DEPARTMENT OF PHYSICS, RANAGHAT COLLEGE

SYLLABUS DISTRIBUTION AND COURSE OUTCOMES (Cos)
ACADEMIC YEAR: 2018 to 2023

FOR B. Sc. (PHYSICS HONOURS) COURSES (SEM: I, II, III, IV, V and VI)

SL. NO.	COURSE CODE Credit (4 + 2)	COURSE TITLE AND TOPIC TAUGHT (THEORY AND PRACTICAL)	NAME OF THE TEACHER/ MENTOR	PHYSICS COURSE OUTCOMES
1.	PHY-H-CC-T/P- 01	**Mathematical Physics- I**	TG	This Course will help students in the following ways. Students will understand mathematics and the mathematical concept needed for a proper understanding of physics. At the end students will lean vector calculus like differentiation, integration, orthogonal curvilinear coordinates. They will learn to solve ordinary differential equation for some real physical problems.
		1. Calculus and Vector Calculus		
		2. Vector Integration, Orthogonal Curvilinear Coordinates and Dirac Delta Function and its properties.	KR	
		3. Lab	KR, TG	Hands on training like 2D and 3D graph plotting - plotting functions and datafiles, fitting data using gnu plot's fit function, polar and parametric plots, modifying the appearance of graphs, Surface, and contour plots, exporting plots will pertain for future study in this field
2.	PHY-H-CC-T/P- 02	**Mechanics**		The students would learn about the behaviour of physical bodies it provides the basic concepts related to the motion of all the objects around us in our daily life. The course builds a foundation of various applied field in science and technology; especially in the field of mechanical engineering. The course comprises of the study vectors, laws of motion, momentum, energy, rotational motion, gravitation, fluids, elasticity and special relativity
		1. Fundamental of Dynamics to Rotational Dynamics	SM	
		2. Elasticity to Special theory of Relativity	AB	
		3. Lab	AB, SM, SB	Students would perform basic experiments related to mechanics and get familiar with various measuring instruments would learn the importance of accuracy of measurements
3.	PHY-H-CC-T/P- 03	**Electricity and Magnetism**		It gives an opportunity for the students to learn about one of the fundamental interactions of electricity and magnetism, both as separate phenomena and as a singular electromagnetic force. The course contains vector analysis, electrostatics, magnetism, electromagnetic induction and Maxwell's equations. The course is very useful for the students in almost every branch of science and engineering
		1. Electric field and electric potential to Magnetic Properties of Matter.	KR	

		2. Electromagnetic Induction to Ballistic Galvanometer	SM	
		3. Lab	RS, KR, SB	Students would gain practical knowledge about electricity and magnetism and measurements such as: Resistance, Voltage, current etc.

SL. NO.	COURSE CODE	COURSE TITLE AND TOPIC TAUGHT	NAME OF THE TEACHER/ MENTOR	COURSE OUTCOMES
4.	PHY-H-CC-T/P-04	**Waves and Optics**		The course comprises of the study of superposition of harmonic oscillations, waves motion (general), oscillators, sound, wave optics, interference, diffraction, polarization. The course is important for the students to make their career in various branches of science and engineering, especially in the field of photonic engineering.
		1. Superposition of two perpendicular Harmonic Oscillations to Fresnel Diffraction	AB	
		2. Lab	SM, SB	The practical knowledge of wave motion doing experiments: Tuning fork, electric vibrations. They would also learn optical phenomena such as interference, diffraction and dispersion and do experiments related to optical devices: Prism, grating, spectrometers.
5.	PHY-H-CC-T/P-05	**Mathematical Physics-II**		Would learn mathematical methods to solve the various problems in physics. The topics include the calculus of functions, Fourier transform, special functions and special integrals, partial differential equations, complex analysis, and variables.
		1. Fourier Series to Frobenius Method and Special Functions	TG	
		2. Some Special Integrals to Partial Differential Equations	RS	
		3. Lab	SM	Learn the Basic Programming Concept, Improve the logical as well as Computational ability.
6.	PHY-H-CC-T/P-06	**Thermal Physics**		• To understand various thermodynamic processes like isothermal, isobaric, isochoric processes, and laws of thermodynamics.
		1. Introduction to Thermodynamics to 2nd Law of Thermodynamics and Practical	AB	• To understand the concept of entropy • To understand Carnot's cycle, Heat engines and Refrigerators • To understand Principle of thermometry and various types of thermometers like Liquid filled thermometers, Gas filled thermometers, Bimetallic thermometers, Platinum resistance thermometer
		2. 2nd Law of Thermodynamics, Entropy and Thermodynamic Potentials	SM	• The course contains kinetic theory of gases and the behavior of real gases

		3. Kinetic Theory of Gases	SG	
		4. Lab	AB, SB	Students would gain practical knowledge about heat and radiation, thermodynamics, thermos- emf etc. and perform various experiments

SL. NO.	COURSE CODE	COURSE TITLE AND TOPIC TAUGHT	NAME OF THE TEACHER/ MENTOR	COURSE OUTCOME
7.	PHY-H-CC-T/P-07	**Digital Systems and Applications**	KR	The students would gain the knowledge of CRO and its use. They would know about Integrated circuits. The course has been deigned to learn Digital circuits, Boolean Algebra, Data Processing circuits, Arithmetic Circuits, Computer Organization etc. which are foundations block of Digital Electronics.
		1. Introduction to CRO to Introduction to Assembly Language.		
		2. Lab		Students will learn to handle CRO to measure voltage, time period of periodic wave form. Learn to design various Logic gates and use of 8085 Microprocessor.
8.	PHY-H-CC-T/P-08	**Mathematical Physics-III**	TG	The emphasis of the course is on applications in solving problems of interest to physicists. Students will be examined based on problems, seen and unseen. Would learn mathematical methods to solve the various problems in physics. The topics include complex analysis, integral transform, Laplace transform etc.
		1. Complex Analysis and Integral Transforms		
		2. Laplace Transforms	RS	
		3. Lab	SM	Learn the Basic Programming Concept, Improve the logical as well as Computational ability.
9.	PHY-H-CC-T/P-09	**Elements of Modern Physics**	AB	Students would know about the basic principles in the development of modern physics. The topics covered in the course build a foundation of undergraduate physics students to study the advance branches: quantum physics, Radioactivity and Lasers. The course contains the study of Planck's hypothesis, photoelectric effect, Compton effect, matter waves, atomic models, Schrodinger wave equations, and brief idea of Radioactivity.
		Planck's quantum, Planck's constant and light as a collection of photons....... Radioactivity, Laser		
		Lab	AB	In this course students would be able to understand Basic experiments of modern physics such as: Determination of Plank's and Boltzmann's constants, Determination of ionization potential, Wavelength of H-spectrum, Single and double slit diffraction, Photo electric effect and determination of e/m
10.		**Analog Systems and Applications**		In this course students would be able to understand semiconductor diodes, Amplifiers, Op amps and its applications

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	PHY-H-CC-T/P-10	Semiconductor Diodes to Conversion	KR	Students would learn about electronic circuits such as Amplifiers and Oscillators. Various types of Amplifier and Oscillator circuits their working and applications in domestic, industrial, and scientific devices/equipment.
11.	PHY-H-CC-T/P-11	**Quantum Mechanics and Applications** 1. Time dependent Schrodinger equation to Quantum theory of	AB	Quantum mechanics provides a platform for the physicists to describe the behavior of matter and energy at atomic and subatomic level. The course plays a fundamental role in explaining how things happen beyond our normal observations. The course includes the study of Schrodinger equations, particle in one dimension potential, quantum theory of H like atoms, atoms/molecules in electric and magnetic fields.
		hydrogen-like atoms 2.Atoms in Electric & Magnetic Fields to Many electrons' atoms	TG	
		3. Lab	SM	Various practical problems solving methods related to Quantum Mechanics would be learned by students.
12.	PHY-H-CC-T/P-12	**Solid State Physics** 1. Theory	RS	Students would be able to understand various types of crystal structures and symmetries and understand the relationship between the real and reciprocal space and learn the Bragg's X-ray diffraction in crystals. Would also learn about phonons and lattice.
		2. Lab	RS	The course Provides practical knowledge of various physical phenomena such as: magnetism, dielectrics, ferroelectrics, and semiconductors. Students would gain a hands-on learning experience by performing experiments on these properties of materials.
13.	PHY-H-CC-T/P-13	**Electro-Magnetic Theory** 1. Theory	TG	The study of electromagnetic theory provides foundation for the students to understand advanced courses of physics. The astrophysics part of the course opens scope for students seeking research opportunities in space, atmospheric and planetary sciences etc. The course involves the study of electromagnetic theory, Maxwell's equations and electromagnetic waves, radiations from moving charges.
		2. Lab	RS	Students will be able to understand polarization of light, Stefan's Law of Radiation, and determination of Boltzmann Constant.
14.	PHY-H-CC-T/P-14	**Statistical Mechanics** 1. Classical Statistics and Classical Theory of Radiation.	AB	The course includes the study of Basic postulates, application of classical distribution to ideal gases, imperfect gases, BE, FD, MB statistics and black body radiation.
		2. Quantum Theory of Radiation, BE statistics and FD statistics.	KR	
		3. Lab	KR	Student will learn C/C++/ Scilab for solving the problems based on Statistical Mechanics.

PHYSICS-H-DSE 1-4 (ELECTIVES)

SL. NO.	COURSE CODE	COURSE TITLE AND TOPIC TAUGHT	NAME OF THE TEACHER/ MENTOR	COURSE OUTCOME
15.	PHY-H-DSE-T/P-01	**Classical Dynamics**		In this course students would learn to apply the Newtonian laws using various mathematical formulations to describe the motions of macroscopic objects using generalized coordinates, momentum, forces, and energy. Studying classical dynamics would help to understand advanced branches of physics.
		1. Classical Mechanics of Point Particles and Electromagnetic Radiation	SG	
		2. Special Theory of Relativity	SM	
16.	PHY-H-DSE-T/P-02	**Nuclear and Particle Physics**		In this course students would know about the general properties of nuclei, nuclear forces and detectors, radioactive decay, and nuclear reactions. The course expands the knowledge of students especially, the various applications of nuclear physics The course builds a foundation for the students to carry out research in the field of nuclear physics, high energy physics, nuclear astrophysics, nuclear reactions and applied nuclear physics.
		1. General Properties of Nuclei to Nuclear Reactions	RS	
		2. Nuclear Astrophysics to Particle physics	KR	
17.	PHY-H-DSE-T/P-03	**Communication Electronics**		This course helps the students to gain basic ideas of the construction and working of electronic devices and circuits and to understand the fundamentals of communication systems. The communication electronics has wide applications in computing, process control, signal processing, communication systems, digital instruments etc.
		1. Theory	SM	
		2. lab	SM	
18.	PHY-H-DSE-T/P-04	**Bio- Physics/ Dissertation**		Course would provide the applications of physical laws in the understanding of biological processes, various methods in the Biophysical analysis including florescence spectroscopy, Raman spectroscopy and characterization of bio molecules would be studied.
		1. Building Blocks & Structure of Living State to Open systems and chemical thermodynamics	SG	
		2. Diffusion and transport to Bioenergetics and Molecular motors	AB	
		3. Dissertation Project	KR, RS, TG, SM	This course is based on preliminary research-oriented topics both in theory and experiments. The students are given particular research problems under the supervision of faculty members of the department. Students have the opportunity to work on theoretical as well as experimental topics in current physics.

Skill Enhancement Courses (SEC) (For Honours)

(Syllabus revised from 2022-23 session)

SL. NO.	COURSE CODE	COURSE TITLE AND TOPIC TAUGHT	NAME OF THE TEACHER/ MENTOR	COURSE OUTCOME
15.	PHY—H-SEC-T/P-01	Physics Workshop Skills/ Computational Physics Skills/ Electrical circuits & Network Skills/ Basic Instrumentation Skills (Semester III)	SG SM	**Physics Workshop Skills** The aim of this course is to enable the students to familiar and experience with various mechanical and electrical tools through hands-on mode **Computational Physics** The aim of this course is not just to teach computer programming and numerical analysis but to emphasize its role in solving problems in Physics • Highlights the use of computational methods to solve physical problems • Use of computer language as a tool in solving physics problems (applications) • Course will consist of hands-on training on the Problem solving on Computers **Electrical Circuits and Network Skills** The aim of this course is to enable the students to design and trouble shoots the electrical circuits, networks, and appliances through hands-on mode **Basic Instrumentation Skills** This course is 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
16.	PHY—H-SEC-T/P-02	Renewable Energy & Energy Harvesting/ Radiation Safety/ Technical Drawing/ Applied Optics/ Weather Forecasting (Semester-IV)	RS KR	**Renewable Energy & Energy Harvesting**: The aim of this course is not just to impart theoretical knowledge to the students but to provide them with exposure and hands-on learning wherever possible **Radiation Safety** The aim of this course is for awareness and understanding regarding radiation hazards and safety. The list of laboratory skills and experiments are there in the course are to be done in continuation of the topics **Technical Drawing** Students will get exposure in various engineering drawing and CAD drawing **Applied Optics** Theory includes only qualitative explanation. Various experiments on those topics will give knowledge about the course to the students **Weather Forecasting** The aim of this course is not just to impart theoretical knowledge to the students but to enable them to develop an awareness and understanding regarding the causes and effects of different weather phenomenon and basic forecasting techniques

SYLLABUS DISTRIBUTION AND COURSE COMPLETION REPORT

FOR B. Sc. (GENERAL) COURSES (SEM: I, II, III, IV, V and VI)

SL. NO.	COURSE CODE	COURSE TITLE AND TOPIC TAUGHT	NAME OF THE TEACHER/ MENTOR	COURSE OUTCOME
1.	PHY-G-CC-T/P-01	Mathematical Physics – I/**Mechanics**/Electricity and Magnetism		The students would learn about the behavior of physical bodies it provides the basic concepts related to the motion of all the objects around us in our daily life. The course builds a foundation of various applied field in science and technology, especially in the field of mechanical engineering. The course comprises of the study vectors, laws of motion, momentum, energy, rotational motion, gravitation, fluids, elasticity, and special relativity.
		1. Fundamentals of Dynamics to Rotational Dynamics	SG	
		2. Elasticity to Oscillations	AB	
		3. Non-Inertial Systems and Special Theory of Relativity	RS	
		4. Practical	SG, AB, SB	Students would perform basic experiments related to mechanics and also get familiar with various measuring instruments would learn the importance of accuracy of measurements.
2.	PHY-G-CC-T/P-02	Waves and Optics/Mathematical PhysicsII/**Thermal Physics**/Digital Systems and Applications		The course makes the students able to understand the basic physics of heat and temperature and their relation with energy, work, radiation and matter. The students also learn how laws of thermodynamics are used in a heat engine to transform heat into work. The course contains the study of laws of thermodynamics, thermodynamic description of systems, thermodynamic potentials, kinetic theory of gases, theory of radiation and statistical mechanics.
		1. Introduction to Thermodynamics to Maxwell's Thermodynamic Relations	SM	
		2. Kinetic Theory of Gases	SG	
		3. Practical	SG, SB	Students would gain practical knowledge about heat and radiation, thermodynamics, thermo emf etc. and perform various experiments.
3.	PHY-G-CC-T/P-03	Mathematical Physics – III/Elements of Modern Physics/**Analog Systems and Applications**		In this course students would be able to understand semiconductor diodes, Amplifiers, Op amps and its applications.
		1. Semiconductor Diodes to Bipolar Junction transistors	SG	

SL. NO	COURSE CODE	COURSE TITLE AND TOPIC TAUGHT	NAME OF THE TEACHER/ MENTOR	
		2. Amplifiers to Feedback in Amplifiers	TG	
		3. Sinusoidal Oscillators to Conversion	RS	
		4. Practical	SG	Students would learn about electronic circuits such as Amplifiers and Oscillators. Various types of Amplifier and Oscillator circuits their working and applications in domestic, industrial, and scientific devices/equipment.
4.	PHY-G-CC-T/P-04	Quantum Mechanics and Applications/ Solid State Physics/ **Electromagnetic Theory/** Statistical Mechanics		The study of electromagnetic theory provides foundation for the students to understand advanced courses of physics. The astrophysics part of the course opens scope for students seeking research opportunities in space, atmospheric and planetary sciences etc. The course involves the study of electromagnetic theory, Maxwell's equations and electromagnetic waves, radiations from moving charges
		1. Maxwell Equations to EM Wave in Bounded Media	SG	
		2. Polarization of Electromagnetic Waves to Optical Fibers.	RS	
		3. Practical	SG, RS, SB	Students will be able to understand polarization of light, Stefan's Law of Radiation, and determination of Boltzmann Constant.

SL. NO.	COURSE CODE	COURSE TITLE AND TOPIC TAUGHT	NAME OF THE TEACHER/ MENTOR	COURSE OUTCOME
5.	PHY-G-DSE-T/P-01	Mechanics/Electricity and Magnetism/ Thermal Physics and Statistical **Mechanics**/Waves and Optics		The students would learn about the behavior of physical bodies it provides the basic concepts related to the motion of all the objects around us in our daily life. The course builds a foundation of various applied field in science and technology, especially in the field of mechanical engineering. The course comprises of the study vectors, laws of motion, momentum, energy, rotational motion, gravitation, fluids, elasticity, and special relativity.
		1. Vectors to Rotational Motion	SG	
		2. Oscillations, Special Theory of Relativity	TG	
		3. Gravitation, Elasticity	AB	
		4. Practical	SG, SB	Students would perform basic experiments related to mechanics and get familiar with various measuring instruments would learn the importance of accuracy of measurements.
6.	PHY-G-DSE-T/P-02	**Digital, Analog Circuits and Instrumentation**/Elements of Modern Physics/Solid State Physics/Quantum Mechanics/Nuclear and Particle Physics		Students will get knowledge on Digital electronics, various semiconductor devices, Operational Amplifiers, and other instrumentations skills.
		1. UNIT-1: Digital Circuits	SG	
		2. UNIT-2: Semiconductor Devices and Amplifiers	TG	
		3. UNIT-3: Operational Amplifiers (Black Box approach), UNIT-4: Instrumentations	SM	
		4. Practical	SG, TG	Students would learn in experimenting about electronic circuits such as Amplifiers and Oscillators. Various types of Amplifier and Oscillator circuits their working and applications in domestic, industrial, and scientific devices/equipment like CRO etc.
7.	PHY-G-SEC-T/P-01	**Electrical Circuit and Network Skill**		The aim of this course is to enable the students to design and trouble shoots the electrical circuits, networks, and appliances through hands-on mode.
		1. Basic Electricity Principles to Generators and Transformers.	SM	
		2. Electric Motors to Electrical Wiring.	TG	
8.		**Radiation Safety**		

	PHY-G-SEC-T/P-02	1. Basics of Atomic and Nuclear Physics to Interaction of Neutrons.	SM	The aim of this course is for awareness and understanding regarding radiation hazards and safety. The list of laboratory skills and experiments are there in the course are to be done in continuation of the topics.
		2. Radiation detection and monitoring devices: Radiation Quantities and Units to Application of nuclear techniques.	TG	
9.	PHY-G-SEC-T/P-03	**Applied Optics**	AB	Theory includes only qualitative explanation. Various experiments on those topics will give knowledge about the course to the students.
		1. Sources and Detectors		
		2. Fourier Optics, Holography, Photonics: Fibre Optics	TG	
10.	PHY-G-SEC-T/P-04	**Renewable Energy and Energy Harvesting**		The aim of this course is not just to impart theoretical knowledge to the students but to provide them with exposure and hands-on learning wherever possible.
		1. Fossil fuels and Alternate Sources of energy to Ocean Energy.	AB	
		2. Geothermal Energy to Demonstrations and Experiments.	TG	

Generic Elective Course (GEC) (For Honours)
(SEM: I, II, III and VI)
(Syllabus revised from 2022-23 session)

SL. NO.	COURSE CODE	COURSE TITLE AND TOPIC TAUGHT	NAME OF THE TEACHER/ MENTOR	COURSE OUTCOME
1.	PHY—H-GE-T/P-01	**Mechanics/** Electricity and Magnetism		The students would learn about the behavior of physical bodies it provides the basic concepts related to the motion of all the objects around us in our daily life. The course builds a foundation of various applied field in science and technology, especially in the field of mechanical engineering. The course comprises of the study vectors, laws of motion, momentum, energy, rotational motion, gravitation, fluids, elasticity, and special relativity.
		1. Vectors to Rotational Motion	KR	
		2. Gravitation to Special Theory of Relativity	AB	
		3. Practical	RS, AB, TG, SB	Students would perform basic experiments related to mechanics and get familiar with various measuring instruments would learn the importance of accuracy of measurements.
2.	PHY—H-GE-T/P-02	**Thermal Physics and Statistical Mechanics/** Waves and Optics		The course makes the students able to understand the basic physics of heat and temperature and their relation with energy, work, radiation and matter. The students also learn how laws of thermodynamics are used in a heat engine to transform heat into work. The course contains the study of laws of thermodynamics, thermodynamic description of systems, thermodynamic potentials, kinetic theory of gases, theory of radiation and statistical mechanics like MB, BE and FD statistics.
		1. Laws of Thermodynamics, Thermodynamical Potentials	RS	
		2. Kinetic Theory of Gases, Theory of Radiation, Statistical Mechanics.	SG	
		3. Practical	SG, RS, TG, SB	Students would gain practical knowledge about heat and radiation, thermodynamics, thermos- emf etc. and perform various experiments.
3.	PHY—H-GE-T/P-03	**Mechanics/** Electricity and Magnetism		The students would learn about the behavior of physical bodies it provides the basic concepts related to the motion of all the objects around us in our daily life. The course builds a foundation of various applied field in science and technology, especially in the field of mechanical engineering. The course comprises of the study vectors, laws of motion, momentum, energy, rotational motion, gravitation, fluids, elasticity, and special relativity.
		1. Vectors to Rotational Motion	RS	
		2. Gravitation to Special Theory of Relativity	SG	
		3. Practical	RS, KR, SB	Students would perform basic experiments related to mechanics and get familiar with various measuring instruments would learn the importance of accuracy of measurements.

4.	PHY—H-GE-T/P-04	**Thermal Physics and Statistical** Mechanics/ Waves and Optics		The course makes the students able to understand the basic physics of heat and temperature and their relation with energy, work, radiation and matter. The students also learn how laws of thermodynamics are used in a heat engine to transform heat into work. The course contains the study of laws of thermodynamics, thermodynamic description of systems, thermodynamic potentials, kinetic theory of gases, theory of radiation and statistical mechanics like MB, BE and FD statistics
		1. Theory	RS	
		2. Practical	RS, AB, SB	Students would gain practical knowledge about heat and radiation, thermodynamics, thermos- emf etc. and perform various experiments.

PROGRAMME OUTCOMES (POs)
(B. Sc. Physics Hons. and General)

Knowledge Outcomes:

After completing B. Sc. (Physics) Programme students will be able to:

1. Apply the basic principles of Physics to the events occurring in our everyday life.
2. Try to find out or analyse scientific reasoning and critical thinking through the knowledge that they acquired in classrooms, laboratory etc. and apply them in various real life situations.

Skill Outcomes:

After completing B.Sc. (Physics) Programme students will be able to:

1. Use of computers and various software and programming skills
2. apply the knowledge to develop the sustainable and eco-friendly technology for pollution free environment
3. collaborate effectively on team-oriented projects in the field of Physics
4. Communicate scientific information in a clear and concise manner both orally and in writing or through audio visual presentations.

Generic outcomes:

After completing the course Students will

1. develop ability to work in group.
2. develop capacity of critical reasoning, judgment, and communication skills.
3. Develop abilities for logical thinking.

PROGRAMME SPECIFIC OUTCOMES (PSOs)
(B. Sc. Physics Hons. and General)

At the completion of this undergraduate programme in Physics students will be benefited with the following Programme Specific Outcomes:

1. To understand the basic laws and explore the fundamental concepts of physics
2. To understand the concepts and significance of the various physical phenomena.
3. To carry out experiments to understand the laws and concepts of Physics.
4. To apply the theories learnt and the skills acquired to solve real time problems.
5. To acquire a wide range of problem-solving skills, both analytical and technical and to apply them.
6. To motivate the students to take Physics as a subject in their carrier through research and other related jobs in reputed institutions.
7. This course introduces students to the methods of experimental physics. Emphasis will be given on laboratory techniques specially the importance of accuracy of measurements.
8. Providing a hands-on learning experience such as in measuring the basic concepts in properties of matter, heat, optics, electricity, and electronics.