Department of Physics

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

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)

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 B for the session 2025-26
(For Affiliated Colleges according to National Education Policy-2020)

Subject-Physics

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-A3)	C24PHY301T	Thermodynamics and Statistical Physics	3	3	20	50	70	2.5
	C24PHY301P	Thermodynamics and Statistical Physics Lab	1	2	10	20	30	3
Discipline Specific Course (DSC-A4)	C24PHY302T	Waves and Oscillations	4	4	30	70	100	3
Discipline Specific Course (DSC-A5)	C24PHY303T	Mathematical Methods in Physics-I	4	4	30	70	100	3
Minor Course (MIC-3/Vocational)	C24VOC333T	Thermodynamics	2	2	15	35	50	2
	C24VOC333P	Thermodynamics Lab	2	4	15	35	50	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

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-A6)	C24PHY401T	Optics	3	3	20	50	70	2.5
	C24PHY401P	Optics Lab	1	2	10	20	30	3
Discipline Specific Course (DSC-A7)	C24PHY402T	Physics of Semiconductor Devices	4	4	30	70	100	3
Discipline Specific Course (DSC-A8, Elective)	C24PHY403T	Astronomy and Astrophysics	4	4	30	70	100	3
Discipline Specific Course (DSC-A9) Practicum	C24PHY404P	Semiconductor Physics Lab	4	8	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-3)	C24VAC408T	Introduction to Satellites	2	2	15	35	50	2

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-III

Discipline Specific Course (DSC-A3)
C24PHY301T: Thermodynamics and Statistical Physics

Paper Code: 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.

C24PHY301P: Thermodynamics and Statistical Physics Lab

Paper Code: 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 (CO)

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-A4)

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-II

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-III

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

Discipline Specific Course (DSC-A5)

C24PHY303T: Mathematical Methods in Physics – I

Paper Code: C24PHY303T
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

C24PHY303T

	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

Vocational Course (MIC-3/VOC)
C24VOC333T: Thermodynamics

Paper Code: C24VOC333T
30 Hrs (2Hrs /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

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.

.

C24VOC333P: Thermodynamics Lab

Paper Code: C24VOC333P
60 Hrs (4 Hrs /week) **External Marks: 35**
Credit: 2 **Internal Marks: 15**
Time: 3 Hrs **Total Marks: 50**

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.

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. Introduction to Thermodynamics and its Applications, Stowe Keith, University Press (India) Pvt. Ltd, Hyderabad
2. Introductory Thermodynamics, Pierre Infelta, BrownWalker Press, Boca Ratan, Florida
3. Fundamentals of Thermodynamics, J. K. Johnson, University of Pittsburgh 2009
4. Advanced Practical Physics for students, B.L.Flint & H.T.Worsnop, 1971, Asia Publishing House.

Course Outcomes (CO)

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

Mapping of CO with PO
C24VOC333T and C24VOC333P

	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

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
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

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. 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 CO's with PO's
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

Semester-IV

Discipline Specific Course (DSC-A6)
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-A7)

C24PHY402T: Physics of Semiconductor Devices

Paper Code: C24PHY402T
60 Hrs (4Hrs /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 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 π-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.

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.

Mapping of COs with POs

C24PHY402T

	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

S= Strong, M = Medium, W= Weak

Discipline Specific Course (Elective) (DSC-A8)

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 (Practical) (DSC-A9)

C24PHY404P: Semiconductor Physics Lab

Paper Code: C24PHY404P
120 Hrs (8 Hrs /week) **External Marks: 70**
Credit: 4 **Internal Marks: 30**
Time: 3 Hrs **Total Marks: 100**

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 eight experiments. The examiner will allot one practical at the time of end term examination. Students are required to get minimum pass marks as per university rules in this practical course.

Suggested Books:

1. Semiconductor Physics and Devices: Donald A Neaman and Dhrubes Biswas, 4th Edition, McGraw Hill, India
2. Solid State Electronic Devices, B. G. Streetman & S. K. Banerjee, 6th Edn.,2009, PHI Learning
3. 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 working of semiconductor, and various phenomena involved in semiconductor.
CO2. Learn the use of pn junction as rectifier, LED, clipping and clamping circuits.
CO3. Develop an understanding about the working of bipolar junction transistors and characteristics.
CO4. Enhance skill by performing experiments on basic electronics circuits.

Mapping of COs with POs

C24PHY404P

	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

S= Strong, M = Medium, W= Weak

Physics
Minor Course (MIC-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, Ajoy Ghatak, 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-3)
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