



HYDERABAD (SIND)
NATIONAL COLLEGIATE BOARD

HSNC Board's

Smt. Chandibai Himathmal Mansukhani College (Autonomous)

(Affiliated to the University of Mumbai)

University College Code : 217-JD Office : T14



Principal : Dr. Manju Lalwani Pathak

Ref No: CHM (A) AC/C/01/2025

Date: 18th June 2025

CIRCULAR

The immediate attention of all concerned is invited to this office Circular No. CHM (A) AC 05/2025 dated 19th May, 2025 regarding the Choice Based and Credit Based Syllabus (CBCS) for all subjects of F.Y.B.Sc. & T.Y.B.Sc. in Physics SEM - I & SEM – V respectively.

It is hereby communicated that the recommendations of the syllabus made by the Ad-hoc Board of Studies in Physics coordinated by the Dean, Faculty of Pure Sciences in the meeting of Academic Council held on 23rd May, 2025 vide item No. 5.1, have been accepted and subsequently passed.

In accordance, therewith, the syllabus as per the CBCS has been brought into force with effect from the academic year 2025 – 2026 and accordingly the same is attached for reference and is available on the College's website www.chmcollege.in

Ulhasnagar - 421 003

18th June, 2025

Dr. Manju Lalwani Pathak

Principal & Chairperson, Academic Council

Copy forwarded for information to:-

- 1) The Dean, Faculty of Humanities.
- 2) The Chairperson, Ad-hoc Board of Studies.
- 3) The Controller of Examination.
- 4) The Registrar



HSNC Board's
Smt. Chandibai Himathmal Mansukhani College, Ulhasnagar
(Autonomous)
Affiliated to the University of Mumbai

Bachelor of Science
(Physics)
(Aided Course)

Semester – V

Choice Based and Credit Based Syllabus
with effect from the
Academic Year 2025-2026

PREAMBLE

The B.Sc. Physics program is three years (six semesters) program designed to provide a comprehensive understanding of both theoretical and practical aspects of Physics at undergraduate level. This program introduces students to core concepts and principles that are fundamental for further studies in physics, engineering, and related fields.

The syllabus includes a variety of subjects such as **Mathematical Physics, Classical Mechanics, Atomic and Molecular Physics, Nuclear Physics, Solid State Physics, Electrodynamics, Relativity, Electronics and Electronic Instrumentation**. These subjects aim to enhance students' understanding of physical phenomena, develop their problem-solving skills, and prepare them for higher education, research or industrial applications.

Through rigorous coursework and practical experiments, the B. Sc. Physics program is designed to shape students into competent physicists with a broad and deep understanding of physical principles, making them well-equipped for various career opportunities and advanced academic pursuits.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO1: Advanced Understanding of Core Physics Concepts: Students will demonstrate a deep understanding of advanced topics in Physics by applying principles of Physics to solve complex physical problems and predict real-world phenomena.

PSO2: Skill in Experimental Physics and Instrumentation: Students will acquire hands-on expertise in performing experiments using modern laboratory instruments and computing tools to analyze experimental data with precision.

PSO3: Application of Mathematical Techniques in Physics: Students will be proficient in using advanced mathematical techniques, including differential equations, linear algebra, vector calculus, and Laplace transforms, to solve complex problems in Electrodynamics, Mechanics, and Atomic and Molecular Physics.

PSO4: Critical Thinking and Analytical Skills: Students will develop the ability to analyze physical systems critically, evaluate experimental results, estimate errors, and use their knowledge to approach new challenges in research or higher studies.

**Smt. Chandibai Himathmal Mansukhani College
(Autonomous)**

**Third Year B. Sc.
(Physics)**

Semester- V

**Title: Mathematical, Thermal and Statistical Physics
Paper I**

**with effect from
Academic Year 2025-2026**

Title: Mathematical, Thermal and Statistical Physics

Course Code: CHM(A)USPH501

Sr. No.	Heading	Particulars
1	Description of the Course	This course introduces students to the mathematical techniques required to understand the physical phenomena at the undergraduate level and get exposure to important ideas of statistical mechanics. The course includes problem solving using the concept of probability, introduction to complex numbers, statistical mechanics and quantum statistics.
2	Vertical	--
3	Type Teaching Method	Theory Lecture/ discussion/ presentation
4	Credit	2.5 Credits
5	Hours allotted	48 Hours
6	Marks allotted	100 Marks
7	Course Objectives: 1. To solve simple problems in probability. 2. To understand the concept of independent events and work with standard continuous distributions. 3. To understand the concept of complex numbers and their applications. 4. To understand the important ideas of statistical mechanics.	
8	Learning Outcomes: Upon completion of the course, student will be able to: LO1 solve simple problems in probability LO2 work with standard continuous distribution LO3 work with complex numbers LO4 work with statistical mechanics	

UNIT I: Probability

- Review of basic concepts
- Introduction
- sample space
- events
- independent events
- conditional probability
- probability theorems
- methods of counting (derivation of formulae not expected)
- random variables
- continuous distributions (omit joint distributions)
- binomial distribution
- the normal distribution
- the Poisson distribution

UNIT II: Complex Numbers

- Introduction,
- Real and imaginary parts of the complex numbers,
- the complex plane,
- the terminology and notation,
- the complex algebra: (i) simplifying to $x + iy$ form, (ii) complex conjugate of a complex expression, (iii) Finding the absolute value of z , (iv) Complex equations, (v) Graphs, (vi) Physical Applications

UNIT III: Statistical Mechanics

- Particle states,
- system states,
- Microstates and Macrostates of a system,
- Equilibrium and fluctuations,
- Irreversibility,
- The equiprobability postulate,
- Statistical Ensemble,
- The number of states accessible to a system,
- phase space.

UNIT IV: Quantum Statistics

- Statistical distributions,
- Maxwell-Boltzmann statistics,
- molecular energies in an ideal gas,
- quantum statistics (except Bose-Einstein condensate),
- Rayleigh-Jeans formula,
- Planck radiation laws

10

Scheme of Examination and Assessment Pattern

Paper –100 Marks

A. External Examination: Semester End External - 75 marks Time: 2.5 Hours

Format of Question Paper

Each paper shall consist of FIVE questions. All questions are compulsory and will have internal options. Choice in papers has to be TWO times.

Question No	Nature of Questions	Marks
Q1	From unit I	15
Q2	From unit II	15
Q3	From unit III	15
Q4	From unit IV	15
Q5	Will consist of questions from all the four units with equal weightage of marks allotted to each unit.	15
Total		75

B. Internal Examination: Continuous Evaluation - 25 marks

	Assessment / evaluation	Marks
1.	assignment/ MCQ's/ Match the Pairs/ Answer in one sentence/Powerpoint presentation	20
2.	Active participation	05
Total		25

11

REFERENCES:

1. Mathematical Methods in the Physical sciences: Mary L. Boas Wiley India, 3rd edition (Unit-I: 15.1-15.9 Unit-II: 2.1-2.5.)
2. Statistical and Thermal physics: An Introduction: S. Lokanathan & R. S. Gambhir, PHI, Sixth printing Nov. 2013. (Unit-III : 1.1 to 1.10)
3. AB: Concepts of Modern Physics: Arthur Beiser and Kok Wai Cheah, Mc Graw Hill International, 6th edition. (Unit-IV: 9.1-9.6 (except Bose-Einstein condensate))

**Smt. Chandibai Himathmal Mansukhani College
(Autonomous)**

**Third Year B. Sc.
(Physics)**

Semester- V

**Title: Solid State Physics
Paper II**

**with effect from
Academic Year 2025-2026**

Title: Solid State Physics
Course Code: CHM(A)USPH502

Sr. No.	Heading	Particulars
1	Description of the Course	This course introduces students to the basic concepts of crystal physics, electrical properties of metals, band theory of solids and conduction in semiconductors, diode theory and superconductivity.
2	Vertical	--
3	Type Teaching Method	Theory Lecture/ discussion/ presentation
4	Credit	2.5 Credits
5	Hours allotted	48 Hours
6	Marks allotted	100 Marks
7	Course Objectives: 1. To learn about the basics of crystallography and study the different crystal structures. 2. To learn about the electrical properties of metals on the basis of classical and quantum theory, to learn about the band theory of solids. 3. To learn about the density of states, Fermi probability distribution function, conduction in semiconductors. 4. To learn about Semiconductor Physics and superconductivity.	
8	Learning Outcomes: Upon completion of the course, student will be able to: LO1 Understand the basics of crystallography and study the different crystal structures. LO2 Understand the electrical properties of metals, band theory of solids, demarcation among the types of materials LO3 Understand the importance of Fermi probability distribution function conduction in semiconductors and BCS theory of superconductivity. LO4 Demonstrate quantitative problem solving skills in all the topics covered.	

UNIT I: Crystal Physics

- Crystal Physics: Lattice points and space lattice,
- The basis and crystal structure, Unit Cells and lattice parameters, Primitive Cells,
- Crystal Systems, Bravais space lattices,
- Metallic crystal structures,
- Relation between the density of crystal material and lattice constant in a cubic lattice,
- Other Cubic Structures - Diamond Cubic Structure, Sodium Chloride Structure,
- Directions, Planes, Miller Indices,
- Important planes in simple cubic structure, Separation between lattice planes in a cubic crystal.

UNIT II: Electrical properties of metals

- Classical free electron theory of metals and its drawbacks[Qualitative discussion: Determination of thermal Velocity. Ohms law, Discussions on Resistivity dependence on various factor, Relaxation time, Collision time and mean free path, Relation between electrical conductivity and Thermal conductivity (Wiedemann Franz law)],
- Quantum theory of free electrons Sommerfeld free electron model, Potential energy Box,
- Fermi Dirac statistics and electronic distribution in solids,
- Density of energy states and Fermi energy,
- The Fermi distribution function,
- Heat capacity of the Electron gas, Mean energy of electron gas at 0 K,
- Electrical conductivity from quantum mechanical considerations, Failure of Sommerfeld's free electron Theory
- Thermionic Emission: Richardson-Dushman equation (Derivation not required)

UNIT III: Band Theory of Solids and Conduction in Semiconductors

- Band theory of solids,
- The Kronig- Penney model (Omit solution of determinant),
- Brillouin zones,
- Number of wave functions in a band,
- Motion of electrons in a one-dimensional periodic potential,
- Distinction between metals, insulators and intrinsic semiconductors.
- Electrons and Holes in an Intrinsic Semiconductor,
- Conductivity of a Semiconductor,
- Carrier concentrations in an intrinsic semiconductor,
- Donor and Acceptor impurities,
- Charge densities in a semiconductor,
- Fermi level in extrinsic semiconductor,
- Hall Effect.

UNIT IV: Diode Theory and Superconductivity

- Semiconductor-diode Characteristics: Qualitative theory of the p-n junction,
- The p-n junction as a diode,

- | | |
|--|--|
| | <ul style="list-style-type: none">• Band structure of an open-circuit p-n junction,• The current components in a p-n junction diode (omit derivation),• Quantitative theory of p-n diode currents,• The Volt-Ampere characteristics, The temperature dependence of p-n characteristics, Diode resistance.• Superconductivity: A survey of Superconductivity,• An account of mechanism of Superconductors,• Effects of magnetic field,• Flux Exclusion: The Meissner effect,• The Penetration depth,• Type I and Type II Superconductors |
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Scheme of Examination and Assessment Pattern

Paper –100 Marks

A. External Examination: Semester End External - 75 marks Time: 2.5 hours

Format of Question Paper

Each paper shall consist of FIVE questions. All questions are compulsory and will have internal options. Choice in papers has to be TWO times.

Question No	Nature of Questions	Marks
Q1	From unit I	15
Q2	From unit II	15
Q3	From unit III	15
Q4	From unit IV	15
Q5	Will consist of questions from all the four units with equal weightage of marks allotted to each unit.	15
		Total 75

B. Internal Examination: Continuous Evaluation - 25 marks

	Assessment / evaluation	Marks
1.	assignment/ MCQ's/ Match the Pairs/ Answer in one sentence/Powerpoint presentation	20
2.	Active Participation during course	05
		Total 25

11

REFERENCES:

1. Solid State Physics: S. O. Pillai, New Age International, 6th Ed.

Unit-I: Chapter 4: II, III, IV, V, VI, XIV, XV, XVI, XVII, XVIII, XIX, XX, XXII.**Unit-II: Chapter 6: II, III, IV, V, XIV, XV, XVI, XVII, XVIII, XX, XXXV, XXXI.****Unit-III: Chapter 6: XXXVI, XXXVII, XXXVIII, XXXIX, XXXX, XXXXI****Unit-IV: Chapter 8: II,III,IV,VII,XI,XIII**2. Electronic Devices and Circuits: Millman, Halkias & Satyabrata Jit. (3rd Ed.) Tata McGraw Hill (**Unit-III: 4.1 to 4.6, 4.10, Unit-IV: 5.1 to 5.8**)

3. Introduction to Solid State Physics - Charles Kittel, 7th Ed. John Wiley & Sons.

4. Modern Physics and Solid State Physics: Problems and solutions New Age International.

5. Elementary Solid State Physics-Principles and Applications: M.Ali Omar, Pearson Education, 2012.

Additional References:

1. Solid State Physics: A. J. Dekker, Prentice Hall.

	2. Electronic Properties of Materials: Rolf Hummel, 3rd Ed. Springer. 3. Semiconductor Devices: Physics and Technology, 2nd Ed. John Wiley & Sons. 4. Solid State Physics: Ashcroft & Mermin, Harcourt College Publisher.
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**Smt. Chandibai Himathmal Mansukhani College
(Autonomous)**

**Third Year B. Sc.
(Physics)**

Semester- V

Title: Physics Practical-I

**with effect from
Academic Year 2025-2026**

Title: Physics Practical
Course Code: CHM(A)USPHP05

Sr. No.	Heading	Particulars
1	Description of the Course:	This course introduces students to the basic skills of experiments in Physics by understanding relevant concepts and by using the laboratory equipment.
2	Vertical	--
3	Type Teaching Method	Practical
4	Credit	2.5
5	Hours allotted	96 Hours
6	Marks allotted	100 Marks
7	Course Objectives: 1. To understand the underlying concept of the experiment. 2. To learn the use of various laboratory equipment. 3. To learn about experimental data collection and interpretation. 4. To obtain the result of the experiment and present it neatly.	
8	Learning Outcomes: Upon completion of the course, student will be able to: LO1 Understand the underlying concept of the experiment LO2 Understand the use of various laboratory equipment LO3 Understand the importance of Fermi probability distribution function conduction in semiconductors and BCS theory of superconductivity. LO4 Demonstrate quantitative problem solving skills in all the topics covered.	

Practical Course I

1. Determination of 'g' by Kater's pendulum
2. Surface tension of soap solution
3. Young's modulus Koenig's method
4. Velocity of sound in air using CRO
5. Determination of Rydberg's constant
6. Determination of e/m by Thomson's method
7. Edser's 'A' pattern
8. Determination of wavelength by Step slit
9. RP of Prism
10. Searle's Goniometer

SKILL EXPERIMENTS

1. Estimation of errors from actual experimental data
2. Soldering and testing of a transistor as a switch.
3. Optical Levelling of Spectrometer
4. Schuster's method
5. Laser beam profile
6. Use of electronic balance: Find the density of a solid cylinder
7. Dual trace CRO: Phase shift measurement
8. C1/C2 by B G
9. Internal resistance of voltage and current source
10. Use of DMM to test diode, transistor and β factor

Note:

1. The certified journal must contain a minimum of 6 from each Practical Course
2. Minimum 6 skill experiments to be performed in semester V.
3. A separate index and certificate in journal is must for each semester course.
4. The external examination for Practical shall be conducted at the end of each Semester
5. A candidate will be allowed to appear for the practical examination only if the candidate submits a certified journal of TYBSc Physics

10	Scheme of Examination and Assessment Pattern Paper –100 Marks External Examination: Semester End External - 100marks Time: 3 hours The learner has to appear for Two Practical sessions of three hours and 100 marks each as part of his/her Practical course examination <table><tr><th>Sr. No.</th><th>Particulars of external practical examination</th><th>Marks</th></tr><tr><td>1</td><td>Laboratory work (1 Experiment)</td><td>80</td></tr><tr><td>2</td><td>Journal</td><td>10</td></tr><tr><td>3</td><td>Viva</td><td>10</td></tr><tr><td colspan="2">Total</td><td>100</td></tr></table>	Sr. No.	Particulars of external practical examination	Marks	1	Laboratory work (1 Experiment)	80	2	Journal	10	3	Viva	10	Total		100
Sr. No.	Particulars of external practical examination	Marks														
1	Laboratory work (1 Experiment)	80														
2	Journal	10														
3	Viva	10														
Total		100														
11	REFERENCES: 1. Advanced course in Practical Physics: D. Chattopadhyaya, PC. Rakshit & 2. B. Saha (8th Edition) Book & Allied (P) Ltd. 3. BSc Practical Physics: Harnam Singh. S. Chand & Co. Ltd. – 2001. 4. A Text book of Practical Physics: Samir Kumar Ghosh New Central Book Agency (4th edition). 5. B Sc. Practical Physics: C. L. Arora (1st Edition) – 2001 S. Chand & Co. 6. Practical Physics: C. L. Squires – (3rd Edition) Cambridge Univ. Press. 7. University Practical Physics: D C Tayal, Himalaya Publication. 8. Advanced Practical Physics: Worsnop & Flint.															

**Smt. Chandibai Himathmal Mansukhani College
(Autonomous)**

**Third Year B. Sc.
(Physics)**

Semester- V

**Title: Atomic and Molecular Physics
Paper III**

**with effect from
Academic Year 2025-2026**

Title: Atomic and Molecular Physics

Course Code: CHM(A)USPH503

Sr. No.	Heading	Particulars
1	Description of the Course	This course introduces students to the basic concepts of Atomic Physics and Molecular Physics. It includes application of Quantum Mechanics in Atomic Physics, concept of electron spin, vector atom model, effect of magnetic field on atomic spectra, Molecular spectroscopy of diatomic molecules, Raman Spectroscopy, NMR, ESR and their applications..
2	Vertical	---
3	Type Teaching Method	Theory Lecture/ discussion/ presentation
4	Credit	2.5 Credits
5	Hours allotted	48 Hours
6	Marks allotted	100 Marks
7	Course Objectives: 1. To apply quantum mechanics concepts in atomic physics. 2. To study vector atom model to understand atomic spectra. 3. To study effect of magnetic field on atoms and its application 4. This course will be useful to get an insight into atomic and molecular spectroscopy and their applications.	
8	Learning Outcomes: Upon completion of the course, student will be able to: LO1 Understand the application of quantum mechanics in atomic physics LO2 Understand the importance of electron spin, symmetric and antisymmetric wave functions and vector atom model LO3 Understand effect of magnetic field on atoms and its application . LO4 Understand Molecular Physics and its applications	

Syllabus**UNIT I: Hydrogen Atom , Concept of Electron Spin**

- Hydrogen atom: Schrödinger's equation for Hydrogen atom, Separation of variables, Quantum Numbers: Principal quantum number, Orbital quantum number, Magnetic quantum number.
- Quantization of angular momentum direction,
- Electron probability density (Radial part).
- Electron spin: Spin quantum number, The Stern-Gerlach experiment,
- Pauli Exclusion principle, electron configuration, Hund's rule, quantum states, Spectral notations of quantum states.
- symmetric and Anti-symmetric wave functions

UNIT II: Vector Atom Model , Effect of Magnetic Field on Atoms

- Spin orbit coupling, Total angular momentum,
- Vector atom model, L-S and j-j coupling.
- Radiative transitions (Origin of spectral lines), Selection rules.
- Effect of Magnetic field on atoms, the normal Zeeman effect (Review – Classical explanation) based on Quantum mechanics, The Lande g - factor, Anomalous Zeeman effect

UNIT III: Molecular Spectroscopy

- Molecular spectra (Diatomic Molecules): Rotational energy levels, Rotational spectra, Vibrational energy levels, Vibrational-Rotational spectra. Electronic Spectra of Diatomic molecules: The Born- Oppenheimer approximation, Intensity of vibrational-electronic spectra: The Franck-Condon principle.
- Infrared spectrometer & Microwave spectrometer

UNIT IV: Raman Spectroscopy , ESR and NMR

- Raman effect: Quantum Theory of Raman effect, Pure Rotational Raman spectra: Linear molecules, symmetric top molecules, Asymmetric top molecules, Vibrational Raman spectra: Raman activity of vibrations, Experimental set up of Raman Effect.
- Electron spin resonance: Introduction, Principle of ESR, ESR spectrometer
- Nuclear magnetic resonance: Introduction, principle and NMR instrumentation.

10

Scheme of Examination and Assessment Pattern

Paper –100 Marks

A. External Examination: Semester End External - 75 marks Time: 2.5 hours

Format of Question Paper

Each paper shall consist of FIVE questions. All questions are compulsory and will have internal options. Choice in papers has to be TWO times.

Question No	Nature of Questions	Marks
Q1	From unit I	15
Q2	From unit II	15
Q3	From unit III	15
Q4	From unit IV	15
Q5	Will consist of questions from all the four units with equal weightage of marks allotted to each unit.	15
		Total 75

B. Internal Examination: Continuous Evaluation - 25 marks

	Assessment / evaluation	Marks
1.	assignment/ MCQ's/ Match the Pairs/ Answer in one sentence/Powerpoint presentation	20
2.	Active Participation	05
		Total 25

11

REFERENCES:

1. Concepts of Modern Physics: Arthur Beiser, Sixth edition, Tata McGraw Hill edition

(Unit-I: 6.1 to 6.7, 7.1 to 7.3, 7.5**Unit-II: 7.7, 7.8, 6.8, 6.9, 6.10)**

2. Perspectives of Modern Physics: Arthur Beiser McGraw Hill

(Unit-III: 14.1, 14.3, 14.5, 14.7)

3. Fundamentals of Molecular Spectroscopy: C. N. Banwell & E. M. McCash (TMH).(4th Ed.)

(Unit-II: 5.6**Unit-III: 2.5, 3.8****Unit-IV: 4.1.1, 4.1.2, 4.2.1, 4.2.2, 4.2.3, 4.3.1,4.3.2 , 7.2, 7.2.1,7.5.1)****Additional References:**

1. Atomic Physics (Modern Physics): S.N.Ghoshal. S.Chand Publication (for problems on atomic Physics).

**Smt. Chandibai Himathmal Mansukhani College
(Autonomous)**

**Third Year B. Sc.
(Physics)**

Semester- V

Title: Electrodynamics

Paper IV

**with effect from
Academic Year 2025-2026**

Title: Electrodynamics
Course Code: CHM(A)USPH504

Sr. No.	Heading	Particulars
1	Description of the Course	This course explains the phenomena associated with charged particles in motion and changing electric and magnetic field. It involves study of Electrostatics, Magnetostatics, Electrodynamics and Electromagnetic waves.
2	Vertical	---
3	Type Teaching Method	Theory Lecture/ discussion/ presentation
4	Credit	2.5 Credits
5	Hours allotted	48 Hours
6	Marks allotted	100 Marks
7	Course Objectives: 1. To study the laws of electrodynamics. 2. To study Maxwell's equations. 3. To understand the nature of EM waves and its propagation through different media and interfaces. 4. Solve numerical problems using Electrodynamics theory.	
8	Learning Outcomes: Upon completion of the course, student will be able to: LO1 Understand the laws of electrodynamics and be able to perform calculations using them. LO2 Understand the use of Maxwell's equations in analyzing the electromagnetic field due to time varying charge and current distribution. LO3 Understand the nature of EM waves and its propagation through different media and interfaces. LO4 Develop quantitative problem-solving skills	

UNIT I: Electrostatics

- Review of the coulomb's law and Gauss law, Divergence of Electrostatic field, the curl of Electrostatic field, The Electric Potential, Work Done to Move a point Charge, The Energy of a Point Charge Distribution, Continuous Charge Distribution.
- Dirac Delta Function
- The classic image problem-Point charge and grounded infinite conducting plane and conducting sphere.

UNIT II: Electrostatics in Matter and Magnetostatics

- Dielectrics, Induced Dipoles, Alignment of polar molecules-Uniform electrostatics field and non-uniform electrostatics field, Polarization, Bound charges and their physical interpretation modification of Gauss' law for dielectrics ,A deceptive parallel, Susceptibility, Permittivity, Dielectric constant and relation between them, Energy in dielectric systems.
- Review of Biot-Savart's law and Ampere's law, Straight-line currents, The Divergence and Curl of $\mathbf{B}$, Applications of Ampere's Law in the case of along Straight wire and a long solenoid, Comparison of Magneto-statics and Electrostatics, Magnetic Vector Potential.

UNIT III: Magnetostatics in Matter and Electrodynamics

- Magnetization, Understanding free and bound currents, Physical interpretation of bound currents, Diamagnetism, Paramagnetism and ferromagnetism
- Torques and Forces on Magnetic Dipoles, Effect of a Magnetic Field on Atomic Orbits Ampere's law in magnetized materials, Magnetics susceptibility and permeability deceptive parallel, Boundary Conditions.
- Electrodynamics before Maxwell, Maxwell's correction to Ampere's law, Maxwell's equations in matter, Magnetic charge, Boundary conditions

UNIT IV: Electromagnetic Waves

- The continuity equation-Conservation of charge, Poynting's Theorem-Conservation of energy.
- The wave equation for $\mathbf{E}$ and $\mathbf{B}$ in a free space
- plane Monochromatic electromagnetic waves
- Energy and Momentum of electromagnetic waves in vacuum,
- Propagation of EM waves in linear non-conducting media,
- Reflection and Transmission of EM waves at normal incidence,
- Oblique incidence(Qualitative analysis)

10

Scheme of Examination and Assessment Pattern

Paper –100 Marks

A. External Examination: Semester End External - 75 marks Time: 2.5 hours

Format of Question Paper

Each paper shall consist of FIVE questions. All questions are compulsory and will have internal options. Choice in papers has to be TWO times.

Question No	Nature of Questions	Marks
Q1	From unit I	15
Q2	From unit II	15
Q3	From unit III	15
Q4	From unit IV	15
Q5	Will consist of questions from all the four units with equal weightage of marks allotted to each unit.	15
		Total 75

B. Internal Examination: Continuous Evaluation - 25 marks

	Assessment / evaluation	Marks
1.	assignment/ MCQ's/ Match the Pairs/ Answer in one sentence/Powerpoint presentation	20
2.	Active Participation	05
		Total 25

11

REFERENCES:

1. DG: Introduction to Electrodynamics, David J. Griffiths (3rdEd) Prentice Hall of India.

Additional References:

1. Foundations of Electromagnetic Theory, 4th edition, John R. Reitz, Frederick J. Milford, Robert W. Christy. Pearson India
2. Introduction to Electrodynamics: A.Z.Capria and P.V.Panat, Narosa Publishing House
3. Engineering Electrodynamics: William Hayt Jr.&John H.Buck(TMh).

**Smt. Chandibai Himathmal Mansukhani College
(Autonomous)**

**Third Year B. Sc.
(Physics)**

Semester- V

Title: Physics Practical-II

**with effect from
Academic Year 2025-2026**

Title: Physics Practical
Course Code: CHM(A)USPHP06

Sr. No.	Heading	Particulars
1	Description the Course:	This course introduces students to the basic skills of experiments in Physics by understanding relevant concepts and by using the laboratory equipment.
2	Vertical	---
3	Type Teaching Method	Practical
4	Credit	2.5
5	Hours allotted	96 Hours
6	Marks allotted	100 Marks
7	Course Objectives: 1. To understand the underlying concept of the experiment. 2. To learn the use of various laboratory equipment. 3. To learn about experimental data collection and interpretation. 4. To obtain the result of the experiment and present it neatly.	
8	Learning Outcomes: Upon completion of the course, student will be able to: LO1 Understand the underlying concept of the experiment LO2 Understand the use of various laboratory equipment LO3 Understand the importance of Fermi probability distribution function conduction in semiconductors and BCS theory of superconductivity. LO4 Demonstrate quantitative problem solving skills in all the topics covered.	

Practical Course II

1. L/C by Maxwell's bridge
2. Band gap energy of Ge diode
3. Design and study of transistorized astable multivibrator (BB)
4. Design and study of Wien bridge oscillator
5. Design and study of first order active low pass filter circuit (BB)
6. Design and study of first order active high pass filter circuit (BB)
7. Application of IC 555 timer as a ramp generator (BB)
8. LM 317 as constant current source
9. Counters Mod 2, 5, 10 (2 x 5, 5 x 2)
10. Solar cell characteristics and determination of V_{oc} , I_{sc} and P_{max}

Note:

1. The certified journal must contain a minimum 6 from each Practical Course
2. A separate index and certificate in journal is must for each semester course.
3. The external examination for Practical shall be conducted at the end of each Semester
4. A candidate will be allowed to appear for the practical examination only if the candidate submits a certified journal of TYBSc Physics

10	Scheme of Examination and Assessment Pattern Paper –100 Marks External Examination: Semester End External - 100marks Time: 3 hours The learner has to appear for Two Practical sessions of three hours and 100 marks each as part of his/her Practical course examination <table><tr><th>Sr. No.</th><th>Particulars of external practical examination</th><th>Marks</th></tr><tr><td>1</td><td>Laboratory work (1 Experiment)</td><td>80</td></tr><tr><td>2</td><td>Journal</td><td>10</td></tr><tr><td>3</td><td>Viva</td><td>10</td></tr><tr><td colspan="2">Total</td><td>100</td></tr></table>	Sr. No.	Particulars of external practical examination	Marks	1	Laboratory work (1 Experiment)	80	2	Journal	10	3	Viva	10	Total		100
Sr. No.	Particulars of external practical examination	Marks														
1	Laboratory work (1 Experiment)	80														
2	Journal	10														
3	Viva	10														
Total		100														
11	REFERENCES: 1. Advanced course in Practical Physics: D. Chattopadhyaya, PC. Rakshit & 2. B. Saha (8th Edition) Book & Allied (P) Ltd. 3. BSc Practical Physics: Harnam Singh. S. Chand & Co. Ltd. – 2001. 4. A Text book of Practical Physics: Samir Kumar Ghosh New Central Book Agency (4th edition). 5. B Sc. Practical Physics: C. L. Arora (1st Edition) – 2001 S. Chand & Co. 6. Practical Physics: C. L. Squires – (3rd Edition) Cambridge Univ. Press. 7. University Practical Physics: D C Tayal, Himalaya Publication. 8. Advanced Practical Physics: Worsnop & Flint.															

**Smt. Chandibai Himathmal Mansukhani College
(Autonomous)**

**Third Year B. Sc.
(Physics)**

Semester- V

**Title: Electronic Instrumentation
(Applied Component)**

Paper V

**with effect from
Academic Year 2025-2026**

Title: Electronic Instrumentation (Applied Component)
Course Code: CHM(A)USACEI501

Sr. No.	Heading	Particulars
1	Description the Course:	This course introduces students to Analog Circuits, Instruments and Consumer Appliances. It includes the study of various transducers and sensors , measuring instruments and display devices, data acquisition systems , D to A and A to D converters, PCB fabrication, principle and working of consumer appliances like Microwave oven and medical instruments like ECG, EEG, CT scan and MRI.
2	Vertical	---
3	Type Teaching Method	Theory Lecture/ discussion/ presentation
4	Credit	2 Credits
5	Hours Alloted	48 Hours
6	Marks allotted	100 Marks
7	Course Objectives: 1. Understand the construction, working and uses of different types of transducers 2. Get the knowledge about signal conditioning, devices used and their operations. 3. Get acquainted with the measuring instruments used in the laboratory & types of display devices. 4. Get the insight of the modern medical instruments.	
8	Learning Outcomes: Upon completion of the course, student will be able to: LO1 Understand the construction, working and uses of different types of transducers LO2 Understand the concept of signal conditioning, devices used and their operations. LO3 Use the measuring instruments in the laboratory and different display devices LO4 Get the insight of the modern medical instruments in principle, which are used in day to day life.	

UNIT I: Transducers, Sensors and Signal Processing

- **Transducers:** Definition, Classification, Selection of Transducer, Strain gauges (wire, foil, & semiconductor), LVDT, Gas sensor (Fundamental aspects), Humidity sensor (Resistive).
- **Idea of Signal Processing:** Precision rectifier and its Types Active Peak detector, Active Positive Clamper, Active Positive and Negative Clippers

UNIT II: SMPS, Measuring Instruments & Display Devices

- **Switching Regulators:** Basic and Monolithic Switching regulators (buck, boost and buck – boost) (Only basic Configurations)
- **Digital Storage Oscilloscope:** Digital Storage Oscilloscope.
DMM: 3 ½ Digit, resolution and sensitivity, general specification.
- **Microphone, Loudspeaker characteristics, types (list only), Multi-way speaker system (woofer and tweeter)**
- **Display Devices:** Types, LCD, LED, OLED
- **LED (Construction, Working & Applications), Multicolor LED, Seven Segment Display**

UNIT III: Data Acquisition and Conversion

- **Data acquisition system:** Objectives of DAS, Signal conditioning of inputs, Types of Data Acquisition system, [Data Transmission systems IEEE-488 GPIB*]
- **D to A Converters:** Resistive divider network, Binary ladder network
- **A to D Converters:** Successive approximation type, Voltage to Time (Single slope, Dual slope)

UNIT IV: PCB, Consumer Appliances, Medical instruments

- **Printed Circuit Board:** Idea of PCB, Types of PCB, PCB Fabrication Methods.
- **Microwave Oven:** Operating principle, block diagram, Magnetron (Construction & Working)
- **Medical instruments:** Bio-Potential, Types of electrodes, ECG, EEG, EMG, CT Scan and MRI (principle, block diagram and features), Ultrasonography: working principle

10

Scheme of Examination and Assessment Pattern

Paper –100 Marks

A. External Examination: Semester End External - 75 marks Time: 2.5 hours

Format of Question Paper

Each paper shall consist of FIVE questions. All questions are compulsory and will have internal options. Choice in papers has to be TWO times.

Question No	Nature of Questions	Marks
Q1	From unit I	15
Q2	From unit II	15
Q3	From unit III	15
Q4	From unit IV	15
Q5	Will consist of questions from all the four units with equal weightage of marks allotted to each unit.	15
		Total 75

B. Internal Examination: Continuous Evaluation - 25 marks

	Assessment / evaluation	Marks
1.	Assignment/ MCQ's/ Match the Pairs/ Answer in one sentence/Powerpoint presentation/ Project	20
2.	Active Participation	05
		Total 25

11

REFERENCES:

1. Basic Electronics Solid state - B. L. Thereja, S Chand & Company, New Delhi.
2. A Textbook of Applied Electronics – R S Sedha, S Chand & Company, New Delhi.
3. Transducers and display systems: B. S. Sonde, Tata McGraw-Hill Publishing Company Limited, New Delhi.
4. Digital principles and applications: A.P. Malvino and D. P. Leach. Tata McGraw-Hill.
5. Modern Electronic Instruments and Measurement techniques- Albert
6. D. Helfrick, Willam D. Cooper, Prentice Hall India Pvt. Ltd, New Delhi.
7. Electronic components and materials: Principles, Manufacture and Maintenance- S. M. Dhir, Tata McGraw-Hill Publishing Company Limited, New Delhi.
8. A Textbook of Applied Electronics – R S Sedha, S Chand & Company, New Delhi.
9. Electronic Instrumentation – H S Kalsi, Tata McGraw-Hill Publishing Company Limited, New Delhi.
10. Medical instrumentation Application and design- J. C. Wobster
11. Introduction to Bio-medical Electronics: Joseph-Du-bary, McGraw Hill Co. Ltd.

**Smt. Chandibai Himathmal Mansukhani College
(Autonomous)**

**Third Year B. Sc.
(Physics)**

Semester- V

**Title: Practical-Electronic Instrumentation
(Applied Component)**

**with effect from
Academic Year 2025-2026**

Title: Practical- Electronic Instrumentation (Applied Component)
Course Code: CHM(A)USACEI5P1

Sr. No.	Heading	Particulars
1	Description of the Course	This course introduces students to the application of Analog Circuits, Instruments and Consumer Appliances. It includes the application of various sensors, measuring instruments and display devices, carry out D to A and A to D conversion, PCB fabrication and fabrication of simple appliances.
2	Vertical	---
3	Type Teaching Method	Practical discussion/ presentation/ Project
4	Credit	2 Credits
5	Hours allotted	48 Hours
6	Marks allotted	100 Marks
7	Course Objectives: 1. Understand the construction, working and applications of different types of sensors. 2. Get acquainted with the measuring instruments used in the laboratory & types of display devices.	
8	Learning Outcomes: Upon completion of the course, student will be able to: LO1 Understand the construction, working and applications of different types of sensors. LO2 Use the measuring instruments in the laboratory and different display devices	

Note: 1. Perform Minimum EIGHT Experiments (at least two experiments from each group and two experiments from any two groups).

2. Group C experiments must be performed on Bread Boards.

GROUP - A

1. Characteristics of Photo diode and photo transistors.
2. Thermistor as sensor in temperature to voltage converter using OPAMP. (C&D Ch.8)
3. Study of LVDT characteristics. (K Ch. 13)
4. Study of Load Cell / Strain Guage. (K Ch. 13)
5. Study of seven segment display.
6. Basic Instrumentation Amplifier using 3 Op-Amps coupled to resistance bridge. (C & D Ch. 8)

GROUP - B

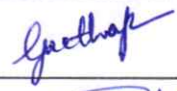
1. Temperature to frequency Conversion using 555 timer. (C & D Ch.13)
2. OPAMP D/A Converter: Binary weighted resistors.
3. OPAMP D/A Converter: Ladder network. (M & L Ch. 12)
4. Half wave precision rectifier using precision op-amps (OPA177) (C & D Ch. 7)
5. Positive and Negative Clippers/ Clampers using op-amp.(124/324). (G Ch. 8)
- 6 Second Order active Low/ High Pass filter (frequency response & phase relation) (K.Ch15)

GROUP - C

1. Study of variable dual power supply using LM 317& LM 337 ($\pm 3\text{v}$ to $\pm 15\text{v}$). (C&D Ch.13)
2. Constant Current source using OPAMP and PNP transistor (o/p current less than 50 mA) (C & D Ch 5)
3. Simple microphone amplifier using a transistor.
4. Low voltage audio amplifier using IC LM386
5. Construction of Audio power amplifier using IC TBA 810.
6. Square and Triangular wave generator using OPAMPs with concept of duty cycle (M.Ch 23)

10	Scheme of Examination and Assessment Pattern Paper –100 Marks External Examination: Semester End External - 100 marks Time: 3 hours <table><tr><th>Sr. No.</th><th>Particulars of External Practical Examination</th><th>Marks</th></tr><tr><td>1</td><td>Laboratory Work</td><td>80</td></tr><tr><td>2</td><td>Journal</td><td>10</td></tr><tr><td>3</td><td>Viva</td><td>10</td></tr><tr><td></td><td>TOTAL</td><td>100</td></tr></table> Note: 1. A certified Journal of Electronic Instrumentation must contain a minimum of EIGHT Experiments in each semester. At least TWO experiments from each sub groups and two experiments from any two groups, as mentioned in the syllabus, should be performed and reported in journal. 2. Every candidate will be required to perform ONE experiment (from sub groups A or B or C) at the semester end practical examination. 3. A candidate will be allowed to appear for the Practical Examination only if the candidate submits his/her certified Journal or a certificate from the Head of the Department of Physics stating that the candidate has completed the practical Course of Electronic Instrumentation of the respective semester as per requirements.	Sr. No.	Particulars of External Practical Examination	Marks	1	Laboratory Work	80	2	Journal	10	3	Viva	10		TOTAL	100
Sr. No.	Particulars of External Practical Examination	Marks														
1	Laboratory Work	80														
2	Journal	10														
3	Viva	10														
	TOTAL	100														
11	REFERENCES: 1. H & C: Modern Electronic Instrumentation & Measurement Techniques by Albert D. Helfrick & William D. Cooper PHI) Edition. 2. C & D: OPAMPs and linear integrated circuits” by Coughlin & F. F. Driscoll (6th edition PHI) 3. G: OPAMPs and linear integrated circuits by R.A. Gayakwad (4th edition, PHI). 4. M: Electronic Principles by A. P. Malvino, (PHI), 6th edition. 5. K: Electronic Instrumentation by H. S. Kalsi, (TMH) 2nd Edition 6. M & L: Digital Principle and Applications” by Malvino and Leach, (TMH),5th edition, 7. RPJ: Modern Digital Electronics. R .P. Jain, (TMH), 3rd edition.															

Syllabus Committee:

Sr No	Name of the Faculty	Designation and College	Signature
1.	Dr. Kavita Harisinghani	Head of Department of Physics, Associate Professor, Smt. CHM College, Ulhasnagar	
2.	Dr. Rashmi Deshpande	Associate Professor, Smt. CHM College, Ulhasnagar	
3.	Mrs. Geetha Nair	Associate Professor, Smt. CHM College, Ulhasnagar	
4.	Dr. Preyoshi Bose	Assistant Professor, Smt. CHM College, Ulhasnagar	
5.	Dr. Smita Kale	Assistant Professor, Smt. CHM College, Ulhasnagar	
6.	Mr. Sarang Kavali	Assistant Professor, Smt. CHM College, Ulhasnagar	

Name & Signature of the BoS Chairperson: Dr. Kavita Harisinghani 

Name & Signature of the Dean: Dr. Neena Anand 