DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY,
CHHATRAPATI SAMBHAJINAGAR.

CIRCULAR NO.SU/ B.Sc./NEP/52/2023

It is hereby inform to all concerned that, the syllabus prepared by the Board of Studies & Ad-hoc Boards and recommended by the Dean, Faculty of Science & Technology the **Academic Council at its meeting held on 30 November 2023 has accepted the Following Syllabi as per Norms of National Education Policy – 2020** under the Faculty of Science & Technology run to the Affiliated Colleges, Dr.Babasaheb Ambedkar Marathwada University as appended herewith:-

Sr.No.	Courses	Semester
1.	B.Sc. Home Science	Ist and IInd semester
2.	B.Sc. Biotechnology	Ist and IInd semester
3.	B.Sc.Agrochemical and Fertilizer	Ist and IInd semester
4.	B.Sc. Geology	Ist and IInd semester
5.	B.Sc. Computer Science	Ist and IInd semester
6.	B.Sc. Microbiology	Ist and IInd semester
7.	B.Sc.Analytical Chemistry	Ist and IInd semester
8.	B.Sc.Environmental Science	Ist and IInd semester
9.	B.Sc.Dairy Science and Technology	Ist and IInd semester
10.	B.Sc. Chemistry	Ist and IInd semester
11.	B.Sc. Polymer Chemistry	Ist and IInd semester
12.	B.Sc. Biochemistry	Ist and IInd semester
13.	B.Sc. Bioinformatics	Ist and IInd semester
14.	B.Sc. Physics	Ist and IInd semester
15.	B.Sc.Instrumentation Practice	Ist and IInd semester
16.	B.Sc. Non Conventional and Conventional Energy	Ist and IInd semester
17.	B.Sc. Horticulture	Ist and IInd semester
18.	B.Sc. Forensic Science & Cyber Security	Ist and IInd semester
19.	B.Sc.Industrial Chemistry	Ist and IInd semester
20.	B.Sc.Zoology	Ist and IInd semester

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This shall be effective from the Academic Year 2024-25 and onwards.

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

University Campus,
Chhatrapati Sambhajinagar
431 004.
REF.No.SU/2023/19381-89
Date:- 15.12.2023.

★ ★ ★ ★ ★★★★★

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. Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.
2] The Section Officer,[B.Sc.Unit] Examination Branch, Dr. Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar
3] The Programmer [Computer Unit-1] Examinations, Dr. Babasaheb Ambedkar Marathwada University, Chhatrpati Sambhajinagar.
4] The Programmer [Computer Unit-2] Examinations, Dr. Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar
5] The In-charge,[E-Suvidha Kendra], Rajarshi Shahu Maharaj Pariksha Bhavan, Dr. Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar
6] The Public Relation Officer, Dr. Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar
7] The Record Keeper, Dr. Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar

DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY,
CHHATRAPATI SAMBHAJINAGAR- 431 004, (M. S.), INDIA

FACULTY OF SCIENCE AND TECHNOLOGY

Bachelor of Science in Physics

(B. Sc. in Physics)

[3 Years/4 Years (Honors) U.G. Program]

As Per

National Education Policy-2020

Course Structure and Curriculum

(Outcome-based Curriculum)

Physics Syllabus

For

B. Sc. First Year

Semester-I and II

Dr. Babasaheb Ambedkar Marathwada University
Chhatrapati Sambhajinagar–431004, (M.S.), India

Effective from Academic Year: 2024-25

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

6/11/2023

Title of the Course: B. Sc. Physics

Preamble:

The curriculum for the B. Sc. (Physics) programme is designed to cater to the requirement of New Education Policy following the University Grants Commission (UGC) guidelines. The New Education Policy envisions a transformative shift towards holistic and multidisciplinary undergraduate education, which can produce versatile, reflective, and inventive individuals. 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 NEP, 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

B.Sc. Physics (First Semester)

Dr. Babasaheb Ambedkar Marathwada University,
Chhatrapati Sambhaji Nagar

Course and credit distribution structure as per NEP-2020

Illustrative Credit distribution for three/four year Honors with Research Degree Programme with multiple entry and exit options.

B.Sc. First Year (I[st] semester) Subject: Physics

Course Type	Course Code	Course Name	Teaching Scheme (Hrs/Week)		Credits assigned		Total Credits
			Theory	Practical	Theory	Practical	
Discipline Specific Core Course Mandatory	PHYT/DSC-1/100	**Mechanics and Properties of Matter**	2	---	2	---	2+2+2=6
	PHYT/DSC-2/101	**Heat and Thermodynamics**	2	---	2	---	
	PHYP/DSC-3/126	**Practical** (Based on DSC-1/100 and Dsc-2/101)	---	4	---	2	
Open Elective (OE) (Choose any one from OE-01 and from OE-02 pool of courses)	PHYT/OE-1/102	1) Everyday physics 2) Soil Physics	2	---	2	---	2+2=4
	PHYT/OE-2/103	1) Data science in Physics 2) Physics in Sports	2	---	2	---	
VSC (Choose any one from pool of courses)	PHYT/VSC-1/104	1) Electrical Measurements	1	---	1	---	2+2=4
	PHYT/VSC-2/105	2) Electronic Communication	1	---	1	---	
	PHYP/VSC-1/127	1) Practical based on PHYT/VSC-1/104	---	2	---	1	
	PHYP/VSC-2/128	2) Practical based on PHYT/VSC-2/105	---	2	---	1	
SEC (VSEC) (Choose any one from pool of Courses)	PHYT/SEC-1/106	1) Basic Instrumentation skill	1	---	1	---	
	PHYT/SEC-2/107	2) Medical Physics	1	---	1	---	
	PHYP/SEC-1/129	1) Practical based on PHYT/SEC-1/106	---	2	---	1	
	PHYP/SEC-2/130	2) Practical based on PHYT/SEC-2/107	---	2	---	1	
AEC, VEC, IKS Ability Enhancement Courses	AEC-1	English (Common across faculty)	2	---	2	---	2+2+2=6
	VEC-1	Constitution of India (Common Across faculty)	2	---	2	---	
	IKS-1	IKS-1	2	---	2	---	
OJT, FP, CEP, CC, RP	CC-1	Health and Wellness (Common across faculty)	---	4	---	2	2
			16	**12**	**16**	**6**	**22 Credits**

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

Important Notes:

i) **Nomenclature**: DSC: Discipline Specific Course, OE- Open elective, VSC-Vocational Skill Core, SEC – Skill Enhancement Course, AEC- Ability Enhancement Course, VEC: Value Education Courses, IKS: Indian Knowledge System, OJT: On the Job Training, FP: Field Project, CEP: Community Engagement Programme, CC: Curricular Course, RP: Research Project.

Composition of Curriculum

Board of Studies in Physics

Sr. No.	Name and Organization	Designation
01	**Dr. B. N. Dole,** Professor and Head, Department of Physics, Dr. B. A. M. University, Chatrapati Sambhajinagar.	Chairman
02	**Dr. S. T. Alone,** Associate Professor, Rajarshi Shahu College, Pathri, Dist. Chatrapati Sambhajinagar.	Member
03	**Dr. C. M. Kale**, Associate Professor, Indraraj College, Sillod, Dist. Chhatrapati Sambhajinagar	Member
04	**Dr. M. L. Mane**, Associate Professor, S. M. R. G. Shinde College, Paranda, Dist. Dharashiv	Member
05	**Dr. G. M. Dharane,** Associate Professor, Department of Physics, Dr. B. A. M. University, Chatrapati Sambhajinagar.	Member
06	**Dr. C. T. Birajdar,** Associate Professor, S. M. P. College, Murum, Dist. Dharashiv	Member
07	**Dr. S. B. Deshmukh,** Professor, R.G. Bagadia Arts, S. B. Lakhotia Commerce and R Benzonji Science College, Jalna	Member
08	**Dr. R. H. Kadam,** Professor, Shrikrishna College, Gunjoti, Dist. Dharashiv	Member
09	**Dr. S. B. Sayyad,** Associate Professor, Miliya Arts, Science and Management College, Beed	Member
10	**Dr. P. T. Sonwane,** Associate Professor, Sant Ramdas Arts, Commerce and Science College, Ghansawangi, Dist. Jalna	Member
11	**Dr. V. B. Patil,** Professor, Department of Physics, Punyashlok Ahilyadevi Holkar Solapur University, Solapur	Member
12	**Shri. Uday Deshpande,** Scientist F, UGC-DAE Consortium for Scientific Research University, Indore	Member
13	**Dr. S. E. Shirsath,** Lecturer, Vivekanand College, Chhatrapati Sambhajinagar	Member
14	**Dr. Arvind Chinchure,** Baner Road, Pune, IN - 411045 **Email:**chinchure@gmail.com	Member

15	**Shri. L. Malleshwara Rao,** Officer in R&D at Sterlite Technologies Ltd. Chhatrapati SambhajiNagar, Maharashtra, India	Member

B. Sc. First Year Physics

(Semester-I)

Course Name: Mechanics and Properties of Matter

Course Code: PHYT/DSC-1/100

Contact Hours: 30 **Credit: 02** **Max. Marks: 50**

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

- Understand Newton's laws and apply them in calculations of the motion of simple systems.
- Use the free body diagrams to analyze the forces on the object.
- Understand the concepts of friction and the concepts of elasticity, fluid mechanics and be able to perform calculations using them.
- Apply the laws of thermodynamics to formulate the relations necessary to analyze a thermodynamic process.
- Demonstrate quantitative problem-solving skills in all the topics covered

Unit – I: Mechanics and Elasticity **[17 L]**

Mechanics: Newton's law of Gravitation (Statement only), Gravitational Field Gravitational Potential, Gravitational Potential of mass, Gravitational potential and field due to spherical shell and solid sphere (at a point, outside, inside and on the surface). Compound Pendulum-expression of time period, Interchangeability of center of suspension and oscillation, Kater's Pendulum, Problems.

Elasticity: Introduction, Stress and Strain, Hook's law and Coefficient of elasticity, Young's modulus, Bulk modulus, Modulus of rigidity, Twisting couple on a cylinder, Bending of Beam - Bending moment, cantilever loaded at free end- (a) When weight of beam is ineffective, (b) When weight of beam is effective, Depression of Beam supported at centre, Problems.

Unit – II: Properties of liquids **[13 L]**

Viscosity: Introduction, Concept of viscous force and viscosity, Coefficient of viscosity, Steady and Turbulent flow, Reynolds number, Equation of continuity, Bernoulli's Theorem, Problems

Surface Tension: Angle of contact, Factors affecting surface tension, Difference of pressure across a curved surface, Determination of S.T. by Jaeger's method, Problems.

Learning Resources:

1) Elements of Properties of Matter - D. S. Mathur (S. Chand, 11 th edition, 1992)
2) Physics for Degree students-C. L. Arora and P.S.Heme (S. Chand, I st edition 2010)
3) Mechanics and Electrodynamics - Brijlal,N. Subrahmanyam, Jivan Seshan (S.Chand, 7 th edition)
4) Concepts of Physics: H. C. Verma, BharatiBhavan Publisher.
5) University Physics: Sears and Zeemansky, XIth/XIIth Edition, Pearson Education.

B. Sc. First Year Physics

(Semester-I)

Course Name: Heat and Thermodynamics

Course Code: PHYT/DSC-2/101

Contact Hours: 30 **Credit: 02** **Max. Marks: 50**

Course Objectives: *On completion of the course, students will be able to,*

- Understand the concepts of Heat and Thermodynamics.
- Describe and apply the physical concepts of heat, transport phenomena and laws of thermodynamics.
- Perform calculations of heat conduction in various geometries.
- Develop ability among the students to identify, remember and grasp the meanings, definitions and laws of heat and thermodynamics.

Unit – I: Thermal conductivity and real gas **[15L]**

Thermal Conductivity: Introduction, transference of heat, coefficient of thermal conductivity, rectilinear flow of heat along a metal bar (i) Before the steady state reached, (ii) if the heat lost by radiations is negligible and (iii) After steady state is reached, methods of radial flow of heat, (i) spherical shell method and (ii) flow of heat along the wall of a cylindrical tube, comparison of conductivities of different metals (Ingen-Housz experiment), Problems.

Real gas: Introduction, change of state, behavior of gases at high pressure, reason for modification of a gas equation, Van-der Waal's Equation of state, critical point and critical constants, estimation of critical constants, constants of Van-der Waal's equation, Problems.

Unit – II: Transport phenomena and Thermodynamics **[15L]**

Transport Phenomena: Mean free path, sphere of influence, expression for mean free path, variation of mean free path with temperature and pressure, transport phenomena, transport of mass (self-diffusion), viscosity of a gas (momentum), energy of a gas (thermal conductivity), problems.

Thermodynamics: Introduction, thermodynamic system, zeroth law of thermodynamics, adiabatic process, adiabatic equation of a perfect gas, isothermal process, indicator diagram, first law of thermodynamics, work done during isothermal process and adiabatic process, reversible and irreversible process, second law of thermodynamics (Kelvin and Clausius statement), Heat engines, Carnot's ideal heat engine, Carnot's cycle (work done and efficiency), principle of refrigeration, Carnot's theorem, problems.

Learning Resources:

1) Heat, Thermodynamics and Statistical Physics – Brijlal, N. Subrahmanyan, P. S. Heme, (S. Chand, 2008 Edition)
2) Heat and Thermodynamics – D. S. Mathur (S. Chand Publications)
3) Text Book of Heat and Thermodynamics – J. B. Rajam, C. L. Arora (S. Chand 9th Edition)

4) Heat and Thermodynamics – S. S. Singhal, J. P. Agarwala, S. Prakash (Pragati Prakashan)
5) Thermodynamics and Statistical Physics – S. L. Kakani
6) Heat and Thermodynamics – M. S. Yadav (Anmol Publications, 2002 edition)

B. Sc. First Year Physics
(Semester-I)

Course Name: Practical Based on PHYT/DSC-1/100 and PHYT/DSC-2/101

Course Code: PHYP/DSC-3/126

Contact Hours: 60 **Credit: 02** **Max. Marks: 50**

Course Objectives: *On completion of the course, students will be able to,*

- To familiarize students with fundamental experimental techniques related to principles of elasticity, surface tension, viscosity and thermal conductivity.
- To enable students to gain practical insights into the concepts of elasticity, surface tension, viscosity and heat transfer.
- To prepare students for advanced laboratory work and research in the related areas of study.

1. Determination of acceleration due to gravity by using Kater's Pendulum.
2. Y by bending loaded at center
3. Y by cantilever (Oscillation method)
4. Moment of inertial by using fly wheel.
5. η by Maxwell's needle
6. Determination of 'Y' and 'η' by flat spiral spring
7. Surface tension of a liquid by using Jaeger's method
8. Viscosity of a liquid by using Poiseuille's method
9. To find the co-efficient of thermal conductivity of copper using Searle's apparatus.
10. Thermal conductivity of a bad conductor by using Lee's disc method.

Note: Students should perform at least six experiments

Learning Resources:

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. First Year Physics

(Semester-I)

Course Name:1) Everyday Physics

Course Code: PHYT/OE-1/102

Contact Hours: 30 **Credit: 02** **Max. Marks: 50**

Course Objectives: *On completion of the course, students will be able to,*

- This course serves as a phenomenological introduction to physics. It aims to introduce students to physical concepts that are relevant to everyday life
- Perform basic calculation/estimations to solve simple physics related problems.
- Make correct judgement/decisions on physics related issues in their daily life based on basic physics principles.

Unit – I: Vital life **[16L]**

Transportation: Linear motion, Speed, velocity, acceleration, Force, Newton's laws, circular motion, friction, collision, energy and momentum

Sports: Force, projectile motion, rotation, moment of inertia, angular momentum

Home electricity: Electrostatics, electric potential, current, resistance, Ohm's law, Kirchhoff's voltage and current laws, electric power, AC/DC voltage, rectifier, motors, refrigeration, electric safety.

Unit – II: Sustainable weather solutions **[14L]**

Weather and Climate: Energy, heat and temperature, the first law thermodynamics, energy heat transfer, black body radiation

Green Energy: Electricity as energy, Electromagnetic Induction, thermal power generation, heat engine, nuclear power, solar power, wind power, biofuels

Learning Resources:

1. Conceptual Physics By Paul G. Hewitt, Pearson Education (2017)
2. Physics Beyond the Comfort Zone By Peter Watson, (2014)
3. Fundamentals of Physics with Applications By Arthur Beiser, McGraw Hill Education (2017)

B. Sc. First Year Physics

(Semester-I)

Course Name: 2) Soil Physics

Course Code: PHYT/OE-1/102

Contact Hours: 30 **Credit: 02** **Max. Marks: 50**

Course Objectives: *On completion of the course, students will be able to,*

- Understanding Soil Composition: Gain knowledge of the composition of soil, including minerals, organic matter, air, and water, and their influence on soil properties.
- Soil Structure and Texture: Learn how soil particles are organized to form aggregates and how particle size distribution affects soil texture and structure.
- Soil Water Relations: Understand the movement, retention, and availability of water in soils, soil water potential.

Unit – I: Soil Physics and its properties **[17L]**

Introduction to Soil Physics: Introduction, Importance of Soil Physics, Interactions of Soil Physics with Other Disciplines, Soil Formation, Soil Profile, Soil Texture, Soil Separates, Methods for Particle Size Measurement, Particle Shapes

Properties of soil physics: Physical Properties of Soil, Soil Colour, Soil Particle Density, Soil Bulk Density, Soil Porosity, Soil Water Content, Soil Structure, Types of Soil Structure, Properties of Soil Aggregates

Unit – II: Energy State of Soil Water **[13L]**

Definitions and Components of Soil Water Potential, Total Soil Water Potential, Pressure Potential, Matric Potential, Gravitational Potential, Soil Water Potential Measurement Devices, Piezometer, Tensiometer, Dewpoint Potentiometer.

Learning Resources:

1. Soil physics an introduction by Manoj K. Shukla, CRC press, Taylor & Francis group (2014).
2. Textbook of Soil Physics By Arun Kumar Saha, Anuradha Saha, Kalyani Publishers, India (2012)
3. Textbook of Soil Science by T. Biswas, S Mukherjee McGraw Hill Education (India); 2nd edition (2017)
4. Fundamentals of soil science Henry D. Forth, John Wiley & Sons, 8th Edition (1990).
5. Soil physics companion by A. W. Warrick, CRC press, (2002).
6. Soil Physics by Ghildyal BP & Tripathi RP, New Age International (2001)

B. Sc. First Year Physics
(Semester-I)
Course Name: 1) Data Science in Physics
Course Code: PHYT/OE-2/103

Contact Hours: 30 **Credit: 02** **Max. Marks: 50**

Course Objectives: *On completion of the course, students will be able to,*

In this course, students explore how the principles of physics can be integrated into the field of data science. Students will gain insights into how physics concepts can improve the collection, analysis, and modeling of data. The subjects help students to involve acquiring a fundamental understanding of physics and its practical application in the context of data science.

Unit – I: Data science **[15L]**

Introduction, purpose of data science, components of data science, role of a data scientist, problems and solutions using data science, benefits, challenges, and applications of data science, data science life cycle. Understanding the course's interdisciplinary nature, A physicist's view of the natural world and probabilities.

Unit – II: Data Acquisition Techniques in Physics **[15L]**

Types of data, data to information, information to knowledge, critical differences between information and knowledge, exploring the fundamental concepts of physics in data science, Data Collection in Physics, Data Sampling, Data Calibration, Data Analysis, Benefits of Data Science in Physics, Challenges and Limitations

Learning Resources:

1. Physics of Data Science and Machine Learning by Ijaz A. Rauf, CRC Press, Taylor & Francis Group, LLC (2022)
2. Data Science: A Beginner's Guide: A Beginner's Guide by C. Raju, Penguin Business-India, (2023)
3. Data Science for Civil Engineering, A Beginner's Guide by R. K. Jain P. S. Dhotre D. T. Mane P. N. Mahalle, CRC Press, Taylor & Francis Group, LLC (2023)
4. Data Analysis Techniques for Physical Scientists by Pruneau Claude A, Cambridge University Press (2017)

B. Sc. First Year Physics

(Semester-I)

Course Name: 2) Physics in Sports

Course Code: PHYT/OE-2/103

Contact Hours: 30 **Credit: 02** **Max. Marks: 50**

Course Objectives: *On completion of the course, students will be able to,*

- Understand the physics behind popular sports.
- Use physical principles to solve problems relating to the physics of sports.
- Use sport as a means of enhancing Physics classes.

UNIT I: Fundamentals of Physics in Sports **[15L]**

Sports Training Principle, basic biomechanics, Length, Mass andTime: The Basic Units Average speed, Velocity, and Acceleration (Bicycle racing, Marathon, Sprint), Gravity and Falling Bodies without air resistance (Jumping, Diving, Sky Diving), Air and water resistance (Running, Jumping, water Diving, Sky Diving, scuba Diving, swimming, buoyancy, Eddy Resistance, Frontal Resistance), Vectors and Projectile Motion: Two-dimensional problems without air resistance (Baseball, Football, Basketball, throwing), Force; Newton's Laws of Motion (used in all game & sports), Archimedes law of lever (used in all game & sports) Friction (Skiing, Skating, ball games, skin friction in swimming), Momentum Conservation, Collisions and Impact, (Football, Motor racing, accident, Tennis, Baseball batting, soccer,wrestling), Torque and Rotation (Football, throwing, blocking, and tackling), Rotational Motion Centripetal Force, Centrifugal force, (Bicycle racing, skating, hammer throw, motor racing)

UNIT II: Concepts of Physics in Sports **[15L]**

Angular Momentum Conservation (Football throwing, Figure skating, Diving, Gymnastics) Work, Energy, Power (Baseball pitching, Diving), Temperature and Heat; Heat loss by conduction and radiation (Uniforms, Heat exhaustion), Elasticity (Bungee Jumping), Fluids and Pressure; Bernoulli's effect in sports (Scuba diving, Hang Gliding, Sailing, swimming, snowboarding), Air and Fluid Resistance, Drag force, Terminal speed (Sky diving, Auto racing), Magnus Force (Baseball Pitching; Curve ball, Slider, Knuckle ball, Cut fast ball; Football throwing and kicking; Volleyball hitting, Spins in Tennis, Table Tennis and Soccer) Projectile Motion: (Baseball Pitching, Curve ball, ball, Football throwing and kicking, Volleyball hitting, Spins, Soccer).

Learning Resources:

1. Dick Frank W. et al., (2014), Sports Training Principles: An Introduction to Sports Science, Bloomsbury Publishing Plc 50 Bedford Square, London WC1B 3DP.
2. Dick Frank W., (2015), Sports Training Principles: An Introduction to Sports Science. Six Edition, Bloomsbury Publishing Plc 50 Bedford Square, London WC1B 3DP.
3. G. Suryakant, (2020). Sports Mathematics, Chinmay Publication, Aurangabad.
4. Payton Carl & Bartlett Roger, (2007), Biomechanical Evaluation of Movement in Sports and Exercise: The British Association of Sports and Exercise Sciences Guide (BASES Sports Exercise Science), Routledge Taylor & Francis Group New York 270 Madison Ave, New York, NY 1016

5. McGinnis Peter M., (2013), Bio-mechanics of Sports and Exercise, Third Edition, Human Kinetic Publication. 1607 N Market Street P.O. Box 5076 Champaign, IL 61825-5076 United States.
6. Vassilos McLnnes Spathopoulos, (2013), An Introduction to the Physics of Sports.
7. Michale Lisa, (2015), The Physics of Sports, McGraw-Hill Education Australia.
8. John Eric Goff, (2010), Gold Medal Physics The Science of Sports, Johns Hopkins University Press, Baltimore.

B. Sc. First Year Physics
(Semester-I)

Course Name: 1) Electrical Measurements

Course Code: PHYT/VSC-1/104

Contact Hours: 15 **Credit: 01** **Max. Marks: 25**

Course Objectives: *On completion of the course, students will be able to,*

- Emphasis is laid on the meters used to measure current & voltage.
- To have an adequate knowledge in the measurement techniques for power and energy, frequency and phase, resistance, capacitance and impedance
- Elaborate discussion about potentiometer.
- Detailed study of resistance, inductance and capacitance measurement

Unit - I: Basics of Measurements and Techniques **[15L]**

Basics of Measurements: Accuracy, Sensitivity, Precision, resolution, reliability, repeatability, validity, errors in the measurements and their analysis, units and standards of measurement.
Concept of basis electrical instruments: Galvanometer, Voltmeter, Ammeter, Ohmmeter, Wattmeter, Multimeter, Oscilloscope, potentiometer, meter bridge.
Measurements Techniques: Measurements of voltage and current, measurements of power and energy, measurements of frequency and phase, measurement of resistance, capacitance and impedance.
Study of Electrical devices: Resistor, capacitors, PN junction diode, Zener diode, photo diode, LED, Solar cell, rectifier, amplifiers.

Learning Resources:

1. Electronics Instruments and Instrumentation Technology- Anand, PHI
2. Doebelin, E.O., Measurement systems, McGraw Hill, Fourth edition, Singapore, 1990.
3. A Course in Electronic and Electrical Measurements and Instrumentation, S.K. Kataria & Sons, Delhi, 2003.

B. Sc. First Year Physics
(Semester-I)
Course Name: 2) Electronic Communication
Course Code: PHYT/VSC-2/105

Contact Hours: 15 **Credit: 01** **Max. Marks: 25**

Course Objectives: *On completion of the course, students will be able to,*

- Analyze the power and transmission bandwidth of Amplitude and Frequency Modulated signals.
- Familiarize the process of reproduction of base band signal.
- Analyze various pulse analog and pulse digital Modulation Techniques.
- Understand the transmission of binary data in communication systems.
- To introduce the students to modulation and various analog and digital modulation schemes.

Unit – I: Modulation **[15L]**

Amplitude Modulation: Introduction to Modulation, Need for Modulation, Ordinary Amplitude Modulation – Modulation index, Side bands, AM Power, Double Side Band Suppressed Carrier Modulation, AM demodulation, Applications of AM.

Frequency Modulation: Modulation index and sidebands, Principles of Phase Modulation, Frequency Modulation verses Amplitude Modulation, FM demodulation, Applications of FM.

Pulse Modulation: Pulse Amplitude Modulation, Pulse Width Modulation, Pulse Position Modulation, Pulse Code Modulation, Delta Modulation.

Transmission of Binary Data in Communication Systems: Digital Codes, Principles of Digital Transmission, Transmission Efficiency, Modem Concepts and Methods – FSK, BPSK, Error Detection and Correction.

Learning Resources:

1. Louis E. Frenzel, Principles of Electronic Communication Systems, 3rd Edition. Tata Mcgraw Hill.
2. Wayne Tomasi, Electronic Communications Systems, 5th Edition, Pearson Education.
3. Kennedy's Electronic Communication Systems by George Kennedy, Brendan Davis , Srm Prasanna
4. Principles of Digital Communication – Robert G. Gallager
5. Modern Digital and Analog Communication Systems – B.P Lathi & Zhi Ding
6. ELECTRONIC COMMUNICATIONS, by Dennis Roddy and John Coolen

B. Sc. First Year Physics

(Semester-I)

Course Name: 1) Practical based on PHYT/VSC-1/104

Course Code: PHYP/VSC-1/127

Contact Hours: 30 **Credit: 01** **Max. Marks: 25**

Course Objectives: *On completion of the course, students will be able to,*

- Student develop the skill reading the electrical instruments.
- Minimization of errors and get exposure to know the idea of measurements.
- To do handling and repair the electrical instruments.

List of Experiments for the test of lab skills

1. Measure current, resistance and voltage of any conducting wire.
2. Collect various resistors and calculates its values
3. Study the parts of digital multimeter and test the continuity of any circuit.
4. Prepare the chart/model showing resistor, capacitors, PN junction diode, Zener diode, photo diode, LED, Solar cell, rectifier, amplifiers etc.
5. Measure the voltage of Dry cell, Daniel cell, lead-acid cell.
6. Measure the internal resistance of the cell by using meter bridge

Note: Students should perform at least four experiments

B. Sc. First Year Physics

(Semester-I)

Course Name: 2) Practical based on PHYT/VSC-2/105

Course Code: PHYP/VSC-2/128

Contact Hours: 30 **Credit: 01** **Max. Marks: 25**

Course Objectives: *On completion of the course, students will be able to,*

- This course provides the basic knowledge of communication devices.
- Knowledge of modulation and demodulation techniques, amplifier, oscillators, multiplexing and different types of modulation and demodulation circuits etc.

List of experiments:

1. Study of Amplitude Modulation
2. Study of Frequency Modulation
3. Study of Amplitude Demodulation
4. Study of Frequency Demodulation
5. Study of Pulse Width Modulation (PWM)
6. Study of Pulse Amplitude Modulation (PAM)
7. Study of Pulse Position Modulation (PPM)
8. Study of Pulse Code Modulation (PCM)
9. Study of Delta Modulation (DM)
10. Study of Frequency Shift Keying (FSK)
11. Study of Binary Phase Shift Keying (BPSK)

Note: Students should perform at least four experiments

B. Sc. First Year Physics
(Semester-I)
Course Name: 1) Basic Instrumentation Skill
Course Code: PHYT/SEC-1/106

Contact Hours: 15 **Credit: 01** **Max. Marks: 25**

Course Objectives: *On completion of the course, students will be able to,*

- Get exposure with various aspects of instruments and their usage through hands-on mode.
- Describe primary blocks of an Instrumentation System and Qualities of Measurement.
- Classify physical measurement backgrounds.

Unit - I: Basic Measurements and instruments **[15L]**

Basic of Measurement: Instruments accuracy, precision, sensitivity, resolution range etc. Errors in measurements and loading effects.

Voltmeter, Ammeter and Multimeter: Principles of measurement of dc voltage and dc current, ac voltage, ac current and resistance. Specifications of a multimeter and their significance.

Use of Oscilloscope: Use of CRO for the measurement of voltage (dc and ac), frequency and time period. Special features of dual trace, Introduction to digital oscilloscope, probes. Digital storage Oscilloscope.

Signal and pulse Generators: Block diagram, explanation and specifications of low frequency signal generator and pulse generator. Brief idea for testing, specifications. Distortion factor meter, wave analysis.

Digital Multimeter: Comparison of analog & digital instruments. Block diagram and working of a digital multimeter. Working principle of time interval, frequency and period measurement using universal counter/ frequency counter, time- base stability, accuracy and resolution.

Learning Resources:

1. Basic instrumentation skill by H.S. Kalsi
2. Electronic Instrument Handbook by Clyde F. Coombs
3. Introduction to measurements and instrumentation by Arun K. Ghosh.

B. Sc. First Year Physics
(Semester-I)
Course Name: 2) Medical Physics
Course Code: PHYT/SEC-2/107

Contact Hours: 15 **Credit: 01** **Max. Marks: 25**

Course Objectives: *On completion of the course, students will be able to,*

- 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: Medical equipment's and imaging technologies **[15L]**

Medical Equipment's: Thermometer, Optical thermometer, Thermal gun, LASER gun, Infrared thermometer, Reflex hammer, radiography, Weighing machine, Glucometer, Oximeter, ECG machine, Stethoscope, X-Ray machine, CT scan, Ultrasound machine.

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

Magnetic Resonance Imaging (MRI): Introduction to MRI, 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, Ultrasound imaging in radiotherapy for treatment.

Learning Resources:

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. First Year Physics

(Semester-I)

Course Name: 1) Practical Based on PHYT/SEC-1/106

Course Code: PHYP/SEC-1/129

Contact Hours: 30 **Credit: 01** **Max. Marks: 25**

Course Objectives: *On completion of the course, students will be able to,*

- Get exposure with various aspects of instruments and their usage through hands-on mode.
- Experiments listed below are to be done in continuation of the topics.

List of Experiments for the test of lab skills

1. Use of Digital multimeter for measuring dc voltages and current
2. Use of Digital multimeter for measuring Resistance, ac voltages and current
3. Circuit tracing of Laboratory electronic equipment,
4. Trouble shooting a circuit
5. Study of Signal and pulse Generators
6. Frequency measurement using Oscilloscope
7. AC and DC Voltage measurement using Oscilloscope
8. Comparison of two frequencies using oscilloscope
9. Circuit tracing of Laboratory electronic equipment,

Note: Students should perform at least four experiments

B. Sc. First Year Physics

(Semester-I)

Course Name: 2) Practical Based on PHYT/SEC-2/107

Course Code: PHYP/SEC-2/130

Contact Hours: 30 **Credit: 01** **Max. Marks: 25**

Course Objectives: *On completion of the course, students will be able to,*

- Student develop the skill reading the medical instruments.
- Minimization of errors and get exposure to know the idea of measurements.
- To do handling and repair the electrical instruments
- To develop the skills to touch the social awareness.

List of Experiments for the test of lab skills

1. Measure sugar level in blood using glucometer of five students in our class.
2. Measure the blood pressure.
3. To compare the body temperature of the students in our class using thermal gun and thermometer.
4. Measure the weight of the students in our class and calculate the underweight and overweight students.
5. Check the pulse rate using stethoscope of minimum five students in our class.
6. Observe the film/ photograph of X-ray, CT scan, MRI and write your conclusions.
7. Measure the oxygen level with the help of oximeter and ten male and female and draw the conclusions.

Note: Students should perform at least four experiments

AS PER NEP 2020

Structure of the Course

For

B.Sc. Physics

SEMESTER – II

Dr. Babasaheb Ambedkar Marathwada University,
Chhatrapati Sambhajinagar

Course and credit distribution structure as per NEP-2020

Illustrative Credit distribution for three/four year Honors with Research Degree Programme with multiple entry and exit options.

B.Sc. First Year (IInd semester) Subject: Physics

Course Type	Course Code	Course Name	Teaching Scheme (Hrs/Week)		Credits assigned		Total Credits
			Theory	Practical	Theory	Practical	
Discipline Specific Core Course Mandatory	PHYT/DSC-4/150	**Optics**	2	---	2	---	2+2+2=6
	PHYT/DSC-5/151	**Electricity and Magnetism**	2	---	2	---	
	PHYP/DSC-6/176	**Practical** Based on (PHYT/DSC-4/150 and PHYT/DSC-5/151	---	4	---	2	
Minor (Choose any one from pool of courses)	PHYT/MN-1/152	1) Fundamentals of Biophyiscs 2) Physics of Environmental Science	2	---	2	---	2
Open Elective (OE) (Choose any one from OE-03 and from OE-04 pool of courses)	PHYT/OE-3/153	1) A. I. for Physics 2) Solar System	2	---	2	---	2+2=4
	PHYT/OE-4/154	1) Basics of Space Science 2) Aviation Physics	2	---	2	---	
VSC (Choose any one from pool of courses)	PHYT/VSC-3/155	1) Wireless communication devices	1	---	1	---	2+2=4
	PHYT/VSC-4/156	2) Computer Assembling	1	---	1	---	
	PHYP/VSC-3/177	Practical based on PHYT/VSC-3/155	---	2	---	1	
	PHYP/VSC-4/178	Practical based on PHYT/VSC-4/156	---	2	---	1	
SEC (VSEC) (Choose any one from pool of Courses)	PHYT/SEC-3/157	1) Instrumentation Physics	1	---	1	---	
	PHYT/SEC-4/158	2) Renewable Energy	1	---	1	---	
	PHYP/SEC-3/179	Practical based on PHYT/SEC-3/157	---	2	---	1	
	PHYP/SEC-4/180	Practical based on PHYT/SEC-4/158	---	2	---	1	
AEC, VEC, IKS Ability	AEC-2	English (Common across faculty)	2	---	2	---	2+2=4

Enhancement Courses	VEC-2	Constitution of India (Common Across faculty)	2	---	2	---	
OJT, FP, CEP, CC, RP	CC-2	Yoga Education/Sports and Fitness (Common across faculty)	---	4	---	2	2
			16	**12**	**16**	**6**	**22 Credits**

B. Sc. First Year Physics
(Semester-II)
Course Name: Optics
Course Code: PHYT/DSC-4/150

Contact Hours: 30 **Credit: 02** **Max. Marks: 50**

Course Objectives: *On completion of the course, students will be able to,*

- Acquire the basic concept of optics and its applications.
- Explain how image formation takes place in lenses
- Understand the operations of many modern optical devices
- Understand the optical phenomenon such as interference and diffraction

Unit – I: Geometrical Optics and Instruments **[17L]**

Optics: Introduction to lenses, Location of the image, sign conversions, Thin Lens, Lens Equations, Lens Makers formula, Cardinal points of optical system (Six Points) and corresponding planes, Deviation by Lens, Coaxial Lens System (equivalent focal length and cardinal points), Problems

Optical Instruments: Introduction, The Simple Magnifier, Field of View, stop and pupils, Objective and eyepiece, Need of multiple lens eye piece, Huygen's Eye-piece, Ramsden's Eye-piece, Comparison of Ramsden's eyepiece with Huygen's Eyepiece, Gauss Eye-piece, Problems

Unit – II: Interference and Diffraction **[13L]**

Interference: Introduction, Interference in thin film due to reflected and transmitted light, wedge shaped thin film, Newton's rings by reflected light, determination of wavelength, Michelson's Interferometer, type of fringes, determination of wavelength and difference in wavelength, Problems.

Diffraction: Introduction, Types of Diffraction, Plane diffraction grating, Rayleigh's Criterion for resolution, Resolving power of prism and grating, Problems

Learning Resources:

1. Optics - A.R. Ganesan, 4th edition, Pearson Education.

2. A Textbook of Optics - N. Subhramanyam, Brijlal, M.N. Avadhanulu, S. Chand Publication.
3. Physical Optics - A.K. Ghatak, McMillan, New Delhi
4. Fundamental of Optics - F.A. Jenkins, H.E.White, Mc Graw-Hilll International edition
5. Principles of Optics - D.S. Mathur, Gopal Press, Kanpur.

B. Sc. First Year Physics
(Semester-II)
Course Name: Electricity and Magnetism
Course Code: PHYT/DSC-5/151

Contact Hours: 30 **Credit: 02** **Max. Marks: 50**

Course Objectives: *On completion of the course, students will be able to,*

- Develop an understanding on the concepts of electricity and magnetism.
- To understand the knowledge of various mathematical operations required for electrostatics and magnetostatics.
- Explain the fundamental concepts and operations of vector analysis.
- To increase the ability to perform calculations of various mathematical expressions and laws.
- To develop ability among the students to identify, remember and grasp the meanings, definitions and laws of electricity and magnetism.

Unit – I: Electrostatics and Dielectrics **[17L]**

Electrostatics: Coulomb's law, electric field, field due to point charge, electric flux, Gauss law (with proof), differential form of gauss law, electric potential, potential due to a point charge, field and potential due to a point charge, Problems.

Dielectrics Introduction, polar and non-polar molecules, fundamental definitions of dielectrics (dielectric constant, dielectric polarization, polarizability, polarization vector, and dielectric displacement), Relation between D, E and P, molecular field in a dielectric (Clausius – Mossotti relation), Problems.

Unit – II: Magnetostatics **[13L]**

Introduction, magnetic field, magnetic flux, magnetic induction, Biot and Savart law, magnetic induction at a point due to straight conductor carrying current, magnetic field at the center of circular coil carrying current, magnetic induction on the axis of solenoid, Ampere's law, differential form of Ampere's law, torque on a current loop in uniform magnetic field, moving coil ballistic galvanometer – expression for charge, Problems.

Learning Resources:

1. Mathematical Methods in Physics – D. Biswas (New Central book agency, 2009 edition)
2. Electricity and Magnetism – R Murugeshan (S. Chand, 2008 edition)
3. Electrodynamics – Gupta, Kumar, Singh (Pragati Prakashan, Merrut, 18th Edition, 2005)
4. Foundation of Electromagnetic theory – Reitz, Milford, Chirstey IIIrd Edition)
5. Fundamentals of Physics – Halliday Rensik and Walkar, 8th Edition
6. Electromagnetic – B. B. Laud
7. Electricity and Magnetism – Brijlal, Subramanyan (Ratan Prakashan (Revised edition, 1997)
8. Electricity and Magnetism – Edward M. Purcell, 1986, McGraw – Hill Education
9. Electricity and Magnetism – D. C. Tayal, 1988, Himalaya Publishing house.

B. Sc. First Year Physics
(Semester-II)
Course Name: Practical Based on PHYT/DSC-4/150 and PHYT/DSC-5/151
Course Code: PHYP/DSC-6/176

Contact Hours: 60 **Credit: 02** **Max. Marks: 50**

Course Objectives: *On completion of the course, students will be able to,*

- To enable students to gain practical insights into the principle of light, optical instruments, electrical circuits, and magnetic phenomena.
- To develop students' skill in handling and operating laboratory equipment's and instruments used in experiments related to optics, electricity and magnetism.

List of experiment

1. Use of multimeter for measuring voltage, current and resistance.
2. Determination of dielectric constant of liquid/solid.
3. I-H curve.
4. Field along the axis of circular coil.
5. Determination of wavelength of light by Newton's rings.
6. Resolving power of telescope.
7. Specific rotation by Laurent's half shade polarimeter.
8. λ by grating (normal incidence)
9. Determination of frequency of AC mains by sonometer
10. Comparison of capacitor using De'Sauty's method
11. Measurement of constants of B. G.

Note: - At least six experiments should be performed.

Learning Resources:

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. First Year Physics
(Semester-II)
Course Name: 1) Fundamentals of Biophysics
Course Code: PHYT/MN-1/152

Contact Hours: 30 **Credit: 02** **Max. Marks: 50**

Course Objectives: *On completion of the course, students will be able to,*

- This course is designed to introduce students to the fundamental concepts and principles of biophysics. It provides an interdisciplinary approach that combines the principles of physics with biological systems, focusing on the physical principles underlying various biological processes.

Unit - I: Atomic & Molecular structure **[15]**

Structure of atom-Models & theories, Periodic table, Concept of bonding; valence of carbon; hybridizations of carbon; hybridizations of nitrogen & oxygen; molecular orbital theories, polar & non polar molecules; inductive effect; Secondary bonding: weak interactions, hydrogen bonding; dipole-dipole & dipole induced dipole interactions; London dispersion forces. Bonds within molecules-Ionic, covalent, Hydrogen, Electrostatic, Disulphide & peptide bonds, Van-der Waals forces Bond lengths & Bond energies, Bond angles, Structural isomerism; optical isomerism & optical activity.

Unit – II: Physical Foundations of Biophysics **[15]**

Thermodynamics of Biological system: First and second laws of thermodynamics, activation energy. Biological systems as open, non-equilibrium systems, concept of free energy, unavailable energy and entropy, heat content of food, bomb calorimetry, Enthalpy, Negative entropy as applicable to biological systems. thermodynamics of passive and active transport, glycolytic oscillations, biological clocks.

Learning Resources:

1. Biophysical Science, Ackerman E.A. Ellis, L.E.E. & Williams L.E. (1979), Prentice-Hall Inc.
2. Physical Chemistry For Life Sciences, Barrow. C. (1974), McGraw-Hill.
3. Biophysical chemistry, Bloomfield V.A. and Harrington R.E. (1975), W.A.Freeman and CO.
4. Biophysical chemistry, Cantor C.R. and Schimmel P.R. (1980), W.A.Fremman and Co.
5. Biophysics, concepts and mechanisms, Casey E.J. (1967), Affiliated East west press.

B. Sc. First Year Physics

(Semester-II)

Course Name: 2) Physics of Environmental Science

Course Code: PHYT/MN-1/152

Contact Hours: 30 **Credit: 02** **Max. Marks: 50**

Course Objectives: *On completion of the course, students will be able to,*

- Build conceptual understanding related to the basic principles behind various environmental processes.
- The paper has been divided into two sections, with the view to introduce students to the fundamental of physics associated and basic atmospheric physics.

Unit – I: Fundamentals of environmental Physics **[15L]**

Basic concepts of light and matter: spectroscopic concepts: Introduction to the concept of absorption and transmission of light, Beer-Lambert law; scattering of light, Rayleigh and Mia scattering.

Basic concepts of pressure, work and energy: concept of heat transfer, conduction, convection; concept of temperature, lapse rate (dry and moist adiabatic); laws of thermodynamics; Concept of enthalpy, entropy, Free energy, concept of heat and work, Carnot engine, Gas laws: Charles' law, Boyle's law, Avogadro's law.

Unit – II: Basic atmospheric Physics **[15L]**

Concept of Atmospheric physics: Concept of Albedo, solar constant, Heat budget of the earth atmospheric system. Types of forces and their relation (pressure gradient, viscous, Coriolis, gravitational, centripetal, and centrifugal force); lapse rate (dry and moist adiabatic); Radiation Inversion ad subsidence inversion, concept of mixing depth, concept of pollutant dispersal, Point source Gaussian plume model.

Concept of Weather and Climate: Introduction to climate parameters: temperature, humidity: absolute, relative and specific humidity, dew point, atmospheric pressure. Climatological normal.

Learning Resources:

1. Forinash, K. 2010. Foundation of Environmental Physics. Island Press
2. Boeker, E. & Grondelle, R. 2011. Environmental Physics: Sustainable Energy and Climate Change. Wiley.
3. John Monteith & Mike Unsworth, 2008, Principles of environmental physics, Elsevier.

B. Sc. First Year Physics
(Semester-II)
Course Name:1) A.I. for Physics
Course Code: PHYT/OE-3/153

Contact Hours: 30 **Credit: 02** **Max. Marks: 50**

Course Objectives: *On completion of the course, students will be able to,*

- Attain the knowledge and skills necessary to comprehend the fundamental concepts of artificial intelligence.
- Utilize AI techniques to address physics-related issues
- Grasp the fundamentals of machine learning, effectively analyze intricate physics datasets, master Python for AI applications in physics,
- Stay abreast of the latest advancements in AI, particularly within the domain of physics.

Unit – I: Fundamentals of AI and Machine learning **[17L]**

Introduction to AI in Physics: Introduction To AI, A Brief History of Physics, Introduction to Machine Learning, Impact of Physics on Machine Learning, Introduction to Analog Computers and Quantum Computers,

Machine Learning Fundamentals: Overview of machine learning and its significance in physics research, Types of machine learning: (a) supervised learning - Regression and classification algorithms, Linear regression, decision trees, and random forests, (b) unsupervised learning-Clustering and dimensionality reduction, K-means clustering, PCA, and t-SNE.

Unit – II: Python for AI in physics applications **[13L]**

Review of Python programming for physics applications, Introduction to key Python libraries (NumPy, SciPy, Matplotlib), Introduction to popular AI libraries and frameworks used in physics, Overview of TensorFlow, PyTorch, Keras, and scikit-learn

Learning Resources:

4. AI for Physics by Volker Knecht, CRC Press Taylor & Francis Group, LLC (2023)
5. Machine Learning by by S Sridhar, M Vijayalakshmi Oxford University Press; 1st edition (2021)
6. Introduction to Machine Learning by Jeeva Jose, Khanna Book Publishing Co. (P) LTD 1st edition (2020)
7. Artificial Intelligence: A Modern Approach, by Stuart Russell and Peter Norvig, Pearson Education; 4th edition (2022)
8. Machine Learning using Python by Manaranjan Pradhan, U Dinesh Kumar, Wiley (2019)

B. Sc. First Year Physics
(Semester-II)
Course Name: 2) Solar System
Course Code: PHYT/OE-3/153

Contact Hours: 30 **Credit: 02** **Max. Marks: 50**

Course Objectives: *On completion of the course, students will be able to,*

- Gain a deep understanding of the formation and evolution of our solar system, the celestial bodies within it, and historical perspectives.
- They will explore the motion of planets and Kepler's laws, offering insights into celestial mechanics. The course will also delve into the sun, its structure, and its profound impact on Earth.
- In addition, students will study the inner and outer planets, comparative planetology, and relevant exploration missions.
- Furthermore, the course will shed light on moons, their roles, and their potential habitability, while also delving into asteroids and comets, providing students with an extensive knowledge of these fascinating objects within our cosmic neighborhood.

Unit – I: Solar System **[17L]**

Introduction to solar system: Formation and evolution of the solar system, Overview of celestial bodies in the solar system, Historical perspectives on the solar system, Motion of Planets, Keplars 1st and 2nd law.

The Sun: Structure and properties of the sun, Solar energy and its impact on Earth, Solar observations and missions.

The Inner and Outer Planets: The Inner Planets: Mercury, Venus, Earth, and Mars, Comparative planetology and geology, Exploration missions to the inner planets.

The Outer Planets: Jupiter, Saturn, Uranus and Neptune, Rings, moons, and unique features, Missions to the outer planets and their moons.

Unit – II: Moons, Asteroids, and Comets **[13L]**

The role and characteristics of moons: Types and functions of moons, Moons in the context of planetary systems, Key moons of the solar system, Moon formation and properties, Geology, atmospheres, and potential habitability, Notable moon missions and discoveries.

Asteroids and comets in the solar system: Types and distribution of asteroids, Asteroid composition and classification, Composition, structure, and orbits of comets, The life cycle of comets.

Learning Resources:

1. The Origin and Evolution of the Solar System by MM Woolfson, Institute of Physics Publishing Bristol and Philadelphia, (2000)
2. Physics and Chemistry of the Solar System by John S. Lewis 2nd Edition, Elsevier Academic Press (2004)
3. A Brief History of Time by Stephen Hawking, Bantam Publisher (1988)

B. Sc. First Year Physics
(Semester-II)
Course Name: 1) Basics of Space Science
Course Code: PHYT/OE-4/154

Contact Hours: 30 **Credit: 02** **Max. Marks: 50**

Course Objectives: *On completion of the course, students will be able to,*

- Provide students with a thorough grasp of materials and coatings designed for extreme conditions, historical aspects of astronomy and related techniques, and satellite systems.
- This preparation equips students to effectively tackle real-world challenges in these specialized areas of study.

UNIT – I: Astronomy **[17L]**

Physics of Space Science: Materials and coatings to withstand extreme conditions - polymers and ceramic composites - strength, thermal protection, surface treatments –- chemical techniques to enhance durability and functionality, Liquid and solid propellants - chemical reactions, combustion and oxidation, to generate thrust - formulations for efficiency, stability, and safety.

Introduction to Astronomy

History of Astronomy, How Astronomers work, Optical Astronomy, Gamma-Ray and X-Ray Astronomy, Ultraviolet Astronomy, Infrared Astronomy, Radio Astronomy, Mapping the Sky -(a) The Constellations (b) Coordinate Systems (c) Altazimuth Systems

UNIT – II: Satellite Systems **[13L]**

Fundamentals of Satellite Systems, Basic Characteristics of Satellites, Improved space platforms and launching Systems, Transponder, Spacecraft and Repeater, Spacecraft Communications, Spacecraft Antennas - (a) Horn Antennas, (b) Reflector Antennas, Satellite Orbit Configurations, Satellite Network Architectures, General Features of Satellite Networks

Learning Resources:

1. A Textbook of Astronomy and Astrophysics by Suresh Chandra and Mohit Kumar Sharma, Dreamtech Press-India (2019)
2. Astrophysics for People in a Hurry by Neil Degrasse Tyson, W. W. Norton & Company; 1st edition (2017)
3. Introduction to Rocket Science and Space Exploration by A. Sivathanu Pillai, CRC Press, Taylor & Francis Group, LLC (2023)
4. Introduction to Satellite Communication by Bruce R. Elbert, Artech House Publishers; 3rd edition (2018)
5. Introduction to Satellite Communication by Sapna Katiyar, S.K. Kataria & Sons (2012)

B. Sc. First Year Physics
(Semester-II)
Course Name: 2) Aviation Physics
Course Code: PHYT/OE-4/154

Contact Hours: 30 **Credit: 02** **Max. Marks: 50**

Course Objectives: *On completion of the course, students will be able to, gain a deep understanding of the characteristics of matter, energy, and the principles governing flight. The course delves into concepts such as forces, motion, thermodynamics, and fluid mechanics, which are foundational in understanding aviation and aerospace. Furthermore, students will explore the four forces of flight and how they relate to aircraft stability, flight control surfaces, and the theory of flight. By the end of this course, students will have a solid grasp of the physical principles that underpin aviation and be well-equipped to analyze and comprehend the dynamics of flight and aircraft behavior.*

Unit-I: Components of Aviation Physics **[15L]**

(Definition and Brief Description only) Characteristics of Matter - Mass and Weight, Attraction, Porosity, Density, Specific Gravity, Potential Energy, Kinetic Energy, Force, Work, Power, and Torque, Simple Machines- Lever, Pulley, Gear, Inclined Plane, Stress-Tension, Compression, Strain, Uniform Motion, Newtons Laws of Motion, Heat Energy, Heat Transfer, Thermal Expansion, Gas Laws (Boyle's, Charles, General, Dalton's), Fluid Mechanics, Bernoulli's Principle, Speed of Sound, Mach Number, Doppler Effect, Composition of the Atmosphere.

Unit-II: Aircraft Theory of Flight **[15L]**

Introduction, Four Forces of Flight (Weight, Lift, Thrust, Drag), Bernoulli's Principle and Subsonic Flow, Lift and Newton's Third Law, Airfoils, Camber, Chord Line, Relative Wind, Angle of Attack, Boundary Layer Airflow, Boundary Layer Control, Wingtip Vortices, Axes of an Aircraft, Theory of Flight, Static Stability, Dynamic Stability, Longitudinal Stability, Lateral Stability, Directional Stability, Dutch Roll, Aircraft Theory of Flight, Flight Controls and the Lateral Axis, Flight Controls and the Longitudinal Axis, Flight Controls and the Vertical Axis, Tabs (Trim, Anti-servo, Balance, Sevo), Supplemental Lift-Modifying Devices (Flaps, Leading-Edge Slots, Leading-Edge Slats,

Learning Resources:

1. Fundamentals of Aerodynamics by John D Anderson Jr., McGraw-Hill Education; 6th edition (2016)
2. Physics for Aviation by Noel Dreska, Intl Aviation Pub 1992)
3. Introductory Physics with Aviation Applications by W. Brian Lane and Paul R. Simony, Publisher-Lulu.com (2017)

B. Sc. First Year Physics

(Semester-II)

Course Name:1) Wireless Communication Devices

Course Code: PHYT/VSC-3/155

Contact Hours: 15 **Credit: 01** **Max. Marks: 25**

Course Objectives: *On completion of the course, students will be able to,*

- Understand the fundamentals of wireless communication
- Emphasis on information to role of wireless communications optimizations.
- Learn and understand the different wireless technologies.
- Elaborate discussion about wireless communication systems.
- Dynamic study of wireless technologies, networking protocols.

Unit - I: Wireless Network Technologies **[7L]**

Wireless Network: Introduction to wireless network, Wireless Communication (Radio, Microwave, Infra-red, Light Transmission). Basics of wireless networking components as WLAN, WWAN, WPAN, 4G, 5G technologies, and their applications.

Unit - II: Mobile Communication Systems **[8L]**

Introduction to communication system, Elements of a communication system, Understanding different communication systems as GSM, CDMA, LTE, VoLTE and other mobile communication systems. Basics of antennas, Antenna theory, types and their applications in wireless systems.

Learning Resources:

1. Wireless Communications (Principles and Practice)- Theodore S. Rappaport, Pearson
2. Fundamentals of Wireless Communication, David Tse and Pramod Viswanath, Cambridge.
3. Wireless Communications and Networking, Vijay K. Garg, Morgan Kaufmann Publication.

B. Sc. First Year Physics
(Semester-II)
Course Name: 2) Computer Assembling
Course Code: PHYP/VSC-4/156

Contact Hours: 15 **Credit: 01** **Max. Marks: 25**

Course Outcome: *On completion of the course, students will be able to,*

- Identify various types of computer hardware and software
- Understand the procedures of opening and fixing computer parts
- Install computer operating system, device driver and application software
- Install computer peripheral
- Able to test and troubleshoot computer

Unit I. Basics of Computer Assembling **[15L]**

Introduction to PC Hardware: Study of basic I/O systems, Types of Memories- Static RAM and Dynamic RAM, ROM, PROM, EPROM, EEPROM, CPU (Central Processing Unit)- ALU and control unit.

Motherboard and Processor: Study of different types of Motherboards, Motherboard Configuration, Identifying Internal and External connectors, Types of data cables, Types of Processor- Intel Pentium IV, Dual core, Core 2 Duo, Quad processor etc,.

Hard Disk: Formatting of Hard disk, Partitioning of Hard disk in different logical drives, Disk defragmentation, Disk clean up, Scan disk etc,.

Learning Resources:

1. The Hardware/Software Interface" by David A. Patterson and John L. Hennessy -.
2. Computer Architecture: A Quantitative Approach" by John L. Hennessy and David A.
3. Inside the Machine: Jon Stokes -.
4. Memory Systems: Cache, DRAM, Disk" by Bruce Jacob, Spencer Ng, and David Wang
6. Motherboard Manual: A Tech Lover's Guide" by Thomas Angel
7. Intel Microprocessors" by Barry B. Brey.

B. Sc. First Year Physics

(Semester-II)

Course Name: Practical based on PHYT/VSC-3/155

Course Code: PHYP/VSC-3/177

Contact Hours: 30 **Credit: 01** **Max. Marks: 25**

Course Outcome: *On completion of the course, students will be able to,*

- Develop the skill enhancement of communication devises.
- Optimization of errors and get advanced wireless networking.
- Easy handling and repair the advanced wireless networking instruments.

List of Experiments for the test of laboratory skills

1. Test the different sections of mobile phone.
2. Transfer an image, audio and video file using Bluetooth protocol with varying distance between two devices and analyze the performance.
3. Configure Wi-Fi setting in mobile devices using mobile tethering.
4. Hands-on experience with wireless communication devices.
5. Study the component used in wireless communications tools.
6. Hands-on experience with simulators used in wireless communication instruments.

B. Sc. First Year Physics

(Semester-II)

Course Name: Practical based on PHYT/VSC-4/156

Course Code: PHYP/VSC-4/178

Contact Hours: 30 **Credit: 01** **Max. Marks: 25**

Course Objectives: *On completion of the course, students will be able to,*

- Familiarization with computer components: Students should be able to identify and describe the function of each major component of a computer system, including the CPU, motherboard, RAM, storage devices, power supply, and peripherals.
- Physically assemble a computer system, including mounting the motherboard, installing the CPU, connecting peripherals, and securing all components within the computer case.

List of Experiments for the test of laboratory skills

1. Front panel indicators and switches and front side and rear side connectors.
2. Familiarize the computer system layout: Making positions of SMPS, Motherboard, FDD, HDD, CD, DVD, and Add on Cards.
3. Configure Bios setup program and troubleshoot the typical problems using Bios utility
4. To install Hard disc and configure to the PC's
5. Printer installation and servicing troubleshoot.
6. Install and configure scanner, web cam, cell phone and biometric device with system and troubleshoot the problems.

B. Sc. First Year Physics
(Semester-II)
Course Name: 1) Instrumentation Physics
Course Code: PHYT/SEC-3/157

Contact Hours: 15 **Credit: 01** **Max. Marks: 25**

Course Objectives: *On completion of the course, students will be able to,*

- Classify physical measurement backgrounds.
- Select transducers and sensors as per application demand.
- Identity terminals of industry grade transducers and sensors.
- Describe operation of basic transducers employed for industrial process parameter monitoring applications

Unit I: Transducers and Sensors **[15 L]**

Transducers: Classification of Transducers; Active, Passive transducers, Variable inductance type transducers, Capacitive transducers

Resistance Transducers: Thermistors, RTD, (PT-100), thermocouple, Types of thermocouple J,K,R,S,T (Based on material, temperature ranges)

Pressure transducer: Non elastic pressure transducer: (U tube, well type manometer); Elastic pressure transducer: (Bourdon Tube, Bellows, Diaphragm), Piezo electric pressure Transducers, Strain Gauge, Types of strain gauge: bonded, unbounded, semiconductor

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 measuring transducers: 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).

Sensors: 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)

Special purpose sensors: Gas sensors, accelerometer, gyro sensor, humidity sensor, reed switch, thickness sensor, tilt sensors

(Note: Please focus on classifications of Transducers and sensors with brief explanations due to the limited syllabus scope)

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.
4. Biomedical instrumentation- M. Arumugam
5. Course in electrical and electronic measurements and instruments- A.K Sawhney
6. Electronic instrumentation and measurements techniques- W.D. Cooper
7. Instrumentation devises and system- C.S Rangan, V.S.T.V Mani and G.K Sharma

B. Sc. First Year Physics
(Semester-II)
Course Name: 2) Renewable Energy
Course Code: PHYT/SEC-4/158

Contact Hours: 15 **Credit: 01** **Max. Marks: 25**

Course Objectives: *On completion of the course, students will be able to,*

- Know the need of renewable energy resources, historical and latest developments
- Discuss Bio-Energy through fermentation and explain sources of geothermal energy
- Describe biogas plants and Properties and characteristics of biogas
- Explain the working principle of ocean thermal energy conversion systems
- Compare Solar, Wind and bio energy systems, their prospects, advantages and limitations

Unit I- Energy sources **[15 L]**

Introduction to energy sources: Energy sources and their availability, non-conventional sources, Sun as a source of energy, Solar cell fundamentals, (i) semiconductor, (ii) P-N junction, (iii) generation of electron – hole pair by photon absorption, (iv) I-V characteristics of solar cell, Principle of wind energy conversion, Applications of wind energy, Geothermal energy resources, Bio-Energy through fermentation - Pyrolysis, gasification and combustion Biogas plants-Properties and characteristics of biogas., Principle of ocean thermal energy conversion (OTEC), Tidal power generation, advantages of renewable energy sources, prospects of renewable energy sources.

Electrical storage: Lead acid battery, basic battery theory.

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. First Year Physics

(Semester-II)

Course Name: Practical Based on PHYT/SEC-3/157

Course Code: PHYP/SEC-3/179

Contact Hours: 30 **Credit: 01** **Max. Marks: 25**

Course Objectives: *On completion of the course, students will be able to,*

- Get exposure with various aspects of transducers and sensors and their usage through hands-on mode.
- Experiments listed below are to be done in continuation of the topics.

List of Experiments for the test of lab skills

1) Study characteristics of Thermistor
2) Measurement of temperature using thermocouple
3) Measurement of Pressure using Piezo electric pressure Transducers
4) Measurement of Pressure using Non elastic pressure transducer
5) Measurement of Pressure using elastic pressure transducer
6) Measurement of Flow using flow transducer (any one)
7) Measurement of Level using Level transducer (any one)
8) Study of sensor (any one)
9) Study of Special purpose sensor (any one)