WELCOME

DEPARTMENT OF PHYSICS

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PROGRAMME OUTCOME(PO) & COURSE OUTCOME (CO)

FOR CBCS

Department of Physics

Under Graduate Programme

Programme Outcome (PO)-Course Outcome (CO)

SESSION 2018-2019

INTRODUCTION: The University Grants Commission (UGC) has taken various measures by means of formulating regulations and guidelines and updating them, in order to improve the higher education system and maintain minimum standards and quality across the Higher Educational Institutions in India. The various steps that the UGC has initiated are all targeted towards bringing equity, efficiency and excellence in the Higher Education System of country. These steps include introduction of innovation and improvements in curriculum structure and content, the teaching-learning process, the examination and evaluation systems, along with governance and other matters. The introduction of Choice Based Credit System is one such attempt towards improvement and bringing in uniformity of system with diversity of courses across all higher education institutes in the country. The CBCS provides an opportunity for the students to choose courses from the prescribed courses comprising of core, elective, skill enhancement or ability enhancement courses. The courses shall be evaluated following the grading system, is considered to be better than conventional marks system. This will make it possible for the students to move across institutions within India to begin with and across countries for studying courses of their choice. The uniform grading system shall also prove to be helpful in assessment of the performance of the candidates in the context of employment.

Outline of the Choice Based Credit System being introduced:

1. **Core Course (CC):** A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.
2. **Elective Course:** Generally a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/ subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the student's proficiency/skill is termed as an Elective Course.

   2.1 **Discipline Specific Elective Course (DSEC):** Elective courses that are offered by the main discipline/subject of study is referred to as Discipline Specific Elective. The University/Institute may also offer discipline related Elective courses of interdisciplinary nature (to be offered by main discipline/subject of study).

   2.2 **Generic Elective Course (GEC):** An elective course chosen generally from an unrelated discipline/subject, with an intention to seek exposure is called a Generic Elective.

3. **Ability Enhancement Courses/ Skill Enhancement Courses:**

   3.1 **Ability Enhancement Compulsory Course (AECC):** Ability enhancement courses are the courses based upon the content that leads to Knowledge enhancement. They (i) Environmental Science, (ii) English Communication) are mandatory for all disciplines.

   3.2 **Skill Enhancement Course (SEC):** These courses may be chosen from a pool of courses designed to provide value-based and/or skill-based instruction.

CBCS CURRICULUM FOR SEMESTERIZED UNDER-GRADUATE COURSE IN PHYSICS (PROGRAMME/GENERAL)

A. TOTAL Number of courses in UG-CBCS B.Sc. GENERAL:

Types of course	Core course (CC)	Elective course	Ability Enhncemnt Course		TOTAL
		Discipline specific elective course (DSE)	Ability Enhancmnt compulsory course(AECC)	Skill Enhancmnt course (SEC)	
No. of course	12	6	2	4	24
Credit/course	6	6	2	2	120

TABLE-1: DETAILS OF COURSES OF B.SC. (GENERAL) UNDER CBCS

S. No.	Particulars of Course	Credit Point	
1.	**Core Course: 12 Papers**	**Theory + Practical**	**Theory + Tutorial**
1.A.	Core Course: Theory (12 papers)	12x4 = 48	12x5 = 60
1.B.	Core Course (Practical/Tutorial)*(12 papers)	12x2 = 24	12x1 = 12
2.	**Elective Courses: (6 papers)**		
A.	DSE: Theory (6 papers)	6x4 = 24	6x5 = 30
B.	DSE(Pract./ Tutor.)* (6 papers)	6x2 = 12	6x1 = 6
	#Optional Dissertation/ Project Work in place of* one *DSE paper (6 credits) in 6th semester		
3. Ability Enhancement Courses			
A.	Ability Enhancement compulsory course (AECC): (Theory)*(2 papers) (2 papers of 2 credits each)	2x2 = 4	2x2 = 4
B.	Skill Enhancement Course (SEC): (Theory)*(4 papers) (4 papers of 2 credits each)	4x2 = 8	4x2 = 8
	Total Credit:	**120**	**120**
	## ***Wherever there is a practical, there will be no tutorial and vice- versa.***		

TABLE-2: SEMESTER WISE DISTRIBUTION OF COURSES & CREDITS IN B.SC. GENERAL

Courses/ (Credits)	Sem-I	Sem-II	Sem-III	Sem-IV	Sem-V	Sem-VI	Total No. of Courses	Total credit
CC-1,2,3 (6)	3 (1A,2A, 3A)	3 (1B,2 B,3B)	3 (1C,2C, 3C)	3 1D,2D, 3D)	-	-	12	72

DSE - 1,2,3 (6)	-	-	-	-	3 (1A,2A,3A)	3 (1B,2B,3B)	6	36
AECC (2)	1	1	-	-	-	-	2	04
SEC (2)	-	-	1	1	1	1	4	08
Total No. of Course/ Sem	4	4	4	4	4	4	24	--
Total Credit /Semester	**20**	**20**	**20**	**20**	**20**	**20**	**--**	**120**

TABLE-3: SEMESTER & COURSEWISE CREDIT DISTRIBUTION IN B.SC.(GENERAL)

(6 Credit: 75 Marks)

SEMESTER-I			
Course Code	**Course Title**	**Course wise Class (L+T+P)**	**Credit**
PHY-G-CC-T-01 PHY-G-CC-P-01	Mathematical Physics – I/Mechanics /Electricity and Magnetism	Core (60L+60P)	6 (4T+2P)
from other discipline	from other discipline	Core	6
from other discipline	from other discipline	Core	6
AECC-01	English Communication/ Environmental Science	AECC	2
Total	**4 courses**	**Total**	**20**
SEMESTER-II			
Course Code	**Course Title**	**Course Nature**	**Credit**
PHY-G-CC-T-02 PHY-G-CC-P-02	Waves and Optics/Mathematical Physics-II/Thermal Physics/Digital Systems and Applications	Core (60L+60P)	6 (4T+2P)
from other discipline	from other discipline	Core	6
from other discipline	from other discipline	Core	6
AECC-02	English Communication/ Environmental Science	AECC	2
Total	**4 courses**	**Total**	**20**
SEMESTER-III			
Course Code	**Course Title**	**Course Nature**	**Credit**
PHY-G-CC-T-03 PHY-G-CC-P-03	Mathematical Physics – III/Elements of Modern Physics/Analog Systems and Applications	Core (60L+60P)	6 (4T+2P)
from other discipline	from other discipline	Core	6
from other discipline	from other discipline	Core	6
PHY-G-SEC-T-01	Any one from **TABLE-4.2**	SEC (30L)	2
Total	**4 courses**	**Total**	**20**
SEMESTER-IV			
Course Code	**Course Title**	**Course Nature**	**Credit**
PHY-G-CC-T-04			

PHY-G-CC-P-04	Quantum Mechanics and Applications/ Solid State Physics/ Electromagnetic Theory/ Statistical Mechanics	Core (60L+60P)	6 (4T+2P)
from other discipline	from other discipline	Core	6
from other discipline	from other discipline	Core	6
PHY-G-SEC-T-02	Any one from **TABLE-4.2 (not taken earlier)**	SEC (30L)	2
Total	**4 courses**	**Total**	**20**

SEMESTER-V			
Course Code	**Course Title**	**Course Nature**	**Credit**
PHY-G-DSE-T-01 PHY-G-DSE-P-01	Mechanics/Electricity and Magnetism/ Thermal Physics and Statistical Mechanics/Waves and Optics	DSE (60L+60P)	6 (4T+2P)
from other discipline	from other discipline	DSE	6
from other discipline	from other discipline	DSE	6
PHY-G-SEC-T-03	Any one from **TABLE-4.2 (not taken earlier)**	SEC (30L)	2
Total	**4 courses**	**Total**	**20**
SEMESTER-VI			
Course Code	**Course Title**	**Course Nature**	**Credit**
PHY-G-DSE-T-02 PHY-G-DSE-P-02	Digital, Analog Circuits and Instrumentation/Elements of Modern Physics/Solid State Physics/Quantum Mechanics/Nuclear And Particle Physics	DSE (60L+60P)	6 (4T+2P)
from other discipline	from other discipline	DSE	6
from other discipline	from other discipline	DSE	6
PHY-G-SEC-T-04	Any one from **TABLE-4.2 (not taken earlier)**	SEC (30L)	2
Total	**4 courses**	**Total**	**20**
Total (All semesters)	***24 courses***	***Total***	***120***

TABLE-4.1: Choices for Pass: Core Papers (Credit: 06 each)

Core Papers(Credit: 06 each) : 4 papers to be selected for Pass/General Students			
1. Mathematical Physics-I	5. Mathematical Physics-II	9. Elements of Modern Physics	13. Electromagnetic Theory
2. Mechanics)	6. Thermal Physics	10. Analog Systems and Applications	14. Statistical Mechanics
3. Electricity and Magnetism	7. Digital Systems and Applications	11. Quantum Mechanics and Applications	
4. Waves and Optics	8. Mathematical Physics III	12. Solid State Physics	

TABLE-4.2: Skill Enhancement Courses (Credit: 02 each)

For Pass COURSE (may be chosen) : 1 paper for Semester-III ; 1 paper for Semester-IV;1 paper for Semester-V and 1 paper for Semester-VI **Skill Enhancement Course-1 & Skill Enhancement Course-2**			
1.Physics Workshop Skills	3.Electrical Circuits & Network Skills	5.Renewable Energy & Energy Harvesting	7.Radiation Safety
2.Computational Physics Skills	4. Basic Instrumentation Skills	6.Technical Drawing	8. Applied Optics
			9.Weather Forecasting

TABLE-4.3: Discipline specific elective course (DSE) (Pass/General course only): (Credit: 06 each)

For Pass/General COURSE:1 paper for Semester-V and 1 paper for Semester-VI			
1.Mechanics	3.Thermal Physics and Statistical Mechanics	5.Digital, Analog Circuits and Instrumentation	7.Solid State Physics
2.Electricity and Magnetism	4. Waves and Optics	6.Elements of Modern Physics	8. Quantum Mechanics
			9.Nuclear and Particle Physics

Programme Outcomes (PO)

Knowledge Outcomes

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

1. Apply the basic principles of Physics to the events occurring around us and also in the world.
2. Try to find out or analyse scientific reasoning for various things.

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 video presentations

Generic outcomes

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 (PSO)

PSO1. The new CBCS Physics Syllabus Introduced from the academic session 2018-2019 is both diversified and job-oriented. It helps to develop both intellectual and technical skills of the students.

PSO2. After completion of B.Sc. (Programme), the students can enrol themselves for M.Sc. degree in Physics.

PSO3. They can also appear in JAM, CUET and other entrance tests for getting admission in integrated Ph.D. course in different premier research institutes in India as well as Masters in different central Universities.

PSO4. They have also the opportunity to study B.Tech, MCA and other technical courses after graduation in Physics.

PSO5. Moreover, they can get admission in B. Ed. Course and have the opportunity to get job as school teachers.

PSO6. Skill enhancement course is helpful to develop technical skills of the students. It will help them to find jobs in different technical fields also.

PSO7. After all undergraduates in Physics have the opportunity of getting jobs in different public as well as
private sectors.

PSO8. To help the students prepare for subjects/ discipline specific national level competitive exams.

COURSE OUTCOME (CO)

SEM	COURSE /COURSE CODE	CREDIT	CONTENT OF KU SYLLABUS	COURSE OUTCOME (CO)
I	**PHY-G-CC-T-01 /P-01 (Mathematical Physics-I)**	4T+2P =6	❖ Calculus	**CO 1**. Various properties of function and series expansions of function are depicted here in detail. Differential equations up to second order as well as partial derivatives and their properties are mentioned in this section.
			❖ Vector Calculus	**CO 2**. Different properties of vectors and their operations are mentioned. Vector differential operator and its role in various cases are represented here.
			❖ Vector Integration	**CO 3.** Integration of vectors and related basic theorems are discussed in detail.
			❖ Orthogonal Curvilinear Coordinates	**CO 4.** Vector operations and vector differential operator are studied in different coordinates systems.
			❖ Dirac Delta function and its properties	**CO 5**. Properties of Dirac Delta function and expressions of special functions as delta function are analyzed here
			❖ Practical	**CO 6**. Computer Programme are developed to solve different numerical problems
	OR,PHY-G-CC-T-01/P-01 (Mechanics)	4T+2P =6	❖ Fundamentals of Dynamics	**CO 7**.Fundamental properties of reference frames, Galilean transformations and dynamics of a system of particles are described.
			❖ Work and Energy	**CO 8**.Basic descriptions of work, kinetic energy, potential energy, energy conservation law, conservative and non-conservative forces and work done by them are mentioned.

			❖ Collisions	**CO 9**.A detailed study of elastic and inelastic collisions between particles in different reference frames.
			❖ Rotational Dynamics	**CO 10**.This topic helps learner to get a brief idea of angular momentum and its conservation principle, torque and moment of inertia. Students also learn how to calculate moment of inertia for different shapes and kinetic energy of a rotational body.
			❖ Elasticity	**CO 11**.Definition of elastic constants and relations between them are studied in detail with the calculation of twisting torque for a cylinder or wire.
			❖ Fluid Motion	**CO 12.**Kinematics of moving fluids.
			❖ Gravitation and Central Force Motion	**CO 13**.Fundamentals of gravitation and a detailed study of motion of a particle under central force field are described.
			❖ Oscillations	**CO 14**.This topic helps students to solve the differential equation of simple harmonic oscillator for different cases like with and without damping force and with externally applied sinusoidal force. They also get a brief idea of resonance, sharpness of resonance and quality factor.
			❖ Non-Inertial Systems	**CO 15**.Laws of Physics in rotating coordinate systems with development of Coriolis force and its applications are elaborately described.
			❖ Special Theory of Relativity	**CO 16.** A brief description of postulates of Special Theory of Relativity, Lorentz transformation, Lorentz contraction, time dilation, mass-energy equivalence, relativistic Doppler effect and four vector are introduced.
			❖ Practical	**CO 17**.Students learn some laboratory based experiments related to Mechanics.*Ex*–determine the moment of inertia,g by using bar or Kater's pendulum etc

	OR,PHY-G-CC-T-01/P-01 (Electricity and Magnetism)	4T+2P =6	❖ Electric Field and Electric Potential ❖ Dielectric Properties of Matter ❖ Magnetic Field	**CO 18.** Student will learn about electric field, electric field lines, electric flux. **CO19**. Student will learn Gauss' Law in electrostatic and its application to charge distributions. **CO 20**. Student will learn about the Conservative nature of Electrostatic Field. **CO 21.**Student will learn Laplace's and Poisson equations. **CO 22.**Student will learn about Potential and Electric Field of a dipole. **CO 23**.Student will learn about the Surface charge and force on a conductor. **CO 24**.Student will learn about image charges. **CO 25.**Student will learn about Electric Field in matter. **CO 26.**Student will learn Polarization Charges. **CO 27.**Student will learn about Electrical Susceptibility and Dielectric Constant. **CO 28.**Student will learn about Displacement vector D. Relations between E, P and D. Gauss' Law in dielectrics. **CO 29.**Student will learn about Magnetic force between current elements. **CO 30.**Student will learn about Biot-Savart's Law and its simple applications: straight wire and circular loop. **CO 31**.Student will learn about Magnetic Dipole and its Dipole Moment. **CO 32**.Student will learn about Ampere's Circuital Law and its application. **CO 33**.Student will learn about Vector Potential.

			❖ Magnetic Properties of Matter ❖ Electromagnetic Induction ❖ Electrical Circuits ❖ Network theorems ❖ Ballistic Galvanometer ❖ Practical	**CO 34.**Student will learn about Torque on a current loop in a uniform Magnetic Field. **CO 35**.Student will learn about Magnetization vector(M) and Magnetic Intensity(H) **CO 36**.Student will learn about Magnetic Susceptibility and permeability. **CO 37**.Student will able to find Relation between B, H, M. B-H curve and hysteresis. **CO 38.**Student will learn about Faraday's Law and Lenz's Law. **CO 39.** Student will learn about Self Inductance and Mutual Inductance. **CO 40**.Student will learn about Reciprocity Theorem. **CO 41**.Student will learn about Kirchhoff s laws for AC circuits. **CO 42**.Student will learn about Complex Reactance and Impedance. **CO 43**Student will learn about (1) Resonance, (2) Power Dissipation and (3) Quality Factor, and (4) Band Width of LCR circuit. **CO 44.**Student will learn Thevenin theorem, Norton theorem, Superposition theorem, Reciprocity theorem, Maximum Power Transfer theorem. **CO 45.**Student will learn Ballistic Galvanometer: Current and Charge Sensitivity. **CO 46.** Student will learn Electromagnetic damping. Logarithmic damping, CDR. **CO47**. Students learn some laboratory based experiments related to Electricity And Magnetism. **CO48.** Students would gain practical knowledge about measurements such as:Resistance , Voltage, current etc.

II	**PHY-CC-G-T-02/P-02 (Waves and Optics)**	4T+2P =6	❖ Superposition of Collinear Harmonic oscillations	**CO 01**: Student will learn Linearity and Superposition Principle. **CO 02**: Student will learn Superposition of two collinear oscillations having equal frequencies and (2) different frequencies (Beats). **CO 03**: Student will learn Superposition of N collinear Harmonic Oscillations with (1) equal phase differences and equal frequency differences.
			❖ Superposition of two perpendicular Harmonic Oscillations	**CO 04** Student will learn Graphical and Analytical Methods.Lissajous Figures (1:1 and 1:2) and their uses.
			❖ Wave Motion	**CO 05** : Student will learn Plane and Spherical Waves, Longitudinal and Transverse Waves. **CO 06**: Student will learn about Plane Progressive (Travelling) Waves and Wave Equation. **CO 07**: Student will learn about Particle and Wave Velocities and Differential Equation. **CO 08**: Student will learn how to find Pressure of a Longitudinal Wave. Energy Transport.
			❖ Velocity of Waves	**CO 09** : Student will learn Velocity of Transverse Vibrations of Stretched Strings. **CO 10**: Student will learn Velocity of Longitudinal Waves in a Fluid in a Pipe. **CO 11**: Student will learn about Newton's Formula for Velocity of Sound and Laplace's Correction.
			❖ Superposition of Two Harmonic Waves	**CO 12** : Student will learn about Standing (Stationary) Waves in a String: Fixed and Free Ends. **CO 13**: Student will learn about Phase and Group Velocities and Changes with respect to Position and Time.

				CO 14 : Student will learn about Energy of Vibrating String and Transfer of Energy. **CO 15** : Student will learn about Normal Modes of Stretched Strings and Plucked and Struck Strings. **CO 16** : Student will learn Melde's Experiment and Longitudinal Standing Waves and Normal Modes. **CO 17**: Student will learn to treat Open and Closed Pipes and Superposition of N Harmonic Waves.
			❖ Wave Optics	**CO 18** : Student will learn Electromagnetic nature of light. **CO 19** : Student will learn Huygens Principle and Temporal and Spatial Coherence.
			❖ Interference	**CO 20** : Student will learn Division of amplitude and wavefront. **CO 21** : Student will learn Young's double slit experiment and Lloyd's Mirror and Fresnel's Bi-prism. **CO 22** : Student will learn Interference in Thin Films: parallel and wedge-shaped films. **CO 23**: Student will learn Fringes of equal inclination and Fringes of equal thickness. **CO 24**: Student will learn to measure wavelength and refractive index. **CO 25**: Student will learn Michelson Interferometer and Idea of form of fringes.
			❖ Interferometer	**CO 26** : Student will learn Determination of Wavelength, (3) Wavelength Difference, (4) Refractive Index, and (5) Visibility of Fringes. **CO 27** : Student will get an idea about Fabry-Perot interferometer.
			❖ Diffraction	**CO 28**: Student will learn diffraction of light, Kirchhoff s Integral Theorem,

				Fresnel-Kirchhoff s Integral formula and its application to rectangular slit.
			❖ Fraunhofer diffraction	**CO 29** : Student will learn Circular aperture, Resolving Power of a telescope. **CO 30**: Student will learn about Diffraction grating and Resolving power of grating.
			❖ Fresnel Diffraction	**CO 31** : Student will learn Fresnel's Half-Period Zones for Plane Wave. **CO 32**: Student will learn about Fresnel diffraction pattern of a straight edge, a slit and a wire.
			❖ Practical	**CO 33:** 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
	OR,PHY-CC-G-T-02/P-02 (Mathematical physics II)	4T+2P =6	❖ Fourier Series ❖ Frobenius Method and Special Functions □	**CO1**.A detailed study of different function sand its application are described, **CO2**.Expansion of periodic functions in a series of sine and cosine functions and determination of Fourier coefficients discussed in details. **CO3**. This topic helps learner to get a brief idea of some special functions and their application, **CO4.** Singular Points of Second Order Linear Differential Equations and their importance are elaborately described. **CO5.** Fundamentals of Legendre, Bessel, Hermite and Laguerre Differential Equations are described.

			❖ Some Special Integrals ❖ Theory of Errors ❖ Partial Differential Equations	**CO6**. A brief description of Beta and Gamma Functions and Relation between the mare included. **CO7**. Expression of Integrals in terms of Gamma Functions are elaborately described. **CO8.** This topic helps students to solve different problems with the concept of functions. **CO9.** Fundamentals of Systematic and Random Errors, Propagation of Errors,Normal Law of Errors are described in details. **CO10.** A detail idea how to solve Laplace's Equation in problems of rectangular, cylindrical and spherical symmetry using separation of variables. Wave equation and its solution for vibrational modes of a stretched string, rectangular and circular membranes are discussed in details
	OR,PHY-CC-G-T-02/P-02 (THERMAL PHYSICS)	4T+2P =6	**Introduction to Thermodynamics** ❖ Zeroth and First Law of Thermodynamics ❖ Second Law of Thermodynamics ❖ Entropy ❖ Thermodynamic Potentials ❖ Maxwell's Thermodynamic Relations	CO1. Define Zeroth Law and explain its applications.Also students will able to explain the 1stlaw of Thermodynamics as well as its applications. CO2. Define the statement of the 2nd law of thermodynamics and can explain its applications. CO3. State the basic concept of entropy and can assemble the Carnot's cycle as well as 3rd law of thermodynamics. CO4. Classify different thermodynamic potentials & can apply these. Also can explain the 1st & 2nd order phase transitions with examples. CO5. Apply Maxwell's relations in different processes.

			Kinetic Theory of Gases ❖ Distribution of Velocities ❖ Molecular Collisions ❖ Real Gases ❖ Laboratory Experiments	CO6. Recall Maxwell-Boltzmann law of distribution of velocities in detail. CO7. Summaries transport phenomenon in Ideal gas. CO8. Understand the behaviour of real gases can design different P-V diagrams. CO9. Practice of different basic experiments on thermodynamics in laboratory.
	OR,PHY-CC-G-T-02/P-02 (Digital Systems and Applications)	4T+2P =6	❖ Introduction to CRO ❖ Integrated Circuits ❖ Digital Circuits ❖ Boolean algebra ❖ Data processing circuits ❖ Arithmetic circuits ❖ Sequential Circuits ❖ Timers	CO 1. Block diagram of CRO, role of various parts and its applications are discussed here. CO 2. Components of Integrated circuits advantages and drawbacks of ICs, and their classifications are depicted here. CO 3. Various types of number systems and their conversion to each other, realization of basic logic circuits (logic gates) using diodes and transistors are studied here. In addition basic logic gates are used to construct logic circuits. CO 4.De Morgan's theorems are investigated based on the Boolean variables. Besides conversion of truth tables into equivalent logic circuits are studied here. CO 5.Basic idea of Multiplexers, De-multiplexers, Decoders, Encoders and their applications are discussed here. CO 6.Based on the binary operations various arithmetic circuits are analyzed here. CO7. SR, D, and JK Flip-Flops. Clocked (Level and Edge Triggered) Flip-Flops, Preset and Clear operations,Race-around conditions in JK Flip-Flop. M/S JK Flip-Flop are studied here. CO8.IC 555:block diagram and applications of A stable multi vibrator and

				Mono stable multi vibrator are represented here.
			❖ Shift registers	CO9. Serial-in-Serial-out, Serial-in-Parallel-out, Parallel-in-Serial-out and Parallel-in-Parallel-out Shift Registers (only up to 4 bits) are investigated here.
			❖ Counters(4 bits)	CO10.Ring Counter,Asynchronous counters, Decade Counter,Synchronous Counter are studied in this section.
			❖ Computer Organization	CO11.Basic concepts of input output devices and functional operation of computer are given.
			❖ Intel 8085 Microprocessor Architecture	CO12. Main features of 8085 Microprocessor, Block diagram, Components and functions and applications are represented here.
			❖ Introduction to Assembly Language	CO13.Introductory idea of 1 byte, 2 byte & 3 byte instructions are mentioned here.
			❖ Practical .	CO 14.To perform Practical Experiments related to theory for technical skills
III	**PHY-CC-G-T-03/P-03 (Mathematical Physics-III)**	4T+2P =6	❖ Complex Analysis	CO1.Complex numbers, functions of complex variables, and their various properties, related theorems and solution of problems regarding complex variables are discussed elaborately.
			❖ Integrals Transforms	CO2.Fourier transforms of various functions and its applications in solving differential equations are studied here.
			❖ Laplace Transforms	CO3.Laplace's transforms of elementary functions, its properties and applications in various cases are discussed in detail.
			❖ Practical	CO 4. various Numerical problems are solved using computers resulting in technical skills.

	OR,PHY-CC-G-T-03/P-03 (Elements of Modern Physics)	4T+2P =6	❖ Planck's quantum Theory & Black Body Radiation ❖ Heisenberg uncertainty principle & Wave Packets ❖ Two slit interference experiment & Schrodinger equation ❖ One dimensional infinitely rigid box ❖ Size and structure of atomic nucleus ❖ Radioactivity ❖ Lasers ❖ Different Laboratory Experiments	CO1. Explain Photo electric effects of light & Compton Scattering. CO2. State the Heisenberg Uncertainty principle and able to explain the wave particle duality. CO3. Contract the Schrodinger equation for non-relativistic particles. CO4. Define the tunnelling effects. CO5. Conceptualise the structure of atoms and nucleus. CO6. Understand the basic concept of Radioactivity. CO7. Comprehend basic principle and use of Lasers. CO8. Practice of different basic experiments on modern Physics in laboratory.
	OR,PHY-CC-G-T-03/P-03 (Analog Systems and Applications)	4T+2P =64T+ 2P=6	❖ Semiconductor diodes ❖ Two terminal devices and their applications ❖ Bipolar Junction Transistors ❖ Amplifiers	CO 1.To study the fundamental properties of Semiconductor diodes and the mechanism of current follow in PN junction diodes. CO 2.To provide knowledge about the performance and efficiency of various two terminal devices. CO 3.To study the different characteristic curves of BJT and to analyse the mechanism of current flow in transistors. CO 4.To provide knowledge about transistor biasing stabilization circuits and classification of different amplifiers.

			❖ Coupled Amplifiers ❖ Feedback in Amplifiers ❖ Sinusoidal Oscillators ❖ Operational Amplifiers (Black box approach) ❖ Applications of Op- Amps ❖ Conversions ❖ Practical	CO 5.It deals with the frequency response of R-C coupled amplifier. CO 6.Effects of positive and negative feedback on different parameters of amplifiers are dealt with. CO 7. To study the different types of oscillators. CO8.It deals with different characteristics of Ideal and Practical OPAMP (IC 741). CO 9.It gives the knowledge of applications of Op-Amps in designing circuits to solve different mathematical operations. CO 10. To study A/D and D/A conversion, etc. CO 11.To perform Practical Experiments related to theory for technical skills
IV	**PHY-CC-G-T-04/P-04 (Quantum Mechanics and Applications)**	4T+2P =6	❖ Time dependent Schrodinger equation ❖ Time independent Schrodinger equation- Hamiltonian ❖ General discussion of bound states in an arbitrary potential	CO 1. An introduction of quantum mechanics along with the properties of wave function, eigen value, eigen function, different types of operators and their expectation values. CO 2. An overview of stationary states, wave packets and uncertainty principle is described along with the general solution of time independent Schrodinger equation. CO 3. This topic helps students to understand the applications of the time independent Schrodinger equation in one-dimension for square well potential and simple harmonic oscillator. CO 4. A detailed study on the application of the time independent Schrodinger equation for hydrogen-like atoms.

			❖ Quantum theory of hydrogen-like atoms ❖ Atoms in electric & magnetic Fields ❖ Atoms in external magnetic fields ❖ Many electron atoms ❖ Practical	CO 5. A brief discussion on space quantisation, Larmor's theorem, electron spin magnetic moment, gyromagnetic ratio and Bohr magneton. CO 6. Qualitative discussion on normal and anomalous Zeeman effect, Paschen Back and Stark effect. CO 7. This topic helps students to understand fine structure, vector atom model and spin orbit coupling (L-S and J-J coupling) in atoms. CO 8.Using Scilab, solutions of Schrodinger equation for the ground state and the first excited state for different type of potentials are studied.
	OR,PHY-CC-G-T-04/P-04 (Solid State Physics)	4T+2P =6	❖ Crystal Structure ❖ Elementary Lattice Dynamic	CO 1 : Student will learn about Amorphous and Crystalline Materials. CO 2: Student will learn about Lattice Translation Vectors and Lattice with a Basis -Central and Non-Central Elements. CO 3: Student will learn Unit Cell, Miller Indices, Reciprocal Lattice, Types of Lattices. CO 4 : Student will learn Brillouin Zones and Diffraction of X-rays by Crystals. CO 5 : Student will learn about Bragg's Law and Atomic and Geometrical Factor. CO 6 : Student will learn Lattice Vibrations and Phonons, Linear Monoatomic and Diatomic Chains. CO 7 : Student will learn Acoustical and Optical Phonons and Qualitative Description of the Phonon Spectrum in Solids. CO 8 : Dulong and Petit's Law, Einstein and Debye theories of specific heat of solids, T^3 law.

			❖ Magnetic Properties of Matter ❖ Dielectric Properties of Materials ❖ Ferroelectric Properties of Materials ❖ Elementary band theory	CO 9: Student will learn about : Dia, Para, Ferri and Ferromagnetic Materials. CO 10: Student will learn Classical Langevin Theory of dia-and Paramagnetic Domains and Quantum Mechanical Treatment of Paramagnetism. CO 11 : Student will learn about Curie's law, Weiss's Theory of Ferromagnetism and Ferromagnetic Domains. CO 12 : Student will get an idea about Hysteresis and Energy Loss. CO 13 : Student will learn about Polarization, Local Electric Field at an Atom and Depolarization Field. CO 14: Student will learn about Classical Theory of Electric Polarizability. CO 15: Student will learn about Normal and Anomalous Dispersion. CO 16: Student will learn about Cauchy and Sellmeir relations, Langevin-Debye equation. CO 17: Student will learn Plasma Oscillations, Plasma Frequency, Plasmons, TO modes. CO 18: Student will learn about Classification of crystals. CO 19: Student will learn Piezoelectric effect, Pyroelectric effect, Ferroelectric effect and Electrostrictive effect. CO 20: Student will learn about Curie-Weiss Law, Ferroelectric domains, PE hysteresis loop. CO 21: Student will learn Kronig Penny modeland Band Gap in solids. CO 22: Student will learn about Conductor, Semiconductor (P and N type) and insulator. CO 23: Student will learn about Conductivity of Semiconductor, mobility and Hall Effect. CO 24: Student will learn how to find conductivity & Hall coefficient of a solid.

			❖ Superconductivity	CO 25: Student will learn about Superconductors and superconductivity. CO 26: Student will learn Meissner effect. CO 27: Student will learn Critical Temperature and Critical magnetic field of superconductor. CO 28: Student will learn Type I and type II Superconductors, London's Equation and Penetration Depth CO 29:Student will learn about Idea of BCS Theory(No derivation)
	OR,PHY-CC-G-T-04/P-04 (Statistical Mechanics)	4T+2P =6	❖ Maxwell Equations ❖ EM Wave Propagation in Unbounded Media ❖ EM Wave in Bounded Media ❖ Polarization of Electromagnetic Waves ❖ Rotatory Polarization ❖ Wave Guides ❖ Optical Fibers	CO1. Define Maxwell's equation andexplain its applications. CO2. Identifythe EMwave propagation through different unbound media. CO3. Identifythe EM wave propagation through different kind of bounded media. CO4. Describe the basic concept on polarisation of EM wave and explain its applications CO5. Analyse the optical rotation of polarization process. CO6. Define optical wave-guides & phase and group velocity of guided waves. CO7. Definedifferent types of optical fibres.

			❖ Different Laboratory Experiments	CO8. Practice of different basic experiments on EM radiation in laboratory.
V	**PHY-G-DSE-T-01/P-01(Mechanic)**	4T+2P =6	❖ Vectors	CO 01: This topic help students to understand vector algebra and scalar and vector product .
			❖ Ordinary Differential Equations	CO 02: Student learn about 1st and 2nd order homogeneous differential equations with constant coefficients
			❖ Laws of Motion	CO 03: This topic help students to understand the frames of reference and Newton's laws of motion
			❖ Momentum and energy	CO 04: This topic help students to understand The conservation law of energy and Momentum
			❖ Rotational Motion	CO 05: This topic helps learner to get a brief idea of angular momentum and its conservation principle, torque and moment of inertia. Students also learn how to calculate moment of inertia for different shapes and kinetic energy of a rotational body.
			❖ Gravitation	CO 06: Fundamentals of gravitation and a detailed study of motion of a particle under central Non-Inertial Systems□Special Theory of Relativity□Practical force field are described.
			❖ Oscillations	CO 07: A detailed study of elastic and inelastic collisions between particles in different reference frames.
			❖ Elasticity	CO 08: Definition of elastic constants and relations between them are studied in detail with the calculation of twisting torque for a cylinder or wire.

			❖ Speed Theory of Relativity ❖ Practical	CO 09: A detailed study of constancy of speed of light and postulates of special theory of relativity. CO 10: Students learn some laboratory based experiments related to Mechanics.*Ex*–determine the moment of inertia,g by using bar or Kater's pendulum etc
	OR,PHY-G-DSE-T-01/P-01 (Electricity and Magnetism)	4T+2P =6	❖ Vector Analysis ❖ Electrostatics ❖ Magnetism	CO 01: Student learn about scalar and vector product .curl and their significance and Gauss- divergence theorem and Stoke's theorem of vector(statement only) CO 02: The use of Coulomb's law and Gauss' law for the electrostatic force CO 03: Student will learn about electric field, electric field lines, electric flux. CO 04: Student will learn about the Conservative nature of Electrostatic Field. CO 04: Student will learn about the Conservative nature of Electrostatic Field. CO 05: Student will learn Polarization Charges. CO 06: Student will learn about Electrical Susceptibility and Dielectric Constant. CO 07: The relationship between electrostatic field and electrostatic potential. CO 08: The use of the Lorentz force law for the magnetic force CO 09: Student will learn about Biot-Savart's Law and its simple applications: straight wire and circular loop. CO 10. Student will learn about Magnetic Dipole and its Dipole Moment. CO 11. Student will learn about Ampere's Circuital Law and its application. CO 12 . Student will learn about Vector Potential..

			❖ Electromagnetic Induction ❖ Maxwell's equation and Electromagnetic wave propagation ❖ Practical	CO 13: The use of Ampere's law to calculate magnetic fields CO 14: The use of Faraday's law in induction problems . CO 15: Student will learn about Lenz's law and mutual inductance CO 16: The basic laws that underlie the properties of electric circuit elements CO 17: The equation of continuity Maxwell's equation ,Poynting vector. CO 18: Students learn some laboratory based experiments related to Electricity And Magnetism. **CO 19.** Students would gain practical knowledge about measurements such as:Resistance , Voltage, current etc.
	OR,PHY-G-DSE-T-01/P-01 (Thermal Physics And Statistical Mechanics)	4T+2P =6	❖ Law's of Thermodynamics ❖ Thermodynamics potential	CO 01: Define Zeroth Law and explain its applications.Also students will able to explain the 1ST law of Thermodynamics as well as its applications. CO 02:Define the statement of the 2ND law of thermodynamics and can explain its applications. CO 03 : The students also learn how laws of thermodynamics are used in a heat engine to transform heat into work. CO 04 Thermodynamic potentials. Enthalpy and Maxwell's relation and its application

			❖ Kinetic Theory of Gases ❖ Theory of Radiation ❖ Statistical Mechanics ❖ Practical	CO 05: Maxwell law of distribution of velocities in detail. Mean free path(Zeroth Order) CO 06:The students also learn Blackbody radiation, Spectral distribution, Concept of Energy density, Derivation of Planck's law, Deduction of Wien's distribution law, Rayleigh-Jeans Law, Stefan Boltzmann Law and Wien's displacement law from Planck's law CO 07: Apply the Thermodynamic behavior of Ideal, Bose, Fermi gases and applications of statistical mechanics. CO 08: Maxwell-Boltzmann law of distribution of velocities in detail. CO 09: about Maxwell Boltzmann statistics, Bose Einstein statistics and Fermi Dirac Statistics To get the knowledgethe coefficient of thermal conductivity of Cu by Searle's Apparatus.
	OR,PHY-G-DSE-T-01/P-01(waves And Optics)	4T+2P =6	❖ Superposition of Collinear Harmonic oscillations ❖ Superposition of two perpendicular Harmonic Oscillations. ❖ Wave Motion - General ❖ Fluids	CO 01: Student will learn Linearity and Superposition Principle. CO 02: Student will learn Superposition of two collinear oscillations having equal frequencies and (2) different frequencies (Beats). CO 03: Student will learn Graphical and Analytical Methods.Lissajous Figures (1:1 and 1:2) and their uses. CO 04: Student will learn Transverse waves on a string. Travelling and standing waves on a string. Normal Modes of a string. Group velocity, Phase velocity. Plane waves. Spherical waves, Wave intensity

			❖ Sound ❖ Wave Optics ❖ Interference ❖ Michelson's Interferometer ❖ Diffraction ❖ Polarization ❖ Practical	CO 05: Student will learn about Surface Tension ,Poiseuille's formula and variation of viscosity of a liquid with temperature-lubrication. CO 06: Student will learn Simple harmonic motion - forced vibrations and resonance - Fourier's Theorem - Application to saw tooth wave and square wave - Intensity and loudness of sound - Decibels - Intensity levels - musical notes - musical scale. CO 07 : Student will learn about Electromagnetic nature of light. Definition and Properties of wave front. Huygens Principle. CO 08: Student will learn about Interference: Division of amplitude and division of wavefront. Young's Double Slit experiment. Lloyd's Mirror and Fresnel's Biprism. Phase change on reflection: Stokes' treatment. Interference in Thin Films: parallel and wedge-shaped films. Fringes of equal inclination (Haidinger Fringes); Fringes of equal thickness (Fizeau Fringes). Newton's Rings: measurement of wavelength and refractive index. CO 09: Student will learn (1) Idea of form of fringes (no theory needed), (2) Determination of wavelength, (3) Wavelength difference, (4) Refractive index, and (5) Visibility of fringes. CO 10: Student will learnFresnel's Half-Period Zones for Plane Wave. CO 11: Student will learn about Theory of a Zone Plate and Multiple Foci of a Zone Plate. CO 12: Student will learn about Transverse nature of light waves. Plane polarized light – production and analysis. Circular and elliptical polarization. CO 13: Students would gain practical knowledge about the Refractive Index of the Material of a Prism using Sodium

				Light,the value of Cauchy Constants,AND e the Coefficient of Viscosity of water by any method ETC
VI	**PHY-G-DSE-T-02/P-02(Digital,analog circuits and Instrumentation)**	4T+2P =6	❖ Digital Circuits ❖ Semiconductor devices and Amplifiers	CO 01:Student will learn about Difference between Analog and Digital Circuits. Binary Numbers. Decimal to Binary and Binary to Decimal Conversion, AND, OR and NOT Gates (Realization using Diodes and Transistor). NAND and NOR Gates as Universal Gates. XOR and XNOR Gates. CO 02:Student will learn about De Morgan's Theorems. Boolean Laws. Simplification of Logic Circuit using Boolean Algebra. Fundamental Products. Minterms and Maxterms. Conversion of a Truth Table into an Equivalent Logic Circuit by (1) Sum of Products Method and (2) Karnaugh Map. CO 03:Student will learn about Binary Addition. Binary Subtraction using 2's Complement Method). Half Adders and Full Adders and Subtractors, 4-bit binary Adder-Subtractor. CO 04: Student will learn about Semiconductor Diodes: P and N type semiconductors. Barrier Formation in PN Junction Diode. Qualitative Idea of Current Flow Mechanism in Forward and Reverse Biased Diode. PN junction and its characteristics. Static and Dynamic Resistance. Principle and structure of (1) LEDs, (2) Photodiode, (3) Solar Cell. CO 05:Student will learn about Bipolar Junction transistors: n-p-n and p-n-p Transistors. Characteristics of CB, CE and CC Configurations. Current gains α and β, Relations between α and β. CO 06:Student will learn about Characteristics of an Ideal and Practical Op-Amp (IC 741), Open-loop and

			❖ Operational Amplifiers(Black Box approach) ❖ Instrumentation's ❖ Practical	closed- loop Gain. CMRR, concept of Virtual ground. Applications of Op-Amps: (1) Inverting and non-inverting Amplifiers, (2) Adder, (3) Subtractor, (4) Differentiator, (5) Integrator, (6) Zero crossing detector. CO 07: Student will learn about Introduction to CRO: Block Diagram of CRO. Applications of CRO. CO 08:Student will learn about Power Supply: Half-wave Rectifiers. Centre-tapped and Bridge Full-wave Rectifiers Calculation of Ripple Factor and Rectification Efficiency, Basic idea about capacitor filter, Zener Diode and Voltage Regulation CO 09: Students would gain practical knowledge about To verify and design AND, OR, NOT and XOR gates using NAND gates. To minimize a given logic circuit. Half adder, Full adder and 4-bit Binary Adder AND Adder-Sub tractor using Full Adder I.C. CO 10: To design an astable multivibrator of given specifications using 555 Timer. CO 11: To design a monostable multivibrator of given specifications using 555 Timer. CO 12:To study IV characteristics of PN diode, Zener and Light emitting diode. CO 13: To study the characteristics of a Transistor in CE configuration.
	OR,PHY-G-DSE-T-02/P-02(Elements And Modern Physics)	4T+2P =6	❖ Planck's quantum Theory & Black Body Radiation ❖ Heisenberg uncertainty principle & Wave Packets ❖ Two slit interference experiment & Schrodinger equation	CO1. Explain Photo electric effects of light & Compton Scattering. CO2. State the Heisenberg Uncertainty principle and able to explain the wave particle duality. CO3. Contract the Schrodinger equation for non-relativistic particles.

			❖ One dimensional infinitely rigid box ❖ Size and structure of atomic nucleus ❖ Radioactivity ❖ Practical	CO4. Define the tunnelling effects. CO5. Conceptualise the structure of atoms and nucleus. CO6. Understand the basic concept of Radioactivity. CO7. Practice of different basic experiments on modern Physics in laboratory.
	OR,PHY-G-DSE-T-02/P-02(Solid State Physics)	4T+2P =6	❖ Crystal Structure ❖ Elementary Lattice Dynamic ❖ Magnetic Properties of Matter	CO 1 : Student will learn about Amorphous and Crystalline Materials. CO 2: Student will learn about Lattice Translation Vectors and Lattice with a Basis -Central and Non-Central Elements. CO 3: Student will learn Unit Cell, Miller Indices, Reciprocal Lattice, Types of Lattices. CO 4 : Student will learn Brillouin Zones and Diffraction of X-rays by Crystals. CO 5 : Student will learn about Bragg's Law and Atomic and Geometrical Factor. CO 6 : Student will learn Lattice Vibrations and Phonons, Linear Monoatomic and Diatomic Chains. CO 7 : Student will learn Acoustical and Optical Phonons and Qualitative Description of the Phonon Spectrum in Solids. CO 8 : Dulong and Petit's Law, Einstein and Debye theories of specific heat of solids, T^3 law. CO 9: Student will learn about : Dia, Para, Ferri and Ferromagnetic Materials. CO 10: Student will learn Classical Langevin Theory of dia-and Paramagnetic Domains and Quantum Mechanical Treatment of Paramagnetism.

			❖ Dielectric Properties of Materials ❖ □Elementary band theory□ ❖ Superconductivity ❖ Practical	CO 11 : Student will learn about Curie's law, Weiss's Theory of Ferromagnetism and Ferromagnetic Domains. CO 12 : Student will get an idea about Hysteresis and Energy Loss. CO 13 : Student will learn about Polarization, Local Electric Field at an Atom and Depolarization Field. CO 14: Student will learn about Classical Theory of Electric Polarizability. CO 15: Student will learn about Normal and Anomalous Dispersion. CO 16: Student will learn about Cauchy and Sellmeir relations, Langevin-Debye equation. CO 17: Student will learn Plasma Oscillations, Plasma Frequency, Plasmons, TO modes. CO 18: Student will learn about Curie-Weiss Law, Ferroelectric domains, PE hysteresis loop. CO 19: Student will learn about Conductor, Semiconductor (P and N type) and insulator. CO 20: Student will learn about Conductivity of Semiconductor, mobility and Hall Effect. CO 21: Student will learn about Superconductors and superconductivity. CO 26: Student will learn Meissner effect. CO 27: Student will learn Critical Temperature and Critical magnetic field of superconductor. CO 28: Student will learn Type I and type II Superconductors, London's Equation and Penetration Depth CO 29:Student will learn about Idea of BCS Theory(No derivation) CO 30:Students would gain practical knowledge about Solid State Physics

Skill Enhancement Course [PHY-G-SEC-T-(01-04) To be studied in GENERAL/PASS course] (Credit: 02 each)	
1. Computational Physics	**CO 01:** This course would introduce students with the basic knowledge of computers their applications in solving common and scientific problems, the course include scientific programming languages, scientific word processing and graphical analysis.
2. Radiation and Safety	**CO 01:** The students would gain the knowledge of different types of radiation and its interactions with matter, would also know about the photons, charged particles, neutrons, about radiation detection, monitoring and safety measures, and also learn about the applications of nuclear techniques.
3.Renewable Energy And Energy Harvesting	**CO 01:** The students would gain the knowledge of Fossil fuels and nuclear energy, their limitation, need of renewable energy, non-conventional energy sources. An overview of developments in Offshore Wind Energy, Tidal Energy, Wave energy systems, Ocean Thermal Energy Conversion, solar energy, biomass, biochemical conversion, biogas generation, geothermal energy tidal energy, Hydroelectricity. **CO 02:** The students would gain the knowledge of Solar energy, its importance, storage of solar energy, solar pond, non convective solar pond, applications of solar pond and solar energy, solar water heater, flat plate collector, solar distillation, solar cooker, solar green houses, solar cell, absorption air conditioning. Need and characteristics of photovoltaic (PV) systems, PV models and equivalent circuits, and sun tracking systems **CO 03:** The Students Would Gain The Knowledge Of Fundamentals Of Wind Energy, Wind Turbines And Different Electrical Machines In Wind Turbines, Power Electronic Interfaces, And Grid Interconnection Topological.Also Learn About Tide Characteristics And Statistics, Tide Energy Technologies, Ocean Thermal Energy, Osmotic Power, Ocean Bio-Mass. **CO 04 :** The Students Would Gain The Knowledge Of Linear generators, physics mathematical models, recent applications

4.Electrical Circuits & Network Skills	**CO 01:** The Students Would Gain The Knowledge Of Voltage, Current, Resistance, and Power. Ohm's law. Series, parallel, and series-parallel combinations. AC Electricity and DC Electricity. Familiarization with multimeter, voltmeter and ammeter.AND Main electric circuit elements and their combination. Rules to analyze DC sourced electrical circuits. Current and voltage drop across the DC circuit elements. Single-phase and three-phase alternating current sources. Rules to analyze AC sourced electrical circuits. Real, imaginary and complex power components of AC source. Power factor. Saving energy and money. **CO 02:** Student will learn about Single-phase, three-phase & DC motors. Basic design. Interfacing DC or AC sources to control heaters & motors. Speed & power of ac motor. **CO 03:** Student wil learn about Different types of conductors and cables. Basics of wiring-Star and delta connection. Voltage drop and losses across cables and conductors. Instruments to measure current, voltage, power in DC and AC circuits. Insulation. Solid and stranded cable. Conduit. Cable trays. Splices: wirenuts, crimps, terminal blocks, split bolts, and solder. Preparation of extension board.

SESSION -2022-2023

CBCS CURRICULUM FOR SEMESTERIZED UNDER-GRADUATE COURSE IN PHYSICS (PROGRAMME/GENERAL)

INTRODUCTION: The University Grants Commission (UGC) has taken various measures by means of formulating regulations and guidelines and updating them, in order to improve the higher education system and maintain minimum standards and quality across the Higher Educational Institutions in India. The various steps that the UGC has initiated are all targeted towards bringing equity, efficiency and excellence in the Higher Education System of country. These steps include introduction of innovation and improvements in curriculum structure and content, the teaching-learning process, the examination and evaluation systems, along with governance and other matters. The introduction of Choice Based Credit System is one such attempt towards improvement and bringing in uniformity of system with diversity of courses across all higher education institutes in the country. The CBCS provides an opportunity for the students to choose courses from the prescribed courses comprising of core, elective, skill enhancement or ability enhancement courses. The courses shall be evaluated following the grading system, is considered to be better than conventional marks system. This will make it possible for the students to move across institutions within India to begin with and across countries for studying courses of their choice. The uniform grading system shall also prove to be helpful in assessment of the performance of the candidates in the context of employment.

Outline of the Choice Based Credit System being introduced:

1. **Core Course (CC):** A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.

2. **Elective Course:** Generally a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/ subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the student's proficiency/skill is termed as an Elective Course.

2.1 **Discipline Specific Elective Course (DSEC)**: Elective courses that are offered by the main discipline/subject of study is referred to as Discipline Specific Elective. The University/Institute may also offer discipline related Elective courses of interdisciplinary nature (to be offered by main discipline/subject of study).

2.2 **Generic Elective Course (GEC):** An elective course chosen generally from an unrelated discipline/subject, with an intention to seek exposure is called a Generic Elective.

3. **Ability Enhancement Courses/ Skill Enhancement Courses:**

3.1 **Ability Enhancement Compulsory Course (AECC):** Ability enhancement courses are the courses based upon the content that leads to Knowledge enhancement. They (i) Environmental Science, (ii) English Communication) are mandatory for all disciplines.

3.2 **Skill Enhancement Course (SEC):** These courses may be chosen from a pool of courses designed to provide value-based and/or skill-based instruction.

CBCS CURRICULUM FOR SEMESTERIZED UNDER-GRADUATE COURSE IN PHYSICS (PROGRAMME/GENERAL)

A. TOTAL Number of courses in UG-CBCS B.Sc. GENERAL:

Types of course	Core course (CC)	Elective course	Ability Enhancement Course		TOTAL
		Discipline specific elective course (DSE)	Ability Enhancement compulsory course(AECC)	Skill Enhancement course (SEC)	
No. of course	12	6	2	4	24
Credit/course	6	6	2	2	120

TABLE-1: DETAILS OF COURSES OF B.SC. (GENERAL) UNDER CBCS

S. No.	Particulars of Course	Credit Point	
1.	**Core Course: 12 Papers**	**Theory + Practical**	**Theory + Tutorial**
1.A.	Core Course: Theory (12 papers)	12x4 = 48	12x5 = 60
1.B.	Core Course (Practical/Tutorial)*(12 papers)	12x2 = 24	12x1 = 12
2.	**Elective Courses: (6 papers)**		
A.	DSE: Theory (6 papers)	6x4 = 24	6x5 = 30
B.	DSE (Pract./ Tutor.)* (6 papers)	6x2 = 12	6x1 = 6
#Optional Dissertation/ Project Work in place of* one *DSE paper (6 credits) in 6th semester			
3. Ability Enhancement Courses			
A.	Ability Enhancement compulsory course (AECC): (Theory)*(2 papers) (2 papers of 2 credits each)	2x2 = 4	2x2 = 4

B.	Skill Enhancement Course (SEC): (Theory)*(4 papers) (4 papers of 2 credits each)	4x2 = 8	4x2 = 8
Total Credit:		**120**	**120**
## ***Wherever there is a practical, there will be no tutorial and vice- versa.***			

TABLE-2: SEMESTER WISE DISTRIBUTION OF COURSES & CREDITS IN B.SC. GENERAL

Courses/ (Credits)	**Sem-I**	**Sem-II**	**Sem-III**	**Sem-IV**	**Sem-V**	**Sem-VI**	**Total No. of Courses**	**Total credit**
CC-1,2,3 (6)	**3 (1A,2A, 3A)**	**3 (1B,2B, 3B)**	**3 (1C,2C, 3C)**	**3 1D,2D, 3D)**	**-**	**-**	**12**	**72**
DSE - 1,2,3 (6)	**-**	**-**	**-**	**-**	**3 (1A,2A,3A)**	**3 (1B,2B,3B)**	**6**	**36**
AECC (2)	**1**	**1**	**-**	**-**	**-**	**-**	**2**	**04**
SEC (2)	**-**	**-**	**1**	**1**	**1**	**1**	**4**	**08**
Total No. of Course/ Sem	**4**	**4**	**4**	**4**	**4**	**4**	**24**	**--**
Total Credit /Semester	**20**	**20**	**20**	**20**	**20**	**20**	**--**	**120**

TABLE-3: SEMESTER & COURSEWISE CREDIT DISTRIBUTION IN B.SC.(GENERAL)

(6 Credit: 75 Marks)

SEMESTER-I			
Course Code	Course Title	Course wise Class (L+T+P)	Credit
PHY-G-CC-T-01 PHY-G-CC-P-01	Mechanics	Core (60L+60P)	6 (4T+2P)
from other discipline	from other discipline	Core	6
from other discipline	from other discipline	Core	6

AECC-01	English Communication/ Environmental Science	AECC	2
Total	4 courses	Total	20
SEMESTER-II			
Course Code	Course Title	Course Nature	Credit
PHY-G-CC-T-02 PHY-G-CC-P-02	Electricity and Magnetism	Core (60L+60P)	6 (4T+2P)
from other discipline	from other discipline	Core	6
from other discipline	from other discipline	Core	6
AECC-02	English Communication/ Environmental Science	AECC	2
Total	4 courses	Total	20
SEMESTER-III			
Course Code	Course Title	Course Nature	Credit
PHY-G-CC-T-03 PHY-G-CC-P-03	Thermal Physics and Statistical Mechanics	Core (60L+60P)	6 (4T+2P)
from other discipline	from other discipline	Core	6
from other discipline	from other discipline	Core	6
PHY-G-SEC-T-01	Renewable Energy & Energy Harvesting	SEC(30L)	2
Total	4 courses	Total	20
SEMESTER-IV			
Course Code	Course Title	Course Nature	Credit
PHY-G-CC-T-04 PHY-G-CC-P-04	Waves and Optics	Core (60L+60P)	6 (4T+2P)
from other discipline	from other discipline	Core	6
from other discipline	from other discipline	Core	6
PHY-G-SEC-T-02	Weather Forecasting	SEC(30L)	2
Total	4 courses	Total	20
SEMESTER-V			
Course Code	Course Title	Course Nature	Credit
PHY-G-DSE-T-01 PHY-G-DSE-P-01	Digital, Analog Circuits and Instrumentation/ Elements of Modern Physics	DSE (60L+60P)	6 (4T+2P)
from other discipline	from other discipline	DSE	6
from other discipline	from other discipline	DSE	6
PHY-G-SEC-T-03	Electrical Circuits & Network Skills	SEC(30L)	2
Total	4 courses	Total	20
SEMESTER-VI			

Course Code	Course Title	Course Nature	Credit
PHY-G-DSE-T-02	Solid State Physics/ Nuclear and Particle Physics	DSE	6
PHY-G-DSE-P-02		(60L+60P)	(4T+2P)
from other discipline	from other discipline	DSE	6
from other discipline	from other discipline	DSE	6
PHY-G-SEC-T-04	Basic Instrumentation Skills	SEC(30L)	2
Total	4 courses	Total	20
Total (All semesters)	*24 courses*	*Total*	*120*

Programme Outcomes (PO)

Knowledge Outcomes

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

5. Apply the basic principles of Physics to the events occurring around us and also in the world.
6. Try to find out or analyse scientific reasoning for various things.

Skill Outcomes

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

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

Generic outcomes

Students will

4. Develop ability to work in group
5. Develop capacity of critical reasoning, judgment and communication skills.
6. Develop abilities for logical thinking

Programme Specific Outcomes (PSO)

PSO1. The new CBCS Physics Syllabus (new) Introduced from the academic session 2022-2023 is both diversified and job-oriented. It helps to develop both intellectual and technical skills of the students.

PSO2. After completion of B.Sc. (Programme), the students can enrol themselves for M.Sc. degree in Physics.

PSO3. They can also appear in JAM, CUET and other entrance tests for getting admission in integrated Ph.D. course in different premier research institutes in India as well as Masters in different central Universities.

PSO4. They have also the opportunity to study B.Tech, MCA and other technical courses after graduation in Physics.

PSO5. Moreover, they can get admission in B. Ed. Course and have the opportunity to get job as school teachers.

PSO6. Skill enhancement course is helpful to develop technical skills of the students. It will help them to find jobs in different technical fields also.

PSO7. After all undergraduates in Physics have the opportunity of getting jobs in different public as well as private sectors.

PSO8. To help the students prepare for subjects/ discipline specific national level competitive exams.

COURSE OUTCOME (CO)

SEM	COURSE /COURSE CODE	CREDIT	CONTENT OF KU SYLLABUS	S. NO	COURSE OUTCOME (CO)
1ST	**PHY-G-CC-T-01/P-01 (Mechanic)**	**4T+2P =6**	❖ Vectors	01	CO 01: This topic help students to understand vector algebra and scalar and vector product .
			❖ Ordinary Differential Equations	02	CO 02: Student learn about 1st and 2nd order homogeneous differential equations with constant coefficients
			❖ Laws of Motion	03	CO 03: This topic help students to understand the frames of reference and Newton's laws of motion
			❖ Momentum and energy	04	CO 04: This topic help students to understand The conservation law of energy and Momentum
			❖ Rotational Motion	05	CO 05: This topic helps learner to get a brief idea of angular momentum and its conservation principle, torque and moment of inertia. Students also learn how to calculate moment of inertia for different shapes and kinetic energy of a rotational body.
			❖ Gravitation	06	CO 06: Fundamentals of gravitation and a detailed study of motion of a

					particle under central Non-Inertial Systems Special Theory of Relativity Practical force field are described.
			❖ Oscillations	07	CO 07: A detailed study of elastic and inelastic collisions between particles in different reference frames.
			❖ Elasticity	08	CO 08: Definition of elastic constants and relations between them are studied in detail with the calculation of twisting torque for a cylinder or wire.
			❖ Speed Theory of Relativity	09	CO 09: A detailed study of constancy of speed of light and postulates of special theory of relativity.
			❖ Practical	10	CO 10: Students learn some laboratory based experiments related to Mechanics.*Ex*–determine the moment of inertia,g by using bar or Kater's pendulum etc
2 N D	**PHY-G-CC-T-01/P-01 (ELECTRICITY AND MAGNETISM)**	**4T+2P =6**	❖ Vector Analysis	11	CO 01: Student learn about scalar and vector product .curl and their significance and Gauss-divergence theorem and Stoke's theorem of vector(statement only)

			❖ Electrostatics	12	CO 02: The use of Coulomb's law and Gauss' law for the electrostatic force
				13	CO 03: Student will learn about electric field, electric field lines, electric flux.
				14	CO 04: Student will learn about the Conservative nature of Electrostatic Field.
				15	CO 05: Student will learn Polarization Charges.
				16	CO 06: Student will learn about Electrical Susceptibility and Dielectric Constant.
				17	CO 07: The relationship between electrostatic field and electrostatic potential.
				18	CO 08: The use of the Lorentz force law for the magnetic force
			❖ Magnetism	19	CO 09: Student will learn about Biot-Savart's Law and its simple applications: straight wire and circular loop.
				20	CO 10. Student will learn about Magnetic Dipole and its Dipole Moment.
				21	CO 11. Student will learn about Ampere's Circuital Law and its application.

				22	CO 12 . Student will learn about Vector Potential..
				23	CO 13: The use of Ampere's law to calculate magnetic fields
			❖ Electromagnetic Induction	24	CO 14: The use of Faraday's law in induction problems .
				25	CO 15: Student will learn about Lenz's law and mutual inductance
				26	CO 16: The basic laws that underlie the properties of electric circuit elements
			❖ Maxwell's equation and Electromagnetic wave propagation	27	CO 17: The equation of continuity Maxwell's equation ,Poynting vector
				28	CO 18: Students learn some laboratory based experiments related to Electricity And Magnetism.
			❖ Practical	29	**CO 19.** Students would gain practical knowledge about measurements such as:Resistance , Voltage, current etc.
3RD	**PHY-G-CC-T-03/P-03 (Thermal Physics and Statistical Mechanics)**	**4T+2P =6**	❖ Law's of Thermodynamics	30	CO 01: Define Zeroth Law and explain its applications.Also students will able to explain the 1ST t law of Thermodynamics as well as its applications.

				31	CO 02:Define the statement of the 2ND law of thermodynamics and can explain its applications.
				32	CO 03: The students also learn about Entropy temperature diagrams and Third law of thermodynamics
			❖ Thermodynamics potential	33	CO 04 : The students also learn about how laws of thermodynamics are used in a heat engine to transform heat into work.
				34	CO 05: Thermodynamic potentials. Enthalpy and Maxwell's relation and its application
			❖ Kinetic Theory of Gases	35	CO 06: Maxwell law of distribution of velocities in detail. Mean free path(Zeroth Order)
				36	CO 07: The students also learn about Clausius-Clapeyron Equation
			❖ Theory of Radiation	37	CO 08:The students also learn Blackbody radiation, Spectral distribution, Concept of Energy density, Derivation of Planck's law, Deduction of Wien's distribution law, Rayleigh-Jeans Law, Stefan Boltzmann Law and Wien's displacement law from Planck's law
			❖ Statistical Mechanics	38	CO 09: Apply the Thermodynamic behavior

					of Ideal, Bose, Fermi gases and applications of statistical mechanics.
				39	CO 10: Maxwell-Boltzmann law of distribution of velocities in detail.
				40	CO 11: To get the knowledge about Maxwell Boltzmann statistics, Bose Einstein statistics and Fermi Dirac Statistics
			❖ Practical	41	CO 12: Students would gain practical knowledge about the coefficient of thermal conductivity of Cu by Searle's Apparatus.
4TH	**PHY-G-CC-T-03/P-03 (Waves and Optics)**	**4T+2P =6**	❖ Superposition of Two Collinear Harmonic oscillations	42	CO 01: Student will learn Linearity and Superposition Principle.
				43	CO 02: Student will learn Superposition of two collinear oscillations having equal frequencies and (2) different frequencies (Beats).
			❖ Superposition of Two Perpendicular Harmonic Oscillations	44	CO 03: Student will learn Graphical and Analytical Methods.Lissajous Figures (1:1 and 1:2) and their uses.
			❖ Waves Motion-General	45	CO 04: Student will learn Transverse waves on a string. Travelling and standing waves on a string. Normal Modes of a string. Group velocity, Phase velocity. Plane waves.

					Spherical waves, Wave intensity
			❖ Fluids	46	CO 05: Student will learn about Surface Tension ,Poiseuille's formula and variation of viscosity of a liquid with temperature-lubrication.
			❖ Sound	47	CO 06: Student will learn Simple harmonic motion - forced vibrations and resonance - Fourier's Theorem - Application to saw tooth wave and square wave - Intensity and loudness of sound - Decibels - Intensity levels - musical notes - musical scale.
			❖ Wave Optics	48	CO 07 : Student will learn about Electromagnetic nature of light. Definition and Properties of wave front. Huygens Principle.
			❖ Interference	49	CO 08: Student will learn about Interference: Division of amplitude and division of wavefront. Young's Double Slit experiment. Lloyd's Mirror and Fresnel's Biprism. Phase change on reflection: Stokes' treatment. Interference in Thin Films: parallel and wedge-shaped films. Fringes of equal inclination (Haidinger Fringes); Fringes of equal thickness (Fizeau Fringes). Newton's Rings: measurement of wavelength and refractive index.
			❖ Michelson's Interferometer	50	CO 09: Student will learn (1) Idea of form of fringes (no theory needed), (2) Determination of

					wavelength, (3) Wavelength difference, (4) Refractive index, and (5) Visibility of fringes
			❖ Diffraction	51	CO 10: Student will learn Fresnel's Half-Period Zones for Plane Wave.
			❖ Polarization	52	CO 11: Student will learn about Theory of a Zone Plate and Multiple Foci of a Zone Plate.
				53	CO 12: Student will learn about Transverse nature of light waves. Plane polarized light – production and analysis. Circular and elliptical polarization.
			❖ Practical	54	CO 13: Students would gain practical knowledge about the Refractive Index of the Material of a Prism using Sodium Light,the value of Cauchy Constants,AND e the Coefficient of Viscosity of water by any method ETC

DISCIPLINE SPECIFIC ELECTIVE COURSE (DSE) (ANY TWO FOR PASS/GENERAL COURSE ONLY): (CREDIT: 06 EACH)

5TH	**PHY-G-DSE-T-01/P-01(Digital, Analog Circuits and Instrumentation)**	**4T+2P =6**	❖ Digital Circuits	55	CO 01:Student will learn about Difference between Analog and Digital Circuits. Binary Numbers. Decimal to Binary and Binary to Decimal Conversion, AND, OR and NOT Gates (Realization using Diodes and Transistor). NAND and NOR Gates as Universal Gates. XOR and XNOR Gates.
				56	CO 02:Student will learn about De Morgan's Theorems. Boolean Laws.

					Simplification of Logic Circuit using Boolean Algebra. Fundamental Products. Minterms and Maxterms. Conversion of a Truth Table into an Equivalent Logic Circuit by (1) Sum of Products Method and (2) Karnaugh Map.
				57	CO 03:Student will learn about Binary Addition. Binary Subtraction using 2's Complement Method). Half Adders and Full Adders and Subtrac B Btors, 4-bit binary Adder-Subtractor.
			❖ Semiconductor Devices and Amplifiers	58	CO 04: Student will learn about Semiconductor Diodes: P and N type semiconductors. Barrier Formation in PN Junction Diode. Qualitative Idea of Current Flow Mechanism in Forward and Reverse Biased Diode. PN junction and its characteristics. Static and Dynamic Resistance. Principle and structure of (1) LEDs, (2) Photodiode, (3) Solar Cell.
				59	CO 05:Student will learn about Bipolar Junction transistors: n-p-n and p-n-p Transistors. Characteristics of CB, CE and CC Configurations. Current gains α and β, Relations between α and β.
			❖ Operational Amplifiers (Black Box approach)	60	CO 06:Student will learn about Characteristics of an Ideal and Practical Op-Amp (IC 741), Open-loop and closed- loop Gain. CMRR, concept of Virtual ground. Applications of Op-Amps: (1) Inverting and non-inverting Amplifiers, (2) Adder, (3) Subtractor, (4) Differentiator, (5)

					Integrator, (6) Zero crossing detector.
				61	CO 07: Student will learn about Barkhausen's Criterion for Self-sustained Oscillations
				62	CO 08: Student will learn about Determination of Frequency of RC Oscillator
			❖ Instrumentations	63	CO 09: Student will learn about Introduction to CRO: Block Diagram of CRO. Applications of CRO.
				64	CO 10:Student will learn about Power Supply: Half-wave Rectifiers. Centre-tapped and Bridge Full-wave Rectifiers Calculation of Ripple Factor and Rectification Efficiency, Basic idea about capacitor filter, Zener Diode and Voltage Regulation.
				65	CO 11: Students would gain practical knowledge about To verify and design AND, OR, NOT and XOR gates using NAND gates. To minimize a given logic circuit. Half adder, Full adder and 4-bit Binary Adder AND Adder-Sub tractor using Full Adder I.C.
				66	CO 12: To design an astable multivibrator of given specifications using 555 Timer.
				67	CO 13: To design a monostable multivibrator of given specifications using 555 Timer.
			❖ Practical	68	CO 14:To study IV characteristics of PN diode, Zener and Light emitting diode.
				69	CO 15: To study the characteristics of a

					Transistor in CE configuration
				70	CO 16:To verify and design AND, OR, NOT and XOR gates using NAND gates.
	OR,PHY-G-DSE-T-01/P-01(Elements of Modern Physics)	**4T+2P =6**	❖ Quantum Mechanics	71	CO1. Explain Photo electric effects of light & Compton Scattering.
				72	CO 2. State the Heisenberg Uncertainty principle and able to explain the wave particle duality.
				73	CO 3. Contract the Schrodinger equation for non-relativistic particles.
				74	CO 4. Define the tunnelling effects.
				75	CO 5: Student learn about Probability and probability current densities in one dimension
			❖ Atomic and Nuclear Physics	76	CO 6: Conceptualise the structure of atoms and nucleus.
				77	CO 7: Understand the basic concept of Radioactivity.
				78	CO 8: Student will learn about calculation of energy levels for hydrogen like atoms and their spectra.
				79	CO 09: Student will learn about Size and structure of atomic nucleus and its relation with atomic weight; Impossibility of an electron being in nucleus as a consequence of the uncertainty principle
				80	CO 10: Student will learn about Nature of nuclear force, NZ graph, semi-empirical mass formula and binding energy

				81	CO 11: Student will learn about Mean life and half-life; α decay; β-decay - energy released, spectrum and Pauli's prediction of neutrino; γ-ray emission.
			❖ Practical	82	CO 12: To determine value of Boltzmann constant using V-I characteristic of PN diode
				83	CO 13: To determine work function of material of filament of directly heated vacuum diode.
				84	CO 14: To determine the ionization potential of mercury.And many concept about practical of radioactivity
6TH	**PHY-G-DSE-T-02/P-02(Solid State Physics)**	**4T+2P=6**	❖ Crystal Structure	85	CO 1 : Student will learn about Amorphous and Crystalline Materials.
				86	CO 2: Student will learn about Lattice Translation Vectors and Lattice with a Basis -Central and Non-Central Elements.
				87	CO 3: Student will learn Unit Cell, Miller Indices, Reciprocal Lattice, Types of Lattices.
				88	CO 4 : Student will learn Brillouin Zones and Diffraction of X-rays by Crystals.
				89	CO 5 : Student will learn about Bragg's Law and Atomic and Geometrical Factor.
			❖ Elementary Lattice Dynamic	90	CO 6 : Student will learn Lattice Vibrations and Phonons, Linear Monoatomic and Diatomic Chains.

				91	CO 7 : Student will learn Acoustical and Optical Phonons and Qualitative Description of the Phonon Spectrum in Solids.
				92	CO 8 : Dulong and Petit's Law, Einstein and Debye theories of specific heat of solids, T^3 law.
			❖ Magnetic Properties of Matter	93	CO 9: Student will learn about : Dia, Para, Ferri and Ferromagnetic Materials.
				94	CO 10: Student will learn Classical Langevin Theory of dia-and Paramagnetic Domains and Quantum Mechanical Treatment of Para magnetism
				95	CO 11 : Student will learn about Curie's law, Weiss's Theory of Ferromagnetism and Ferromagnetic Domains.
				96	CO 12 : Student will get an idea about Hysteresis and Energy Loss.
			❖ Dielectric Properties of Materials	97	CO 13 : Student will learn about Polarization, Local Electric Field at an Atom and Depolarization Field.
				98	CO 14: Student will learn about Classical Theory of Electric Polarizability.
				99	CO 15: Student will learn about Normal and Anomalous Dispersion.
				100	CO 16: Student will learn about Cauchy and Sellmeir relations, Langevin-Debye equation.
				101	CO 17: Student will learn Plasma Oscillations, Plasma Frequency, Plasmons, TO modes.

			❖ Ferroelectric Properties of Materials	102	CO 18: Student will learn about Curie-Weiss Law, Ferroelectric domains, PE hysteresis loop.
			❖ Elementary band theory	103	CO 19: Student will learn about Conductor, Semiconductor (P and N type) and insulator.
				104	CO 20: Student will learn about Conductivity of Semiconductor, mobility and Hall Effect.
			❖ Superconductivity	104	CO 21: Student will learn about Superconductors and superconductivity.
				105	CO 26: Student will learn Meissner effect.
				106	CO 27: Student will learn Critical Temperature and Critical magnetic field of superconductor.
				107	CO 28: Student will learn Type I and type II Superconductors, London's Equation and Penetration Depth
				108	CO 29:Student will learn about Idea of BCS Theory(No derivation)
			❖ Practical	109	CO 30:Students would gain practical knowledge about Solid State Physics
	OR,PHY-G-DSE-T-02/P-02(Nuclear and Particle Physics)	**4T+2P =6**	❖ General Properties of Nuclei	110	CO 01: Student will learn about Constituents of nucleus and their Intrinsic properties, quantitative facts about mass, radii, charge density (matter density), binding energy, average binding energy and its variation with mass number, main features of binding energy versus mass number curve

			❖ Nuclear Models	111	CO 02: Student will learn about liquid drop model approach, semi empirical mass formula and significance of its various terms, condition of nuclear stability, two nucleon separation energies, Fermi gas model (degenerate fermion gas, nuclear symmetry potential in Fermi gas).
				112	CO 03: Student will learn about basic assumption of shell model, concept of mean field, residual interaction, concept of nuclear force.
			❖ Radioactivity decay	113	CO 04:Student will learn about (a) Alpha decay: basics of α-decay processes, theory of α-emission, Gamow factor, Geiger Nuttall law, α-decay spectroscopy. (b) β-decay: energy kinematics for β -decay, positron emission, electron capture, neutrino hypothesis. (c) Gamma decay: Gamma rays emission & kinematics, internal conversion.
			❖ Nuclear Reaction	114	CO 05: Student will learn about types of Reactions, Conservation Laws, kinematics of reactions, Q-value, reaction rate, reaction cross section, Concept of compound and direct reaction, resonance reaction, Coulomb scattering(Rutherford scattering).
			❖ Nuclear Astrophysics	115	CO 06: Student will learn about Early universe, primordial nucleosynthesis (particle nuclear interactions), stellar nucleosynthesis, concept of gamow window, heavy

					element production: r- and s- process path.
			❖ Interaction of Nuclear Radiation with matter	116	CO 07:Student will learn about Energy loss due to ionization (Bethe- Block formula), energy loss of electrons, Cerenkov radiation. Gamma ray interaction through matter, photoelectric effect, Compton scattering, pair production, neutron interaction with matter
			❖ Detector for Nuclear Radiation	117	CO 08: Student will learn about Gas detectors: estimation of electric field, mobility of particle, for ionization chamber and GM Counter.
				118	CO 09:Student will learn about Semiconductor Detectors (Si and Ge) for charge particle and photon detection (concept of charge carrier and mobility), neutron detector.
			❖ Particle Accelerators	119	CO 10: Student will learn about accelerator facility available in India: Van-de Graaff generator (Tandem accelerator), Linear accelerator, Cyclotron, Synchrotrons.
			❖ Particle physics	120	CO 11: Student will learn about Particle interactions; basic features, types of particles and its families.
				121	CO 12:Student will learn about Symmetries and Conservation Laws: energy and momentum, angular momentum, parity, baryon number, Lepton number, Isospin, Strangeness and charm, concept of quark model, color quantum number and gluons.

			❖ Practical	122	CO 13 Student will learn about :Students would gain practical knowledge about N uclear and Particle Physics

Skill Enhancement Course [PHY-G- SEC-T-(01-04)

To be studied in GENERAL/PASS course] (Credit: 02 each)

PHY-G-SEC-T-01 **Renewable Energy & Energy Harvesting**	**2T= 2**	❖ **Fossil fuels and Alternate Sources of energy:**	123	**CO 01**: 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
		❖ **Solar energy:** ❖ **Wind Energy harvesting:**	124	**CO 02:** The students would gain the knowledge of Fossil fuels and nuclear energy, their limitation, need of renewable energy, non-conventional energy sources. An overview of developments in Offshore Wind Energy, Tidal Energy, Wave energy systems, Ocean Thermal Energy Conversion, solar energy, biomass, biochemical conversion, biogas generation, geothermal energy tidal energy, Hydroelectricity.
		❖ **Ocean Energy:** ❖ **Geothermal Energy:**	125	**CO 03:** The students would gain the knowledge of Solar energy, its importance, storage of solar energy, solar pond, non convective solar pond, applications of solar pond and solar energy, solar water heater, flat plate collector, solar distillation, solar cooker, solar green houses, solar cell, absorption air conditioning. Need and characteristics of photovoltaic (PV) systems, PV models and equivalent circuits, and sun tracking systems
		❖ **Hydro Energy:**	126	**CO 04:** The Students Would Gain The Knowledge Of Fundamentals Of Wind

		❖ **Piezoelectric Energy harvesting:** ❖ **Electromagnetic Energy Harvesting**		Energy, Wind Turbines And Different Electrical Machines In Wind Turbines, Power Electronic Interfaces, And Grid Interconnection Topological.Also Learn About Tide Characteristics And Statistics, Tide Energy Technologies, Ocean Thermal Energy, Osmotic Power, Ocean Bio-Mass. 127 **CO 05 :** The Students Would Gain The Knowledge Of Linear generators, physics mathematical models, recent applications
PHY-G-SEC-T-02 **Weather Forecasting**	**2T**	❖ **Introduction to atmosphere:** ❖ **Measuring the weather:** ❖ **Weather systems:** ❖ **Climate and Climate Change:** ❖ **Basics of weather forecasting:**	128	**CO 01:** 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
			128	**CO 02:** Student learn about Elementary idea of atmosphere: physical structure and composition; compositional layering of the atmosphere
			129	**CO 03:** Student learn about forces acting to produce wind and measuring wind speed and direction
			130	**CO 04:** Student learn about Weather forecasting: analysis and its historical background; need of measuring weather; types of weather forecasting; weather forecasting methods; criteria of choosing weather

				station; basics of choosing site and exposure;
PHY-G-SEC-T-03 **Electrical Circuits & Network Skills**	**2T**	❖	**131**	**CO 01:** The Students Would Gain The Knowledge Of Voltage, Current, Resistance, and Power. Ohm's law. Series, parallel, and series-parallel combinations. AC Electricity and DC Electricity. Familiarization with multimeter, voltmeter and ammeter.AND Main electric circuit elements and their combination. Rules to analyze DC sourced electrical circuits. Current and voltage drop across the DC circuit elements. Single-phase and three-phase alternating current sources. Rules to analyze AC sourced electrical circuits. Real, imaginary and complex power components of AC source. Power factor. Saving energy and money.
			132	**CO 02:** Student will learn about Single-phase, three-phase & DC motors. Basic design. Interfacing DC or AC sources to control heaters & motors. Speed & power of ac motor.
			133	**CO 03:** Student wil learn about Different types of conductors and cables. Basics of wiring-Star and delta connection. Voltage drop and losses across cables and conductors. Instruments to measure current, voltage, power in DC and AC circuits. Insulation. Solid and stranded cable. Conduit. Cable trays. Splices: wirenuts, crimps, terminal blocks, split bolts, and solder. Preparation of extension board.

PHY-G-SEC-T-04 **Basic Instrumentation Skills**	**2T**	❖ **Basic of Measurement** ❖ **Electronic Voltmeter** ❖ **Cathode Ray Oscilloscope** ❖ **Signal Generators and Analysis Instruments** ❖ **Impedance Bridges & Q-Meters**	**134**	**CO 01:** Student will learn about Principles of measurement of dc voltage and dc current, ac voltage, ac current and resistance. Specifications of a multi meter and their significance.
			135	**CO 02:** Student will learn about Advantage over conventional multimeter for voltage measurement with respect to input impedance and sensitivity. Principles of voltage, measurement (block diagram only). Specifications of an electronic Voltmeter/ Multimeter and their significance.
			136	**CO 03:** Student will learn about Block diagram of basic CRO. Construction of CRT, Electron gun, electrostatic focusing and acceleration (Explanation only- no mathematical treatment), brief discussion on screen phosphor, visual persistence & chemical composition. Time base operation, synchronization.
			137	**CO 04:** Student will learn about Use of CRO for the measurement of voltage (dc and ac frequency, time period. Special features of dual trace, introduction to digital oscilloscope, probes. Digital storage Oscilloscope: Block diagram and principle of working.

		❖ **Digital Instruments** ❖ **Digital Multimeter**	**138**	**CO 05:** Student will learn about Block diagram, explanation and specifications of low frequency signal generators. pulse generator, and function generator.
			139	**CO 06:** Student will learn about Block diagram of bridge. working principles of basic (balancing type) RLC bridge. Specifications of RLC bridge. Block diagram & working principles of a Q-Meter. Digital LCR bridges.
			140	**CO 07:**Student will learn about Principle and working of digital meters. Comparison of analog & digital instruments. Characteristics of a digital meter. Working principles of digital voltmeter.
			141	**CO 08:** Student will learn about 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.