

**Programme Outcomes, Programme Specific Outcomes,
Course Objectives and Course Outcomes of the CBCS
Syllabus for B.Sc. Physics**

**Department of Physics
Ramakrishna Mission Vivekananda Centenary College
Rahara, Kolkata – 700118**

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List of Core Courses (CC)

Sl. No.	Course Code	Course Name	Semester
1.	UGPHYCC01	Mathematical Physics - I	SEM-I
2.	UGPHYCC02	Mechanics	
3.	UGPHYCC03	Electricity and Magnetism	SEM-II
4.	UGPHYCC04	Waves and Optics	
5.	UGPHYCC05	Mathematical Physics - II	SEM-III
6.	UGPHYCC06	Thermal Physics	
7.	UGPHYCC07	Digital Systems and Applications	
8.	UGPHYCC08	Mathematical Physics - III	SEM-IV
9.	UGPHYCC09	Elements of Modern Physics	
10.	UGPHYCC10	Analog Systems and Applications	
11.	UGPHYCC11	Quantum Mechanics and Applications	SEM-V
12.	UGPHYCC12	Solid State Physics	
13.	UGPHYCC13	Electromagnetic Theory	SEM-VI
14.	UGPHYCC14	Statistical Mechanics	

Note: All of these courses are mandatory for Physics Honours students.

List of Discipline Specific Elective (DSE) Courses

Sl. No.	Course Code	Course Name	Semester
1.	UGPHYDSE01	Advanced Mathematical Physics - I	SEM-V
2.	UGPHYDSE02	Classical Dynamics	
3.	UGPHYDSE03	Communication Electronics	
4.	UGPHYDSE04	Advanced Mathematical Physics - II	SEM-VI
5.	UGPHYDSE05	Nuclear and Particle Physics	
6.	UGPHYDSE06	Nano Materials and Applications	
7.	UGPHYDSE07	Dissertation / Project work	

Note:

Any two are to be selected in SEM-V and any two from the rest are to be selected in SEM-VI

List of Skill Enhancement Courses (SEC)

Sl. No.	Course Code	Course Name	Semester
1.	UGPHYSEC01	Value Education and Indian Culture	SEM-III
2.	UGPHYSEC02	Spoken Tutorial	SEM-IV

List of Generic Elective (GE) Courses

Sl. No.	Course Code	Course Name	Semester
1.	UGPHYGE01	Mechanics	SEM-I
2.	UGPHYGE02	Thermal Physics and Statistical Mechanics	SEM-II
3.	UGPHYGE03	Waves and Optics	SEM-III



4.	UGPHYGE04	Electricity and Magnetism	SEM-IV
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Note: To be selected by the students other than Physics Honours.

Semester wise course distribution (B. Sc., Physics)

Semester	Course Code	Course Name	Credit	Total Credit
SEM-I	UGPHYCC01	Mathematical Physics - I	6×1	20
	UGPHYCC02	Mechanics	6×1	
	UGPHYGE01*	Mechanics	6×1	
	UGPHYAECC01	English Communication	2×1	
SEM-II	UGPHYCC03	Electricity and Magnetism	6×1	20
	UGPHYCC04	Waves and Optics	6×1	
	UGPHYGE02*	Thermal Physics and Statistical Mechanics	6×1	
	UGPHYAECC02	Environmental Science	2×1	
SEM-III	UGPHYCC05	Mathematical Physics - II	6×1	26
	UGPHYCC06	Thermal Physics	6×1	
	UGPHYCC07	Digital Systems and Applications	6×1	
	UGPHYSEC01	Value Education and Indian Culture	2×1	
	UGPHYGE03*	Waves and Optics	6×1	
SEM-IV	UGPHYCC08	Mathematical Physics - III	6×1	26
	UGPHYCC09	Elements of Modern Physics	6×1	
	UGPHYCC10	Analog Systems and Applications	6×1	
	UGPHYSEC02	Spoken Tutorial	2×1	
	UGPHYGE04*	Electricity and Magnetism	6×1	
SEM-V	UGPHYCC11	Quantum Mechanics and Applications	6×1	24
	UGPHYCC12	Solid State Physics	6×1	
	DSE	Any two are to be opted (Ref: Table-1.5)	6×2	
SEM-VI	UGPHYCC13	Electromagnetic Theory	6×1	24
	UGPHYCC14	Statistical Mechanics	6×1	
	DSE	Any two are to be opted (Ref: Table-1.5)	6×2	
Total Credit (Full Program)				140

* For other than Physics Honours students.



Programme Outcomes (POs)

After completion of the B.Sc. Degree program, the students will be able to

PO No.	Program Outcomes	Cognitive Level
PO-1	Recognize the scientific tempers and attitudes, which in turn can prove to be beneficial for the society since the scientific developments can make a nation or society to grow at a rapid pace.	R
PO-2	Understand scientific knowledge and exchange ideas with other stakeholders; make people aware about sustainable utilization of resources with ethical approach.	U
PO-3	Understand and apply the issues of environmental contexts and sustainable development as a basic interdisciplinary concern.	U, Ap
PO-4	Create the ability to perform experiments and to analyse & interpret the obtained accurate results and thus gain the ability to solve problems, to involve in critical, independent, and creative thinking.	An, E, C
PO-5	Possess expertise to apply and formulate ideas which will provide them competitive advantage in pursuing higher studies from India or abroad; and seek jobs in academia, research or industries.	Ap, E
PO-6	Assemble the acquired in-depth knowledge of applied subjects towards the inculcation of professional and employment skills so that students can make a career and become an entrepreneur in diverse fields.	C

R= remembering, U = understanding, Ap = applying, An = analysing, E = evaluating, and C = creating

Programme Specific Outcomes (PSOs)

After completion of the B.Sc. degree program in Physics, the students will be able to

PSO No.	Program Specific Outcomes	Cognitive Level
PSO-1	Remember basic laws of physics and have clear understanding in diverse premises of physics.	R, U
PSO-2	Apply conceptual understanding of basic laws & principles of physics to analyze variety of physical phenomena of general real-world problems.	U, Ap, An
PSO-3	Understand, analyze and evaluate the impact of physics in the domain of interdisciplinary science.	U, An, E
PSO-4	Construct simple experimental set-ups to acquire better understanding. Inspect and design various electronic & electrical devices for domestic, engineering, medical and/or laboratory need.	An, C
PSO-5	Apply computational methods in solving problems in physics and other related areas. Build up numerical models for physical processes.	Ap, C

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Mathematical Physics – I		
Core Course	Course Code : UGPHYCC01	SEM-I

Course objectives

- 1) To understand and apply mathematics as a tool in physical sciences.
- 2) Remember vector identities and apply vector algebra and calculus to analyze various physical systems.
- 3) Gain ability to write down computer program to solve physical problems.



Course Outcomes (COs)

After successful completion of this course, the students will be able to

CO No.	Course Outcomes	Cognitive Level	PO Addressed	PSO Addressed
CO-1	Understand and apply elementary calculus, limits & continuity, plotting functions, Taylor & binomial series to analyze physical problems.	U, Ap, An	PO2, PO3, PO4	PSO2
CO-2	Simplify & formulate physical problems in differential equations and solve.	An, E, C	PO4	PSO2, PSO3
CO-3	Remember vector identities and solve associated problems.	R, An	PO1, PO4	PSO1
CO-4	Understand the necessity of orthogonal coordinate systems, probability theory and Dirac delta function.	U, Ap	PO5	PSO2
CO-5	Analyze and construct computer programming to solve problems.	An, C	PO4, PO6	PSO5

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Mechanics		
Core Course	Course Code : UGPHYCC02	SEM-I

Course objectives

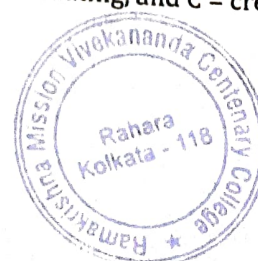
- 1) To understand laws of motion and apply those laws to analyze various types of motion.
- 2) Understand basic notion of theory of relativity.
- 3) Able to solve mechanical system by numerical means.

Course Outcomes (COs)

After successful completion of this course, the students will be able to

CO No.	Course Outcomes	Cognitive Level	PO Addressed	PSO Addressed
CO-1	Remember laws of motion and understand various types of motions (eg. SHM).	R, U	PO1	PSO1
CO-2	Understand and analyze the phenomena of collisions and idea about centre of mass and laboratory frames and their correlation	U, An	PO2	PSO2
CO-3	Understand the principles of elasticity and compare material based on elastic modulus.	U, An	PO4	PSO4
CO-4	Apply Kepler's law to describe the motion of planets and satellite.	Ap	PO3	PSO2
CO-5	Understand basics of special theory of relativity.	U	PO2	PSO1, PSO2
CO-6	Construct simple experimental set-ups to acquire better understanding about the course as well as to develop skill.	U, C	PO4, PO5, PO6	PSO4

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Electricity and Magnetism		
Core Course	Course Code : UGPHYCC03	SEM - II

Course objectives

- 1) To remember and understand the laws of electrodynamics and apply these laws to solve physical problems.
- 2) To understand basic theory of AC/DC circuit analysis and gain ability to construct circuit on demand.

Course Outcomes (COs)

After successful completion of this course, the students will be able to

CO No.	Course Outcomes	Cognitive Level	PO Addressed	PSO Addressed
CO-1	Remember and understands fundamental laws of electrodynamics	R, U	PO1, PO2	PSO1
CO-2	Understand complex reactance & impedance in AC circuits.	U	PO2, PO3, PO4	PSO2, PSO3
CO -3	Apply laws of electricity and magnetism to evaluate electro-magnetic fields for charges and currents.	Ap	PO4, PO6	PSO3, PSO4
CO -4	Simplify complicated networks through network theorems. Construct DC circuits for better understanding.	An, C	PO4	PSO4, PSO5

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Waves and Optics		
Core Course	Course Code : UGPHYCC04	SEM - II

Course objectives

- 1) To understand wave motion in elastic media.
- 2) To understand various terms associated with acoustics and address them in environmental context.
- 3) To understand basic theory of light wave and associated physics.
- 4) To analyze optical properties of material by spectrum analysis.

Course Outcomes (COs)

After successful completion of this course, the students will be able to

CO No.	Course Outcomes	Cognitive Level	PO Addressed	PSO Addressed
CO-1	Understand oscillatory motions. Solve differential equations of free, damped and forced oscillations.	U	PO2	PSO1
CO-2	Remember and understand the acoustical terms like sound intensity, loudness, intensity level, Bel, decibel, phon.	R, U	PO1, PO3	PSO1



CO -3	Analyze vibration of stretched string to determine formation of different tones.	An, E	PO4, PO5	PSO3
CO -4	Remember and understand basic principles of light propagation. Understand interference, diffraction.	R, U	PO1, PO2, PO4	PSO1, PSO2, PSO3
CO-5	Estimate the chemical nature of the source from spectrum analysis.	An, C	PO4, PO6	PSO4, PSO5

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Mathematical Physics - II		
Core Course	Course Code : UGPHYCC05	SEM - III

Course objectives

- 1) To gain extensive knowledge on Fourier series, differential equations, variational calculus and special functions and their applicability in physical systems.
- 2) Gain ability to write down computer program to solve physical system through numerical methods.

Course Outcomes (COs)

After successful completion of this course, the students will be able to

CO No.	Course Outcomes	Cognitive Level	PO Addressed	PSO Addressed
CO-1	Understand Fourier series and Fourier transform. Apply to analyze various periodic & non-periodic functions.	U, Ap, An	PO2, PO6	PSO2, PSO3, PSO5
CO-2	Understand the technique of series solution of 2nd order linear differential equations. Solve partial differential equations by the method of separation of variables.	U, AP	PO3, PO5, PO6	PSO2, PSO5
CO -3	Understand special mathematical functions and orthogonal polynomials.	U	PO2, PO5	PSO2, PSO3
CO -4	Understand the basic ideas of variational calculus. Apply in simple problems.	U, Ap	PO3, PO5	PSO2, PSO3, PSO5
CO-5	Construct numerical programming to solve differential equations.	An, C	PO4, PO6	PSO5

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Thermal Physics		
Core Course	Course Code : UGPHYCC06	SEM - III

Course objectives

- 1) To understand basic theory of thermodynamics and its applicability in various interdisciplinary/multidisciplinary fields.
- 2) To understand and analyze behaviour of ideal gas and real gas systems.
- 3) Gain ability to perform experiments to demonstrate basics of thermal physics.

Course Outcomes (COs)

After successful completion of this course, the students will be able to

CO No.	Course Outcomes	Cognitive Level	PO Addressed	PSO Addressed
CO-1	Remember and understand laws of thermodynamics	R, U	PO1, PO2	PSO1
CO-2	Understand the interrelationship between thermodynamic functions and able to use these relationships to solve practical problems.	U, Ap	PO2, PO3	PSO2
CO -3	Understand basic ideas of kinetic theory of gas, Maxwell-Boltzmann law of velocity distribution and transport properties.	U	PO2	PSO5
CO -4	Understand real gas behaviour and apply equation of states to determine critical constants.	U, Ap	PO3, PO5	PSO2, PSO5
CO-5	Construct simple experimental set-ups to validate theoretical aspects.	An, C	PO4, PO6	PSO4

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Digital Systems and Applications		
Core Course	Course Code : UGPHYCC07	SEM - III

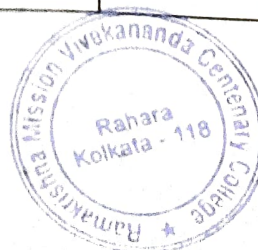
Course objectives

- 1) To understand Boolean logic and binary number system as pillars of digital era.
- 2) To understand basic logic gate operation and apply it to develop digital circuits.
- 3) To understand basics of computer architecture.

Course Outcomes (COs)

After successful completion of this course, the students will be able to

CO No.	Course Outcomes	Cognitive Level	PO Addressed	PSO Addressed
CO-1	Remember and understand Boolean logic and its connection to digital electronics.	R, U	PO1, PO2	PSO1
CO-2	Understand basics of number system and their arithmetic operations	U	PO2, PO5	PSO1, PSO3
CO -3	Synthesize Boolean functions, simplify digital circuits by employing Boolean algebra.	An, Ap, E	PO4, PO6	PSO3, PSO4



CO -4	Understand operation of sequential and combinational circuits to construct simple devices.	U, Ap, C	PO4, PO6	PSO3, PSO4
CO-5	Understand fundamentals of basic computer architecture.	U	PO2, PO5	PSO1, PSO5

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Mathematical Physics - III		
Core Course	Course Code : UGPHYCC08	SEM - IV

Course objectives

- 1) To gain extensive knowledge on complex analysis, integral transformations and linear algebra as mathematical tools to analyze physical systems.
- 2) Gain ability to write down computer program to solve physical system through numerical methods.

Course Outcomes (COs)

After successful completion of this course, the students will be able to

CO No.	Course Outcomes	Cognitive Level	PO Addressed	PSO Addressed
CO-1	Understand and apply theory of complex variables to solve physical problems.	U, Ap	PO2, PO5	PSO2, PSO5
CO-2	Understand Fourier transform and analyze various functions	U, Ap	PO3	PSO2, PSO3
CO -3	Apply matrix algebra to solve linear systems.	Ap, An	PO5, PO6	PSO3, PSO5
CO -4	Write down computer programs to solve physical problems.	An, C	PO4, PO5, PO6	PSO3, PSO5

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Elements of Modern Physics		
Core Course	Course Code : UGPHYCC09	SEM - IV

Course objectives

- 1) To understand basic notion of quantum mechanics and appreciate its applicability in nuclear physics and laser physics to analyze the systems as quantum systems.
- 2) Gain ability to perform experiment with quantum mechanical systems.

Course Outcomes (COs)

After successful completion of this course, the students will be able to

CO No.	Course Outcomes	Cognitive Level	PO Addressed	PSO Addressed
CO-1	Understand the inadequacies of classical mechanics and appreciate the historical development of	U, Ap	PO3, PO5	PSO1, PSO2



	quantum mechanics and its applicability.			
CO-2	Apply Schrödinger equation to analyze time dependent and time independent quantum mechanical problems	Ap	PO2, PO4	PSO2, PSO5
CO -3	Remember and understand nuclear properties (eg. nuclear structure, radioactivity, fission, fusion etc.)	R, U	PO2, PO5	PSO1
CO -4	Understand basics of laser theory and apply laser techniques as experimental device.	U, Ap, C	PO3, PO5, PO6	PSO3, PSO4
CO-5	Understand quantum mechanical tunnelling and determine fundamental constants through experiments.	U, E	PO4, PO5	PSO2, PSO4

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Analog Systems and Applications		
Core Course	Course Code : UGPHYCC10	SEM - IV

Course objectives

- 1) To understand basics of solid state electronic devices and their applications towards industrial and household demands.
- 2) To perform experiments to understand basic mechanism of devices and also to construct circuits for practical purpose.

Course Outcomes (COs)

After successful completion of this course, the students will be able to

CO No.	Course Outcomes	Cognitive Level	PO Addressed	PSO Addressed
CO-1	Understand working mechanism of various semiconductor devices like diodes, solar cell, rectifier, transistors etc.	U	PO2, PO5, PO6	PSO1, PSO2
CO-2	Evaluate transistor parameters and employ it as amplifier stage in analog circuits.	An, C	PO4,	PSO3, PSO4
CO -3	Understand the working of OP-AMP and its versatile applications.	U, Ap	PO3, PO5	PSO3, PSO4
CO -4	Understand the working principle of oscillator and apply the knowledge to design oscillator circuit of specific frequencies.	Ap, C	PO4, PO6	PSO4

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Quantum Mechanics and Applications		
Core Course	Course Code : UGPHYCC11	SEM - V

Course objectives

- 1) Understand quantum mechanical states and operators.
- 2) Gain ability to apply formulation of quantum mechanics for analyzing quantum systems (e.g. atoms) in absence/presence of external perturbations.
- 3) To perform experiments and computer simulations to observe quantum mechanical effects.

Course Outcomes (COs)

After successful completion of this course, the students will be able to

CO No.	Course Outcomes	Cognitive Level	PO Addressed	PSO Addressed
CO-1	Understand Schrödinger equation and dynamical evolution of quantum states, acceptability & interpretation of wave function, operators, eigen values, eigen functions.	U	PO2, PO5	PSO1, PSO2
CO-2	Gain knowledge on bound quantum systems and apply to analyse bound quantum mechanical systems like simple harmonic oscillator, hydrogen-like atoms etc.	Ap, An	PO3, PO4, PO5	PSO2, PSO3
CO-3	Understand and explain the vector atom model, angular momentums, concepts of space quantization etc.	U	PO3	PSO1, PSO2
CO-4	Explain observed dependence of atomic spectral lines on external perturbations (Zeeman effect, Paschen Back & Stark effect).	An	PO4, PO5	PSO3, PSO4
CO-5	Perform experiments to observe quantum phenomena and construct specific experimental techniques to identify chemical nature of source of radiation.	An, E, C	PO4, PO5, PO6	PSO3, PSO4
CO-6	Estimate of magnetic field at a remote location by analyzing the spectrum of outcoming radiation.	C	PO4, PO5, PO6	PSO3, PSO4, PSO5

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Solid State Physics		
Core Course	Course Code : UGPHYCC12	SEM - V

Course objectives

- 1) To understand basics of crystalline systems and analyze crystal structures.
- 2) To classify solid substances based on electrical and magnetic properties and associated applicability of these in material sciences.
- 3) To analyze macroscopic properties of solids through experiments.



Course Outcomes (COs)

After successful completion of this course, the students will be able to

CO No.	Course Outcomes	Cognitive Level	PO Addressed	PSO Addressed
CO-1	Understand basic concept of crystal structure. Apply the ideas to analyze crystal structure of unknown sample.	U, Ap, An	PO3, PO4, PO6	PSO2, PSO4
CO-2	Understand elementary lattice vibrations, phonons, specific heat of solids, dielectric properties of materials etc.	U	PO2, PO5	PSO1, PSO5
CO -3	Understand energy band formation in solids and analyze materials as metal, insulator and semiconductors based on band structure.	U, An	PO4, PO5	PSO2, PSO3
CO -4	Understand magnetism in material and the superconductivity phenomena.	U	PO2, PO5	PSO2, PSO3
CO-5	Perform experiments to demonstrate various important phenomena and predict the crystal structure of an unknown.	U, E, C	PO4, PO6	PSO3, PSO4, PSO5

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Electromagnetic Theory		
Core Course	Course Code : UGPHYCC13	SEM - VI

Course objectives

- 1) To understand the theory of electromagnetism governed by Maxwell's equations.
- 2) To understand electromagnetic wave and application of it in modern communication systems.
- 3) To analyze optically active substances using polarized light through experiments.

Course Outcomes (COs)

After successful completion of this course, the students will be able to

CO No.	Course Outcomes	Cognitive Level	PO Addressed	PSO Addressed
CO-1	Remember and understand basic laws of electrodynamics.	R, U	PO2	PSO1
CO-2	Deduce wave equation from Maxwell's equations.	Ap	PO3, PO5	PSO2
CO -3	Apply Maxwell's equations to understand the reflection and refraction of EM wave. Understand wave guides.	Ap, An	PO3, PO4	PSO2, PSO3
CO -4	Understand polarization of light. Analyze polarization states by retardation plates.	U, An	PO4, PO5	PSO3, PSO4
CO-5	Understand the phenomenon associated with EM wave through experiments and estimate concentration of optically active solutes.	U, An, C	PO3, PO4, PO6	PSO3, PSO4

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Statistical Mechanics		
Core Course	Course Code : UGPHYCC14	SEM - VI

Course objectives

- 1) To understand basic notion of statistical mechanics and apply the formulation of statistical mechanics for macroscopic systems to analyze their macroscopic properties.
- 2) Gain ability to write down computer program to simulate statistical systems to obtain various physical properties.

Course Outcomes (COs)

After successful completion of this course, the students will be able to

CO No.	Course Outcomes	Cognitive Level	PO Addressed	PSO Addressed
CO-1	Remember and understand laws of thermodynamics and their applications.	R, U	PO2	PSO1
CO-2	Appreciate statistical interpretation of thermodynamics, microcanonical, canonical and grand canonical ensembles.	U	PO3, PO6	PSO1, PSO5
CO -3	Apply the statistical approach to calculate macroscopic properties of bosonic and fermionic systems.	Ap, An	PO3, PO4, PO5	PSO2, PSO5
CO -4	Apply theoretical knowledge to write down computer codes to simulate and extract statistical properties of system of particles.	Ap, C	PO5, PO6	PSO2, PSO4, PSO5

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Advanced Mathematical Physics - I		
DSE Course	Course Code : UGPHYDSE01	SEM - V

Course objectives

- 1) Apply integral transformation to analyze physical systems in multidisciplinary area.
- 2) Apply linear algebra and tensor algebra to understand various systems.
- 3) Gain ability to write down computer programs to analyze physical systems.

Course Outcomes (COs)

After successful completion of this course, the students will be able to

CO No.	Course Outcomes	Cognitive Level	PO Addressed	PSO Addressed
CO-1	Understand Laplace transformation and its application to various branches of science	U, Ap	PO3, PO6	PSO2, PSO3
CO-2	Understand basic idea of Linear Vector Space.	U	PO3, PO6	PSO2, PSO3
CO -3	Understand and apply the method of coordinate transformations to nalyze physical systems through tensor algebra	U, An	PO3, PO5	PSO3



CO -4	Understand Contravariant & Covariant vectors. Contravariant, Covariant and Mixed Tensors.	U	P02, P06	PS02
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Classical Dynamics		
DSE Course	Course Code : UGPHYDSE02	SEM - V

Course objectives

- 1) To understand motion of point particles and dynamical behaviour near equilibrium.
- 2) Understand fluid dynamics from interdisciplinary framework.
- 3) Understand the detail theory of STR and related dynamics.

Course Outcomes (COs)

After successful completion of this course, the students will be able to

CO No.	Course Outcomes	Cognitive Level	PO Addressed	PSO Addressed
CO-1	Understand and analyze motion of charged particle in electro-magnetic field.	U, An	P03, P05	PS02, PS05
CO-2	Apply Lagrangian and Hamiltonian formulation in mechanical systems.	Ap, An	P03, P05	PS02, PS03
CO -3	Understand fundamentals of fluid dynamics: continuity equation, Poiseuille's equation, Navier-Stoke's equation, turbulence and perform related experiments.	Ap, An, C	P04, P05	PS04, PS05
CO -4	Understand basic ideas of special theory of relativity and associated physics.	U	P02, P05	PS02, PS05

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Communication Electronics		
DSE Course	Course Code : UGPHYDSE03	SEM - V

Course objectives

- 1) To understand the basic theory of communication systems.
- 2) To perform experiment with communication system devices.
- 3) Gain ability to be equipped with modern technologies as per present industrial demands.

Course Outcomes (COs)

After successful completion of this course, the students will be able to

CO No.	Course Outcomes	Cognitive Level	PO Addressed	PSO Addressed
CO-1	Understand the basic idea and development of electronic communication systems	U	P02, P05	P02, P03
CO-2	Understand electronic signal processing: modulation and demodulation. Apply their understandings to	An, C	P04, P06	PS04, PS05



	analyze signal-to-noise ratio.			
CO -3	Gain an extended knowledge in navigation systems and have a clear idea on GPS	U	PO2, PO6	PSO2, PSO3
CO -4	Design few simple communication devices: modulator, demodulator etc through their laboratory works.	Ap, C	PO3, PO5, PO6	PSO5

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Advanced Mathematical Physics - II		
DSE Course	Course Code : UGPHYDSE04	SEM - VI

Course objectives

- 1) To understand the basic theory variational calculus and apply the technique to analyze physical systems.
- 2) To understand basics of group theory and its connection to different domains in physics.
- 3) To have detail knowledge on the theory of probability and distribution function to describe random processes in physical systems.

Course Outcomes (COs)

After successful completion of this course, the students will be able to

CO No.	Course Outcomes	Cognitive Level	PO Addressed	PSO Addressed
CO-1	Understand variational calculus and its application to analyze dynamical systems	U, Ap	PO2, PO5	PSO2, PSO5
CO-2	Know about Lagrangian and Hamiltonian and can apply to solve dynamical systems.	Ap, An	PO3, PO4, PO5	PSO2, PSO3
CO -3	Understand basics of Sets and Group theory. Understand classifications of groups.	U	PO2, PO5	PSO2
CO -4	Acquire detail understanding on the theory of probability and various probabilistic distribution functions. Perform computer simulations.	An, C	PO4, PO5, PO6	PSO3, PSO5

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Nuclear and Particle Physics		
DSE Course	Course Code : UGPHYDSE05	SEM - VI

Course objectives

- 1) To understand the structure of nucleus and related semi-classical models to describe sub-nuclear processes (e.g. alpha decay, fission, fusion etc.)
- 2) To understand radioactivity process and its application towards multidisciplinary fields (e.g. medical science).
- 3) To understand mechanism of nuclear detectors and particle accelerator.



Course Outcomes (COs)

After successful completion of this course, the students will be able to

CO No.	Course Outcomes	Cognitive Level	PO Addressed	PSO Addressed
CO-1	Gain in-depth and up-to date information about nuclear and particle physics.	R, U	PO2	PS01
CO-2	Understand the notions of nuclear models and application of these models to explain nuclear phenomenon.	U, Ap	PO3, PO4, PO5	PS02, PS03, PS05
CO -3	Understand radioactivity: α , β and γ -decay. Application of radioactivity in various branches (e.g., nuclear medicine, carbon dating etc.)	U, Ap, C	PO3, PO5, PO6	PS02, PS03, PS05
CO -4	Understand nuclear reaction mechanisms, interaction of nuclear particles and radiation with matter, nuclear detector mechanism.	U, An, C	PO4, PO6	PS03, PS04
CO-5	Have an idea about fundamental particles and particle accelerator.	R, U	PO1, PO5	PS01

R= remembering, U = understanding, Ap = applying, An = analysing, E = evaluating, and C = creating

Nano Materials and Applications		
DSE Course	Course Code : UGPHYDSE06	SEM – VI

Course objectives

- 1) To understand the essential modifications of physical properties of materials in nano scale dimension.
- 2) Gain ability to synthesize nano materials and characterize their properties with sophisticated instruments.
- 3) To understand the extensive application of nano materials in multidisciplinary fields.

Course Outcomes (COs)

After successful completion of this course, the students will be able to

CO No.	Course Outcomes	Cognitive Level	PO Addressed	PSO Addressed
CO-1	Understand the properties of materials having nano-scale dimension.	U	PO3, PO6	PS01, PS03
CO-2	Have detail knowledge on device applications of nano materials (like carbon nano-tubes).	Ap, C	PO4, PO5, PO6	PS03, PS05
CO -3	Understand electron dynamics in nano dimension for further understanding of transport phenomena and optical properties.	U, An	PO3, PO5	PS03, PS05
CO -4	Capable of dealing with sophisticated instruments to characterize properties of nano materials.	Ap, An, C	PO4, PO6	PS04, PS05

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Dissertation or Project work		
DSE Course	Course Code : UGPHYDSE07	SEM - VI

Course objectives

- 1) To gain clear understanding to address new problems.
- 2) Apply the knowledge in physics and allied areas to analyze the assigned problem.
- 3) Acquire adequate level of creativity to extend the assigned problem or related problem.

Course Outcomes (COs)

After successful completion of this course (Project Work), the students will be able to

CO No.	Course Outcomes	Cognitive Level	PO Addressed	PSO Addressed
CO-1	Understand the assigned problem.	U	PO2, PO3	PSO1
CO-2	Apply suitable method to examine the problem critically.	Ap, An	PO3, PO4	PSO2, PSO3, PSO4
CO -3	Draw some conclusions after completion of the project work.	E	PO4, PO5	PSO3
CO -4	Plan an extended version of the same problem or a similar kind of problem associated with the given problem.	C	PO4, PO5, PO6	PSO4, PSO5

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Value Education and Indian Culture		
Course : SEC	Course Code : UGPHYSEC01	SEM - III

Course objectives

- 1) Attain awareness about daily routine, self-evaluation & Integral Personality Development.
- 2) Understand the educational needs, the Power of thoughts and the Science of Peace.
- 3) Understand the relation: Values and enlightened citizenship.
- 4) Attain awareness about the Indian Practice and Culture.
- 5) Demonstrate the importance of Four Yogas.
- 6) Acquire idea about Modern India: her hopes, challenges and Swami Vivekananda.

Course Outcomes (COs)

After successful completion of this course, the students will be able to

CO No.	Course Outcomes:	PO Addressed	PSOs Addressed	Cognitive Level
CO-1	Define, understand and apply the daily routine, self evaluation & Integral Personality Development	PO1	PSO2	R, U, Ap
CO-2	Learn, and apply the Power of thoughts & the Science of Peace	PO3	PSO2, PSO3	U, Ap
CO-3	Understand the relation: Values and	PO2	PSO2	U



	enlightened citizenship			
CO-4	Discuss the awareness about the Indian Practice and Culture	PO4	PS03	C
CO-5	Demonstrate and practice the Four Yogas	PO6	PS03	U, Ap
CO-6	Explain and analyze the idea about Modern India: her hopes, challenges and Swami Vivekananda	PO6	PS02, PS03	U, An

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Spoken Tutorial		
Course : SEC	Course Code : UGPHYSEC02	SEM - IV

This Skill Enhancement Course is conducted as **Spoken Tutorial Courses** in collaboration with national level higher education institutes (e.g. IITs) according to their course schedule in a particular academic session.

Mechanics		
GE Course	Course Code : UGPHYGE01	SEM - I

Course objectives

- 1) To understand mathematics as a tool for quantitative analysis of physical systems.
- 2) To analyze mechanical systems to describe the associated dynamics.
- 3) To understand general properties of matter from multidisciplinary point of view.

Course Outcomes (COs)

After successful completion of this course, the students will be able to

CO No.	Course Outcomes	Cognitive Level	PO Addressed	PSO Addressed
CO-1	Understand to apply basic mathematical tools to solve mechanical systems.	U, Ap	PO2, PO3	PSO1, PSO2
CO-2	Remember laws of motion and understand various types of motions.	R, U	PO2	PSO1
CO -3	Understand the principles of elasticity and compare material based of elastic modulus.	U, An	PO3, PO4	PSO2, PSO3
CO -4	Apply Kepler's law to describe the motion of planets and satellite in circular orbit, through the study of law of Gravitation	Ap	PO3, PO5	PSO2, PSO5
CO-5	Understand basics of special theory of relativity	U	PO2, PO5	PSO2, PSO3
CO-6	Construct simple experimental set-ups to acquire better understanding about the course as well as to develop skill.	Ap, C	PO4, PO5, PO6	PSO4, PSO5

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Thermal Physics and Statistical Mechanics		
GE Course	Course Code : UGPHYGE02	SEM - II

Course objectives

- 1) To understand the laws of thermodynamics and their applications in multidisciplinary fields
- 2) To understand basic notion of statistical mechanics and its application to analyze properties of gaseous systems.

Course Outcomes (COs)

After successful completion of this course, the students will be able to

CO No.	Course Outcomes	Cognitive Level	PO Addressed	PSO Addressed
CO-1	Remember and understand laws of thermodynamics	R, U	PO2	PSO1
CO-2	Understand the interrelationship between thermodynamic potentials and use these relationships to solve practical problems.	U, Ap	PO3	PSO2, PSO4,
CO -3	Understand basic ideas of kinetic theory of gas, Maxwell-Boltzmann's law of velocity distribution and transport properties.	U	PO3, PO4	PSO3, PSO4
CO -4	Understand the formulation of statistical mechanics and its application to macroscopic systems.	U, Ap	PO3, PO4, PO5	PSO3, PSO4, PSO5
CO-5	Construct simple experimental set-ups to validate theoretical aspects.	E, C	PO4, PO6	PSO4, PSO5

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Waves and Optics		
GE Course	Course Code : UGPHYGE03	SEM - III

Course objectives

- 1) To understand oscillatory motion and analyze associated dynamical systems.
- 2) To appreciate electrical analogy of mechanical systems.
- 3) To understand and analyze elastic and electromagnetic wave propagation and associated phenomena.

Course Outcomes (COs)

After successful completion of this course, the students will be able to

CO No.	Course Outcomes	Cognitive Level	PO Addressed	PSO Addressed
CO-1	Understand oscillatory motions. Solve differential equations of free, damped and forced oscillations.	U, Ap	PO2, PO3, PO5	PSO2, PSO4, PSO5
CO-2	Remember and understand the acoustical terms like sound intensity, loudness, intensity level, Bel, decibel, phon.	R, U	PO2, PO3, PO5	PSO1, PSO3



CO -3	Remember and understand basic principles of light propagation. Understand interference, diffraction.	R, U	PO4, PO6	PS01, PS04
CO -4	Determine wavelength of light, dispersive power of prism and frequencies of string vibration through experiments.	An, E, C	PO4, PO5, PO6	PS03, PS04, PS05

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Electricity and Magnetism		
GE Course	Course Code : UGPHYGE04	SEM - IV

Course objectives

- 1) To understand and apply laws of electricity and magnetism to analyze physical systems.
- 2) Perform experiment to evaluate physical parameters in connection to electricity and magnetism.

Course Outcomes (COs)

After successful completion of this course, the students will be able to

CO No.	Course Outcomes	Cognitive Level	PO Addressed	PSO Addressed
CO-1	Remember and understands fundamental laws of electrodynamics	R, U	PO2	PS02
CO-2	Apply laws of electricity and magnetism to evaluate electro-magnetic fields for charges and currents.	Ap, An	PO3, PO4, PO5	PS02, PS03, PS04
CO-3	Understand the self and mutual inductance.	U	PO2, PO4	PS02, PS04
CO -4	Understand the Maxwell's equations and apply Maxwell's equations to deduce EM wave equation, electromagnetic field energy and field momentum.	U, Ap	PO3, PO5, PO6	PS03, PS04, PS05
CO -5	Perform several experiments related to the course for better understanding and developing skill.	Ap, C	PO4, PO6	PS04, PS05

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English Communication		
AEC Course	Course Code : UGPHYAECC01	SEM - I

Course objectives

- 1) To enhance English communication skill for further higher studies.
- 2) Gain an insight into cultural literacy and cross-cultural awareness.



Course Outcomes (COs)

After successful completion of this course, the students will be able to

CO No.	Course Outcome	Cognitive Level	POs Addressed	PSOs Addressed
CO 1	Engage in self-directed English language learning.	R,	PO1, PO2, PO3	PSO1
CO 2	Be responsible and ethical English users.	R, U	PO1, PO2, PO3	PSO1, PSO2
CO 3	Enhance their English language proficiency in the aspects of reading, writing, listening and speaking.	R, U	PO1, PO2, PO3	PSO1, PSO2
CO 4	Develop academic literacy required for undergraduate learning, further studies and research.	Ap	PO3, PO5	PSO2, PSO4
CO 5	Apply the requisite communicative skills and strategies to future careers.	Ap	PO3, PO5	PSO3, PSO5
CO 6	Gain an insight into cultural literacy and cross-cultural awareness.	Ap	PO3, PO5	PSO3

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Environmental Science		
AEC Course	Course Code : UGPHYAECC02	SEM - II

Course objectives

- 1) Remembers and understands the concept, components and function of natural resources and ecosystems.
- 2) Understand and evaluate the Cause, effects and control measures of various environmental pollutants.
- 3) Understand the basic idea about the disasters and its management.
- 4) Understand and apply the knowledge about the social, environmental issues and environmental legislation.

Course Outcomes (COs)

After successful completion of this course, the students will be able to

CO No.	Course Outcomes:	PO Addressed	PSOs Addressed	Cognitive Level
CO-1	Define and demonstrate the concept, components and function of natural resources and ecosystems.	PO1	PSO3	R, U
CO-2	Define, illustrate and analyze the cause, effects and control measures of various environmental pollutants.	PO3	PSO3	R, U, An
CO-3	Demonstrate the basic idea about the disasters and its management.	PO3	PSO3	U
CO-4	Illustrate and apply the knowledge about the social, environmental issues and environmental legislation.	PO4	PSO3	U, Ap
CO-5	Define, demonstrate and evaluate the impact of human population on the Environment	PO6	PSO3, PSO5	R, U, E

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