine the coefficient of thermal conductivity of a bad conductor by Lee and Charlton's disc method.
7. To determine the temperature co-efficient of resistance by Platinum resistance thermometer.
8. To study the variation of thermo emf across two junctions of a thermocouple with temperature.
9. To record and analyze the cooling temperature of an hot object as a function of time using a thermocouple and suitable data acquisition system
10. To calibrate Resistance Temperature Device (RTD) using Null Method/Off-Balance Bridge
11. To prove the law of probability by using one coin, two coins and 10 or more coins.
12. To determine the coefficient of increase of volume of air at constant pressure.
13. To determine the coefficient of increase of pressure of air at constant volume.
14. Computer simulation of Maxwell-Boltzmann distribution, Fermi- Dirac & Bose-Einstein
15. Study of statistical distribution from the given data and to find most probable, average, and rms value
16. Mechanical Equivalent of heat (J) by Joule's calorimeter.

**Note: The list of experiments may vary. Student will perform at least six experiments. The examiner will allot one practical at the time of end term examination. Students are required to get minimum pass marks separately as per university rules in theory and practical components of the course.**

**Suggested Books:**


1. Thermal Physics and Statistical Mechanics, S.K. Roy, New Age International Publishers, New Delhi
2. Thermodynamics and Statistical Physics, J.K. Sharma and K.K. Sarkar, Himalaya Publishing House, Bombay
3. Introduction to Thermodynamics and its Applications, Stowe Keith, University Press (India) Pvt. Ltd, Hyderabad
4. Introductory Thermodynamics, Pierre Infelta, BrownWalker Press, Boca Ratan, Florida
5. Fundamentals of Thermodynamics, J. K. Johnson, University of Pittsburgh 2009
6. Thermodynamics and Its Applications, Jefferson Tester, Michael Modell, 3rd Edition
7. Thermodynamics, Statistical Thermodynamics & Kinetics, Thomas Engel, Philip Reid, 2nd Edition
8. Advanced Practical Physics for students, B.L.Flint & H.T.Worsnop, 1971, Asia Publishing House.


Course Outcomes (COs)

After completing this course, the student will be able to:

CO1. Understand the thermodynamics systems, laws of thermodynamics and their significance, Joule-Thomson effect and entropy.

CO2. Know about the Clausius-Clapeyron and Clausius latent heat equations, Internal energy (U), Helmholtz function (F), Enthalpy (H), Gibbs function (G) of rigidity, Application of Maxwell relations: relations between two specific heats of gas.

CO3. Understand the basics of statistical physics, Classical and quantum statistics, and Maxwell's distribution of speed & velocity.

CO4. Know about the Dulong and Petit Law, B. E. condensation and the F. D. energy distribution Law for electron gas.

CO5. Perform experiments on thermodynamics and statistical physics by different methods and compare the experimental values with the standard values

**Mapping of COs with POs**
**C24MIC333T and C24MIC333P**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|---|---|---|---|---|---|---|---|
| CO1 | M | S | M | S | M | S | S |
| CO2 | M | S | M | S | M | S | M |
| CO3 | M | S | M | S | M | S | M |
| CO4 | M | S | S | S | M | S | S |
| CO5 | M | S | S | S | S | S | S |

S= Strong, M = Medium, W= Weak

**Physics**
**Multidisciplinary Course (MDC-3)**
**C24MDC323T: Introductory Modern Physics**

**Paper Code: C24MDC323T**
**30 Hrs (2 Hrs /week)** **External Marks: 35**
**Credits: 2** **Internal Marks: 15**
**Time: 2 Hrs** **Total Marks: 50**

**Note**: The examiner is required to set five questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 3 marks each. In addition to this, four more questions (each question may be of 2-3 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt three questions in all selecting one from each unit in consisting of 10 marks in addition to the compulsory Question No.1.

**Unit-I**

**Introduction to electromagnetic spectra**: -Electromagnetic radiations, radio waves, microwaves, Infrared radiations (IR), Visible light, Ultraviolet (UV) light-Rays, Gamma rays, range Applications of electromagnetic Radiations. Dispersion of light, Photoelectric effect, Einstein's explanation. Compton scattering (Only Qualitative), Pair production and annihilation.

**Unit-II**

**Atomic structure**: Rutherford scattering, Rutherford's model and its drawbacks, Bohr atomic model; quantization rule, atomic stability, calculation of energy levels for hydrogen atom and their spectra.
**Wave properties of matter**: De-Broglie wavelength and matter waves; Wave-particle duality, wave packets, phase velocity, group velocity and their relations.

**C24MDC323P: Introductory Modern Physics Lab**

**Paper Code: C24MDC323P**
**30 Hrs. (2 Hrs. /week)** **External Marks: 15**
**Credit: 1** **Internal Marks: 10**
**Time: 3 Hrs.** **Total Marks: 25**

**Practical**

1. To determine the angle of dispersion.
2. Photo-electric effect: photo current versus intensity and wavelength of light; maximum energy of photo-electrons versus frequency of light
3. To determine the Planck's constant using LEDs of at least 4 different colours.
4. To determine the thickness of a thin wire using a laser Source.
5. To find the specific rotation coefficient for cane sugar using polarimeter.
6. Study the characteristics of Photodiodes
7. To compare Illuminating power of two sources

**Note: The list of experiments may vary. Student will perform at least six experiments. The examiner will allot one practical at the time of end term examination. Students are required to get minimum pass marks separately as per university rules in theory and practical components of the course.**

**Suggested Books:**


1. Concepts of Modern Physics, Arthur Beiser, 2002, McGraw-Hill.
2. Introduction to Modern Physics, Rich Meyer, Kennard, Coop, 2002, Tata McGraw Hill
3. Modern Physics, Knneth S.Krane, JOHN WILEY & SONS, INC
4. "Electromagnetic Waves "by Umran S. Inan and Aziz S. Inan

**Course Outcomes (COs)**

After completing this course, the student will be able to:

CO1. Understand the electromagnetic spectrum, photoelectric effect, Compton scattering and pair production.
CO2. Know about the description of atomic structure and its various models, and wave properties of matter.
CO3. Perform experiments on measuring the Planck's constant, photo current versus intensity and wavelength of light etc., and compare the experimental values with the standard values.

**Mapping of COs with POs**
**C24MDC323T and C24MDC323P**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|---|---|---|---|---|---|---|---|
| CO1 | M | S | M | S | M | S | S |
| CO2 | M | S | M | S | M | S | S |
| CO3 | M | S | M | S | M | S | M |

S= Strong, M = Medium, W= Weak

**Physics**
**Skill Enhancement Course (SEC-3)**
**C24SEC330T: Numerical Techniques**

**Paper Code: C24SEC330T**
**30 Hrs (2 Hrs /week)** **External Marks: 35**
**Credits: 2** **Internal Marks: 15**
**Time: 2 Hrs** **Total Marks: 50**

**Note**: The examiner is required to set five questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 3 marks each. In addition to this, four more questions (each question may be of 2-3 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt three questions in all selecting one from each unit in consisting of 10 marks in addition to the compulsory Question No.1.

**Unit-I**

**Introduction to Fortran:** Computer architecture and organization, memory and input/output devices, Binary and decimal arithmetic, Fortran character set, Data types and integer constant, variables, Arithmetic expression, Assignment statement, Format statement, Read/write statement, Unformatted input/output statements, Algorithm, Flowcharts,
FORTRAN statement & subprograms: GOTO, Computed GOTO, Arithmetic If, logical If, If Then Else, Nested If Then Else, DO loops, Continue statement, nested do loop. Data statement, Double precision, Logical data, Complex data, While structure, Arrays and subscripted variables, Subprograms.

**Unit-II**

**Solutions of algebraic equations:** Bisection method, Iteration method, Newton-Raphson method, Muller's method, Quotient-Difference method, Secant Method.
**Algorithm, flowchart and program:** Finding the roots of a quadratic equations, motion of a projectile, summing a series of numbers, finding factorial of given number, motion in a central force field, addition and multiplication of two matrices, solution of algebraic equations using Bisection and Newton Raphson method.

**C24SEC330P: Numerical Techniques Lab**

**Paper Code: C24SEC330P**
**30 Hrs (2 Hrs /week)** **External Marks: 15**
**Credit: 1** **Internal Marks: 10**
**Time: 3 Hrs** **Total Marks: 25**

**Practical**

1. Program to find finite integral by Simpson's 1/3 rule
2. Program to find the average and standard deviation
3. Program to compute product of two matrices
4. Program to short marks in ascending order
5. Program to short marks in descending order
6. Compute the sum of a finite series upto correct 3 decimal places
7. Fitting of a straight line using least square method

**Note: The list of experiments may vary. The list of experiments may vary. Student will perform at least six experiments. The examiner will allot one practical at the time of end term examination. Students are required to get minimum pass marks separately as per university rules in theory and practical components of the course.**

**Course Outcomes (COs)**

After completing this course, the student will be able to:
CO1. Understand the basics of computer, memory units, number systems; and their conversion.
CO2. Know about the FORTRAN statements and their sub program.
CO3. Familiar with the FORTRAN programming used in various field of science.

## Suggested Books:


1. FORTRAN 77 and Numerical Methods, C.Xavier, New Age International 1994.
2. William E. Mayo and Martin Cwiakala, Programming with Fortran 77, Schaum's outline serios, McGraw Hill, Inc.
3. Fortran 77, Programming and applications by RC Verma et al. Allied Publishers, New Delhi.
4. R C Desai, Fortran Programming and Numerical methods, Tata McGraw Hill, New Delhi.


**Mapping of COs with POs**
**C24SEC330T & C24SEC330P**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|---|---|---|---|---|---|---|---|
| CO1 | M | M | S | M | M | M | M |
| CO2 | M | M | S | S | M | S | M |
| CO3 | M | M | S | S | M | S | S |

S= Strong, M = Medium, W= Weak

**Value Added Course (VAC-3)**
**C24VAC304T: Renewable Energy**

**Paper Code: C24VAC304T**
**30 Hrs (2 Hrs /week)** **External Marks: 35**
**Credits: 2** **Internal Marks: 15**
**Time: 2 Hrs** **Total Marks: 50**

**Note**: The examiner is required to set five questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 3 marks each. In addition to this, four more questions (each question may be of 2-3 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt three questions in all selecting one from each unit in consisting of 10 marks in addition to the compulsory Question No.1.

**Unit-I**

**Introduction: -** Fundamentals of Sustainable Energy & Development, Introduction to Renewable energy – Need of switching to Renewable Energy sources, Difference between Renewable & Non-renewable sources,
**Solar Energy**: Principles of solar energy conversion, Photovoltaic effect and solar cell technology, Types of solar panels and their efficiency,
**Wind Energy**: Wind energy resources and distribution, Types of wind turbines and their applications, Power generation from wind energy.

**Unit-II**

**Geothermal Energy**: Geothermal Energy and its sources, geothermal power plants, its types and operation, Applications of geothermal heat pumps
**Biomass Energy**: Biomass as a renewable energy source, Biomass conversion technologies: combustion, gasification, and anaerobic digestion
**Advantages of Renewable Energy: -**Sustainability, Reduced Greenhouse Gas Emissions, Energy Security, Job Creation.
**Disadvantages of Renewable Energy:** - Intermittency, High Upfront Costs, Land Requirements, Technology Limitations.

**Suggested Books:**


1. Introduction to Renewable Energy by Vaughn C. Nelson, CRC Press, 2016.
2. Renewable Energy: Sources for Fuels and Electricity by Thomas B. Johansson et al.
3. Wind Energy Handbook by Tony Burton et al., Wiley, 2011..
4. Solar Electricity Handbook: A Simple, Practical Guide to Solar Energy by Michael Boxwell, Greenstream Publishing, 2023.
5. Fundamentals of Geophysics by William Lowrie, Cambridge University Press, 2nd edition, 2012.


**Course Outcomes (COs)**
After completing this course, the student will be able to:
CO1. Understand the basics of renewable and non-renewable energy sources.
CO2. Know about the various types of renewable energy sources and their working.
CO3. Understand the advantage and disadvantage of renewable energy sources.

**Mapping of COs with POs------C24VAC304T**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|---|---|---|---|---|---|---|---|
| CO1 | M | M | S | S | M | S | S |
| CO2 | M | M | S | M | M | S | S |
| CO3 | M | M | S | M | M | S | M |

S= Strong, M = Medium, W= Weak

# Semester-IV

**Discipline Specific Course (DSC-A7)**
**C24PHY401T: Optics**

**Paper Code: C24PHY401T**
**45 Hrs (3 Hrs /week)** **External Marks: 50**
**Credits: 3** **Internal Marks: 20**
**Time: 2.5 Hrs** **Total Marks: 70**

**Note:** The examiner is required to set nine questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 2 marks each. In addition to this, eight more questions (each question may be of 2-3 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt five questions in all selecting one from each unit in addition to the compulsory Question No.1. All questions carry equal marks. 20% numerical problems are to be set. Use of scientific calculator (nonprogrammable) is allowed.

**UNIT-I**

**Interference:** Division of amplitude and division of wave front, Young's Double Slit experiment, Fresnel's Biprism, Phase change on reflection: Stokes' treatment.
Interference in Thin Films: parallel and wedge-shaped films, Newton's Rings: measurement of wavelength and refractive index (for reflected wave).

**UNIT-II**

**Diffraction:** Fresnel Diffraction: Fresnel's Assumptions, Fresnel's Half-Period Zones for Plane Wave, Rectilinear Propagation of Light, Theory of a Zone Plate and its application, Multiple Foci of a Zone Plate, Fraunhofer diffraction: Single slit, Double slit multiple slits and 'n' multiple slits, Diffraction grating (Only Qualitative), Resolving power of Grating, Rayleigh Criteria of the limit of resolution and Resolving Power of a telescope.

**UNIT-III**

**Polarization:** Polarization by reflection, refraction and scattering, Malus Law, Phenomenon of double refraction, Analysis of polarized Light. Nicol prism, Quarter wave plate and half wave plate, production and detection of (i) Plane polarized light (ii) Circularly polarized light and (iii) Elliptically polarized light. Optical activity, Fresnel's theory of optical rotation, Specific rotation.

**UNIT-IV**

**Fiber Optics:** Optical Fibers - Construction and working, Critical angle of propagation, Acceptance angle, Numerical Aperture, Modes of propagation, Types of optical fibers, Attenuation. Advantages and applications of Optical Fiber.

**C24PHY401P: Optics Lab**

**Paper Code: C24PHY401P**
**30 Hrs (2 Hrs /week)** **External Marks: 20**
**Credit: 1** **Internal Marks: 10**
**Time: 3 Hrs** **Total Marks: 30**

**Practical**

1. To determine Refractive index of the material of a prism using sodium source.
2. Determination of wave length of sodium light using Newton's Rings.
3. To determine the dispersive power of a prism.
4. To draw a graph between wave length and minimum deviation for various lines from a Mercury discharge source.
5. Determination of wavelength of sodium light by using a diffraction grating.
6. Resolving power of a telescope.
7. Comparison of Illuminating Powers by a Photometer.
8. Measurement of (a) Specific rotation (b) concentration of sugar solution using polarimeter.
9. Ordinary and extra ordinary refractive indices for calcite or quartz.
10. To find the equivalent focal length of a lens system by nodal slide assembly.

**Note: The list of experiments may vary. Student will perform at least six experiments. The examiner will allot one practical at the time of end term examination. Students are required to get minimum pass marks separately as per university rules in theory and practical components of the course.**

## Suggested Books:


1. Optics, AjoyGhatak, 2008, Tata McGraw Hill
2. Lasers and Non-Linear Optics, B.B.Laud, New Age International (P) Ltd., Publishers, New Delhi
3. Lasers, Principles, Types and Applications, K.R. Nambiar, New Age International (P) Ltd., Publishers, New Delhi
4. Laser, Theory & Applications by K. Thyagarajan and A.K. Ghatak, Macmillan India limited
5. A textbook of optics by N. Subrahmanyam and Brijlal, S. Chand & Company
6. B.Sc. Practical Physics, C.L. Arora, S. Chand Publisher, New Delhi
7. Advanced Level Practical Physics, M. Nelkon and Ogborn, Henemann Education Books Ltd., New Delhi


**Course Outcomes (COs)**

After completing this course, the students will be able to:

CO1. Understand the Interference, Young's double slit experiment, Fresnel's Biprism, Newton's Rings: measurement of wavelength and refractive index.
CO2. Understand diffraction and its various types, resolving power of grating and telescopes.
CO3. Distinguish between the plane, circular and elliptical polarized light, and use of polarimeter for calculating the specific rotation.
CO4. Develop an understanding on the basic concepts of optical fiber and its various properties.
CO5. Learn about different types of optical fiber and their applications.
CO6. Learn to present observations, results analysis and different concepts related to experiments of optics.

**Mapping of COs with POs**
**C24PHY401T and C24PHY401P**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|---|---|---|---|---|---|---|---|
| CO1 | M | S | M | M | M | S | M |
| CO2 | M | S | M | M | M | S | M |
| CO3 | M | S | M | M | M | S | M |
| CO4 | M | S | S | M | M | S | S |
| CO5 | M | S | S | S | M | S | S |
| CO6 | M | S | S | S | M | S | S |

S= Strong, M = Medium, W= Weak

**Discipline Specific Course (DSC-A8)**

**C24PHY402T: Physics of Semiconductor Devices**

**Paper Code: C24PHY402T**
**45 Hrs (3Hrs /week)** **External Marks: 50**
**Credits: 3** **Internal Marks: 20**
**Time: 2.5 Hrs** **Total Marks: 70**

**Note**: The examiner is required to set nine questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 2 marks each. In addition to this, eight more questions (each question may be of 2-3 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt five questions in all selecting one from each unit in addition to the compulsory Question No.1. All questions carry equal marks. 20% numerical problems are to be set and use of scientific calculator (nonprogrammable) is allowed.

**UNIT – I**

**Physics of Semiconductors:** The Energy-Band theory of Crystals, Classification of materials, Direct and indirect band gap semiconductors, Intrinsic and extrinsic semiconductors, concept of effective mass, Donor and Acceptor impurities, mass action law, Carrier Concentrations; The Fermi Level, Charge densities in semiconductors, Electrical properties of Ge and Si, Generation and recombination of charges, Carrier diffusion, Continuity equation, Injected minority-carrier charge, The Potential variation within a graded semiconductor.

**UNIT – II**

**Semiconductor Diodes:** Open circuit p-n junction, V-I characteristics and their dependence, Ideal Diode, The Diffusion capacitance, Breakdown Diodes, Tunnel Diode, Semiconductor Photodiode, LED, Diode as circuit element, Load line, Piecewise linear diode model, p-n junction as rectifier (half, full and bridge rectifier), Ripples, Filters (capacitor, inductor and $\pi$-filters), Clipping and clamping circuits.

**UNIT – III**

**Bipolar Junction Transistors (BJT):** The junction transistor and its current components, I-V characteristics, Transistor as an amplifier, Type of transistors, Common-Base (CB), Common-Emitter (CE), Common-Collector (CC) configuration, characteristics of CE, CB, and CC configurations.

**UNIT – IV**

**Number System and Codes**: Decimal, Binary, Hexadecimal and Octal number systems, base conversions.
**Logic Gates and Boolean algebra**: Introduction to Boolean Algebra and Boolean operators: De Morgan's Theorems, Boolean Laws, simplifications of Logic Circuits using Boolean Algebra, Positive and negative logic, Truth Tables of OR, AND, NOT.

## C24PHY402P: Physics of Semiconductor Devices Practical

**Paper Code: C24PHY402P**
**30 Hrs (2 Hrs /week)** **External Marks: 20**
**Credit: 1** **Internal Marks: 10**
**Time: 3 Hrs** **Total Marks: 30**

Practical

1. Study of depletion capacitance of diode and its variation with reverse bias.
2. To design circuits for OR, AND, NOT, and NAND logic gates and verify their truth tables.
3. To study Zener diode as a voltage regulator.
4. To study the frequency response of passive filters (low pass, high pass, band pass, band reject) using passive devices.
5. To study half wave and full wave rectifier.
6. To Study I-V characteristics of PN Junction diode.
7. To Study input and output characteristics of n-p-n Transistor
8. To Study input and output characteristics of p-n-p Transistor
9. To study Voltage Doubler and Trippler circuits.

**Note: The list of experiments may vary. Student will perform at least six experiments. The examiner will allot one practical at the time of end term examination. Students are required to get minimum pass marks separately as per university rules in theory and practical components of the course.**

### Suggested Books:


1. Semiconductor Physics and Devices: Donald A Neaman and Dhrubes Biswas, 4th Edition, McGraw Hill, India
2. Integrated Electronics, J. Millman and C.C. Halkias, 1991, Tata Mc-Graw Hill.
3. Basic Electronics and Linear Circuits, N. N. Bhargava et. al., 2nd Edition, McGraw Hill, India
4. Electronics: Fundamentals and Applications, J.D. Ryder, 2004, Prentice Hall.
5. Solid State Electronic Devices, B. G. Streetman & S. K. Banerjee, 6th Edn.,2009, PHI Learning
6. B.Sc. Practical Physics, C.L. Arora, S. Chand Publisher, New Delhi


**Course Outcomes (COs)**

After completing this course, the students will be able to:

CO1. Understand the physics of semiconductor, types of semiconductor and various phenomena involved in semiconductor.
CO2. Analyse the use of pn junction as rectifier, LED, clipping and clamping circuits.
CO3. Develop an understanding about the bipolar junction transistors and characteristics.
CO4. Learn about different types of number systems, logic gates and Boolean algebra.
CO5. Enhance skill by performing experiments on basic electronics circuits.

**Mapping of COs with POs**
**C24PHY402T and C24PHY402P**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|---|---|---|---|---|---|---|---|
| CO1 | M | S | M | M | M | S | S |
| CO2 | M | S | M | M | M | M | S |
| CO3 | M | S | M | M | M | S | M |
| CO4 | M | S | S | M | M | M | S |
| CO5 | M | S | S | S | M | S | S |

S= Strong, M = Medium, W= Weak

**Discipline Specific Course (DSC-A9)**

**C24PHY403T: Astronomy and Astrophysics**

**Paper Code: C24PHY403T**
**60 Hrs (4 Hrs /week)** **External Marks: 70**
**Credits: 4** **Internal Marks: 30**
**Time: 3 Hrs** **Total Marks: 100**

**Note**: The examiner is required to set nine questions in all. The first question will be compulsory consisting of seven short questions covering the entire syllabus consisting of 2 marks each. In addition to this, eight more questions (each question may be of 2-3 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt five questions in all selecting one from each unit and the compulsory Question No.1. All questions carry equal marks

**UNIT – I**

**Astronomical Scales:** Astronomical Distance, Mass and Time, Scales, Brightness, Radiant Flux and Luminosity, Measurement of Astronomical Quantities Astronomical Distances, Stellar Radii, Masses of Stars, Stellar Temperature.
**Basic concepts of positional astronomy**: Celestial Sphere, Geometry of a Sphere, Spherical Triangle, Astronomical Coordinate Systems, Geographical Coordinate Systems, Horizon System, Equatorial System, Diurnal Motion of the Stars, Conversion of Coordinates. Measurement of Time, Sidereal Time, Apparent Solar Time, Mean Solar Time, Equation of Time, Calendar. Basic Parameters of Stars: Determination of Distance by Parallax Method; Brightness, Radiant Flux and Luminosity, Apparent and Absolute magnitude scale.

**UNIT – II**

**Astronomical techniques:** Basic Optical Definitions for Astronomy (Magnification Light Gathering Power, Resolving Power and Diffraction Limit, Atmospheric Windows), Optical Telescopes (Types of Reflecting Telescopes, Telescope Mountings, Space Telescopes, Detectors and Their Use with Telescopes (Types of Detectors, detection Limits with Telescopes).
**Sun and Solar System:** Solar Parameters, Solar Photosphere, Solar Atmosphere, Chromosphere. Corona, Solar Activity, Basics of Solar Magneto-hydrodynamics,

**UNIT – III**

**The milky way:** Basic Structure and Properties of the Milky Way, Nature of Rotation of the Milky Way Stars and Star Clusters of the Milky Way, Properties of and around the Galactic Nucleus.
**Galaxies:** Galaxy Morphology, Hubble's Classification of Galaxies, Elliptical Galaxies (The Intrinsic Shapes of Elliptical, de Vaucouleurs Law, Stars and Gas). Spiral and Lenticular Galaxies (Bulges, Disks, Galactic Halo) The Milky Way Galaxy, Gas and Dust in the Galaxy, Spiral Arms.

**UNIT – IV**

**Large scale structure & expanding universe**: Cosmic Distance Ladder (An Example from Terrestrial Physics, Distance Measurement using Cepheid Variables), Hubble's Law (Distance- Velocity Relation), Clusters of Galaxies (Viral theorem and Dark Matter).

**Suggested Books:**


1. Modern Astrophysics, B.W. Carroll & D.A. Ostlie, Addison-Wesley Publishing Co.
2. Introductory Astronomy and Astrophysics, M. Zeilik and S.A. Gregory, 4th Edition, Saunders College Publishing.
3. Fundamental of Astronomy (Fourth Edition), H. Karttunen et al. Springer Baidyanath Basu,
4. Textbook of An introduction to Astrophysics, Second printing, Prentice Hall of India Private limited, New Delhi,2001.

**Course Outcomes (COs)**

After completing this course, the student will be able to:

CO1. Understand the basics of astronomical measurements and about positional astronomy.
CO2. Know about the astronomical techniques, Sun and Solar Systems.
CO3. Understand the basic structures and properties of the Milky Way.
CO4. Learn about the large scale structure and universe expansion.

**Mapping of COs with POs**

**C24PHY403T**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|---|---|---|---|---|---|---|---|
| CO1 | M | M | S | M | M | S | M |
| CO2 | M | S | S | M | M | M | M |
| CO3 | S | S | S | S | S | S | S |
| CO4 | M | S | S | S | M | M | S |

S= Strong, M = Medium, W= Weak

**Discipline Specific Course Elective (DSC-A10)**

**C24PHY404T: Electromagnetic Theory**

**Paper Code: C24PHY404T**
**60 Hrs (4 Hrs /week)** **External Marks: 70**
**Credits: 4** **Internal Marks: 30**
**Time: 3 Hrs** **Total Marks: 100**

Note: Paper setter is to set nine questions in all. Question no. 1 (compulsory based on the entire syllabus) will consist of seven short answer type questions, each of two marks. Rest of Eight questions is to be set uniformly selecting two questions from each Unit. A student is required to attempt five questions in all selecting one from each Unit and a compulsory question 1. The question paper shall contain 20% numerical problems in the relevant papers.

**UNIT-I**

**Motional EMF**, Faraday's Law of induction, Induced electric field, Lenz's law, Inductance, Self- induction of a single coil, Mutual induction of two coils, Transformers, Energy stored in magnetic field,

**Maxwell`s equations:** Maxwell's fixing of Ampere's law, Displacement current, Maxwell's equations in vacuum.

**UNIT-II**

**Maxwell's equations in matter**, Boundary Conditions, Continuity equation, Poynting Theorem and Poynting vector, Maxwell Stress tensor, Conservation of Momentum and angular momentum in electromagnetic field, Energy density in electromagnetic field.

**UNIT-III**

**The wave equation**, Sinusoidal waves, Wave equations for **E** and **B** fields, Electromagnetic wave propagation through vacuum and isotropic dielectric medium, transverse nature of EM waves, Energy and momentum in EM waves, Propagation in linear media, Reflection and transmission at Normal and Oblique incidence, Brewster's angle, Wave guides, TEM waves

**UNIT-IV**

**Scalar and vector potential** for electromagnetic fields, Gauge Transformation, Coulomb Gauge, Lorentz Gauge, Electric and magnetic dipole radiation (no derivation needed, discussion of results only), Magnetism as relativistic phenomenon, Transformation of electric and magnetic fields between two inertial frames.

**Suggested Books:**


1. D.J. Griffiths, Introduction to Electrodynamics, 3rd Edn, 1998, Benjamin Cummings.
2. Electricity and Magnetism, Edward M.Purcell,1986,McGraw-HillEducation..
3. Electricity and Magnetism, J.H. Fewkes & J. Yarwood. Vol. I, 1991, Oxford Univ. Press.
4. University Physics, Ronald Lane Reese, 2003, ThomsonBrooks/Cole.

**Course Outcomes (COs)**

After completing this course, the students will be able to:

CO1. Understand about the induction phenomena, Maxwell's equation and energy stored in a magnetic field.

CO2. Learn about the continuity equation, Poynting Theorem and Poynting vector, Maxwell Stress tensor, Conservation of Momentum and angular momentum in electromagnetic field.

CO3. Develop an understanding on the basic concepts of wave equation, Sinusoidal waves, Wave equations for **E** and **B** fields, Electromagnetic wave propagation through vacuum and isotropic dielectric medium.

CO4. Learn about the reflection and transmission at Normal and Oblique incidence, Brewster's angle, Wave guides and TEM waves.

CO5. Understand about the Scalar and vector potential for electromagnetic fields, Gauge Transformation, Coulomb Gauge and Lorentz Gauge.

**Mapping of COs with POs**

**C24PHY404T**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|---|---|---|---|---|---|---|---|
| CO1 | M | S | M | M | M | S | M |
| CO2 | M | S | M | M | M | S | M |
| CO3 | M | S | M | M | M | S | M |
| CO4 | M | S | S | M | M | S | S |
| CO5 | M | S | S | S | M | S | S |

S= Strong, M = Medium, W= Weak

**Physics**
**Minor Course (MIN-4/VOC)**
**C24VOC433T: Introduction to Optics**

**Paper Code: C24VOC433T**
**30 Hrs (2 Hrs /week)** **External Marks: 35**
**Credits: 2** **Internal Marks: 15**
**Time: 2 Hrs** **Total Marks: 50**

**Note:** The examiner is required to set five questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 3 marks each. In addition to this, four more questions (each question may be of 2-3 parts) will be set consisting of two questions from each unit consisting of 10 marks each. The student/candidate is required to attempt three questions in all selecting one from each unit in addition to the compulsory Question No.1.

**UNIT-I**

**Interference:** Division of amplitude and division of wave front, Young's Double Slit experiment, Interference in Thin Films: parallel and wedge-shaped films, Newton's Rings: measurement of wavelength
**Diffraction:** Fresnel Diffraction: Fresnel's Assumptions, Fresnel's Half-Period Zones for Plane Wave, Fraunhofer diffraction: Single slit, double slit multiple slits and 'n' multiple slits, Diffraction grating (Only Qualitative), Resolving power of Grating, Rayleigh Criteria of the limit of resolution and Resolving Power of a telescope.

**UNIT-II**

**Polarization:** Polarization by reflection, refraction and scattering, Malus Law, Analysis of polarized Light. Nicol prism, Quarter wave plate and half wave plate, production and detection of (i) Plane polarized light (ii) Circularly polarized light and (iii) Elliptically polarized light, specific rotation.
**Fiber Optics**: Optical Fibers – Construction and working, Critical angle of propagation, Acceptance angle, Numerical Aperture, Modes of propagation, Types of optical fibers, Attenuation. Advantages and applications of Optical Fiber.

**C24VOC433P: Introduction to Optics Lab**

**Paper Code: C24VOC433P**
**60 Hrs (4 Hrs /week)** **External Marks: 35**
**Credit: 2** **Internal Marks: 15**
**Time: 3 Hrs** **Total Marks: 50**

**Practical**

1. To determine Refractive index of the material of a prism using sodium source.
2. Determination of wave length of sodium light using Newton's Rings.
3. To determine the dispersive power of a prism.
4. To draw a graph between wave length and minimum deviation for various lines from a Mercury discharge source.
5. Determination of wavelength of sodium light by using a diffraction grating.
6. Resolving power of a telescope.
7. Comparison of Illuminating Powers by a Photometer.
8. Measurement of (a) Specific rotation (b) concentration of sugar solution using polarimeter.
9. Ordinary and extra ordinary refractive indices for calcite or quartz.
10. To find the equivalent focal length of a lens system by nodal slide assembly.

**Note: The list of experiments may vary. Student will perform at least six experiments. The examiner will allot one practical at the time of end term examination. Students are required to get minimum pass marks separately as per university rules in theory and practical components of the course.**

## Suggested Books:


1. Optics, AjoyGhatak, 2008, Tata McGraw Hill
2. Laser, Theory & Applications by K. Thyagarajan and A.K. Ghatak, Macmillan India limited
3. A textbook of optics by N. Subrahmanyam and Brijlal, S. Chand & Company
4. B.Sc. Practical Physics, C.L. Arora, S. Chand Publisher, New Delhi
5. Advanced Level Practical Physics, M. Nelkon and Ogborn, Henemann Education Books Ltd., New Delhi


**Course Outcomes (Cos)**

After completing this course, the students will be able to:

CO1. Understand the Interference, Young's double slit experiment, Newton's Rings: measurement of wavelength and refractive index, diffraction and its various types, resolving power of grating and telescopes.
CO2. Distinguish between the plane, circular and elliptical polarized light, and use of polarimeter for calculating the specific rotation.
CO3. Develop an understanding on the basic concepts of optical fiber and its various properties.
CO4. Learn to present observations, results analysis and different concepts related to experiments of optics.

**Mapping of COs with POs**
**C24VOC433T and C24VOC433P**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|---|---|---|---|---|---|---|---|
| CO1 | S | S | M | S | M | S | M |
| CO2 | M | S | M | M | M | S | M |
| CO3 | M | S | M | S | M | S | M |
| CO4 | S | S | S | M | S | S | S |

S= Strong, M = Medium, W= Weak

**Physics**
**Value Added Course (VAC)**
**C24VAC408T: Introduction to Satellites**

**Paper Code: C24VAC408T**
**30 Hrs (2 Hrs /week)** **External Marks: 35**
**Credits: 2** **Internal Marks: 15**
**Time: 2 Hrs** **Total Marks: 50**

**Note**: The examiner is required to set five questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 3 marks each. In addition to this, four more questions (each question may be of 2-3 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt three questions in all selecting one from each unit in consisting of 10 marks in addition to the compulsory Question No.1.

**Unit-I**

**Introduction: -** Historical background of Indian Space Satellites, Concept of Satellite, ideas and theories, Concept of Orbits, the transfer orbit, hurdles in launching a satellite, space scarcity in space. Indian space program, Objectives of the Indian Space Program, Organizational set-up, Indian National Satellites. Milestones in India's Space Programme.

**Unit-II**

**Communication Satellite:** Orbit and Description: A brief History of Satellite Communication. Satellite Frequency bands, Satellite Systems, Applications, Orbital Period and Velocity, Effects of Orbital inclination, Azimuth and Elevation, Coverage and Slant range, Eclipse, Orbital perturbations, Placement of a Satellite in a Geo-Stationary Orbit Classification of Satellites based on Orbit Height. Indian remote sensing satellites. Launch vehicle technology.

**Suggested Books:**


1. Satellite Technology, Anil K Maini and Varsha Aggarwal, Willey Publisher.
2. Hand book of space technology, Denial Jubb, Willey Publisher.
3. Indian Space program- Gurbir Singh, Astrotalkuk Publication.


**Course Outcomes (COs)**
After completing this course, the student will be able to:

CO1. Understand the basics of Indian Space Satellites such as theories, launching a satellite, space scarcity in space and Indian space program.
CO2. Know about the communication satellite, Satellite Systems, and Placement of a Satellite in a Geo-Stationary Orbit.
CO3. Understand the Classification of Satellites based on Orbit Height, Indian remote sensing satellites, and Launch vehicle technology.

**Mapping of COs with POs**
**C24VAC408T**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|---|---|---|---|---|---|---|---|
| CO1 | M | M | M | S | M | S | S |
| CO2 | M | M | S | S | M | S | S |
| CO3 | M | M | S | S | M | S | M |

S= Strong, M = Medium, W= Weak