POST GRADUATE DEPARTMENT OF PHYSICS

UNIVERSITY OF KASHMIR, SRINAGAR

(Course Curriculum M.Sc Physics SEMESTER-I)

Academic years 2021, 2022 and 2023

Certainly! Here is the LaTeX code for the table for Semester - I:
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Type of Course	**Course Code**	**Title of Course**	**No. of Credits**
Core (CR)			
CR	PHY18101CR	Mathematical Physics - I	04
CR	PHY18102CR	Quantum Mechanics - I	04
CR	PHY18103CR	Lab. Course	04
Discipline Centric Electives (DCE)			
DCE	PHY18104DCE	Classical Mechanics	04
DCE	PHY18105DCE	Antenna and Wave Propagation	04
DCE	PHY18106DCE	Electronics	04
Generic Electives (GE)			
GE	PHY18107GE	Introduction to Astronomy	02
GE	PHY18108GE	Environmental Physics	02
Open Electives (OE)			
OE	PHY18109OE	Biophysics	02

Table 1: Semester - I Course Details

Title:Mathematical Physics - I **(Course Code:PHY18101CR)**

Max.Marks:100 **Int. Assessment:** 20 **Ext. Examination:** 80 **Credits:** 04

Course Outcome:The course is designed to introduce the student to the mathematical tools and techniques so as to equip him/her with the skills to solve problems in all of Physics, particularly Quantum Mechanics, Classical Physics, Condensed Matter, Nuclear Physics, Electronics etc.

Learning Outcome:Upon completion of the course, the student should:

- have an understanding of the complex space, complex variables and functions
- be able to apply various theorems and formulas in complex analysis to solve integrals
- be able to identify various types of singularities
- be able to conveniently use complex analysis to evaluate real integrals
- comprehend the use of Beta and Gamma functions
- develop an understanding of the partial and ordinary differential equation, and use them to solve problems in Physics
- Understand and make use of the special mathematical functions in Physics

Unit-I
Complex functions, Analytic functions, Cauchy - Riemann conditions, Cauchy's Integral Theorem, Multiply connected regions, Singularities, Cauchy's Integral formula, Derivatives, Taylor and Laurent expansion, Analytic continuation, Poles and Branch Points, Calculus of Residues, Residue theorem, Cauchy principal value, Evaluation of Definite Integral using Cauchy's residues.

Unit-II
The Gamma Function: Definitions, Simple Properties, Factorial and Double factorial, Digamma and Polygamma Functions, Stirling's Series; The Beta Function, Legendre duplication formula. Infinite series, Convergence tests, Riemann Zeta Functions, Dirac Delta function and its properties

Unit-III
Partial Differential Equations, Classes and Characteristics, Boundary Conditions, First-order, Separable variables, Solution of linear first-order ODEs; Separation of variables in cartesian, Spherical Polar and Cylindrical Coordinates. Singular points, Solution of Second order

Differential Equations using Frobenius Method, Limitations of series approach; Second solution, Linear independence of solutions.Orthogonal Functions, Self-Adjoint ODEs

Unit-IV

Bessel Functions of First kind, Orthogonality, Neuman Functions, Henkel Functions, Modified Bessel Functions, Spherical Bessel Function; Legendre Function, Orthogonality, Associated Legendre Function, Spherical Harmonics, Hermite Functions, Laguerre Functions.

Text Books:

1. Mathematical Methods for Physicists (7th Ed.), G. B. Arfken and H. J. Weber and F. E. Harris (Academic Press)

References:

1. Mathematical Methods For Students of Physics and Related Fields, Sadri Hassani, Springer (2009)
2. Mathematical Physics: A Modern Introduction to its Foundations, Sadri Hassani, Springer (2009)
3. Advanced Engineering Mathematics by Michel D, Greenberg
4. Mathematical Methods for Physics and Engineering (3rd Ed.), Riley, Hobson and Bence, Cambridge
5. Advanced Engineering Mathematics, E Kreyzig (8th Ed.), Wiley

Title: Quantum Mechanics - I **(Course Code: PHY18102CR)**

Max.Marks:100 **Int. Assessment:** 20 **Ext. Examination:** 80 **Credits:** 04

Course Outcome:Upon completing this course, students will possess a comprehensive understanding of foundational quantum principles, mathematical frameworks, and the application of Schrodinger's equation to describe quantum systems. They will demonstrate proficiency in solving complex problems related to angular momentum, motion in central fields, and the Coulomb problem, showcasing the ability to analyze and interpret quantum phenomena. Additionally, students will be developing critical thinking skills essential for addressing theoretical concepts and real-world applications in quantum mechanics

Learning Outcome:

- Master the foundational concepts of the quantum mechanics including the Double-Slit Experiment and Stern-Gerlach Experiment.
- Apply advanced mathematical concepts, including linear vector spaces, inner product spaces, and Dirac Notation, to describe quantum systems and operations in finite as well in infinite dimensions.
- Grasp the concept of uncertainty relations and their significance in quantum mechanics, recognizing the limitations in simultaneously measuring certain pairs of observables.
- Solve problems using Schrodinger's equation, demonstrating proficiency in understanding wavefunctions, current density, and the general properties of motion in one dimension.
- Analyze and solve problems related to specific quantum systems, including potential wells, linear oscillators, motion in a homogeneous field, and transmission coefficients.
- Analyze Propagator and Path integrals for free particle and Harmonic oscillator.
- Understand the properties of angular momentum and the effects of symmetries on quantum systems, including parity and time reversal invariance.
- Apply the addition of angular momentum, Clebsch-Gordon coefficients, and evaluate symmetry relations, demonstrating a deep understanding of rotational dynamics in quantum systems.

- Analyze motion in centrally symmetric fields, including spherical waves, three-dimensional oscillators, and the resolution of a plane wave.
- Addressing the Coulomb problem in parabolic coordinate systems.

Unit-I

The Double-Slit Experiment and Stern-Gerlach Experiment. Linear Vector Spaces, Inner Product Spaces and the Dirac Notation. Linear Operators, Matrix Elements of Linear Operators, Active and Passive Transformations, The Eigenvalue Problem, Functions of Operators and Related Concepts, Generalization to Infinite Dimensions. Uncertainity Relations.

Unit-II

Schrodinger's equation, Fundamental properties, Current density, General Properties of motion in one dimension, Potential well, Linear oscillator, Motion in a homogeneous field, Transmission coefficient and applications. Angular momentum, Eigenvalues and eigenfunctions of angular momentum. Symmetries and Their Consequences. Parity and time reversal invariance.

Unit-III

Addition of angular momentum, Clebsch-Gordon Coefficients, Symmetry Relations of CG coefficients, Evaluation of CG coefficients. Matrix representation of the rotation operators, CG series, Determination of the rotation matrices, orthogonality and normalization of the rotation matrices

Unit-IV

Motion in a centrally symmetric field, Spherical waves, Three dimensional oscillator, Resolution of a plane wave.Fall of a particle to the Centre, Motion in a coulomb field (spherical polar coordinates), Discrete and continuous spectrum, Coulomb problem in parabolic coordinate system.

Text Books:

1. R. Shankar, Principles of Quantum Mechanics
2. J. J. Sakurai, Modern Quantum Mechanics

References:

1. L. D. Landau and E. M. Lifshitz , Quantum Mechanics, Pergamon Press
2. K. Gotrified: Quantum Mechanics Advanced Engineering Mathematics, E Kreyzig (8th Ed.), Wiley

Title: Lab. Course **(Course Code: PHY18103CR)**

Max.Marks:100 **Int. Assessment:** 50 **Ext. Examination:** 50 **Credits:** 04

Course Outcome: Develop proficiency in using various laboratory apparatus and instruments and verify the laws of Physics.

Learning Outcome: Learn

- Experimental Technique
- Data Collection and Analysis
- Relate theoretical concepts learned in lectures to real-world physical phenomena
- Utilize technology and software for data collection, analysis, and visualization
- Create clear and accurate graphical representations of experimental data.
- Follow safety guidelines and protocols when conducting experiments.
- Apply theoretical knowledge from lectures to design and conduct experiments.
- Evaluate and understand the uncertainty associated with experimental measurements.
- Develop an understanding of the scientific method through hypothesis testing and experimentation.

Description
There shall be about 20 experiments available in the lab out of which the student shall have to complete at least 06 experiments in this semester.

List of Experiments
The list of experiments presently available is as follows:

1. To determine the wave length of a laser with a diffraction grating.
2. To determine the energy gap of a semiconductor using Four probe method.
3. To determine the curie temperature of an electrical material BaTio3
4. To determine the dead time and absorption Co-efficient using G.M. Counter.
5. ESR: Electron Spin Resonance.

6. To determine the velocity of ultrasound in a given liquid medium (kerosene)
7. To determine the Hall coefficient for a semiconductor sample.
8. Designing and studying RC filters Active and Passive.
9. To Determination of e/m ratio of electron by J.J. Thomson's method.
10. To Determination of e/m ratio of electron by Helical method
11. To determine the velocity of sound using Lissajous figures.
12. Determination of Plank's constant using Photoelectric Effect.
13. Antenna measurements
14. Michelson Interferometer
15. Fabry-Perot Interferometer
16. Study of Regulated Power Supply
17. Study sinusoidal steady-state response of a resonant circuit in the phasor domain.
18. To determine the characteristics of a Solar Cell.
19. Study Digital Fiber Optical Transmitter and Receiver.
20. Fast Fourier Transform (FFT) in Excel

Text Books:

1. Advance Practical Physics Vol I S.P.Singh Pragati Prakashan
2. Advance Practical Physics Vol II S.P.Singh Pragati Prakashan
3. An advanced course in practical Physics D Chattopadhyay and P C Rakshit, New Central book agency Pvt. Ltd.
4. A Manual on Experiments in Physics R Srinivasan, K R Priolkar and T G Ramesh Indian Academy of Science.
5. Experimental Physics Principles and Practice for the Laboratory Ist Edition , Walter Fox Smith Routledge Taylor & Francis

Title: Classical Mechanics **(Course Code: PHY18104DCE)**

Max.Marks:100 **Int. Assessment:** 20 **Ext. Examination:** 80 **Credits:** 04

Course Outcome:This course aims to equip students with a comprehensive understanding of advanced mechanics, employing the Lagrangian approach and variational calculus. Students will delve into the intricacies of virtual work, generalized forces, and d'Alembert's principle to formulate generalized equations of motion. Mastery of the Lagrangian and Euler-Lagrange equations, as well as the Hamiltonian, will be demonstrated through applications to scenarios such as double and spherical pendulums, and particles in electromagnetic fields. Proficiency in variational calculus and the principle of least action will enable students to handle constraints in variational dynamics. Additionally, the course covers Hamiltonian dynamics, theoretical mechanics, oscillations, and the transition from discrete to continuous systems, providing students with a diverse skill set. Ultimately, students will apply their knowledge to solve practical problems, showcasing a holistic understanding of theoretical mechanics, variational calculus, Hamiltonian dynamics, and oscillations in diverse physical systems.

Learning Outcome:

- 1Develop a comprehensive understanding of the Lagrangian approach to mechanics, including the identification of degrees of freedom, constraints, and the application of generalized coordinates.
- Apply the principles of virtual displacement, virtual work, and generalized force in the context of d'Alembert's principle, contributing to the formulation of the generalized equation of motion.
- Master the Lagrangian and Euler-Lagrange equations of motion, and comprehend the Hamiltonian, cyclic coordinates, and canonical momenta, applying them to practical scenarios such as the double pendulum, spherical pendulum, and particles in electromagnetic fields.
- Gain proficiency in variational calculus, Euler equations, and the principle of least action, exploring their role in describing mechanical systems and handling constraints in variational dynamics.
- Understand Hamiltonian dynamics, involving Legendre transformations, Hamilton's equations, conservation laws, and phase space, culminating in an appreciation of Liouville's theorem.

- Develop expertise in theoretical mechanics, including canonical transformations, symplectic notation, and Poisson Brackets, and apply these concepts to derive angular momentum PB relations and explore invariance under canonical transformations.
- Comprehend action-angle variables, adiabatic invariance, and the Hamilton-Jacobi (HJ) equation, including its application in solving problems related to particle motion under central force.
- Explore oscillations, covering simple harmonic oscillators, damped harmonic oscillators, and coupled oscillators, while mastering the general method of solution.
- Understand the transition from discrete to continuous systems and the Hamiltonian formulation of Lagrangian and Hamiltonian for continuous systems.
- Apply the acquired knowledge to solve practical problems, demonstrating a holistic understanding of theoretical mechanics, variational calculus, Hamiltonian dynamics, and oscillations in diverse physical systems.

Unit-I

The Lagrangian Approach to Mechanics: degrees of freedom, constraints and generalized coordinates, virtual displacement, virtual work and generalized force, d'Alembert's principle and the generalized equation of motion, the Lagrangian and the Euler Lagrange equation of motion, the Hamiltonian, cyclic coordinates and canonical momenta, applications; double pendulum, spherical pendulum, particle in electromagnetic field.

Unit-II

Variational calculus and Hamiltonian dynamics: the variational calculus and the Euler equation, the principle of least action and the Euler Lagrange equation, constraints in variational dynamics. Hamiltonian dynamics: Legendre transformations, Hamilton's equations, conservation laws, phase space and Liouville's theorem.

Unit-III

Theoretical Mechanics: canonical transformations and generating functions, symplectic notation, Poisson Brackets (PB); the angular momentum PB relations, invariance of PBs under canonical transformations, action-angle variables and adiabatic invariance, the Hamilton Jacobi (HJ) Equation; HJ equation for Hamilton's characteristic function, separation of variables, particle motion under central force

Unit-IV

Oscillations: the simple harmonic oscillator; the damped harmonic oscillator, the damped simple and damped harmonic oscillator, coupled simple harmonic oscillators; couple pendulum, general method of solution. Lagrangian and Hamiltonian of continuous systems: transition from discrete to continuous systems, the Hamiltonian formulation.

Text Books:

1. 1 Classical Mechanics by Goldstein, Poole and Safko (Pearson Education)
2. Mechanics by Landau and Lifshitz

References:

1. Analytical Mechanics by L. N. Hand and J. D. Finch (Cambridge University Press)

Title: Antenna and Wave Propagation **(Course Code: PHY18105DCE)**

Max.Marks:100 **Int. Assessment:** 20 **Ext. Examination:** 80 **Credits:** 04

Course Outcome:These course outcomes aim to equip students with a comprehensive understanding of antenna fundamentals, array theory, aperture antennas, and satellite communication systems, enabling them to apply their knowledge to real-world problems in the field of communication engineering.

Learning Outcome: Upon completing Unit I, students should be able to:

- Explain the fundamental mechanisms involved in the radiation of electromagnetic waves from antennas.
- Apply Maxwell's equations to solve radiation problems related to antennas.
- Understand the characteristics and properties of an ideal dipole antenna.
- Calculate array factors for linear arrays, both uniformly and non-uniformly excited.
- Describe the principles of phased arrays and various feeding techniques.
- Understand techniques for evaluating gain in reflector antennas.
- Analyze different types of feed antennas for reflectors and understand how to match the feed to the reflector.
- Describe the characteristics and functions of satellite communication systems such as INTELSAT Series, INSAT, VSAT, and INMARSAT.
- Understand the role of satellites in providing internet connectivity and supporting multimedia services like video conferencing.

Unit-I
Antenna Fundamentals and Definitions: Radiation mechanism - over view, Electromagnetic Fundamentals, Solution of Maxwell's Equations for Radiation Problems, Ideal Dipole, Radiation Patterns, Directivity and Gain, Antenna Impedance, Radiation Efficiency. Antenna Polarization Resonant Antennas: Wires and Patches, Dipole antennas, Yagi - Uda Antennas, Micro strip Antenna

Unit-II
Arrays: Array factor for linear arrays, uniformly excited, equally spaced Linear arrays, pattern multiplication, directivity of linear arrays, non- uniformly excited -equally

spaced linear arrays, Mutual coupling, multidimensional arrays, phased arrays, feeding techniques, perspective on arrays. Broad band Antennas: Traveling- wave antennas, Helical antennas, Biconical antennas; Principles of frequency - independent Antennas, spiral antennas, and Log - Periodic Antennas

Unit-III

Aperture Antennas: Techniques for evaluating Gain, reflector antennas - Parabolic reflector antenna principles, Axi -symmetric parabolic reflector antenna, offset parabolic reflectors, dual reflector antennas, Gain calculations for reflector antennas, feed antennas for reflectors, field representations, matching the feed to the reflector, general feed model, feed antennas used in practice

Unit-IV

INTELSAT Series, INSAT, VSAT, Remote sensing, Mobile satellite service: GSM. GPS, INMARSAT, Satellite Navigation System, Direct to Home service (DTH), Special services, E- mail, Video conferencing and Internet connectivity

Text Books:

1. Antenna Handbook by J. D. Kraus

References:

1. Bruce R. Albert, The Satellite Communication Applications Handbook, Artech House, Boston, 1997
2. Stutzman and Thiele, Antenna Theory and Design, 2nd Ed. John Wiley and Sons. Inc.
3. C. A. Balanis,Antenna Theory Analysis and Design, 2nd Ed. John Wiley

Title: Electronics **(Course Code: PHY18106DCE)**

Max.Marks:100 **Int. Assessment:** 20 **Ext. Examination:** 80 **Credits:** 04

Course Outcome:This course builds on the basic knowledge of fundamental physics of Semiconductor Devices and optoelectronic components, energy conversions that influence our society and everyday life. The course will include the introductions to various physical processes and operation principles of key semiconductor devices and optoelectronic devices

Learning Outcome: Upon successful completion students will have the knowledge and skills to

- Distinguish between conductors, nonconductors and semiconductors based on energy band theory
- classify different types of semiconductors
- Employ the concept of Energy Band Theory and Fermi Levels to explain the operating principle of semiconductors
- Recall the basics concepts of semiconductor devices
- Analyze the working operation, characteristics and structure of various electronic devices.
- Understand various applications of electronic devices like diodes, transistors, FET's etc.
- Understand the working and applications of special electronics devices like UJT,SCR and Zener Diode etc
- Apply different types of biasing circuits and models on electronic devices like diodes, transistors, FET's etc
- Classify different types of FETs and demonstrate feedback amplifiers, OP-AMPs, and oscillator circuits.
- Describe the fundamental physical processes of optoelectronic devices
- understanding basic laws and phenomena in the area of Optoelectronics
- Theoretical preparation of students to acquire and apply knowledge and skills in Optoelectronics

Unit-I

Classification of solids based on energy band theory E-K diagram, Concept of effective mass, Mobility and conductivity, (Intrinsic Semiconductors Electrons and Holes in the semiconductors. Extrinsic semiconductors – Donor and Acceptor impurities,) PN junction ,PN junction Diode VI characteristics, Current components in PN diode-Diode current , Reverse saturation current, Majority carrier current components, Current Equations – Diffusion and Drift current, (Switching Characteristics of PN Diode.)

Unit-II

JFET: Basic structure and operation of JFET, calculation of pinch off voltage, volt-ampere characteristics of JFET, the FET small signal model, FET Biasing, FET as a voltage variable resistor (VVR). MOS structure – MOSFET working – MOSFET characteristics – width of depletion region –junction capacitance-threshold voltage. Solid State Devices for Special Applications Zener diode, voltage regulation, Silicon Controlled Rectifier, , UniJunction transistor, UJT-relaxation oscillator, Programmable UJT (PUT), Thermistors

Unit-III

Operational amplifier – Characteristics of an ideal operational amplifier – comparison with 741 – Operational amplifier as a open loop amplifier - Limitations of open loop configuration – Operational amplifier as a feedback amplifier: closed loop gain, input impedance, output impedance of inverting and non-inverting amplifiers - Voltage follower - Differential amplifier: voltage gain. Applications of op-amp: Linear applications – Phase and frequency response of low pass, high pass and band pass filters(first order), summing amplifier – inverting and non-inverting configurations, subtractor, difference summing amplifier, ideal and practical Differentiator, Integrator.

Unit-IV

Optoelectronic Devices Photometry and radiometry units, Classification of optoelectronic devices, Radiative and non-radiative transitions, Light dependent resistors, , Photo-diode, PIN Photodiode, Photo-transistor, Light emitting diodes, Physics of LED, materials for LED, Solar-cells, Semiconductor Laser, population inversion at junction, optical gain and threshold current for lasing.

Text Books:

1. Donald A Neaman, “Semiconductor Physics and Devices”, Third Edition, Tata Mc Graw Hill Inc., 2007.

References:

1. Semiconductor Devices Physics and Technology, S M Sze, (2007), John Wiley

and Sons Inc. Asia.Solid State Electronic Devices, Ben G Streetman, Sanjay Banerjee, (Fifth edition, 2000), Pearson Education, Asia.

2. Semiconductor Optoelectronic Devices, Pallab Bhattacharya, (Second Edition, 1997), Pearson education, Asia.

3. The art of electronics, Paul Horowitz and Winfield Hill, (Second Edition, 1992), Foundation Books, New Delhi.

4. Electronic Principles, AP Malvino, (Sixth Edition, 1999), Tata McGraw Hill, New Delhi.

5. Op-Amps and Linear Integrated Circuits, Ramakant A Gayakwad, (Third Edition, 2004), Eastern Economy Editio

Title:Introduction to Astronomy **(Course Code: PHY18107GE)**

Max.Marks:50 **Int. Assessment:** 10 **Ext. Examination:** 40 **Credits:** 02

Course Outcome:The knowledge of representation of very large and small distances and their practical units are introduced. The students gain knowledge of the different techniques to measure distance of a star and formulas for measuring distances. After studying this course stundents understand the scale of items within the Universe and appreciate the wide variety of objects contained in the Universe. They can understand the relative sizes of the planets within the Solar System and calculate how long it takes for light to reach the Earth from the Sun.

Learning Outcome:

- Understand the concept of the celestial sphere as an imaginary sphere surrounding Earth.
- Familiarity with different coordinate systems (Alt-Azimuth, Equatorial, Ecliptic, Galactic).
- Comprehend the basics of spherical triangles and their application in celestial navigation.
- Explain the reasons for Earth's seasons based on axial tilt and orbital motion.
- Distinguish between Sidereal, Apparent, and Mean Solar Time.
- Recognize and identify major constellations.
- Interpret the Hertzsprung-Russell (H-R) Diagram.
- Recognize the significance of variable stars as distance indicators.

Unit-I

Geometry of the sphere; Celestial Sphere , The cardinal points and circles on the celestial sphere.The alt-azimuth ,equatorial, ecliptic and galactic coordinate systems; Spherical triangle, Twilight, Seasons, Sidereal, Apparent and Mean solar time and their relations, Equation of time, Ephemeris and Atomic Times, Constellations and nomenclature of stars.

Unit-II

Stellar Distances and Magnitudes; Distances of stars by trigonometric parallax method, Magnitude scale and magnitude systems. Atmospheric extinction. Absolute magnitudes and distance modulus. Stellar Classification, H-R Diagram, Black-body approximation to the continuous radiation and temperatures of stars. Variable stars as distance indicators.

Text Books:

1. W. M. Smart, Textbook of Spherical Astronomy
2. K. D. Abhyankar, Astrophysics: Stars and Galaxies, Tata McGraw Hill Publication

References:

1. A. E. Roy, Orbital Motion
2. McCusky,Introduction to Celestial Mechanics.
3. G. Abhell, Exploration of the Universe
4. A. Unsold, New Cosmos
5. Baidyanath Basu, Introduction to astrophysics

Title: Environmental Physics **(Course Code: PHY18108GE)**

Max.Marks:50 **Int. Assessment:** 10 **Ext. Examination:** 40 **Credits:** 02

Course Outcome:The course outcome aims to ensure that students have a comprehensive understanding of the topics to be covered in enabling them to apply their knowledge to real-world situations and contribute to the fields of radiation science and environmental studies.

Learning Outcome: Upon completing the course students should be able to:

- Understand Natural Background Radiation:
- Comprehend Radioactive Pollution:
- Assess Benefits and Risks of Radioactive Sources:
- Explore Ionizing Radiation in Medicine and Research
- Examine Nuclear Power, Fusion, and Fission:
- Discuss Biological Consequences of Ionizing Radiation and cancers
- Atmospheric Composition, Ozone Layer Depletion
- Discuss biological consequences of excessive or insufficient UV exposure.
- Explain the greenhouse effect and its role in maintaining the planet's temperature.

Unit-I

These subjects include among other; Natural background radiation, radon, the benefits and risks related to radioactive sources and radioactive pollution, the use of ionizing radiation in medicine and research, nuclear power, fusion, fission, biological consequences of ionizing radiation, radiation induced cancer

Unit-II

Production and destruction of ozone and the ozone layer, the development of the ozone hole, UV radiation, measurements of ozone and UV radiation, biological effects related to too much and too little UV-exposure, D-vitamin deficiency, skin cancer; The atmosphere and its composition, the greenhouse effect, the role of the greenhouse effect for life on earth, green house gasses, the variations in the global green house effect and its consequences.

Text Books:

1. Radon in the environment by M. Wilkening, Elsevier Publishing Co.
2. Radon Prevalence, measurement , health risks and control byNiren Laxmichand, Nagda Astm Manual Series, Mnl 5 (1994)
3. Nigel Mason and Peter Hughes: Introduction to Environmental Physics: Planet Earth, Life and Climate, Taylor and Francis, 2001

Title: Biophysics **(Course Code: PHY18109OE)**

Max.Marks:50 **Int. Assessment:** 10 **Ext. Examination:** 40 **Credits:** 02

Course Outcome:These course outcomes aim to equip students with a thorough understanding of radiological physics and radiation safety measures, enabling them to apply their knowledge in practical scenarios and contribute to the field of radiation protection.

Learning Outcome: Upon completing the course, students should be able to:

- Define and explain the fundamental properties of electromagnetic radiation.
- Describe the various units used to measure radiation and their interrelationships.
- Understand the concepts of exposure and dose in the context of radiological physics.
- Explain the concept of dose equivalent and its relevance in radiation protection.
- Discuss particle flux and how X-rays and gamma rays interact with matter.
- Understand the principles of dose equivalent limits (DEL) and maximum permissible dose (MPD).
- Evaluate external and internal radiation hazards and their implications for safety.
- Apply radiation protection measures in industrial establishments, radioisotope labs, and diagnostic and therapeutic installations.
- Understand and analyze the ethical and legal implications of radiation safety measures.

Unit-I

Radiological Physics

Properties of Electromagnetic Radiation, Radiation Units, Exposure and Dose, Dose equivalent Unit, Particle flux, X Rays and Gamma Rays, their interaction with matter, Photoelectric and Compton effect, Ion pair production, Principles of Radiation detection and measurements, General requirement of dosimeters, Telegamma Unit (Cobalt Unit), Radio Isotopes in Biology, Agriculture plant breeding, soil plant relationship and plant physiology, Medicine anddiagnosis.

Unit-II

Radiation Safety measures
Natural and manmade Radiation exposure or principle of Dose Equivalent limit (DEL), Maximum permissible Dose (MPD), Evaluation of External and internal Radiation hazards, Radiation protection measures in Industrial establishment, Radio Isotope labs, Diagnostics and therapeutic installations during transportation of Radioactive substances, Disposal of Radioactive waste, Administrative and Legislative aspect of Radiation protection

Text Books:

1. Casarett A.P. (1968), Radiation Biology, Prentice-hall Inc.
2. Clause W.D. (1958), Radiation Biology and Medicine, Addison- Wesley
3. Grosch D.S. (1979), Biological effects of Radiation, Academic Press
4. Howard L. A. (1974), Radiation Biophysics, Prentice Hall Inc.

References:

1. Knoll G. E., Radiation Detection and Measurement, John Wiley and Sons