Jaya College of Arts and Science, Thiruninravur-602024.

Department of Electronics and Communication Science & physics

---

Year

- **2022-2023**

Programme Offered

- **B.Sc (PHYSICS)**

Programme Objective:

- Read, understand and interpret electrical circuits through – verbal, mathematical and graphical methods.
- Use Information Communication Technology to gather knowledge at will.
- Impart skills required to gather information from resources and use them (library and communication skills).
- Offer courses to the choice of the students with skill based courses having interdisciplinary approach.
- Perform experiments and interpret the results of observation, including making an assessment of experimental uncertainties, device performance and fabrication of circuits in PC Boards.
- To give need based education in Electronics of the highest quality at the undergraduate level.
- Provide an intellectually stimulating environment to develop skills and enthusiasms of students to the best of their potential.
- Equip students in methodology related to electronic circuits, devices and systems.
- Attract outstanding students from all backgrounds.

Programme Outcome:

- Apply the basic principles of Physics to the events occurring around us and also in the world.
- Try to find or analyze scientific reasoning for various things.
- Apply the knowledge to develop the sustainable and eco-friendly technology for pollution free environment.
- Collaborate effectively on team-oriented projects in the field of Physics.
- Communicate scientific information in a clear and concise manner both orally and in writing or through audio video presentations.
- Develop capacity of critical reasoning, judgment and communication skills.
- Develop abilities for logical thinking.

- Understand the concepts and significance of the various physical phenomena.
- Apply the theories learnt and the skills acquired to solve real time problems.
- Enhance students academic abilities, personal qualities and transferable skills.
- Acquire a wide range of problem solving skills, both analytical and technical to apply them.

FIRST SEMESTER

Course Content	Name of the Course	Ins. Hrs	Credits	Max. Marks		
				Int.	Ext.	Total
Part – I	Language Paper – I	4	3	25	75	100
Part - II	**BP2-ENG01-Communicative English**	**3**	**3**	**50**	**50**	**100**
Part III	BPS-CSC01-Properties of Matter and Sound	5	4	25	75	100
	Core Practical-I	3	Examination will be held in the end of second semester			
	Allied I – Choose any one*					
	Allied Theory	9	5	25	75	100
	(OR)					
	Allied Theory / Practical	6	3	25	75	100
		3	2	Exam. will be held at the end of II semester		
Part IV	Basic Tamil/Adv. Tamil/NME**	2	2	25	75	100
	BP4-EPSC-English for Physical Sciences	**4**	**4**	**50**	**50**	**100**
Semester-wise Credit Total			21			

* Choose any one – Mathematics or Chemistry

** Choose any one paper from the other department

SECOND SEMESTER

Course Content	Name of the Course	Ins. Hrs	Credits	Max. Marks		
				Int.	Ext.	Total
Part – I	Language Paper – II	4	3	25	75	100
Part - II	English Paper – II	4	3	25	75	100
Part - III	BPS-CSC03-Thermal Physics	6	4	25	75	100
	BPS-CSC02-Practical-I	3	4	40	60	100
	Allied II –Choose any one* Allied Theory	9	5	25	75	100
	Allied Theory / Practical	6	3	25	75	100
		3	2	40	60	100
Part IV	Basic Tamil/Adv. Tamil/ NME**	2	2	25	75	100
	Soft Skills	2	3	50	50	100
Semester-wise Credit Total			24			

**** NME: Choose any one from the other department**

THIRD SEMESTER

Course Content	Name of the Course	Ins. Hrs	Credits	Max. Marks		
				Int.	Ext.	Total
Part – I	Language Paper – III	6	3	25	75	100
Part - II	English Paper – III	4	3	25	75	100
Part - III	BPS-DSC04-Mathematical Methods in Physics	5	4	25	75	100
	Core Practical-II	3	-	Examination will be held in Semester IV		
	Allied III-Choose any one * Allied Theory	8	5	25	75	100
	Allied Theory Practical	5	3	25	75	100
		3	2	Examination will be held in Semester IV		
PART IV	Environmental Studies	2	Examination will be held in Semester IV			
	Soft Skills	2	3	50	50	100
Semester-wise Credit Total			18			

FOURTH SEMESTER

Course Content	Name of the Course	Ins. Hrs	Credits	Max. Marks		
				Int.	Ext.	Total
Part – I	Language Paper – IV	6	3	25	75	100
Part - II	English Paper – IV	4	3	25	75	100
Part - III	BPS-DSC06-Mechanics	5	4	25	75	100
	BPS-DSC05-Core Practical-II	3	4	40	60	100
	Allied IV-Choose any one * Allied Theory	8	5	25	75	100
	Allied Theory and Practical	5	3	25	75	100
		3	2	40	60	100
Part-IV	Environmental Studies	2	2	25	75	100
	Soft Skills	2	3	50	50	100
Semester-wise Credit Total			24			

***ALLIED PAPERS I, II, III & IV**

Part – III	**BMA-CSA01 - Allied Mathematics – I**	9	5	25	75	100
	BMA-CSA02 - Allied Mathematics – II	8	5	25	75	100
	BCY-CSA1A - Allied Chemistry – I (Theory)	6	4	25	75	100
	BCY-CSA2A - Allied Chemistry – II (Theory)	5	4	25	75	100
	BCY-CSAP1 - Allied Chemistry – I & II (Practical)	6 (3+3)	2	40	60	100

FIFTH SEMESTER

Course Content	Name of the Course	Ins. Hrs	Credits	Int. Marks	Ext.Marks	Total
Part-III	BPS-DSC07-Optics &Spectroscopy	5	4	25	75	100
	BPS-CSC08-Electricity and Electromagnetism	5	4	25	75	100
	BPS-CSC09-Quantum Mechanics	5	4	25	75	100
	BPS-DSC10-Basic Electronics	5	4	25	75	100
	BPS-DSE1A-Numerical Methods (OR) BPS-DSE1B-Problem Solving in Physics (OR) BPS-DSE1C-Geophysics	4	5	25	75	100
	Core Practical-III- General	6	Examinations will be held in Semester VI			
	Core Practical-IV- Basic Electronics	6				
	Core Practical-V- Applied Electronics	6				
Part-IV	Value Education	1	2	25	75	100
Semester-wise Credit Total			23			

SIXTH SEMESTER

Course Content	Name of the Course	Ins. Hrs	Credits	Int. Marks	Ext. Marks	Total
Part-III	BPS-CSC11-Core Practical-III-General	2	4	40	60	100
	BPS-CSC12-Core Practical-IV- Basic Electronics	2	4	40	60	100
	BPS-CSC13-Core Practical-V-Applied Electronics	2	2	40	60	100
	BPS-DSC14-Atomic Physics & Lasers	5	4	25	75	100
	BPS-CSC15-Nuclear and Radiation Physics	5	4	25	75	100
	BPS-CSC16-Solid State Physics	5	4	25	75	100
	BPS-CSE2A-Integrated Electronics (OR) BPS-DSE2B-Medical Physics (OR) BPS-DSE2C-Fiber Optics	5	5	25	75	100
	BPS-CSE3A-Microprocessor 8085 and Microcontroller (OR) BPS-DSE3B-Astrophysics (OR) BPS-DSE3C-Weather Forecasting	4	5	25	75	100
Part-V	Extension Activities	1	1			
Semester-wise Credit Total			33			

CORE-I: PROPERTIES OF MATTER AND SOUND

(Common to B.Sc.Physics with Computer Applications)

Course Objective:

- To make the students learn and understand the properties of materials and acoustics.

Course OutCome:

- Analyze the strength of materials in terms of their size and shape.
- Understand the fluid dynamics that gives the fundamental knowledge over many practical applications
- Analyze the phenomena of simple harmonic motion and the properties of systems executing such motions
- Know the different methods of producing ultrasonic waves and its applications
- Determine the modulus of elasticity through different experimental techniques

Syllabus:

UNIT I: ELASTICITY (12 Hours)

Hooke's Law – Stress–Strain diagram –Elastic constants –Poisson's ratio – Relation between elastic constants and Poisson's ratio – Work done in stretching and twisting a wire – Twisting couple on a cylinder -Rigidity modulus by Static torsion– Torsional pendulum (with and without masses**)**

UNIT II: BENDING OF BEAMS (12 Hours)

Cantilever– Expression for Bending moment – Expression for depression at the loaded end of thecantilever–Oscillations of a cantilever – Expression for time period-Experiment to find Young's Modulus – Non-Uniform bending– Experiment to determine Young's Modulus by Koenig's method- Uniform Bending-Expression for elevation-Experiment to determine Young's Modulus using microscope

UNIT III : FLUID DYNAMICS (12 Hours)

Surface tension-: Definition – Molecular forces– Excess pressure over curved surface – Application to Spherical and Cylindrical Drops and Bubbles-Variation of Surface Tension withTemperature —Jaegar's method.

Viscosity:-Definition-Streamline and Turbulent motion – Rate of flow of liquid in a capillary tube-Poiseuille's formula –Corrections-Terminal Velocity and Stoke's formula– Variation ofViscosity of a liquid with Temperature

UNIT IV: WAVES AND OSCILLATIONS (12 Hours)

Simple Harmonic Motion – Differential Equation of SHM – Graphical representation of SHM – Composition of two S.H.M in a straight line-at right angles-Lissajous's figures-Free, Damped, Forced vibrations -Resonance and Sharpness of resonance.

Laws of transverse vibration of strings- Sonometer-Determination of AC frequency using sonometer - Determination of frequency using Melde's apparatus.

UNIT V: ACOUSTICS OF BUILDINGS AND ULTRASONICS (12 Hours)

Intensity of sound – Decibel – Loudness of sound –Reverberation – Sabine's reverberation formula – Acoustic Intensity – Factors affecting the Acoustics of Buildings.

Ultrasonic waves – Production of Ultrasonic Waves – Piezoelectric crystal method – Magnetostriction effect – Application of Ultrasonic Waves.

Books for Study:

1. Elements of Properties of Matter, D. S Mathur, S. Chand & Co (2010)
2. Properties of Matter, BrijLal and N. Subrahmanyam, S.Chand and Co(2003)
3. Textbook of Sound, D.R.Khanna and R.S. Bedi, Atma Ram and sons (1969)
4. A Text Book of Sound, BrijLal and N.Subrahmanyam ,Vikas Publishing House –Second revised edition (1995)

Books for Reference:

1. General Properties of Matter, C.J. Smith, Orient Longman Publishers (1960).

2.Fundamental of General Properties of Matter, H.R Gulati, R Chand and Co, Fifth edition(1977)

3.Vibration and Waves, A.P French, MIT Introductory Physics, Arnold–Heinmann India(1973)

CORE-II: CORE PRACTICAL – I

(Common to B.Sc.Physics with Computer Applications)

(At the end of the Second semester - Any Fifteen Experiments)

Course Objective:

Course OutCome:

Syllabus:

1. Young's modulus – Non-uniform Bending – Pin and microscope.
2. Young's modulus – Uniform Bending – Scale and Telescope
3. Rigidity modulus – Torsional pendulum (without symmetrical masses)
4. Rigidity modulus and Moment of Inertia – Torsional pendulum (With symmetric masses)
5. Surface Tension and Interfacial Surface Tension – Drop Weight Method
6. Coefficient of Viscosity of Liquid – Graduated Burette (radius of capillary tube byMercury pellet method).
7. Sonometer–Frequency of Tuning Fork
8. Sonometer – Relative Density of a Solid and Liquid
9. Specific heat capacity of liquid–Method of Mixtures (Half-time correction).
10. Comparison of Viscosities of two Liquids–Burette Method
11. Focal length, Power, R and Refractive Index of a long Focus Convex Lens
12. Focal length, Power, R and Refractive Index of a Concave Lens
13. P.O. Box – Temperature coefficient of resistance
14. Spectrometer – Refractive index of a Glass Prism
15. Spectrometer – Hollow Prism- Refractive index of a liquid.
16. Newton's law of cooling-Specific heat Capacity of the Liquid
17. Carey Foster's Bridge-Resistance and Specific Resistance
18. Potentiometer – Calibration of a Low Range Voltmeter
19. Deflection magnetometer – Tan A Position

CORE-III: THERMAL PHYSICS

(Common to B.Sc.Physics with Computer Applications)

Course Objective:

- To make the students understand the various thermo dynamical concepts and principles and to solve problems.

Course OutCome:

- Acquire knowledge of Heat and different measurement techniques in calorimetry
- Use thermodynamic terminology correctly
- Explain fundamental thermodynamic properties
- Learn the basic aspects of kinetic theory of gases and the mean free path of molecular collision
- know about Vander Waals' equation of state and the Joule-Thomson effect

Syllabus:

UNIT I :KINETIC THEORY OF GASES AND MEAN FREE PATH(12 Hours)

Review of results of kinetic theory of gases: (Pressure exerted by gas -rms, average and most probable speed-Equipartition Theorem – Heat capacities) - Distribution of molecular velocities in a perfect gas-Distribution of molecular speeds-Mean free path (Zeroth and First order)

UNIT II: TRANSPORT PHENOMENA AND REAL GASES (12 Hours)

Transport phenomena- Viscosity (Zeroth order approximation)- Effects of Temperature and Pressure on viscosity- Thermal Conductivity- Diffusion – Real gases -Deviations from Perfect gas behaviour- Regnault's Experiment – Vander Waals' equation of state – Discussion of Vander Waals' equation – Joule Experiment – Porous Plug experiment – Joule –Thomson Coefficient for Vander Waals' gas

UNIT III: THERMOMETRY AND CALORIMETRY (12 Hours)

Platinum resistance thermometer – Calendar and Griffith's bridge – Thermistor – Specific heat capacity – Specific heat capacity of solids – Dulong and Petit's law – Specific heat capacity of liquid – method of mixtures – Barton's correction – Specific heat capacity of gases – C_p and C_v by Regnault's and Callendar & Barne's

methods – Variation of Specific Heat Capacity of Diatomic Gases.

UNIT IV: FIRST AND SECOND LAW OF THERMODYNAMICS (12 Hours)

Thermodynamic system, surroundings, boundaries-State of system and Thermodynamic variables – Thermodynamic equilibrium- Processes- The Zeroth law and concept of temperature- origin of the first law- Internal energy-Basic thermal, mechanical and diffusive interactions-the first law-applications of first law(heat capacities of gas, adiabatic equation of state and lapse rate)- Enthalpy-Second law –Origin of second law - Heat engines –The Carnot cycle- Carnot cycle as refrigerator –Kelvin, Planck and Clausius statements-Carnot's theorem

UNIT IV: ENTROPY AND THERMODYNAMIC RELATIONS (12 Hours)

Entropy- Entropy change in reversible processes – Reversible heat transfer-Clausius inequality - Entropy change in irreversible process-the principle of increase of entropy- Joule's expansion- the entropy form of first law- Entropy of an Ideal gas- Entropy of mixing - Unavailable energy: Thermal death of universe - Physical concept of entropy- Maxwell relations- Thermodynamic relations involving heat capacities- TdS equations.

Books for Study:

1. Thermal Physics, S.C.Garg, RM Bansal & CK Ghosh ,Tata McGraw Hill Publications,2nd edition. (2018).

Books for Reference:

1. Heat and Thermodynamics, Zemansky, McGraw – Hill Book Co. Inc., New York.

2. Heat and Thermodynamics , Brijlal and N. Subramanyam, S.Chand& Co, New Delhi (2000)

3. Heat, Narayana Moorthy and KrishnaRao, Triveni Publishers, Madras (1969).

4. Fundamentals of Physics, Resnick Halliday and Walker, 6th edition, , John

Willeyand Sons, Asia Pvt.Ltd., Singapore.

5. Fundamentals of Thermodynamics, Carroll M.Leonard, Prentice-Hall of

India (P)Ltd., New Delhi (1965).

https://swayam.gov.in/nd1_noc20_cy14/preview.

CORE-IV: MATHEMATICAL METHODS IN PHYSICS

Course Objective:

- To familiarize students with essential mathematical methods for solving advanced problems in theoretical physics.

Course OutCome:

- To use advanced mathematical methods and theories on various mathematical and physics problems.
- To develop the skill of problem-solving ability
- Use Matrices to solve simultaneous equations
- Solve quantum mechanical problems using special functions and polynomials.
- Apply Fourier series to simple circuits.
- To understand electromagnetic theory with Vector Calculus

Syllabus:

UNIT I: VECTOR CALCULUS (12 Hours)

Scalar and Vector Fields - Gradient of a Scalar function - Divergence of a Vector function - Curl - Line Integral, Surface Integral and Volume Integral (Simple Problems) - Gauss Divergence Theorem - Stoke's Theorem and Green's Theorem (Statement and Proof)- Spherical Polar Coordinates - Expressions for Gradient, Divergence, Curl and Laplacian Operator in Cartesian and Spherical Polar Coordinates.

UNIT II: SPECIAL FUNCTIONS (12 Hours)

Special Functions - Beta and Gamma Functions - Definitions - Symmetry Property of Beta function - Evaluation of Integrals using Beta function - Transformation of Beta function -

Evaluation of Gamma Function - The value of $\Gamma_{1/2}$ - Transformations of Gamma function (Other

forms) - Relation between Beta and Gamma functions - Simple Problems in beta and gamma functions - Series Solutions for Bessel, Legendre and Hermite Differential Equations.

UNIT III: MATRICES (12Hours)

Special Types of Matrices - Symmetric and Skew-symmetric Matrices -Hermitian and Skew- Hermitian Matrices - Orthogonal Matrices - Unitary Matrices - Properties - Characteristics Equation - Determination of Eigen values and Eigen vectors - Properties - Statement and Proof of Cayley - Hamilton Theorem - Simple Problems - Inverse of Matrix by CH Theorem - Diagonalization of 2x2 Real Symmetric Matrices.

UNIT IV: COMPLEX VARIABLES (12 Hours)

Basics of Complex Numbers and their Graphical Representation - Euler's Formula, De-Moivre's Theorem - Functions of Complex Variables - Limit, Continuity and Differentiability - Analytic Function -Definition - Cauchy-Riemann Conditions - Examples of Analytic Functions (Analyticity) - Cauchy-Riemann Conditions in Polar Form

UNIT V: FOURIER SERIES (12 Hours)

Fourier Series in the interval ($-\pi$ to π) - Definition – Dirichlet's Conditions (Statement Only) - Determination of Fourier Coefficients -Even and Odd Functions and their Fourier expansions. Sine and Cosine Periodic Functions - Simple Problems in Fourier Series in the interval ($-\pi$ to π) -Applications of Fourier series - Half Wave Rectifier and Saw Tooth Wave.

Books for Study:

1. Mathematical Physics, H. K. Dass, S. Chand & Co. Ltd. (2010).
2. Mathematical Physics, Sathya Prakash, Sultan Chand & Sons, New Delhi, Fifth Revised andEnlarged Edition, 2006, (Reprint 2007).
3. Mathematical Physics ,B. D. Gupta, Vikas Publishing house Pvt. Ltd. (2010)

BOOKS FOR REFERENCE:

1. Mathematical Methods for Physicists , G. Arfken, (5th Edition) ,Academic Press, (2000).
2. Mathematical Physics , B.S. Rajput, 8th Edition,Pragati Prakashan(1978**).**
3. Foundations of Mathematical Physics , Sadri Hassani, Second Edition.Springer
4. Mathematical methods for Physics and Engineering, K.F.Riley, M.P.Hobson &S.J.Bence ,Cambridge University Press, 3rd Edition.
5. http://phy.syr.edu/~trodden/courses/math methods.
6. http://www.mpipks_dresden.mpg.de/~jochen/methoden/outline/html
7. https://freevideolectures.com/course/3288/electromagnetic-theory/4

8. https://freevideolectures.com/course/3288/electromagnetic-theory/2
9. https://freevideolectures.com/course/3288/electromagnetic-theory/1
10. https://freevideolectures.com/course/3288/electromagnetic
11. theory/3 https://nptel.ac.in/courses/111103070/
12. https://nptel.ac.in/courses/111107112/

CORE-V: MECHANICS

Course Objective:

- To make the students understand the basic principles of mechanics and enable them to analyzeand solve problems

Course OutCome:

- Understand the Newton's law of motion
- Know the motion of a particle in a Gravitational, electric and magnetic fields
- Acquire knowledge on the conservation law
- Gain knowledge on the basics of dynamics of linear and rotational motion
- Realize the basic principles behind planetary motion
- Understand the space - time concept through relativity

Syllabus:

UNIT I: NEWTON'S LAWS OF MOTION (12 Hours)

Newton's Laws of Motion- Forces and Equations of Motion- Motion of a Particle in a Uniform Gravitational Field- Newtonian law of Universal Gravitation-Examples-Electric and Magnetic Forces on a Charged Particle-The Magnetic Field and Lorentz Force-Examples- Motion of Charged Particle in a Uniform Electric and Magnetic Field-Conservation of Momentum-Contact Forces: Friction- Problems

UNIT II : CONSERVATION LAWS (12 Hours)

Definition of concepts-Conservation of Energy-Work-Kinetic and Potential energy-Examples- Conservative Forces-Potential Energy and Conservation of Energy in Gravitational and Electric field- Examples.

Conservation of Linear and Angular Momentum: Internal forces and Momentum conservation- Center of mass- Examples- General Elastic Collision of Particles of Different Masses- System with Variable Mass-Examples- Conservation of Angular Momentum-Torque due to Internal Forces-Torque due to Gravity- Angular momentum about Center Of Mass- Proton scattering by heavy nucleus.

UNIT III: HARMONIC OSCILLATOR AND INVERSE SQUARE LAW OF FORCE

(12 Hours)

Mass on spring-Simple Pendulum (Force, energy and torque method)-Compound Pendulum-LC circuit- Motion of systems displaced from position of stable equilibrium-Average kinetic energy and potential energy.

Inverse Square Law of Forces and Static Equilibrium- Orbits: Equation and Eccentricity-Circularorbit-Kepler's laws- Examples

UNIT IV: ELEMENTARY RIGID BODY DYNAMICS (12 Hours)

The Equation of Motion-Angular Momentum and Kinetic Energy-Moment of inertia-Parallel Axis Theorem- Perpendicular Axis Theorem- Examples-Rotation about fixed axis: Time Dependence of Motion- Examples- Rolling without slipping (three methods)-Torque about Center of Mass-Examples.

UNIT V: SPECIAL RELATIVITY (12 Hours)

Constancy of Speed of light-Michelson-Morley Experiment-Invariance of 'c' – Basic assumptions- Lorentz Transformation- Length Contraction-Examples- Time Dilation of Moving Clocks–Examples–Velocity Transformation– Velocity Addition–Variation of Mass with Velocity-Aberration of light–Longitudinal Doppler Effect

Book for study:

1. Mechanics (in SI units) - (Berkley Physics course-volume 1), Charles Kittel, Walter Dknight etc, Tata McGraw Hill publication, 2017,second edition.

Books for reference:

1. Newtonian Mechanics ,A.P.French, Viva Books Private, (2011).
2. Introduction to mechanics , Kleppner and Kolenkow, McGraw Hill Publishers (SpecialIndian edition), first edition (2010)
3. https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/115101011/lec1.pdf
4. https://nptel.ac.in/courses/115101011/

CORE-VI: CORE Practical - II

(At the end of Fourth semester - Any Fifteen Experiments)

Course Objective:

Course OutCome:

Syllabus:

1. Young's Modulus-Cantilever-Depression-(Static method-Scale and Telescope).
2. Young's Modulus –Uniform bending – Pin &Microscope.
3. Rigidity Modulus-Static Torsion (Scale and Telescope)
4. Compound Pendulum-g and k
5. Sonometer-A.C. Frequency-Steel and Brass wires.
6. Melde's string- Frequency, Relative Density of a solid and liquid.
7. Thermal conductivity o f a bad conductor-Lee's disc method.
8. Spectrometer-Grating N and λ-minimum deviation method.
9. Spectrometer-μ of a glass prism -i-d Curve
10. Airwedge-Thickness of a wire.
11. Deflection Magnetometer – Tan B position
12. m and B_H -Deflection Magnetometer-Tan C position and vibration magnetometer
13. Carey Foster Bridge - Temperature coefficient of resistance of a coil.

14. Potentiometer – Specific resistance of the given wire.
15. Potentiometer-Ammeter calibration.
16. Potentiometer- Emf of thermocouple.
17. Figure of merit of galvanometer (Mirror or Table Galvanometer).
18. Surface tension – Capillary rise method.
19. Specific heat of capacity – Joule's calorimeter.

CORE-VII: OPTICS & SPECTROSCOPY

(Common to B.Sc.Physics with Computer Applications-III Sem.)

Course Objective:

- To understand the defects in lenses and rectifying methods.
- To study the applications of Interference, diffraction and polarization.
- To gain overall knowledge in spectroscopic techniques.

Course OutCome:

- Know the methods of rectifying different defects in lenses.
- Work with interferometers and other optical instruments.
- Distinguish between resolving power and dispersive power.
- Understand the rectilinear propagation of light.
- Be conversant with production and detection of different types of polarized light.
- Extract the dynamic information about the molecules using the spectroscopic techniques

Syllabus:

UNIT I: GEOMETRICAL OPTICS (12 Hours)

Aberration in lenses - Spherical aberration in a lens - Methods of minimizing spherical aberration
- Condition for minimum spherical aberration in the case of two lenses separated by a distance - Chromatic aberration in lenses - Condition for achromatism of two thin lenses (In and out of contact) - Dispersion produced by a thin prism - Achromatic prisms - Combination of prisms to produce (i) Dispersion without deviation (ii) Deviation without dispersion - Direct vision spectroscope.
Eyepieces -Ramsden's and Huygens's eyepieces -Construction, Theory

UNIT II: INTERFERENCE (12 Hours)

Analytical treatment of interference - Expression for intensity - Condition for maxima and minima in terms of phase and path difference - Coherent sources, Interference in thin films – transmitted and reflected - Colour of thin films -Air wedge - Determination of diameter of thin wire - Test for optical flatness - Determination of wavelength of light using Newton's rings - Haidinger's fringes - Michelson's Interferometer – Theory - Applications - Determination of wavelength - Thickness of thin transparent material and resolution of interferometer.

UNIT III: DIFFRACTION (12 Hours)

Fresnel diffraction - diffraction at a circular aperture and narrow wire – Fraunhofer diffraction - Single slit - Double slit - (Simple theory) - Plane diffraction grating – Plane transmission grating element – Missing order - Overlapping spectra - Maximum number of orders - Determination of wavelengths using grating - Normal incidence - Dispersive power of a grating - Rayleigh's criterion for resolution - Limit of resolution of the eye - Resolving power of Telescope and microscope - Resolving power of prism and grating - Difference between resolving power and dispersive power.

UNIT IV: POLARISATION (12 Hours)

Double refraction - Nicol prism - Polarizer and analyser - Huygens explanation of double refraction in uni-axial crystals - Dichroism - Polaroids and their uses - Double image polarizing prisms - Quarter wave plate and Half wave plate - Plane, elliptically and circularly polarized light - Production and detection - Babinet's Compensator - Optical Activity - Fresnel's explanation of optical activity - Specific rotatory power - Determination using Laurent's half shade polarimeter.

UNIT V: SPECTROSCOPY (12 Hours)

Introduction to spectroscopy - Electromagnetic spectrum - Characterization of electromagnetic radiation - Quantization of energy - Regions of the spectrum – Classification of molecules – Microwave spectroscopy – Rigid rotator - Vibrational spectroscopy – Harmonic oscillator - Raman effect - Experimental set up - Characteristics of Raman lines -Ultraviolet spectroscopy- Origin and theory of ultraviolet spectra- Introduction to Nuclear Magnetic Resonance – Quantum description of NMR- Larmor equation - Chemical shift (Qualitative study)

BOOKS FOR STUDY:

1. Optics, AjayGhatak, Tata McGraw-Hill publishing Co. Ltd., New Delhi (1998).
2. A Text book of Optics, Subrahmanyam N., BrijLal and M. N. Avadhanulu, S. Chand & Co., New Delhi (2006).

3. Molecular Structure and Spectroscopy, Aruldhas, Prentice Hall of India Pvt. Ltd., NewDelhi (2005).
4. Optics and Spectroscopy ,R.Murugesan and Kiruthiga Sivaprasath, S. Chand & Co., New Delhi (2006).

BOOKS FOR REFERENCE:

1. Optics, Khanna D. R. &Gulati H. R., S. Chand & Co., New Delhi (1979).
2. Fundamental of optics, Jenkins & White, McGraw Hill 4th edition (1981).
3. Fundamentals of Physics, D. Halliday, R. Resnick and J. Walker, Wiley,6th Edition, New York (2001).
4. H. Lipson and D.S Tannhauser, S.G. Lipson, Optical Physics, (3rd edition), CambridgeUniversity press (1995).
5. Miles V. Klein and Thomas E.Furtak, Optics, John Wiley & sons(2nd edition) (1987)
https://nptel.ac.in/content/storage2/courses/102103044/pdf/mod2.pdf
https://nptel.ac.in/courses/122103011/

CORE-VIII: ELECTRICITY AND ELECTROMAGNETISM

(Vector Treatment Only)

(Common to B.Sc.Physics with Computer Applications-VI Sem.)

Course Objective:

- To give the students a firm understanding of the basics of Electricity and Magnetism.
- To familiarize the fundamentals of electromagnetic theory and applications of electromagneticinduction.

Course OutCome:

- Demonstrate Gauss law, Coulomb's law for the electric field and apply it to systems of point charges as well as line, surface and volume distribution of charges
- Understand the principle of capacitors and dielectric properties
- Explain Faraday and Lenz's laws to articulate the relation between electric and magnetic fields
- Use Ballistic Galvanometer with the state of art.
- Apply Maxwell's equations to arrive at different optical constants

Syllabus:

UNIT I: ELECTROSTATICS I (12 Hours)

Properties of charges - Coulomb's law and its Validity –Superposition Principle – Electric field and Electric Potential – Relations between field and potential - Energy consideration – Flux – Gauss law – Linear, Surface and Volume charge distributions – Solutions of Laplace equation – Stability of Charges – Electric dipole – Multipole expansion

UNITII: CONDUCTORS, CAPACITORS AND DIELECTRICS (12 Hours)

Electrical Images and its Applications (Earthed sheet and earthed Spherical conductor) – Capacitance – Energy Consideration – Classical Radius of an Electron –Polarization Density – Polarization Charge Densities – Relation between D, E and P, Gauss's law in the presence of a dielectric – Boundary condition on D and E

UNIT III :MAGNETIC EFFECTS OF AN ELECTRIC CURRENT(12 Hours)

Biot-Savart's law and its Application to Circular Loop-Helmholtz Galvanometer-Ampere's Circuital Law both in Integral and Differential Form and its Application to Current Carrying Loop, Solenoid and Toroid-Properties of B: Curl and Divergence Force on a current element in a magnetic field-Moving coil Ballistic Galvanometer-Damping Correction-Figure of Merit-Determination of Absolute Capacitance of a capacitor

UNIT IV: ELECTROMAGNETIC INDUCTION (12 Hours)

Faraday's law of Electromagnetic Induction (Differential and Integral form)-Lenz's law-Self Inductance– Mutual Inductance – Coefficient of Coupling-Self Inductance of a long solenoid- Mutual Inductance of two coils- Measurement of L and M using Ballistic Galvanometer- Transformers-Construction and working -Efficiency and Energy loss

UNIT V: ELECTROMAGNETIC WAVES (12 Hours)

Types of currents-Concept of Displacement Current – Maxwell's equations – Maxwell's equations in Free Space-Electromagnetic Waves Equations-Velocity of EM wave-Transverse nature of EM wave-Poynting vector and its significance-Reflection and Transmission of electromagnetic waves at an interface of non-conducting medium.

Books for Study:

1. Electricity and Magnetism, A S Mahajan, A A Rangwala, McGraw Hill, NewDelhi (2017)
2. Introduction to Electrodynamics, David J. Griffith, PHI, NewDelhi, (2012).
3. Electromagnetic theory, Chopra & Agarwal, K Nath& Co.

Books for Reference:

1. Electricity and Magnetism, E M. Purcell, David Morin (3rd Edition) , Cambridge UniversityPress.
2. Basic laws of Electromagnetism, I E Irodov, New Age International Publishers, New Delhi,(2019).
3. Electricity and Magnetism, NavinaWadhwani, PHI, NewDelhi,(2007).
4. Electricity and Magnetism, K.K Tewari, S Chand & Co, NewDelhi,(2007).
5. Fundamentals of Physics – Electricity and Magnetism, Halliday – Resnick and Walker,WileyIndia PvtLtd,(2011).
6. https://swayam.gov.in/nd1_noc20_ph08/preview
7. https://www.youtube.com/playlist?list=PLQNC9KhS56XwsAtI28BZGC9cEGWGhuEOk
8. https://nptel.ac.in/courses/115101005/
9. https://nptel.ac.in/content/storage2/courses/115101004/downloads/module1/ed-1-1-new.pdf

CORE-IX: QUANTUM MECHANICS

(Common to B.Sc.Physics with Computer Applications-VI Sem.)

Course Objective:

- To introduce to the undergraduate students the development and formulation of Quantum Mechanics, its under lying Mathematical and Physical principles through exactly solvable problems.

Course OutCome:

- Know the inadequacies of classical mechanics in explaining microscopic phenomena
- Introduce with the concept of matter waves and their existence proved by experimental¬ procedure and uncertainty principle in physical measurements
- Formulate quantum mechanics through Schrodinger equation and associated different operators
- Derive time dependent and independent Schrödinger equations
- Find eigen values and eigen functions of one dimensional and three-dimensional problems

Syllabus:

UNIT I: ORIGIN OF QUANTUM MECHANICS (12 Hours)

Limitations of Classical Physics- Black – Body Radiation Curve- Optical Spectra- Photoelectric Effect- Specific Heat of Solids – Planck's Quantum Hypothesis - Compton Effect- Quantum Theory of Specific Heat-Bohr Atom Model of Hydrogen Atom- Franck and Hertz Experiment – Inadequacy of (Old) Quantum Theory

UNIT II: WAVE MECHANICS (12 Hours)

Wave Nature of Particles – Matter Waves – Diffraction Experiment- Heisenberg's Uncertainty Principle - Application of Uncertainty Relation – Principle of Super Position –Wave Packet - Time dependent Schrodinger Wave Equation- Interpretation of the Wave Function, Probability Interpretation, Probability Current Density and Equation of Continuity- Ehrenfest theorem-Time Independent Schrodinger Wave Equation-Stationary States, Admissibility Conditions

UNIT III: FORMALISM OF QUANTUM MECHANICS (12 Hours)

Linear Vector Space –Orthogonal Functions –Linear Operator -Eigen Functions and Eigenvalues- Hermitian Operator- Postulates of Quantum Mechanics – Simultaneous Measurability of Observables-Eigen Values of Angular Momentum Operators-Ladder Operators

UNIT IV: ONE DIMENSIONAL EIGEN VALUE PROBLEMS (12 Hours)

Square Well Potential: Rigid Walls, Finite Walls and Potential Barrier – Alpha Emission - LinearHarmonic Oscillator (Series Method) – Free Particle

UNIT V: THREE-DIMENSIONAL ENERGY EIGEN VALUE PROBLEMS (12 Hours)

Particle Moving in a Spherically Symmetric Potential – Radial and Angular Part of Schrodinger Equation - System of Two Interacting Particles -Rigid Rotator – Hydrogen Atom- Radial Equation –Solution to Radial Equation – Energy Eigen Values and Eigen Functions

Books for Study:

1. Quantum Mechanics, G Aruldhas, 2nd ed,PHI,(2013).

Books for Reference:

1. Quantum Mechanics, Leonard L. Schiff, 3rd edition, McGraw-Hill.
2. A Text book of Quantum Mechanics, PM Mathews & K Venkatesan, 2nd ed, Tata McGrawHill, (2011).
3. Quantum Mechanics, V.Devanathan,Narosa Publications
4. Quantum Mechanics , Concepts and Applications, NouredineZettili, 2nd ed,Wiley(2009).
5. Introduction to QuantumMechanics, David Griffiths, 2nd ed,Pearson,(2015).
6. Introduction to modern physics ,H.S.Mani&G.K.Mehta, East West press
7. Concepts of Modern Physics,ArthurBeiser et al, 6th ed, Tata McGrawHill, (2009).
8. https://nptel.ac.in/courses/115101107/
9. https://nptel.ac.in/courses/122106034/

CORE-X: BASIC ELECTRONICS

(Common to B.Sc.Physics with Computer Applications)

Course Objective:

- To study the characteristics and application of various semiconductor devices.
- To study the basics of electronic Instrumentation.

Course OutCome:

- Handle basic electronic devices like diode and transistor
- Construct amplifiers of different specification
- Apply Barkhausen criteria to oscillators
- Understand the different types of multivibrators
- Get an idea about Instrumentation

Syllabus:

UNIT I: SEMICONDUCTORS (10 Hours)

Band gap-Forbidden Gap-Valence and Conduction Bands-Pure Semiconductors-Impurity in Semiconductors-Energy band Diagram and Fermi level-Fermi Energy and Carrier Concentration of Intrinsic and Extrinsic Semiconductors-PN junction-barrier- Voltage across the junction - Junction Diodes- Zener Diodes- V-I characteristics-Light Emitting Diodes-Photo Diodes

UNIT II : TRANSISTOR AMPLIFIER (14 Hours)

Transistors- CB and CE modes-Characteristics-Two Port Representation of a Transistor- h- parameters-AC equivalent circuit using 'h' parameters-Analysis of an Amplifier using h parameters (CE configuration only)-Expression for current gain, voltage gain, input impedance, output impedance and power gain- RC Coupled Amplifier - Frequency Response - Analysis of low, mid and high frequency regions - Classification of Amplifiers - Class A Power Amplifier – Push Pull- Class B Power Amplifier - Emitter Follower

UNIT III : OSCILLATORS AND MULTIVIBRATORS (12 Hours)

Feedback in amplifiers - Effect of Negative Feedback- Barkhuesen Condition For Oscillations - Hartley and Colpit's Oscillators, Phase Shift and Wien's Bridge Oscillators - Expression for Frequency of Oscillation and condition for Oscillation in each case.

Multivibrators - Astable, Monostable and Bistable Multivibrator - using transistors

UNIT IV: SPECIAL SEMICONDUCTOR DEVICES AND WAVE SHAPING CIRCUITS (12 Hours)

Unipolar Devices- FET – Construction- Working -Characteristics - FET Amplifiers-UJT –Construction-Working- Characteristics - UJT-Saw Tooth Wave Generator- SCR – Characteristics –SCR as a Switch-SCR Rectifier.

Clipping and Clamping Circuits - Biased Clipper - RC Time Constant -Integrating and Differentiating Circuits

UNIT V: BASICS OF INSTRUMENTATION (12 Hours)

Definition of measurement and Instrument - Block Diagram of an Instrument – Components – Input, Output, Processing element of an instrument – Functional Elements of Pressure Thermometer– Types of instrument – Basic definition – Accuracy, Precision, Sensitivity, Threshold, Resolution, Drift, Dead Zone, Selectivity, Hysteresis, Range, Bias, Repeatability, Reproducibility – Errors.

Books for Study:

1. Electronic devices and circuits, Theodore F. Bogart, 6th edition, Pearson, 2004.

2. Electronic devices and circuit Theory 11th edition by Robert L. Bolysted and Louis Nashelsky, Pearson, 2017.
3. Elements of Electronics, M.K.Bagde and Singh S.P., S. Chand &Co., New Delhi(1990).
4. Principles of Electronics, V.K. Mehta, Rohit Mehta ,S. Chand & Co.(2006).
5. Applied Electronics , A. Subramanyam ,National Publishing Co.(1997).
6. Hand Book of Electronics, Gupta and Kumar ,PragatiPrakashan,Meerut(2002).
7. Electronics, M. Arul Thalapathi, Comptek Publishers(2005).
8. Elements of Electronic Instrumentation and Measurement, Joseph J Carr, Pearson Education.
9. A course in Electrical and Electronic Measurement and Instrumentation, A. K. Sawhney,DhanpatRai& Co. (Pvt.) Ltd, Nineteenth Revised Edition.(2012).

Books for Reference:

1. Electronic Devices ,Mittal.G.K., G.K. Publishers Pvt. Ltd., (1993).
2. Basic Electronics, B.L. Theraja, S. Chand & Co., (2008).
3. Solid State Electronics, Ambrose and Vincent Devaraj, Meera Publication.
4. Applied Electronics, R.S. Sedha, S. Chand & Co.(1990).
5. Digital Instrumentation, A. J. Bouwen, McGraw Hill,(1986).
6. Electronic Instrumentation andMeasurement Technique, W. D. Cooper and A. D. HelfrickIII Edition, Prentice-Hall, India(1991).
7. Instrumentation, devices and systems, Rangan, Sarma and Mani, Tata Mc-Graw Hill
8. Electronic Instrumentation, H. S. Kalsi , Tata Mc-Graw Hill.
9. E-source: http://www.freestudy.co.uk/instrumentation/
10. https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/122106025/lec39.pdf
11. https://nptel.ac.in/content/storage2/courses/113106062/Lec13.pdf

CORE-XI: CORE PRACTICAL – III (General)

(Common to B.Sc.Physics with Computer Applications)

(At the end of Sixth Semester - Any Fifteen Experiments)

Course Objective:

Course OutCome:

Syllabus:

1. Young's modulus of the material of the beam- Non uniform Bending - Koenig's

method.

2. Young's modulus of the material of the beam- Uniform Bending - Koenig's method.
3. Newton's rings - R_1, R_2 and μ of convex lens.
4. Spectrometer - (i - i') curve - Refractive Index.
5. Spectrometer - Small angled prism - Normal incidence and emergence. Determination ofthe refractive index of the material of prism.
6. Spectrometer – Dispersive power of a prism.
7. Spectrometer – Dispersive power of a grating.
8. Spectrometer - Cauchy's constant.
9. Bifilar pendulum – Parallel threads – verification of two theorems.
10. Field along the axis of a circular coil - Deflection magnetometer - B_H and M.
11. Field along the axis of a circular coil - vibration magnetic needle - B_H.
12. Potentiometer - Calibration of high range voltmeter.
13. Potentiometer – conversion of galvanometer into voltmeter.
14. Potentiometer – conversion of galvanometer into ammeter.
15. Ballistic Galvanometer - Absolute capacitance of a capacitor.
16. Ballistic Galvanometer-Charge Sensitivity
17. Ballistic Galvanometer- Comparison of Mutual inductances.18.Ballistic Galvanometer.-Comparison of Capacities
19. Determination of wavelength He-Ne Laser by diffraction.
20. Spectrometer Grating-Normal incidence method -Wavelength of MercurySpectrum

CORE-XII: CORE PRACTICAL – IV (Basic Electronics)

(Common to B.Sc.Physics with Computer Applications)

(At the end of Sixth Semester - Any Fifteen Experiments)

Course Objective:

Course OutCome:

Syllabus:

1. A.C. Circuit – LCR – Series resonance.
2. A.C. Circuit – LCR – Parallel resonance.
3. Bridge rectifier - Zener regulated power supply - 9V characteristics.
4. Verification of Demorgan's theorem.
5. Emitter follower.
6. FET characteristics.
7. Common Source FET amplifier.
8. UJT characteristics
9. UJT as Relaxation oscillator.
10. SCR characteristics.
11. Transistor – Astable multivibrator.
12. Transistor – Bistable multivibrator.
13. Transistor – Phase shift oscillator.
14. Transistor – Wien's bridge oscillator.
15. NAND and NOR as universal gates.
16. Half Adder &Full adder (using basic logic gates and Ex-OR gate or NAND gates only).
17. Half Subtractor& Full subtractor (using basic logic gates and Ex-OR gate or NAND gatesonly).
18. RC coupled single stage CE Transistor amplifier – frequency response.19.Decode Counter using 7490
20. 4 Bit Shift Register using 7473/7476
21. 4 Bit ripple Counter using 7473/7476

CORE-XIII: CORE PRACTICAL – V (Applied Electronics)

(Common to B.Sc.Physics with Computer Applications)

(At the end of Sixth Semester - Any Fifteen Experiments)

Course Objective:

Course OutCome:

Syllabus:

1. Microprocessor – 8085 – 8 bit Addition
2. Microprocessor – 8085 – 8 bit Subtraction
3. Microprocessor – 8085 – 8 bit Multiplication
4. Microprocessor – 8085 – 8 bit Division
5. Microprocessor – 8085 – Sorting of given set of numbers in ascending order
6. Microprocessor – 8085 – Sorting of given set of numbers in descending order
7. Microprocessor – 8085 – Finding the largest no. in a given set of numbers.
8. Microprocessor– 8085 – Finding the smallest no. in a given set of numbers.
9. Microprocessor– 8085 – reversing the elements in an array.
10. Microprocessor – 8085 – Addition of N Number of single byte numbers
11. Op amp 741 - Inverting, Non - Inverting amplifier, unity follower.
12. Op amp 741 - Summing and difference amplifier
13. Op amp 741 – Differentiator, integrator
14. OP amp 741 – Solving simultaneous equations.
15. OP amp 741 – Astable multivibrator.
16. Op amp 741 – Wien's Bridge oscillator
17. Op amp 741 - Phase Shift oscillator
18. Op amp 741-Solving Simultaneous Equations
19. 555 - Timer - Schmitt Trigger
20. 555 - Timer - Astable operation
21. D/A Converter – 4 bit, binary weighted resistor method

CORE-XIV: ATOMIC PHYSICS & LASERS

(Common to B.Sc.Physics with Computer Applications-IV Sem.)

Course Objective:

- To study the transition from particle to wave nature
- To study the atomic structure and spectral series with electric and magnetic fieldsTo inculcate in depth knowledge in Lasers.

Course OutCome:

- Use Photo electric effect appropriately
- Analyze the atomic structure and associated coupling schemes
- Understand the splitting of spectral lines due to electric and magnetic fields
- Be familiar with X rays and its applications
- Distinguish different types of Lasers.

Syllabus:

UNIT I: PHOTO-ELECTRIC EFFECT (10 Hours)

Richardson and Compton experiment - Laws of Photoelectric emission - Einstein Photo Electric Equation - Millikan's Experiment - Verification of Photoelectric equation -Photo electriccells - Photo emissive cells - Photovoltaic cell - Photo conducting cell - Photomultiplier.

UNIT II: ATOMIC STRUCTURE (10 Hours)

Bohr and Sommerfeld atom models - Vector atom model - Pauli's exclusion principle - Explanation of periodic table - various quantum numbers - angular momentum and magnetic moment - coupling schemes - LS and JJ coupling - special quantisation - Bohr magnetron – Sternand Gerlach experiments.

UNIT III: FINE STRUCTURE OF SPECTRAL LINES (15 Hours)

Excitation and Ionization Potential – Frank and Hertz's experiment - Davis and Goucher's method-Spectral terms and notions - selection rules - intensity rule and interval rule -fine structure of sodium D_2 lines - Alkali Spectra - Fine Structure of Alkali Spectra - Spectrum of Helium - Zeeman effect - Larmor's theorem - Debye's explanation of normal Zeeman effect- Anomalous Zeeman effect - theoretical explanation- Lande's `g' factor and explanation of splitting of D_1 and D_2 lines of sodium -Paschen-Back effect - Stark effect (qualitative study only).

UNIT IV: X-RAYS (10 Hours)

X-rays: Bragg's law - X-ray spectroscopy - characteristic X-ray spectra - continuous X-ray spectra - X-ray absorption and fluorescence - Moseley's law - uses of X-rays-Compton effect -Experimental verification of Compton effect.

UNIT V: Lasers (15 Hours)

Basic principles of laser – Einstein Coefficients – Condition for light amplification - Population inversion - Threshold condition – Optical resonators (Qualitative only) -Types of Lasers –Solid State lasers - Ruby and Nd-YAG Laser - Gas lasers - He-Ne and Co_2 Lasers- Construction and Working- Semiconductor lasers - (Homojunction & Heterojunction)-Industrial and Medical Applications.

Books for Study:

1. Concepts of Modern physics, A Beiser, Tata McGraw Hill, New Delhi (1997).
2. Modern Physics, R Murugeshan, S Chand & Co., New Delhi (2004).
3. Atomic and Nuclear Physics, N Subramanian and BrijLal, S Chand & Co. (2000).

4. Atomic Physics,J .B.Rajam,S.Chand& Co, 20th Edition, New Delhi(2004)
5. Laser theory and applications ,K. Thyagarajan and AjoyGhatak,Cambridge University Press,(1999).
6. An Introduction to laser, Theory and Applications ,M. N.Avadhanulu, S. Chand and Co.,New Delhi (2001).

Books for Reference:

1. Fundamentals of Physics, D Halliday, R Resnick and J Walker,6th edition, Wiley NY(2001).
2. Physics for Engineering, P.K. Palanisamy, Scitech PublishingPvt. Ltd,Chennai.
3. Lasers and non-linear optics, B. B. Laud, New Age International (P) Ltd., IIIEdn., (2011).
4. https://youtu.be/Aoi4j8es4gQ
5. https://www.digimat.in/nptel/courses/video/104104085/L06.html

CORE-XV: NUCLEAR & RADIATION PHYSICS

(Common to B.Sc.Physics with Computer Applications-V Sem.)

Course Objective:

- To study the basic structure of nucleus and nuclear models
- To analyse the radioactivity of nuclear substances and radiation hazardTo introduce the concept of elementary particles.

Course OutCome:

- Describe the nuclear models
- Understand the half life and mean life of radioactive substances and the mechanism of radiation
- Appreciate the production of nuclear energy through nuclear fission
- Understand the aspects of Radiation Physics and the impact on the environment
- Be familiar with the conservation laws associated with elementary particles

Syllabus:

UNIT I: GENERAL PROPERTIES OF NUCLEI (10 Hours)

Nuclear size, charge, mass-Determination of nuclear radius-Mirror nucleus method-Mass defect and Binding energy-Packing Fraction - Nuclear Spin - Magnetic dipole moment -Electric quadrupole moment-Nuclear models-Liquid drop model-Weizacker semi empirical mass formula-Shell model and Magic numbers-Collective model-Nuclear forces-Meson theory of Nuclear Force (qualitative).

UNIT II: RADIOACTIVITY (15 Hours)

Natural Radioactivity-Law of Disintegration-half life and mean life period-units of Radioactivity-Transient and Secular equilibrium-Radiocarbon Dating-Age of Earth - Alpha rays- Characteristics-Geiger-Nuttal law-α-ray Spectra-Gamow's Theory of α-decay (qualitative study)- Beta rays-Characteristics-Beta ray spectra-Neutrino hypothesis-Violation of Parity Conservation- Experimental Verification with Co_{60}-gamma rays and Internal conversion-Nuclear Isomerism.

UNIT III: RADIATION DETECTORS AND PARTICLE ACCELERATOR (10 Hours)

Ionisation chamber-G.M.Counter-Quenching and Resolving time-Scintillation Counter-Photo Multiplier Tube – Thermoluminescence -Thermoluminescence Dosimetry (TLD)- Linear Accelerator-Cyclotron-Synchrocyclotron -Betatron.

UNIT IV: RADIATION PHYSICS (15 Hours)

Nuclear fission - Chain reaction - Reactor theory – Critical size of a reactor - General aspect of reactor design - Classification of reactors - Pressurized heavy water reactor – Fast breeder reactor

- Radiation hazards - Biological effects of radiation – Radiation sickness - Radiation units and Operational limits - Radiation Survey Meters -Pocket Dosimeter - Control of Radiation hazards -Radioisotopes used for therapy - Nuclear medicine - Industrial applications – Food preservatives.

Unit V: ELEMENTARY PARTICLES (10 Hours)

Classification of Elementary Particles-Fundamental Interaction-Elementary Particle- Quantum Numbers - Isospin and Strangeness - Conservation laws and Symmetry-Basic Ideasabout Quark- Quark Model.

BOOKS FOR STUDY

1. Nuclear Physics ,Tayal D.C., Himalaya Publishing House, Mumbai(2006).
2. Elements of Nuclear Physics ,M L Pandya & R P S Yadav KedarNathRamNath (2000)
3. Atomicand Nuclear Physics, N. Subramanyam and Brijlal, S Chand & Co., New Delhi(1996).
4. Nuclear and Particle Physics-An Introduction, Satadal Bhattacharya, University Press(India) Pvt Ltd., Hyderabad.
5. Modern Atomic and Nuclear Physics, AB Gupta, Books andAllied 2014
6. Nuclear Physics, R.C.Sharma, K.Nath & Co., Meerut (2000)

BOOKS FOR REFERENCE

1. Nuclear Physics, R.R.Roy and B.P.Nigam, New Age International (P) Ltd., NewDelhi(1997).
2. Introduction to Modern Physics, H.S.Mani &G.K.Mehta, East West press
3. Fundamentals of Elementary Particle Physics, Longo, McGraw-Hill.
4. Nuclear Physics, S N Ghoshal, S Chand & Co. Edition, (2003).
5. Nuclei and Particles ,Serge., W.A. Benjamin, USA
6. https://nptel.ac.in/courses/115103101/
7. https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/115104043/lec33.pdf
8. https://nptel.ac.in/courses/115102017/

CORE-XVI: SOLID STATE PHYSICS

(Common to B.Sc.Physics with Computer Applications-V Sem.)

Course Objective:

- To understand the fundamental concepts of crystal structure.
- Toanalyze the crystal structure using X-ray diffraction methods.
- To acquire knowledge on the basics of magnetic phenomena on materials and varioustypes of magnetization.

- To learn the properties of superconducting materials.

Course OutCome:

- Helps as pre-requisite for understanding materials science, nanoscience, etc.
- Gives relationship between structure and properties of the solid state systems.
- To understand the importance of superconducting materials in engineering applications.
- To understand the different types of bonding in solid substances.
- To understand the magnetic and dielectric properties of crystalline structures

Syllabus:

UNITI: CRYSTAL STRUCTURE

Crystal lattice – Primitive and Unit cells – Bravais lattices: Two Dimensional and Three Dimensional Bravais lattices – Miller Indices – Structure of Crystals – Close Packing: Hexagonal close packing and Cubic close packing – Sodium chloride structure, ZincBlende structure, Diamond structure.

UNIT II: X RAY DIFFRACTION ANDDEFECTS IN SOLIDS

X ray diffraction – Bragg's law –Van Laue equations- Experimental methods: Laue method, Powder crystal method and Rotating crystal method.

Defects in solids - Point defects - Frenkel and Schottky defects – Equilibrium concentrations - Line defects - Edge dislocation and Screw dislocation - Surface defects -Grain boundary - Effects of Crystal imperfections.

UNIT III: CHEMICAL BONDS

Interatomic forces –Condition for bonding - Different types of chemical bonds - Ionic bond – Cohesive energy of Ionic Crystals and Madelung constant - Born Haber cycle-Covalent bond - Metallic bond - van der Waals bond - Hydrogen bond.

UNIT IV: DIELECTRIC PROPERTIES

Dielectric materials - Polarization, Susceptibility and Dielectric constant - Local fieldor Internal field - Clausius - Mossotti relation - Sources of Polarizability– Electronic Polarizability–lonic Polarizability–Orientational Polarizability -

Frequency and temperature effects on polarization - Dielectric Breakdown – Properties of different types of Insulating materials.

UNIT V: MAGNETISM AND INTRODUCTION TO SUPERCONDUCTORS

Different types of magnetic materials - Classical theory of Diamagnetism (Langevin theory) - Langevin theory of Paramagnetism - Weiss theory of Para magnetism– Heisenberg interpretation on Internal field and Quantum theory of Ferromagnetism –Antiferromagnetism- Hard and soft Magnetic materials.

Superconductivity - General properties –Critical Temperature and Critical Magnetic field - Type I and II Superconductors –Meissner effect - BCS theory - Applications of Super conductors.

Books for Study

1. Introduction to Solid State Physics ,Kittel, Willey Eastern Ltd (2003).
2. Solid state Physics, Rita John ,1st edition, TataMcGraw Hill publishers (2014).
3. Solid State Physics , R L Singhal, Kedarnath Ram Nath& Co., Meerut (2003).

Books for Reference

1. Solid State Physics ,S.O.Pillai, New Age International (P) Ltd.,(2002).
2. Solid State Physics , A. J.Dekker, Macmillan India(1985).
3. Solid State Physics , HC Gupta, Vikas Publishing House Pvt. Ltd., New Delhi (2001).
4. Materials Science and Engineering , V. Raghavan, Prentice Hall of India PrivateLimited,New Delhi(2004).
5. https://nptel.ac.in/courses/115105099/
6. https://nptel.ac.in/courses/115106061/

ELECTIVE-II(A): INTEGRATED ELECTRONICS

(Common to B.Sc.Physics with Computer Applications-IV Sem.)

Course Objective:

- To study the different number systems associated with digital computation
- To introduce the counters and registers.
- To have in-depth knowledge in arithmetic operations of an operational amplifier.

Course OutCome:

- Through knowledge on different number systems
- The skill to simplify the logics using Karnaugh map and Boolean algebra
- Detailed knowledge in storing and retrieving a data through mux and demux
- The skill to customize the counters to the need through serial and parallel counters

Syllabus:

UNIT I: FUNDAMENTAL DIGITAL ELECTRONICS (12 Hours)

Number systems – Binary – Hexadecimal – Binary addition – subtraction (1's and 2's compliment method) – Multiplication - Division - BCD – Conversion – Simplification of logic circuits - using (i) Boolean algebra, (ii) Karnaugh map – Demorgan's theorems -NAND and NOR as Universal Building Blocks.

UNIT II: COMBINATIONAL LOGIC CIRCUITS (12 Hours)

Binary Half & Full adder and Subtractor Circuits - BCD Half & Full Adder and Subtractor Circuits – 4 Bit Binary Adder/Subtractor (IC 7483) - Encoder – Decoder - Multiplexer - Demultiplexer.

UNIT III: SEQUENTIAL LOGIC CIRCUITS (12 Hours)

1 bit Memory-Latch –R-S flip flop- J-K flip flop, D flip flop and T-flip flops -Race around condition - J-K Master/Slave flip flop – Asynchronous and Synchronous Counters - BCD counter – Up/Down counters - Ring and Twisted Ring Counter-Shift Registers - Serial And Parallel Registers.

UNIT IV: OP-AMP- BASIC APPLICATIONS (12 Hours)

Characteristics Parameters – Differential Gain – CMRR – Slew Rate – Bandwidth - Applications

– Unity Follower**,** Inverter, Non-Inverter, Integrator, Differentiator, Summing, Difference and Averaging Amplifier - Solving Simultaneous Equations - Comparator - Square Wave Generator -Schmitt Trigger-Wien's Bridge Oscillator

UNIT V: TIMER, DAC/ADC (12 Hours)

Timer 555 - Internal Block Diagram and Working – Astable Multivibrator– Monostable Multivibrator-Schmitt Trigger-D/A Converter - Binary Weighted Method - A/D Converter – Successive Approximation Method.

Books for Study:

1. Digital Principles and Application, Malvino Leach, Tata McGraw Hill, 4th Edition(1992).
2. Digital Fundamentals, Thomas L. Floyd, Universal Book Stall, New Delhi(1998).
3. Introduction to Integrated Electronics, V.Vijayendran, S. Viswanathan (Printersand Publishers) Pvt. Ltd., Chennai (2005).
4. OP - AMPs and Linear Integrated Circuits, Ramakant A. Gayakwad, Prentice Hall of India(1994).

Books for Reference:

1. Digital Electronics, Practice Using Integrated Circuits - R.P.Jain – Tata McGrawHill(1996).
2. Linear Integrated Circuits, D. Roy Choudhury and Shail Jain - New AgeInternational (P)Ltd.(2003).
3. Electronics, Analog and Digital by I.J. Nagrath - Prentice - Hall of India,NewDelhi(1999).
4. Integrated Electronics, J.Millman and C.Halkias, Tata McGraw Hill, New Delhi(2001)
5. https://nptel.ac.in/courses/117107094/

ELECTIVE-III(A): MICROPROCESSOR 8085 AND MICROCONTROLLER

(Common to B.Sc.Physics with Computer Applications)

Course Objective:

- To study the architecture of the microprocessor 8085 and micro controller 8051

Course OutCome:

- Describe the general architecture of a microcomputer system and architecture &organization of 8085 Microprocessor and understand the difference between 8085 and advanced microprocessor

- Understand and realize the Interfacing of memory & various I/O devices with 8085 microprocessor
- Understand and classify the instruction set of 8085 microprocessor and distinguish the use of different instructions and apply it in assembly language programming.
- Understand the architecture and operation of Programmable Interface Devices and realize the programming & interfacing of it with 8085 microprocessor
- Understand the concepts of interrupts and microcontrollers

Syllabus:

Unit I: Microprocessor 8085 Architecture (12hours)

Introduction to Microprocessor – Architecture of Microprocessor 8085-Internal registers (8-bit & 16-bit)-CPU-ALU-Types of System Bus-Bus Structure-multiplexing and demultiplexing address/data bus-Instruction Register and Decoder - Timing and Control Unit-Interrupts and Serial I/O (principle only)-external memory – Block diagram of 8085-Programmer's model of 8085-pin configuration of 8085.

Unit II: Instruction Set-I (12 hours)

Machine Language and Assembly Language-Addressing modes-types of instruction format-Data Transfer type instructions-Arithmetic and logical instructions– Branching instructions-looping and time delay -system clock-T-state-instruction and machine cycles-Timing diagram for MOV R_d, R_s - MVI A, data8 - LXI R_P, 16bits, memory read and memory write cycle.

Unit III: Instruction Set-II and Programming (12 hours)

Special Instructions: Rotate instructions-stack and subroutine related instructions-PSW- peripheral instructions-I/O and Machine Control Instructions.

Assembly Language Programs – Addition– Subtraction– Multiplication (8-bit) – Division (8-bit) Ascending / Descending Order, Largest/Smallest (single byte)-Addition of N numbers (single byte)-code conversion program.

Unit III: Memory/Io Interface (12 hours)

Memory Interface (Basics) – memory mapped I/O & I/O mapped I/O- Generating

Control Signals – Interfacing 2KX8 EPROM – 2KX8 RAM -Interfacing I/O ports to 8085-Hand shake signals-Functional block diagram and working of PPI-8255-Interfacing 8255 to 8085-LED Interface.

Unit V: Interrupts and Introduction to Microcontrollers (12 hours)

Interrupts in 8085- Generation of RST codes-Hardware, software interrupts and their function- Interrupts pulse width and Triggering levels-Interrupt priority-Vector interrupt model -SIM and RIM instructions-Simple polled and Interrupt controlled data transfer-Introduction to Microcontroller –Comparison of Microprocessor and Microcontroller.

Books for study:

1. Microprocessor Architecture, Programming and Application with the8085, Ramesh S.Gaonakar, PenramLnternational Publishing, Mumbai, (2011).
2. Fundamental of Microprocessor 8085: Architecture Programming, and Interfacing,
   V. Vijayendran,Viswanathan, S., Printers & Publishers Pvt. Ltd (2009).
3. The 8051 Microcontroller, Architecture, Program and application, Kenneth J Ayala, Penram

Books for reference:

1. Microprocessor Organisation and Architecture, LeventhalL.A , Prentice Hall India.
2. Ram, Fundamentals of microprocessors and microcomputers - DhanpatRai Publications,New Delhi
3. The 8080/85 Family: Design, Programming & Interfacing,John Uffenbeck, , PHI India.
4. A. K. Ray & K. M.Bhurchandani, Advance Microprocessor and Peripherals, 2ndEdition,Tata McGraw Hill, 2006
5. Mathur A.P., Introduction to Microprocessors. 3rd edn., Tata McGraw, New Delhi,
6. Muhammed Ali Mazidi, Janice GillispieMazidi – The 8051 Microcontroller and Embedded systems
7. Microprocessors & Microcontrollers by B.P.Singh, Galgotia publications Pvt.Ltd.

ELECTIVE-I(A): NUMERICAL METHODS

Course Objective:

- To study the computational techniques involved in different mathematical manipulation.

Course OutCome:

- Solve simultaneous equations using method of triangularisation
- Find the inverse of a matrix using Gauss Jordan Method
- Solve Algebraic, Transcendental and Differential Equation using different methods
- To fit a curve for the given data using principles of least squares
- Integrate the functions using different rules like Simpsons 1/3 rule

Syllabus:

UNIT I: SIMULTANEOUS LINEAR ALGEBRAIC EQUATIONS (12 Hours)

Method of Triangularisation - Gauss elimination method - Inverse of a matrix - Gauss- Jordan method

UNIT II : NUMERICAL SOLUTION OF ALGEBRAIC, TRANSCENDENTAL AND DIFFERENTIAL EQUATION (12 Hours)

Bisection method – Regula falsi method - Newton - Raphson method - - Horner's method - Solution of ordinary differential equation - Euler's method.

UNIT III : INTERPOLATION (12 Hours)

Finite differences – Operators Δ, ∇, D – Relation between operators –Linear interpolation – Interpolation with equal intervals – Newton forward interpolation formula –Newton backward interpolation formula.

UNIT IV: CURVE FITTING (12 Hours)

Principles of least squares - fitting a straight line - linear regression - fitting an exponential curve.

UNIT V: NUMERICAL INTEGRATION (12 Hours)

Trapezoidal Rule - Simpson's 1/3 rule and 3/8 rule - Applications - Weddle's rule

Books for Study:

1. Numerical methods, M.K.Venkatraman, National Publishing Company, (1990).
2. Numerical methods, V. Rajaraman, Prentice - Hall India Pvt. Ltd., (2003).
3. Numerical methods, P. Kandasamy, K. Thilagavathy and K. Gunavathy, S. Chand & Co. (2002).

Books for References:

1. Numerical methods for Scientific and Engineering computation , Jain Iyenger and Jain, New AgeInternational (P) Ltd.,(2004).
2. Numerical methods,S.S.Sastry, Prentice Hall of India Pvt. Ltd., NewDelhi(2003).

Web Site

http://www.sst.ph.ic.ac.uk/angur/lectures/compphys/compphys.html.

ELECTIVE-I(B): PROBLEMS SOLVING SKILLS IN PHYSICS

Course Objective:

- Physics with problems " pleasure"
- Physics without problems " pressure"
- To inculcate the problem-solving skills in different areas of physics

Course OutCome:

- Think Laterally and provide necessary solution
- Use appropriate mathematical methods to given problem
- Verify whether the answer obtained is correct or not
- Use logical and other skills to solve problem
- Clear all the entrance examinations leading higher education in premier institutions

Syllabus:

UNIT I: PROBLEMS IN MECHANICS (12Hours)

Newton laws of motion for various systems (1, 2 and 3 dimension), Conservation laws and collisions, Rotational mechanics, central force, Harmonic oscillator, special theory of relativity

UNIT II: PROBLEMS IN THERMAL PHYSICS (12Hours)

Kinetic theory– Laws of Thermodynamics – Ideal Gas law–Various Thermodynamic process– Entropy calculation for various process– Heat engine–TS and PV diagram–Free energies and various relations

UNIT III: PROBLEMS IN ELECTRICITY & MAGNETISM (12Hours)

Electrostatics– calculation of Electrostatic quantities for various configurations– Conductors, Magneto statics– Calculation of Magnetic quantities for various configuration, Electromagnetic induction, Poynting vector, Electromagnetic waves.

UNIT IV: PROBLEMS IN QUANTUM MECHANICS (12Hours)

Origin of Quantum mechanics– Fundamental Principles of Quantum mechanics– potential wells and harmonic oscillator– Hydrogen atom

UNIT V: PROBLEMS IN GENERAL PHYSICS & MATHEMATICS (12Hours)

Plotting the graphs for various elementary and composite functions–Elasticity– Viscosity and surface tension– fluids– Buoyancy–pressure–Bernoulli's theorem– applications–waves and oscillations, Errors and propagation of errors.

Books for Reference:

1. Charles Kittel, Walter D knight, Mechanics (in SI units) (Berkeley Physics course– volume1), Tata McGraw Hill publication ,second edition.
2. S.C.Garg, RM Bansal & CKGhosh, Thermal physics, (Tata McGraw Hill Publications),1st edition.
3. E.M.Purcell, Electricity & magnetism (in SI units), Tata Mcgraw hill Publication, 2nd Edition.
4. N.Zettili, Quantum mechanics, Wiley Publishers, second edition.
5. David. J.Griffith, Introduction to quantum mechanics, Pearson Publications, secondedition
6. Halliday & Resnick, Fundamentals of Physics, Wiley Publications, 8th Edition
7. Nelkon and Parker, Advanced level physics, CBS publishers, 7th edition
8. Amith Agarwal, Play with graphs, Arihant Publications
9. D.S.Mathur, Properties of matter, S.Chand Publications, 11th Edition

ELECTIVE-I(C): GEOPHYSICS

Course Objective:

- To make the students understand the basic principles of geophysics, geomagnetism and conceptsof earthquakes.

Course OutCome:

- Understand the different layers of the atmosphere

- Know the details about geophysical and chemical methods
- Gain sufficient knowledge on the earthquakes and Tsunami warning systems
- Have an idea on geomagnetism and gravity
- Understand the radioactivity of the earth

Syllabus:

UNIT I: PHYSICS OF THE EARTH

Introduction to Geophysics- Earth as a member of the solarsystem-Atmosphere-Ionosphere- Asthenosphere-Lithosphere-Hydrosphere and Biosphere-Meteorology-Oceanography and Hydrology.

UNIT II: GEOPHYSICAL AND GEOCHEMICAL METHODS

Geophysical methods: Geo referencing using Arc GIS software-Electrical Methods-Qualitative interpretation of Vertical Electrical Sounding curves –Preparing pseudo cross section for electrical resistivity data and interpretation.

Geochemical methods: Introduction-Principles of groundwater chemistry-Sources of contamination- Ground water quality analysis using geochemical methods.

UNIT III: INTRODUCTION TO SEISMOLOGY

The earth's interior and crust as revealed by earthquakes-Rayleigh waves and Love waves- Elastic rebound theory-Continental drift-Earthquake magnitude and intensity-Horizontal seismograph and seismograph equation-Tsunami-Causes andImpacts-Tsunami warning systems.

UNIT IV: GEOMAGNETISM AND GRAVITY

Historical introduction –The physical origin of magnetism-Causes of the main field-Dynamo theory of earth's magnetism.

Gravitational potential-Laplace's equation and Poisson's equation-Absolute and relativemeasurements of gravity-Worden gravimeter.

UNIT V: GEOCHROLOGY AND GEOTHERMAL PHYSICS

Radioactivity of the earth-Radioactive dating of rocks and minerals-Geological time scale-Theage of the earth.

Flow of heat to the surface of the earth –Sources of heat within the earth-Process and heattransport and internal temperature of earth.

Books for study:

1. Arthur W.Hounslow, Water quality data -Analysis and Interpretation, 1995, Lewispublishers, Washington D.C.
2. Cook,A.H , Physics of the Earth and Planets,McMillanPress,London 1973.
3. John Milsom, Field geophysics-The geophysical field guide III edition, Wiley publications,England.
4. Krauskopf.K.B, Introduction to Geochemistry, McGraw Hill,1967.
5. RamachandraRao, Outline of geophysical prospecting-a manual for geologists, University ofMysore,1975.

Books for reference:

1. Garland, Introduction to Geophysics 11 edition, WB Saunder Company, London, 1979.
2. William Lowrie, Fundamentals of Geophysics, 11Edition, Cambridge press,UK.
3. Nils-Axel Morne, Geochronology-Methods and case studies, INTECH publications .
4. John Raferty, Geochronology –Dating and Precambrian time –The beginning of the world aswe know it,Britannica Educational publishers, New York-2011.
5. Don L.Anderson, Theory of the Earth, Blackwell scientific Publications-1989,UK.
6. https://ocw.mit.edu/courses/earth-atmospheric-and-planetary-sciences/12-201-essentials-of- geophysics-fall-2004/lecture-notes/

ELECTIVE-II(B): MEDICAL PHYSICS

Course Objective:

- To gain a broad and fundamental understanding in Physics while developing particular expertisein medical applications

Course OutCome:

- Understand the different layers of the atmosphere
- Know the details about geophysical and chemical methods
- Gain sufficient knowledge on the earthquakes and Tsunami warning systems
- Have an idea on geomagnetism and gravity
- Understand the radioactivity of the earth

Syllabus:

UNIT-I: X-RAYS

Electromagnetic Spectrum - Production of X-Rays - X-Ray Spectra - Brehmsstrahlung - Characteristic X-Ray - X-Ray Tubes - Coolidge Tube - X-Ray Tube Design - Tube Cooling - Stationary Mode - Rotating Anode X-Ray Tubes - Tube Rating - Quality and Intensity of X-Ray. X-Ray Generator Circuits - Half Wave and Full Wave Rectification - Filament Circuit - Kilo Voltage Circuit - High Frequency generator - Exposure Timers - HT Cables.

UNIT-II: RADIATION PHYSICS

Radiation Units - Exposure - Absorbed Dose - Rad to Gray - Kera Relative Biological Effectiveness - Effective Dose: Sievert (Sv)- Inverse Square Law - Interaction Ofradiation with Matter - Linear Attenuation Coefficient- Radiation Detectors -Thimble Chamber - Condenser Chambers - Geiger Counter - Scintillation Counter -Ionization Chamber - Dosimeters - Survey Methods - Area Monitors - TLD and semiconductor Detectors.

UNIT-III: MEDICAL IMAGING PHYSICS

Radiological Imaging - Radiography - Filters - Grids - Cassette - X-Ray Film - Film processing - Fluoroscopy - Computed Tomography Scanner - Principle Function -Display - Generations - Mammography- Ultrasound Imaging - Magnetic Resonance Imaging - Thyroid Uptake System - Gamma Camera (Only Principle, Function and display)

UNIT-IV: RADIATION THERAPY PHYSICS

Radiotherapy - Kilo Voltage Machines - Deep Therapy Machines - Tele-Cobalt machines - Medical Linear Accelerator - Basics of Teletherapy Units - Deep X-Ray, Telecobalt Units, Medical Linear Accelerator - Radiation Protection - External Beam characteristics - Phantom - Dose Maximum And Build Up - Bolus – Percentage depth Dose - Tissue - Air Ratio - Back Scatter Factor.

UNIT-V: RADIATION PROTECTION

Principles of Radiation Protection - Protective Materials - Radiation Effects - Somatic, Genetic Stochastic and Deterministic Effect- Personal Monitoring Devices- TLD Film Badge - Pocket Dosimeter.

Books for study:

1. Basic Radiological Physics, Dr. K.Thayalan ,Jayapee Brothers MedicalPublishing Pvt. Ltd.New Delhi (2003)
2. Christensen's Physics of Diagnostic Radiology: Curry, Dowdey and Murry -Lippincot Williams and Wilkins (1990)
3. Physics of Radiation Therapy , FM Khan ,Williamd and Wilkins, Thirdedition (2003)
4. The essential Physics of Medical Imaging: Bushberg, Seibert, Leidhold

ELECTIVE-II(C): FIBER OPTICS

Course Objective:

- To gain in depth knowledge in optical fibres

Course OutCome:

- Functional knowledge regarding the need of radiological protection
- Gain knowledge on diagnostic and therapeutic application like X-rays, Ultrasound imaging, Magnetic resonance imaging etc.,
- Gets familiar with various detectors used in medical imaging
- Hands on training which will be useful for the students to enter the job market

Syllabus:

UNITI: FIBER OPTICS – INTRODUCTION

Structure of Fiber-Why Silica (Sio_2) as Fiber-Snell's Law- Total Internal Reflection-Meridional and Skew Rays- - Acceptance Angle and Cone- Numerical Aperture- Goos-Haenchen Shift-Step And Graded Index Fibers - Single Mode and Multimode Fiber – V-Number – Number Of Modesin Step and Graded Multimode Fibers- Analog& Digital Optical Fiber Communication (OFC) System- Advantages Of OFC.

UNIT II: TRANSMISSION CHARACTERISTICS OF OPTICAL FIBERS

Losses in Silica Glass Fibers-Intrinsic, Extrinsic and OH^- Absorption Losses – Scattering Losses- Linear: Rayleigh and Mie Scattering, Nonlinear: Stimulated Brillouin and Raman Scattering- Intramodal and Intermodal Dispersion Losses-Micro and Macro Bending Losses-Evanescent Field-Attenuation Spectrum for an Ultra-Low-Loss Single Mode Fiber.

UNIT III: OPTICAL FIBER CONNECTION

Introduction - Multimode and Single Mode Fiber Joints–Fusion and Mechanical Splices– Cylindrical Ferrule & Duplex and Multiple Fiber Connectors –Grin-Rod Lenses-Three & Four Port and WDM Couplers.

UNIT IV: OPTICAL SOURCES

Basic Concepts of Absorption and Emission of Radiations-LED Power and Efficiency-Double Heterojunction LED-Surface & Edge Emitting LED–Optical Output Power-Output Spectrum- Modulation Bandwidth-Reliability- LASER Diodes-Gain Guided Lasers-Quantum-Well Lasers- Fiber Lasers.

UNIT V: OPTICAL DETECTORS

Optical Detection Principles-Quantum Efficiency-Responsivity-PIN Photodiode-Speed of Response-Noise-Avalanche Photodiodes (APD): Germanium APD-Merits and Demerits- Multiplication Factor-Mid-Infrared Photodiodes – Photo Transistors-Photo Conductive Detectors-Eye Diagrams.

Books for Study:

1. Optical fiber communications: Principles and Practice, John M. Senior, 3rd Edition,Pearson-Prentice Hall, (2009). (unit I – V)
2. Optical Fiber Communications, GerdGeiser, 5th edition, Tata McGraw-Hill Education Pvt.Ltd., (2017). (unit IV-V)

Books for Reference:

1. Fiber Optic Communication And Other Application, Henry Zanger and Cynthia Zanger,
   Merrill Pub. Co. (1991)
2. Fiber Optics in Telecommunications, N.Sharma, TataMcGraw Hill, (1987).
3. Optical Fiber Systems: Technology, Design and Applications, K.Kao Charles, McGraw-Hill,1st Ed edition (1982).
4. Fiber-optic communication systems, Govind P Agrawal, John Wiley (2007).

5. Introduction to fiber optics, AjoyGhatakand K. Thyagarajan, Cambridge University Press(2004).
6. Fiber optic essentials, K. Thyagarajan and AjoyGhatak, John Wiley (2007).
7. https://swayam.gov.in/nd1_noc20_ph07/preview

ELECTIVE-III(B): ASTROPHYSICS

Course Objective:

- To make the students understand the nature of universe from various theories and phenomena.
- To study the importance and science behind the Astrophysics for the future invention and spaceresearch.

Course OutCome:

- Understand the overview of communications signals transmitted over optical fibers and optical fiber communication devices.
- Understand the importance of fiber optic material like GA As laser, LED, modulation formats and modulation and demodulation.
- Understand and differentiate losses and couplers and its function
- Understand the basic concepts in the process involving the parameters like modulation and¬demodulation.
- Learn the various fiber optic materials

Syllabus:

UNIT I – Earliest Astronomy and Theories of Universe

Origin – Earliest Astronomy (2500 – 100 BC) – Pythagorean Spherical Earth – Aristotle's Earthas Centre – Copernicus Theory – Kepler's Law – Galileo's observations – Newton's Synthesis.
Origin of the universe–The Big Bang Theory– The steady state theory–The Oscillating Universetheory.

UNIT II – Astronomical Scales and Instruments

Astronomical Scales– Astronomical Distance – Mass and Time–Stellar

Temperature– Astronomical Instruments–The Earth's Atmosphere and the Electromagnetic Radiation –Optical Telescopes–Radio Telescopes–The Hubble Space Telescope (HST)– Astronomical Spectrographs – Photographic Photometry –Photoelectric Photometry–Spectrophotometry.

UNIT III – Solar System

The sun– Structure of the Sun – Nuclear reactions in sun – Photosphere – Chromosphere – corona – solar prominences –Sunspot cycle – Theory of sunspots – Solar flare– solar constant – Temperature of the sun–Solar energy–Solar wind – Other members of the solar system.

UNIT IV – Stellar Evolution

Birth of a star– Death of a star –Red giant stars –Chandrasekhar limit – white dwarfs –Black holes – Quasars – Nebulae – Supernovae Binary stars – Origin of binary stars –Variable stars – Flare stars – Constellations – Zodiac –Magnitude and brightness –Luminosities of stars – Measurement of stellar distance – Geometrical parallax method – Distance from red shift measurement.

UNIT V – The Milky way Galaxy

The milky way – Basic Structure and Properties of the Milky Way–The General Rotation Law– Density Distribution of Gas and Spiral structure of the Galaxy– The Mass of the Galaxy – Magnetic Field in the Galaxy – Cosmic Rays –Continuous Radio Emission in the Galaxy– Hubble's law–Types of galaxies.

Books for Study:

1. An Introduction to AstroPhysics, BaidyanathBasu, second printing, prentice - Hall of IndiaPrivate limited, New Delhi, 2001.
2. Astro Physics a Modern Perspective, K.S. Krishnasamy,Reprint, New Age International (p)Ltd, New Delhi, 2002.
3. An Introduction to AstroPhysics, BaidyanathBasu,TanukaChattopadhyay,sudhindraNathBiswas, Second Edition(2010), PHI Learning Private Limited.

Books for Reference:

1. Astronomy,S. Kumaravelu,Janki calendar corporation, Sivakasi, 1993.
2. Physics of the Universe,Hewish. A, CSIR publication, New Delhi, 1992.
3. Inside Stars,BimanBasu, CSIR Publication, New Delhi, 1992.
4. Cosmic Vistas,BimanBasu, National Book Trust of India, 2002.
5. Space today, Mohan SundaraRajan, National Book Trust of India, 2000.

6. The Cosmic Voyage through time and space,William K. Hartmann, Wads worth Publishingcompany, Californi, 1990.
7. Astronomy,Baker and Fredrick, ninth edition, Van No strand Rein hold, Co, New York -1964.
8. Textbook of Astronomy and Astrophysics with elements of cosmology,V.B. Bhatia, NarosaPublication.
9. Modern Astrophysics,B.W. Carroll & D.A. Ostlie, Addison-Wesley Publishing Co.
10. Introductory Astronomy and Astrophysics,M. Zeilik and S.A. Gregory, 4 th Edition,Saunders College Publishing.
11. https://nptel.ac.in/courses/115105046/

ELECTIVE-III(C): WEATHER FORECASTING

Course Objective:

- To enable them to develop an awareness and understanding regarding the causes and effects of different weather phenomenon and basic forecasting techniques

Course OutCome:

- To learn basic techniques to measure temperature and its relation with cyclones and anticyclones Gain knowledge of simple techniques to measure wind speed and its directions, humidity and rainfall.
- Understand various causes of climate change like global warming, air pollution, aerosols, ozone depletion and acid rain.
- Develop skills needed for weather forecasting
- Uncertainties in predicting weather based on statistical analysis

Syllabus:

UNIT I: Introduction to Atmosphere

Elementary idea of atmosphere-Physical structure and composition-compositional layering of the atmosphere-Variation of pressure and temperature with height- Air temperature-Requirements to measure air temperature-Temperature sensors- types; atmospheric pressure: its measurement-Cyclones and anticyclones- its characteristics.

UNIT II: Measuring the Weather

Wind- forces acting to produce wind; wind speed direction: units, its direction- measuring wind speed and direction; humidity, clouds and rainfall, radiation: absorption, emission and scattering in atmosphere-Radiation laws.

UNIT III: Weather Systems

Global wind systems- air masses and fronts- classifications- jet streams- local thunderstorms- tropical cyclones: classification- tornadoes- hurricanes.

UNIT IV: Climate and Climate Change

Climate: its classification- causes of climate change-global warming and its outcomes- airpollution- aerosols, ozone depletion, acid rain, environmental issues related to climate.

UNIT V: Basics of Weather Forecasting:

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- satellites observations in weather forecasting- weather maps- uncertainty and predictability- probability forecasts.

Books for Reference:

1. Aviation Meteorology, I.C. Joshi, 3rd edition 2014, Himalayan Books
2. The weather Observers Hand book, Stephen Burt, 2012, Cambridge University Press.
3. Meteorology, S.R. Ghadekar, 2001, Agromet Publishers, Nagpur.
4. Text Book of Agrometeorology, S.R. Ghadekar, 2005, Agromet Publishers, Nagpur.
5. Why the weather, Charls Franklin Brooks, 1924, Chpraman& Hall, London.
6. Atmosphere and Ocean, John G. Harvey, 1995, The Artemis Press.