Girijananda Chowdhury University, Assam

Course Structure and detailed syllabi for three semesters for

Four Year Under Graduate Programme (FYUGP) in Physics

SUMMARISED COURSE STRUCTURE									
SEM	**DSC (Major)**	**DSC (Minor)**	**MDC**	**AEC**	**SEC**	**VAC**	**Internship/ Dissertation/ project**	**Credit**	**Exit option**
I	4	4+4	3	2	3	2		22	Certification
II	4	4+4	3	2	3	2		22	
III	4	4+4	3	2	3	-		20	Diploma
IV	16	-	-	2		2		20	
V	16	-	-		-		4	20	Bachelor Degree
VI	20	-	-	-	-	-		20	
Credit							**Total**	**124**	
VII	8	4+4	-	-	-	-	Project/Dissert ation I (4)/ Core(4)	20	Bachelor Degree (Honours)/ Honours (with Research)
VIII	12	-	-	-	-	-	Project/Dissert ation II (8)/ Core(4+4)	20	
Credit							**Total**	**164**	

YEAR – 1

First Semester				
Code	**Course**	**Category of Course**	**L-T-P**	**Total Credit**
	Introductory Physics	Core	4-0-0	4
	*MINOR-1	Minor	4-0-0	4
	*MINOR-2	Minor	4-0-0	4
	**MDC-I	MDC	3-0-0	3
	AEC-I	AEC	2-0-0	2
	SEC-I	SEC	3-0-0	3
	VAC-I	VAC	2-0-0	2
			TOTAL	22

Second Semester				
Code	**Course**	**Category of Course**	**L-T-P**	**Total Credit**
	Physics in Everyday Life	Core	4-0-0	4
	*MINOR-3	Minor	4-0-0	4
	*MINOR-4	Minor	4-0-0	4
	**MDC-II	MDC	3-0-0	3
	AEC-II	AEC	2-0-0	2
	SEC - II	SEC	3-0-0	3
	VAC -II	VAC	2-0-0	2
			TOTAL	22

EXIT OPTION WITH CERTIFICATION. However, such students who desire to exit after 1 year of study need to undertake a vocational course (4 credits).

***Refer AnnexureI, ****Refer AnnexureII**

YEAR – 2

Third Semester				
Code	**Course**	**Category of Course**	**L-T-P**	**Total Credit**
	Mathematical Physics-I	Core	3-0-2	4
	*MINOR-5	Minor	3-0-2	4
	*MINOR-6	Minor	4-0-0	4
	**MDC-III	MDC	3-0-0	3
	AEC – III	AEC	2-0-0	2
	SEC - III	SEC	3-0-0	3
			TOTAL	20

Fourth Semester				
Code	**Course**	**Category of Course**	**L-T-P**	**Total Credit**
	Mechanics	Major/core	4-0-0	4
	Electricity and Magnetism	Major/core	4-0-0	4
	Mechanics-Lab	Major/core	0-0-4	2
	Electricity and Magnetism-Lab	Major/core	0-0-4	2
	***Elective-1	Major/core	4-0-0	4
	AEC-IV	AEC	2-0-0	2
	VAC-III	SEC	2-0-0	2
			TOTAL	20

*** Refer Annexure-I, ** Refer Annexure-II, ***Refer Annexure-III**

EXIT OPTION WITH DIPLOMA. However, such students who desire to exit after 2 years of study need to undertake a vocational course (4 credits).

YEAR – 3

Fifth Semester				
Code	**Course**	**Category of Course**	**L-T-P**	**Total Credit**
	Semiconductor Physics	Major/core	4-0-0	4
	Waves and Optics	Major/core	4-0-0	4
	Semiconductor Physics-Lab	Major/core	0-0-4	2
	Waves and Optics-Lab	Major/core	0-0-4	2
	***Elective-2	Major/core	4-0-0	4
	Internship	Major/Core	0-0-8	4
			TOTAL	20

***Refer Annexure III**

Sixth Semester				
Code	**Course**	**Category of Course**	**L-T-P**	**Total Credit**
	Thermal Physics	Major/core	4-0-0	4
	Electronics	Major/core	4-0-0	4
	Quantum Mechanics	Major/core	4-0-0	4
	Thermal Physics- Lab	Major/core	0-0-4	2
	Electronics-Lab	Major/core	0-0-4	2
	***Elective-3	Major/core	4-0-0	4
			TOTAL	20

***Refer Annexure III**

EXIT OPTION WITH THREE YEARS BACHELOR'S DEGREE

(A)FOUR YEARS BACHELOR'S DEGREE (HONOURS)

Seventh Semester				
Code	**Course**	**Category of Course**	**L-T-P**	**Total Credit**
	Condensed Matter Physics	Major/core	3-0-2	4
	Research Methodology	Major/core	4-0-0	4
	***Elective-4	Minor	4-0-0	4
	*MINOR-7	Minor	3-0-2	4
	*MINOR-8	Major/core	4-0-0	4
			TOTAL	20

***Refer Annexure I, *** Refer Annexure III**

Eight Semester				
Code	**Course**	**Category of Course**	**L-T-P**	**Total Credit**
	Electromagnetic Theory	Major/core	3-0-2	4
	Statistical Mechanics	Major/core	3-0-2	4
	Modern Physics	Major/core	3-0-2	4
	Introductory Astrophysics	Major/core	4-0-0	4
	Mathematical Physics-II	Major/core	3-0-2	4
			TOTAL	20

EXIT OPTION WITH FOUR YEARS BACHELOR DEGREE (HONOURS)

(B)FOUR YEARS BACHELOR'S DEGREE (HONOURS WITH RESEARCH)

Seventh Semester				
Code	**Course**	**Category of Course**	**L-T-P**	**Total Credit**
	Condensed Matter Physics	Major/core	3-0-2	4
	Research Methodology	Major/core	4-0-0	4
	Research Project(Phase-I)	Minor	0-0-8	4

	*MINOR-7	Minor	3-0-2	4
	*MINOR-8	Major/core	4-0-0	4
			TOTAL	20

***Refer Annexure I**

Eight Semester				
Code	**Course**	**Category of Course**	**L-T-P**	**Total Credit**
	Electromagnetic Theory	Major/core	3-0-2	4
	Statistical Mechanics	Major/core	3-0-2	4
	Modern Physics	Major/core	3-0-2	4
	Research Project(Phase-II)	Major/core	0-0-16	8
			TOTAL	20

EXIT OPTION WITH DEGREE (HONOURS WITH RESEARCH)

LIST OF COURSES:

ANNEXURE-I: (MINOR COURSES)				
Course	**Name of the Course**	**Semester**	**L-T-P**	**Total Credit**
MINOR-1	Introductory Physics	I	4-0-0	4
MINOR-2	Renewable Energy Resources	I	4-0-0	4
MINOR-3	Physics in Everyday Life	II	4-0-0	4
MINOR-4	Atmospheric Physics	II	4-0-0	4
MINOR-5	Mathematical Physics-I	III	3-0-2	4
MINOR-6	Sports Science	III	4-0-0	4
MINOR-7	Mechanics	VII	3-0-2	4
MINOR-8	Electricity and Magnetism	VII	3-0-2	4

ANNEXURE-II: (MDC COURSES)				
Course	**Name of the Course**	**Semester**	**L-T-P**	**Total Credit**
MDC-1	Physics For All	I	3-0-0	3

MDC-2	Physics of Earth	II	3-0-0	3
MDC-3	Indian Contribution to Science	III	3-0-0	3

ANNEXURE-III: (ELECTIVE COURSES) **(any one course from the options, a and b or a, b, c)**				
Course	**Name of the Course**	**Semester**	**L-T-P**	**Total Credit**
Elective-1	(a) Laser and Nonlinear Optics (b) Computational Physics (c) Introduction to Nanoscience	IV	For (a) and (c) 4-0-0 For (b) 2-0-4	4
Elective-2	(a) Spectroscopy (b) X-ray Crystallography	V	4-0-0	4
Elective -3	(a) Plasma Physics (b) Sustainability Science	VII	4-0-0	4
Elective -4	(a) Nuclear Physics (b) Advanced Quantum Mechanics	VIII	4-0-0	4

Detailed Syllabi for three semesters:

SEMESTER-I

DSCC (Major+Minor)	**Introductory Physics**	**L**	**T**	**P**	**C**
		4	**0**	**0**	**4**

Pre-requisite: Basic Science

Course Objectives:

1. To provide the fundamental knowledge of measurements and dimensions
2. To enable students to develop an understanding of different types of matter and their properties.
3. To make students familiar with motion, force and work from the point of view of Physics
4. To introduce the basic ideas about sound propagation through various media.

Course Outcome:

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

CO1: measure some physical properties of matter.
CO 2: understand the fundamental properties of matter.
CO 3: grasp the fundamental concepts of motion, force and work and gravitation
CO 4: understand the basics of sound propagation

Module 1: PHYSICAL WORLD AND ITS MEASUREMENTS	**8 hours**
Physics and its scope, Units and Measurements, Errors in Measurements, Dimensional Analysis **Activity :** 1) To measure fundamental quantities – length (using slide calipers), diameter (using screw gauge), time (using stop clock), weight (using physical balance)	
Module 2: MATTER – NATURE AND BEHAVIOUR	**20 hours**
Definition of matter, solid, liquid and gas, characteristics – shape, volume and density, change of state – melting (absorption of heat, freezing, evaporation, condensation, sublimation Elements, compounds and mixtures – heterogeneous and homogeneous mixtures Atoms and molecules, Chemical formula for common compounds, atomic and molecular masses Electrons, protons and neutrons, valency, atomic number and mass number, isotopes and isobars. **Activity :** 1) Determination of melting point of ice and boiling point of water. 2) Preparation of mixture and compound	
Module 3: MOTION, FORCE AND WORK	**22 hours**
Distance and displacement, velocity, uniform and non-uniform motion along a straight line, acceleration, distance-time and velocity-time graphs for uniform motion and uniformly accelerated motion, elementary idea of uniform circular motion. Gravitation, Universal Law of Gravitation, force of gravitation of the earth (gravity), acceleration due to gravity, mass and weight, free fall Work done by a force, energy, power, kinetic and potential energy, Law of conservation of energy (excluding commercial unit of energy)	
Module 4: SOUND	**10 hours**
Nature of sound and its propagation through various media, speed of sound, range of hearing in humans, ultrasound, reflection of sound, echo	
Total Lecture hours	**60 hours**
Activity : 1) Determination of melting point of ice and boiling point of water. 2) Preparation of mixture and compound.	

Text Book(s)	
1.	Science Textbook for classes IX and X, NCERT Publication
2.	Physics, Part I for class XI, NCERT Publication
Reference Books	
1.	Fundamentals of Physics, David Halliday, Robert Resnick, Jearl Walker, (John Wiley & Sons Inc.)

DSCC (Minor)	**Renewable Energy Resources**	**L**	**T**	**P**	**C**
		4	**0**	**0**	**4**

Pre-requisite: Basic Science

Course Objectives:

1. To provide knowledge about the depleting non-renewable energy sources and alternative energy sources
2. To enable students to develop an understanding of the different applications of renewable energy
3. To make students aware of wind energy and its harvesting and solar energy
4. To develop fundamental idea regarding ocean energy and its potential as an energy resource.
5. To provide fundamental knowledge regarding geothermal energy and hydro energy.

Course Outcome:

After successful completion of the course, the students will be able to CO1: understand and appreciate the need to shift to renewable energy resources CO 2: understand the fundamentals of solar energy generation CO 3: understand the harvesting of wing energy CO 4: develop fundamental ideas about energy in the ocean waves CO 5: develop fundamental knowledge regarding geothermal energy and hydro energy.	
Module 1: FOSSIL FUELS AND ALTERNATE SOURCES OF ENERGY	**9 hours**
Fossil fuels and nuclear energy and their limitation, need of renewable energy, non-conventional energy sources. An overview of developments in offshore wind energy, tidal energy, wind energy systems, solar energy, biomass, biochemical conversion, biogas generation, hydroelectricity	
Module 2: SOLAR ENERGY	**18 hours**
Solar energy, its importance, storage of solar energy, solar pond, solar water heater, solar cooker, solar green houses, solar cell, absorption air conditioning, need and characteristics of photovoltaic(PV) systems, PV models and equivalent circuits, sun tracking systems. **Activity :** 1) To build a solar greenhouse 2) To build a solar box cooker	
Module 3: WIND ENERGY HARVESTING	**18 hours**
Fundamentals of wind energy, wind turbines and different electrical machines in wind turbines, power electronic interfaces and grid interconnection topologies, wind energy conversion, wind mill, basic components of wind mill conversion system, types of wind mills, conversion and efficiency. **Activity :** 3) To construct a vertical wind turbine.	
Module 4: OCEAN ENERGY	**8 hours**
Ocean energy potential against wind and solar, wave characteristics and statistics, wave energy devices. Tide characteristics and statistics, tide energy technologies, ocean thermal energy, osmotic power, ocean bio-mass	
Module 5: GEOTHERMAL ENERGY AND HYDRO ENERGY	**7 hours**
Geothermal resources, geothermal technologies Hydropower resources, hydropower technologies, environmental impact of hydro power sources.	
Total Lecture hours	**60 hours**
Text Book(s)	
1. Non-conventional Energy Sources – G. D Rai, Khanna Publications, 2001 2. Non-conventional Energy Resources – B. H. Khan, McGrae Hill, 3rd edition, 2017	
Reference Books	
1. Solar Energy – Suhas P. Sukhative, Tata McGraw Hill Publishing Company Limited. 2. Wind Energy System – Gary L. Johnson, Printice Hall Inc., New Jersey, 1985.	

MDC	**PHYSICS FOR ALL**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
Pre-requisite: Preliminary concept of Science and Mathematics.					
Course Objective (1)To enhance the fundamental knowledge of systems of units to be used in daily life. (2) To have a broader concept of laws to understand planetary motion, satellites and Global Positioning System. (3)To enhance the knowledge of basics heat and thermodynamics and understanding basics of home appliances. (4) To enhance the knowledge of sound and its propagation. (5) To develop the concept of different phenomena associated with light.					
Course Outcome:					

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

CO1: to understand different systems of units and their inter-conversion relations.
CO 2: to learn the basics of kinematics to relate with satellites and Global Positioning System.
CO 3: to understand the basic theory of heat, temperature, different scales and few household appliances.
CO 4: to understand sound, its
CO 5: propagation to understand different phenomena of light and relate with nature and objects.

Module 1: Units and Measurements	**10 hours**
CGS, FPS, MKS, SI system of units, their inter conversion relations, Dimensional formula of physical quantities. Dimension analysis and its applications to simple problems, Problems on conversion among system of units, . Measured value and absolute value; Accuracy and Precision, Error in measurement and its Types, Error estimation formulae.	
Module 2: Mechanics	**10 hours**
Scalar and Vector quantities, distance, displacement, speed, velocity, acceleration, Circular motion, rotational motion , preliminary idea of angular displacement, velocity, Planetary motion, Gravitational force, acceleration due to gravity in different places, concept of inertia, Newton's laws, natural and artificial satellites, examples, introduction to global positioning system	
Module 3: Heat	**9 hours**
Concepts of Heat and Tempearture, Units of temperature: Centigrade, Fahrenheit and Kelvin scale, their inter-conversion formulae, Heat transfer processes: conduction, convection and radiation, explanation of change of states of matter, working principles of Refrigerator, Air Conditioner, Microwave Oven.	
Module 4: Sound	**8 hours**
Longitudinal nature of sound, Frequency, and its unit and Pitch, Loudness and Intensity, Production and detection of sound , Audible frequency range, infrasonic and ultrasonic sounds, Noise and Music, Principle of Loudspeaker and Microphone, vibration and production of sound in Musical Instruments	
Module 5: Light	**8 hours**
Reflection, Refraction and Dispersion of light, Application of formation of images by plane mirror, convex and concave mirror, formation of rainbow, scattering of colours during sunrise and sunset, blue colour of sky, light production in bulb, different types of light bulbs, Laser, LED, Solar spectrum	
Total Lecture hours	**45 hours**

Text Book(s)

1.	Conceptual Physics, Paul G. Hewitt, Pearson Education, 2017.
2	Physics Made Simple: A complete Introduction to the basic principles of this fundamental science, Christopher G. De Pree, Crown Publisher, 2005
3.	Concept of Physics, H.C Verma, Bharat Bhawan Publisher, 2021

Reference Books

1.	The Basics of Physics, Rusty L. Myers, Greenwood Press, 2005
2.	AK Basics of Physics, Anil Kumar Kakodiya, 2023.

SEMESTER-II

DSCC (major+ minor)	**PHYSICS IN EVERYDAY LIFE**	**L**	**T**	**P**	**C**
		4	**0**	**0**	**4**

Pre-requisite: Preliminary concept of Science and Mathematics

Course Objectives:

(1) To enhance the fundamental knowledge of laws of motion which is helpful to understand the excitement in related activities of life.
(2)To have an overview of heat and temperature in understanding the theory behind thermometers, woodstoves etc.
(3)To develop a concept on sound waves to relate with different instruments.
(4)To create more awareness about electricity and magnetism to relate the theory to practical life.
(5)To enhance the theory of light propagation, formation of images, lasers etc.

Course Outcome:

After successful completion of the course, the students will be able
CO1: to apply the Newton's laws to understand various activities of motion.
CO 2: to understand the concept of heat and temperature in understanding temperature scales and phases.
CO 3: to apply the basics of sound waves in musical instruments.
CO 4: to understand the concepts of electricity, magnetism and its relevance in daily activities.
CO 5: to understand the basics of scattering of light, formation of images, lasers and optical fibres.

Module 1: The laws of motion	**15 hours**
Skating: Inertia, vector quantities, position, velocity, force, acceleration, mass, net force, Newton's first and second laws, inertial frames of reference, unit Falling Bodies: gravity, weight, uniform acceleration, projectile motion, vector components, support forces, Newton's third law, energy, work, conservation of energy, kinetic and potential energies, gravitational potential energy, ramp & its mechanical advantage Seesaws: rotational inertia; angular velocity; torque; angular acceleration; rotational mass, net torque; Newton's first, second, and third laws of motion; centres of mass and gravity; levers; balance Rockets and Space Travel: reaction forces, law of universal gravitation, elliptical orbits, escape velocity, Kepler's laws, speed of light, concepts of general and special relativity, equivalence principle. (Explanation is to be done with related experiments)	
Module 2: Heat and Temperature	**10 hours**
Scales: Thermal energy, Heat and Temperature, different scales of measuring temperature & their relations. Woodstoves: thermal equilibrium, chemical bonds and reactions, conduction, thermal conductivity, convection, radiation, heat capacity Water, Steam and Ice: phases of matter, phase transitions, melting, freezing, condensation, evaporation, relative humidity, latent heats of melting and evaporation, sublimation, deposition, boiling, Airconditioners. (Explanation is to be done with related experiments)	
Module 3: Sound	**10 hours**
Waves: wave motion, transverse and longitudinal waves. Clocks : time and space, natural resonance, harmonic oscillators, simple harmonic motion and its frequency, period, amplitude Musical Instruments: sound; music; vibrations in strings, air, and surfaces; fundamental and higher-order modes; harmonic and non harmonic overtones; sympathetic vibration; standing and	

travelling waves; transverse and longitudinal waves; velocity and wavelength of mechanical waves; superposition, different types of musical instruments (Explanation is to be done with related experiments)	
Module 4: Electricity and magnetism	**15 hours**
Static Electricity: electric charge, electrostatic forces, Coulomb's law, electrostatic potential energy, voltage, charging by contact, electric polarization, electrical conductors and insulators Current: electric current; electric circuits; direction of current flow; electrical resistance; voltage drops; voltage rise; relationship among current, voltage, and power; Ohm's law; resistors and their series and parallel combinations. Household Magnets: earth as a magnet, magnetic pole, magnetostatic forces, Coulomb's law for magnetism, ferromagnetism, magnetic polarization, magnetic domains, magnetic materials, magnetic fields, magnetic flux , relationship between electric and magnetic fields Electric power distribution: direct and alternating currents, superconductivity, transformers, induction, magnetic field energy, relationship between changing magnetic fields and electric fields, Lenz's law, inductors, induced emf, electrical safety, generators, motors (Explanation is to be done with related experiments)	
Module 5: Light	**10 hours**
Reflection and refraction, index of refraction, dispersion, and interference in electromagnetic waves Cameras: eye and camera, refracting optics, converging lenses, real images, focus, focal lengths, f-numbers, the lens equation, diverging lenses, virtual images, light sensors, vision and vision correction, different types of defects in human eye. LEDs and Lasers, optical fibres, metals, insulators, and semiconductors; photoconductors; p-n junction diodes; light-emitting diodes; incoherent and coherent light; spontaneous and stimulated emission; population inversion; laser amplification and oscillation; laser safety, optical fibre: structure and light propagation (Explanation is to be done with related experiments)	
Total Lecture hours	**60 hours**

Text Book(s)

1.	Physics in our daily lives, Umme Ammara, gurucool publishing
2	The Physics of Everyday Things, James KaKalios, RH US(2017)
3.	Physics in Everyday Life, Shaswant Goswami, Vedang Sati, (2016)
4.	How Things Work The Physics of Everyday Life, Louis A. Bloomfield, Wiley publishing(WileyPLUS)

Reference Books

1.	Feynmann Lectures on Physics , Matthew Sands, Richard Feynmann and Robert B.LeightonVol I, Vol II, Vol III.
2.	Storm in a Teacup: The Physics of Everyday Life, Helen Czerski, Publisher Black Swan

DSCC (Minor)	Atmospheric Physics	L	T	P	C
		4	0	0	4

Pre-requisite: Basic Physics

Course Objectives:

1. To provide fundamental knowledge regarding the earth's atmosphere
2. To give an in-depth introduction of atmospheric thermodynamics
3. To introduce atmospheric aerosols and analyse its impact on the global climate
4. To introduce students to different methods of atmospheric observation

Course Outcome:

After successful completion of the course, the students will be able to CO1: get acquainted with the different layers of the atmosphere and the related physical phenomenon. CO 2: know the thermodynamics of the atmosphere. CO 3: know about atmospheric aerosols and clouds and impact on climate CO 4: learn principles and applications of remote sensing and meteorological measurements	
Module 1: INTRODUCTION TO EARTH'S ATMOSPHERE	**14 hours**
State of the earth's atmosphere: main constituents of dry air, CO2, ozone, water vapour, aerosols; vertical thermal structure of the atmosphere : troposphere, stratosphere, mesosphere, thermosphere and exosphere; environmental lapse rate, hydrostatic equilibrium, hydrostatic equation	
Module 2: ATMOSPHERIC THERMODYNAMICS	**18 hours**
Gas Laws, Ideal Gas Law, Dalton's Law, First Law of Thermodynamics, equivalence between heat and work, thermal capabilities, isothermal, isochoric, isobaric transformation, adiabatic transformation, Poisson relation, thermodynamic properties of water, latent heat, Clausius-Clapeyron's relation, Approximation and consequences of Clausius-Clapeyron relation, moist air, mean molecular weight of dry and moist air.	
Module 3:AEROSOL AND CLOUD	**14 hours**
Classification of atmospheric aerosol, production and removal mechanisms, concentration and size distribution, adsorption and scattering of solar radiation, Rayleigh scattering and Mie scattering, Beer-Bouguer-Lambert Law Macro and microphysical characteristics of cloud: droplet growth and cloud dissipation mechanism, radiative transfer in cloudy atmosphere, role of aerosol and cloud in climate.	
Module 4: ATMOSPHERIC OBSERVATIONS	**14 hours**
General principles of meteorological measurements and observational procedures, conventional and self recording measurements of atmospheric variables, upper air measurements: pilot balloons, radiosonde, ozonesonde, GPS sonde. Surface based remote sensing: working principle and applications of LIDAR, SONAR, Water RADAR, radiological satellites, multiscanner radio-meters and their applications in the observation of weather parameters.	
Total Lecture hours	**60 hours**
Text Book(s)	
1. Physics of the Atmosphere and Climate – Murray L. Salby, Cambridge University Press 2. Introduction to Atmospheric Physics – D.G. Andrews, Cambridge University Press	
Reference Books	
1. An Introduction to Dynamic Meteorology- Vol. 1., James R. Holton. 2. Remote Sensing of Aerosols, Clouds and Precipitation – T. Islam, Y. Hu, A. A. Kokhanovsky, J. Wang (Eds.) Elsevier	

MDC	**Physics of the Earth**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Pre-requisite: Basic Physics

Course Objectives:

1. To provide fundamental knowledge regarding the earth and the universe
2. To give an in-depth introduction structure of the earth and its components
3. To introduce dynamical processes related to solid earth, hydrosphere, atmosphere and biosphere
4. To make students aware of different factors disturbing the earth's ecosystem

Course Outcome:

After successful completion of the course, the students will be able to CO1: gain basic knowledge about planet earth and the atmosphere CO 2: know the structure of different components of the earth. CO 3: learn about dynamical processes related to the earth CO 4: identify different factors which create threats to the stability of our ecosystem.	
Module 1: THE EARTH AND THE UNIVERSE	**12 hours**
Origin of universe, creation of elements and earth. A holistic understanding of our dynamic planet through Astronomy, Geology, Meteorology and Oceanography. General characteristics and origin of the universe, the Big Bang Theory. Age of the universe and Hubble constant, formation of galaxies, earth's orbit and spin, Asteroids: origin, types and examples, meteorites and asteroids, earth in the solar system, origin, size, shape, mass, density, rotational and revolution parameters and its age.	
Module 2: STRUCTURE	**11 hours**
The Solid Earth: Mass, dimensions, shape and topography, internal structure, magnetic field, geothermal energy The Hydrosphere: The oceans, their extent, depth, volume, chemical composition, river systems The Atmosphere: Layers, variation of temperature with altitude, variation of density and pressure with altitude, cloud formation The Cryosphere: Polar caps and ice sheets, mountain glaciers, permafrost.	
Module 3: DYNAMICAL PROCESSES	**15 hours**
The Solid Earth: Origin of the magnetic field, source of geothermal energy, convection of the earth's core and production of its magnetic field, mechanical layering of the earth, introduction of geophysical methods of earth investigation, concept of plate tectonics; types of earth movements, Earthquake and earthquake belts, Richter scale, geophones. **Hydrosphere**: Ocean circulations, oceanic current system and effect of Corioli's force, tides, tsunamis **The Atmosphere**: Atmospheric circulation, weather and climate changes, earth's temperature and greenhouse effect **Biosphere**: water cycle, carbon cycle	
Module 4: DISTURBING THE EARTH	**7 hours**
Contemporary dilemmas – (a) human population dynamics (b) Atmosphere: greenhouse gas emissions, climate change, air pollution (c) Hydrosphere: fresh water depletion, water pollution (d) Geosphere: chemical effluents, nuclear waste (e) Bioshpere: biodiversity loss, deforestation. Robustness and fragility of ecosystems.	
Total Lecture hours	**45 hours**
Text Book(s)	
1. Physics of the Earth, Frank D. Stacey, Paul M. Davis, 2008, Cambridge University Press 2. Planet Earth, Cosmology, Geology and the Evolution of Life and Environment, C. Emiliani, 1992, Cambridge University Press.	
Reference Books	
1. The Blue Planet : An Introduction to Earth System Science, Brian J. Skimnner, Stephen C. Portere, 1994, John Wiley & Sons 2 The Solid Earth: An Introduction to Global Geophysics, C. M. R. Fowler, 1990, Cambridge University Press	

SEMESTER-III

DSCC (Major+Minor)	Mathematical Physics I	L	T	P	C
		3	0	2	4

Pre-requisite: Basic Physics and Mathematics

Course Objectives:

1. To provide the fundamental knowledge of calculus and differential equations.
2. To enable students to learn different properties vectors and their differentiation and integration.
3. To make students familiar with orthogonal curvilinear coordinates.
4. To introduce the dirac delta function and its properties.

Course Outcome:

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

CO1: Apply the fundamentals of Calculus to solve simple problems.
CO 2: Learn the basics of vector differentiation and vector integration and their applications.
CO 3: Express gradient, divergence and curl in orthogonal curvilinear coordinates.
CO 4: understand the properties of Dirac Delta function

Module 1: CALCULUS	**15 hours**

Recapitulation: Differentiation, plotting of functions, intuitive ideas of continuous, differentiable etc. functions and plotting of curves. Approximation: Taylor and Binomial series (statements only)
First Order and Second Order differential equations: First Order differential equations and Integrating factor. Homogeneous equations with constant coefficients, Wronskian and general solution.
Calculus of functions of more than one variable: Partial derivatives, exact and inexact differentials. Integrating factor , with simple examples.

Module 2: VECTOR CALCULUS	**18 hours**

Properties of vectors, Scalar product and vector product, scalar triple product and their interpretation in terms of area and volume, respectively. Scalar and vector fields.
Vector differentiation: Directional derivatives and normal derivative. Gradient of a scalar field and its geometrical interpretation. Divergence and curl of a vector field. Del and Laplacian operators, vector identities.
Vector Integration: Ordinary integrals of vectors. Multiple integrals, Jacobian, notion of infinitesimal line, surface and volume elements. Line, surface and volume integrals of vector fields, flux of a vector field. Gauss' Divergence Theorem, Green's and Stokes Theorems and their applications (no rigorous proofs)

Module 3:ORTHOGONAL CURVILINEAR COORDINATES	**7 hours**

Orthogonal curvilinear coordinates. Derivation of gradient, divergence, curl and Laplacian in Cartesian, spherical and cylindrical coordinate systems.

Module 4: DIRAC DELTA FUNCTION AND ITS PROPERTIES	**5 hours**

Definition of Dirac delta function. Representation as a limit of a Gaussian function and rectangular function. Properties of Dirac delta function.

Total Lecture hours	**45 hours**
(Mathematical Physics Laboratory)	**30 hours**
Total hours (Lecture +Lab)	**75 hours (45T+30P)**

Text Book(s)

1. Mathematical Methods for Physicists, G.B. Arkfen, H.J. Weber, F.E, Harris, 2013, 7th edition, Elsevier
2. An Introduction to Ordinary Differential Equations, E.A. Coddington, 2009, PHIO Learning.

Reference Books

1. Mathematical Tools for Physics, Lames Nearning, 2010, Dover Publications
2. Mathematical Methods for Scientists and Engineers, S.S. McQuarrie, 2003, Viva Book

Practical

Prerequisite : Basic Computer Skills

Course Objective :

1) Makes students gain a broad perspective about the uses of computers in engineering industry. .
2) Develops basic understanding of computers, the concept of algorithm and algorithmic thinking.
3) An ability to incorporate exception handling in object-oriented programs.
4) Develops the use of the C programming language to implement various algorithms, and develops the basic concepts and terminology of programming in general

Course Outcome:

CO1: Get the basic knowledge in fundamentals of programming, algorithms and programming technologies and fundamentals of Computer Science.
CO2: The course will help to give a basic idea how to Control the sequence of the program and give logical outputs
CO3: Construct programs involving decision structures and loops
CO4: Get concept of Strings for writing programs related to character array.

List of Experiments :

1) Development of programs using multiple arithmetic and logical operators. Programs for addition, subtraction, multiplication etc.
2) Programs using simple control statements such as if else, while, do while etc. Making a program for a calculator for example. Extracting the digits of an integer, reversing digits, finding sum of digits etc.
3) Programs using For loop, switch statement etc. eg. Finding average of numbers, multiplication of numbers etc. Checking for primes, generation of Armstrong numbers. .
4) Generation of the Fibonacci sequence, finding the square root of a number, calculation of factorials, printing various patterns using for loop.
5) Programs using Arrays: declaring and initializing arrays. Program to do simple operations with arrays. Strings – inputting and outputting strings. Using string functions such as strcat, strlen etc. Writing simple programs for strings without using string functions.

Total Lab Hours :	30 Hours

Text Books :

1) PROGRAMMING IN ANSI C BY E. BALGURUSWAMY, TATA MC-GRAW HILL
2) PROGRAMMING WITH C, SCHAUM SERIES

DSCC (minor)	**Sports Science**	**L**	**T**	**P**	**C**
		4	**0**	**0**	**4**

Pre-requisite: Preliminary concept of Science and Mathematics

Course Objectives:

(1) To enhance the fundamental knowledge of dynamics which is helpful to understand the field of sports like shooting, discuss throw etc.
(2) To develop the basic idea on gravitation to understand climbing, scating, swimming etc.
(3)To have an outlook on food and nutrition of our body.
(4)To enhance the basics of kinesiology, biomechanics and sports.
(5)To be aware of mental and physical health for a positive lifestyle.

Course Outcome:

After successful completion of the course, the students will be able
CO1: to understand the basics of dynamics required for understanding physics behind sports
CO 2: to learn the conservation laws to relate with practical field of sports.
CO 3: to understand the importance of food and nutrition for good health.
CO 4: to understand kinesiology, biomechanics and sports.
CO 5: to learn about physical fitness and positive lifestyle.

Module 1: Dynamics	**15 hours**
Measurement: Physical quantities, Standards and Units, International system of Units, Standards of time, length and mass, Precision and significant figures **Newton's laws of motion**: Newton's first law. Force, mass. Newton's second law. Newton's third law, Mass and weight. Applications of Newton's laws. **Projectile motion**: Shooting a falling target, Physics behind Shooting, Javelin throw and Discus throw.	
Module 2: Gravitation	**10 hours**
Conservation laws: Conservation of linear momentum, collisions – elastic and inelastic. Angular momentum. (Physics behind Carom, Billiards, Racing) **Centre of mass**: Physics behind Cycling, Rock climbing, Skating **Gravitation**: Origin, Newton's law of gravitation, Archimedes's principle, Buoyancy & Physics behind swimming	
Module 3: Health	**10 hours**
Food and Nutrition: Proteins, Vitamins, Fat, Blood pressure. Problems due to the deficiency of vitamins. **Energy:** Different forms of Energy, Conservation of mass-energy **Physical exercises:** Walking, Jogging and Running, Weight management	
Module 4: Kinesiology, Biomechanics & Sports	**15 hours**
Meaning & Importance of Kinesiology & Biomechanics in Physical Education & Sports , Newton's Law of Motion & its application in sports, example of Friction and its effects in Sports, examples, Effect of exercise on the functioning of Various Body Systems. (Circulatory System, Respiratory System, Neuro-Muscular System etc)	
Module 5: Physical Fitness, Wellness & Lifestyle	**10 hours**
Components of Physical fitness, Components of Health related fitness , Components of wellness Preventing Health Threats through Lifestyle Change , Concept of Positive Lifestyle, Introduction to Yoga, mental and physical benefits of yoga.	
Total Lecture hours	**60 hours**

Text Book(s)

1. Yakov Perelman. Physics for Entertainment. Createspace Independent Pub, 2010.
2 Yakov Perelman. Physics Everywhere. Prodinnova Publishers, 2014.
3. Vassilios McInnes Spathopoulos. An Introduction to the Physics of Sports. Createspace

4.	Independent Publishing Platform, 2013. Swaminathan M. Handbook of Food and Nutrition. Bangalore Press. 2012.

Reference Books

1. 2. .	Walter Lewin. For the Love of Physics. Taxmann Publications Pvt. Ltd., 2012. Srilakshmi B. Food Science. New Age International Pub. 2015.

MDC	**Indian Contribution to Science**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Pre-requisite: Preliminary concept of Science and Mathematics.

Course Objectives:

1. To enhance the knowledge of Indian science from ancient to modern..
2. To develop interest on ancient discoveries.
3. To identify ancient rituals and relations with modern methods.
4. To gather knowledge about the Nobel Lauretes of Indian origin.
5. To enhance the knowledge of the lives of Indian scientists.

Course Outcome:

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

CO1: to learn the development of science from ancient to modern India.
CO 2: to learn different fields of science originated in ancient India
CO 3: to learn the traditional Indian customs and rituals, its relation to science, its effect.
CO 4: to know about Nobel Laureates of Indian origin.
CO 5: to know about the life of few scientists of India.

Module 1: India's Contribution to Science and Technology (from Ancient to Modern)	**10 hours**
Proindependence: Water management, Iron and Steel, Farming Techniques and Fertilisers, Physics, Medicine and Surgery, Post Independence: Atomic Energy, Space, Electronics and Information Technology, Oceanography, Biotechnology, Council of Scientific and Industrial Research, The beginning of Indian Astronomy, Chemistry in Early Literature, Medicinal Tradition in Ancient India	
Module 2: Science in Ancient India	**8 hours**
Different studies on plants and animals, Biodiversity and folk traditions, Mathematics in India by early Indian astronomers, early historical period, classical period, Metallurgy in India	
Module 3: Indian Traditional Knowledge	**7 hours**
About nature, flora and fauna, Sacred groves, wildlife, Bishnois and conservation, Ayurveda, elements of nature, ways of treatment, medical instruments in ancient India, yoga, traditional knowledge in relation to science, customs and beliefs in different parts of India, positive and negative side,	
Module 4: Nobel Laureates of Indian Origin	**8 hours**
Sir Ronald Ross, Sir C.V Raman, Subrahmanyan Chandrasekhar, Har Govind Khorana, Venkataraman Ramakrisnan, their contributions.	
Module 5: Lives of few Scientists and their contributions	**12 hours**
Sushruta, Bhaskara II, Aryabhatta, Jagadish Chandra Bose, Acharya Prafulla Chandra Roy, Birbal Sahni, P.C Mahalanobis, Meghnad Saha, Satyendra Nath Bose, Srinivas Ramanujam, Salim Ali,,Panchanan Maheshwari, B.P Pal, Homi Jehangir Bhaba, Kalpana Chawla, Sunita Williams, Smt Anna Mani, E.K Janaki Ammal	
Total Lecture hours	**45 hours**

Text Book(s)	
1.	A Short History of Science and Technology In India, Dr Sanjay Sen, Mahabeer Publications, 2019
2.	Doctors, Scientists, & Engineers of Ancient India, S, Narain, Kalpaz Publications, 2017
3.	From the Beginning of Time: Modern Science and the Puranic Universe, Ganesh Swaminathan, 2020
Reference Books	
1.	India's Glorius Scientific Tradition, Suresh Soni, Prabhat Prakashan, 2020
2.	The Unknown, Chiranit Majumdar, Notion Press Media Pvt Ltd, 2022
3.	Lilavati's Daughters: The Women Scientists of India, Edited by Rohini Godbole and Ram Ramaswamy, Published by Indian Academy of Sciences, ISBN 978-81-8465-005-1