Dr.BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD

CIRCULAR NO.SU/B.Sc./CBC&GS /67/2023

It is hereby inform to all concerned that, the syllabi prepared by the Board of Studies, Ad-hoc Boards and recommended by the Dean, Faculty of Science & Technology, the Hon'ble Vice-Chancellor has accepted the **following syllabi of Bachelor of Science with Practical Pattern of Question Paper under the scheme of Choice Based Credit & Grading System** in his emergency powers under section 12(7) of the Maharashtra Public Universities Act, 2016 on behalf of the Academic Council as appended herewith.

Sr.No.	Courses	Semester
1.	**B.Sc. Biotechnology (Degree)**	**IIIrd & IVth semester**
2.	**B.Sc. Automobile Technology (Degree)**	**IIIrd & IVth semester**
3.	**B.Sc. Workshop Technology (Degree)**	**IIIrd & IVth semester**
4.	**B.Sc. Refrigeration and Air Conditioning (Degree)**	**IIIrd & IVth semester**
5.	**B.Sc.Physics (Optional)**	**IIIrd & IVth semester**
6.	**B.Sc.Chemistry (Optional)**	**IIIrd & IVth semester**
7.	**B.Sc.Analytical Chemistry (Optional)**	**IIIrd & IVth semester**
8.	**B.Sc. Statistics (Optional)**	**IIIrd & IVth semester**

This is effective from the Academic Year 2023-24 and onwards.

All concerned are requested to note the contents of this circular and bring the notice to the students, teachers and staff for their information and necessary action.

University Campus,
Aurangabad-431 004.
REF.NO.SU/2023/ 670-77
Date:- 03.06.2023.

★
★
★
★
★★★★★

Deputy Registrar,
Academic Section

Copy forwarded with compliments to :-

1] **The Principal of all concerned Colleges,**
Dr. Babasaheb Ambedkar Marathwada University,

2] **The Director, University Network & Information Centre, UNIC, with a request to upload this Circular on University Website.**

Copy to :-

1] The Director, Board of Examinations & Evaluation, Dr.BAMU,A'bad.

2] The Section Officer,[B.Sc.Unit] Examination Branch,Dr.BAMU,A'bad.

3] The Programmer [Computer Unit-1] Examinations, Dr.BAMU,A'bad.

4] The Programmer [Computer Unit-2] Examinations, Dr.BAMU,A'bad.

5] The In-charge,[E-Suvidha Kendra], Rajarshi Shahu Maharaj Pariksha Bhavan, Dr.BAMU,A'bad.

6] The Public Relation Officer, Dr.BAMU,A'bad.

7] The Record Keeper, Dr.BAMU,A'bad.

DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD

Physics Syllabus

As per

Choice Based Credit & Grading System

B. Sc. S. Y.
Semester III & IV

Dean
Faculty of Science & Technology
Dr. Babasaheb Ambedkar Marathwada University, Aurangabad

2015 2023
(Dr. B N Dole)

Effective from
Academic Year- 2023-24

B.Sc. Second Year Physics Syllabus
Choice Based Credit System Syllabus
To be implemented from Academic Year 2023-24

Title of the Course: B. Sc. Physics

Preamble:

The curriculum for the B. Sc. (Physics) programme is designed to cater to the requirement of Choice Based Credit System following the University Grants Commission (UGC) guidelines. In the proposed structure, due consideration is given to Core and Elective Courses (Discipline specific - Physics), along with Ability Enhancement (Compulsory and Skill based) Courses. Furthermore, continuous assessment is an integral part of the CBCS, which will facilitate systematic and thorough learning towards better understanding of the subject. The systematic and planned curricula from first year to the third year (comprised of six semesters) shall motivate the student for pursuing higher studies in Physics and inculcate enough skills for becoming an entrepreneur.

Objectives:

- To foster scientific attitude, provide in-depth knowledge of scientific and technological concepts of Physics.
- To enrich knowledge through problem solving, minor/major projects, seminars, tutorials, review of research articles/papers, participation in scientific events, study visits, etc.
- To familiarize with recent scientific and technological developments
- To create foundation for research and development in Physics.
- To help students to learn various experimental and computational tools thereby developing analytical abilities to address real world problems.
- To train students in skills related to research, education, industry, and market.
- To help students to build-up a progressive and successful career in Physics.

Structure of the Course

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad

Choice Based Credit System (CBCS) Curriculum for Physics Under Faculty of Science and Technology
Course Structure and Scheme of Examination
B.Sc. Three Year Undergraduate Degree Program

	Course Code	Course Title	Total periods (Teaching periods/ week)	Credits	Scheme of Examination			
					Max Marks	CIA	UA	Min Marks
Semester III								
Optional I (DSC-1C) Core Courses	PHY-311	Core Course **(Statistical Physics and Relativity)**	45(3/week)	2	50	10	40	20
	PHY-312	Core Course **(Modern and Nuclear Physics)**	45(3/week)	2	50	10	40	20
	PHY-321	Lab course 3 (Based on PHY-311)	45(3/week)	1.5	50	10	40	20
	PHY-322	Lab course 4 (Based on PHY-312)	45(3/week)	1.5	50	10	40	20
Skill Enhancement course (SEC-1)	SEC-313	SEC-1 Any one skill to be chosen out of two SEC-1(A): **Medical Physics,** SEC-1(B): **Sensor and Instrumental Physics**	45(3/week)	2	50	10	40	20
Ability Enhancement compulsory courses (AECC-3)	CLE-3	Communication skills in English-III	45(5/week)	3	50	10	40	20
	AECC-3	Marathi/Hindi/Urdu/Sanskrit A student can opt for any one of these languages (SL-III)	45(4/week)	3	50	10	40	20
			315	15	350	70	280	140
Total Credits for Semester III : 15 (Theory : 12 ; Laboratory : 3)								
Semester IV								
Optional I (DSC-1D) Core Courses	PHY-411	Core Course **(Semiconductor and Digital Electronics)**	45(3/week)	2	50	10	40	20
	PHY-412	Core Course **(Condensed Matter Physics)**	45(3/week)	2	50	10	40	20
	PHY-421	**Lab course 5** (Based on PHY- 411)	45(3/week)	1.5	50	10	40	20
	PHY-422	**Lab course 6** (Based on PHY- 412)	45(3/week)	1.5	50	10	40	20
Skill Enhancement course (SEC-2)	SEC-413	SEC-2 Any one skill to be chosen out of two SEC-2 (C): **Renewable energy** SEC-2 (D): **Physics Workshop Skill**	45(3/week)	2	50	10	40	20
Ability Enhancement compulsory courses (AECC-4)	CLE-4	Communication skills in English-IV	45(5/week)	3	50	10	40	20
	AECC-4	Marathi/Hindi/Urdu/Sanskrit A student can opt for any one of these languages (SL-IV)	45(4/week)	3	50	10	40	20
Additional credits		Environmental Studies	45(3/week)	2*				
			360	17	350	70	280	140
Total Credits for Semester IV : 17 (Theory : 12; Laboratory : 5)								

2015 2023

Faculty of Science & Technology
Dr. Babasaheb Ambedkar Marathwada University, Aurangabad

Important Notes:

i) **Nomenclature**: DSC- Discipline Specific Core course, SEC – Skill Enhancement Course, AECC- Ability Enhancement compulsory course, DSE- Discipline Specific Elective, UA-University Assessment (Semester End), CIA-Continuous Internal Assessment.

ii) **There shall be one skill enhancement course (SEC) IIIrd to VIth Semester (any one SEC course to be chosen (any one from three optional subjects) from the basket of SEC courses for the respective semester.**

iii) **Code description**: XXX code has to be decided by BoS of the respective subject while designing their respective curriculum (e.g., for Physics it will be PHY; for Electronics it will be ELE)

- The codes for first semester courses will start from XXX-111, Second-semester courses will start from XXX-211 and so on
- XXX-111: The first digit indicates the Semester Number; the second two digits indicate paper numbers for the first-semester courses and the same analogy is for the remaining semesters
- The codes for theory courses will start from XXX-111 (for the first semester and the same analogy is for the remaining semesters)
- The codes for practical courses will start from XXX-121 (for the first semester and the same analogy is for the remaining semesters)
- The codes for Ability Enhancement compulsory courses will start from XXX-131 (for the first semester and the same analogy is for the remaining semesters)

iv) **Assessment**: 80% for University Assessment (Semester End Examination) and 20 % for Continuous Internal Assessment (CIA)

v) **Continuous Internal Assessment (CIA): Theory** (10 Marks): Internal Test 05 Marks (Two Internal Tests of 05 marks each and average of the two tests will be considered) and 05 Marks for Assignment/tutorials.

vi) **Continuous Internal Assessment (CIA): Practical** (10 Marks): 07 Marks for Internal Practical Examination and 03 Marks for record book/submission of collection and field survey report and excursion report

vii) Practical examination: Annual examination

B. Sc. Second Year Physics
(Semester-III)
(Statistical Physics and Relativity)
Course Code: PHY-311

Periods 45 **Credit 02** **Marks 50 (CA=10, ESE 40)**

Course Outcome: On successful completion of this course students will be able to:

- Show an analytic ability to solve problems relevant to statistical mechanics.
- Can explain the procedures for deriving the relation between thermodynamic parameters such as pressure, temperature, entropy and heat capacity from the distribution functions.
- Can apply the methods of statistical physics in other fields of physics and related fields
- Demonstrate knowledge and broad understanding of Special Relativity

Unit I- Basic Concepts in Statistical Physics **[10 L]**

Introduction, probability, some basis rules of probability theory, permutation and combination, macrostates and microstates, phase space, principle of equal a priori probability, thermodynamic probability, probability distribution, Problems

Unit II- Classical statistics **[11 L]**

Maxwell-Boltzmann energy distribution law, evaluation of gi, α and β, M.B. distribution function for ideal gas, Molecular Speed (Vmp, $\bar{V}$, Vrms), Thermodynamic functions in terms of Partition Function, Problems

Unit III- Quantum statistics **[11 L]**

Quantum statistics I: Need of quantum statistics, Bose-Einstein distribution law, Planck's radiation law,

Quantum statistics II: Fermi-Dirac distribution law, Fermi level and Fermi energy, EFO for electrons in a metal, electron energy distribution, comparison of M-B, F-D and B-E statistics, difference between classical and quantum statistics, Problems.

Unit IV- Theory of relativity **[13 L]**

Introduction, frame of reference, Postulates of Special Relativity, Galilean transformation, Michelson Morley experiment, Einstein's special theory of relativity, Lorentz transformation equation, length contraction, time dilation, addition of velocities, variation of mass-energy equivalence, Problems.

Reference Books:

1) Heat, thermodynamics & statistical Physics- Brijlal, N. Subrahmanyam, P.S. Hemne. S. Chand Publication
2) Modern physics – R. Murgeshan, Kiruthiga Shivprasath, S. Chand Publication.
3) Statistical Mechanics by Satya Prakash, Kedar Nath Ram Nath Publisher, Delhi
4) Concepts of Modern Physics by Arthur Beiser Publisher McGraw-Hill

B. Sc. Second Year Physics
(Semester-III)
(Modern and Nuclear Physics)
Course Code: PHY-312

Periods 45 **Credit 02** **Marks 50 (CA=10, ESE 40)**

Course Outcome: On successful completion of this course students will be able to:

- Able to explain the factors influencing photoelectric effect, explain the experimental setup and apply it for applications
- understand the fundamentals of lasers, laser systems, their characteristics and diversified applications including industry, medicine and Defense
- use this knowledge for applications of lasers in specific fields of their interest
- Demonstrate the ability to critically evaluate the results in nuclear and particle physics
- Identify the strengths and limitations of various nuclear models

Unit – I: Photoelectric effect **[12 L]**

Introduction, Lenard's method to determine e/m for photoelectrons, Richardson and Compton experiment, Relation between photoelectric current and retarding potential, Relation between velocity of photoelectrons and frequency of light, photoelectric cells- (1) Photo- emissive cell (2) Photo- voltaic cell (3) Photoconductive cell, Applications of photoelectric cells.

Unit – II: Lasers **[11 L]**

Introduction, induced absorption, spontaneous emission, stimulated emission, population inversion, properties of laser beam, laser pumping, Types of laser-Ruby laser, He-Ne laser, carbon dioxide (CO_2) laser, Applications of laser-Biological, medical and industrial.

Unit – III: Nuclear forces and models **[12 L]**

Introduction, Binding energy, Nuclear stability, Nuclear forces, Meson theory of nuclear forces, liquid drop model, shell model, Energy released in Fission, Chain reaction, Atom bomb, Nuclear Reactors, Nuclear fusion, Source of stellar energy.

Unit - IV: Particle accelerators and detectors **[10 L]**

Linear accelerator, Cyclotron, Synchrocyclotron, Betatron, Ionization chamber, proportional counter, Geiger – Muller counter.

Reference Books:

1) Modern Physics- J. B. Rajan
2) Modern Physics- R. Murugeshan, Er. Kirutyhiga, Sivaprasath. S.Chand Publication
3) LASERS: Fundamentals and Applications, K. Thyagarajan, Ajoy Ghatak
4) Nuclear Physics- Kaplan
5) Nuclear Physics- B.N.Srivastava
6) Atomic and nuclear physics-N. Subramanyan and Brijlal.

B. Sc. Second Year Physics
(Semester-III)
Physics Practical: Lab Course-3
Course Code: PHY-321

Credit 1.5 **Marks-50 (CIA-10 and UA-40)**

List of Experiments:

1. Study of temperature dependence of total radiation
2. To draw the histogram of theoretical Gaussian curve
3. Velocity of sound using Helmholtz resonator
4. Surface tension by Fergusons method
5. e/m by Thomson's tube experiment
6. I-V characteristics of solar cell
7. Viscosity of liquid using Searle's viscometer
8. M. I. by Bifilar suspension
9. Viscosity of liquid by using oscillating disc method.

Note: Students should perform at least six experiments

Books:

1. B. Sc. Practical Physics – C. L. Arora (S. Chand Publications)
2. College Practical Physics – Khanna and Gulati (S. Chand Publication)
3. Practical Physics – Gupta and Kumar (Pragati Prakashan, Meerut)
4. A text book of Practical physics – Shrinivasan and Balsubramanyam.

B. Sc. Second Year Physics
(Semester-III)
Physics Practical: Lab Course-4
Course Code: PHY-322

Credit 1.5 **Marks-50 (CIA-10 and UA-40)**

List of Experiments:

1. To verify the inverse square law using photocell
2. 'h' by photocell
3. To compare the luminous intensities of two lights sources using photocell
4. Measurement of the focal length of a given convex lens using laser
5. Diffraction of grating using laser beam
6. Beam divergence of a diode laser
7. Determination of the diameter of a thin wire using laser
8. Determination of wavelength of He-Ne laser by transmission grating and reflection grating.
9. To draw the plateau curve for GM counter
10. To find the dead time of GM counter

Note: Students should perform at least six experiments

Books:

1. B. Sc. Practical Physics – C. L. Arora (S. Chand Publications)
2. College Practical Physics – Khanna and Gulati (S. Chand Publication)
3. Practical Physics – Gupta and Kumar (Pragati Prakashan, Meerut)
4. A text book of Practical physics – Shrinivasan and Balsubramanyam.

B. Sc. Second Year Physics
(Semester-III)
Skill Enhancement Course

NOTE:
Any one skill Enhancement Course to be chosen out of two either 'SEC-1(A): Medical Physics,' or 'SEC-1(B): Sensor and Instrumental Physics

B. Sc. Second Year Physics
(Semester-III)
Title of the course: SEC-1(A) Medical Physics
Course code: SEC-313

Periods 45 **Credit 02** **Marks 50 (CA=10, ESE 40)**

Learning Objectives:

At the completion of this course, the student should be –

- To learn the construction of X-ray generator
- Explain different types of radiation, their sources/properties.
- The basic principles and working of CT, MRI and Ultrasound Imaging.
- Able to provide adequate knowledge about the medical testing equipment.
- Able to transfer knowledge and skills to students as well as younger professionals.

Unit I: X-ray Generators **[13 L]**

Discovery - Production - Properties of X-rays - X-ray spectrum : characteristics and continuous spectra - Design of hot cathode X-ray tube - Basic requirements of medical diagnostic, therapeutic and industrial radiographic tubes - Rotating anode tubes - Hooded anode tubes - Rating of tubes - standard exposure charts, Limitations on loading Safety devices in X-ray tubes - Insulation and cooling of X-ray tubes – Design requirements for X-ray equipment, Faults detection in X-ray equipment such as pitting of anode, filament evaporation etc., - Types of X-ray units (Fixed radiography, CT, Interventional radiology, C-Arm, Mammography, Bone Mineral Densitometer, dental X-ray units etc.,). Filtration in the X-ray machines

Unit II: Radioactivity. **[11 L]**

Radioactivity - General properties of alpha, beta and gamma rays - Laws of radioactivity - Half life and Average Life - Laws of successive transformations - Natural radioactive series - Radioactive equilibrium - Alpha ray spectra - Beta ray spectra - Gamma emission - Electron capture - Internal conversion - nuclear isomerism - Artificial radioactivity.

Unit III: Computed Tomography, MRI and Ultrasound Imaging. **[11 L]**

Computed Tomography (CT): Principle, CT imaging system, image reconstruction and processing, acquisition and image quality.

Magnetic Resonance Imaging (MRI): NMR Principle, techniques involved MR image acquisition and reconstruction, safety and applications of MRI in radiotherapy for treatment planning.

Ultrasound imaging (US): construction and working of a transducer, B-mode signal processing, modern imaging methods, image artifacts- US imaging in radiotherapy for treatment planning.

Unit IV: Medical testing equipment. **[10 L]**

Construction, working of the medical testing equipment: Thermometer, Optical thermometer, Infrared thermometer, Reflex hammer, radiography, Weighing machine, Glucometer, ECG machine, Stethoscope, X-Ray machine, CT scan, PET machine, MRI, Infusion pump, medical laser, Ultrasound machine.

Reference Books:

1. F. M. Khan, The Physics of Radiation therapy, 3rd Edition, Lippincott Williams &Wikins, Philadelphia, 2003
2. Radiation Physics in Radiology, Oliver R., Blackwell Science Ltd; 1st Edition (1966).
3. Radiation Physics for Medical Physicists, E. B. Podgarsak, Springer Verlag, 1st Edition (1996).
4. The essential physics of medical imaging, Bushberg, S.T., Seibert, J.A, Leidholt, E.M. & Boone, J.M., Baltimore: Williams & Wilkins 1st Edition (1990).

B. Sc. Second Year Physics
(Semester-III)
Title of the course: SEC-1(B) Sensor and Instrumental Physics
Course code: SEC-313

Periods 45 **Credit 02** **Marks 50 (CA=10, ESE 40)**

Learning Objectives:

At the completion of this course, the student should be –

- Describe primary blocks of an Instrumentation System and Qualities of Measurement.
- Classify physical measurement backgrounds.
- Select transducers as per application demand.
- Identity terminals of industry grade transducers.
- Describe operation of basic transducers employed for industrial process parameter monitoring applications

Unit I: Basic Measurement devices **[11L]**

Ammeter: DC Ammeter, Multi range Ammeter, Voltmeter, Multi Range Voltmeter. Multimeter: Multimeter operating instructions. Digital Voltmeter: Introduction, Resolution and Sensitivity of Digital meter, General specification of DVM. Oscilloscope: Introduction, Basic principle, Block diagram of Oscilloscope, Simple CRO. Function Generator: Introduction, Basic principle, Block diagram of Function Generator.

Unit II: Transducers and Sensors **[11L]**

Resistance Transducers, Variable inductance type transducers, Capacitive Limit Switches, Proximity Detectors, Hall Effect Sensor, Photoelectric sensors: Through beam sensor, Retro-reflective sensor, Limited-reflective sensor, Mark sensor, Distance-settable Sensor, Applications of Photoelectric sensor. Ultrasonic Sensors. Photoelectric pick-up & Proximity sensor (non-contact type). Rotary and translational encoders

Special purpose sensors:

Gas sensors, accelerometer, gyro sensor, humidity sensor, reed switch, thickness sensor, tilt sensors

Unit III: Temperature and Pressure measurement. **[11L]**

Temperature: Definition and units, Different temperature scales & their conversions; Classification of temperature measuring transducers: Gas Filled thermometer, Bimetallic thermometer, Thermistors, RTD – (PT-100) , Thermocouple – Seeback& Peltier effect, Types J, K, R , S, T(Based on material, temperature ranges), Non-Contact measurement methods, Pyrometer.

Pressure measurement - Pressure: Definition, Types - Absolute, Gauge, Atmospheric, Vacuum (Definition, Units), Classification of Pressure measuring devices; Non elastic pressure transducer: U tube, well type manometer; Elastic pressure transducer: Bourdon Tube, Bellows, Diaphragm; Strain Gauge: Working principle, construction, piezo resistance co-efficient; Types of strain gauge: bonded, unbounded, semiconductor

Unit IV: Flow and Level Measurement **[12L]**

Flow measurement - Flow: Definition, Types of Flow – Laminar, turbulent, Reynolds number Classification of flow measuring transducers: Variable head flow meter- Venturi meter, orifice plate meter, Variable area flow meter – Rota meter, Electromagnetic Flow meter, Ultrasonic flow meter-Doppler Type, Solid flow measurement.

Level Measurement - Classification of level measurement methods: Float type – linear & rotary potentiometer (Contact type), Capacitive type (Contact type), Ultrasonic type (non-contact type) Radiation type (non-contact type), RADAR type (non-contact type).

Reference Books:

1. Electronics Instrumentation – H. S. Kalsi; Second Edition, 2004,Tata McGraw Hill Publishing Co. Ltd; N. Delhi
2. Instrumentation and Control - D. Patranabis; Publishing PHI Learning Private Limited, New Delhi
3. Industrial Electronics – Terry Bartlet; Cengage Learning India Edition, Second Indian Reprint, 2006, New Delhi.

B. Sc. Second Year Physics
(Semester-IV)
(Semiconductor and digital Electronics)
Course code PHY-411 * Theory Paper-VII

Periods 45 **Credit 02** **Marks 50 (CA=10, ESE 40)**

Course Outcome: On successful completion of this course students will be able to:

- Basic semiconductor devices
- Various transistor basing techniques and detailed study of Single stage amplifier
- How amplifier can be converted into oscillator
- Importance of Op-amp and its various circuits
- Number systems, Logic gates and Boolean Algebra

Unit – I: Semiconductor devices: **[10 L]**

Semiconductor diode, Construction, Working and Characteristics of semiconductor diode, Construction, Working and Characteristics of Bipolar Junction Transistor, Transistors IV characteristics (CE, CB and CC configuration). Construction, Working and IV Characteristics of FET.

Unit – II: Transistor biasing and Amplifiers: **[12 L]**

Faithful amplification, Essentials of Transistor biasing. Selection of operating point, bias stability, transistor biasing circuits [only circuit diagram, advantages and disadvantages for fixed bias (base bias), collector feedback bias, emitter feedback bias (self-bias)]. Voltage divider bias (circuit diagram, Circuit analysis, stability factor), Single stage transistor amplifier, How transistor amplifies–Graphical demonstration of transistor amplifier.

Unit – III: Oscillators and Op-Amp: **[12L]**

Introduction, Oscillatory tank circuit, Positive feedback Amplifier -Oscillator. Essentials of Transistor Oscillator, Explanation of Barkhausen Criterion, Hartley Oscillator (LC), Phase Shift Oscillator (RC).

Differential Amplifier, CMRR, Parameters of OP–amp, Schematic Symbol and Block Diagram of OP-Amp, Applications of Op-Amp- inverting & non-inverting amplifier. Op-Amp as an adder and subtractor.

Unit - IV: Digital Electronics: **[11L]**

Number systems: (Binary, Decimal, Hexadecimal), Decimal to Binary conversion, Binary to Decimal conversion, Binary to Hexadecimal conversion, Hexadecimal to Binary conversion.Binary-Coded Decimal Code (BCD Code), Logic Gates: OR, AND, NOT, NAND, NOR, XOR (logic symbol, Truth table, Boolean expression), Combination of Basic Logic Gates, NAND as universal building block

Boolean algebra: Boolean theorems (Single variable and multivariable theorems), De-Morgan's first and second theorem

Reference Books:

1. Basic principle of electronics- V. K. Mehta.
2. Basic Electronics & Linear circuits- N.N. Bhargawa
3. An introduction to Electronics edition-II or III - A.P. Malvino
4. Radio engineering- M.L. Gupta.
5. An introduction of Electronics - K.J.M. Rao

B. Sc. Second Year Physics
(Semester-IV)
(Condensed Matter Physics)
Course code PHY-412 * Theory Paper-VIII

Periods 45 **Credit 02** **Marks 50 (CA=10, ESE 40)**

Course Outcome: On successful completion of this course students will be able to:

- Expose students to the basic concepts in condensed matter physics
- Recognize common crystal structures.
- Explain the physics of different types of bonds and Bonding in solids
- Describe electrical conduction in crystals.
- Thermal properties of solids
- The details study of Hall effect.

Unit I. Crystal Physics **[12L]**

Introduction, lattice point and space lattice, the basis and the crystal structure, Unit cell, (primitive, non-primitive Wigner-Sietz primitive cell), symmetry operations, point groups and space groups, Bravais lattices-Bravais lattice in two dimensions (Plane lattice), and Bravais lattice in three dimensions (Space lattice), representation of plane-Miller indices, different crystal structures-1. Simple cubic structure, 2. Face centered cubic structure, 3. Body centered cubic structure, 4. Hexagonal closed packed structure, 5. Other cubic structure-Diamond structure, Zinc Blande structure, NaCl structure.

Unit II. Bonding in solids **[11L]**

Introduction, concept of inters atomic forces, cohesive energy and types of bonding, primary bonding- (ionic bonding, covalent bonding and metallic bonding), secondary bonding- (Vander Waals bonding and hydrogen bonding).

Unit III. Thermal properties of solids **[11L]**

Introduction, Classical theory of lattice heat capacity (Concept and comparison with experimental values), Einstein's theory of lattice heat capacity, Debye's model of lattice heat capacity, density of modes, limitations of Debye's model.

Unit IV. Free electron in crystals **[11L]**

Introduction, the outstanding properties of metals, Drude-Lorentz's theory, electrical conductivity, thermal conductivity, Wiedemann Franz relation, significance of Fermi energy level, Hall effect, Hall voltage and Hall coefficient, experimental determination of Hall coefficient, Importance of Hall effect.

Reference Books:

1. Physics for degree student- C. L. Arora & Dr. P. S. Hemne- S. Chand publication
2. Solid state Physics-Structure and properties of materials, - M A Wahab - Narosa Publishing House
3. Principles of the Solid State-H. V. Keer- New Age International Publishers.
4. Applied Solid State- Physics-Rajnikant-Wiley India Pvt. Ltd.
5. Solid State Physics- S. O. Pillai (VIIth Edition)- New Age International Publishers.

6. Solid State Physics and Electronics – R. K. Puri & V.K. Babbar- S. Chand publication
7. Solid State Physics- A. J. Dekker- The Macmillan Press Ltd.
8. Fundamentals of Solid-State Physics-C.M. Kale, K. M. Jadhav, N. N. Waghule-Rushi Publication.
9. Introduction to Solid State Physics, VIIth Edition - C. Kittel.
10. Fundamentals of Solid-State Physics-Saxena, Gupta, Saxena- Pragati prakashan, Meerat.

B. Sc. Second Year Physics
(Semester-IV)
Physics Practical: Lab Course-5
Course Code: PHY-421

Credit 1.5 **Marks-50 (CIA-10 and UA-40)**

List of Experiments:

1. I-V Characteristics of transistor in CB configuration
2. I-V Characteristics of transistor in CE configuration
3. I-V Characteristics of Zener diode
4. I-V Characteristics of FET
5. Study of OR, NOT, AND gates
6. Study of Op-amp as adder
7. Study of Op-amp as subtractor
8. Study of RC Oscillator (Phase shift Oscillator)
9. Study of LC Oscillator (Hartley Oscillator)

Note: Students should perform at least six experiments

B. Sc. Second Year Physics
(Semester-IV)
Physics Practical: Lab Course-6
Course Code: PHY-422

Credit 1.5 **Marks-50 (CIA-10 and UA-40)**

List of Experiments:

1. Energy band gap of semiconductor using thermistor
2. Thermal conductivity by Forb's method
3. Rydberg constant using Excel
4. I-H curve using Excel
5. Calibration of bridge wire using Carry-Foster's bridge.
6. Determination of absolute capacity of condenser using B.G.
7. To determine the Hall coefficient of a semiconductor sample.
8. Study V-I characteristics of a solar cell.
9. To analyze the XRD data of the two given sample and find out the lattice constant

Note: Students should perform at least six experiments

B. Sc. Second Year Physics
(Semester-IV)
Skill Enhancement Course

NOTE:
Any one skill Enhancement Course to be chosen out of two either 'SEC-2(C) Renewable energy' or 'SEC-2(D) Physics Workshop Skill'

B. Sc. Second Year Physics
(Semester-IV)
Title of the course: SEC-2(C) Renewable energy
Course code: SEC-413

Periods 45 **Credit 02** **Marks 50 (CA=10, ESE 40)**

Learning Objectives: At the completion of this course, the student should be –

- Know the need of renewable energy resources, historical and latest developments
- Discuss wind energy conversion systems and explain sources of geothermal energy
- Describe different biogas plants and working of different gasifiers
- Explain the working principle of different fuel cells and ocean thermal energy conversion systems
- Compare Solar, Wind and bio energy systems, their prospects, advantages and limitations

Unit I- Introduction to Energy sources **[13 L]**

Energy sources and their availability, non-conventional sources, advantages of renewable energy sources, prospects of renewable energy sources.

Sun as a source of energy: Solar energy collectors – flat plate collectors and concentrating collectors, solar energy, storage systems – mechanical, electrical, chemical and electro-magnetic, solar pond, applications of solar energy – solar water heating, solar distillation, solar cooking.

Unit II- Wind and Geothermal Energy **[12 L]**

Wind Energy: Introduction, Principle of wind energy conversion, Advantages and disadvantages of wind mills, Applications of wind energy

Geothermal energy: Introduction - Estimates of Geothermal Power - Nature of geothermal fields - Geothermal resources - Hydrothermal (convective) Resources Geo pressured resources

Unit III- Bio-Energy **[10 L]**

Energy from biomass - Sources of biomass - Different species - Conversion of biomass into fuels - Energy through fermentation - Pyrolysis, gasification and combustion Biogas plants - Properties and characteristics of biogas.

Unit IV- Ocean -Energy **[10 L]**

Introduction, Principle of ocean thermal energy conversion (OTEC), Tidal power generation, Tidal energy technologies, Energy from waves, Wave energy conversion, Wave energy technologies, advantages and disadvantages.

Reference Books:

1. Non-Conventional Energy Resources by B.H. Khan, Tata McGraw Hill Pub.,2009
2. Solar Energy, Fundamentals and Applications, Garg, Prakash, Tata McGraw Hill
3. Solar energy - M P Agarwal - S Chand and Co. Ltd
4. Solar energy - Suhas P Sukhative Tata McGraw - Hill Publishing Company Ltd
5. Non-conventional energy sources - G.D Rai - Khanna Publishers, New Delhi

B. Sc. Second Year Physics
(Semester-IV)
Title of the course: SEC-2(D) Physics Workshop Skill
Course code: SEC- 413

Periods 45 **Credit 02** **Marks 50 (CA=10, ESE 40)**

Learning Objectives:

At the completion of this course, the student should be –

- The students to familiar and experience with various mechanical and electrical tools through hands-on mode

Unit I: Introduction: **[12 L]**

Measuring units. conversion to SI and CGS. Familiarization with meter scale, Vernier caliper, Screw gauge and their utility. Measure the dimension of a solid block, volume of cylindrical beaker/glass, diameter of a thin wire, thickness of metal sheet, etc. Use of Sextant to measure height of buildings, mountains, etc.

Unit II: Mechanical Skill: **[13 L]**

Concept of workshop practice. Overview of manufacturing methods: casting, foundry, machining, forming and welding. Types of welding joints and welding defects. Common materials used for manufacturing like steel, copper, iron, metal sheets, composites and alloy, wood. Concept of machine processing, introduction to common machine tools like lathe, shaper, drilling, milling and surface machines. Cutting tools, lubricating oils. Cutting of a metal sheet using blade. Smoothening of cutting edge of sheet using file. Drilling of holes of different diameter in metal sheet and wooden block. Use of bench vice and tools for fitting. Make funnel using metal sheet.

Unit III: Electrical and Electronic Skill: **[10 L]**

Use of Multimeter. Soldering of electrical circuits having discrete components (R, L, C, diode) and ICs on PCB. Operation of oscilloscope.Making regulated power supply. Timer circuit, electronic switch using transistor and relay.

Unit IV: Introduction to prime movers: **[10 L]**

Mechanism, gear system, wheel, Fixing of gears with motor axel. Lever mechanism, lifting of heavy weight using lever. braking systems, pulleys, working principle of power generation systems. Demonstration of pulley experiment.

Reference Books:

1. A text book in Electrical Technology - B L Theraja – S. Chand and Company.
2. Performance and design of AC machines – M.G. Say, ELBS Edn.
3. Mechanical workshop practice, K.C. John, 2010, PHI Learning Pvt. Ltd.
4. Workshop Processes, Practices and Materials, Bruce J Black 2005, 3rd Edn., Editor Newnes [ISBN: 0750660732]
5. New Engineering Technology, Lawrence Smyth / Liamennessy, TheEducational Company of Ireland [ISBN: 0861674480]

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad

Question Paper Pattern

Nature of Question Paper (Theory) for choice-based credit system (CBCS) semester pattern.

Subject: Physics

Time: 2 hours | Max. Marks: 40

Instructions:

1. All questions are compulsory.
2. All questions carry equal marks.
3. Draw neat diagrams and give equations wherever necessary.
4. Figures to the right indicate full marks.
5. Use of logarithmic table and calculator is allowed.

Q. 1) Long answer questions (Solve any one) 10

A. Question from Unit – I

B. Question from Unit – III

Q. 2) Long answer questions (Solve any one) 10

A. Question from Unit – II

B. Question from Unit – IV

Q. 3) Short answer questions / problems (5 Marks for each) 10

A. Short answer question / problem from Unit – I

B. Short answer question / problem from Unit – III

OR

A. Short answer question / problem from Unit – II

B. Short answer question / problem from Unit – IV

Q. 4) Multiple Choice Questions (MCQ) 10

Note: Ten MCQ's having four alternatives based on theory and numerical.
(Minimum two MCQ's from each chapter)

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad

Scheme of Practical examination and marks (Practical) for choice-based credit system (CBCS) semester pattern.

B. Sc. Second Year Semester-III (**PHY-321, 322**) and Semester- IV (**PHY-421, 422**)

Subject: Physics

i) **Continuous Internal Assessment (CIA): Practical** (10 Marks): 07 Marks for Internal Practical Examination and 03 Marks for record book /submission of collection and field survey report and excursion report

ii) Practical examination: Annual examination

*Continuous Internal Assessment (CIA) For 40 Marks distribution

Course title	Internal Practical Examination	Record book	Total
PHY-321	07 Marks	03 Marks	10 Marks
PHY-322	07 Marks	03 Marks	10 Marks
PHY-421	07 Marks	03 Marks	10 Marks
PHY-422	07 Marks	03 Marks	10 Marks
Total	**28 Marks**	**12 Marks**	**40 Marks**

PRACTICAL EXAMINATION (UA)

1. Experimental performance 321 + 421 – 70 marks + Viva voce 10 marks = 80 Marks
2. Experimental performance 322 + 422 – 70 marks + Viva voce 10 marks = 80 Marks

****

Dr. S.T. Alone.

Dr. G.M. Dharne

20/5/2023

(Dr. B.N Dole)
Chairman, BOS