MANONMANIAM SUNDARANAR UNIVERSITY
Tirunelveli – 627012, Tamil Nadu.
DEPARTMENT OF PHYSICS
Integrated M. Sc Physics Programme
Under Choice Based Credit System (CBCS)
(For those admitted from the academic year 2019-20 onwards)
Regulations, Course structure, Scheme of Examinations and Syllabus

1.0 Regulations

1.1 Objectives :

- To impart basic knowledge in the discipline of Physics including its phenomenology, theories concepts, general principles and techniques.
- To enable the students to have a thorough exposure to the different branches of Physics so as to gain a comprehensive knowledge in the subject of Physics.
- To understand the links of Physics to other disciplines and also to the societal issues.
- To bridge the gap between the plus two and post graduate levels of Physics by providing a more complete and logical framework in almost all the areas of basic Physics.

1.2 Duration of the Course :

The duration of the integrated M.Sc. (Physics) under CBCS course is 5 years. Successful students will be awarded a B.Sc. (Physics) degree at the end of third academic year and also a M.Sc. (Physics) degree at the end of fifth academic year. The students have an option to exit from the program with the B.Sc. (Physics) degree alone. Students who have passed all the papers during the first three years of the course alone will be permitted to continue the course in the fourth year.

1.3 Eligibility:

Candidates who have scored sixty percentage of marks in the Higher Secondary School Examinations (+ 2) conducted by the Board of Higher Secondary Examination, Tamil Nadu with the subjects ***Mathematics, Physics and Chemistry*** or in an equivalent course of study, as recognized by the Government of Tamil Nadu /Central Government are eligible for admission into the course.

1.4 Mode of Admission:

An entrance examination with objective type questions will be conducted for eligible applicants. A merit list will be prepared by combining a maximum of 50 % marks obtained in the entrance examination and an another maximum of 50 % marks secured in the ***Physics paper*** at the level of Higher Secondary School examinations. Admission will be based on the merit and reservation policy of the Government of Tamil Nadu. The candidates who have completed / cleared the National level examinations such as IIT JEE / AIMPT / KVPY or any other equivalent National

level examinations will be exempted from appearing the above entrance examination and will be awarded a maximum of 50 % marks for the same.

2.0 Details of various core, elective and supportive course papers along with credits, marks and teaching hours for the students admitted from the academic year 2019 – 2020 and onwards:

Sem.	Part	S.No.	Subject	Credits	Contact Hours / Week	Marks	
						Max.	Passing Min.
I	I	1.	Tamil / Other language	4	4	100	50
	II	2.	English	4	4	100	50
	III	3.	**C1 :** Properties of Matter and Sound	4	4	100	50
		4.	**C2 :** Mechanics	4	4	100	50
		5.	**Practical I :** General	2	4	100	50
		6.	Allied Mathematics - I	3	3	100	50
		7.	Allied Mathematics Practical - I	2	4	100	50
	IV	8.	**Common 1:** Environmental Studies	2	2	100	50
	Subtotal			**25**	**29**	**800**	**400**
II	I	9.	Tamil / Other language	4	4	100	50
	II	10.	English	4	4	100	50
	III	11.	**C3 :** Heat and thermodynamics	4	4	100	50
		12.	**C4 :** Optics and spectroscopy	4	4	100	50
		13.	**Practical II :** Optics	2	4	100	50
		14.	Allied Mathematics - II	3	3	100	50
		15.	Allied Mathematics Practical - II	2	4	100	50
	IV	16.	**Common 2:** Value Based Education / Social Harmony	2	2	100	50
	Subtotal			**25**	**29**	**800**	**400**
III	I	17.	Tamil / Other language	4	4	100	50
	II	18.	English	4	4	100	50
	III	19.	**C5 :** Electricity and Electromagnetism	4	4	100	50
		20.	**Practical III :** Heat and Electricity	2	4	100	50
		21.	Allied Chemistry - I	3	3	100	50
		22.	Allied Chemistry Practicals - I	2	4	100	50
	IV	23.	**NME – I :** Conventional and Non-Conventional Energy sources	3	3	100	50
		24.	**Mandatory:** Yoga	2	2	100	50
	Subtotal			**24**	**28**	**800**	**400**

IV	I	25.	Tamil / Other language	4	4	100	50
	II	26.	English	4	4	100	50
	III	27.	**C6 :** Analog electronics	4	4	100	50
		28.	**Practical IV :** Electronics	2	4	100	50
		29.	Allied Chemistry - II	3	3	100	50
		30.	Allied Chemistry Practical - II	2	4	100	50
	IV	31.	**NME- II:** Biomedical Instrumentation	3	3	100	50
		32.	**Mandatory:** Computers for Digital Era	2	2	100	50
	V	33.	**EA:** (NCC, NSS, YRC, YWF)	1	-	-	-
	Subtotal			**25**	**28**	**800**	**400**
V	III	34.	**C7 :** Atomic physics	4	4	100	50
		35.	**C8 :** Classical and statistical mechanics	4	4	100	50
		36.	**C9 :** Relativity and Quantum mechanics	4	4	100	50
		37.	**C10 :** Basics of data communication and programming in C	4	4	100	50
		38.	**Practical V :** Digital Electronics and Computer programming	2	4	100	50
		39.	**Elective I :**	3	3	100	50
	IV	40.	**Skill Based Common:** Personality Development / Effective Communication / Youth Leadership	2	2	100	50
	Subtotal			**23**	**25**	**700**	**350**
VI	III	41.	**C11 :** Nuclear physics	4	4	100	50
		42.	**C12 :** Solid state physics	4	4	100	50
		43.	**C13 :** Digital and Communication Electronics	4	4	100	50
		44.	**C14 :** Mathematical Methods	4	4	100	50
		45.	**Elective II :**	3	3	100	50
		46.	**Skill Based Common:**	2	2		
		47.	Mini Project (Group)	9	9	100	50
	Subtotal			**30**	**30**	**500**	**250**
Total				**152**	**169**	**4400**	**2200**

C : Core **EA :** Extension Activity **NME:** Non Major Elective

(Allied and NME Courses offered to the students of other Integrated PG Programmes)

Sem.	Subject	Credits	Contact Hours / Week	Marks		
				Max.	Passing Min.	
I / III	Allied Physics – I	3	3	100	50	For the students of anyother Integrated PG Programmes of the University Departments
	Allied Physics Practical - I	2	4	100	50	
II / IV	Allied Physics – II	3	3	100	50	
	Allied Physics Practical - II	2	4	100	50	
III	Non Major Elective – I (Conventional and Non-Conventional Energy sources)	For the students of any other Integrated PG Programmes of the University Departments				
IV	Non Major Elective– II (Biomedical Instrumentation)					

3.0 Scheme of Evaluation :

For evaluation of theory papers (core, allied, elective) the Continuous Internal Assessment (CIA) will be of 25 marks and External Examination for 75 marks. Core Practicals and Allied Practicals carry a maximum of 100 marks with 50 % internal and 50 % external. Mini project carry a maximum of 100 marks with 25 % internal and 75 % external.

3.1 Core, Allied and Elective papers :

(a) Continuous Internal Assessment :

- There will be three internal tests, each for a maximum of 25 marks and for a limited portion of the syllabus for all the theory papers. Each test will be held for duration of 1 hour. The question paper pattern for the internal test is given below:

Section	Type of Questions	Max. Marks
Part A	Objective Type -5 Questions	5 X 1 = 05
Part B	2 out of 3 problems Questions	2 X 5 = 10
Part C	1 out of 2 Descriptive or Analytical Questions	1 X 10 = 10
	Total Marks	25

➢ For the first 6 semesters, the Continuous Internal Assessment **25 marks** are divided as **20 marks** for the internal written test (average of the marks from the best two tests out of three tests) and **5 marks** for the assignment activities.

➢ For the 4th and 5th years the CIA component is divided into three components viz., **15 marks** for the internal test, **5 marks** for seminar and **5 marks** for the assignment activities.

➢ There is no passing minimum in the internal test marks for each paper.

(b) External Examinations :

➢ The duration of the University examination for each theory course is 3 hours. The question paper pattern for the end-semester examination of each theory paper is given below:

Section	Type of Questions	Max. Marks
Part A	Objective Type -10 Questions (2 from each units)	10 X 1 = 10
Part B	Unit-wise choice – Either (a) or (b) type – 5 Questions Problems	5 X 5 = 25
Part C	Unit-wise choice-Either (a) or (b) type – 5 Descriptive or analytical Questions	5 X 8 = 40
	Total Marks	75

➢ There is a passing minimum of 50% in the University examinations in each theory course and there is a passing minimum of 50% in the overall component, i.e. out of the total marks in the CIA component and the University examination for each theory course.

➢ There will be a special supplementary examination for those candidates who have failed in only one subject in the entire programme.

3.2 Practical :

The CIA and the University Examination marks will be awarded as per the table given below:

Phase of Examinations	**Marks**	**Methodology**
Phase I - Continuous Assessment	**Continuous Assessment** : 25 marks	"N" number of practicals be conducted based on the practicals prescribed in the syllabus and the marks should be distributed equally for each practicals. There is no passing minimum in

		the Internal Continuous Assessment.
	Test : 25 marks	Two tests should be conducted and average of tests will be taken
	Total : 50 marks	**<u>Calculation of marks:</u>** Sum of marks awarded to number of practicals (25 marks) + the Average Marks of two tests (25 marks).
Phase II - End semester assessment – Practical Examinations	**Course teacher** : 25 marks **External Examiner** : 25 marks **Total : 50 marks** { for Practicals : 20 marks Records : 5 marks }	Only one practical examination be conducted at the end of semester for the students on lot basis by appointing TWO examiners from the same Department / one from the other institution. 1. Course Teacher 2. External Examiner (From Other Institution / from the same Department) Passing minimum: 50% (25 marks) in the External

3.3 Mini Project work:

A mini project is to be carried out by a group of a maximum of three students. The mini project work shall be based on any research oriented topics, both in the fields of theoretical and experimental physics under the guidance of a faculty member of the Department as a Project Supervisor. After completion of the project work at the end of semester VI, each student should submit two copies of the project report / thesis to the Department on or before a date as notified for the same. The project viva-voce examination for the students will be conducted individually.

CIA (Max.: 25 marks)				End – Semester Examination (Max.: 75 marks)				
Marks for Reviews (Average of the best two of the three compulsory Reviews) (Max.: 25 marks)				Marks for Thesis Evaluation (Max.: 25 marks)		Marks for Viva-Voce Exam (with the Dept. Faculty Member/ Course Students) (Max.: 50 marks)		Total (Max.)
Review I	Review II	Review III	Average of the best two (Max.)	Project Supervisor (Max.)	External (from outside the Institution) (Max.)	Project Supervisor (Max.)	External (from outside the Institution) (Max.)	
25	25	25	25	12.5	12.5	25	25	75

There is no passing minimum for the CIA components and for the CIA in total. There is passing minimum of 50% in the University examinations in Project course and there is a passing minimum of 50% in the overall component, i.e. out of the total marks in the CIA component and the University examination for each Project course.

SYLLABUS
SEMESTER – I

Core paper 1: PROPERTIES OF MATTER AND SOUND

L	T	P	C
4	0	0	4

Objective:

- To expose students to the fundamentals of properties of matter and sound.

Unit I: Elasticity

Elasticity –Hooke's law – Elastic moduli – Poisson's ratio – Beams – bending of beams – Expression for bending moment –Cantilever- Theory of uniform and non – uniform bending - Determination of young's modulus -Koenig's method – Torsion of a body – Expression for couple per unit twist – Work done in twisting a wire – Torsional oscillations of a body - Rigidity modulus by dynamic torsion method (Torsional pendulum) and static torsion method. **(9 hrs)**

Unit II: Surface Tension

Surface tension – definition – Molecular forces – Explanation of surface tension on kinetic theory – Surface energy – work done in increasing the area of a surface – Excess pressure inside a curved liquid surface – Excess pressure inside a spherical and cylindrical drops and bubbles-drop weight method- - angle of contact- Quincke's method-variation of surface tension with temperature-experimental determination-Jaegar's method. **(12 hrs)**

Unit III: Viscosity

Viscosity – Co efficient of viscosity – Streamlined and turbulent motion – critical velocity – Rate of flow of liquid in a capillary tube – Poiseuille's formula –viscosity of highly viscous liquid-terminal velocity-stoke's method-Ostwald Viscometer-viscosity of gas-Mayer's formula-Rankine 's method. **(12 hrs)**

Unit IV: Sound

Simple Harmonic Motion –Composition of two S.H.M in a straight line-at right angles-Lissajous's figures- Free, Damped, Forced vibrations - Resonance - Fourier theorem-application. Laws of transverse vibration of strings - Sonometer-Determination of AC frequency using sonometer - Determination of frequency using Melde's apparatus-Decibels - Intensity levels - decibel-noise pollution. **(12 hrs)**

Unit V: Ultrasonics and Acoustics

Ultrasonics –Production – Piezoelectric crystal method – Magnetostriction method – Properties and Applications Acoustics of building – Reverberation- Sabine's Reverberation formula (No derivation) - Factors affecting acoustics of building- Sound distribution in an auditorium-Requisites for good acoustics. **(13 hrs)**

Learning outcome:

On completion of the course, the student will be able to

- Identify the materials suitable for construction of buildings, based on the moduli of elasticity.
- Have knowledge on properties of liquids and its determination.
- Understand the physics of sound and its applications

- To know the different methods of producing ultrasonic waves and its applications
- The concepts of acoustic comfort and better understanding of the theories used in building acoustics

Book Study:

1. Elements of properties of matter – D.S. Mathur – S. Chand & Co., 2004.
2. Properties of matter – R. Murugesan – S. Chand & Co., 2004.
3. Properties of matter – Brijlal and Subramanian S. Chand & Co., 2006.
4. D.R.Khanna and R.S. Bedi, Textbook of Sound, Atmaram and sons (1969)
5. N.Subrahmanyam and BrijLal, A Text Book of Sound,Vikas Publishing House - Second revised edition(1995)

Books for reference:

1. Fundamentals of General Properties of Matter by H.R.Gulati, S. Chand & Co., NewDelhi (1982).
2. Fundamental of Physics, D. Hallidary , Resnick and J Walker, 6th Edition, Wiley, New York 2001.

Core paper 2: MECHANICS

L	T	P	C
4	0	0	4

Objective:

- To give the students fundamental ideas on conservation laws, rotational and vibrational motion of rigid bodies, Gravitational fields and some idea about fluid mechanics

Unit I: Laws of Motion

Laws of conservation of energy, linear momentum and angular momentum - work energy theorem - work done by gravitational force - work done by spring force - potential energy - conservative and non conservative forces - potential energy curve–Collision – Elastic and inelastic collision – (Fundamental laws of impact) – Newton's law of impact – coefficient of restitution – Impact of a smooth sphere on a fixed plane – Direct impact between two smooth spheres – Oblique impact between two smooth spheres – Calculation of final velocities of the spheres – Loss of K.E due to impact. **(12 hrs)**

Unit II: Dynamics of Rigid body

Moment of inertia – Theorems of perpendicular and parallel axes – M.I of a circular ring, disc, solid sphere, hollow sphere and cylinder about all axes – Compound pendulum – theory – equivalent simple pendulum – reversibility of centers of oscillation and suspension – determination of g and k **(12 hrs)**

Unit III: Gravitation

Newton's law of gravitation – Kepler's laws of gravitation – G by Boy's method – Mass and density of earth – Acceleration due to gravity – Variation of g with altitude, depth and rotation of earth - Value of g at poles and equator. Gravitational field – Gravitational potential – Gravitational potential due to spherical shell – Gravitational potential due to a solid sphere (inside and outside) **(12 hrs)**

Unit IV: **Central Force Motion**

Angular velocity, angular momentum and K.E of rotation – Torque and angular acceleration – Relation between them – Expression for acceleration of a body rolling down an inclined plane without slipping. Center of mass –velocity and acceleration of centre of mass – determination of motion of individual particle– system of variable mass. Rocket motion- Satellite

(12 hrs)

Unit V: **Statics and Hydrodynamics**

Friction-laws of friction-angle of friction-cone of friction-Centre of gravity-solid and hollow tetrahedron-solid and hollow hemisphere –Centre of pressure – vertical rectangular lamina – vertical triangular lamina. Hydrodynamics -Equation of continuity– Pitot's tube and Venturimeter – Euler's equation of unidirectional flow – Torricelli's theorem – Bernoulli's theorem and its applications. **(12 hrs).**

Learning outcome:

On completion of the course, the student will be able to

- Understand and define the laws involved in mechanics
- apply conservation laws in collision experiments.
- derive Bernoulli's principle and apply pressure-velocity relation in fluid flow in the field of fluid dynamics

Books for Study:

1. Mechanics – Part I and II by Narayanamoorthy, National Publishing Company.
2. Mechanics by D.S.Mathur, S.Chand& Co., 2nd Edition (2001).
3. Mechanics by P. Duraipandian, LaxmiDuraipandian, MuthamizhJayapragasam,
4. S.Chand& Co., New Delhi (1988).
5. Properties of Matter by R.Murugeshan, S. Chand & Co., New Delhi (2001).

Books for Reference:

1. Fundamentals of Physics by D. Halliday, R.Rensick and J. Walker, 6th edition, Wiley,NY (2001).

3. HEAT AND THERMODYNAMICS

L	T	P	C
4	0	0	4

Objective :

- To understand the phenomena connected with various units of measurement of temperature, knowing the concept of specific heat capacities of matter, transmission of heat, concept of lowering the temperature, liquefying gases and process of making heat to do mechanical work.

Unit I: Thermometry and Calorimetry

Platinum resistance thermometer - Calendar and Griffith's bridge - Thermoelectric effect – Seebeck effect - Thermoelectric thermometers- International temperature scale – Thermistor- Specific heat capacity of solids – Regnault's method of mixtures(solid) – specific heat capacity of liquids – Callendar and Barnes method – Specific heat capacity of gases – C_p and C_v – Meyer's relation – C_v by Joly's differential steam calorimeter method – C_p by Regnault's method. **(12 hrs)**

Unit II : Low Temperature Physics

Joule - Kelvin effect - Liquefaction of Air-Linde's Process—liquefaction of hydrogen - liquefaction of helium-Kammerling - Onne's method - Helium I and II - Lambda point - production of low temperatures - adiabatic demagnetization - practical applications of low temperature - refrigerators and air-conditioning machines - super fluidity - application of super fluidity. **(12 hrs)**

Unit III: Transmission of Heat

Conduction – coefficient of thermal conductivity – Rectilinear flow of heat along a bar – convection – lapse rate – Stability of the atmosphere – Newton's law of cooling – determination of specific heat capacity of liquid - Radiation - black body – Kirchhoff's law – Stefan – Boltzmann law - energy distribution in black body spectrum - Wien's law – Rayleigh Jean's law– Planck's law - solar constant – water flow pyroheliometer. **(12 hrs)**

Unit IV: Kinetic Theory of Gases

Kinetic Theory of gases- assumptions - Molecular collisions – mean free path – expression for mean free path – Transport phenomenon – Brownian motion and its features - expression for viscosity, Diffusion and thermal conductivity of gas. Experimental verification -Vander walls equation of state - Determination of Vander walls constant - Relation between Vander Wall's constant and critical constants. **(12 hrs)**

Unit V: Thermodynamics

Zeroth and first law of thermodynamics – reversible and irreversible processes – isothermal process-adiabatic process-gas equation during adiabatic process - work done during adiabatic and isothermal process - second law of thermodynamics – Carnot's engine – its efficiency.

Entropy – change of entropy in reversible and irreversible processes – temperature – entropy diagrams – physical significance of entropy - change of entropy when ice converted into steam - third law of thermodynamics – Extensive and Intensive thermodynamic variables – distinction between them – Maxwell thermodynamical relations – derivation and application - Clausius - Clapeyron equation and specific heat relation . **(12 hrs)**

Course Outcomes:

On completion of the course, the student will be able to

- learn experimental methods to determine the transmission of heat.
- understand the laws of thermodynamics and their applications.
- analze Maxwell's thermo dynamical relations and their applications

Text Books:

1. Heat and Thermodynamics – Brijlal and Subramanyam, S.Chand & Co, 16th Edition New Delhi, 2005.
2. Heat and Thermodynamics – D.S. Mathur, Sultan Chand & Sons, 5th Edition, New Delhi, 2014.
3. Thermal Physics – R. Murughesan and Kiruthiga Sivaprasath, S.Chand & Co, II Edition, New Delhi, 2008

Books for Reference:

1. Heat & Thermodynamics – J.B. Rajan, SC Publisher, New Delhi, 1985.
2. Concepts of Physics Volume I and II – H.C. Varma, Bharati Bhawan Publishers, New Delhi, 2015
3. M. Narayanamoorthy and N. Nagarathinam, Heat, National publishing Co,Chennai, Eight edition, 1987.

4. OPTICS AND SPECTROSCOPY

L	T	P	C
4	0	0	4

Objective :

- To understand the concept of aberrations in lenses and prisms, phenomenon like interference, diffraction, polarization through wave nature of light and its applications and to gain knowledge in spectroscopy.

Unit I: Geometrical optics

Lens – Spherical aberration in lenses – Methods of minimizing spherical aberration – chromatic aberration in lenses – condition for achromatism of two thin lenses (in and out of contact) –Aplanatic lens –Dispersion – Angular and Chromatic dispersion – combination of prisms to produce i)dispersion without deviation ii) deviation without dispersion –Direct vision spectroscope – Eyepieces – Ramsden's and Huygens's eyepieces – simple microscope (magnifying glass)– compound microscope. **(12 hrs)**

Unit II: Interference

Conditions for interference – Theory of interference fringes – interference due to reflected light (thin films) -colours of thin films – wedge shaped thin film – theory – determination of diameter of a thin wire by Air wedge – test for optical flatness – Newton's rings by reflected light – Determination of wavelength of light - Michelson's Interferometer – theory and its Application (Measurement of wavelength) – Jamin's interferometers – determination of refractive index of gases. **(11 hrs)**

Unit III: Diffraction

Fresnel's diffraction –Rectilinear propagation of light – zone plate –action of zone plate - diffraction at circular aperture – opaque circular disc – Fraunhofer diffraction at single slit – Double slit – Plane diffraction grating – theory of plane transmission grating - experiment to determine wavelength(Normal incidence method) –resolving power– Rayleigh's criterion for resolution – resolving power of a telescope – resolving power of a microscope – resolving power of a prism - resolving power of grating. **(12 hrs)**

Unit IV: Polarisation

Double refraction –Nicol Prism – Nicol Prism as polarizer and analyzer – Huygens's explanation of double refraction in uniaxial crystals– Plane, elliptically and circularly polarized light– Quarter wave plates and Half wave plates – Production and detection of plane, circularly and elliptically polarized light- Optical activity– Fresnel's explanation of optical activity – Specific rotatory power –Laurent's half shade polarimeter. **(13 hrs)**

Unit V: Spectroscopy

Infrared spectroscopy – sources and detector – uses – ultraviolet spectroscopy – sources – quartz spectrograph - applications - Raman Spectroscopy – Quantum theory of Raman effect – applications – Nuclear magnetic resonance –Nuclear quadrupole resonance -– Electron spin resonance spectroscopies- (Qualitative study)

(13 hrs)

Learning Outcome :

On completion of the course the students will have:

- The knowledge of geometric optics is helps in the practical design of many optical systems and instruments including aberrations in lens system.
- The study of phenomena interference, diffraction, and polarization lays the foundation for an understanding of concepts such as as holograms, interferometers.
- The knowledge of Spectroscopy helps to extract the dynamic information about the molecule

Text Books:

1. A text book of Optics – Subramanyam and Brijlal, S. Chand and co.., 25th Edition, New Delhi 2004.
2. Optics and Spectroscopy –R.Murugeshan, S. Chand and co., 6th Edition, New Delhi, 2008.
3. Elements of Spectroscopy – S.L. Gupta, V.Kumar and R.C.Sharma Pragati Prakashan, 13th Edition, Meerut, 1997.
4. Molecular structure and spectroscopy – G.Aruldhass, PHI Pvt Ltd, , II Edition, New Delhi, 2007.

Books for Reference:

1. Optics – Sathyaprakash, Ratan Prakashan Mandhir, VIIth Edition, New Delhi, 1990.
2. Introduction to Molecular Spectroscopy –C.N.Banewell,TMH publishing co. IV Edition, New Delhi, 2006.
3. Ajoy Ghatak, *Optics*, (TMH), New Delhi, Fourth edition, 2009.
4. Singh & Agarwal, *Optics and Atomic Physics*, Pragati Prakashan Meerut, Nineth edition, 2002.
5. Fundamentals of Physics, by D.Halliday, R. Resnick and J. Walker, Wiley, 6thEdition, New York (2001).

5. ELECTRICITY AND ELECTROMAGNETISM

L	T	P	C
4	0	0	4

Objectives:

- To provide comprehensive knowledge and understanding of the basics of Electricity and Magnetism. To expose the students to the applications of Electricity and Magnetism.

UNIT I: **MAGNETIC EFFECT OF ELECTRIC CURRENT**

Magnetic flux and magnetic induction- Biot Savart law- magnetic induction at a point due to a straight conductor carrying current - magnetic induction at a point on the axis of a circular coil carrying current- amperes circuital law- magnetic field inside a long solenoid - toroid- Lorent'z force on a moving charge- direction of force-torque on a current loop in a uniform magnetic field -Moving coil Ballistic galvanometer-theory -experiment to find charge sensitivity and absolute capacity of a capacitor-De-sauty's bridge

(12 hrs)

UNIT II: THERMAL AND CHEMICAL EFFECT OF ELECTRIC CURRENT

Thermoelectricity- Seebeck effect- laws of thermo e.m.f-– measurement of thermo e.m.f using potentiometer-Peltier effect-demonstration—Thomson effect- demonstration - thermodynamics of thermo couple –thermo electric diagram –uses-applications-thermopile-Boy's radio micrometre –thermo-milli ammeter Faradays laws of electrolysis- electrical conductivity of an electrolyte-specific conductivity- Kohlrausch's bridge method of determining the specific conductivity of an electrolyte -Arrhenius theory of electrolytic dissociation- mobility of ions- Secondary cells- Gibbs –Helmholtz equation for a reversible cell **(12 hrs)**

UNIT III: ELECTROMAGNETIC INDUCTION

Faraday's laws of electromagnetic induction-self induction –self inductance of a long solenoid –toroidal solenoid-determination of L by Anderson's and Rayleigh's methods-Owen's bridge-mutual induction-mutual inductance between two co-axial solenoids-experimental determination of mutual inductance –-co-efficient of coupling- energy stored in a coil- eddy currents- uses - Earth inductor-uses-search coil- induction coil and its uses

(12 hrs)

UNIT IV: AC AND DC CIRCUITS

Growth and decay of current in LC,LR and CR circuits with d.c.voltages - determination of high resistance by leakage –growth and decay of charge in LCR circuit-conditions for the discharge to be oscillatory –frequency of oscillation. Alternating Current- j operator method – use of j operator in the study of AC circuits-Resistance in an AC circuit-Inductance in an AC circuit- Capacitance in an AC circuit-AC through an inductance and resistance in series- capacitance and resistance in series – LCR series resonance circuit -sharpness of resonance-parallel resonance circuit -power in an AC circuit-power factor.

(12 hrs)

UNIT V: MAXWELL'S EQUATION & ELECTROMAGNETIC WAVES

Introduction- Maxwell's equations- -Displacement current- Poynting vector-Electromagnetic waves in free space-Hertz experiment for production and detection of EM waves - Wave equations for Electric field and Magnetic field- monochromatic plane waves-

EM waves in a matter-Reflection and Transmission at normal incidence and oblique incidence-Polarization by reflection. **(12 hrs)**

Learning Outcome :

On the completion of the course students will be able to:

- understand fundamental laws of electricity and magnetism and electromagnetic waves ,identify and explain chemical, thermal and magnetic effect of electric current,analyses and solves electrical circuits with dc and ac source
- apply the knowledge of electricity and magnetism to technological advances
- To develop problem solving skills.

Books for study:

1. R. Murugeshan, Electricity and Magnetism (2008) S Chand & Co, New Delhi
2. BrijLal & Subramanyam, Electricity and Magnetism,(2005)
3. Ratan Prakashan Mandir Publishers, Agra
4. M.Narayanamurthy & N.Nagarathnam, Electricity & Magnetism, NPC pub., Revised edition.

Books for Reference:

1. Electricity and Magnetism -D.N.Vasudeva (Twelfth revised edition)
2. Electricity and Magnetism - K.K.Tiwari (S.Chand &Co.)
3. Electricity and Magnetism -E.M.Pourcel,Berkley Physics Cource, Vol.2 (Mc Grraw-Hill)
4. 4. Electricity and Magnetism - Tayal (Himalalaya Publishing Co.)
5. D.Halliday, R.Resnick and J.Walker, Fundamentals of Physics – Electicity and Magnetism (2011), Wiley India,Pvt Ltd
6. David J. Griffith, Introduction to Electrodynamics, (2012) PHI, New Delhi

6. ANALOG ELECTRONICS

L	T	P	C
4	0	0	4

Objectives:

- To enable the students to understand the aspects of analog electronics in a lucid and comprehensive manner.

Unit I: Linear circuit analysis and semiconductor diodes

Constant voltage source - constant current source - Maximum power transfer theorem - Thevenin's theorem - procedure for finding Thevenin Equivalent circuit - PN junction theory - V-I characteristics of a PN junction diode - Half wave rectifier - Bridge rectifier - Efficiency - filters - Shunt capacitor filter – pi filter - Zener diode - equivalent circuit - voltage egulator - LED - V-I characteristics – advantages - applications - photo diode - characteristics - applications. **(12 hrs)**

Unit II: Transistor Amplifier

Transistor - Different modes of operations-CB mode &CE mode - Two port representation of a transistor- h parameter - AC equivalent circuit using h parameters- analysis of amplifiers using h parameters (CE only) - RC coupled amplifier - transformer coupled amplifier - power amplifier - classification of amplifiers - Class A, Class B and Class C - Push pull amplifier – Emitter follower. **(14 hrs)**

Unit III: Oscillators and Multivibrator

Feedback principle -effect negative feedback-and Barkhaussen criterion - Phase shift and Wien Bridge oscillators using transistors –Expression for frequency- Multivibrators-Astable , Monostable and Bistable multi vibrators using transistors - Schmitt trigger. **(12 hrs)**

Unit IV: Special Semiconductor Devices

clipping and clamping circuits - Differentiating circuit - Integrating circuit-
-Field effect Transistor FET-MOSFET- UJT-SCR -characteristics - FET as a VVR-UJT relaxation oscillator-SCR as a switch and rectifier **(10 hrs)**

Unit V: Operational Amplifier

Operational Amplifier- characteristics-parameters-applications- Inverting amplifier - Non inverting amplifier - Voltage follower- Adder - Subtractor - Integrator – Differentiator- Solving simultaneous equations-comparator -square wave generator -Wien bridge oscillator -Schmitt trigger **(12 hrs)**

Learning Outcomes:

On completion of the course the students will be able to:

- illustrate network theorems like Thevenin's theorem, Norton's theorem etc.,
- understand the fundamental principles of semiconductors including p-n junctions and zener diode

- understand the operation of transistor can amplifier, oscillator and multivibrator
- To acquire knowledge on transistor and its applications

Books for Study:

1. Hand Book of Electronics by Gupta and Kumar - PragatiPrakashan – Meerut(2002).
2. Principles of Electronics by V.K. Mehta, Rohit Mehta S. Chand & Co.(2006).
3. Electronics by M. Arul Thalapathi, ComptekPublishers(2005).
4. Elements of Electronics by M.K.Bagde and Singh S.P., S. Chand & Co., NewDelhi(1990).
5. Applied Electronics by A. Subramanyam – National Publishing Co.(1997)
6. OP - AMPs and Linear Integrated Circuits by Ramakant A. Gayakwad, PrenticeHall of India(1994).

Books for Reference:

1. Electronic Devices by Mittal.G.K., G.K. Publishers Pvt. Ltd., (1993).
2. Basic Electronics by B.L. Theraja, S. Chand & Co., (2008).
3. Solid State Electronics by Ambrose and Vincent Devaraj, Meera Publication.
4. Applied Electronics by R.S. Sedha, S. Chand & Co.(1990).

7. ATOMIC PHYSICS

L	T	P	C
4	0	0	4

Objective:

- To provide an introductory account about the atomic structure and the impact of X-rays.

Unit I: BAND THEORY OF SOLIDS

The free electron theory of metals – expressions for electrical conductivity – thermal conductivity – Wiedman-Franz's law-Hall effect-magneto resistance- determination of electronic charge – Millikan' s oil drop method – electron microscope – Band theory of solids – classification of solids on the basis of band theory. **(12 hrs)**

Unit II: POSITIVE RAYS:

Discovery-properties- analysis – Thomson's parabola method – Aston's mass spectrograph – Bainbridge's mass spectrograph – Dempster's mass spectrograph – Dunnington's method of determining e/m. **(12 hrs)**

Unit III : ATOMIC STRUCTURE

Early atomic spectra-Thomson model-Alpha particle scattering-Rutherford 's nuclear model-drawbacks-Bohr atom model –Bohr's interpretation of the Hydrogen spectrum-correction for nuclear motion-evidences in favour of Bohr's theory-Ritz combination principle-correspondence principle-Sommerfield's relativistic atom model-drawbacks- the vector atom model – Quantum numbers associated with the vector atom model – the Pauli's exclusion principle – periodic classification of elements **(11 hrs)**

Unit IV: FINE STRUCTURE OF SPECTRAL LINES

Coupling schemes-L-S Coupling-j-j Coupling- Hund rules- magnetic dipole moment due to orbital motion of the electron- due to spin of the electron - Stern and Gerlach experiment-spin-orbit coupling-optical spectra-spectral terms-spectral notation- selection rules- intensity rules- interval rule- fine structure of sodium D line- hyperfine structure- Normal Zeeman effect- theory and experiment- quantum mechanical explanation - Larmor's theorem-Anomalous Zeeman effect- Paschen –Bach effect-Stark effect. **(12 hrs)**

Unit V: X-Rays and Photo Electric Effect

Production of X-rays – properties-absorption of X-rays – X-ray absorption edges- Bragg's law – Bragg's X-ray spectrometer –the powder crystal method – Laue's method – Rotating crystal method –X-ray spectra- continuous spectra- characteristic spectra-Moseley's law - importance–width of spectral lines- Doppler broadening-collision broadening-X-ray Detectors-scintillation detector- semiconductor detectors Compton effect- theory and experimental verification.

Photo Electric Effect: Einstein's photoelectric equation-photoelectric cells- photo emissive cells-photovoltaic cells-photoconductive cells-applications of photoelectric cells **(13 hrs)**

Learning Outcomes:

On completion of the course the students will have:

- Understand the evolution of Different atomic models and their merit and limitations
- Adequate knowledge on the fundamental principles governing the structure of the atom and the interactions of particles at high energies.
- Sufficient knowledge in atomic physics to follow courses at the advanced level.

Books for Study:

1. Modern Physics by R. Murugeshan, KiruthigaSivaprasath, S. Chand & Co., New Delhi(2008).
2. Modern Physics by D.L.Sehgal, K.L.Chopra and N.K.Sehgal. Sultan Chand & Sons Publication, 7th Edition, New Delhi(1991).
3. Atomic Physics by J.B. Rajam, S. Chand & Co., 20thEdition, New Delhi (2004).
4. Atomic and Nuclear Physics by N. Subrahmanyam and BrijLal, S. Chand & Co. 5th Edition, New Delhi(2000).

Book for Reference :

1. Modern Physics by J.H. Hamilton and Yang, McGraw-HillPublication, (1996).
2. Concepts of Modern Physics by A. Beiser, Tata McGraw-Hill, New Delhi (1997).
3. Fundamentals of Physics by D.Halliday, R.Resnick and J. Walker, Wiley, 6thEdition, New York(2001).
4. Modern Physics by Kenneth S.Krane, John Willey & sons, Canada (1998).

8. CLASSICAL AND STATISTICAL MECHANICS

L	T	P	C
4	0	0	4

Objective:

- To understand the mechanics of systems of particles and their equations of motion.To study the concept of statistics of molecules.

UNIT I: Mechanics of a System of Particles
External and internal forces, centre of mass-Conservation of linear momentum-Conservation of angular momentum-Conservation of energy-work-energy theorem-Conservative forces-examples-Constraints-Types of constraints- Examples-Degree of freedom-Generalized coordinates (transformation equations)- Generalized velocities-Generalized Momentum. **(13 hrs)**

UNIT II: Lagrangian Formulations
Principle of virtual work, D'Alembert's principle, Lagrange's equation of motion for conservative and non conservative systems-Simple applications-simple pendulum-Atwood's machine-compound pendulum- Hamilton's principle- Deduction of Lagrange's equation of motion from Hamilton's principle- Deduction 0f Hamilton's principle from D'Alembert's principle. **(13 hrs)**

UNIT III: Hamiltonian Formulations
Phase space-The Hamiltonian function H -Hamilton's Canonical equation of motion-Physical significance of H- Deduction of Canonical equation from a variational principle-Applications-Harmonic oscillator-Planetary motion- Compound pendulum **(12 hrs)**

UNIT IV: Classical Statistics
Micro and macro states-The mu-space and gamma space-fundamental postulates of statistical mechanics-Ensembles-different types - Thermodynamical probability-entropy and probability-Boltzmann's theorem- Maxwell-Boltzmann statistics- Maxwell-Boltzmann energy distributive law- Maxwell-Boltzmann velocity distributive law. **(11 hrs)**

UNIT V: Quantum Statistics
Development of Quantum statistics- Bose - Einstein and Fermi - Dirac statistics - Derivation of Planck's radiation formula from Bose – Einstein statistics - Free electrons in metal- Fermi gas-Difference between classical and quantum statistics **(11 hrs)**

Learning Outcomes:

On completion of the course the students will have:

- Known the usage of Lagrangian and Hamiltonian Mechanics.
- the required knowledge to apply the principles of statistical mechanics to selected problems.

Text books:

1. J.C. Upadhyaya, July 2005, **Classical Mechanics**, Published by Himalya Publishing House, Mumbai
2. Brijlal & Subramaniam, Reprint 1998, **Heat & Thermodynamics**, S. Chand & Company Ltd
3. Agarwal, **'Statistical Physics'** S.Chand & co New Delhi 1996

Reference:

1. Gupta,B.D., Satyaprakash, 1991, Classical Mechanics, 9th ed., Kadernath Ramnath Publ., Meerut
2. Gupta, Kumar, Sharma, 2005, **Classical Mechanics**, PragatiPrakashan Publ., Meerut.
3. Murray R.Spiegal, 1981, Theoretical Mechanics, Schaum's outline series, Mc Graw Hill Publ. Co., New Delhi.

9. RELATIVITY AND QUANTUM MECHANICS

L	T	P	C
4	0	0	4

Objectives:

- The aim of this course is to acquire sufficient knowledge in the concept of Relativity, dual nature of matter waves, Evolution of Quantum mechanics, Schrodinger equation and its applications and Operator formalism

Unit I: Relativity

Frames of reference - Galilean transformation - Michelson - Morley experiment -Postulates of special theory of relativity - Lorentz transformation - length Contraction – time dilation - Relativity of simultaneity - addition of velocities - variation of mass with velocity– Mass energy relation - Elementary ideas of general relativity. **(12 hrs)**

Unit II: Wave Nature of Matter

Phase and group velocity - wave packet - expression of De Brogile's wave length -Davisson and Germer's experiment - G.P.Thomson's experiment - Heisenberg's uncertainty principle and its consequences. **(12 hrs)**

Unit III: Schrodinger Equation

Inadequacy of classical mechanics - Basic postulates of quantum mechanics - Schrodinger equation - Properties of wave function - Probability interpretation of wavefunction - linear operators - self adjoint operators - expectation value - eigenvalues and eigenfunctions - commutativity and compatibility. **(12 hrs)**

Unit IV: Angular Momentum in Quantum Mechanics

Orbital angular momentum operators and their commutation relations - separation of three dimensional Schrodinger equation into radial and angular parts - Elementary ideas of spin angular momentum of an electron - Pauli matrices. **(12 hrs)**

Unit V: Solutions of Schrodinger Equation

Free particle solution - Particle in a box - Potential well of finite depth (one dimension) - linear harmonic oscillator - rigid rotator and hydrogen atom. **(12 hrs)**

Learning Outcomes:

On completion of the course the students will be able

- to gain knowledge in the concepts of special and theory of relativity
- to evolve ideas about dual nature of matter
- to recognize basic terms in Quantum Mechanics and different operator mechanism
- to Apply of Schrödinger’s equation to micro system

Books for Study:

1. A Text book of Quantum mechanics by P.M.Mathews and S.Venkatesan, TataMcGraw - Hill, New Delhi(2005).
2. Quantum Mechanics by V.K.Thankappan, New Age International(P) Ltd.Publishers, New Delhi(2003).
3. Quantum mechanics by K.K.Chopra and G.C. Agrawal, Krishna PrakasamMedia(P) Ltd., Meerut First Edition(1998).
4. Modern Physics by R. Murugeshan and KiruthigaSivaprasath, S. Chand &Co.,(2008).

Books for Reference:

1. Mechanics and Relativity by Brijlal Subramanyam, S.Chand& Co., New Delhi, (1990).
2. Concepts of modern physics by A.Beiser. Tata McGraw - Hill, 5thedition, NewDelhi(1997).
3. Introduction to quantum mechanics by Pauling and Wilson, McGraw – Hill.
4. Quantum mechanics by A.Ghatak and Loganathan, Macmillan India Pvt. Ltd.

10. BASICS OF DATA COMMUNICATION AND PROGRAMMING IN C

L	T	P	C
4	0	0	4

Objective:

- To introduce to data communication and Programming in C

Unit I: Data Communication

Introduction to Data Communication - Network, protocols and standards standard organizations - line configuration - topology- transmission mode - classification of network. **(12 hrs)**

Unit II:

Parallel and serial transmission - Interface standards - modems-guided media- types of error - Multiplexing - Types of Multiplexing- Multiplexing application- Telephone system – ether net. **(12 hrs)**

Unit III:

Analog and digital network: Access to ISDN-broadband ISDN-X.25 Layers- Atm – Repeaters – Bridges – Routers – Gateway - TCP/IP Network - World Wide web.

(12 hrs)

Unit IV: Introduction to Programming in C

Basic structure of C Program – character set – identifiers and keywords- constants and variables - data types – operators and expressions – Relational, Logical and Assignment operators – increment and decrement operators – Arithmetic expressions – Mathematical functions. **(12 hrs)**

Unit V:

Data input and output – getchar, putchar, scan f, print f, gets, puts functions – Decision making – branching and looping – if, if-else, else if ladder, switch, break, continue, goto – while, do while – for, nested loops – Arrays (one dimensional and two dimensional) – declaration – initialization – simple programs. **(12 hrs)**

Text book:

1. Balagurusamy.E, (2008), ”Programming in ANSI C” , Second Edition, Tata McGraw Hill.
2. Brijendra Singh,Data communications and Computer Networks, second edition

References:

1. Kamthane Ashok.N, (2013), ”Programming in C”, 2nd Edition, Pearson Education.
2. Yashvant P. Kanetkar, (2008), “Let us C”, 8th Edition, Infinity science press.

11. NUCLEAR PHYSICS

L	T	P	C
4	0	0	4

Objectives:

- To acquire knowledge on static properties of nuclei and its stability. To understand the background of various nuclear models. To know about different modes of decay and interaction of nuclear radiations with matter

UNIT I: Properties and structure of Nuclei

General properties of nucleus- binding energy – BE/A curve - significance - proton electron theory- proton neutron theory -Nuclear forces – characteristics Meson theory of nuclear forces – Yukava Potential- Nuclear models. **(11 hrs)**

UNIT II: Radio Activity

Fundamental laws of radio activity –theory of α ,β and Υ decay- properties of alpha, beta and gamma rays - neutrino and its properties-electron capture. - nuclear isomers- Mossabauer effect - applications- Radio carbon dating- radio isotopes – uses. **(13 hrs)**

UNIT III: Nuclear Reactions

Kinematics of nuclear reaction-Nuclear fission –Nuclear fusion – Nuclear reactor-uses - atom bomb - hydrogen bomb-fusion reactor –plasma confinement –artificial transmutation-Q value of nuclear reaction-types of nuclear reaction **(12 hrs)**

UNIT IV: Nuclear Detectors and Particle Accelerators

Neutron sources and properties- Detectors-G.M.Counter-scintillation counter- bubble chamber-Wilson cloud chamber - Accelerators-cyclotron- synchrocyclotron – betatron - synchrotrons **(12 hrs)**

UNIT V: **Cosmic Rays and Elementary Particles**

Cosmic rays-introduction-discovery-latitude, altitude and azimuth effects- longitudinal effect-north –south effect-seasonal and diurnal changes-primary and secondary cosmic rays-nature of cosmic rays- cosmic ray showers-Van Allen belt- origin of cosmic radiation. Elementary particles-introduction-particles and antiparticles-antimatter-the fundamental interaction-elementary particle quantum numbers-conservation laws and symmetry-the quark model **(12 hrs)**

Learning Outcomes:

On completion of the course the students will have:

- Understanding on the basics of nuclear physics that treats atomic nuclei as self-bound many-body quantum systems
- Knowledge about particle- antiparticle, decay processes and their outcomes.
- Basic interaction between fundamental particles.

Books for Study:

1. Atomic and Nuclear Physics by N. Subrahmanyam and Brijlal, S Chand & Co.,New Delhi (1996).
2. Nuclear Physics by Tayal D.C., Himalaya Publishing House, Mumbai(2006).
3. Nuclear Physics by R.C.Sharma, K.Nath& Co., Meerut (2000)
4. Nuclear Physics by Irving Kaplan, Narosa Publishing house, New Delhi.

Books for Reference :

1. Nuclear Physics by R.R.Roy and B.P.Nigam, New Age International (P) Ltd., NewDelhi(1997).
2. Fundamentals of Elementary Particle Physics by Longo, McGraw-Hill.
3. Nuclei and Particles by Serge., W.A. Benjamin, USA
4. Elements of Nuclear Physics by ML Pandya and RPS Yadav, Kedarnath Ram Nath,Meerut.

12. SOLID STATE PHYSICS

L	T	P	C
4	0	0	4

Objective:

- To understand the different types of bonding in solids. To understand the magnetic and dielectric properties of crystalline structures. To acquire knowledge on the basics of magnetic phenomena on materials and various types of magnetization. To know the properties of superconducting materials.

UNIT I: Bonding in Solids

Types of bonds in crystals - Ionic, covalent, Metallic, Vander waal's and Hydrogen Bonding - Bond energy of sodium chloride molecule - variation of inter atomic force with inter atomic spacing -cohesive energy - cohesive energy of ionic solids - application to sodium chloride crystal - evaluation of Madelung constant for sodium chloride. **(12 hrs)**

UNIT II: Crystal Structure and Crystal Diffraction

Crystal Lattice -Primitive and unit cell-seven classes of crystal-Bravais Lattice- Miller Indices-Structure of crystals-- Simple cubic, Face centered cubic, Body centered cubic and Hexagonal close packed structure -Sodium Chrloride, Zinc Blende and Diamond Structures. Crystal Diffraction – Bragg's law-Experimental methods-Laue method, powder method and rotating crystal method-Reciprocal lattice- Intensity and structure factor. **(14 hrs)**

UNIT III: Magnetic Properties

Spontaneous Magnetization – Weiss Theory – Temperature dependence of Magnetization - classical Theory of Diamagnetism – Weiss theory of Para magnetism – Ferromagnetic domains – Bloch wall – Basic ideas of anti- ferromagnetism – Ferrimagnetisms – Ferrites in computer Memories. **(10 hrs)**

UNIT IV: Dielectric Properties

Band theory of solids –classification of insulators, Semiconductors, conductors – intrinsic and extrinsic semiconductor – Carrier concentration for electron - Barrier Potential Calculation – Rectifier Equation Dielectrics - Polarization – frequency and temperature effects on polarization-dielectric loss-Clausius Mosotti relation-determination of dielectric constants.

(12 hrs)

UNIT V: Super Conductivity

Introduction - General Properties of Superconductors - effect of magnetic field -Meissner effect - effect of current - thermal properties - entropy - specific heat -energy gap - isotope effect - London equations - AC & DC Josephson effects - applications - Type–I and Type–II Superconductors - Explanation for the Occurrence of Super Conductivity - BCS theory - Application of Superconductors - High T_C superconductors.

(12 hrs)

Learning Outcomes:

- Summarize how crystalline materials are studied using diffraction
- Able to discuss about the interatomic forces and bonds between solids
- Explain the behavior of solids with their magnetic properties.
- Analyze the importance of superconducting materials in engineering applications.

Books for Study:

1. Materials Science by M.Arumugam, Anuradha Agencies Publishers.,(2002).
2. Solid State Physics by R L Singhal, Kedarnath Ram Nath& Co., Meerut (2003).
3. Introduction to Solid State Physics by Kittel, Willey Eastern Ltd(2003).
4. Materials Science and Engineering by V. Raghavan, Prentice Hall of India PrivateLimited, New Delhi(2004).

Books for Reference:

1. Solid State Physics by S.O.Pillai, New Age International (P) Ltd.,(2002).
2. Solid State Physics by A. J.Dekker, Macmillan India(1985).
3. Solid State Physics by HC Gupta, Vikas Publishing House Pvt. Ltd., New Delhi (2001).

13. DIGITAL AND COMMUNICATION ELECTRONICS

L	T	P	C
4	0	0	4

Objectives:

- To acquire knowledge on number system, arithmetic building blocks, memories. To understand the fundamental concepts of logic gates, counters, registers, fiber optics etc. To develop skill to build and troubleshoot combinational digital circuits.

Unit I: Digital Fundamentals

Number Systems and Conversions - BCD Code - Gray code - 1's and 2's complements – Basic logic gates - NAND, NOR and EX-OR gates - NAND and NOR as Universal Building blocks - Laws and theorems of Boolean algebra – NAND-NAND circuits - Karnaugh's map- SOP and POS- applications **(12 hrs)**

Unit II : Sequential Logic

RS, Clocked RS, D, J-K and J-K Master-Slave Flip-flop - Shift registers and Counters- Multiplexers and Demultiplexers – Decoders and Encoders - Memory Circuits -D/A and A/D converters **(12 hrs)**

Unit III: Modulation and Demodulation

Amplitude modulation - Frequency modulation, Phase Modulation and Pulse Width Modulation - Detectors of AM, FM, PM and PWM, PLL - Noise in Communication Systems **(12 hrs)**

Unit IV: Digital and Satellite Communication

ASK, FSK, PSK Modulation and Demodulation, Advantages and disadvantages of digital communication. Communication Satellite Systems - Telemetry - Tracking and Command System Satellite Links - Commonly Used frequency in Satellite Communication - Multiple access - Error Detection. **(12 hrs)**

Unit V : Fibre Optic Communication

Basic Fibre Optic System - Advantages of Fibre Optic System - Propagation of light through fibre - Numerical aperture - Acceptance angle - Losses and distortion in optical fibres - Basic fibre Optical communication and links - Special applications **(12 hrs)**

Course Outcomes:

On completion of the course the students will be able to :

- Understand the structure of various number system and basic logic gates.
- to design and solve the Boolean Algebra simplification and Karnaugh Maps.
- to construct sequential circuits and to design counters.

- Understanding AM, FM and PM modulation and demodulation techniques
- Learn the basic concepts of fiber optics and types of fiber
- Learn the working principle of satellite communication system

Books for Study:

1. Digital Principles and Application by Malvino Leach, Tata McGraw Hill, 4thEdition(1992).
2. Digital Fundamentals by Thomas L. Floyd, Universal Book Stall, New Delhi(1998).
3. Introduction to Integrated Electronics by V.Vijayendran, S. Viswanathan (Printersand Publishers) Pvt. Ltd., Chennai(2005).

Books for Reference:

1. Digital Electronics by Practice Using Integrated Circuits - R.P.Jain - Tata McGrawHill(1996).
2. Linear Integrated Circuits by 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 by J.Millman and C.Halkias, Tata McGraw Hill, New Delhi(2001)

14. MATHEMATICAL METHODS

L	T	P	C
4	0	0	4

Objectives:

- To understand various approximation methods to find solution to problems which do not have exact solutions.

UNIT I: Errors and Root of Equations

What is Numerical analysis-numbers and their accuracy-errors-measurement of errors-round off error-truncation error-absolute error-relative error- percentage error-inherent error-accumulated error-general error formulae – convergence Roots of equations-Iterationmethod - Maclaurin's series method-Newton - Raphson method - Von-Moisesformula - Bisection method. **(12 hrs)**

UNIT II: **Matrix and Linear Equations**

Introduction- pivotal condensation method- system of linear equations- Gauss Elimination method-Gauss Seidal Iteration method-Gauss Jordan elimination method- Matrix Inversion method . **(12 hrs)**

UNIT III: **Interpolation and Approximation**

Linear Interpolation –Quadratic Interpolation - Lagrange's Interpolation – Richardson's Extrapolation –Aitken's iterated Interpolation **(12 hrs)**

UNIT IV: Numerical Differentiation and Integration

Numerical differentiation-approximation of derivatives using interpolation polynomials - Taylor series method. Numerical Integration - trapezoidal rule-simpson's 1/3 and 3/8 rules **(12 hrs)**

UNIT V: **Differential Equations**

Introduction-Euler's method (Adams Bashforth first order method)- backward Euler method- Taylor' s series method- Runge-kutta method - predictor corrector methods **(12 hrs)**

Learning Outcomes:

On completion of the course the students will have:

- the ability to solve equation using an appropriate numerical method.

Books for study and Reference:

1. Introductory methods of numerical analysis – S.S. Sastry, Prentice Hall of India, New Delhi (2000)
2. Numerical methods – A. Singaravelu, Meenakshi Agency, Chennai (2001).
3. Numerical method in Science and Engineering – M.K. Venkataraman, PHI –New Delhi (1997)
4. Mechanics and Mathematical methods, R. Murugesan, S. Chand & Co, NewDelhi (1999)
5. Numerical methods by P. Kandasamy, K. Thilagavathy and K. Gunavathy, S. Chand & Co. (2002).

Core practical - I: GENERAL
(Any TEN Experiments - I Semester)

L	T	P	C
0	0	4	2

1. Young's Modulus – By Stretching
2. Young's Modulus – Cantilever
3. Young's Modulus – Non-uniform bending – Pin and microscope
4. Young's Modulus – Uniform bending – Optic lever
5. Rigidity Modulus – Static Torsion (Searle's Torsion)
6. Rigidity Modulus – Torsional pendulum (without identical masses)
7. Rigidity Modulus & Moment of inertia – Torsional pendulum (with identical masses)
8. Surface Tension of a liquid by capillary rise.
9. Surface tension and interfacial surface tension – Drop weight method.
10. Variation of Surface Tension with temperature (Jaeger's method)
11. Coefficient of Viscosity of liquid – Graduated burette
12. Comparison of Viscosity of two liquids.
13. Viscosity of a liquid – Stoke's method.
14. Specific heat capacity of a liquid – Method of mixtures (Half-time correction)
15. Specific heat capacity of a liquid – Newton's law of Cooling
16. Coefficient of apparent expansion of a liquid – Pyrometer.
17. Specific heat of a liquid using ice
18. Sonometer – Frequency of tuning fork
19. Sonometer – Relative density of a solid and liquid
20. Any other experiment

Core practical – II: OPTICS

(Any TEN Experiments – II Semester)

L	T	P	C
0	0	4	2

1. Focal length, Power, R and μ of a convex lens (UV & conjugate foci)
2. Focal length, Power, R and μ of concave lens (In contact, out of contact)
3. Spherical mirrors – Focal length
4. Liquid Lens- Refractive index of a liquid
5. Spectrometer – μ of a liquid (Hollow prism)
6. Spectrometer – μ of a small angled prism
7. Spectrometer – Dispersive power of a prism
8. Spectrometer – i-d curve
9. Refractive index using stoke's formula (i-i curve)
10. Refractive index of a convex lens – Newton's rings.
11. Refractive index by total internal reflection
12. Wavelength and dispersive power of a grating
13. Grating – Oblique incidence
14. Fresnel's Biprism
15. The Air wedge
16. Newton's Rings – μ of a liquid
17. The Polarimeter
18. Michelson's Interferometer
19. Fabre- Perot Interferometer
20. Any other experiment in optics

Core practicals - III: HEAT AND ELECTRICITY

(Any TEN Experiments – III Semester)

L	T	P	C
0	0	4	2

1. Melting point and Boiling point
2. Specific Heat of a conductor
3. Specific Heat of a liquid
4. Specific Heat of a gas
5. Thermal conductivity- Searle's method
6. Thermal conductivity -Forbe's apparatus
7. Thermal conductivity of a bad conductor- Lee's Disc method
8. Thermal conductivity of a powder- Lee's Disc
9. Thermal conductivity of glass
10. Thermal conductivity of rubber
11. Potentiometer- Measurement of Resistance
12. Potentiometer-Calibration of Voltmeter by standardization method of low range
13. Potentiometer- Calibration of an Ammeter.
14. Comparison of Capacitance- Ballistic Galvanometer
15. Comparison of EMF 's using Ballistic Galvanometer
16. Measurement of Inductance using Ballistic Galvanometer
17. Owen's Bridge – Inductances in series and parallel
18. De Sauty's Bridge – Capacitances in series and parallel
19. LCR series resonant circuit
20. Any other experiment in Heat
21. Any other experiment in Electricity

L	T	P	C
0	0	4	2

Core practical - IV: ELECTRONICS
(Any TEN Experiments – IV Semester)

1. Principles of Soldering, Usage of Multimeter, CRO and Function generator
2. Zener diode characteristics
3. Bridge Rectifier using diodes
4. Dual Regulated power supply using ICs
5. CE configuration characteristics
6. CB configuration characteristics
7. CC configuration characteristics
8. Single stage amplifier with and without feedback
9. RC coupled transistor amplifier
10. Voltage follower – Frequency response
11. Monostable Multivibator
12. Astable Multivibrator
13. Bistable Multvibrator
14. Colpitt's Oscillator
15. Wien's Bridge Oscillator
16. Hartley Oscillator
17. Low pass and High pass filters
18. Differentiator and Integrator
19. Clipping and Clamping
20. Any other experiment in electronics

Core practical – V: DIGITAL ELECTRONICS & COMPUTER PROGRAMMING IN C LANGUAGE
(Any TEN Experiments – V Semester)
(Select each 5 experiments from Section A and B)

L	T	P	C
0	0	4	2

A: Digital Electronics Practical

1. Construction of AND, OR, NOT, X-OR gates using discrete components
2. Logic gates using IC's
3. NAND as universal gate
4. NOR as universal gate
5. Verification of De Morgan's laws
6. Half adder and full adder
7. R-S, J-K and D flip-flops
8. J-K Master-Slave flip-flop
9. Shift Register
10. Asynchronous Ripple counter
11. Synchronous Up-Down counter
12. Any other experiment in Digital Principles

B: Computer Programming Practical

1. Write a C program to find the sum, average, standard deviation for a given set of numbers.
2. Write a C program to generate ―n‖ prime numbers.
3. Write a C program to generate Fibonacci series.
4. Write a C program to print magic square of order n where n > 3 and n is odd.
5. Write a C program to sort the given set of numbers in ascending order.
6. Write a C program to check whether the given string is a palindrome or not using pointers
7. Addition of numbers. Finding the largest and smallest of the given numbers
8. Sum of the series, Ascending and Descending order
9. Bisection method
10. Newton Raphson Method
11. Regular Falsi Method
12. Least Squares Method
13. Trapezoidal rule
14. Simpson's rule
15. Gaussian integration
16. Matrix addition and subtraction
17. Any other numerical method

1. Alied Physics –I: Properties Of Matter, Thermal Physics And Optics

L	T	P	C
3	0	0	3

Objective:

- To understand the concept of strength of materials, viscous properties of liquids, heat transformation from one place to another, converting heat to do mechanical work and basic properties of light such as interference and diffraction.

UNIT I: Properties of Matter

Young's modulus – Rigidity modulus – Bulk modulus – Poisson's ratio (definition alone) – Bending of beams – Expression for bending moment – determination of young's modulus – uniform and non-uniform bending.

Expression for Couple per unit twist – work done in twisting a wire – Torsional oscillations of a body– Rigidity modulus of a wire and M.I. of a disc by torsion pendulum.

UNIT II: Viscosity

Viscosity – Viscous force – Co-efficient of viscosity – units and dimensions – Poiseuille's formula for co-efficient of viscosity of a liquid – determination of co- efficient of viscosity using burette and comparison of Viscosities - Bernoulli's theorem – Statement and proof – Venturimeter – Pitot tube.

UNIT III: Conduction, Convection and Radiation

Specific heat capacity of solids and liquids – Dulong and Petit's law – Newton's law of cooling – Specific heat capacity of a liquid by cooling – thermal conduction –coefficient of thermal conductivity by Lee's disc method.

Convention process – Lapse rate – green house effect – Black body radiation – Planck's radiation law – Rayleigh Jean's law, Wien's displacement law – Stefan's law of radiation. (No derivations).

UNIT IV: Thermodynamics

Zeroth and I Law of thermodynamics – II law of thermodynamics – Carnot's engine and Carnot's cycle – Efficiency of a Carnot's engine – Entropy – Change in entropy in reversible and irreversible process – change in entropy of a perfect gas – change in entropy when ice is converted into steam.

UNIT V: Optics

Interference – conditions for interference maxima and minima – Air wedge – thickness of a thin wire – Newton's rings – determination of wavelength using Newton's rings.

Diffraction – Difference between diffraction and interference – Theory of transmission grating – normal incidence – optical activity – Biot's laws – Specific rotatory power – determination of specific rotatory power using Laurent's half shade polarimeter.

Text Books:

1. Properties of matter – Brijlal and Subramanyam – Eurasia Publishing co., New Delhi, III Edition 1983
2. Element of properties of matter – D.S.Mathur – S.Chand & Company Ltd, New Delhi, 10th Edition 1976
3. Heat and Thermodynamics–Brijlal& Subramanyam, S.Chand & Co, 16th Edition 2005
4. Heat and Thermodynamics – D.S. Mathur, SultanChand & Sons, 5th Edition 2014.
5. Optics and Spectroscopy –R.Murugeshan, S.Chand and co., New Delhi, 6th Edition 2008.
6. A text book of Optics – Subramanyam and Brijlal, S. Chand and co.. New Delhi, 22nd Edition 2004.
7. Optics – Sathyaprakash, Ratan Prakashan Mandhir, New Delhi, VIIth Edition 1990.

Outcome:

Students studying allied physics can able to know, various modulus involved in the materials, flow of liquids due to viscous forces, transmission of heat due to process of conduction, convection and radiation and various laws involved in heat transformation, various thermodynamic laws and the concept of entropy, and the phenomenon like interference and diffraction, optical activity of liquids and its uses.

2. Allied Physics-II: Electricity, Electronics, Atomic And Nuclear Physics

L	T	P	C
3	0	0	3

Objective:

- To understand the concepts of resistance of materials, capacity of conductors, effect of magnetic field due to passage of current, idea about the atom models and energy released in breaking of atom, basic semi conductor diodes, transistor and basic logic gates.

UNIT I: Current Electricity

Ohm's law – Law of resistance in series and parallel – Specific resistance – capacitors – capacitors in serial and parallel – Kirchoff's laws – Wheatstone's network – condition for balance

Carey-Foster's bridge – measurement of resistance – measurement of specific resistance – determination of temperature coefficient of resistance – Potentiometer – calibration of Voltmeter.

UNIT II: Electromagnetism

Electromagnetic Induction – Faraday's laws – Lenz law – Self Inductance – Mutual Inductance – Coefficient of Coupling

A.C. Circuits – Mean value – RMS value – Peak value – LCR in series circuit – impedance – resonant frequency – sharpness of resonance.

UNIT III: Atomic and Nuclear Physics

Bohr's atom model – radius energy – Atomic excitation – Ionization potential – Frank and Hertz Method – Nucleus – Nuclear properties – Mass defect – Binding energy.

Radio isotopes – Uses of radio isotopes – Nuclear fusion and Nuclear fission – X-rays – Production – properties –Derivation of Bragg's law – uses in industrial and medical fields.

UNIT IV: Analog Electronics

Semiconductor – PN junction diode – Bridge rectifier – Zener diode – Regulated power supply.

Transistor – Working of a transistor – CE Configuration – current gain relationship between □ and □ – Transistor Characteristics – CE Configuration only – CE amplifier – feedback – Hartley oscillator – Colpitt's oscillator.

UNIT V: Digital Electronics

Number system – Decimal – Binary – Octal and Hexadecimal system – Double Dabble method – Binary addition, subtraction and multiplication – conversion of one number system to another number system.

Logic gates – OR, AND, NOT, XOR, NAND and NOR gates – truth tables – Half adder and Full adder – Laws and theorems of Boolean's algebra – De Morgan's theorems.

Books for Study and Reference:

1. Electricity and Magnetism – R. Murugesan, S. chand & co, 2001.
2. Modern Physics – R. Murugesan, S. chand & co, 1998.
3. Basic Electronics – B.L. Theraja, S. chand & co, 2003.

Outcome:

Students studying allied physics can able to know, amount of current that can pass through a conductor using ohms law and its applications, effect of magnetic field due to current and concept of resonant frequency in tuning circuits, atom models and how energy can be released in nuclear fission and fusion processes, construction of a rectifier, amplifiers and oscillator, basic digital electronics principles through logic gates and the laws governing them.

ALLIED PHYSICS PRACTICALS – I

L	T	P	C
0	0	4	2

(Any TEN Experiments)

1. Potentiometer – Temperature coefficient of resistance
2. Potentiometer – Calibration of low range ammeter
3. Potentiometer – Calibration of low range voltmeter
4. Lee's disc – Coefficient of thermal conductivity of a bad conductor
5. Thermal conductivity of a powder- Lee's Disc
6. Newton's law of cooling – Verification
7. p-n Junction Diode –I-V Characteristics
8. Zener diode Characteristics – I-V Curve and break down voltage
9. Basic logic gates (OR, AND and NOT) – Construction and Verification using discrete components
10. De Morgan's theorem – Verification using ICs
11. Focal length, Power, R and μ of a convex lens (UV & conjugate foci)
12. Focal length, Power, R and μ of concave lens (In contact, out of contact)
13. Any other experiment

ALLIED PHYSICS PRACTICALS – II

L	T	P	C
0	0	4	2

(Any TEN Experiments)

1. Spectrometer – Refractive index of material of a prism
2. Spectrometer – Wavelength of mercury lines – grating – minimum deviation method.
3. Spectrometer – Determine the angle of minimum deviation and verify i-d curve method.
4. Spectrometer – Dispersive power of the prism for various colours.
5. Spectrometer – Refractive index of material of a prism
6. Spectrometer – Wavelength of Spectral lines in normal incidence – prism
7. Spectrometer – Wavelength of Spectral lines in oblique incidence – prism
8. Spectrometer – Wavelength of Spectral lines in normal incidence – grating
9. Spectrometer – Wavelength of Spectral lines in oblique incidence – grating
10. Air Wedge – Thickness of a thin wire.
11. Newton's ring – Radius of curvature and refractive index
12. Joule's calorimeter- Specific heat capacity of a liquid
13. Any other experiment

Non Major Elective – I: CONVENTIONAL AND NON – CONVENTIONAL ENERGY SOURCES

L	T	P	C
3	0	0	3

Objective:

- *To understand the different kinds of Energy Sources*
- *To study the basics of Renewable & Non-renewable energy sources*
- *To learn the fundamental principles and theory of Solar, Wind energy*
- *To understand the Biogas production from Biomass*

UNIT- I: Conventional Energy Sources

Conventional energy sources: coal – oil – agricultural and organic waste – water power – Nuclear power – New energy technologies. **(9 hrs)**

UNIT- II: Non-conventional Energy Sources: Solar energy

Basis of solar energy – solar radiation and its measurement – solar energy collector – Solar energy storage – applications of solar energy. **(9 hrs)**

UNIT- III: Wind energy

Basic principles of wind energy conversion- the nature of the wind – the power of the wind – maximum power – wind energy conversion – basic components of wind energy conversion systems. **(9 hrs)**

UNIT- IV: Bio mass energy

Basis of bio mass energy – bio mass conversion – technologies – wet process – dry process – photosynthesis. Bio gas plants – classification – methods of obtaining energy from bio mass. **(9 hrs)**

UNIT-V: Additional alternate energy sources

Geothermal energy sources – energy from ocean – chemical energy sources – hydrogen energy – magneto hydrodynamic – thermo electric power. **(9 hrs)**

(Total : L = 45 hrs)

Books for study:

1. G. D. Rai, Non – Conventional Energy Sources, Khanna Publishers, New Delhi, 5th Edition, 2012.
2. Godfrey Boyle, Renewable Energy: Power for a sustainable Future, Alden Oess Limited, Oxford, 1996.
3. D. P. Kothari, K. C. Singal & Rakesh Ranjan, Renewable energy sources and emerging Technologies, Prentice Hall of India pvt. Ltd., New Delhi, 2008.

Books for references:

1. H.P. Garg and J. Prakash, Solar Energy Fundamentals and application, Tata McGraw- Hill Publishing company ltd, 1997.
2. S. P. Sukhatme, Solar energy, Tata McGraw- Hill Publishing company ltd, 1997.

Non Major Elective - II : BIOMEDICAL INSTRUMENTATION

L	T	P	C
3	0	0	3

Objective:

- *The principle, design and working of various biomedical instruments are dealt in a simple manner.*
- *It will stimulate the students to understand the design and functioning of various medical equipment.*

UNIT – I: Biopotential Recorders

Characteristics of the recording system – Electrocardiography (ECG) - Electroencephalography (EEG) - Electromyography (EMG) – Electroretinography (ERG) – Electroculography (EOG). **(9 hrs)**

UNIT – II: Physiological assist devices

Pacemakers – Pacemaker batteries - Artificial heartvalves - (Principle - block diagram and operation) – Defibrillators – Nerve and muscle stimulators – Heart –lung machine – Kidney machine. **(9 hrs)**

UNIT-III: Operation theatre equipment

Introduction – Surgical diathermy – Short-wave diathermy – Microwave diathermy – Ultrasonic diathermy – Ventilators - Anesthesia machine – Flowmeters – Blood flowmeter and its applications – Ultrasonic Blood flowmeter – Laser based Doppler blood flow meter. **(10 hrs)**

UNIT – IV: Specialised Medical equipment

Blood cell counter – Electron Microscope – Radiation detectors – Geiger Muller Counter – Cloud chamber – X-ray tube & Machine – Radiography and Fluoroscopy – Image intensifiers – Angiography – Applications of X-ray examination. **(10 hrs)**

UNIT – V: Advances in Biomedical Instrumentation

Computers in medicine – Lasers in medicine – Endoscopes– Nuclear imaging techniques – Computer tomography – Ultrasonic imaging systems – Magnetic resonance imaging. **(7 hrs)**

(Total : L = 45 hrs)

Book for study:

1. M. Arumugam, Bio-medical Instrumentation, Anuradha Agencies, Chennai, 10th edition, reprint, 2013.

Books for references:

1. R.S. Khandpur, Handbook of Biomedical Instrumentation, Tata McGraw Hill Publishing Company Limited, Newdelhi, Reprint, 2002.
2. Nandini K. Jog, Electronics in Medicine and Biomedical Instrumentation, PHI Learning Pvt. Ltd., 2nd Edition, 2013.

Skill Based Papers

1. BASIC INSTRUMENTATION SKILL

L	T	P	C
3	0	0	3

Objectives:

- To get exposure with various aspects of instruments and their usage through hands-on mode.

Unit 1: Basic of Measurement:
Instruments accuracy, precision, sensitivity, resolution range etc. Errors in measurements and loading effects. **Multimeter:** Principles of measurement of dc voltage and dc current, ac voltage, ac current and resistance. Specifications of a multimeter and their significance. **Electronic Voltmeter:** Advantage- Principles of voltage,measurement (block diagram only). Specifications of an electronic Voltmeter/Multimeter and their significance. **AC millivoltmeter:** Type of AC millivoltmeters:

Unit 2: Cathode Ray Oscilloscope:
Block diagram of basic CRO. Construction of CRT,Electron gun, electrostatic focusing and acceleration (Explanation only– no mathematical treatment),. Time base operation, synchronization. Front panel controls.Use of CRO for the measurement of voltage (dc and ac frequency, time period).

Unit 3: Signal Generators and Analysis Instruments:
Block diagram, explanation and specifications of low frequency signal generators. pulse generator, and function generator. Brief idea for testing, specifications. Distortion factor meter, wave analysis.

Unit 4: Impedance Bridges & Q-Meters:
Block diagram of bridge. working principles of basic (balancing type) RLC bridge. Specifications of RLC bridge. Block diagram & working principles of a Q- Meter. Digital LCR bridges.

Unit 5: Digital Instruments:
Principle and working of digital meters. Comparison of analog &digital instruments. Characteristics of a digital meter. Working principles of digitalvoltmeter **Digital Multimeter:** Block diagram and working of a digital multimeter-Working

Reference Books:

1. A text book in Electrical Technology - B L Theraja - S Chand and Co.
2. 2.Performance and design of AC machines - M G Say ELBS Edn.
3. Digital Circuits and systems, Venugopal, 2011, Tata McGraw Hill.
4. 4.Logic circuit design, Shimon P. Vingron, 2012, Springer.
5. Digital Electronics, Subrata Ghoshal, 2012, Cengage Learning.
6. 6.Electronic Devices and circuits, S. Salivahanan & N. S.Kumar, 3rd Ed., 2012, Tata Mc-Graw Hill

2. PROBLEMS SOLVING SKILLS IN PHYSICS

L	T	P	C
3	0	0	3

objective:

- Main objective of this course is to make the student to solve problems in core physics. Minimum of 20 problems based on various principles of Physics are required in each unit.

Unit 1: Problems in Mechanics

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

Unit II: Problems in Thermal Physics

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

Unit III: Problems in Electricity & Magnetism

Electrostatics- calculation of Electrostatic quantities for various configurations-Conductors,Magneto statics- Calculation of Magnetic quantities for various configuration,Electromagnetic induction, Poyntingvector, Electromagneticwaves.

Unit IV: Problems in Quantum mechanics

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

Unit V: Problems in General Physics& Mathematics

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.

Course Outcome: At the end o the course students will be able

- to develop problem skills
- to appear for research oriented entrace examinations

Text book for reference:

1. Mechanics(in SI units) by Charles Kittel, Walter D knight etc. (Berkeley Physics course-volume 1), Tata McGraw Hill publication ,second edition.
2. Thermal physics by S.C.Garg,RM Bansal &CK Ghosh. (Tata McGraw Hill Publications), 1st edition.
3. Electricity & magnetism(in SI units) by E.M.Purcell, Tata Mcgraw hill Publication, 2nd Edition.
4. Quantum mechanics by N.Zettili, Wiley Publishers, second edition.
5. Introduction to quantum mechanics by David. J.Griffith, Pearson Publications, second edition.

Elective Papers

1. NANOPHYSICS

L	T	P	C
3	0	0	3

Objectives:

- To create the basic knowledge in nano materials. To understand the scientific perspective of nanomaterials. To identify the techniques suitable for nanomaterial synthesis. To know the significance of nanomaterials.

UNIT I: Nanomaterials

History of Nanotechnology- Nanostructures- synthesis of oxide nano particles- Synthesis of semiconductor nano particles- Synthesis of metallic nano particles

UNIT II: Quantum Hetero structure

Super lattice- preparation of Quantum nanostructure- Quantum well laser- Quantum cascade laser-Quantum wire- Quantum dot- Application of Quantum dots.

UNIT III: Carbon Nanotubes

Discovery of Nanotubes- Carbon Allotropes- Types of carbon Nanotubes- Graphene sheet to a single walled nanotube- Electronic structure of Carbon Nanotubes- Synthesis of Carbon Nanotube.

UNIT IV

Nanocrystalline soft material- Permanent magnet material- Theoretical background- Super paramagnetism- Coulomb blockade-Quantum cellular Automata.

UNIT V: Application of Nanotechnology

Chemistry and Environment – Energy applications of nanotechnology- Information and Communication- Heavy industry-Consumer goods- Nanomedicine - Medical application of Nanotechnology

Text Book:

1. Text book of Nanoscience and Nanotechnology – B. S. Moorthy, P. Sankar, Baldev Raj, B. B. Rath and James Murdy University Press – IIM
2. Nanophysics, Sr. Geradin Jayam, Holy Cross College, Nagercoil (2010)

Reference:

1. 'Nanoscience and Nanotechnology: Fundamentals to Frontiers'
2. M.S. Ramachandra Rao, Shubra Singh, Wiley India pvt. Ltd., New Delhi. (2013).
3. 'Nano the Essentials' - T. Pradeep, Tata Mc.Graw Hill company Ltd (2007)
4. '*The Chemistry of Nano materials : Synthesis, Properties and Applications*', Volume 1 C. N. R. Rao, A. Mu¨ller, A. K. Cheetham, , Germany (2004).

2. ENERGY PHYSICS

L	T	P	C
3	0	0	3

Objective :

- To provide an understanding of the present energy crisis and various available energy sources .

UNIT I: Introduction to Energy Sources

World's reserve of Commercial energy sources and their availability-India's production and reserves-Conventional and non-conventional sources of energy, comparison – Coal- Oil and natural gas –applications - merits and demerits.

(8 hrs)

UNIT II: Solar Thermal Energy

Solar constant -Solar spectrum-Solar radiations outside earth's atmosphere –at the earth surface- on tilted surfaces -Solar Radiation geometry-Basic Principles of Liquid flat plate collector –Materials for flat plate collector -Construction and working- Solar distillation–Solar disinfection - Solar drying-Solar cooker(box type)-Solar water heating systems – Swimming pool heating. **(9 hrs)**

UNIT III: Photovoltaic Systems

Introduction-Photovoltaic principle-Basic Silicon Solar cell- Power output and conversion efficiency-Limitation to photovoltaic efficiency-Basic photovoltaic system for power generation-Advantages and disadvantages-Types of solar cells- Application of solar photovoltaic systems - PV Powered fan – PV powered area - lighting system – A Hybrid System. **(10 hrs)**

UNIT IV: Biomass Energy

Introduction-Biomass classification- Biomass conversion technologies-Bio-gas generation-Factors affecting bio-digestion -Working of biogas plant- floating and fixed dome type plant -advantages and disadvantage of -Bio-gas from plant wastes-Methods for obtaining energy from biomass- Thermal gasification of biomass-Working of downdraft gasifier- Advantages and disadvantages of biological conversion of solar energy. **(10 hrs)**

UNIT V: Wind Energy and Other Energy Sources

Wind Energy Conversion-Classification and description of wind machines, wind energy collectors-Energy storage-- Energy from Oceans and Chemical energy resources-Ocean thermal energy conversion-tidal power, advantages and limitations of tidal power generation-Energy and power from waves- wave energy conversion devices- Fuel cells- and application of fuel cells- batteries- advantages of battery for bulk energy storage- Hydrogen as alternative fuel for motor vehicles. **(8 hrs)**

Books for study:

1. Kothari D.P., K.C. Singal and Rakesh Ranjan, Renewable energy sources and emerging Technologies, Prentice Hall of India, 2008.

2. 2.Solar Energy-principles of thermal collection and storage-
S.P.SUKHAME-tata- McGraw-Hill publishing company ltd.

Books for References:

1. Chetan Singh Solanki, Solar Photvoltaics Fundamentals, Technologies and
2. Applications, 2ndEdition, PHI Learning Private Limited, 2011.
3. Rai G. D, Non conventional Energy sources, 4th Edition, Khanna Publishers,2010.
4. Jeffrey M. Gordon, Solar Energy: The State of the Art, Earthscan, 2013.
5. Kalogirou S.A., Solar Energy Engineering: Processes and Systems , 2nd
6. Edition, Academic Press, 2013.
7. Zobaa A.F.and Ramesh Bansal, Handbook of Renewable Energy Technology, World Scientific, 2011.

3. MATHEMATICAL PHYSICS

L	T	P	C
3	0	0	3

Objective:

- To understand the various mathematical methods used in Physics.

UNIT1 : Vectors

Vectors and scalars-Vector algebra-The scalar product-The vector (cross or outer) product-The triple scalar product-The triple vector product-The linear vector space Vn- Vector differentiation -Space curves - Motion in a plane - A vector treatment of classical orbit theory - Vector differential of a scalar field and the gradient - Conservative vector field - The vector differential operator - Vector differentiation of a vector field - The divergence of a vector - The operator , the Laplacian - The curl of a vector.

UNIT 2: Differential Equation

First-order differential equations - Separable variables -Exact equations- Integrating factors -Bernoulli's equation- Second-order equations with constant coefficients - Nature of the solution of linear equations - General solutions of the second-order equations - Finding the complementary function - Finding the particular integral - Rules for D operators - The Euler linear equation - Solutions in power series.

UNIT 3: Matrix

Definition of a matrix - Four basic algebra operations for matrices - Equality of matrices - Addition of matrices - Multiplication of a matrix by a number - Matrix multiplication - The commutator - Powers of a matrix - Functions of matrices - transpose of a matrix - Symmetric and skew-symmetric matrices - The matrix representation of a vector product - The inverse of a matrix - A method for finding A-1 - Systems of linear equations and the inverse of a matrix - Complex conjugate of a matrix - Hermitian conjugation - Hermitian/anti-Hermitian matrix - Orthogonal matrix (real) - Unitary matrix - Rotation matrices - Trace of a matrix.

UNIT 4: Laplace Transformation

Definition of the Laplace transform - Existence of Laplace transforms - Laplace transforms of some elementary functions - Shifting (or translation) theorems - The first shifting theorem - The second shifting theorem - The unit step function - Laplace transform of a periodic function - Laplace transforms of derivatives - Laplace transforms of functions defined by integrals - A note on integral transformations.

UNIT 5: Partial Differential Equations

Linear second-order partial differential equations - Solutions of Laplace's equation: separation of variables - Solutions of the wave equation: separation of variables - Solution of Poisson's equation. Green's functions - Laplace transform solutions of boundary-value problems

Books for study :

1. Mathematical Methods for Physicists: A concise introduction, - *TAIL. CHOW* – Cambridge University Press

Books for Reference:

1. Mathematical physics- Piyoosh kumar tyagi , RBSA Publishers
2. Mathematical physics- Satya prakash-Sultan Chand & Co:
3. 3.Mechanics and mathematical physics -R.Murugesan- Sultan Chand & Co:
4. Mathematical physics-Gupta- Sultan Chand & Co:

4. SPECTROSCOPY

L	T	P	C
3	0	0	3

Objective:

- To understand atomic and molecular spectra and the instrument techniques

Unit I: Microwave Spectroscopy

Rotation of molecules – Classification of molecules – Rotation spectra of diatomic molecules – Intensities of Spectral lines – Effect of Isotopic Substitution – Non-rigid rotator – Spectrum of a Non-Rigid Rotator – Polyatomic Molecules – Symmetric Top molecules – Asymmetric Top molecules

-Techniques and Instrumentation – Chemical analysis by Microwave spectroscopy.

Unit II : Infrared Spectroscopy

I.R. Spectroscopy – Vibrating diatomic molecules – Simple Harmonic Oscillator

- Anharmonic oscillator – Diatomic vibrating rotator – IR Spectrum of carbon monoxide - Interaction of rotations and vibrations – Vibration of Polyatomic molecules – Analysis by IR techniques.

Unit III :Raman Spectroscopy

Raman effect: Discovery – Quantum theory of Raman effect – Classical theory of Raman Effect –Pure rotational Raman Spectra- Linear molecules – Raman Spectrum of symmetric top molecules - Vibrational Raman spectra – Rule of mutual exclusion – Overtone and Combination Vibrations - Rotational Fine Structure – Polarization of light and the Raman Effect - Structure determination from IR and Raman spectroscopy.

Unit IV : Electronic spectroscopy

Born - Oppenheimer approximation – Vibrational coarse structure: Progressions – Frank-Condon principle – Dissociation energy and Dissociation products – Rotational Fine Structure of Electronic Vibration Transitions - Fortrat diagram - Predissociation – Diatomic molecules.

Unit V :Instrumentation

Instrumentation and Techniques in Infrared spectroscopy – Sources – monochromators – Sample cells – Detectors – Single beam Infra red spectrometer – Double beam Infra red spectrometer

Book For Study :

1. Fundamentals Of Molecular Spectroscopy - Colin N Banwell Elaine- M MccashFifth Edition

Book For Reference:

1. 1.Molecular structure and spectroscopy - G. Aruldhas, PHI Learning Pvt. Ltd, India.
2. 2.Hand book of Analytical Instruments -R.S. Khandpur, Tata MC Grow Hill Ltd

5. COMPUTER PROGRAMMING IN C++

L	T	P	C
3	0	0	3

Objective:

- To provide knowledge about the basics of Computer programming in C++ and to solve problems by writing programs.

UNIT 1: **WHAT IS C++**

Introduction - tokens - keywords - identifiers and constants - declaration of variables - basic data types - user defined data types-derived data types - symbolic constants - operators in C++ -expressions and their type-hierarchy of arithmetic operators- scope resolution operator – declaring, initializing and modifying variables-special assignment operators - all control structures-structure of a simple C ++ program

UNIT 2: ARRAYS AND FUNCTIONS IN C++

Introduction - one dimensional and two dimensional arrays-initialization of arrays-array of strings Functions-introduction-function with no argument and no return values- function with no argument but return value - function with argument and no return values- function with argument and return values- call by reference- return by reference- function prototyping - inline functions - local, -global and static variables- -function overloading - virtual functions-main function-math library functions.

UNIT 3: CLASSES AND OBJECTS

Introduction - specifying a class - defining member functions-C++ program with class - nesting of member functions - private member functions - objects as function arguments - arrays within a class-array of objects-static class members-friend functions-constructors - parameterized constructors-multiple constructors - constructors with default arguments - copy constructor.

UNIT 4: OPERATOR OVERLOADING, INHERITANCE AND POINTERS

Introduction -defining operator overloading - overloading unary operators - binary operators Inheritance - single inheritance - multiple inheritance - multilevel inheritance - hybrid inheritance - hierarchial inheritance-virtual base class-abstract class Pointers-definition-declaration- arithmetic operations

UNIT V: MANAGING CONSOLE I/O OPERATIONS

Introduction - C++ stream - C++ stream classes - unformatted I/O Operations - formatted console I/O operations - working with files - classes for file steam operations - opening and closing a file - file pointers and their manipulations.

Course Outcomes:

- Understand the lexical elements in 'c'- programming.
- Be aware of different types of operators and expressions in c language.
- Choose the loops and decision making statements to solve the problem
- Implement different operation an arrays.
- Use function to solve the given problem
- Understand pointers, structures etc

Book for Study:

1. E. Balagurusamy, Programming in ANSI C, Sixth Edition, McGraw Hill Education(India)Private Limited, New Delhi.

Books for reference:

1. Schaum's Outlines : Programming with C , Byron S. Gottfried, Tata McGraw Hill Pub. Co Ltd., New Delhi, 5/e, 2007
2. Yashvant Kanetkar, Programming with C,2nd edition, Tata McGraw Hill, New Delhi,1998.

6. MICROPROCESSOR FUNDAMENTALS

L	T	P	C
3	0	0	3

Objective:

- This course deals with the basic concepts of microprocessor, programming instructions and interfacing concepts.

Unit 1 : Architecture

Architecture of 8085 – registers, flags, ALU, address and data bus, demultiplexing address/data bus – control and status signals – control bus, Programmer's model of 8085 –Pin out diagram – Functions of different pins.

Unit 2 : Programming Techniques

Instruction set of 8085 – data transfer, arithmetic, logic, branching and machinecontrol group of instructions – addressing modes – register indirect, direct, immediate andimplied addressing modes.Assembly language & machine language – programming techniques: addition,subtraction, multiplication, division, ascending, descending order, largest and smallest(single byte)

UNIT 3 : Interfacing memory to 8085

Memory interfacing – Interfacing 2kx8 ROM and RAM, Timing diagram of 8085 (MOVRd, Rs – MVI Rd,data(8)) .

Unit 4 : Interfacing I/O Ports to 8085

Interfacing input port and output port to 8085 – Programmable peripheral interface 8255 – flashing LEDs.

Unit 5 : Interrupts

Interrupts in 8085 - hardware and software interrupts – RIM, SIM instructions priorities – simple polled and interrupt controlled data transfer.

Course Outcome:

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

- to know the basic ideas on microprocessor, memory and I/O devices
- to be familiar with the basic concepts of microprocessor architecture and interfacing
- to acquire skills in the programming instruction sets of microprocessor
- to apply the programming instructions to perform simple programs using microprocessor

Books of Study:

1. Microprocessor Architecture programming and application with 8085 / 8080A. byR.S.Gaonkar, Wiley Eastern Ltd.(1992).
2. Fundamental of microprocessor 8085 by V. Vijayendran, S.ViswanathanPublishers, Chennai(2003).
3. Fundamentals of Microprocessors and microcomputers by B.Ram - Dhanpat RAI publication.

Books for Reference:

1. Introduction to microprocessor by AdityaMathur - Tata Mc.Graw Hill Publishing Company Ltd.(1987).
2. Microprocessor and digital system by Dougles V. Hall - 2nd Edition - McGraw Hill Company(1983).

7. OPTO ELECTRONICS

L	T	P	C
3	0	0	3

Objective:

To give an introductory account of the basic principles of Optoelectronic devices. To understand the principle and working of LASER. To gain information about fibre optic communication

Unit 1:

Introduction – PN junction as a Light Source (LED) – LED materials – Advantages – LCD _ Characteristics and action of LCD – Advantages.

Unit 2:

Laser- Introduction– characteristics of Laser– Spontaneous and stimulated emission– Einstein coefficients- condition for population inversion– three level scheme– semi conductor.

Unit 3:

Photo detector- characteristics of photo detectors– PN junction photo detector– PIN photo diode- Avalanche photo diode- Photo transistor.

Unit 4:

Introduction – principle of optical fibre – light transmission in a optical fibre – Acceptance angle – Numerical aperture.

Unit 5:

Fibre index profiles – Step index, graded fibre (transmission of signals) – Advantages of fibre optic communications, optical switching – Logic gates.

Text Bok:

1. Semiconductor physics and Optoelectronics – P. K. Palanisamy, SCITECH Publication, Chennai 2002.
2. Optical fibres and Fibre Optic Communication – Sabir Kumar Sarkar IV Revised Edition 2003.

Reference Books:

1. Opto Electronics – Wilson & Hawker, Prentice Hall of India 2004.

8. INTEGRATED ELECTRONICS

L	T	P	C
3	0	0	3

Course Objectives:

- To understand the fundamental concepts of logic gates, counters, registers, etc. To exhibit proficiency in the basic concepts of circuit analysis involving operational amplifier and conversion of analog and digital signals.

Unit 1 : Fundamental Digital Electronics

Number systems – binary – hexadecimal – Binary addition – subtraction (1's and 2'scompliment 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 2 : Combinational Logic Circuits

Half adder, full adder, half subtractor and full subtractor – 4 bit adder/subtractor -decoder, encoder - multiplexer - demultiplexer.

Unit 3 : Sequential Logic Circuits

R.S flip flop, D flip flop and JK flip flops - JK Master Slave flip flop – synchronousand ripple counters - BCD counter – Up/Down counters - shift registers - serial and parallel registers - ring and twisted ring counter.

Unit 4 : OP-AMP Basic Applications

Characteristics parameters – differential gain – CMRR – Slew rate – bandwidth
-applications – inverter, non-inverter, integrator, differentiator, summing, difference andaveraging amplifier - solving simultaneous equations - comparator - square wave generator -Wien's bridge oscillator - Schmitt trigger

Unit 5 : Timer, DAC/ADC

Timer 555 - Internal block diagram and working - astablemultivibrator–Schmitt trigger.D/A converter - binary weighted method - A/D converter – successive approximation method.

Learning Outcomes:

On completion of the course the students will be able to:

- Explain how primitives of Boolean algebra are used to describe processing of digital signals.
- Design and analyze of electronic circuits
- Analyze, design and implement combinational logic circuits

Books for Study:

1. Digital Principles and Application by Malvino Leach, Tata McGraw Hill, 4th Edition(1992).

2. Digital Fundamentals by Thomas L. Floyd, Universal Book Stall, New Delhi(1998).
3. Introduction to Integrated Electronics by V.Vijayendran, S. Viswanathan (Printersand Publishers) Pvt. Ltd., Chennai(2005).
4. OP - AMPs and Linear Integrated Circuits by Ramakant A. Gayakwad, PrenticeHall of India(1994).

Books for Reference:

1. Digital Electronics by Practice Using Integrated Circuits - R.P.Jain - Tata McGrawHill(1996).
2. Linear Integrated Circuits by 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 by J.Millman and C.Halkias, Tata McGraw Hill, New Delhi(2001)

9. MEDICAL PHYSICS

L	T	P	C
3	0	0	3

Objective:

- To understand the basics about the biological systems in our body, their behavior, and the diagnostic devices.

Unit 1:

Basic Anatomical Terminology- Standard anatomical position, Planes, Familiarity with terms like – Superior, Inferior, Anterior, Posterior, Medial, Lateral, Proximal, Distal. – Forces on and in the Body – Physics of the Skeleton
– Heat and Cold in Medicine- Energy work and Power of the Body.

Unit 2:

Pressure system of the body- Physics of Cardiovascular system- Electricity within the Body – Applications of Electricity and Magnetism in Medicine.Sound in medicine- Physics of the Ear and Hearing- Light in medicine- Physics of eyes and vision.

Unit 3:

Transducers- performance of characteristics of transducer- static and dynamic active transducers – (a) magnetic induction type (b) piezoelectric type (c) photovoltaic type (d) thermoelectric type.Passive transducer- (a) resistive type – effect and sensitivity of the bridge (b) capacitive transducer (c) linear variable differential transducer (LVDT)**.**

Unit 4:

X-rays- Production of X-rays- X-ray spectra- continues spectra and characteristic spectra- Coolidge tube- Electro Cardio Graph (ECG) - Block diagram- ECG Leads- Unipolar and bipolar-ECG recording set up.

Unit 5:

Electro Encephalo Graph (EEG) - origin- Block diagram- Electro Myogragh (EMG) – Block diagram- EMG recorder- Computer Tomography (CT) principle- Block diagram of CT scanner.

Text Books:

2. Medical Physics –John R. Cameron and James G.Skofronick, 1978, John Willy & Sons.
3. Bio medical instrumentation – E D II, Dr M. Arumugam, Anuradha Agencies 1997.

10. ASTROPHYSICS

L	T	P	C
3	0	0	3

Objective:

- To provide exposure to the student at preliminary level astronomical aspects related to the physics and its observation details..

Unit 1:

Birth of Modern Astronomy – Geocentric and Heliocentric theories – Kepler's laws of planetary motion – Newtonian gravitation – Celestial sphere – Planets – Terrestrial and Jovian planets (Planets individual description is not required in detail) - Asteroids- Meteorites – Comets.

(10 hrs)

Unit 2:

Telescopes – Elements of telescope – Properties of images – Types of Optical telescopes – Refracting and Reflecting telescopes- Radio telescope – Spectrograph – Limitations – Photographic photometry – Photoelectric photometry – Spectrophotometry – Detectors and image processing. **(9 hrs)**

Unit 3:

Sun – Physical properties – Composition – Core – Nuclear Reactions – Photosphere – Chromosphere – Corona – Sunspots – Sunspot cycle – Solar Wind – Auroras – space weather effects – History of the Earth – Temperature of a planet – The atmosphere – Pressure and Temperature distribution – Magnetosphere – Eclipses – Solar and Lunar Eclipses.

(9 hrs)

Unit 4:

Classification of Stars – The Harvard Classification system – Luminosity of a Star – Hertzprung-Russel Diagram – Stellar evolution using the HR diagram – Theoretical evolution of stars – White Dwarfs – Neutron stars-Black holes – Event horizon – Basic physics of Black Holes. **(9 hrs)**

Unit 5:

Galaxy nomenclature – Types of Galaxies – Spiral – Elliptical – irregular galaxies – Milky Way Galaxy and its structure – Rotation and Mass Distribution Rotation curve and Doppler shift – Star clusters – Galactic clusters – Pulsars Cosmological Models – Big bang theory – Steady state theory – Hubble's law – Olber's paradox.

(8 hrs)

Text Books:

1. Niclolas. A. Pananides and Thomas Arny, 1979, Introductory Astronomy, Addison Wesley Publ. Co.
2. A. Mujiber Rahman, Concepts to Astrophysics, scitech Publications, Chennai.

References:

1. Abell, Morrison and Wolf, 1987, Exploration of the Universe, 5th ed., Saunders

College Publ.
2. Carrol and Ostlie, 2007, Introduction to Modern Astrophysics, 2nd ed., Pearson International.
3. William J. Kaufmann, III, 1977, Macmillan Publishing company, London.
4. Abhyankar, K.D., Universities Press.

11. WEATHER FORECASTING

L	T	P	C
3	0	0	3

Course Objective:

- The main objective of the course is not only to impart theoretical knowledge to the students and to enable them to develop an awareness and understanding regarding the causes and effects of different weather phenomenon and basic forecasting techniques

Unit 1: 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 2: 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 3: Weather systems

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

Unit 4: Climate and Climate Change

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

Unit 5: Basics of weather forecasting:

Weather forecasting: analysis and its historicalbackground; 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.

Reference books:

1. Aviation Meteorology, I.C. Joshi, 3rd edition 2014, Himalayan Books
2. The weather Observers Hand book, Stephen Burt, 2012, Cambridge
3. University Press.
4. Meteorology, S.R. Ghadekar, 2001, Agromet Publishers, Nagpur.
5. Text Book of Agro meteorology, S.R. Ghadekar, 2005, Agromet Publishers, Nagpur
6. Atmosphere and Ocean, John G. Harvey, 1995, The Artemis Press.

12. RADIATION SAFETY

L	T	P	C
3	0	0	3

Objectives:

- To make them aware and understand radiation hazards and safety.

Unit 1: Basics of Atomic and Nuclear Physics:

Basic concept of atomic structure; X rays characteristic and production; concept of bremsstrahlung and auger electron, Thecomposition of nucleus and its properties, mass number, isotopes of element, spin,binding energy, stable and unstable isotopes, law of radioactive decay, Mean life and half life, basic concept of alpha, beta and gamma decay, concept of cross section and kinematics of nuclear reactions, types of nuclear reaction, Fusion, fission.

Unit 2: Interaction of Radiation with matter:

Types of Radiation: Alpha, Beta, Gamma and Neutron and their sources, sealed and unsealed sources,Interaction of Photons -Photo-electric effect, Compton Scattering, Pair Production, Linear and Mass -Attenuation Coefficients, Interaction of Charged Particles: Heavy charged particles- Beth-Bloch Formula, Scaling laws, Mass Stopping Power, Range, Straggling,Channeling and Cherenkov radiation. Beta Particles-Collision and Radiation loss(Bremsstrahlung), Interaction of Neutrons- Collision, slowing down and Moderation

Unit 3: Radiation detection and monitoring devices:

Radiation Quantities and Units:Basic idea of different units of activity, KERMA, exposure, absorbed dose,equivalent dose, effective dose, collective equivalent dose, Annual Limit of Intake (ALI) and derived Air Conentration (DAC). Radiation detection: Basic concept and working principle of *gas detectors* (Ionization Chambers, Proportional Counter,Multi-Wire Proportional Counters (MWPC) and Gieger Muller Counter), *Scintillation Detectors* (Inorganic and Organic Scintillators), *Solid States Detectors* and *NeutronDetectors, Thermo luminescent Dosimetry.*

Unit 4: Radiation safety management:

Biological effects of ionizing radiation, Operational limits and basics of radiation hazards evaluation and control: radiation protection standards, International Commission on Radiological Protection (ICRP) principles, justification, optimization, limitation, introduction of safety and risk management of radiation. Nuclear waste and disposal management. Brief idea about Accelerator driven Sub-critical system (ADS) for waste management

Unit 5: Application of nuclear techniques:

Application in medical science (e.g., MRI, PET,Projection Imaging Gamma Camera, radiation therapy), Archaeology, Art, Crime detection, Mining and oil.

Industrial Uses: Tracing, Gauging, Material Modification, Sterization, Food preservation

Reference Books:

1. W.E. Burcham and M. Jobes – Nuclear and Particle Physics – Longman (1995)
2. G.F.Knoll, Radiation detection and measurements.
3. Thermoluninescense Dosimetry, Mcknlay, A.F., Bristol, Adam Hilger
4. (Medical Physics Hand book 5).
5. W.J.Meredith and J.B.Massey, "Fundamental Physics of Radiology". John
6. Wright and Sons, UK, 1989.
7. A.Martin and S.A.Harbisor, An Introduction to Radiation Protection, John
8. Willey &Sons, Inc. New York, 1981.
9. W.R. Hendee, "Medical Radiation Physics", Year Book – Medical Publishers Inc. London, 1981.

13. FUNDAMENTALS OF PHYSICS –I

L	T	P	C
3	0	0	3

Objective:

- To introduce some basic concept of Physics like measurement of physical quantities, states of matter, kinds of energies and energy sources to students studying other than Physics.

Unit 1:

S.I. Units – measurements of length, mass, time and other physical quantities
– Dimensional formula for area, volume, density and force – Uses of dimension.

Unit II:

Matter – Solid, Liquid, Gas and Plasma – Application of Plasma – change of state – specific heat capacity – specific latent heat of ice and steam.

Unit III:

Kinds of energy – Mechanical energy, Thermal energy, Optical energy, Sound energy, Electrical energy, Atomic and Nuclear energy, (Examples) – Conservation of energy.

Unit IV:

Renewable and non – renewable energy – Fossil fuel – coal Oil – Solar – Wind – Biomass – OTEC.

Unit V:

Mirror – Laws of reflection – Image formation (Concave and Convex mirror) Lens – Law's of refraction – Image formation (Concave and Convex lens) – Defects of eye and rectification.

Book for Study

1. First Year B. Sc Physics – B.V. Narayan Rao, New Age International (P) Lt, 1998.

Reference Books :

1. Mechanics – D.S. Mathur – S.Chand & Co., 2002.
2. Properties of matter – D.S. Mathur – S. Chand & Co., 2002.
3. Properties of matter – Brijlal Subramanian – S. Chand & Co., 2006.

14. FUNDAMENTALS OF PHYSICS –II

L	T	P	C
3	0	0	3

Unit 1:
Electric current- voltage and resistance- Ohm's law- Kirchhoff's law- Resistances in series and in parallel.

Unit 2:
DC Source – Primary cells – Leclanche and Daniel cell – Secondary cells – Lead Acid Accumulator – DC generator.

Unit 3:
Alternating current generation by hydro, thermal and atomic power stations– RMS value – Peak value (Quantitative) – AC generator – no derivation.

Unit 4:
Measurement of Electric power by Wattmeter- simple calculations- Induction coil- Wattless current- Power factor.

Unit 5:
Simple electrical circuits – resistor, capacitor and inductor connected to AC source (independently) – Relationship between emf and current in each case. Diode – Bridge Rectifier.

Reference Books:
1. Electricity and Magnetism – R. Murugesan – S. Chand & Co 2004.

15. ENERGY PHYSICS

L	T	P	C
3	0	0	3

Objective:

- To make the students to understand the present day crisis of need for conserving energy and alternatives are provided.

Unit 1: Conventional Energy Sources

World reserve- Commercial energy sources and their availability – Various forms of energy – Renewable and Conventional energy system – comparison – Coal, oil and natural gas – applications – Merits and Demerits.

Unit 2: Solar energy

Renewable energy sources – Solar energy – nature and Solar radiation – components – Solar heaters – Crop dryers – Solar cookers – Water desalination (block diagram) -Photovoltaic generation – merits and demerits.

Unit 3: Biomass energy fundamentals:

Biomass energy – classification – Photosynthesis – Biomass conversion process

Unit 4: Biomass Utilization

Gobar gas plants – Wood gasification – advantage & disadvantages of biomass as energy source

Unit 5: Other forms of energy sources

Geothermal energy – Wind energy – Ocean thermal energy conversion –Energy from waves and tides (basic ideas).

Books for study:

1. D.P. Kothari, K.C. Singal & Rakesh Ranjan, Renewable energy sources and emerging Technologies, Prentice Hall of India Pvt. Ltd., New Delhi (2008).
2. Suhas P Sukhatme, *Solar energy -- Principles of thermal collection and storage,* Tata McGraw-Hill Publishing company, New Delhi, Second edition, 2012.

Books for References:

1. S.A. Abbasiand Nasema Abbasi, Renewable Energy sources and their environmental impact, PHI Learning Pvt. Ltd., New Delhi (2008).

16. LASER PHYSICS

L	T	P	C
3	0	0	3

Objective:

- To introduce the physical and engineering principles of laser operation and their applications.

Unit 1: Fundamentals of LASER

Spontaneous emission – Stimulated emission – Meta stable state –Population inversion – Pumping – Laser Characteristics

Unit 2: Production of LASER

Helium – Neon Laser – Ruby Laser – CO2 Laser – Semiconductor Laser

Unit 3: Industrial Applications of LASER

Laser cutting – Welding – Drilling – Hologram – Recording and reconstruction of hologram

Unit 4: Lasers in Medicine

Lasers in Surgery – Lasers in ophthalmology – Lasers in cancer treatment

Unit 5: Lasers in Communication

Optic fibre communication – Total internal reflection – Block diagram of fibre optic communication system – Advantages of fibre optic communication.

Books for study:

1. N. Avadhanulu , *An introduction to LASERS*, S. Chand & Company,2001.

Books for References:

1. William T. Silfvast, *Laser fundamentals*, University Press, Published in South Asia by Foundation books, New Delhi, 1998
2. K. Thyagarajan and A.K. Ghatak, *LASER Theory and Application*, Mc Millan, India Ltd, 1984.