PSG College of Arts & Science

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B.Sc. PHYSICS

2016 - 2019

BSc PHYSICS

Scheme of Examinations

(For the students admitted in June 2014-2015 & onwards)

CODE NO.	SUBJECT	EXAM DURA-TION (Hrs)	Max. Marks			Credit points
			CA	CE	Total	
First Semester						
	Part –I					
14LAU01 12LAU01 14LAU01	Tamil – I OR Hindi – I OR French-I	3	25	75	100	3
	Part –II					
14EU01	Communicative English – I Interpersonal Communication	3	25	75	100	3
	Part –III					
14PHU01	Mechanics	3	25	75	100	4
14PHU02	Properties of Matter and Acoustics	3	25	75	100	4
14PHU03	Mathematics-I (Allied-MA)	3	25	75	100	4
**	Physics Practical – I	-	-	-	-	-
Second Semester						
	Part –I					
14LAU02 12LAU02 14LAU02	Tamil – II OR Hindi – II OR French-II	3	25	75	100	3
	Part –II					

14EU02	Communicative English - II Academic Communication	3	25	75	100	3
	Part –III					
14PHU04	Thermal and Statistical Physics	3	25	75	100	4
14PHU05	Astrophysics	3	25	75	100	4
14PHU06	Mathematics-II (Allied-MA)	3	25	75	100	4
14PHU07	Physics Practical – I	3	40	60	100	4
	Part –IV					
14VEU01	Value Education*	-	100	-	100	2

Third Semester

	Part –I					
14LAU03 12LAU03 14LAU03	Tamil – III OR Hindi – III OR French-III OR	3	25	75	100	3
	Part –II					
14EU03	Communicative English III- English for Career	3	25	75	100	3
	Part –III					
14PHU08	Electricity and Magnetism	3	25	75	100	4
14PHU09	Atomic, Molecular and Laser Physics	3	25	75	100	4
14PHU10	Chemistry – I (Allied-CH)	3	25	75	100	4
-	Physics Practical – II	-	-	-	-	-
-	Chemistry Practical (Allied-CH)	-	-	-	-	-
	Part –IV					
14ESU01	Environmental Studies	-	100	-	100	2

Fourth Semester

	Part –I					

14LAU04 12LAU04 14LAU04	Tamil – IV OR Hindi – IV OR French-IV	3	25	75	100	3
	Part –II					
14EU04	Communicative English- IV English Through Literature And Newspapers	3	25	75	100	3
	Part –III					
14PHU11	Optics	3	25	75	100	4
14PHU12	Electronic Instrumentation and Communication systems	3	25	75	100	4
14PHU13	Chemistry – II (Allied-CH)	3	25	75	100	4
14PHU14	Physics Practical – II	3	40	60	100	4
14PHU15	Chemistry Practical (Allied-CH)	3	40	60	100	4
	Part –IV					
14SBU01	**Skill Based Subject:** Internet Security	-	100	-	100	2

Cont …

CODE NO.	SUBJECT	EXAM DURA-TION (Hrs)	Max. Marks			Credit points
			CA	CE	Total	
Fifth Semester						
	Part –III					
14PHU16	Quantum Mechanics & Relativity	3	25	75	100	4
14PHU17	Mathematical Physics	3	25	75	100	4
14PHU18	Principles of Digital Electronics	3	25	75	100	4
14PHU19A 14PHU19B	**Core Elective – I:** Semiconductor Electronics OR Biomedical Instrumentation	3	25	75	100	4
-	Physics Practical – III	-	-	-	-	-
-	Physics Practical – IV	-	-	-	-	-
	Part –IV					
14NME01	**Non-Major Elective (1) :** EDC	-	100	-	100	2
14NME02	**Non-Major Elective (2) :** General Awareness (On-line Test)	1½	-	100	100	2
Sixth Semester						
	Part –III					
14PHU20	Nuclear Physics	3	25	75	100	4
14PHU21	Material Science	3	25	75	100	4
14PHU22	Microprocessor Architecture and Programming	3	25	75	100	4
	Core Elective – II:	3	25	75	100	4

14PHU23A OR 14PHU23B	Alternate Energy Resources OR Bio Nano Physics					
14PHU24	Physics Practical – III	3	40	60	100	5
14PHU25	Physics Practical – IV	3	40	60	100	5

PART-V			**Credits**
1.	**Extension Activity** : NSS / NCC / Sports / Department Activity	I – VI semesters	2
2.	**Competence Enhancement :** Add-on Course / Women's Studies / Extra paper	I – VI semesters	2
		Grand Total	**140**

14PHU01 **MECHANICS** **Semester I / 60 Hrs**

UNIT – I (12 Hrs)

HYDROSTATICS: Fluids – Liquids and Gases – Hydrostatic pressure – Hydrostatic pressure due to a liquid column – The hydrostatic paradox – A liquid transmits pressure equally in all directions – Pascal's law – Thrust on an immersed plane – Centre of pressure – Change of depth of centre of pressure – Particular cases of centre of pressure – Change of depth of centre of pressure. Principle of Archimedes – Equilibrium of floating bodies – Stability of equilibrium – Rolling and pitching of a ship – Determination of metacentric height – pressure due to a compressible fluid or a gas – Measurement of atmospheric pressure – Correction of barometric reading – Change of pressure with altitude.

UNIT – II (13 Hrs)

DYNAMICS OF RIGID BODIES: Moment of inertia – Radius of gyration – Dimensions and units of moment of inertia – Analogous parameters in translational and rotational motion – General theorems on moment of inertia – Calculation of moment of inertia (Rectangular Lamina, Circular Lamina & Sphere) – Moment of inertia of a flywheel – Experimental determination – Moment of inertia of a Diatomic molecule. Compound Pendulum – Interchangeability of centers of suspension and oscillation – Bar Pendulum – Kater's Reversible Pendulum – Conical Pendulum.

UNIT – III (10 Hrs)

BENDING OF BEAMS: Beam – Bending of a beam – Some definitions – Bending moment – Stiffness of a beam – The Cantilever (Depression of its loaded end) – Determination of Young's modulus for the material of a beam – Method of bending – Determination of elastic constants.

UNIT – IV (13 Hrs)

JET PLANES, ROCKETS AND SATELLITES: Jet propulsion – Thrust supplied by the jet – Efficiency of the jet – Effect of smaller cross-section of the jet. Rocket planes – Rocket fuel – Specific impulse – Shape of the rocket – The multi-stage rocket –Take off of the rocket – Salvaging of the various stage rockets. Satellites – Conditions for a satellite to be placed in orbit – Launching of the satellite – Stability of the rocket during flight – Form of the satellite – Weight and size of the satellite – Material of the frame of the satellite – Duration of satellite's existence – Other essentials – Return of artificial satellite – Uses of an artificial satellite.

UNIT – V (12 Hrs)

LAGRANGIAN AND HAMILTONIAN MECHANICS: Mechanics of system of particles – Constraints of motion – Generalized coordinates and the transformation equation – Simple illustration for the transformation equation. Configuration space – Principle of virtual work – D'Alembert's principle – Lagrange's equations – Applications: Atwood's machine – Bead sliding on a uniformly rotating wire. Phase space – Hamilton's equations of motion – physical significance of the Hamiltonian function – Applications: Motion of a particle in a central force field – Motion of a charged particle in an electromagnetic field.

BOOKS FOR STUDY:

1. Elements of Properties of Matter – D. S. Mathur, S. Chand & Company Ltd [Unit I, II & IV]

2. Mechanics – D. S. Mathur, S. Chand & Company Ltd [Unit II & III]

3. Dynamics – M. Narayanamurti and Nagarajan, National Publishing Company Ltd [Unit V]

BOOKS FOR REFERENCE:

1. Modern Physics – R. Murugeshan, S. Chand & Company Ltd

2. Classical Mechanics – S. L. Gupta, V. Kumar & H. V. Sharma, Pragati Prakashan Educational Publishers

14PHU02 PROPERTIES OF MATTER AND ACOUSTICS Semester I / 60 Hrs

UNIT I (12 Hrs)

ELASTICITY: Modulus of elasticity- Poisson's ratio- Relation between elastic constants and Poisson's ratio-Energy stored- Twisting couple on a cylinder- Torsional pendulum (with and without weights)- Bending of beams- Bending moment- Cantilever loading- Transverse vibrations of cantilever-Non uniform and uniform bending of a beam-Koenig's method – Determination of Y and n for the material of the spring.

UNIT II (12 Hrs)

VISCOSITY AND LOW PRESSURE: Newton's law- Poiseuilles flow- Stoke's fall- Rotation viscometer- Ostwald viscometer- Meyer's formula for viscosity of gas-Rankine's method- Effect of temperature and pressure on viscosity- Air pump- Rotary oil pump-Mercury diffusion pump- McLeod gauge-Pirani gauge- Knudsen Gauge.

UNIT III (12 Hrs)

SURFACE TENSION: Molecular interpretation- surface energy- Pressure difference across a curved surface- Excess pressure in liquid drops and air bubbles-Molecular forces- Shape of liquid meniscus in capillary tube-Angle of contact- Capillary rise and energy consideration- Jaeger's method-Quincke's drop- Vapour pressure over flat and curved surfaces.

UNIT IV (12 Hrs)

WAVES AND OSCILLATIONS: Transverse and longitudinal waves- Equation of Wave motion-Plane progressive wave- speed of transverse wave on a string- Energy in wave motion- Superposition of waves- Interference, reflection and transmission of wave- Standing waves normal modes of a string- Resonance-Sound Waves in gases- Organ pipes- Beats- Doppler effect- Applications

UNIT V (12 Hrs)

ULTRASONICS AND ACOUSTICS: Ultrasonics- Piezo-electric effect-Piezo-electric generator-Magneostriction effect- Magnetostriction oscillator-Detection and application of ultrasonic-Acoustics-Reverberation time and its measurement- Sabine's formula-Absorption coefficient and its determination- Condition for good acoustical design of an auditorium- Noise and its measurement-Noise reduction sound insulation

BOOKS FOR STUDY:

1. D.S Mathur- Elements of Properties of Matter: S.Chand and Co

2. Brij lal and N. Subrahmanyam- Properties of Matter :- S.Chand and Co (2003)

3. N.Subrahmanyam and Brij Lal- A Text Book of Sound: Vikas Publishing House

(Second Revised edition- 1995)

BOOKS FOR REFERENCE:

1. H.R Gulati- Fundamental of General Properties of Matter- R.Chand and Cofifth edition (1977)

2. N.K Bajaj- The Physics Of Waves And Oscillations- TATA MCGRAW-HILL (1988)

3. A.P French- Vibration And Waves- Mit Introductory Physics- Arnold-Heinmann India (1973)

4. Satya prakash and Akash Saluja- Oscillations And Waves- Pragati Prakashan (2002)

14STU03 / 14PHU03 / 14CHU02

Mathematics I (Allied)

(For BSc Statistics, Physics and Chemistry)

Unit I

Theory of Equations: Relation Between Roots and Coefficients-Solving Equations When Roots are in A.P,G.P,H.P and When Relations Between Roots are Given With Simple Conditions-Diminishing the Roots by a Constant 'h'-Solving Reciprocal Equations.

Unit II

Curvature: Radius of Curvature, Centre of Curvature, Evolutes and Involutes (Cartesian Co-ordinates Only)

Unit III

Integral Calculus : Properties of Definite Integrals- Reduction Formulae - Beta and Gamma Functions.

Unit IV

Multiple Integrals: Double and Triple Integrals.

Unit V

Trigonometry: Expansions of $\sin n\theta$, $\cos n\theta$, $\tan n\theta$, $\sin^n\theta$, $\cos^n\theta$-Infinite Series of $\sin\theta$, $\cos\theta$, $\tan\theta$ in Powers of - Hyperbolic Functions.

Text Book:

"Ancillary Mathematics" Volume I and II by **S. Narayanan, R.Hanumantha Rao, and T.K. Manicavachagam Pillay,** S. Viswanathan Printers and Publishers. 2007

Unit I : Chapter 2 : (Volume I)

Unit II : Chapter 6 : Section 6.4 (Volume I)

Unit III : Chapter 1 : Sections 1.11 to 1.15 (Volume II)

Unit IV : Chapter 3 : (Volume II)

Unit V : Chapter 5 : Sections 5.1 to 5.3 (Volume I)

14PHU04 THERMAL AND STATISTICAL PHYSICS Semester II /60 Hrs

UNIT-I (10 Hrs)

THERMOMETRY & THERMOELECTRICITY: Basic principle- Scales of temperature-Standardization-Liquid thermometer-Mercury thermometer-errors and correction-Clinical thermometer-Gas thermometer-principle-standard constant volume thermometer-Electrical resistance thermometer-principle-Platinum resistance thermometer-Construction and working-Thermoelectric thermometer-Seeback effect-principle, construction and working of thermoelectric thermometer-

UNIT-II (12 hrs)

NATURE OF HEAT: Andrews experiment on CO_2-results of importance-Amagatt's experiments-results and discussion-van der waals equation of state-critical constants-reduced equation of state-law of corresponding state- low temperature physics-Historical perspective-Critical constants and joule-Thomson effect-porous plug experiment-theory and results- liquefication of gases- principle of series refrigeration- liquefaction of hydrogen, helium-properties of liquid He-I and II-thermodynamics of wavelength transition march towards absolute zero (adiabatic demagnetization of paramagnetic salts)-Super conductivity and Super fluidity.

UNIT-III (13 hrs)

TRANSMISSION OF HEAT: Introduction-thermal conductivity-thermal diffusivity -thermal investigations- experimental determination of thermal conductivity-Forbes method-thermal conductivity of bad conductors-lees method-conductivity of gases- Weidman-Franz law-practical applications - convection- application- radiation- introduction- sources- measurements - blackbody radiation-properties-Stefan Boltzmann law-Newton's law from Stefan's law-experimental verification-laboratory method-distribution of energy in the black body spectrum-Wien's law, Rayleigh jean's law and Planck's law-Application of thermal radiation.

UNIT-IV (13 hrs)

THERMODYNAMICS: Introduction –First law of thermodynamics-Application-Isothermal, Adiabatic, Isobaric and Isochoric process- Work done, Indicator diagram-applications-specific heat of a body-Second law of thermodynamics-Heat engines-Carnot ideal engine-Carnot cycle-Carnot's refrigerator-Efficiency-Carnot's theorem and corollary-Entropy-Entropy of an ideal gas-T-S diagram-entropy and reversible and irreversible processes -Increase of in entropy-Application of second law-Third law of thermodynamics-thermodynamic potentials-definition-properties-applications – Maxwell's thermodynamic relations-Applications-Specific heat equations-latent heat equation.

UNIT-V(12 hrs)

STATISTICAL PHYSICS: Introduction-statistical mechanics-statistical equilibrium-probability-Theorems in statistical thermodynamics-Maxwell Boltzmann distribution law-Maxwell Boltzmann distribution interms of temperature-Maxwell Boltzmann distribution and ideal gas-Quantum statistics-phase space-Fermi Dirac distribution law- electron gas-Bose Einstein distribution law-photon gas-comparison of the three statistics.

BOOKS FOR STUDY:

A text book of Heat- J.B. Rajam. S. Chand & Co 1958

A Treatise on Heat-M.N. Saha & B.N Srivatsava Science Book Agency Calcutta.

Heat and Thermodynamics- Zemanski, TMH publishers

Heat and Thermodynamics – Brijlal -Subramaniam. S.Chand & Co

BOOKS FOR REFERENCE:

A text book of Heat - D.S.Mathur. S.Chand & Co

Thermal Physics – Charles Kittel & W H. Freeman Publications – USA

14PHU05 ASTROPHYSICS Semester II / 60 Hrs

UNIT I (12 Hrs)

GENERAL ASTRONOMY: System of Coordinates- Altazimuth, Equatorial (local and Universal), Ecliptic and Galactic systems. Magnitude scale and magnitude systems-correction for observed magnitudes. The proper motion-stellar parallax- Trigonometric, cluster and secular parallaxes. Method of Luminosity distance.

UNIT –II (12 Hrs)

SOLAR SYSTEM PROPERTIES OF STARS: Solar system-Astronomical Instruments-Refracting telescope-Reflecting telescope-Radio telescope measurement of distance-Size-Rotation – Mass of the sun-Surface temperature – Atmosphere -Planets- Asteroids – Comets -Meteorites-Sun - Star- Physical Properties of Stars-Masses of stars-Stellar Evolution-Milky Way Galaxy – Expanding Universe- Big-bang theory-Black hole-Supernova.

UNIT III (12 Hrs)

STELLAR STRUCTURE: Equations of stellar structure-Russel-vogt theorem-Ideas of polytropic model-stellar opacity-Free-Free transitions, Bound-Free transitions and electron scattering. Eddington's standard model. Homologous model for main sequence stars-Schwarzchild's model for real stars.

UNIT IV (12 Hrs)

STELLAR EVOLUTION: The virial theorem-application to an isothermal gas sphere-evolution of stars near the main sequence effect of hydrogen depletion-Schoenberg-Chandrasekhar limit of an isothermal core-nuclear time scaleages of clusters-Star formation-Jean's criterion.

UNIT V (12 Hrs)

STELLAR ENERGY SOURCES: Thermonuclear fusion-CN cycle-pp chain-simple formulae for the energy generation rates-abundances for the elements in the stars structure of the sun from helioseismology-problems of nucleo synthesis.

BOOKS FOR STUDY:

1. Astrophysics-Stars and Galaxies - K. D. Abhayankar, Tata McGraw Hill, 1995.

2. Text Book of Astronomy and Astrophysics with elements of Cosmology - V.B.Bhatia, Narosa

Publishing House.

3. Introduction to Astrophysics - Baidyanath Basu, Prentice Hall(India)

BOOKS FOR REFERENCES:

1. An Introduction to the Sun and the stars - Simon. F. Green and Mark.R.Jones, Cambridge University Press, (2004).

2. Compendium of Practical Astronomy - Gunter Dectmar Roth, Vol. 1, Springer Verlag.

3. The Physics of stars - A.C.Phillips- John Wiley and sons(1999).

14STU06 / 14PHU06 /

14CHU05

Mathematics II (Allied)

(For BSc Statistics, Physics and Chemistry)

Unit I

Matrices: Evaluation of eigen values and eigen vectors – Cayley Hamilton Theorem – Diagonalization.

Unit II

Partial Differential Equations: Formation of Partial Differential Equations – General Integral, Particular Integral and Complete Integral – Standard Forms – Largrange's Form of Linear First Order Equations

Unit III

Fourier Series: Full Range and Half Range Series – Development in Cosine Series – Development in Sine Series (Except Harmonic Analysis).

Unit IV

The Laplace Transform: Inverse laplace transform – Solving ordinary differential equations by laplace transform.

Unit V

Solving Simultaneous Linear Equations by Gauss Elimination – Gauss Jordan – Gauss Jacobi – Gauss Seidal Method.

Text Book:

1."Ancillary Mathematics" Volume I and II by **S. Narayanan, R.Hanumantha Rao, and T.K. Manicavachagam Pillay,** S. Viswanathan Printers and Publishers. 2007
(For Units I, II, III & IV)
2."**Numerical Methods in Science and Engineering**" by **Dr.M.K.Venkataraman**. The National Publishing Company. Fifth Edition. August 2004.
(For Unit V)

Unit I : Chapter 3 : Sections 3.4, 3.5 (Volume I)

Unit II : Chapter 6 : Sections 6.1 to 6.6 (Volume II)

Unit III : Chapter 2 : Sections 2.1 to 2.5 (Volume II)

Unit IV : Chapter 7 : Sections 7.1 to 7.4 (Volume II)

Unit V : Chapter 4 : Sections 1 to 3, 6 (Text Book 2)

14PHU07 **PHYSICS PRACTICAL - I** **Semester II**

AT THE END OF II Semester

*ANY 15 EXPERIMENTS**

1. Young's modulus – Uniform bending – optic lever.
2. Young's modulus – Non-Uniform bending – Pin and microscope.
3. Surface tension – capillary rise method.
4. Surface tension and interfacial surface tension – drop weight method.
5. Searle's Viscometer – viscosity of highly viscous liquid.
6. Melde's experiment – relative density of solid and liquid.
7. Compound pendulum.
8. Specific heat capacity of a liquid – Newton's law of cooling.
9. Thermal conductivity of a bad conductor- Lee's disc.
10. Spectrometer – μ of a solid prism.
11. Air wedge – Thickness of a wire.
12. Newton's rings – Radius of curvature.
13. Potentiometer – calibration of ammeter.
14. Potentiometer – calibration of low range voltmeter.
15. Coefficient of viscosity – graduated burette
16. Comparison of radii – graduated burette.
17. Melde's Experiment – Determination of frequency.
18. Sonometer – AC frequency determination.
19. Fibre optic kit- Numerical aperture (Demonstration only).

*Subject to the availability of the equipments, class hours etc.

14PHU08 ELECTRICITY AND MAGNETISM Semester III /52 Hrs

UNIT I (11 Hrs)

ELECTROSTATICS: Gauss law and its applications- Gauss Divergence theorem and differential form of Gauss law- Poisson's and Laplace equations. Electric potential- potential as line integral of electric field- Relation between electric field and electric potential. An atomic view of dielectrics- Polarization and charge density-Gauss law for dielectric medium - Relation between D,E and P. Dielectric constant, Susceptibility and relation between them

UNIT II (10 Hrs)

CURRENT ELECTRICITY: Current and current density- Equation of continuity- Ohm's law and electrical conductivity. Drude - Lorentz theory of electrical conduction. Kirchoff's Law and analysis of multi loop circuits- Carey Foster bridge- Potentiometer and its uses- Network theorems- Superposition theorem-Reciprocity theorem- Thevenin theorem- Norton's theorem.

UNIT III (10 Hrs)

THERMO ELECTRICITY: Faraday's Laws of Electrolysis- ionic velocities and mobilities. Calculation and experimental determination of ionic mobilities- transport number. Seebeck and Peltier effect- Thermo emf- Laws of Thermoelectricity- Peltier coefficient- determination of thermo emf- Thomson effect and Thomson coefficient- application of thermodynamics.

UNIT IV(10 Hrs)

ALTERNATING CURRENTS: Peak, average and RMS value of alternating current- J operator method- series and parallel resonance circuits- Power consumed by an AC circuit- power factor- Transformers. Growth and decay of current in LR and CR circuits, decay constants- Determination of high resistance by leakage.

UNIT V (11 Hrs)

MAGNETISM: Properties of Magnetic material: Magnetic susceptibility and permeability- Dia, Para, Ferro magnetic materials- Langevin theory for Dia and Para magnetism- Domain theory for Ferro magnetism- Hysteresis- Ampere's circuital law and its applications. Maxwell's equations- Fundamental law of electromagnetism- Maxwell's equations- Significance.

BOOKS FOR STUDY:

1. R.Murugeshan, Electricity and Magnetism, (2008) S Chand & CO New Delhi.
2. Brijlal and Subramanyam, Electricity and Magnetism, (2005 Ratna Prakashan Mandir Publishers, Agra.

BOOKS FOR REFERENCE:

1. David J.Griffith, Introduction to Electro Dynamics, (2012) PHI, New Delhi.
2. Navina Wadhwani, Electricity and Magnetism, (2010) PHI, New Delhi.
3. A.K Tiwari, Electricity and Magnetism, (2007), S Chand & Co, New Delhi.
4. Halliday-Rensick and Walker, Fundamentals of Physics- Electricity and Magnetism, (2011), Wiley India Pvt Ltd.

14PHU09 ATOMIC, MOLECULAR AND LASER PHYSICS Semester III /52 Hrs

UNIT 1 (11 HOURS)

Bohr atom model – Interpretation of hydrogen atom – effect of nuclear motion on atomic spectra – Evidences in favour of Bohr's theory – critical potentials – methods of excitation of atoms – Experimental determination of critical potential – Frank and Hertz method. Optical spectra - Zeeman effect - Lorentz classical theory of normal effect, shift, experiment - Larmor's theorem - quantum mechanical explanation of the normal and anomalous effect.

UNIT 2 (10HOURS)

Vector atom model, quantum numbers associated with vector atom model-Paschen – Back effect-Stark effect- Einstein's photoelectric equation-experimental verification-photoelectric cells-photo emissive cell-photo voltaic cell, photoconductive cell-Application of photoelectric cells.

UNIT 3 (10 HOURS)

Continuous X-ray spectra-characteristic X-ray spectrum-Mosley law-Compton scattering-theory and experimental verification - absorption of X-rays – Bragg's law-crystal structure- -diffraction of X-rays-powder crystal method-Laue's method –Rotating crystal method

UNIT 4 (10 HOURS)

LASER DEVICES AND THEIR APPLICATIONS: Principles of Lasers - pumping - He-Ne laser - CO_2 Laser - semiconductor laser - Laser induced fusion - fusion process - Laser energy requirements - Laser induced fusion reactor - LIDAR - Laser tracking - Lasers in industry and medicine (Qualitative Treatment only).

UNIT 5 (11 HOURS)

SPECTROSCOPY: Positive rays – Aston's mass spectrograph – Dempster's mass spectrograph – isotopes – mass defect and packing fraction- UV- Principles-Instrumentation-Applications -IR-Principles-Instrumentation-Applications-Raman spectroscopy – Introduction – quantum theory – characteristics of Raman lines – instrumentation.

BOOK FOR STUDY:

R.Murugesan: Modern Physics 2007 (S.Chand &Co)

REFERENCE BOOK:

Arther Beiser – Concepts Of Modern Physics 2003 (Tata McGraw Hill Edition)

14PHU10 **Chemistry - I (50 Hours)** **Semester III**

(Allied for BSc Physics)

Objectives

- To develop a foundation in the concepts and facts in all areas of chemistry
- To gain basic knowledge in the fields of drugs, dyes and environmental chemistry

UNIT I Inorganic Chemistry **(10 hrs)**

Shapes of simple molecules – VSEPR theory – shape of XeF_2, XeF_4, IF_5, SF_6, ClF_3 and PCl_5 – coordination chemistry. Werners theory - nomenclature – EAN rule – types of chelates – analytical application of coordination compounds. Sulphur compounds –sodium hydrosulphite, per acids of sulphur – preparation, properties and uses. Interhalogen compounds – ICl, BrF_3, IF_5, IF_7 types, preparation properties structures and uses.

UNIT II Organic Chemistry **(10 hrs)**

Alkaloids – general classification and properties – coniine, piperine, nicotine –isolation and uses. Terpenoids – classification and isoprene rule – isolation and uses of menthol, citral camphor. Dyes – classification – acid dyes, basic dyes, mordant dyes and vat dyes. Polymers – classification – preparation, properties and uses of polyester, epoxide, Teflon, alkyd resin, rubbers PVC, poly acrylonitrile and bio degradable polymers.

UNIT III

Physical Chemistry **(10 hrs)**

Solid state chemistry – elements of symmetry-plane, center, and axis of symmetry. Unit cell of simple body center and face center cubic crystals. Weiss and miller indices, nature of unit cell of NaCl- diamond and graphite. Isomorphism and polymorphism.

UNIT IV Kinetics and Colloids **(10 hrs)**

Chemical kinetics – rate, rate constant, order and molecularity, deviation of 1^{st} and 2^{nd} order rate constants. Examples of 1^{st} order reaction – decomposition of H_2O_2, hydrolysis of ethyl acetate, inversion of cane sugar. Examples of 2^{nd} order reaction –conversion of ammonium cyanate into urea. Methods of determining order of reaction. Complex thermal reactions – consecutive, parallel and opposite reactions.

UNIT V Energy and Environmental Chemistry **(10 hrs)**

Environment – components and segments. Radioactive pollution and effects – control measures. Energy- conventional, non-conventional sources of energy – need for energy alternative solar option-p, n semi conductor, photovoltaic effect-silicon solar cell.

Reference Books

1. 1. Principles of Physical Chemistry, B.R. Puri, L.R. Sharma and M.S. Pathania, Shoban Lal Nagin Chand and Company, Jalandhar, 27th Edition, 1986.
2. Organic Chemistry, R.T. Morrison and R.N. Boyd, Prentice Hall of India Private Limited, New Delhi, 6th Edition, 2004 .
3. Text book of Inorganic Chemistry, P.L.Soni, Sultan Chand and Sons, New Delhi, 13th Edition, 1981.

4. Environmental Chemistry, A.K.De, Wiley Eastern LT, New Age international Lt., New Delhi, 3rd Edition, 1995.

14PHU11 **OPTICS** **Semester IV /52 Hrs**

UNIT-I (11 Hrs)

GEOMETRICAL OPTICS: Introduction-concept of ray of light-laws of reflection, refraction-optical path- Fermat's principle-colour dispersion-parallel beam-critical angle-Total internal reflection-plane parallel plate-refraction by prism -spherical surfaces- first order theory-spherical aberration at single surface- thin lens-coma-aplanatic lens-astigmatism-curvature of field- Abbe's conduction-chromatic aberration.

UNIT-II (10 Hrs)

OPTICAL INSTRUMENTS: The Eye - Compound microscope-objectives-telescope-astronomical telescope-Galileo's telescope-eyepieces- Ramsden eyepiece - Huygen's eyepiece-spectrometer-constant deviation spectrometer-Abbe's spectrometer- Epidiascope.

UNIT-III (11 Hrs)

PHYSICAL OPTICS: Nature of light-Theories of light-light waves-interference of light- coherent sources-interference in thin films- Newton's rings-applications-Haidinger's fringes- Interferometry-F.P Interferometer, Michelson interferometer-applications-Multiple beam interferometry - -L.G plate-interference filter(qualitative)-Diffraction-rectilinear propagation of light- Fresnel - Fraunhofer diffraction-diffraction due to circular aperture-opaque disc - narrow wire - single slit, double slit and N slits.

UNIT-IV (10 hrs)

POLARIZATION AND OPTICS OF CRYSTALS: Polarization of wave-polarization by reflection- Brewster's law-double refraction- Nicol prism production, detection and analysis of polarized light-optical activity- Fresnel's explanation of rotatory polarization - specific rotation-Quarter wave plate – Half wave plate - polarimeter- Laurent's half shade polarimeter - physical explanation of optical activity of liquids and solution(qualitative treatment).

UNIT-V (10 Hrs)

HOLOGRAPHY AND FIBER OPTICS: Holography: Introduction- theory - requirements-construction and reconstruction applications-Fibre Optics: Optical fibre-Numerical aperture- Fibre optic communication system - types of optical fibres - advantages- fibre optic sensors-industrial applications and medical applications.

BOOKS FOR STUDY:

1. A text book of Optics – Brij Lal & Subramaniam, S. Chand Publishers

2. Optics – Ajoy Ghatak TMH Publishers

3. A text book of Engineering Physics - M. N. Avadhanulu, S. Chand Publishers

BOOKS FOR REFERENCE:

Fundamentals of Optics - Francis A. Jenkins & Harvey E. White (3rd.ed.) McGraw-Hill 1957

14PHU12 ELECTRONIC INSTRUMENTATION AND COMMUNICATION SYSTEMS
Semester IV /52

Hrs

UNIT-I (11 Hrs)

MEASUREMENT SYSTEMS: Introduction- Measurement system architecture-Errors in measurements- Standards used in measurements- Electrical standards-Time and frequency-Physical standards-DC Null measurements-Wheatstone Bridge analysis-Kelvin Bridge-Andreson constant - current loop-Potentiometer-AC Null measurement-AC operation of Wheatstone's bridges-AC bridges.

UNIT-II (11 Hrs)

BASIC ELECTRICAL MEASUREMENTS: Introduction-DC Voltage Measurements-Electromechanical DC voltmeters-Static Electric field and charged surface measurements-DC current measurements- Electro mechanical DC ammeter-Magneto optic current errors- AC voltage measurements-Electro mechanical AC voltmeters- Iron vane Voltmeters- Vacuum thermocouple-Analog electronic AC voltmeter- AC amplifier- Rectifier-AC voltmeter-AC current measurements.

UNIT-III (10 Hrs)

Specific gravity Monitoring – Measurement of liquid level-Viscosity measurement of humidity and moisture- Measurement of P_H value- Bio medical measurements / Bio metrics-measurement of environmental air pollution parameter-computer aided measurement-fibre optic transducer.

UNIT-IV (10 Hrs)

WAVE GUIDES & RADIO WAVE PROPAGATION: Introduction-Rectangular wave guides, modes-propagation in free space-Tropospheric propagation-Ionospheric propagation-surface wave-low frequency and ultra low frequency propagation-antennas-power gain of an antenna-effective length and area of an antenna-types of an antennas (qualitative treatment analysis).

UNIT-V (10 Hrs)

TELEVISION AND SATELLITE COMMUNICATION- Introduction -Television-signal transmission and reception-satellite communication- Kepler's laws-orbits-geostationary orbit-power systems - altitude control - satellite station keeping-antenna look analysis-limits of visibility-transponters-digital carrier transmission-multiple access methods- Facsimile transmission.

BOOKS FOR STUDY:

Units 1-3: Electronic instrumentation and measurement systems B.C.Nakara KK Chaudary,TMH Publication ,3 rd edition.

Unit- 4&5: Electronic Communications - Dennis Roddy-John Coolen

Prentice Hall India - 4th edition

BOOK FOR REFERENCE:

1. Modern Electronic Instrumentation and Measurement Techniques -Albert D. Helfrick, William David Cooper - Prentice Hall PTR, 5th Ed 1990
2. Advanced Electronic Communications Systems - Wayne Tomasi - Prentice Hall PTR, 4th edition 1998

14PHU13 **Chemistry - II (50 Hours)** **Semester IV**

(Allied for BSc Physics)

Objectives

- To develop a foundation in the concept and facts in all areas of chemistry
- To be familiar with the fundamental reactions involved in chemistry
- To create awareness for safe handling of chemicals and laboratory hygiene

UNIT I Analytical Chemistry (10 hrs)

Statistical analysis of analytical data – the mean and median-precision and accuracy-confidence limits and standard deviation. Errors-classification and elementary treatment of errors, minimization of errors. Rejection of data-significant figures and reporting of data. Laboratory hygiene and safety – simple first aid procedure for accidents in laboratory.

UNIT II Organic Chemistry (10 hrs)

Heterocyclics-definition and classification- furan, thiophene and pyridine- preparation, properties and uses. Amino acids – definition-examples-classification- properties of amino acids and uses. Protein definition-examples-classification- properties of amino acids and uses. Soaps – definition- types of soaps-manufacture of soap – mechanism of cleaning action. Detergents – definition – examples-types of detergents – difference between soaps and detergents.

UNIT III Physical Chemistry (10 hrs)

Electrochemistry-Faraday's law, specific conductivity, equivalent conductivity, definition and determination. Kohlrausch law, Oswald's dilution law – limitation – conductometric titration. pH and buffer solution-definition, importance of pH and buffer in living system. Over voltage, corrosion and passivity.

UNIT IV Thermodynamics (10 hrs)

Heterogeneous and homogeneous system – isothermal, adiabatic process, isobaric process. Reversible and irreversible processes-fist law of thermodynamics-relation between C_p and C_v-Joule Thomson effect-principle and instrumentation and analytical applications of UV, IR and Raman spectroscopy.

UNIT V Environmental Chemistry (10 hrs)

Environmental pollution-introduction, pollutant, classification of pollutants. Types of pollution. Thermal pollution-defnition, source, effects, controls adn prevention. Noise pollution – introduction, definition, sources, measurments, effects, prevention, and control.

Reference Books

1. Principles of Physical Chemistry, B.R. Puri, L.R. Sharma and M.S. Pathania, Shoban Lal Nagin Chand and Company, Jalandhar, 27th Edition, 1986.
2. Organic Chemistry, R.T. Morrison and R.N. Boyd, Prentice Hall of India Private Limited, New Delhi, 6th Edition, 2004 .
3. Text book of Inorganic Chemistry, P.L.Soni, Sultan Chand and Sons, New Delhi, 13th Edition, 1981.
4. Environmental Chemistry, A.K.De, Wiley Eastern LT, New Age international Lt., New Delhi, 3rd Edition, 1995.

14PHU14 PHYSICS PRACTICAL-II Semester: IV

(AT THE END OF THE FOURTH SEMESTER)

ANY 16 EXPERIMENTS*

1. Comparison of emfs – BG.
2. Figure of Merit - BG.
3. Spectrometer – μ of a liquid.
4. Spectrometer – i-d - curve.
5. Spectrometer – grating – normal incidence..
6. Spectrometer – dispersive power of prism.
7. Deflection magnetometer – TanC position – Pole strength of a bar magnet
8. Determination of M and B_H using deflection & vibration magnetometer
9. Field along the axis of a circular coil carrying current – to find B_H.
10. Field along the axis of a circular coil carrying current – to find pole
11. Potentiometer – internal resistance
12. Rigidity Modulus – static torsion
13. Torsional pendulum – n and I.
14. Sonometer – verification of laws and determination of frequency.
15. Stoke's method – viscosity of a highly viscous liquid.
16. Cantilever – depression – pin and microscope method.
17. Characteristics of Junction diode.
18. Characteristics of Zener diode.
19. Transistor characteristics - common base (CB) configuration.
20. Transistor characteristics - common emitter (CE) configuration.
21. Joule's calorimeter – specific heat capacity of a liquid – Barton's correction.
22. Carry Foster's bridge – specific resistance.
23. Zeeman effect (Demonstration only)

*Subject to the availability of the equipments, class hours etc,

14PHU15/14BOU16/
14ZOU17/14NDU09 Chemistry Practical (50 Hours) Semesters-I&II

(For Physics, Botany, Zoology, Nutrition, Food Service Management and Dietetics)

UNIT I

Acidimetry and Alkalimetry (9 Hrs)

1. Estimation of sodium hydroxide
2. Estimation of sodium carbonate
3. Estimation of hardness of water

UNIT II

Permanganometry (9 Hrs)

4. Estimation of ferrous sulphate
5. Estimation of ferrous ammonium sulphate
6. Estimation of oxalic acid

UNIT III

Dichrometry (8 Hrs)

7. Estimation of ferrous iron using internal indicator
8. Estimation of ferrous iron using external indicator

UNIT IV

Organic Analysis (12 Hrs)

Analysis of organic compounds to detect (i) Special elements present/absent (ii) Aromatic/ aliphatic (iii) Saturated / unsaturated

UNIT V

Detection of Functional Groups by Confirmatory Tests (12 Hrs)

Glucose, benzoic acid, cinnamic acid, succinic acid, benzaldehyde, acetophenone, benzamide, urea, aniline and phenol.

Reference Books

1. Basic Principles of Practical Chemistry, V. Venkateswaran, R. Veeraswamy and A.R. Kulandaivelu,
2. Practical chemistry, A.O. Thomas, Scientific Book Centre, Cannanore –I, 7th edition 1999.

14PHU16 QUANTUM MECHANICS & RELATIVITY Semester V/60 Hrs

UNIT-I (12 Hrs)

BASIC CONCEPTS: Conclusion from the electromagnetic theory-properties of photons-photons and gravity-The effect of(Gravitational Red Shift) gravity on Astronomical radiations-Einstein's photoelectric equation-Role of constants c and h physics-The Electron volt-de Broglie's matter waves-Absence of matter waves in macroscopic world-Davisson and Germer's experiment on diffraction of electrons-Matter waves(due to electrons) in atoms-wave-particle duality in nature-Quantum properties of micro particles.

UNIT-II (12 Hrs)

HEISENBERG'S UNCERTAINTY PRINCIPLE: - Introduction-uncertainty principle – illustration of Heisenberg's uncertainty principle with Bohr's idealized thought experiment-Application of uncertainty principle- electron microscope- advantages over the ordinary optical microscope- applications.

UNIT-III (12 Hrs)

SCHRODINGER'S WAVE EQUATION: Introduction- Schrodinger's wave equation- derivation – applications – solution of Schrodinger's equation for a particle in a box- linear harmonic oscillator – qualitative – explanation of Tunneling effect. (Penetration of a particle through one-dimensional potential barrier).

UNIT-IV (12 Hrs)

SPECIAL THEORY OF RELATIVITY: Introduction – Michelson – Morley experiment – Galilean transformation and Newtonian relativity – inadequacy of Galilean transformation – fundamental postulates of special theory of relativity – Lorentz transformation equations – Fitzgerald contraction and time dilation – experimental evidences – relativity of simultaneity – Einstein's laws of addition of velocities – variation of mass with velocity – equivalence of mass and energy – experimental verification.

UNIT-V (12 Hrs)

GENERAL THEORY OF RELATIVITY: Basic concepts of general theory of relativity – principles of equivalence – equality of gravitational and inertial masses- qualitative ideas of curvature of space – time – geodesics and Einstein's law of gravitation – bending of light, precession of perihelion of Mercury and red shift experimental verifications.

BOOK FOR STUDY:

1. S.P.Singh and M.K.Bagde: Quantum Mechanics.

2. R.Murugesan : Modern Physics.

BOOK FOR REFERENCE:

1. J.B.Rajam : Modern Physics (S.CHAND & CO)- New Delhi.

2. Beiser : Concepts in Modern Physics

3. Powell and Crassmann : Quantum Mechanics.

4. Ghattac and Loganathan : Quantum Mechanics.

14PHU17 MATHEMATICAL PHYSICS Semester V /60 Hrs

UNIT I (12 Hrs)

Gradient of scalar point function – divergence – explanation of divergence – curl – explanation of curl – vector integration – line integral – tangential line integral – surface integral – volume integral – Gauss divergence theorem – Green's theorem in plane – Stoke's theorem.

UNIT II (12 Hrs)

Curvilinear coordinates – transformation of coordinates – orthogonal curvilinear coordinates – unit vectors in curvilinear systems – cylindrical coordinates – spherical coordinates – curl, divergence and gradient in cylindrical and spherical coordinates.

UNIT III (12 Hrs)

Tensor analysis – coordinate transformation – summation convention – contravarient and covariant tensors – contravarient, covariant and mixed tensors of rank two – Kronecker Delta.

UNIT IV (12 Hrs)

Functions of complex variables –analytic function – Cauchy- Riemann equations – sufficient and necessary conditions for a function to be regular – harmonic functions.

UNIT V (12 Hrs)

Line integrals – Cauchy's Integral theorem – Cauchy's integral formula and its derivatives- Cauchy's theorem-– Solving integrals (definite integrals) - simple problems.

BOOKS FOR STUDY:

1. Murray R. Speigal : Schaumn series – Vector analysis and Tensor Analysis (Units I to III)
2. Sathya Prakash: : Mathematical Physics (for Unit IV)
3. M. L. Khanna : Spherical Harmonics.(For Unit V)

14PHU18 PRINCIPLES OF DIGITAL ELECTRONICS **Semester: V / 60 Hrs**

UNIT I (11 Hrs)

LOGIC CIRCUITS: Boolean Algebra – NOT operation – OR operation – AND operation – Boolean equations with Logic circuits – Boolean law & Theorems – Basic laws – OR, AND Double Inversion and Demorgan's theorems – Duality theorems – Sum of Products method – Truth table to Karnaugh Map – Pairs, Quads and Octets – Karnaugh simplification – Product of Sums method.

UNIT II (11 Hrs)

DATA PROCESSING CIRCUITS

Multiplexer – Demultiplexer – 1 to 16 decoders – BCD to Decimal decoders – Seven segment decoder – Encoders- Parity generator – checkers – Read Only Memory – Programmable array logic. Number systems and codes: Binary to Decimal conversion – Decimal to Binary conversion – Octal numbers – Hexa decimal numbers – The ASCII code – The Excess 3 code – The Gray code.

UNIT III (13 Hrs)

ARITHMETIC CIRCUITS

Binary addition - Binary Subtraction – Unsigned Binary numbers - sign magnitude numbers – 2's complement representation – 2's complement Arithmetic – Arithmetic building blocks – The Adder – Subtractor. Flip – Flops: RS flip flop – Clocked RS flip flop – D flip flop – Edge triggered D flip flop – JK flip flop – JK Master Slave flip flop – Schmitt trigger.

UNIT IV (13 Hrs)

SHIFT REGISTER AND COUNTERS

Types – Serial In Serial Out – Serial In Parallel Out – Parallel In Serial Out – Parallel In Parallel Out – Ring counter – Asynchronous counter – Decoding gates – Synchronous counter – Mod 3 counter – Mod 5 counter – shift counter.

UNIT V (12 Hrs)

SEMICONDUCTOR MEMORIES

Basic – Memory addressing – ROM PROM and EPROM – RAM – DRAM – Dynamic RAM. D/A and A/D Conversion: Variable – Resistor Network – Binary ladder – D/A converter – A/D converter – Simultaneous conversion – Counter method – continuous A/D conversion

BOOKS FOR STUDY:

1. Digital Principles and Applications – Albert Paul Malvino & Donald P Leach (Fourth Edition, TMH)

BOOKS FOR REFERENCE:

Integrated Electronics – Millmann & Halkeias TMH publications

CORE ELECTIVE - I

14PHU19A SEMICONDUCTOR ELECTRONICS Semester V/70 Hrs

UNIT I (14 Hrs)

Semi Conductor – commonly used semiconductors – energy band description of semi conductors – effect of temperature on semiconductors –n- type and p-type semiconductors – majority and minority carriers - p-n junction – volt ampere characteristics of p-n junction – semi conductor diodes – full wave bridge rectifier - efficiency of a full wave rectifier – ripple factor – filter circuits – Types of filter circuits - Zener diode – Zener diode as voltage stabilizer.

UNIT II (14 Hrs)

Transistors – transistor symbols – CB, CE, CC connections – load line analysis (CE) – operating point transistor biasing – base resister, feedback resister and voltage divider bias method – design of single stage transistor amplifier – RC coupled amplifier – multistage amplifier – transformer coupled amplifier – classification of power amplifiers – push pull amplifier.

UNIT III (14 Hrs)

Feed back –principles of negative voltage feedback – gain of negative voltage feedback amplification – advantage of negative voltage feedback – feedback circuit – principle of negative current feed back – current gain with negative current feed back – effects of negative current feedback – emitter follower – DC analysis – voltage gain, input impedance and output impedance of emitter follower – application of emitter follower.

OPAMP –ideal OPAMP – parameters of OPAMP – inverting and Non-inverting OPAMP – Application – Adder, subtractor, integrator, differentiator, unity gain follower.

UNIT IV (14 Hrs)

Oscillators – essentials of a transistor oscillator – tuned collector oscillator – Hartley and Colpitts' oscillators – Phase shift and Weinbridge oscillators – crystal oscillator – modulation – types of modulation – amplitude modulation- frequency modulation – Demodulation – stages of super heterodyne receiver.

UNIT V (14 Hrs)

Switching action of a transistor – types of multivibrators – astable, monostable and bistable multivibrators – differentiating and integrating circuits – clipping and clamping circuits – characteristics of FET, MOSFET and SCR- SCR full wave rectifier.

BOOKS FOR STUDY:

1. Basic Electronics - Theraja B.L
2. Principle of Electronics - Mehta V.K S. Chand & Co

BOOKS FOR REFERENCE:

1. Semiconductor Devices- Kanaan Kano, Pearson Education (2004)
2. Semiconductor Device Fundamentals - Robert F. Pierret, Pearson Education (2006)
3. Transistors - Dennis Le Croissette, Pearson Education (1989)
4. Semiconductor Devices: Basic Principles - Jasprit Singh, John Wiley and Sons (2001)

CORE ELECTIVE - I

14PHU19B BIOMEDICAL INSTRUMENTION Semester V/70 Hrs

UNIT – I (14 Hrs)

Cells and their structure – Transport of ions through the cell membrane- resting and action potentials – characteristics pf resting potentials-bioelectric potentials-nerve tissues and organs. Design of medical instruments- components of the biomedical instrument system –electrodes-half cell potential-purpose of electrode paste-electrode material-types of electrodes:- micro electr4ode-micropipet-depth and needle electrode-surface electrode-chemical electrodes.

UNIT –II (14Hrs)

Transducers: Active transducers:- magnetic induction type-piezoelectric type-photovoltaic type-thermo electric type – passive transducers :- resistive transducers- strain gauge – strain resistance relation – strain gauge as pressure transducer – photo electric type resistive transducer –thermistor type transducer – metallic wire transducer- capacitive transducer – capacitance pressure transducer – inductive transducer –LVDT.

UNIT – III (14Hrs)

Biopotential recorders :-Introduction – characteristics if the recording system – writer and pen damping effects – ECG – origin of cardiac action potential – ECG lead configutrations – ECG recording set up – practical considerations for ECG recording

- Analysis of recorded ECG signals – vector cardiography .

UNIT – IV (14Hrs)

Phono-cardiography :- echocardiography – electroencephalography (ECG) – orgin of EEG – brain waves – placement of electrodes – recording setup – analysis of EEG electromyography (EMG) – recording set up – elecroretinography (ERG) and electrooculography (EOG)

UNIT – V (14 Hrs)

Pacemakers – energy requirements to excite heart muscle – methods of stimulations – different modes of operation – pacemakers batteries – artificial heart valves – different natural heart valves – different types of artificial heart valves – defibrillators - different types of defibrillators – heart lung machine

BOOK FOR STUDY:

Dr.M.Arumugam – Bio Medical Instrumentation 2003 – Anuradha Agencies

14EDCPHU SOLAR ENERGY AND ITS UTILIZATION (26 Hrs)

Semester: V/ 26 Hrs

UNIT – I: (8 Hrs)

Introduction – Energy sectors – Primary energy consumption of countries- Oil crisis of 1973 – Classification of Energy Resources – based on usability, traditional use, long term availability, commercial application and origin -Consumption trend of primary energy sources.

UNIT – II: (9 Hrs)

Importance of non-conservational energy sources – Energy chain – Common forms of energy – Advantages and disadvantages of conventional energy sources-Salient features of non-conventional energy sources – merits-demerits-power densities in various energy sources-Environmental aspects of energy – Greenhouse effect- pollution-indoor and outdoor pollution- Energy scenario in India.

UNIT – III: (9 Hrs)

Solar collectors – Solar water heater- Solar cookers -box type cooker paraboloidal dish type solar cooker-community solar cooker-advance solar cooker – Solar furnaces – working and advantages -Solar greenhouse – winter and summer greenhouse- Solar desalination-simple basin type solar still.

BOOK FOR STUDY:

1. B.H. KHAN – Non-conventional Energy Resources, Tata Mc Graw Hill Publishing Ltd, 2006.
2. G.D. RAI – Solar Energy Utilization, Khanna Publishers, 1995.

14PHU20 **NUCLEAR PHYSICS** **Semester: VI/ 60 Hrs**

UNIT –I (13 Hrs)

Theories of Nuclear composition – proton – electron and proton – Neutron structures – Nuclear size – Experimental determination – measurement of Nuclear mass – isotopes – binding energy – mass defect and packing fraction – stability of nuclei – Weizasacker's semi empirical mass formula – Nuclear spin – Magnetic dipole moment – Nuclear models – Liquid drop model and Shell model (qualitative study only) Nuclear forces – Properties – Yukawa's theories of nuclear forces (qualitative study only).

UNIT – II (13 Hrs)

Natural radioactivity – properties of alpha rays – Gamow's theory of alpha decay (qualitative study) – alpha ray spectra – measurement of alpha ray energies – Range of alpha particle and its measurement – Geiger Nuttal law – properties of beta particles – Measurement of beta ray energies – continuous beta ray spectra-Neutron theory of beta decay – properties of gamma rays – interaction of gamma rays with matter – Nuclear isomerism – law of radioactive disintegration – half life period – law of successive disintegration – radioactive equillibrium – age of the earth.

UNIT – III (10 Hrs)

Detection of radiation –ionization chamber – GM counter- Wilson's cloud chamber – Bubble chamber – Scintillation counter – photographic emulsion technique – particle accelerators – Linear resonance accelerator – cyclotron –synchrocyclotron – betatron – Electron synchrotron.

UNIT – IV (12 Hrs)

Nuclear reactions: Artificial transmutations – Rutherford's experiment – Q value of the reaction – induced radioactivity – radio isotopes and their uses – transurnanic elements – nuclear energy – nuclear fission – qualitative explanation of fission using liquid drop model – chain reaction – condition for sustained chain reaction – controlled chain reaction – principle, construction and uses of nuclear reactor, atom bomb – nuclear fusion – stellar energy – controlled fusion – fusion – hydrogen bombs.

UNIT – V (12 Hrs)

Cosmic rays: discovery – primary and secondary cosmic ray – latitude effect, altitude effect and east west asymmetry – interaction of cosmic rays in the earth atmosphere – origin of secondary cosmic rays – experimental methods in cosmic ray research (qualitative) – cosmic ray shower – cascade theory – Van Allen belt – origin of cosmic ray – pair production and annihilation. Elementary particles: Classification – leptons – mesons and hyperons – the fundamental interaction – strong, weak, electromagnetic and gravitational interactions-Quark.

BOOKS FOR STUDY:

1) R.Murugesan – Nuclear Physics
2) Mani and Mehta – Modern Physics 1990.

REFERENCE BOOKS:

1) S.N.Ghoshal – Atomic and nuclear physics volume II
2) David and Halliday - Introductory Nuclear Physics
3) J.B.Rajam – Atomic Physics Pragathi Prakasam Publishers
4) Keplan – Nuclear Physics.

14PHU21 **MATERIAL SCIENCE** **Semester: VI/ 60 Hrs**

UNIT – I (11 Hrs)

CRYSTAL GEOMETRY AND CRYSTAL IMPERFECTIONS: The space lattice – space lattices and crystal structure – Crystal Directions and planes- Point imperfections – the geometry of dislocations – other properties of dislocations- surface imperfections.

UNIT –II (13 Hrs)

CONDUCTORS, SEMICONDUCTORS AND INSULATORS: The resistivity range – The free electron theory – conduction by free electrons – conductor and resistor materials – super conducting materials – The energy gap in solids –intrinsic semi-conductors – extrinsic semi conductors – semiconductor materials – Growth of semiconductor materials (Qualitative treatment) – Dielectrics- Polarization- Temperature and Frequency effects- Electric breakdown.

UNIT – III (12 Hrs)

MAGNETIC MATERIALS: Introduction – Different types of magnetic materials- Classical theory of Dia – Para magnetic materials- Domain theory of ferromagnetic materials- Ferrites. Hysterisis – Growth of Crystals from solution, melt and vapour (Qualitative)

POLYMERS: Classification of polymers- Structure of long chain polymers- Crystallinity of long chain polymers.

UNIT –IV (12 Hrs)

NANO MATERIALS AND APPLICATION: Introduction – various routes for the synthesis of nano materials- electronic structure of nano materials- correlation properties with size – semiconductor quantum dots- properties and applications of nano materials- nano medicines.

UNIT – V (12 Hrs)

NON DESTRUCTIVE TESTING (NDT): Radio graphic methods – photo elastic method – electrical method – ultrasonic methods – visual and other optical methods – thermal methods – surface defect detection by NDT – equipments used in non destructive testing- Microscope-Electron microscope – production of ultrasonic waves – magnetostriction ultrasonic generator – Piezo electric ultrasonic generator.

BOOKS FOR STUDY:

1. V.Raghavan- Material Science & Engineering A First Course (UNITS I, II, III) - Printice Hall of India, 2012, Fifth edition.

2. T.Pradeep – Nano: The essentials Tata Mc Hills Publishers (UNIT IV)

3. M.Arumugam – Material Science (Physics of materials) (UNIT V)

REFERENCE BOOKS:

1. M.A.Omer – Elementary Solid State Physics – Principles and applications
2. A.J.Dekkar – Solid State Physics

14PHU22 MICROPROCESSOR ARCHITECHTURE AND PROGRAMMING

Semester: VI/ 60 Hrs

UNIT – I (12 Hrs)

MICRO COMPUTERS, MICRO PROCESSOR AND ASSEMBLY LANGUAGE: Digital computers – computer languages – from large computers to single – chip microcomputers**.**

MICRO PROCESSOR ARCHITECTURE AND MICROCOMPUTER SYSTEMS: Microprocessor Architecture and its operations – Memory – input and output (I/O) Devices – Examples of a microcomputer system – Review: Logic Devices for interfacing.

UNIT – II (12 Hrs)

8085 MICRO PROCESSOR ARCHITECTURE AND MEMORY INTERFACING: The 8085 MPU – Example of a Microcomputer – Memory – input and output displays – How does an 8085 – Based Single Board Micro computer work.

INTERFACING I/O DEVICES: Basic interfacing concepts – interfacing output displays – interfacing input devices – memory – mapped I/O and I/O mapped I/O schemes.

UNIT – III (12 Hrs)

INTRODUCTION I/O 8085 ASSEMBLY LANGUAGE PROGRAMMING: The 8085 programming model – instruction classification – instruction format – How to write, Assemble and Execute a simple program – Overview of the 8085 instruction set.

INTRODUCTION TO 8085 INSTRUCTION: Data Transfer (copy) operations – Arithmetic operations – Logic operations – Branch operations – Writing assembly language programs – Debugging a program.

UNIT – IV (12 Hrs)

PROGRAMMING TECHNIQUES WITH ADDITIONAL INSTRUCTIONS: Programming techniques; Looping, counting and indexing – Additional Data transfer and 16-bit Arithmetic instructions – Arithmetic operations Related to Memory.

UNIT – V (12 Hrs)

STACK AND SUBROUTINES: Stack, Stack Pointer, Stack related instructions: PUSH, POP, XTHL, XCHG, SPHL, etc.; Subroutines, Unconditional/Conditional Call and Return instructions,

CODE CONVERSION, BCD, ARITHMETIC AND 16-BITS DATA OPERATORS: BCD-to-Binary conversion – BCD-to-Seven segment LED code conversion –Multiplication – subtraction with carry.

BOOKS FOR STUDY:

1. Microprocessor Architecture Programming and Application - Ramesh.S.Gaonkar
2. 8085 Microprocessor and its applications – A. Nagoor Kani
3. 8085 Microprocessor and its applications – V. Rajendran

REFERENCE BOOKS:

1. Introduction to Microprocessor - A.P. Mathur

2. Introduction to Microprocessor Hardware, Software, programming - Leventhal

CORE ELECTIVE - II

14PHU23A **ALTERNATE ENERGY RESOURCES** **Semester: VI/ 70 Hrs**

UNIT – I (14 Hrs)

INTRODUCTION: The Sun – Production and transfer of solar energy -consumption pattern – Oil shock – Types based on usage –usage pattern of primary energy sources – Necessity of harnessing alternate energy resources – Energy chain –Energy and its major classifications- alternate energy sources and their significances- Strategy for meeting the future energy requirements Global and National scenarios- Prospects of renewable energy sources- Global context –Indian context- scope of alternative energy system in India.

UNIT – II (14 Hrs)

SOLAR ENERGY : Introduction-Solar radiation - beam and diffuse radiation, solar constant-Photovoltaic conversion-Principles of Solar thermal conversion- solar collectors- Solar water heater-solar passive space heating and cooling systems- solar industrial heating systems- solar pond- solar still- flat plate collectors- concentrating collectors-solar cookers – solar furnaces- solar green house-solar desalination- solar pumping – satellite solar power stations.

UNIT – III (14 Hrs)

BIOMASS ENERGY: Biomass conversion technologies- photosynthesis- Biogas generation plants-classification- advantages and disadvantages, constructional details-site selection, digester design consideration, filling a digester for starting- maintaining biogas production- Fuel properties of bio gas-utilization of biogas.

UNIT – IV (14 Hrs)

GEOTHERMAL ENERGY: Estimation and nature of geothermal energy- geothermal sources and resources like hydrothermal, geo-pressured hot dry rock, magma. Advantages- disadvantages and application of geothermal energy- prospects of geothermal energy in India.

WIND ENERGY: Principle of wind energy conversion; Basic components of wind energy Conversion systems;-wind mill components- various types and their constructional features- design considerations of horizontal and vertical axis wind machines.

UNIT – V (14 Hrs)

HYDROGEN ENERGY: Introduction- Hydrogen Production methods, Hydrogen storage-hydrogen transportation- utilization of hydrogen gas- hydrogen as alternative fuel for vehicles. **FUEL CELLS:** Introduction, Design principle and operation of fuel cell- Types of fuel cells- conversion efficiency of fuel cell- application of fuel cells.

BOOK FOR STUDY:

1. B.H. Khan – Non-conventional Energy Resources, Tata Mc Graw-Hill
2. Publishing Company Ltd, 2006.
3. G.D. Rai – Solar Energy Utilization, Khanna Publishers, 1995.

4. S.P. Sukhatme- solar energy – Principles of thermal collection and storage- 2nd edition. Tata Mc-Hill –coy 2006.

BOOKS FOR REFERENCE:

1. Alternative Energy Sources - B.L. Singhal Tech Max Publication
2. Non Conventional Energy Resources - S.Hasan Saeed and D.K.Sharma
3. Fuel Cells - Bockris and Srinivasan; McGraw Hill
4. Magneto Hydrodynamics - Kuliovsky and Lyubimov, Addison
5. Solar Engineering of Thermal Processes - Duffic and Beckman, John Wiley

CORE ELECTIVE - II

14PHU23B **BIO AND NANO PHYSICS** **Semester: IV/70 Hrs**

UNIT – I (14 Hrs)

LAWS OF PHYSICS AND CHEMISTRY: Introduction – The electronic structure of the atoms – Molecular Orbital and Covalent bonds – Molecular interaction (a) Strong interaction (b) Weak interaction – Stereochemistry and chirality – Thermodynamics – Entropy – Enthalpy – The free energy of a system – Chemical potential – Oxidation-reduction potential – Radioactivity – Rate of radioactivity decay – Measurement of radioactivity – Biological effects of radiation – Applications of radio isotopes

UNIT –II: (14HRS)

PHYSICO-CHEMICAL TECHNIQUES TO STUDY BIOMOLECULES: Introduction – Hydration of macromolecules – Role of friction – Sedimentation – The ultracentrifuge –Rotational diffusion – Flow birefringence measurements – Electric birefringence – Light Scattering – Small angle X- ray Scattering – mass spectrometry – MALDI-TOF

UNIT –III (14 Hrs)

MACROMOLECULAR STRUCTURE: Introduction – Nucleic acid structure – The chemical structure of nucleic acids – Conformational possibilities of monomers and polymers – The double helical structure of DNA – polymorphism of DNA – DNA supercoiling and unusual DNA structures - DNA nanostructures – The structure of the transfer RNA – Protein structure – Amino acids and primary structure of protein – The peptide bond and secondary structure of the proteins- Tertiary structure-Supersecondary and domain structure – Quaternary structure – Virus structure

UNIT – IV (14Hrs)

ENERGY PATHWAYS IN BIOLOGY: Introduction – Free energy – Coupled Reactions –Group transfer potential – Role of pyridine nucleotides – Photosynthesis – Photosystem I- Photosystem II – Photophosphorylation and carbon fixation – Energy conversion pathways – Oxidation – Glycolysis – The Krebs cycle - The respiratory chain – Membrane transport – Active transport – Chemi-osmotic theory – passive transport

UNIT V (14Hrs)

SMART AND NANO MATERIALS: Self-healing structures-Recognition-Separation-Catalysts-Heterogeneous Nano structures and Composites-Encapsulation-Consumer goods-Biosensors-Molecular motors-Neuro-Electronic Interfaces-Protein Engineering-Carbon nanotubes-Soft molecule Electronics-Memories.

BOOKS FOR STUDY

1. Biophysics – Vasantha Pattabhi, N.Gautham. II edition (2009).Narosa Publishing House, New Delhi.

2. Nano Technology-Mark Ratner & Daniel Ratner. II Indian Reprint, 2005, Pearson Education.

REFERENCE BOOKS

1. Biophysics principles and techniques – M A. Subramanian, MJP pulishers, India

2. Basic Biophysics – M.Daniel – Agrobios Publishers.

14PHU24 PHYSICS PRACTICAL - III **Semester: VI**

(AT THE END OF SIXTH SEMESTER)

ANY 16 EXPERIMENTS*

1. Young's modulus –cantilever – dynamic method.
2. Young's modulus -Cantilever – depression – scale and telescope.
3. Spectrometer – Cauchy's constants
4. Spectrometer – grating – minimum deviation – dispersive power.
5. Potentiometer – resistance of a thermistor.
6. Ballistic Galvanometer – comparison of mutual inductances.
7. Ballistic Galvanometer – high resistance by leakage.
8. Conversion of galvanometer into a milli-voltmeter and to check with a Potentiometer.
9. Series resonant circuits
10. Voltage doublers and voltage quadruplers.
11. CRO – study of waveforms – Lissajous figures – determination of frequency
12. Young's modulus – Koenig's method – non uniform bending.
13. Young's modulus – Koenig's method –uniform bending.
14. Spectrometer – small angled prism.
15. Spectrometer – i – i' curve
16. Potentiometer – EMF of a thermocouple.
17. Potentiometer – calibration of high range voltmeter
18. Ballistic Galvanometer – absolute capacity of a condenser.
19. Ballistic Galvanometer – absolute mutual inductance
20. Parallel resonant circuits.
21. Regulated power supply using Zener diode – percentage of regulation.
22. Construction of DC power supply 9-0-9 $\bar{V}$
23. Hall effect (Demonsration)
24. Diffraction and interference using optic bench(Demonstration)

*Subject to the availability of the equipments, class hours etc.,

14PHU25 **PHYSICS PRACTICAL – IV (ELECTRONICS)** **Semester: VI**

(EXAMINATION AT THE END OF SIXTH SEMESTER)

***Any 16 Experiments Only**

1. Verification of Truth tables of IC gates: OR, AND, NOT, XOR, NOR and NAND.
2. NAND as universal building block- AND, OR, NOT
3. Verification of De Morgan's theorems.
4. Study of RS Flip-Flop.
5. Half adder and Full adder
6. Half Subtractor and Full Subtractor.
7. 4 BIT – Binary Adder & Subtractor using 7483.
8. BCD to seven segment Decoder(LED Display)
9. Binary Counter using 7493.
10. Parity checks logic.
11. Up/Down Counter using 74190
12. Study of Multiplexer using 74151
13. R.C. Coupled Amplifier – Transistor single stage
14. Hartley Oscillator – Solid State
15. Astable Multivibrator
16. Bistable Multivibrator
17. Differential and Integrating Circuits
18. Thermistor Characteristics
19. Study of Solar Cell
20. Logic Gates – Discrete components
21. Study of LDR
22. Testing of IC's – IC tester (Demonsration)
23. Using of micro processor kit(Demo only)

*Subject to the availability of the equipments, class hours etc.,