UNDER GRADUATE DEPARTMENT OF PHYSICS

B. Sc. – Physics Programme

(w. e. f. 2015-16 batch onwards)

Semester	Part	Course No.	Course Title	Hours	Credits	Marks
I	I	TAM / HIN / FRE 12XX		3	2	30
	II	ENG12XX		3	2	30
	IIIC	PHY1371	Physics Lab - I	3	3	45
	IIIC	PHY1551	Physics of Motion	5	5	75
	IIIC	PHY1553	Energy Physics	5	5	75
	IIIS	MAT14XX		5	4	60
	IVE	TAM12XX / Basic Tamil / Advance Tamil / NME12XX Non-Major		3	2	30
	IVLS	LSC12XX	Life Skill Course - I	3	2	30
	V	NCA / NCN / NSS / PED / SLP 11XX				
			Total	**30**	**25**	
II	I	TAM / HIN / FRE 12XX		3	2	30
	II	ENG12XX		3	2	30
	IIIC	PHY1372	Physics Lab - II	3	3	45
	IIIC	PHY1552	Geometrical & Physical Optics	5	5	75
	IIIC	PHY1554	Electrodynamics	5	5	75
	IIIS	MAT14XX		5	4	60
	IVE	TAM12XX / Basic Tamil / Advance Tamil / NME12XX Non-Major		3	2	30
	IVLS	LSC12XX	Life Skill Course - II	3	2	30
	V	NCA / NCN / NSS / PED / SLP 11XX			1	
			Total	**30**	**25+1**	
III	I	TAM / HIN / FRE 22XX		3	2	30
	II	ENG22XX		3	2	30
	IIIC	PHY2671	Physics Lab - III	6	6	90
	IIIC	PHY2573	Analog Electronics	5	5	75
	IIIC	PHY2475	Mathematical Physics	4	4	60
	IIIC	PHY2477	Modern Optics	4	4	60
	IIIS	CHE24XX		5	4	60
	V	NCA / NCN / NSS / PED / SLP 21XX				
			Total	**30**	**27**	
IV	I	TAM / HIN / FRE 22XX		3	2	30
	II	ENG22XX		3	2	30
	IIIC	PHY2672	Physics Lab - IV	6	6	90
	IIIC	PHY2574	Digital Electronics	5	5	75
	IIIC	PHY2476	Classical Mechanics	4	4	60
	IIIC	PHY2478	Quantum Mechanics & Relativity	4	4	60
	IIIS	CHE24XX		5	4	60
	V	NCA / NCN / NSS / PED / SLP 21XX			1	
			Total	**30**	**27+1**	

Semester	Part	Course No.	Course Title	Hours	Credits	Marks
V	IIIC	PHY3671	Physics Lab - V	6	6	90
	IIIC	PHY3673	Thermodynamics & Statistical Physics	6	6	90
	IIIC	PHY3575	Solid State Physics	5	5	75
	IIIC	PHY3677	Microprocessor & Communication Systems	6	6	90
	IVLS	LSC32XX	Life Skill Course - III	3	2	30
	IV	EVS32XX	Environment and Physics	4	2	30
			Total	**30**	**27**	
VI	IIIC	PHY3672	Physics Project	6	6	90
	IIIC	PHY3674	Atomic Physics & Spectroscopy	6	6	90
	IIIC	PHY3576	Nuclear Physics	5	5	75
	IIIC	PHY3680	Astronomy & Astrophysics	6	6	90
	IVLS	LSC32XX	Life Skill Course - IV	3	2	30
	IV	VAL32XX	Value Education	4	2	30
			Total	**30**	**27**	

Part III Supportive Courses offered to Non-Major Students:

Semester	Course No.	Course Title (Theory Cum Lab Courses)	Hours	Credits	Marks
I	PHY1481	Physics for Chemists – I	3+2	3+1	45+15
II	PHY1482	Physics for Chemists - II	3+2	3+1	45+15
III	PHY2481	Physics for Mathematics - I	3+2	3+1	45+15
IV	PHY2482	Physics for Mathematics – II	3+2	3+1	45+15
		Total	**20**	**16**	

Part IVLS Life-Skill Courses:

Semester	Course No.	Course Title	Hours	Credits	Marks
I	PHY1291	Handling of Tools & Machines	3	2	30
II	PHY1292 / PHY1294	Physics of Music / Photography & Digital Editing	3	2	30
V	PHY3291 / PHY3293	PC Management & Maintenance / Medical Instrumentation	3	2	30
VI	PHY3292 / PHY3294	Alternate Energy Resources / Consumer Electronics	3	2	30
		Total	**12**	**8**	

Part IVE Non-Major Elective Courses:

Semester	Course No.	Course Title	Hours	Credits	Marks
I	PHY1201	Basic Electricity &Electronics	3	2	30
II	PHY1202	Wonders of Sky	3	2	30
		Total	**6**	**4**	

PHY 2573 **Analog Electronics** **5 hr/5 cr**

Course Objective: *Enable the Students*

- *To understand the characteristics and applications of semiconductor devices and circuits.*
- *To analyze, select and bias the devices and study their applications.*
- *To construct, analyze, verify, and troubleshoot analog circuits using appropriate techniques and test equipment.*

Unit 1: Kirchhoff's Voltage Law, Kirchhoff's Current Law. Constant voltage source and current source and their conversion. Superposition Theorem. Thevenin's Theorem, Norton's Theorem and their conversion. Intrinsic and Extrinsic semiconductors, Energy Band diagram. Fermi level- Forward and reverse bias. Diode equation (no derivation) - regulated power supply and ripple factor - Clippers, clampers. Biased clipper and clamper, voltage multipliers, half wave & full wave rectification- bridge rectifier. Zener diode-voltage regulator, light emitting diodes, Laser diodes.

Unit 2: Bipolar Junction Transistors (BJT): Transistor fundamentals -configurations, DC operating point and load line. BJT characteristics - fixed bias, emitter bias potential divider bias. Analysis of above circuits and their design, variation of operating point and its stability.Two–port network. Hybrid Parameters.

Unit 3: Transistors Amplifier: Small Signal common base and common emitter amplifiers : AC equivalent circuit, hybrid model and their use in amplifier design. Multistage amplifiers, frequency response of basic & compound configuration, Power amplifiers: Class A, B, AB, C.

Unit 4: Feedback & Oscillator Circuits: Feed back- effect of positive and negative feedback, basic feedback topologies & their properties. Phase shift and Wien's bridge, RC oscillators with theory. Colpitt's and Hartley LC oscillators. Crystal Oscillators.

Unit 5: Operational Amplifier & FET: Characteristics of Op-Amp - Pin out of IC 741. Differential and Common mode operation. Inverting & Non Inverting Amplifier, Differential amplifier- Summing and difference amplifier. Integrator - differentiator - Comparator. Field-Effect Transistors (FET)-JFET- current-voltage characteristics. FET types only. FET amplifier.

Text Book(s)

1. Albert Malvino, David Bates , **Electronic Principles**. 8th Edition,. McGraw-Hill Education. 2015.
2. Floyd, **Electronic devices**, 5th Edition,, Pearson Education, 2001.

References

1. B.L.Theraja, **Basic electronics solid state,** S. Chand Publications, 2006.
2. V.K.Metha & Rohit Metha, **Principles of Electronics**, S Chand Publications, 2005.

PHY 2475 Mathematical Physics 4 hr/4 cr

Course Objective: *Enable the Students*

- *To gain knowledge in differential equations which are essential to solve advanced problems in physics.*
- *To understand special functions in mathematical methods.*
- *To learn the essentials of matrices.*

Unit 1: Differential Equations

Partial differential equations in Physics – method of separation of variables - separation of Helmholtz equation in Cartesian, spherical polar coordinates – Laplace's equation in various coordinate systems

Unit 2: Special Functions – I

Bessel functions – spherical Bessel function – Legendre polynomials – Hermite polynomials – Lagurre polynomials – recurrence relations – orthonormality relations.

Unit 3: Special Functions – II

Beta, gamma , Dirac Delta, Green's, Airy Functions – Green function for one dimensional problem - Eigen function expansion of Green's function

Unit 4: Matrices

Orthogonal, Unitary and Hermitian matrices and its properties – Eigen value and Eigen vector of a matrix – Matrix Diagonalization – Matrix representation of Linear operators – Special matrices in Physics

Unit 5: Integral Transforms

Fourier Integral – Fourier Transform – Convolution theorem – Applications of Fourier Transform – Laplace Transform – Laplace Transform of Derivatives - Convolution theorem – Applications of Laplace transforms

Text Book

1. K. Chattopadhyay, **Mathematical Physics**, New Age International, 2013.
   Unit 1: Chapter 2.1 – 2.3 ; Unit 2: Chapter 5.1 - 5.7; Unit 3: Chapter 5.8- 5.9, 6.1 -6.3; Unit 4: Chapter 7.8 - 7.10; Unit 5: Appendix B1 – B 9.

References

1. Charlie Harper, **Introduction to Mathematical Physics,** PHI Learning Pvt. Ltd., 2012.
2. Arfken, Weber, and Harris, **Mathematical Methods for Physicists,** Elsevier India Pvt. Ltd., 2013.

PHY 2477 Modern Optics 4 hr/4 cr

Course Objective: *Enable the Students*

- *To understand the fundamentals of propagation of light waves*
- *To understand the working principles of LASERS*
- *To gain knowledge about Fourier Optics*
- *To learn the fundamentals of Fiber optics*
- *To understand the concepts of Crystal Optics*

Unit 1: Light Wave

Reflection from Dielectrics – Intensities of the Transmitted Light - Internal Reflection – Phase Change on Reflection – Metallic Reflection – Optical Constants of Metals

Unit 2: Laser

Einstein Coefficients – Light Amplification – Threshold Condition – Laser Rate equation (Three Level Only) – Variation of Laser Power around Threshold – Line Broadening Mechanisms (no derivation) – types Lasers.

Unit 3: Fourier Optics

Fresnel and Fraunhofer Diffraction: Fraunhofer Diffraction – Diffraction Formula – Rectangular Aperture - Fresnel Diffraction – Diffraction Integral – Diffraction of a Gaussian Beam - Fourier Transform and Some of its Important Properties – holography.

Unit 4: Crystal Optics

Double Refraction – Wave Surface of Uniaxial Crystals – Propagation of Plane Wave in Uniaxial crystals – Elliptically and Circularly Polarized Light – Quarter and Half Wave Plates – Babinet Compensator.

Unit 5: Fiber Optics

Optical Fiber – Numerical Aperture – Multimode Graded Index Fibers – Single Mode Fibers – Pulse Dispersion in Step Index Fiber - Fiber Optic Communication Systems.

Text Book(s)

1. Jenkins and White, **Fundamentals of Optics,** 4th Edition, McGraw Hill, International Editions, New Delhi (2011).
   Unit 1: Chapter 25.1-25.4, 25.8, 25.9; Unit 4: Chapter 26.1, 26.2, 26.9, 27.1, 27.2, 27.4.
2. Ghatak A and K Thyagarajan, **Optical Electronics**, Cambridge University Press, Cambridge (1988).
   Unit 2: Chapter 8; Unit 3: Chapter 4.1-4.3, 5.1, 5.2, 5.4, 6.1, 6.2; Unit 5: Chapter 13.

References

1. Ajoy Ghatak, **Optics**, 3rd Edition, Tata McGraw Hill Limited, New Delhi (2005).

PHY 2574 **Digital Electronics** **5 hr/5 cr**

Course Objective: *Enable the Students*

- *To understand the fundamentals of Digital Electronics*
- *To know the different number systems and codes used in digital electronics*
- *To gain knowledge about logic gates and Boolean algebra*
- *To learn about the combinational and sequential logic systems*
- *To understand the function of D/A and A/D converters*
- *To be exposed to various memory devices*

Unit 1: Digital Signals and Logic, Storing and transferring digital information, Basic Gates and universal logic Gates, Positive and Negative logic, Combinational Logic Circuits: Boolean laws and basic theorems, Sum-of-Products method, Karnaugh map (up to 4 variables), Karnaugh simplification (with don't care conditions), Product-of-Sum method, POS simplification.

Unit 2: Binary number system, Decimal-Binary-Octal and Hexadecimal-their representation, Inter-conversion, BCD, Weighted binary codes, ASCII character code, excess-3 code, Gray code and Error detecting and correcting code, Binary to Gray code conversion and vice-versa, Binary addition and subtraction, Unsigned and Sign-magnitude numbers, 2's complement representation, 2's complement arithmetic, Half adder, Full adder, Half subtractor, Full subtractor.

Unit 3: Data Processing Circuits: Multiplexers, Demultiplexers, Decoders: 1-of-16 Decoder, BCD-to-decimal Decoders, Seven-segment Decoders, Encoders: Decimal to binary, Decimal to BCD, Octal to binary and Priority Encoders, Exclusive -OR Gates, Parity checker, Parity generator, Magnitude comparator, Read-only Memory, Programmable Array Logic, Programmable Logic Arrays.

Unit 4: Flip-flops: RS Flip-flops, Gated Flip-flops, Edge-triggered RS, D and JK Flip-flops, Flip-flop Timing, JK Master/slave Flip-flops. Shift Registers, Serial in-Serial out, Serial in-Parallel out, Parallel in-Serial out and Parallel in-Parallel out shift registers, Ring Counters, Synchronous and Asynchronous Counters, Mod-3 and mod-6 counters, Decade Counters, Cascaded counters, Synchronous up/down counter.

Unit 5: Schmitt Trigger, Astable, Monostable and Bistable multivibrators, Basics of digital signal processing, A/D conversion, Simultaneous type A/D converter - Successive approximation type A/D converter, Specifications of D/A converter, Binary-Weighted-input D/A converter, Memory: Basic terms and ideas, Memory addressing, RAMs, ROMs, PROMs and EPROMs.

Text Book(s)

1. Donald P Leach, Albert Paul Malvino and Goutam Saha, **Digital Principles and Applications,** 6th Edition, The McGraw-Hill Companies 2006.
   Unit 1: Chapter 1.1, 1.3, 1.4, 2.1, 2.2, 2.4, 3.1-3.8; Unit 2: Chapter 5.1-5.8, 6.1-6.8; Unit 3: Chapter 4.1-4.7, 4.8-4.12; Unit 4: Chapter 8.1-8.7, 9.1-9.6, 10.1, 10.3-10.6; Unit 5: Chapter 7.3- 7.5, 13.1-13.7.
2. Thomas L Floyd, **Digital Fundamentals,** 8th Edition, Pearson Education 2003.
   Unit 2: Chapter 2.10, 2.11; Unit 4: Chapter 9.5; Unit 5: Chapter 14.1, 14.3, 14.5.

References

1. Morris M Mano and Michael D Ciletti, **Digital Design,** 4th Edition, Pearson Prentice Hall 2006.
2. S Salivahanan and S Arivazhagan, **Digital Circuits and Design,** 4th Edition, Vikas Publishing House Pvt Ltd 2013.

PHY 2476 **Classical Mechanics** **4 hr/4 cr**

Course Objectives: *Enable the Students*

- *To review Newtonian mechanics and constraints.*
- *To introduce the concepts of generalized coordinates and Lagrangian formulation.*
- *To impart the applications of central force motion and Hamiltonian formulations.*
- *To inculcate a strong emphasis on the foundations of rigid body dynamics and small oscillations.*

Unit 1: Review of Newtonian Mechanics and Constrained Motion

Frames of reference - inertial and non-inertial frames - Mechanics of a particle - Motion under constant, time- dependent, velocity dependent forces. Motion of charged particle in Magnetic field - System of particles: centre of mass –conservation of linear and angular momentum - kinetic energy for a system of particles - Energy conservation of system of particles. Constraints - Holonomic – Non-holonomic constraints – Scleronomous and Rheonomous constraints

Unit 2: Lagrangian Formulation and Variational Principle

Generalized coordinates - degrees of freedom - configuration of space - Lagrange's equations - Kinetic energy in generalized co-ordinates - generalized momentum - first integrals of motion - and cyclic coordinates - velocity dependent potential - dissipative force - Newtonian and Lagrangian formalisms. Variational Principle: Hamilton's principle-deduction of Hamilton's principle-Lagrange's equation from Hamilton's principle .

Unit 3: Central force Motion and Hamiltonian Formalism

Reduction to one-body problem-general properties of central force motion-effective potential-classification of orbits-Motion in a central force field- inverse square law of force-Kepler's laws- laws of gravitation from Kepler-Scattering in a central force field. Hamiltonian formalism: The Hamiltonian of system- Hamilton's equations of motion-Hamilton's equations from variational principle-Integrals of Hamilton's equations.

Unit 4: Canonical Transformations, Poisson Brackets and Rotational motion

Canonical transformations-Poisson brackets-Poisson bracket and integrals of motion-the canonical invariance of Poisson bracket-Lagrange's brackets

Motion of rigid bodies: Angular momentum-kinetic energy-Inertia tensor-principal axes- Euler's angles-Infinitesimal rotations- rate of change of a vector - Coriolis forces- Euler's Equations of motion-Force free motion of a symmetrical top.

Unit 5: Small oscillations

Theory of small oscillations: Equilibrium and potential energy-Theory of small oscillations- normal modes-two coupled pendulum-longitudinal vibrations of CO_2 molecule.

Text Book

1. G.Aruldhas, **Classical Mechanics,** PHI Learning Private Limited, 2013. Unit1: Chapter 1, 2 & 3 1.1-1.8, 2.1-2.6, 3.1,3.3-3.4; Unit 2 : Chapter 3 & 4 3.2,3.5-3.8, 3.10-3.12,4.1-4.4; Unit 3: Chapter 5 & 6 5.1-5.8, 5.12, 6.1-6.4; Unit 4: Chapter 6 6.6-6.12; Unit 5: Chapter 8 & 9 8.1-8.12, 9.1-9.5.

References

1. J. C. Upadhyaya, **Classical Mechanics**, HimalayaPublishing House.
2. K. Sankara Rao, **Classical Mechanics,** PHI Learning Private Limited,2011
3. H. Goldstein, **Classical Mechanics,** Narosa PublishingHome, New Delhi.

PHY 2478 Quantum Mechanics and Relativity 4 hr/4 cr

Course Objective: *Enable the Students*

- *To understand the inadequacies of classical physics*
- *To understand the fundamentals of quantum mechanics*
- *To learn the skills of quantum mechanics and its applications to free state and bound states*
- *To understand the concepts of Special theory of relativirty.*

Unit 1: Dual nature of matter

Electromagnetic waves - blackbody radiation- photoelectric effect - X-ray diffraction - Compton effect - pair production - photons and gravity - De-Broglie waves - Davisson and Germer experiment-uncertainty principle.

Unit 2: Elements of quantum mechanics

Wave function- linearity and superposition-normalization- probability density-probability current density-expectation value-Schrodinger wave equation- statistical interpretation- time dependent and independent form- operators: Hermitian operators- commuting and non-commuting observables- Eigen values and Eigen functions- momentum.

Unit 3: Free State problems

Particle in field free space- Wave packet- phase and group velocities- step potential-barrier potential-particle flux: incident- penetrated and reflected- transmission probability- finite square well-free states- delta function potential.

Unit 4: Bound state problems

Infinite potential well- particle in a box- degeneracy- quantized states- normalized wave functions- expectation values- harmonic oscillator- energy Eigen values and Eigen functions- zero point energy-. Schrodinger equation for one electron atom-separation of variables- radial and angular part of Schrodinger equation- quantum numbers- spherical harmonics (qualitative discussion only)

Unit 5: Theory of relativity

Galilean and Newtonian relativity- Michelson-Morley experiment- Einstein's relativity- postulates- Lorentz transformation- length contraction- time dilation- mass variation- mass-energy equivalence-- Lorentz transformation- velocity transformation-relativistic momentum, force and kinetic energy- Minkowski space

Text Book(s)

1. Arthur Beiser, **Concepts of modern physics,** 4th Edition. - Tata McGraw-Hill (2003).
   Unit 1: Chapter 2.1-2.9, 3.1-3.5, 3.7-3.9; Unit 2: Chapter 5.1-5.7; Unit 4: Chapter 5.8, 5.11, 6.1-6.7; Unit 5: Chapter 1.1-1.9.
2. D.J. Griffiths, **Introduction to Quantum Mechanics**
   Unit 2: Chapter 2-1.1-1.5; Unit 3: Chapter 2-2.4-2.6, Text-1-5.9, 5.10.

References

1. F.K.Ritchmeyer, E. H. Kennard and John N. Kooper, **Introduction to Modern Physics.**
2. Cohen Tannoudji, Bernard Diu and F.Lalou, **Quantum mechanics** (vol.1& vol.2).

PHY 2671 Physics Lab – III 6 hr/6 cr

Course Objective: *Enable the Students*

- *To have hands-on experience in the measurements*
- *To record and process the measurements*
- *To correlate with the respective theoretical concepts and*
- *To draw non-trivial conclusions of the significance of the experiments*

S. No.	Experiment
1	Solar Constant – using Lee's Disc
2	Spectrometer – Cauchy's Constants
3	Spectrometer – (i-i') Curve
4	Spectrometer – Dispersive Power
5	Newton's Rings
6	Fresnel's biprism
7	Field along the axis of a circular coil – Determination of M &B_H
8	LCR circuits - Series
9	Constant Deviation Spectrograph – Calibration and Wavelength measurement
10	Potentiometer – Calibration of Voltmeter / Ammeter
11	Joule's Calorimeter
12	De Sauty Bridge – Capacitance of a Capacitor
13	Temperature Coefficent - Thermistor
14	Measurement of e/m ratio of electron – using CRT
15	Bandgap measurement - Semiconductors
16	Charge of electron – Milliken's oil drop method
17	Measurement of Hall Coefficient
18	Michelson Interferometer – Wavelength separation
19	Measurement Planck's constant – Photoelectric Effect
20	Spectral Analysis

PHY 2672 Physics Lab – IV 6 hr/6 cr

Course Objective: *Enable the Students*

- *To have hands-on experience in the measurements*
- *To record and process the measurements*
- *To correlate with the respective theoretical concepts and*
- *To draw non-trivial conclusions of the significance of the experiments*

S. No.	Experiment
1	Dual Power Supply – PCB Making
2	Dual Power Supply – Construction & Characterization
3	Phase, frequency and voltage measurements - using CRO
4	Full Wave Rectifier
5	Bridge Rectifier
6	Network Theorems
7	Zener diode Characterization – Voltage regulation
8	Wave Shaping – Clipping & Clamping
9	Transistor Characteristics
10	Single stage amplifier
11	Transistor multivibrators – Monostable & Astable
12	Square wave generation Using 555 & 741
13	Colpitt's Oscillator
14	Phase shift Oscillator
15	Hartley Oscillator
16	FET Characteristics
17	FET Amplifier
18	Op-amp – Characteristics
19	Op-amp – applications
20	Op-amp – Filters

PHY 2481 Physics for Mathematics-I 5(3+2) hr / 4(3+1) cr

Course Objective: *Enable the Students*

- *To understand the fundamental of Mechanics and wave motion*
- *To know the motion of a particle in one, two and three dimensions*
- *To gain knowledge about the properties of gravitation which is one of the fundamental and universal forces of nature*
- *To develop a mathematical description of waves.*
- *To import skills in measurements by doing experiments*

Unit 1: Position, Velocity and Acceleration, One dimensional kinematics, Motion with constant acceleration, Free falling bodies, Projectile motion, Linear momentum, Impulse, Force, Conservation of momentum, Two-body collision, Rotational variable, Rotation with constant acceleration, Relationship between linear and angular variables, Angular momentum of a particle, System of particles, Torque, Conservation of angular momentum.

Unit 2: Work done on a system by external forces, Internal energy in a system of particle, Frictional work, Conservation of energy in a system of particles

Unit 3: Newton's law of universal gravitation, Gravitational constant, Gravitation near the earth's surface, The two shell theorem, Gravitational potential energy, Motions of planets and satellites,

Unit 4: Simple harmonic oscillator, Simple harmonic motion, Energy in simple harmonic motion, Applications of simple harmonic motion, Damped harmonic motion, Forced oscillations.

Unit 5: Mechanical waves, Types of waves, Travelling waves, Sinusoidal waves, The wave equation, Interference of waves, Standing waves and resonance, Properties of sound waves, Travelling sound waves, Speed, power and intensity of sound waves, Interference of sound waves, Standing longitudinal waves, Vibrating systems and sources of sound, Beats, The Doppler effect.

Text Book

1. David Halliday, Robert Resnick and Kenneth S Krane, **Physics-Vol I,** 5th Edition, John Wiley & Sons, Inc 2007.
   Unit 1: Chapter 2.3- 2.6, 4.3, 6.2- 6.5, 8.2, 8.4, 8.5, 10.1, 10.2, 10.4; Unit 2: Chapter 13.1-13.4; Unit 3: Chapter 14.2- 14.7; Unit 4: Chapter 17.2- 17.5, 17.7, 17.8; Unit 5: Chapter 18.1- 1.3, 18.5, 18.8, 18.10, 19.1- 19.9.

References

1. D.S.Mathur, **Elements of Properties of Matter**, 11th Edtion, S.Chand Publications, 2014.
2. Brij Lal and N. Subrahmanyam, **Properties of Matter**, 4th Edition, Eurasia Publishing House (Pvt) Ltd., 2003

List of Experiments:

Objective: *Enable the Students*

- *To have hands-on experience in the measurements*
- *To record and process the measurements*
- *To correlate with the respective theoretical concepts and*
- *To draw non-trivial conclusions of the significance of the experiments*

S. No.	Experiment
1	Error Analysis (Simple pendulum / UV method)
2	Precise Linear Measurements (Screw Gauge & Vernier Calipers)
3	Usage of Travelling Microscope – Radius of the Capillary tube
4	Spectrometer – Refractive Index
5	Spectrometer – grating
6	Thermal Expansion (Light & Telescope) – Coefficient of thermal expansion
7	Compound Pendulum – 'g' and Radius of Gyration
8	Sonometer – Verification of Laws
9	Newton's Law of Cooling – Specific heat capacity of Liquid
10	Plane grating – using CD

PHY 2482 Physics for Mathematics-II 5(3+2) hr / 4(3+1) cr

Course Objective: *Enable the Students*

- *To understand the basics of Electricity and Magnetism*
- *To know the fundamental laws of electricity and the behavior of a capacitor*
- *To gain knowledge about magnetic field and inductance coil*
- *To understand the operation of electronic devices*
- *To import skills in measurements by doing experiments*

Unit 1: Electric charge, Coulomb's law, Continuous charge distribution, Electric field, Electric field of point charges and of continuous charge distributions, Gauss' law, Applications of Gauss' law,

Unit 2: Electric potential energy, Potential due to point charges, collection of point charges and an electric dipole, Electric potential of continuous charge distributions, Calculating the field from the potential, Potential of a charged conductor, Capacitance, Capacitors in series and parallel, Energy stored in an electric field, Capacitor with a dielectric.

Unit 3: Magnetic force on a moving charge and a current- carrying wire, Torque on a current loop, Magnetic field due to a moving charge, Magnetic field of a current and a solenoid, Ampere's law, Faraday's law of induction, Lenz's law, induction and energy transfers, Self inductance, LR circuit, LCR circuit.

Unit 4: Intrinsic and Extrinsic semiconductor, Formation and V-I characteristics of PN junction diode, Zener diode and LED, Transistors, Various configurations of transistor, CE transistor amplifier, Operational amplifier and its characteristics, inverting and non inverting amplifier, adder, subtractor, differentiator, integrator.

Unit 5: Logic gate – Universal logic gates - Half adder, Full adder, Half subtractor, Full subtractor - Decoders: 1-of-16 Decoder, BCD-to-decimal Decoders, Seven-segment Decoders - Flip-flops: RS Flip-flops, D and JK Flip-flops, Shift Registers - Synchronous and Asynchronous Counters.

Text Book(s)

1. David Halliday, Robert Resnick and Kenneth S Krane, **Physics-Vol II**, 5th Edition, John Wiley & Sons, Inc 2002.
   Unit 1: Chapter 25.2, 25.4, 25.5, 26.2- 26.4, 27.4, 27.5; Unit 2: Chapter 28.2, 28.5-28.7, 28.9, 30.1- 30.6; Unit 3: 32.2, 32.5, 32.6, 33.1, 33.2, 33.4, 33.5, 34.2, 34.3, 36.1-36.4, 37.3.
2. B.L.Theraja, **Basic Electronics-Solid State**, 5th Edition, S.Chand & Company Ltd, 2005.
   Unit 4: Chapter 12.24, 12.25, 13.1- 13.7, 14.1, 15.1, 16.3, 17.9-17.11, 17.13, 17.14; Unit 5: Chapter 18.1, 18.6, 22.5- 22.7, 31.18- 31.21, 31.24-31.25, 31.27- 31.30.

References

1. Thomas L Floyd, **Digital Fundamentals** , 8th Edition, Pearson Education 2003.
2. A. Ambrose and T. Vincent Devaraj**, Elements of Solid State Electronics,** 4th Edition, Meera Publications 1993.

List of Experiments:

Objective: *Enable the Students*

- *To have hands-on experience in the measurements*
- *To record and process the measurements*
- *To correlate with the respective theoretical concepts and*
- *To draw non-trivial conclusions of the significance of the experiments*

S. No.	Experiment
1	Coefficient of Viscosity – Burette Method
2	Surface Tension – Capillary Rise
3	Young's Modulus - Uniform bending
4	Rigidity Modulus – Torsion Pendulum
5	Melde's Apparatus
6	Specific heat Capacity – Method of mixtures
7	Junction Diode Characteristics
8	Logic gates – universal gates
9	OP-AMP – Inverting & Non-inverting
10	Lee's Disc – Thermal conductivity

Undergraduate Department of Physics (SF)

Programme for B.Sc Physics from 2015 series

SEM	Part	Course No.	Course Title	Hours	Credits	Marks
1	I	TAM/FRE/HIN		3	2	30
1	II	ENS 1361	Conversational skill	3	2	30
1	IIIC	PHS1331	Physics Lab – I	3	3	45
1	IIIC	PHS1553	Mechanics	5	5	75
1	IIIC	PHS 1555	Geometrical Optics	5	5	75
1	IIIS	MAS1471	Mathematics – I	5	4	60
1	IVLS1	PHS 1231	Life Skill – I	3	2	30
1	IVNME1	PHS 1233	NME – I	3	2	30
			Total	**30**	**25**	**375**
2	I	TAM/FRE/HIN		3	2	30
2	II	ENS1362	Reading & Writing skill	3	2	30
2	IIIC	PHS1332	Physics Lab – II	3	3	45
2	IIIC	PHS1554	Electricity & Magnetism	5	5	75
2	IIIC	PHS 1556	Analog Electronics	5	5	75
2	IIIS	MAS1472	Mathematics – II	5	4	60
	IVLS2	PHS 1232	Life Skill – II	3	2	30
2	IVNME2	PHS 1234	NME – II	3	2	30
2	V	XXXxxxx	Extension Activity(NSS/NCC,PED,SLP)	2	1+1	
			Total	**30**	**25**	**375**
3	I	TAM/FRE/HIN		3	2	30
3	II	ENS2361	Studies Skill	3	2	30

3	IIIC	PHS2661	Physics Lab – III	6	6	90
3	IIIC	PHS2463	Thermodynamics& Statistical Physics	4	4	60
3	IIIC	PHS2445	Astrophysics& Relativity	4	4	60
3	IIIC	PHS 2547	Physical Optics	5	5	75
3	IIIS	CHE2471	Chemistry – I	5	4	60
			Total	**30**	**27**	**405**
4	I	TAM/FRE/HIN		3	2	30
4	II	ENS2362	Career Skill	3	2	30
4	IIIC	PHS2662	Physics Lab – IV	6	6	90
4	IIIC	PHS2464	Classical & Quantum Physics	4	4	60
4	IIIC	PHS2446	Digital Electronics	4	4	60
4	IIIC	PHS 2548	Mathematical Physics	5	5	75
4	IIIS	CHE2472	Chemistry – II	5	4	60
4	V	XXXxxxx	Extension Activity(NSS/NCC,PED,SLP)	2	1+1	
			Total	**30**	**27**	**405**

SEM	Part	Course No.	Course Title	Hours	Credits	Marks
5	IIIC	PHS3661	Physics Lab – V	6	6	90
5	IIIC	PHS3553	Atomic Physics and Spectroscopy	5	5	75
5	IIIC	PHS3445	Energy Physics	4	4	60
5	IIIC	PHS3447	Computational Physics	4	4	75
	IIIC	PHS3449	Medical Physics	4	4	60
5	IVLS3	PHS3231	Life Skill Course -III	3	2	30
5	IVVE	PHS 3200	Environmental Physics	4	2	30
			Total	**30**	**27**	**405**
6	IIIC	PHS3662	Physics Project	6	6	90
6	IIIC	PHS3554	Communication system and Microprocessor	5	5	75
6	IIIC	PHS3446	Nuclear Physics	4	4	60
6	III C	PHS3448	Solid State Physics	4	4	60
6	III C	PHS3450	Modern Optics	4	4	60
6	IVLS	PHS3232	Life Skill Course - IV	3	2	30
6	IVVE	HVS 3200	Value Education	4	2	30
			Total	**30**	**27**	**405**
Grand Total for Semester I - VI				**180**	**158**	**2370**

Courses offered to Non-Major Students by the Department of PHYSICS

SEM	Course No.	Course Title	Hours	Credits	Marks
I	PHS1471	Physics for Mathematics – I	5	4	60
II	PHS1472	Physics for Mathematics – II	5	4	60
III	PHS 2473	Microcontroller and programming	5	4	60
III	PHS2471	Physics for Chemists – I	5	4	60
IV	PHS2472	Physics for Chemists – II	5	4	60
		Total	**20**	**16**	**240**

Part III Major Supportive Courses

Part IVLS Life Skill Courses:

SEM	Course No.	Course Title	Hours	Credits	Marks
I	PHS1231	Maintenance of Home Appliances	3	2	30
II	PHS1232	FM Radio theory & practice	3	2	30
V	PHS3231	Medical Instrumentation	3	2	30
VI	PHS3232	Renewable Energy	3	2	30
		Total	**12**	**8**	**120**

Part IVE Non Major Elective Courses

SEM	Course No.	Course Title	Hours	Credits	Marks
I	PHS1233	Basic Electronics	3	2	30
II	PHS1234	Wonders of Sky	3	2	30
		Total	**6**	**4**	**60**

PHS 2661 PHYSICS LAB III 6 hr / 6cr

Preamble

The study of light and the interaction of light with matter is termed optics. The refractive quality of lenses is frequently used to manipulate light in order to change the apparent size of images. Magnifying glasses, spectacles, contact lenses, microscopes and refracting telescopes are all examples of this manipulation. Electric currents and the magnetic moments of elementary particles give rise to a magnetic field, which acts on other currents and magnetic moments. The magnetic state (or magnetic phase) of a material depends on temperature and other variables such as pressure and the applied magnetic field.

Objectives

Enable the students

- To impart skills in measurement, design.
- To plan experimental procedures and keep records.
- To understand results to reach non-trivial conclusion about significance of results of the experiments.

1) Study the interference pattern formed by Young's Double slit experiment
2) Study the Spherical aberration of different lenses
3) Spectrometer: Determine the angle of emergence for various angles of incidence and to draw the (i-i') curve and also to find the refractive index of the prism using spectrometer.
4) Spectrometer (plane transmission grating): Determine the number of lines per meter of the grating and to find the wavelength of spectral lines using Spectrometer.
5) Spectrometer: Determine the refractive index of a small angled prism
6) To determine the radii of curvature of a double convex lens by forming Newton's ring
7) Interpret the I-V characteristics of the Solar Cell
8) Determine the wavelength of the given source using Fresnel's Biprism
9) To compare the emf of two primary cells using potentiometer.
10) To Calibration of Low range voltmeter using potentiometer.
11) Determination of M and B_H using Bar magnet
12) Construct LCR series & parallel
13) Determine the value of unknown inductor using Anderson Bridge
14) Determine the specific heat capacity of liquid using Joule's Calorimeter
15) To determine thermal conductivity of a bad conductor using Lee's disc
16) Determine the B_H of the Magnet using Field Along the axis of a circular coil
17) Study the Resolving power of telescope

A minimum of any **sixteen** experiments shall be carried out.

PHS 2463 THERMODYNAMICS AND STATISTICAL PHYSICS 4 hr /4 cr

Preamble

Thermo-dynamics is the subject of the relation of heat to forces acting between contiguous parts of bodies, and the relation of heat to electrical agency. The laws of thermodynamics are explained in terms of microscopic constituents by statistical mechanics. A common use of statistical mechanics is in explaining the thermodynamic behaviour of large systems.

Objectives

Enable the students

- To understand the fundamental concept of thermodynamics
- To aware the principles of partition function, transport phenomenon and its applications
- To gain knowledge in statistical Physics

Unit 1 : Thermodynamic systems

The Zeroth law of thermodynamics – thermodynamic equilibrium – Measurement of temperature - equation of state of an ideal gas and real gases – Expansivity and Compressibility - first law of thermodynamics – internal energy – Heat Capacity - Joule-Thomson effect - Carnot cycle – heat engine and refrigerator.

Unit 2 : Second law of thermodynamics

The second law of thermodynamics – Entropy – Tds equations – Entropy and Enthalpy of an ideal gas– Helmholtz function and Gibbs function – thermodynamic potentials – Maxwell Relations - phase transitions – Clausius-Clapeyron equation - third law of thermodynamics.

Unit 3: Applications of thermodynamics and Kinetic theory

Chemical potential – Gibbs Phase Rule - Black body radiation - Kinetic theory – principle of equipartition of energy – classical theory of specific heat capacity – Transport Phenomena: Viscosity, diffusion.

Unit 4: Statistical physics

Energy states and energy levels - macrostates and microstates – thermodynamic probability – Bose-Einstein statistics –Fermi-Dirac statistics – the Maxwell-Boltzmann statistics

Unit 5: Applications of statistical physics

BE, FD, and MB distribution functions – Comparison of distribution functions for indistinguishable particles - statistical interpretation of entropy – comparison of distribution functions for indistinguishable particles – partition function. Applications of statistical physics –distribution molecular velocities – experimental verification - ideal gas in gravitational field –quantized linear oscillator.

Text Book:

F. W. Sears and G. L. Salinger, Thermodynamics, Kinetic theory, and Statistical Thermodynamics, IIIrd ed., Narosa Publishing House(1998).

References:

1. David Halliday, Robert Resnick and Kenneth S. Krane. "*Physics Vol. II",* Vth ed., John Wiley , (2002)
2. R. P. Feynmann, Feynmann lectures on Physics Vol.I, Addison-Wesley Narosa Pub (1989).
3. H.C Verma, ,"Concepts of Physics", Bharati Bhawan (P&D) (2015)

PHS 2445 ASTROPHYSICS AND RELATIVITY 4hr/ 4 cr

Preamble

Modern astronomical research often involves a substantial amount of work in the realms of theoretical and observational physics. Some areas of study for astrophysicists include their attempts to determine the properties of dark matter, dark energy, and black holes; whether or not time travel is possible, wormholes can form, or the multiverse exists; and the origin and ultimate fate of the universe. Concepts introduced by the theories of relativity include spacetime as a unified entity of space and time, gravitational time dilation, and length contraction.

Objectives

Enable the students

- To understand the concept of solar system, birth and evolution of a star
- To know the principles and working of detector instruments
- To earn knowledge in understanding galaxy, basis of origin of universe

Unit 1: Positional Astronomy and Gravitation

Birth of modern astronomy- Geocentric and heliocentric –Copernicus revolution – Kepler cosmology – Celestial sphere – coordinate systems: horizontal , equatorial systems – Kepler's Laws – Newtonian gravitation – seasons – Eclipse – Solar, lunar - Tides and precession - solar family – inventor of solar systems – our moon – mariner and mars – Venus and mercury –Jovian planets.

Unit 2: Stellar Objects

Stellar distance- stellar spectra –the Hertzsprung- Russel diagram - magnitude of star light – evolutionary stages of stars – birth of stars – maturity and old age star clusters white dwarfs as dead stars – fate of stars.

Unit 3: Observational Astronomy

Astronomical observations – optical telescopes – Reflecting – refracting – telescope mount – electronic detector – spectroscopy – Radio telescope – resolving power of radio telescope – radio interferometry – UV-IR-X-ray telescopes.

Unit 4: Galaxies & Cosmos

Galaxy - types of galaxies- Cosmological principles –big bang the expanding universe- cosmological model – open, close universe – steady state universe – Hubble's law – maximum age of universe - Evidence for Einstein's gravitation.

Unit 5: Relativity Theory

Special Theory of Relativity - Lorentz transformation - Length contraction and time dilation - Conservation of mass and momentum - General Theory of Relativity - Relativistic Doppler shift and aberration of light - Elementary ideas about general theory of relativity with observational tests.

Text Books :

1. William Kaufmann **"**Astronomy: The Structure of the Universe**"**, McMillan Publishing Co.inc, New York(1999).

2. R.Alder, M.Bazrin and M.Schiffer, , 'Introduction to General Theory of Relativity', McGraw Hill Publications(1975) .

References:

1. George O.Abell, Exploration of the Universe, Tata McGraw Hill Publishing, New Delhi(1978) .
2. Frank H.Shu,The Physical Universe : An Introduction to Astronomy, , University Science Books(1982***)***.

PHS 2547 PHYSICAL OPTICS 5hr/ 5 Cr

Preamble

Physical optics is an intermediate method between geometric optics, which ignores wave effects, and full wave electromagnetism, which is a precise theory. The concepts of physical optics is applied in electrical engineering and applied physics.

Objectives

Enable the Students

- To understand the nature and propagation of light waves
- To understand the basic principles of interference, diffraction and polarization of light
- To know the various experimental methods involving the above said properties of light

UNIT 1: Interference

Huygen's principle - Young's experiment – Interference fringes from a double source –Fresnel's Biprism – Fresnel's mirror – Lloyd's mirror – Michelson interferometer – circular fringes and localized fringes – white light fringes – Newton's rings – Fabry Perot interferometer

UNIT 2: Diffraction - Fraunhofer

Fraunhofer diffraction for single slit – rectangular aperture – circular aperture - resolving power - diffraction due to a double slit – effect of finite width of source slit - diffraction due to a grating – formation of spectra by grating

UNIT 3: Diffraction - Fresnel

Fresnel's diffraction – shadows – Fresnel's half period zones – circular aperture – zone plates – circular division of wave front – strip division of wave front – Cornu's spirals – Fresnel's integrals – diffraction by straight edge

UNIT 4: Polarization

Polarization by reflection – polarising angle and Brewster's law – pile of plates – law of Malus – Dichoric crystal – double refraction – Nicol prism – refraction by calcite crystals – optical activity by scattering

UNIT 5: Lasers and Applications

Stimulated emission – Einstein's quantum theory of radiation – Basic principles of Laser – Characteristics , three level and four level Laser system, pumping rate equation, threshold condition –Solid state Laser – Semiconductor laser – Gas laser - applications

Text Books:

1. Jenkins and White, Fundamentals of optics, 3rd Edn, Mc Graw Hills, International Editions, New Delhi, (2000).
2. Ajoy Ghatak, Optics, 3rd edn, Tata McGraw Hill Limited, New Delhi, (2005).
3. Ghatak and Thygarajan, Lasers, Theory and applications, Macmillan India Ltd., New Delhi, (1984).

References:

1. B.B.Laud, Lasers and Non linear Optics,2nd edition, New Age International(o) Ltd, Publishers, New Delhi (1987).
2. Frank L.Pedrotti & Leno S.Pedrotti, Introduction to Optics, Prentice – Hall Int. Inc. New Jersey(1992).
3. Halliday, Resnick and Krane, Physics, Part II 5thedn, Wiley, NY(2003).
4. K.K.Sharma, Optics-principle and application, Elsevier, New Delhi, (2006).

PHS 2471 PHYSICS FOR CHEMISTS-I (3 + 2) hr / (3 + 1)cr

(Theory cum Lab course) (3 Hrs Theory& 2 Hrs Lab)

Preamble

Physics intersects with many interdisciplinary areas of research, such as biophysics, biochemistry and quantum chemistry and the boundaries of physics are not rigidly defined. New ideas in physics often explain the fundamental mechanisms of other sciences while opening new avenues of research in areas such as mathematics and philosophy.

Objectives:

Enable the Students

- to understand the physical nature of light
- to gain knowledge of electronic components and semiconductor devices.
- to understand the basic laws of electric and Magnetic fields.

UNIT 1:Wave Optics

Huygens's wave theory- reflection and refraction of light waves- Interference-Interference in thin films-diffraction –Single slit diffraction-diffraction at circular aperture –

UNIT 2 : Optical instruments

Dispersion of light waves through Prism- resolving power of Prism,telescopes - polarization – double refraction- circular polarization -speed of lenses- - Magnifiers-Types of Magnifiers.

UNIT 3: Electricity

Coulomb's law-electric dipole-electric field lines-Flux- Gauss's law- Applications of Gauss law- Electric Potential- Potential of continuous charge distribution-Capacitors-parallel plate capacitors-Capacitors with dielectrics- Electric current-Resistors in series and parallel.

UNIT 4: Magnetism

Magnetic flux -Biot-Savart's law-Ampere's law- Laws of electromagnetic induction -Magnetization-Magnetic materials- Alternating current-single loop LCR circuit-Transformer.

UNIT 5: Solid State Electronics

Semiconductors-Intrinsic and extrinsic semiconductors, N and P type-P-N junction diode-Diode as rectifier- Zener diode-characteristics-voltage regulation--Transistors and its uses- Oscillators- Transducers- Introduction to OP-AMP- Characteristics- Adder-subtractor –Integrator and Differentiator-Boolean algebra- Logic gates – NAND, NOR as Universal building blocks.

LABORATORY COMPONENTS

1. Small distance measurement using screw gauge and vernier calliper
2. Error analysis
3. Determine the radius of capillary tube Travelling Microscope
4. Find the Resolving power of the Prism using spectrometer
5. Familiarisation of Multimeter and CRO
6. Verify the Ohm's Law using Potential dividing circuits
7. Verifying Truth tables using Logic gates.
8. Verify the Arithmetic operation using OP-AMP
9. Verify the transverse laws of vibration using Sonometer
10. Determine the wavelength of the given source using Young's double Slit experiments
11. Determine the resonance frequency using LCR parallel Circuit
12. Determine the B_H of the bar magnet using Field along the axis

A minimum of any **Ten** experiments shall be carried out.

Text Books:

1. Resnick, Halliday&Krane , Physics, Part – I, 5thedn, Wiley, (2004)
2. Resnick, Halliday&Krane ,Physics, Part – II, 5thedn, Wiley,(2002).
3. Jenkins & White,Fundamentals of Optics, 4thedn, Mcgraw Hill pub, (1976).
4. B.L.Theraja, Basic electronics, S. Chand & Company(1989) .

References:

1. Jerold Touger,Introductory Physics, Wiley Student Edition, New Delhi, (2006).
2. Serway&Faugher, College Physics, 6thedn, Thomson Brooks/Cole, (2005)
3. Hugh D. Youg& Roger A. Freedman,, University Physics, 11thedn, sears and Zemansky's, India, (2005)

PHS 2473 Microcontroller and programming (3+ 2) hrs / (3 + 1)cr
(Theory cum Lab course) (3 Hrs Theory& 2 Hrs Lab)

Preamble

Microcontrollers are used in automatically controlled products and devices, such as automobile engine control systems, implantable medical devices, remote controls, office machines, appliances, power tools, toys and other embedded systems. By reducing the size and cost compared to a design that uses a separate microprocessor, memory, and input/output devices. Microcontrollers make it economical to digitally control even more devices and processes.

Objectives:

Enable the Students

- To learn the architecture and programming of a microcontroller.
- To understand the use of peripheral devices ,
- To study the interfacing with microcontroller to design a digital system.

Unit 1: Introduction to Microcontrollers

Different types of microcontrollers – processor architectures – microcontroller memory types – control storage – variable area – program counter stack – hardware interface register – microcontroller features – 8051 microcontroller

Unit 2: 8051 Processor architecture

The CPU – addressing modes – external addressing – interrupts -8051 instruction executions

Unit 3: 8051 Instruction Set

Data movement instructions – arithmetic instruction – bit operators – execution change operators.

Unit 4: 8051 Hardware Features

Device packaging - Power consideration – reset – system clock – parallel input /output – timer – interrupt – serial I/O.

Unit 5: 8051 programming and software

8051 programming – Development tool/environments –assembly language – 8051 assembly programming styles – interpreter.

Text Book:

1) MykePredko, Programming and customizing the 8051 microcontroller,Tata McGraw – Hill Edition (1999).

References:

1) Kenneth J. Ayala,The 8051 Microcontroller, Cengage Learning,(2004).

2) Muhammad Ali Mazidi, Janice Mazidi, Janice Gillispie Mazidi, ,The 8051 Microcontroller and Embedded Systems, by Prentice Hall (1999).

Lab–

1. Write a program to multiplication and division using MUL and DIV instructions.
2. Write a program to transfer a block of data from internal memory to external memory.
3. Write a program to find the sum of two numbers in decimal

4. Write a program to convert decimal number to hexadecimal.
5. Write program to find the largest from a set of n numbers.
6. Write a program to sort a set of numbers in ascending order
7. Write a program to sort a set of numbers in descending order
8. Write an assembly language program for generating a triangular wave
9. Write a program to exchange two set of eight byte data.
10. Write program for sorting the given set of numbers.

A minimum of any **eight** experiments shall be carried out.

PHS 2662 PHYSICS LAB IV 6 hr / 6Cr

Preamble

Analog electronics describes the proportional relationship between a signal and a voltage or current that represents the signal. Electrical signals may represent information by changing their voltage, current, frequency, or total charge. Information is converted from some physical form (such as sound, light, temperature, pressure, position) to an electrical signal. Digital techniques are useful because it is easier to get an electronic device to switch into one of a number of known states than to accurately reproduce a continuous range of values. Digital electronic circuits are usually made from large assemblies of logic gates, simple electronic representations of Boolean logic functions.

Objectives

Enable the students

- To impart skills in measurement, design
- To plan experimental procedures and keep records.
- To understand results to reach non-trivial conclusion about significance of results of the experiments.

1. Construction of Dual power supply
2. Verify the Network Theorems
3. Determine the Zener- Diode Characteristics and Voltage regulator
4. Construct the Wave shaping circuits using diode
5. Determine the input and output Characteristics of a Transistor
6. Construct a Single stage amplifier using Transistor
7. Determine the characteristics of FET amplifier
8. Construct a Hartley Oscillators using Transistor
9. Designing of Push pull amplifier using transistor
10. Op-amp as Integrator and differentiator
11. NAND /NOR as Universal gate
12. Transistor as invertor
13. Multivibrators using IC 555 timer
14. Implement of Boolean expressions
15. JK – Filp Flop as a counter

16. Half Adder ,Full Adder and Subtractor
17. Designing of Encoder and Decoder
18. Construction of Arithmetic and Logic Unit
19. Construction of Multiplexer and Demultiplexers
20. OP-Amp as Active filter
21. Op-Amp as sine wave, square Wave form Generation

A minimum of any **sixteen** experiments shall be carried out.

PHS 2464 CLASSICAL AND QUANTUM MECHANICS 4 hr /4 cr

Preamble

Classical mechanics and quantum mechanics are the two major sub-fields of mechanics. Classical mechanics is concerned with the set of physical laws describing the motion of bodies under the influence of a system of forces. Quantum mechanics including quantum field theory, is a fundamental branch of physics concerned with processes involving , atoms and photons. Important applications of quantum mechanical theory include superconducting magnets, light-emitting diodes and laser, transistor and semiconductors.

Objectives:

Enable the Students

- To understand the basic concepts and application of Lagrangian dynamics, Hamiltonian dynamics, small oscillations, rigid body, nonlinear dynamics.
- To understand the concepts of operator and postulates of quantum mechanics
- To solve the physical problems using the above concepts.

Unit 1: Lagrangian and Hamiltonian Dynamics

Lagrange's equation for conservative and Non- conservative System- Applications of Lagrange's equation- Hamilton's principle- Lagrange's Equation from Hamilton's Principle – Lagrange's equation from variational principles –Advantages- conservation theorem -Hamilton equations of motion –Cyclic coordinates and Conservation theorems- Hamilton equations from variational Principle-The principle of Least action.

Unit 2: The Two body Central Force Problem

Conservative central forces-Classification of Orbits- The Virial Theorem- The Kepler problem; Inverse Square law of Forces– Rutherford scatterings -Scattering in a central force field

Unit 3: Particle properties of waves

Planck's blackbody radiation - de Broglie waves – photoelectric effect – Compton Effect - Wave properties of particles: particle diffraction – Davison and Germer experiment – Heisenberg's uncertainty principle - wave packet - phase and group velocities.

Unit 4: Operator and Postulates of Quantum Mechanics

The wave function – probability density – probability stream (current) density - dynamical operators – linear and hermitian operators – commuting and non-commuting operators – Hamiltonian – angular momentum operators-The Schrodinger's wave equation – time dependent form – linearity and superposition – Schrodinger equation: steady state form - eigenvalues and eigenfunctions.

Unit 5: Exactly solvable problems

Free states: electron beam in a field-free space – step potential – barrier potential – quantum tunneling – square well free states.

Bound states: infinite potential well – particle in a box – degeneracy –quantized states – normalized wave functions – expectation values - Harmonic oscillator – energy eigenvalues and eigenfunctions – zero point energy. Schrodinger equation for a one-electron atom – separation of variables – radial and angular part of Schrodinger equation.

Text Books:

1) C.Upadyaya, "Classical Mechanics" , Himalayan Publishing House, New Delhi(1989).
2) Arthur Baiser ,Shobit Mahajan, S.RaiChoudhury," concept of Modern Physics" 6th Edn, Mc Graw Hill Education (India) Pvt Ltd, New Delhi(2009).

References;

1) P.M.Mathews & K.VengatesanA Text Book of Quantum Mechanics, Tata McGraw Hill, New York ,(Reprint 2002).
2) J.J.Sakurai, Modern Quantum Mechanics, Addition Wisle (1999).
3) S R.Shankar, Principles of Quantum Mechanics, II ed, Springer(2007),

PHS 2446 DIGITAL ELECTRONICS 4hr / 4 Cr

Preamble

Digital electronics that handles digital signals, discrete bands of analog levels rather than by continuous ranges. Digital techniques are useful because it is easier to get an electronic device to switch into one of a number of known states than to accurately reproduce a continuous range of values. Digital electronic circuits are usually made from large assemblies of logic gates, simple electronic representations of Boolean logic functions.

Objectives

Enable the Students

- To acquire a knowledge in number system and Boolean algebra
- To learn the concept of digital electronics and their designs
- To understand with the basic building blocks required for digital devices and equipments.

Unit 1: Number Systems

Decimal – binary – octal and hexadecimal – their representation, inter-conversion, addition and subtraction, negative Numbers. Codes: Weighed binary codes: 8421, 2421, 5211, excess–3 code. Gray code and ASCII code. Binary to gray conversion and vice versa. Error detection and correction. Parity checking

Unit 2: Boolean axioms and theorems

sum of products – product of sums – their conversion – Simplification of Boolean expressions - K-Map – min terms – max terms -(2, 3 and 4 variables). Concept of sequential logic circuit design -positive and negative logic. Basic and derived gates – Universal gates. R-S, Clocked R-S, D, edge triggered, J-K, J-K master slave flip flops.

Unit 3: Decoders and Multiplexer

Basic binary decoder – 2 to 4, 3 to 8 decoders – BCD to seven segment decoder. Encoders: Octal to binary, decimal to binary – priority encoder. Multiplexer- design of 2:1 and 4:1, 8 to 1 and 16 to 1 multiplexer – demultiplexer: 1 to 4 demux and applications. Arithmetic circuits: Half and full adder, Half and full subtractor.

Unit 4: Counters and Registers

Asynchronous and synchronous counter – 2-bit, 3-bit asynchronous binary counter – decade counter. Up-down counter – cascading MOD-counters. Shift registers – semiconductor memory- flash memory. 555 timer: Astable, mono-stable and bi-stable modes – Display multiplexing - Frequency and Time measurement.

Unit 5: Memory Devices

General Memory Operation, CPU-Memory connection, Read only memories, ROM architecture, ROM timing, and types of ROMs, Flash memory, and ROM applications. Semiconductor RAMs, RAM architectures, static RAM, Dynamic RAM

Text Book:

1. Floyd, Digital fundamentals , 8th edition Pearson education (2006)

References:

1. Malvino, leach and saha,Digital principles and applications ,6th edition, McGraw Hill (2006).
2. Modern digital electronics – R.P.Jain, Tata McGraw Hill ,3rd Edition(2003).

PHS 2548 MATHEMATICAL PHYSICS 5hr - 5 cr

Preambles

Mathematical physics refers to development of mathematical methods for application to problems in physics. Mathematical physics covers a very broad academic realm distinguished only by the blending of pure mathematics and physics. The effort to put physical theories on a mathematically rigorous footing has inspired many mathematical developments. The mathematical study of quantum mechanics, quantum field theory and quantum statistical mechanics has motivated results in operator algebras.

Objectives

Enable the students

- To understand the concepts of complex numbers, matrices and special functions.
- To give training in using mathematical tools in solving problems in various branches of Physics.
- To impart mathematical skills to analyze Physical phenomenon.

Unit 1: Complex variables

Function of a complex number-analytical function-transfer function- Cauchy-Riemann equation- C-R in polar form-Cauchy integral theorem-Cauchy's Inequality: Taylor series-Laurent's series.

Unit 2: Matrices

Addition, multiplication of matrices-Null-Diagonal, scalar and unit matrices- Upper triangular and lower triangular matrices- Transpose of a matrix- Symmetric and Skew-Symmetric Matrices- Conjugate of a Matrix- Hermitian and Skew-Hermitian Matrices-Singular and Non-Singular matrices. Adjoint of a matrix-Inverse of a Matrix by Adjoint method-Similarity Transformations-Orthogonal and Unitary Matrices-Trace of a Matrix- Eigen-values and Eigen vectors. Cayley- Hamiliton theorem.

Unit 3: Vector Calculus

Vector differentiation-Gradient-divergence-Curl- vector integrals: line, surface and volume-Gauss- divergence-Stokes and Green's theorem.

Unit 4: Fourier series and Transformation

Fourier series- Dirichlet's theorem and Dirichlet's conditions- properties of Fourier series-Fourier transform- sine and cosine transforms – convolution theorem - simple applications of Fourier transform.

Unit 5: Differential equations and special functions

Linear and non linear differential equations- solution of linear differential equation of first order and second order – Beta and Gamma functions- evaluation of beta function- evaluation of gamma function.

Text Books:

1. Arfkan, Mathematical Physics, 6th edn , ,Sultan Chand & sons,(2012).
2. Erwin KreyszigAdvanced Engineering Mathematics , Wiley Custom Learning Solutions,(2011).

References:

1. B.D.Gupta , Mathematical Physics , Vikas Publishing house PVT LTD, (2004).
2. Murray R. Spiegel , Schaum's Outline series of theory and problems of Vector Analysis and an introduction to tensor , Schaum's Outlines (2009).

PHS 2472 PHYSICS FOR CHEMISTS-II (3 + 2) hr / (3 + 1)cr

(Theory cum Lab course) (3 Hrs Theory& 2 Hrs Lab)

Preamble

Physics intersects with many interdisciplinary areas of research, such as biophysics and quantum chemistry, and the boundaries of physics are not rigidly defined. New ideas in physics often explain the fundamental mechanisms of other sciences while opening new avenues of research in areas such as mathematics and philosophy. This course deals with the aspects of thermodynamics, molecular spectroscopy and their application in chemistry. It also explains the basics ideas of classical and quantum mechanical

Objectives:

Enable the Students

- To understand the laws of thermodynamics
- To know the principles of laser and spectroscopy.
- To know the basics of classical mechanics and quantum mechanics

Unit 1:Thermodynamics

Laws of thermodynamics-Heat capacity and Specific heats- Heat capacity of an ideal gas-Applications of I law-Entropy-Second law of thermodynamics-Carnot engine- efficiency of Carnot engine- entropy and the performance of refrigerators-engines-efficiencies of real engine.

Unit 2: Molecular Spectroscopy

Molecules-Molecular energy- Vibrational and Rotational energy levels-energy levels-electronic spectra of molecules-Infra red spectroscopy – Raman effect-Fraunhofer lines.

Unit 3: Laser

Laser and Laser light-stimulated emission- The Ruby Laser-Helium-Neon gas laser-CO_2 laser-coherence length-frequency doubling-laser safety-Laser Applications

Unit 4: Classical Mechanics

Failure of classical mechanics –Thermal radiation -Planck's radiation law- - Photoelectric effect-characteristics of photoelectron –laws of photoelectric emission- Einstein's photo electric equations- Compton effect-matter waves-De-Broglie Hypothesis

Unit 5: Quantum Mechanics

Heisenberg's uncertainty principle-Schrödinger's equation- particle in a box - electron trapped in a potential well –Barrier tunnelling.

LABORATORY COMPONENTS

1. Determination of the Coefficient of Viscosity of a given liquid using Burette method
2. Determination of the Young Modulus by Cantilever method
3. Determine the Thermo emf of a Thermo Couple
4. Determination of the Surface Tension of a given liquid by Drop Weight Method
5. Determine the Thermal Conductivity of Poor Conductivity using Lee's Disk method
6. Determine the Specific Heat Capacity of a Solid using calorimetric method
7. Determine the resonance frequency using LCRseries Circuit
8. Determine the rigidity modulus using Torsion Pendulum
9. Determination of Spring constant using static and dynamic method
10. Determine the Linear coefficient of Thermal expansion
11. Determine the AC frequency using Melde's apparatus
12. Determine the V I character of a Solar cell

A minimum of any **Ten** experiments shall be carried out.

Text Books:

1. David Halliday, Robert Resnick and Kenneth S. Krane. "*Physics Vol. II",* Vth ed., John Wiley (2002).
2. Arthur Beiser, Concepts of Modern Physics, 6thedn,. Tata McGraw-Hill Education,(2003).
3. Donald P Leach & Albert Paul Malvino, Digital Principles and Applications, 6thedn, McGraw-Hill Education, (2007).
4. C.C.Ouseph,U.J.Rao,V.Vijayendran , Practical Physics and Electronics-, S.VisvanathanPvt.Ltd. (2007).

References:

1. Jerold Touger, Introductory Physics, Wiley Student Edition, New Delhi, (2006)
2. Serway&Faugher, College Physics, 6thedn, Thomson Brooks/Cole,(2005).
3. Hugh D. Youg& Roger A. Freedman,University Physics, 11thedn, sears andZemansky's, India(2005).

DEPARTMENT OF UNDER GRADUATE PHYSICS
B. Sc. – Physics Programme
(w. e. f. 2015-16 batch onwards)

Semester	Part	Course No.	Course Title	Hours	Credits	Marks
V	IIIC	PHY3671	Physics Lab - V	6	6	90
	IIIC	PHY3673	Thermodynamics & Statistical Physics	6	6	90
	IIIC	PHY3575	Solid State Physics	5	5	75
	IIIC	PHY3677	Microprocessor & Communication Systems	6	6	90
	IVLS	LSC32XX	Life Skill Course - III	3	2	30
	IVEVS	EVS3200	Environmental Studies	4	2	30
			Total	**30**	**27**	
VI	IIIC	PHY3672	Physics Project	6	6	90
	IIIC	PHY3674	Atomic Physics & Spectroscopy	6	6	90
	IIIC	PHY3576	Nuclear Physics	5	5	75
	IIIC	PHY3680	Astronomy & Astrophysics	6	6	90
	IVLS	LSC32XX	Life Skill Course - IV	3	2	30
	IVVAL	VAL32XX	Value Education	4	2	30
			Total	**30**	**27**	

Part IVLS Life-Skill Courses:

Semester	Course No.	Course Title	Hours	Credits	Marks
V	PHY3291 / PHY3293	PC Management & Maintenance / Bio-Medical Instrumentation	3	2	30
VI	PHY3292 / PHY3294	HAM Radio & Practice / Consumer Electronics	3	2	30
		Total	**12**	**8**	

PHY 3671 Physics Laboratory – V (6 credits – 6 hrs/wk)

Arithmetic Circuit- Half adder and Full adder.
Combinational logic circuit design using 74xxICs. (For a given problem using POS or SOP)
Design of odd/even parity checkers - using 74180
Encoders - using logic gates
Decoders -using logic gates
Circuits Implementation using Software
Multiplexer - using logic gates
Demultiplexer. - using logic gates
Arithmetic Logic Unit (ALU) using IC 74181.
Construction of 1- bit comparator using 74xxICs and study of 4-bit comparator IC 7485.
Code converters – Binary to gray and Gray to binary.
Verification of basic flip flops using 74xxICs
Master- slave JK flip-flop using IC 7476
Asynchronous counter design
Mod-n counter. using decade counter 7490
3-Bit synchronous counter design
Shift register- SIPO/SISO
Shift register -PISO/PIPO.
Timer 555 - Construction of monostable, astable for a given frequency.
Storing and retrieving data (Ex-3code) - using RAM - IC 7489 or 2114.
(Minimum of 16 Experiments)

PHY 3673 Thermodynamics & Statistical Physics (6 credits – 6 hrs/wk)

Objective: This course enables the students
To understand the fundamentals of thermodynamics
To introduce the concepts of entropy and enthalpy
To gain knowledge in kinetic theory and transport phenomena
To impart the applications of statistical Physics

Unit: I

Thermodynamic systems - The Zeroth law of thermodynamics – Thermodynamic equilibrium – Measurement of temperature - Equation of state of an ideal gas and real gases – Expansivity and Compressibility - The first law of thermodynamics – Work in a volume change - Configuration work and dissipative work - Internal energy – Heat flow - Heat Capacity - Enthalpy - The energy equation: T and V independent - T and P independent - P and V independent - Joule-Thomson effect - Carnot cycle – The heat engine and refrigerator.

Unit: II

The second law of thermodynamics – Entropy – The Tds equations: T and v independent - T and P independent - P and v independent – Entropy and Enthalpy of a pure substance, of an ideal gas, of a van der Waals gas – Helmholtz function and Gibbs function – thermodynamic potentials – Maxwell Relations - phase transitions – Clausius-Clapeyron equation - The third law of thermodynamics.

Unit: III

Applications of thermodynamics to simple systems: Surface tension – Vapor pressure of a liquid drop – The reversible voltaic cell – Black body radiation - Kinetic theory: The principle of equipartition of energy – Classical theory of specific heat capacity – Transport Phenomena: Coefficient of viscosity - Diffusion.

Unit: IV

Statistical physics: Energy states and energy levels - macrostates and microstates – Thermodynamic probability – The Bose-Einstein statistics – The Fermi-Dirac statistics – The Maxwell-Boltzmann statistics - The statistical interpretation of entropy - BE, FD, and MB distribution functions – Comparison of distribution functions for distinguishable particles -– Comparison of distribution functions for indistinguishable particles – partition function.

Unit: V

Applications of statistical physics: The Monatomic ideal gas - The distribution molecular velocities – Ideal gas in gravitational field – The quantized linear oscillator.

Text Books

F. W. Sears and G. L. Salinger, Thermodynamics, Kinetic theory, and Statistical Thermodynamics, IIIrd ed., Narosa Publishing House (1998).

References

David Halliday, Robert Resnick and Kenneth S. Krane. *Physics Vol. II,* Vth ed., John Wiley (2002).

R. P. Feynmann, Feynmann lectures on Physics Vol.I, Addison-Wesley (Narosa Pub.) (1989).

PHY 3575 Solid State Physics (5 credits – 5 hrs/wk)

Objective: This course enables the students

To understand the various crystal structures and theory of crystal binding
To understand the theory of band structure and phonon
To understand the Physics of semiconductors and superconductivity

Unit: I

Crystal Structure and Reciprocal Lattice: Periodic arrays of atoms – Fundamental types of lattice – Packing fraction - Index system for crystal planes – Simple crystal structures – Diffraction of waves by crystals – Bragg law – Reciprocal lattice vectors – Diffraction conditions – Brillouin zones – Reciprocal lattice to SC, BCC, and FCC lattice – Structure factor of BCC and FCC lattice – Atomic form factor.

Unit: II

Crystal Binding and Phonons: Crystals of inert gases – Ionic crystals – Covalent crystals – Metals – Hydrogen bonds – Atomic radii – Vibrations of crystals with monatomic and diatomic basis – Quantization of elastic waves – Phonon momentum – Inelastic scattering by phonons.

Unit: III

Fermi Gas and Energy Bands: Free electron theory in 1D and in 3D – Fermi-Dirac distribution – Density of states – Heat capacity of the electron gas – Electrical conductivity and Ohm's law – Motion of electrons in magnetic field – Hall Effect - Nearly free electron model – Bloch functions – Kronig-Penney model.

Unit: IV

Semiconductors: Band gap - Effective mass – Silicon and germanium – Classifications of material into semiconductor, metal, and insulator - Intrinsic carrier conduction - Impurity conductivity – Donor states – acceptor states – Thermoelectric effects.

Unit: V

Superconductivity: Experimental survey – Destruction of superconductivity by magnetic field – Meissner effect – Isotopic effect – Type I and Type II superconductors – London equation – Coherence length – BCS theory of superconductivity – Flux quantization – Vortex state – DC and Ac Josephson effect – High temperature superconductors.

Text Books

1. **Charles Kittel**, Introduction to Solid State Physics, Wiley-India, 7th edition, 2011

References

S.O. Pillai, Solid State physics, New age international (P) limited (1997).
Ali Omar, Elementary Solid State Physics, Pearson Education India, 1993.

PHY 3677 Microprocessor & Communication Systems (6 credits – 6 hrs/wk)

Objective: This course enables the students

To understand the architecture of microprocessor
To gain the knowledge of interfacing techniques
To understand the basic principle of modulation and demodulation
To gain knowledge in satellite communication

Unit: I

Internal architecture of 8088 microprocessor software model – pipelining, memory timing diagram - Immediate, Register and Memory Addressing modes - Data transfer instruction - Arithmetic and logic instructions - control instruction - conversion of assembly language to machine language.

Unit: II

8088 hardware – Minimum mode maximum mode systems – system clock – Read and write cycle - memory interfacing circuits - 8 bit addition – 16 bit addition & Subtraction – multiplication – ascending order – descending order – simple programs.

Unit: III

Modulation – Need for modulation – Amplitude modulation theory – Frequency spectrum of AM – Representation of AM – Power relation in the AM wave – Generation of AM wave – Evolution of Single Side Band - Suppression of carrier and unwanted side band - Frequency modulation – Mathematical representation of FM – Frequency spectrum of the FM wave – Phase modulation.

Unit: IV

Receiver type – AM receiver – RF section and characteristics – Frequency changing and tracking – Intermediate frequencies and IF amplifiers – Detection and Automatic gain control – Communication receivers – Extension of super heterodyne principle – FM receivers – Basic FM demodulators – Single and Independent side band receivers.

Unit: V

Satellite communication: Introduction – Types of Satellite orbits – Orbital perturbations – Satellite stabilization – Orbital effects on satellites performance – Eclipses – Satellite altitude and earth coverage area – communication satellite – Frequency bands and Payloads – Satellite Telephony, Radio and Television

Text books

Barry.B. Brey, Intel Microprocessors – Architecture programming and interfacing – Fourth edition – Prentice Hall of India Pvt Ltd, 1997

Walter. A. Tribal & Avtar Singh, The 8088 and 8086 microprocessors programming, interfacing, software, hardware and applications – Prentice Hall of India Pvt Ltd, 2005.

George Kennedy, Bernard Davis, Electronic Communication Systems, Fourth Edition, Tata McGraw – Hill Publishing Company, New Delhi, (2003).

Anil. K.Maini, Varsha Agarwal, Satellite Communications, Wiley India Pvt. Ltd, New Delhi, (2011).

References

Simon Haykin, Communication system, Fourth Edition, Wiley India Pvt. Ltd, New Delhi, (2013).

Martin. S. Roden, Analog and Digital Communication Systems, Third Edition, Prentice Hall, India, 1999

S.P. Chowdhury and Sunetra Chowdhury, Microprocessors and Peripherals, Chancellor Press 2004.

PHY 3672 Physics Project (6 credits – 6 hrs/wk)

Objective: This course is to train the students so that each student shall have the confidence to carry out the independent work, group work and experience in handling of various equipments.

Implementation

Students are given the freedom of choosing the topic of the project. It may be theoretical or experimental. After getting approval of the proposed project work within 5 sessions, students are supposed to carry out these projects in the department laboratory. They may choose computer or microprocessor interfacing projects also.

Students are encouraged to have hands-on experience in designing, fabricating, and analyzing the observations using fundamental concepts studied in the course of study.

Mark Distribution

	Weightage
Presentation of Project Proposal	5%
Continuous assessment for each session	50%
Progress report	20%
Final report	10%
Hard copy of the Project report	15%

PHY3674 Atomic Physics & Spectroscopy (6 credits – 6 hrs/wk)

Objective: This course enables the students

To understand the fine structure of atom
To have greater understanding of atomic spectrum with applied fields
To gain knowledge in Molecular spectroscopy
To understand the Raman spectroscopy

Unit: I

Optical spectrum of Hydrogen atom - Bohr's Postulates – Quantitative conclusions –Principal quantum number - Spectra of hydrogen-like atoms – Sommerfeld's extension of the Bohr model –Orbital quantum number –Lifting of orbital degeneracy - Limits of the Bohr-Sommerfeld theory – The Correspondence principle – Rydberg atoms –Lifting of orbital degeneracy in the spectra of Alkali atoms - Magnetic moment of orbital motion – Spin and magnetic moment of electron –Spin-orbit splitting in the Bohr model – Fine structure in Hydrogen atom.

Unit: II

Zeeman effect – Normal and anomalous – Stark effect - Paschen-Back effect – Double resonance and Optical pumping – The spectrum of Helium – Electron repulsion and Pauli principle – Angular momentum coupling – X-ray from outer shell & Bremsstrahlung spectra – Emission line spectra – Fine structure of X-rays – Absorption spectra – Auger effect.

Unit: III

The rotation of molecules – Rotational spectra – Diatomic molecules – Rigid molecule – Intensities of spectral line – isotopic substitution – Non-rigid rotator – Polyatomic molecules – Techniques and Instrumentation – Chemical analysis.

Unit: IV

Vibrating diatomic molecule – Diatomic vibrating rotator –Vibration – Rotation spectrum of Carbon Monoxide – Breakdown of the Born-Oppenheimer approximation – Vibration of Polyatomic molecules – Analysis by infra-red techniques - Techniques and Instrumentation.

Unit: V

Classical theory & Quantum theory of Raman scattering – Pure rotational Raman spectra – Vibrational Raman spectra – Polarization of Light and the Raman effect – Structure determination from Raman and IR spectroscopy - Techniques and Instrumentation – Near IR – FT Raman spectroscopy.

Text Books

Haken, Wolf, Springer-Verlag, Atomic and Quantum Physics, Second edition (1987).
Colin Banwell & Elaine McCash, Fundamentals of Molecular spectroscopy, Tata McGraw-Hill Publishing Company, Fourth edition (2005).

Arthur Beiser, Concepts of Modern Physics, Tata McGraw Hill Publishing company, Sixth edition (2005).
Aruldhas, Molecular structure and Spectroscopy, Prentice-Hall of India, First edition (2004).

PHY 3576 Nuclear and Particle Physics (5 credits – 5 hrs/wk)

Objective: This course enables the students
To know the properties of nucleus
To acquire knowledge about radiation detector and nuclear reactors
To understand the nuclear structure, phenomenon of radioactivity
To know about the basics of elementary particles

Unit: I
Structure and properties of Nucleus: Nuclear size - Nuclear mass – Bainbridge mass spectrometer – mass defect – binding energy – packing fraction – semi empirical mass formula - stability – isotopes – isobars – nuclear forces – meson theory — Fermi Gas model- liquid drop model –predictions of shell model

Unit: II
Radioactive Decay: Law of radioactive disintegration – law of successive disintegration - transient and secular equilibrium – carbon dating – age of earth – alpha decay: Gamow theory – beta decay: neutrino theory - Fermi theory — gamma decay: internal conversion - nuclear isomerism

Unit: III
Radiation detectors and accelerators: GM counter – Wilson cloud chamber – bubble chamber –photographic emulsion – accelerators: – linear accelerators – cyclotron - synchrocyclotron - betatron

Unit: IV
Nuclear reactors: Types of nuclear reactions - Q value equation for nuclear reaction – nuclear transmutation - nuclear fission – nuclear fusion thermonuclear reactions - chain reaction – nuclear reactor – four factor formula – atom bomb

Unit: V
Elementary particles: Classifications of elementary particles – particle interactions – conservation laws – CPT theorem - elementary particle symmetry — SU(3) - quarks model

Text Books

1. **D.C.Tayal** , Nuclear Physics, Himalaya Publishing House, Mumbai, 2011

References

Herald Enge, Introduction to nuclear physics, McGraw Hill, 1981

R. R Roy and B. P. Nigam, Nuclear Physics, New Age International Ltd, 2001.

H.S Hans, Nuclear Physics, New Age International publishers, 2001.

S. B. Patel, Nuclear Physics an Introduction, Wiley Eastern Ltd, 2012

PHY 3680 Astronomy & Astrophysics (6 credits – 6 hrs/wk)

Objective: This course enables the students

To understand the basic concepts of astronomy and solar system
To understand the birth and evaluation of a star
To know the principles and working of detector instrument
To earn knowledge in understanding galaxy
To know the basis of origin of universe

Unit I:

Positional Astronomy and Gravitation: Birth of modern astronomy- Geocentric and heliocentric – the Copernicus revolution. Celestial phenomena, its connection with established (Kepler's laws - Newtonian Gravitation) and new physics; typical physical scales/conditions in astrophysics; order of magnitude estimation; Celestial sphere – coordinate systems: the ecliptic, RA/DEC coordinates, Galactic coordinates; luminosity/flux, magnitude scale, absolute/apparent magnitude - distance measurement, A.U., parsec; – seasons – Eclipse – Solar, lunar - Tides and precession - solar family – inventor of solar systems – our moon – mariner and mars – Venus and mercury – the jovian planets.

Unit II:

Telescopes and Observational Methods: Astronomical observations – Telescopes: optical and infrared, reflecting, refracting, telescope mounts; telescopes' collecting area, diffraction limit, atmospheric seeing; electronic detectors – spectroscopy; Radio telescope – resolving power of radio telescope – radio interferometry; UV, X-ray, gamma ray telescopes.

Unit III:

Stellar Objects: Stars and constellations. Observed stellar properties: main sequence, luminosity dependence on mass, stellar classification based on spectra, connection with Saha ionization formula, Hertzsprung- Russel diagram - magnitude of star light, stellar distances Stellar models: hydrostatic equilibrium, gas/radiation pressure; order of magnitude estimates; opacity: Thomson, Kramer's, scattering, opacities (absorption coefficients), energy balance; nuclear energy production in stars: binding energy per nucleon, efficiency of fusion, calculation of nuclear reaction rates, tunneling in Coulomb barrier, Gamow's calculation - important nuclear reactions in stars: pp chain, neutrino production in the Sun & consequences; CNO cycle, triple alpha reaction.

Binary stars - evolutionary stages of stars – birth of stars, main-sequence evolution, and late stages of evolution; white dwarf physics, electron degeneracy pressure, Chandrasekhar mass limit; old age star clusters, white dwarfs as dead stars; supernovae, formation of heavy objects - fate of stars.

Unit IV:

Galaxy and Extragalactic Astronomy: Galaxies; Milky Way galaxy, types of galaxies, spirals, ellipticals and irregulars, Hubble pitchfork classification. Milkyway components: gas, stars, magnetic field and cosmic rays; satellites; 21 cm line, rotation curve, dark matter; Jeans instability and star formation, HII regions; phases and components of interstellar medium; cosmic rays.

Unit V:

Basic Cosmology : Olber's paradox; difficulty with Newtonian cosmology; modern cosmological principles – the big bang the expanding universe- cosmological model – scale of the universe – open, close universe – steady state universe – Hubble's law – maximum age of universe. Brief introduction to Einstein's general theory of relativity, especially the line element - Schwarzschild metric, horizon, orbits - FRW metric as a consequence of cosmological principle; redshift, angular and luminosity distances; evolution of scale factor from Newtonian cosmology; density parameter. Thermal history of the Universe, big bang nucleosynthesis; microwave background.

Text Books

A. Rai Choudhuri, Astrophysics for Physicists, Cambridge University Press, New York, 2010

Carroll B. W. & Ostle, D. A, An introduction to Modern Astrophysics, Pearson Education- Addison Wesley, 2007

Shu, F, The Physical Universe, University of California, 1982

Harwit, M, Astrophysical Concepts, 3rd ed, Springer-verlag, 2006

Maoz, D, Astrophysics in a nutshell, Princeton University Press, 2006

Padmanabhan,T, Invitation to Astrophysics, World Scientific, 2006.

PHY3200 Environmental Studies (2 Credits -4 hrs/wk)

OBJECTIVES: Enable the Students

to understand the importance of conservation energy
to know about the physical nature of the eco system
to get knowledge about biodiversity
to know about various sources of pollution
to understand the cause of global warming

UNIT 1:

Renewable energy and non renewable energy sources - Worlds reserve of commercial energy sources and their availability – Various forms of energy –fossil fuel availability – applications – merits and demerits - Solar energy – direct and indirect form (basics about wind, ocean energy, biomass) - thermal applications – photo voltaic generations (basics).

UNIT 2:

Ecosystem / Biodiversity and its conservations – concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – Energy flow in the ecosystem – food chain, food webs and ecological pyramids. Introduction, types, characteristics features, structure and functions of pond ecosystem, forest ecosystem, Grass land ecosystem and Desert ecosystem.

Bio-geographical classification of India – values of biodiversity – biodiversity at global, national and local levels – India as a mega diversity nation – Hot spots of biodiversity – conservation of biodiversity.

UNIT 3:

Pollution and environmental impacts: Fossil fuels and the environment – impacts due to non conventional energy sources – Green house effect – CFC – global warming and ozone depletion – Air pollution – effects – criteria of pollutants.

Pollution and meteorology – Indoor air quality – water pollution – Noise pollution – Thermal pollution – nuclear hazards – acid rain – solid waste management – role of an individual in prevention of pollution – Disaster management – floods, earthquake, cyclone and landslides.

UNIT 4:

Social issues / Human population and the environment –Water conservation assessment of risks – Environmental ethics – waste land reclamation – Environmental protection Act (Air Act, Water Act, Wildlife protection Act, Forest Conservation Act) – Environmental auditing – Public awareness.

Text Books:

Dr.Raman Sivakumar, Introduction to environmental science and engineering, 2005.

Erach Bharucha, Text Book of Environmental studies for under Graduate Courses, Universities Press, 2005.

References:

S.P.Sukhatme, Solar Energy, 2nd edn, Tata McGraw-Hill Publishing Company Limited, 2004.

M.N.Rao, H.V.N.Rao, Air Pollution, McGraw-Hill Publishing Company Limited, 1993.

Gilbert. M. Masters, Introduction to Environmental Engineering and Science, Prentice Hall of India Private Limited, New Delhi, 1994.

P.D.Sharma, Ecology and Environment, 7th Edn, Rastogi Publications, 2005.

PHY 3291 PC management and maintenance (2 credits – 3hrs/wk)

Objective: This course enables the students

To understand the various hardware components of PC

To understand the function of an operating system

To assemble and properly configure a basic windows PC

To employ basic techniques to troubleshoot hardware problems.

Unit: I

PC Hardware – I: Different components of a PC- input and output devices-Ports and connectors-CMOS battery- installing power supply, Processor, motherboard, RAM, drives (floppy, HDD and optical), adapter cards and internet cables

Unit: II

PC Hardware – II: BIOS and boot process. Compare and contrast desktop, laptop and tablet- Preventive maintenance- static electricity- identifying beep codes- troubleshooting.

Unit: III

PC Software – I: Installing BIOS Software- installing a windows OS- command line interface- graphical user interface- partition manager- formatting partition- file systems (NTFS, FAT32 and EXT)

Unit: IV

PC Software – II: Device Manager- disk cloning- msconfig- regedit- control panel applets- task manager- system utilities- checkdisk- defragmentation-restore point- control panel applets- preventive maintenance- troubleshooting.

Unit: V

Networking: LAN- WAN- WLAN- peer to peer network- client server network- terminologies:-ip addressing- protocol- bandwidth- DHCP- physical components:- hubs- switches- router- wireless access points- twisted pair cable- fiber optic cable- radio waves- installing a modem- configure NIC driver and modem- attach computer to an existing network- troubleshooting.

Text Books

David Anfinson and Kenneth Quamme, IT Essentials- PC Hardware and Software Companion Guide, Cisco Press (2008)

References

1. **Ron Gilster** , PC Hardware A Beginner's Guide, 2001

PHY 3293 Bio- medical instrumentation (2 credits – 3 hrs/wk)

Objective: This course enables the students

To understand the basics of bio-medical instrumentation design

To understand the various diagnostic principles and instruments

Unit: I

Instrument design: Design of medical instruments - Components of bio medical instrumentation - Electrodes - Transducers - Amplifiers - Isolation amplifier - Instrumentation amplifier - Signal analysis

Unit: II

Diagnostic instruments I: Blood flow meters - Blood cell counters - Radiography - Angiography - Endoscopy

Unit: III

Diagnostic instruments II: X-ray - MRI scan - Ultrasonic imaging - Medical thermography.

Unit: IV

Therapeutic instruments I: Pace maker - Batteries - Artificial heart valves - Heart-lung machine

Unit: V

Therapeutic instruments II: Kidney machine - Physiotherapy and electrotherapy equipment

Text Books

1. **M. Arumugam**, Bio-medical Instrumentation, Ed.2, Anuradha Publications, 2003

References

Willard, Merritt, Dean and Settle, Instrumental methods of analysis, Ed.6 hill valley, California, 1996.

R.S. Khandpur, Handbook of Medical Instrumentation, Tata McgrawHill, 1999

PHY 3292 HAM Radio & Practice (2 credits – 3 hrs/wk)

Objective: Enable the students

To understand the basic principles of radio communication and

To gain knowledge of the various components involved in radio electronics

Unit: I

Amateur Radio Rules & Regulation: Amateur radio - call-sign-Different grades of licensing examinations and licenses – amateur radio rules & regulations - Radio telephony operating procedure- Radio telegraphy operating procedure- The Indian Wireless Telegraphs (Amateur Service) Rules.

Unit: II

Elementary theory of electricity & magnetism: Elementary theory of electricity, conductors and insulators, units, Ohm's law, resistance in-series and parallel, conductance, power and energy, permanent magnets and electromagnets and their use in radio work; self and mutual inductance; types of inductors used in receiving and transmitting circuits, capacitance; construction of various types of capacitors and their arrangements in series and/or parallel.

Unit: III

Elementary theory of alternating currents: Sinusoidal alternating quantities-peak, instantaneous, RMS, average values, phase; reactance, impedance; series and parallel circuits containing resistance, inductance, capacitance; power factor, resonance in series and parallel circuits; coupled circuits; transformers for audio and radio frequencies.

Unit: IV

Radio Receiver and transmitter: Principles and operation of TRF and superheterodyne receivers, CW reception, receiver characteristics-sensitivity, selectivity, fidelity; adjacent channel and image interference; AVC and squelch circuits; signal to noise ratio, Principles and operation of low power transmitter, crystal oscillators, stability of oscillators.

Unit: V

Radio Propagation, Aerials and other safety measures: Wavelength, frequency, nature and propagation of radio waves; ground and sky waves; skip distance; fading**.** Common types of transmitting and receiving aerials-Measurement of frequency and use of simple frequency meters- Safety measures in a ham radio shack.

Text Books

VigyanPrasar, A Comprehensive Study Material for the Ham Radio Enthusiasts, New Delhi, 2010

PHY 3294 Consumer Electronics (2 credits-3hrs/wk)

Objective: Consumer Electronics comprehensively covers the theory, applications and maintenance of various audio/video systems, communication systems and electronic home/office appliances. This course will be of help troubleshooting and maintenance of electronic gadgets.

Unit: I

Passive devices - Resistors - types - colour coding - capacitors - type - colour coding. – Diodes - ac to dc conversion- chokes – Transformers. Electrical charge - current - potential - units of measuring - Ohm's law

Unit: II

Galvanometer, ammeter, voltmeter and multimeter - Electrical energy - power - watt - kWh - consumption of electrical power. ac and DC - Single phase and three phase connections - RMS and peak values.

Unit: III

House wiring - overloading - earthing - short circuiting - Fuses - colour code for insulation wires - Circuit breaker. Electrical switches. Electrical bulbs- Inverter - UPS - Stabilizer - generator and motor

Unit: IV

Fluorescent lamps-LED lamps - street lighting - flood lighting - electrical fans- electrical room heater - wet grinder - mixer - water heater - storage and instant types, electric iron box, microwave oven - induction cooker - fridge.

Unit: V

Microphones, Headphones, loud speakers and room acoustics - Basic concepts of radio transmitter and receiver - Basic concepts of TV- Transmitter and receiver - Dish antenna - DTH system - Mobile communication system - MODEM.

Text books

1**. B L Theraja & A.K. Thereja**, A text book in Electrical Technology, S Chand & Co., 2005

M G Say, Performance and design of AC machines, ELBS Edn.

S.P. Bali, Consumer electronics, Pearson education - 2005

Undergraduate Department of Physics (SF)

Programme for B.Sc Physics from 2015 series

SEM	Part	Course No.	Course Title	Hours	Credits	Marks
1	I	TAM/FRE/HIN		3	2	30
1	II	ENS 1201	Conversational Skills	3	2	30
1	IIIC	PHS1331	Physics Lab – I	3	3	45
1	IIIC	PHS1553	Mechanics	5	5	75
1	IIIC	PHS 1555	Geometrical Optics	5	5	75
1	IIIS	MAS1471	Mathematics – I	5	4	60
1	IVLS1	PHS 1231	Life Skill – I	3	2	30
1	IVNME1	PHS 1233	NME–I	3	2	30
			Total	**30**	**25**	**375**
2	I	TAM/FRE/HIN		3	2	30
2	II	ENS1202	Reading & Writing Skills	3	2	30
2	IIIC	PHS1332	Physics Lab – II	3	3	45
2	IIIC	PHS1554	Electricity & Magnetism	5	5	75
2	IIIC	PHS 1556	Analog Electronics	5	5	75
2	IIIS	MAS1472	Mathematics – II	5	4	60
	IVLS2	PHS 1232	Life Skill – II	3	2	30
2	IVNME2	PHS 1234	NME – II	3	2	30
2	V	XXXxxxx	Extension Activity(NSS/PED,SLP)	2	1+1	
			Total	**30**	**25**	**375**
3	I	TAM/FRE/HIN		3	2	30
3	II	ENS2201	Study Skills	3	2	30
3	IIIC	PHS2661	Physics Lab – III	6	6	90
3	IIIC	PHS2463	Thermodynamics& Statistical Physics	4	4	60
3	IIIC	PHS2445	Astrophysics& Relativity	4	4	60
3	IIIC	PHS 2547	Physical Optics	5	5	75
3	IIIS	CHE2471	Chemistry – I	5	4	60
			Total	**30**	**27**	**405**
4	I	TAM/FRE/HIN		3	2	30
4	II	ENS2202	Career Skills	3	2	30
4	IIIC	PHS2662	Physics Lab – IV	6	6	90
4	IIIC	PHS2464	Classical & Quantum Physics	4	4	60
4	IIIC	PHS2446	Digital Electronics	4	4	60
4	IIIC	PHS 2548	Mathematical Physics	5	5	75
4	IIIS	CHE2472	Chemistry – II	5	4	60
4	V	XXXxxxx	Extension Activity(NSS/PED,SLP)	2	1+1	
			Total	**30**	**27**	**405**

SEM	Part	Course No.	Course Title	Hours	Credits	Marks
5	III C	PHS 3661	Physics Lab – V	6	6	90
5	III C	PHS 3663	Atomic Physics and Molecular Spectroscopy	6	6	90
5	III C	PHS 3665	Renewable Energy & Storage	6	6	90
5	III C	PHS 3559	Medical Physics	5	5	75
5	IV LS3	PHS 3231	Physics in Music	3	2	30
5	IV VE	PHS3200	Environmental Studies	4	2	30
			Total	**30**	**27**	**405**
6	III C	PHS 3662	Project	6	6	90
6	III C	PHS 3664	Communication system and Microprocessor	6	6	90
6	III C	PHS 3556	Nuclear Physics	5	5	75
6	III C	PHS 3668	Solid State Physics	6	6	90
6	IV LS4	PHS 3232	Digital Photography	3	2	30
6	IV VE	VAL0000	HVS	4	2	30
			Total	**30**	**27**	**405**
			Grand Total for Semester I - VI	**180**	**158**	**2370**

Courses offered to Non-Major Students by the Department of PHYSICS

Part III Major Supportive Courses

SEM	Course No.	Course Title	Hours	Credits	Marks
I	PHS1471	Physics for Mathematics – I	5	4	60
II	PHS1472	Physics for Mathematics – II	5	4	60
III	PHS 2473	Microcontroller and programming	5	4	60
III	PHS2471	Physics for Chemists – I	5	4	60
IV	PHS2472	Physics for Chemists – II	5	4	60
		Total	**20**	**16**	**240**

Part IVLS Life Skill Courses:

SEM	Course No.	Course Title	Hours	Credits	Marks
I	PHS1231	Maintenance of Home Appliances	3	2	30
II	PHS1232	FM Radio theory & practice	3	2	30
V	PHS 3231	Physics in Music	3	2	30
VI	PHS 3232	Digital Photography	3	2	30
		Total	**12**	**8**	**120**

Part IVE Non Major Elective Courses

SEM	Course No.	Course Title	Hours	Credits	Marks
I	PHS1233	Basic Electronics	3	2	30
II	PHS1234	Wonders of Sky	3	2	30
		Total	**6**	**4**	**60**

PHS 3661 PHYSICS LAB V (6 credits, 6 hrs)

Objectives: This practical course intends

To impart skills in measurement

To design and plan experimental procedures

To record and process the results to reach non-trivial conclusion about significance of results of the experiments

To enable the students to have hands on experience with modern instrumentation

Troubleshooting the given instrument

Design of Digital to Analog Convertor using network circuit

Design of Analog to Digital Convertor

Execution of Microprocessor programmes using 8086/88(Addition, Subtraction, Multiplication and Division)

Construction of Synchronous Counter

Construction of asynchronous counter

Study of Amplitude and Frequency Modulation

Measurement of Dielectric Constant

Measurement of Numerical aperture of a given optical Fibre

Measurement of wavelength of the spectral lines using Constant Deviation Spectrometer

Determination of wavelength of the monochromatic source using Michelson's Interferometer

Determination of efficiency of Solar Cooker

Determination of Susceptibility – Quinke's method

Measurement of e/m ratio of electron-CRT Method

Measurement of the Charge of Electron - Milliken's oil drop Method

Study of Microprocessor interfacing

Construction of Random Access Memory (RAM)

Construction of Read Only Memory (ROM)

A minimum of **any sixteen** experiments shall be carried out.

REFERENCE

Practical Physics and Electronics, *C.C.Ouseph,U.J.Rao,V.Vijayendran,S.Visvanathan*, Printers and Publishers Pvt.Ltd. 2007.

PHS 3663 ATOMIC PHYSICS & MOLECULAR SPECTROSCOPY (6 Cr, 6hrs)

Objectives: To enable the students

To understand the fine structure of the atom

To correlate atomic structure when treated with external fields

To know the basics of molecular spectroscopy

To analyse the information derived from various spectroscopic techniques

UNIT I: Vector Atom Model and Coupling schemes

Bohr's theory – Its drawbacks – Sommerfeld's atom model – fine structure of H_α line in Balmer series of hydrogen atom – Limitations of Sommerfeld atom model – Vector atom model – Spinning Electron – Space Quantization-Various quantum numbers associated with vector atom model– LS and jj coupling –Pauli's exclusion principle – Electronic Configuration

UNIT II: Atomic Spectra and X-ray Spectra

Spectral terms – selection rules – intensity rules – Spectra of alkali metals – doublet fine structure – Penetrating and Non-Penetrating Orbits – Zeeman Effect– Paschen-Back Effect – Stark Effect .Origin of X-rays – Properties of X-rays-continuous and characteristic X- ray spectrum- Moseley's law – X-ray Diffraction, Bragg's Law

UNIT III: Molecular Spectra and Microwave Spectroscopy

Spectroscopy – Origin and Nature of Molecular Spectra – Factors affecting Line Width, Intensity of spectra – Born-Oppenheimer Approximation Classification of Molecules – Rotation of Molecules-Rotational energy levels – Selection Rules – Rigid Diatomic Molecule – Non-rigid Rotator – Microwave Spectra of symmetric and asymmetric top molecules – Microwave Spectrometer Instrumentation

UNIT IV: Infrared Spectroscopy

Infrared Spectra – Vibrating Diatomic molecule – Vibrational energy levels – Selection Rules – Simple Harmonic Oscillator – Anharmonic Oscillator –Diatomic Vibrating Rotator – vibration-rotation(IR) spectrum of carbon monoxide CO – Breakdown of the Born-Oppenheimer approximation-interaction of rotation and vibration - Vibrations of polyatomic molecules – FTIR Spectrometer

UNIT V: Raman Spectroscopy

Raman Scattering – Classical and Quantum theory of Raman Effect –Pure rotational (Linear molecules), vibrational (Spherical Top) Raman spectra – Raman activity of vibrations – Mutual Exclusion Principle - Raman Spectrometer

TEXT

Introduction to Modern Physics, *F. K. Richtmyer, E. H. Kennard and John N. Cooper,*McGraw-Hill Book Company, 6th Edition, 1969.

Fundamentals of Molecular Spectroscopy,*C.N. Banwell, E.M.Mccash*, Tata McGraw-Hill Book Company,4th Edition, 2016.

REFERENCE

Concepts of Modern Physics,*Arthur Beiser*, McGraw-Hill Book Company, 6th Edition, 1987.

Introduction to Atomic Spectra,*Harvey Elliott White*, Harcourt, Brace & World Inc.1968

Molecular Structure and Spectroscopy,*G. Aruldhas*, Prentice Hall India, 2007.

PHS 3665 RENEWABLE ENERGY AND STORAGE (6 Cr, 6 Hrs)

Objectives: To enable the students

To know the abundance of Solar radiation

To understand the principle of conversion of solar energy into thermal and electrical energy

To get exposed to various types of non-conventional energy sources

To know the methods of energy storage and need for energy conservation

UNIT I: Energy Sources, Solar Radiations and its Measurements

Energy consumption – World's reserve of commercial energy sources and their availability – various forms of energy – renewable and conventional energy systems – fossil fuel availability – applications – merits and demerits

Solar constant –solar radiation at the earth's surface – solar radiation geometry – solar radiation measurements – pyranometer – pyrheliometer– sunshine recorder

UNIT II: Thermal and optical conversion methods

Solar water heating systems – solar cooling and refrigeration – solar thermal electric conversion (Low, Medium, High) – solar still – solar dryers – solar cooking – Photo voltaic conversion – Solar cell principle – types of solar cell – efficiency of solar cell – Solar Green houses

UNIT III: Solar Energy Collectors

Flat plate collectors(FPC) – concentrating collectors – working principle – Thermal loss in FPC – collector efficiency factor – Flow factor – effects of various parameters on performance – evacuated tube solar collectors – types of evacuated tube collector – working principle

UNIT IV: Non-Conventional Energy Sources

Wind energy: type of wind mills – their performance – total, maximum power & forces on the blades– Ocean Energy: OTEC – Open & Closed OTEC system – Waves: energy & power from waves – wave energy conversion by floats – Tides: energy from tides – single pool and modulated single pool tidal systems – Geothermal energy: Nature of Geothermal field – Geothermal sources – Biomass Energy: Photosynthesis – Biomass – Biogas generation – ethanol from wood – wood Gasification

UNIT V: Energy Storage and Energy Conservation

Solar pond – Energy extraction from solar pond – Solar energy storage – Types of storage: thermal – Electrical – Chemical – Mechanical – Hydrogen as a fuel – Fuel cells – working principle – super capacitors – Energy conservation and energy audit

TEXT

Solar Energy Principles of Thermal Collection and Storage, *S.P. Sukhatme*, 2nd Ed. McGraw Hill Publications, New Delhi, 2004.

Non-conventional Sources of Energy, *G. D. Rai*, 4th Edition, Khanna Publications, New Delhi, 2004.

REFERENCES

Solar energy Fundamentals and Applications, *H.B.Garg and J.Prakash*, First revised reprint,Tata McGraw-Hill Publications, 2016.

Solar Energy Utilization, *G. D. Rai*, Khanna publication, 1996.

Power Plant Technology, *M.M.El-Wakil*,Published by Tata McGraw-Hill Education, 1984.

Solar Energy - Fundamentals, Design , Modeling and Applications,*G. N. Tiwari*, Narosa Publishing House, New Delhi, 2004.

PHS 3559 MEDICAL PHYSICS (5 credits, 5hrs/wk)

Objectives: To enable the students

To understand the physical principles involved in biomedical instrumentation

To know the principle and working of diagnostic instruments

To understand the working of bio-potential recorders

To know the working of modern imaging systems

Unit I: Bio-potential Electrodes

Transport of ions through the cell membrane – Bio-electric potential – design of Medical instruments – components of the bio-medical instrumentation systems – Electrodes

Unit II: **Bio signal Acquisition**

Transducers – Biomedical pre-amplifier – isolation amplifier – instrumentation amplifier – bridge amplifier – line driving amplifier – current amplifier – chopper amplifier – Bio-signal analysis

Unit III: Bio-potential Recorders

Characteristics of recording systems – Electrocardiograph(ECG) – Introductory idea about Electroencephalography – Electromyography, Electroretinography – Therapeutic instruments: Pace maker – Batteries – Artificial heart valves – Heart-Lung machine – Kidney machine

Unit IV: Specialized Medical Equipment and Safety Instrumentation

Blood flow meters – gas analyzers – Oxy-meter – Gluco meter – blood cell counters – Radiation detectors – digital thermometer - radiography – angiography – endoscopy. Radiation safety instrumentation – Physiological effects due to 50Hz current passage – microshock and macroshock

Unit V: Advances in Biomedical Instrumentation

X-ray machines and computer tomography – Magnetic resonance imaging system – Ultrasonic imaging systems – Computers in medicine – Lasers in medicine - biomaterials

TEXT

Biomedical Instrumentation, *Dr.M.Arumugam*, 2nd Ed, Anuradha Publications, 2006.

Biomedical Instrumentation and Measurement, *Leslie Cromwell*, Fred J. *Weibell, Erich A. Pfeiffer*, Prentice Hall India Learning Private Limited; 2 edition, 2011.

REFERENCES

Handbook of Biomedical Instrumentation, *R.S.Khandpur***,**AvadhPrakashan, 1999.

Instrumental methods of Analysis, *Willard, Merritt, Dean and Settle*, 4th Ed, Hill Valley, California, 1996.

PHS3200 ENVIRONMENTAL STUDIES 4 Hrs – 2 Credits

Objectives:

To provide knowledge about Eco system

To understand bio diversity and conservation

To learn about the consequences of various types pollution

To acquire knowledge about the importance of environmental conservation and audit

UNIT 1: Ecosystem

Ecosystem / Biodiversity and its conservations – concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – Energy flow in the ecosystem – food chain, food webs and ecological pyramids. Introduction, types, characteristics features, structure and functions of pond ecosystem, forest ecosystem, Grass land ecosystem and Desert ecosystem.

UNIT 2: Biodiversity

Biogeographical classification of India – values of biodiversity – biodiversity at global, national and local levels – India as a mega diversity nation – Hot spots of biodiversity – conservation of biodiversity.

UNIT 3: Pollution and impacts

Pollution and environmental impacts: Fossil fuels and the environment – impacts due to non conventional energy sources – Green house effect – CFC – global warming and ozone depletion – Air pollution – effects – criteria of pollutants.

UNIT 4: Types of Pollution

Pollution and meteorology – Indoor air quality – water pollution – Noise pollution – Thermal pollution – nuclear hazards – acid rain – solid waste management – role of an individual in prevention of pollution – Disaster management – floods, earthquake, cyclone and landslides.

UNIT 5: Environmental conservation and Audit

Social issues / Human population and the environment –Water conservation assessment of risks – Environmental ethics – waste land reclamation – Environmental protection Act (Air Act, Water Act, Wildlife protection Act, Forest Conservation Act) – Environmental auditing – Public awareness.

TEXT:

Dr.Raman Sivakumar, Introduction to environmental science and engineering, Tata McGraw-Hill 2005.

REFERENCES

Erach Bharucha, Text Book of Environmental studies for under Graduate Courses, Universities Press, 2005.

Anjanayalu, A, Introduction to Environmental Science, BS Pub, Hyderabad,2004.

PHS 3662 PROJECT (6 cr, 6 hrs)

Objectives:

To provide the students with an opportunity to acquire knowledge from various areas of physics and correlate their learning to specific areas of interest.

To be able to work independently and also in collaboration with others.

To work towards a time-bound goal.

To learn to analyze the results and to communicate the outcomes, preparing them for the world outside.

Implementation

Students are given the freedom of choosing the topic of the project. It may be either theoretical or experimental. After getting approval for the proposed project work within first 5 sessions, students are supposed to carry out these projects in about 15 x 3 = 45 hrs in laboratory. After the first 5 classes, they must present the first report (Oral & Written). Then the second progress report and the final report are to be submitted at appropriate intervals of time.

Students are encouraged to take the work as a challenge, in order to facilitate the publication of their results leading scientific Journals.

Mark Distribution

		Marks	Weightage
Presentation of project proposal	-	20	10.0%
Continuous assessment for each class	-	100	50.0%
First progress report	-	10	5.0%
Second progress report	-	15	7.5%
Final progress report	-	25	12.5%
For the written & bound report	-	30	15.0%
		200	100%

PHS3664 COMMUNICATION SYSTEMS AND MICROPROCESSOR (6cr, 6hrs)

Objective: Enable the Students

To understand the basic principles of modulation & demodulation

To gain knowledge in digital communication, fibre optics communication and satellite communication

To understand the architecture of microprocessor, the different instructions in microprocessor along with the assembly language

To gain knowledge of interfacing techniques with microprocessor

Unit I: Amplitude and Frequency Modulation

Modulation – need for modulation – Amplitude modulation theory-frequency spectrum of AM – Representation of AM – Power relation in the AM wave – Generation of AM wave – Frequency modulation – Mathematical representation of FM – Frequency spectrum of the FM wave – FM Receivers – Basic FM Demodulators – Receiver types – Introduction to Phase modulation

Unit II: Digital Communication

Digital data transmission systems – coding and error control – Digital system classifications – Digital Communication – Modem classification, Modem interfacing, Network organizations, Switching systems, Network protocols – Pulse Amplitude Modulation – Pulse Width Modulation – Pulse Position Modulation

Unit III: Optical and Satellite Communication

Optical communication – Optical fibre characterization – Optical transmitters and receivers – Satellite Communication – the INTELSAT network – Satellite classes and Station keeping – TDMA-TDMA Synchronization techniques

Unit IV: Architecture and Instructions of 8088 Microprocessor

Internal architecture of 8088 microprocessor and pin diagram – pipelining, memory timing diagram – Addressing modes – Data transfer instruction, Arithmetic and logic instructions, Program Control instruction – Simple assembly language programs

Unit V: Basic I/O Interface

Programmable Peripheral interface PPI 8255A, Programmable Interval Timer 8253 (PIT) – Programmable Direct Memory Access Controller 8237 A – Stepper motor and Seven Segment Display interface

TEXT

Electronic communication systems, *George Kennedy*, 3rd Ed, Tata-McGraw-Hill New Delhi, 2001.

Intel Microprocessors – Architecture programming and interfacing, *Barry B.Brey*,4th Ed, Prentice Hall of India Pvt. Ltd., 1997.

REFERENCES

Analog and Digital Communication Systems, *Martin S. Roden*, 3rd Edition, Prentice – Hall, India,1999

Communication Systems, *B.P.Lathi*, Wiley Eastern Limited, India,2002

Fibre Optics through Experiments, *A.K.Ghatak and M.R.Shenoy*, Viva Books Private Limited, New Delhi, 2005.

The 8088 and 8086 Microprocessors Programming, interfacing software hardware and applications, *Walter A. Tribal and Avtar Singh*,Prentice Hall of India Pvt. Ltd., 1997.

PHS 3556 NUCLEAR PHYSICS (5credits, 5 hrs/wk)

Objective: Enable the students

To know about radiation detector and nuclear reactors
To understand nuclear structure
To understand the phenomenon of radioactivity
To know about the basics of elementary particles

Unit I: Structure and properties of Nucleus

Nuclear mass – Bainbridge mass spectrometer – mass defect – binding energy – packing fraction – stability – size – nuclear forces – meson theory – isotopes – isobars – liquid drop model – semi empirical mass formula –predictions of shell model – Fermi Gas model

Unit II: Radioactive Decay

Law of radioactive disintegration – law of successive disintegration - transient and secular equilibrium – carbon dating – age of earth – alpha decay: Gamow theory – beta decay: Fermi theory – neutrino theory – gamma decay: nuclear isomerism – internal conversion

Unit III: Radiation detectors and accelerators

GM counter – bubble chamber – Wilson cloud chamber – photographic emulsion – accelerators: – linear accelerators – cyclotron – synchrocyclotron – betatron

Unit IV: Nuclear reactors

Q value equation for nuclear reaction – types of nuclear reactions - nuclear transmutation - nuclear fission – chain reaction – nuclear reactor – four factor formula – safety featurers – atom bomb – nuclear fusion thermonuclear reactions

Unit V: Elementary particles

Classifications of elementary particles – particle interactions – conservation laws – CPT theorem - elementary particle symmetry –quark model

TEXT

Nuclear Physics, *D.C.Tayal,* Himalaya Publishing House, Mumbai, 1995

Elements of Nuclear Physics , *M.L. Pandya and R.P.S Yadav,* Kedar Nath Ram Nath publications,2017

REFERENCE

Nuclear Physics -An Introduction, *S. B. Patel*, Wiley Eastern Ltd, 2012.

Nuclear Physics, *H.S Hans,* New Age International publishers, 2001.

Introductory to Nuclear Physics, *Samuel S.M.Wong,* Wiley India Pvt Ltd; Second edition 2013.

PHS 3668 SOLID STATE PHYSICS (6credits, 6hrs/wk)

Objectives: To Enable the Students

To know various Bravais lattice crystals

To understand the theory of crystal binding and phonon

To gain knowledge in the Physics of semiconductor devices

To understand the theory of super conductors

Unit I: Crystal Structure

Crystal lattice – basis - Bravais lattice - crystal planes and Miller indices – unit cells – typical crystal structures – packing fraction – diffraction of waves by crystals – Bragg's law – reciprocal lattice vectors – diffraction condition – Brillouin zones – reciprocal lattice to SC, BCC and FCC lattice – structure factor of BCC and FCC lattice – atomic form factor

Unit II: Crystal Binding and Phonon

Crystals of inert gases – cohesive energy – ionic crystals – covalent crystals – metallic crystals – hydrogen-bonded crystals - Vibrations of crystals with mono-atomic and diatomic basis – phonons – primary scattering mechanisms

Unit III: Energy Bands

Free electron theory in 1D and 3D – Fermi-Dirac distribution – Fermi energy – heat capacity of electron gas – electrical conductivity and Ohm's law – motion of electrons in magnetic field – Hall effect – energy bands - nearly free electron model – origin of band gap – Bloch functions – Kronig-Penney model – classification of materials into metal, semiconductor and insulator

Unit IV: Superconductors

Destruction of superconductivity by magnetic field – Meissner effect – isotope effect – type-I and type-II superconductors – London equation – coherence length – BCS theory of superconductivity – flux quantization – DC and AC Josephson effect – high temperature superconductors

Unit V: Defects and Dislocations

Lattice Vacancies – Diffusion - Colour centers – strength of alloys – general considerations – Hume - Rodhery rules – order - disorder transformation – phase diagram – Kondo effect

TEXT

Introduction to Solid State Physics, *Charles Kittel,*7th edition, John – Wiley, 1996

Principles of Solid State , *H.V.Keer,* New Age International (P) Limited, Publishers, First edition 2005.

REFERENCES

Solid State Physics, *S.O. Pillai,*New Age International (P) Limited, Publishers, 1997

Solid State Physics, *M. A.Wahab,*Narosa Publishing House, Delhi, 1999.

Introduction to Superconductivity, *A.C. Rose-innesand E.H. Rhodrick,* Paramount Press, 1978

PHS 3231 PHYSICS IN MUSIC (2credits, 3hrs/wk)

Objectives: To Enable the Students

To know the basics of sound production and perception
To understand the theory of acoustic waves
To acquire knowledge about the sound characteristic of musical instruments
To understand the properties of sound waves

Unit I: Characteristics of sound waves

Vibrations – periodicity – pitch and frequency – Vibrations in musical instruments – digital sampling– waveforms –resonance – Harmonics (overtones) – spectra and timbre

Unit II: Waves and Properties of Sound

Waves– wave motion – sound propagation – echoes – interference and beats – Sound intensity – Decibel Hearing and the human ear – loudness and intensity – dependence of loudness on pitch

Unit III: Musical Instruments

Piano keyboard – scales and intervals – Natural modes of vibration – standing waves percussion instruments – Strings – Pipes – woodwinds – brass – digital synthesis

Unit IV: Acoustics

Acoustics of buildings: Reverberation and time of reverberation – Absorption co-efficient – Sabine's formula – Measurement of Reverberation time – Acoustic aspects of halls and auditoria

Unit – V: Human Voice – Production and Perception

The human voice – Sound perception and illusion – Binaural effects – Critical bands – masking

TEXT

Musical Acoustics, *Donald E. Hall*, 3rd edition, Brooks-Cole Publishing Co., California, 2002

REFERENCES

Waves and oscillations, *Brij Lal and N Subrahnamyam*, Vikas Publishing House Pvt Limited, 2009

The Science of Sound, *Thomas D. Rossing*, 3rdEdition, Addison-Wesley, 2002

The Acoustical Foundations of Music, *John Backus*, 2ndEdition, (Norton and Co. 1977

The Physics of Musical Instruments, *N.H. Fletcher and T.D. Rossing*, 2ndEdition, Springer 1998

PHS 3232 Digital Photography (2 credits, 3 hrs/wk)

Objective: Enable the students

To comprehend the principle and accessories of Photography
To understand the fundamentals of digital photography
To comprehend and apply the basic tools of digital editing
To impart technical knowledge

Unit I: History of photography

Camera, Pin hole camera – Different types of camera, Dark room, Dark room accessories – developer – fixer – Printing machine – developing film and paper.

Unit II: Lenses and Defects

Lens types –normal, wide angle, telephoto and zoom lenses – lens defects– spherical aberration – chromatic aberration – coma - astigmatism – flare

Unit III: Digital Photography fundamentals

Light Magnification – Power of lenses- Brightness and f-ratios – Field of view – Aperture and stops – shutter speed – Exposure triangle – Focus modes – Light – Flash - Composition – Framing and Layering.

Unit IV: Modern Techniques

Image recording using video camera – editing – mixing – recording using digital camera - pixel– transfer to computer – use of Photoshop –Digital Printers - printing images

Unit V: Digital Editing

Images and Graphic design – to open images from multiple sources – work with layers – masking – other non-destructive edits –adjusting the luminance – correcting color – retouching and healing- sharpening images.

Text

Fundamentals of Photography, C.B. Neblette van NostrandReinttold Co., 1970.
Abode Photoshop 6 Studio, Prentice Hall of India Pvt. Ltd.2000
The digital photography, *Scott Kelby*, published by New Riders, 2008.

References

The Art of Photography, *Bruce Barnbaum*,published by Rocky Nook, 2011
The Photoshop CS book for Digital Photographers, *Scott Kelby*,published by New Riders (2003).

w.e.f. 2020-2021

Semester	Course Code	Course Title	Hrs./Wk.	Credits
I	PHY121V	Physics of Bio-molecules	2	2
II	PHY122V	Foundational Physics of Astronomy	2	2
III	PHY221V	Solar Devices–Installation and Maintenance	2	2
IV	PHY222V	Physics of Medical Equipment	2	2
V	PHY321V	CCTV Installation and Maintenance	2	2
VI	PHY322V	ICT tools for Physics	2	2

PHY121V Physics of Bio-Molecules 2Hrs/ 2Cr

This course introduces students to the physics of biomolecules and experimental techniques used to assess their properties.

By the end of the course, students will be able to

i. identify the building blocks of biomolecules
ii. understand the forces responsible for dynamics of biomolecules
iii. explain the chemical reactions between biomolecules
iv. measure basic physical properties of bio fluids
v. analyse the results of some experimental techniques used in biomolecule characterization

Unit 1: The Building Blocks

Proteins- Lipids- Nucleic Acids- Carbohydrates- Water- Proteoglycans and Glycoproteins- Cells- Viruses- Bacteria- Other Molecules

Unit 2: Mesoscopic Forces

Cohesive Forces- Hydrogen Bonding- Electrostatics- unscreened Electrostatic Interactions- Screened Electrostatic Interactions- the Force between Charged Spheres in Solution- Steric and Fluctuation Forces- Depletion Forces- Hydrodynamic Interactions- Direct Experimental Measurements of Intermolecular and Surface Force

Unit 3: Motility

Diffusion- Low Reynold's Number Dynamics- Motility- First Passage Problem- Rate Theories of Chemical Reactions

Unit 4:Surface Phenomena

Surface Tension- Adhesion- Wetting- Capillarity- Experimental Techniques- Friction- Other Surface Phenomena

Unit 5: Experimental Techniques

Static Scattering Techniques- Dynamic Scattering Techniques- Osmotic Pressure- Force Measurement- Electrophoresis

Textbook

Applied biophysics, Tom Waigh - J. Wiley & Sons (2007).

References

1. "Water and Biomolecules: Physical Chemistry of Life Phenomena" by KunihiroKuwajima, KunihiroKuwajima, Yuji Goto, Fumio Hirata, Terazima and Mikio Kataoka, Springer, 2009.

2. "Physics of biomolecules and cells" by NATO advanced study institute

Bloom's Taxonomy	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**
K1: Remembering					
K2: Understanding		**2**			
K3: Applying			**3**	**3**	**3**
K4: Analyzing			**4**		**4**
K5: Evaluating					
K6: Creating					
Mean					**3.1**

PHY122V *Foundational Physics of Astronomy* *2Hrs / 2Cr*

This course is a novice to beginners in star gazing and imbibes a passion on sky watch.This is planned to introduce the basic concepts of astronomy. The students will familiarize themselves with instrumentation used for analyzing starlight and the innumerous celestial objects.

At the end of the course, the students will be able to

i. understand the specific aspects of the sky, adopting the unaided eye to do star gazing.

ii. identify the spectral classification of stars, its magnitudes and also illustrate the birthand death of stars and to estimate the stellar magnitudes.

iii. comprehend the planets, minor planets, satellites and their properties.

iv. utilize optical telescopes, either for formal research or as a hobby, and record common sky phenomena.

v. delineate the characteristics of galaxies and other celestial objects in the sky.

Unit 1Unaided Eye Astronomy

Sky with unaided eye- pole star- Nadir-Zenith-Celestial sphere – coordinate systems: Horizon system-longitude –latitude system-equatorial system- the ecliptic- RA/DEC coordinates-distance measurement, A.U- parsec.

Unit 2Constellations and Stars

Constellations- Zodiacs-Norton's map– Sky map-Stars- -Stellar distance – Stellar magnitude –spectral classification of stars- H-R diagram – Main sequence stars – Sun as a star- end state of stars – white dwarfs – Novae and Super novae – Neutron star – Black hole.

Unit 3 Solar System

Solar family –Planetary system-Asteroids and meteoroids-natural satellites of planets -seasons – Eclipse – Solar, lunar - Sun –layers of Sun- solar limb darkening-sunspot- solar imaging.

Unit 4 Telescopes and Mounting

Astronomical observations –Types of telescopes – Reflector and refractor type - Recording devices – Photography, Photomultipliers and CCDs. Radio telescope - IR, UV, X – Ray and Gamma ray telescopes- atmospheric seeing-Telescope mounting: Equatorial mounting, Alt-Azimuth mounting.

Unit 5 Galaxies& Mysterious objects

Galaxies; Milky Way galaxy -Types of galaxies - spiral –elliptical and irregulars- Andromeda galaxy -MilkyWay components: gas, stars, magnetic field and cosmic rays-21 cm line-Comets-Star clusters – Binaries-Nebula-Pulsars- Quasars- Aurora borealis- active galactic nuclei.

Textbooks

Jay M. Pasachoff, Roger Tory Peterson, A Peterson Field Guide to Stars and Planets 4th,Updated Edition , Wil Tirion (2019).

References

1. M.Pasachoff, Astronomy: From the earth to the Universe, Brooks/Cole, Thomson Learning, 2002
2. William Kaufmann, Astronomy: The Structure of the Universe, McMillan Publishing Co.inc, New York.(1999).
3. Frank H. Shu,The Physical Universe, An introduction to Astronomy, University Science Books, Mill Valley, California, (1982)

Bloom's Taxonomy	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**
K1: Remembering	**1**				
K2: Understanding		**2**			
K3: Applying			**3**		**3**
K4: Analyzing			**4**		
K5: Evaluating				**5**	
K6: Creating					
Mean					**3**

PHY 221V Solar Devices–Installation and Maintenance 2Hrs / 2Cr

The aim of this course is to enable the Students to know the abundance of solar energy, radiation and to understand the principle of conversion solar energy into thermal conversion andelectricalenergy.Studentsgetexposedtovarioustypesofenergysources,installationand maintenance. They will know the different methods of energystorage.

By the end of this course, students will be able to

i identify the PV system anddesigning

ii list the requirements for installation and maintenance of solarpanel

iii describe the various technical prospects andtroubleshooting

iv identify various types of solar cooker, design and theiruses v

devise methods for energy storagesystems

Unit1 Solar Panel

Components of typical SPV system- Selection of systems design- Standards / regulations on earthing- safety measurement guidelines in solar plant- Designing a solar photo voltaic system

Unit 2 Solar Panelmaintenance

PV plant installation- general and technical requirements- testing before installation, mounting solar modules –maintenance- precautions and preventive steps.

Unit3Solar Water Heating systems

General technical specification - environmental conditions- Sizing of solar water heater system- Installation - Maintenance and trouble shooting.

Unit 4Solar cooker

Principle of solar cooker- Types of solar cooker- Design – Reflector material – Tilt and Orientation – Benefits of Solar Cooker – Maintenance

Unit5 Solar Pond

Design – Construction – types – heat extraction system – salinity gradient – performance and efficiency – Maintenance of solar pond.

Textbook

1. S.P. Sukhatme, Solar energy principles of thermal collection and storage, IIEd. McGraw Hill Publications, New Delhi(2010).

References

1. Solar Energy, Fundamentals Design, modeling and Application: TiwariGN.-2015
2. Shah, Yatish T., Thermal Energy: Sources, Recovery, and Applications. CRC Press. (2018).
3. Hand book on Installation and Maintanence of Solar Panel, CAMTECH,Gwalior. (2013).
4. User's handbook on Solar Water Heaters –MNRE.
5. Solar C1ooking Basics - Rose Bazile.

Bloom's Taxonomy	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**
K1: Remembering	**1**			**1**	
K2: Understanding		**2**	**2**		
K3: Applying		**3**	**3**		
K4: Analyzing	**4**				
K5: Evaluating					**5**
K6: Creating				**6**	**6**
Mean					**5.5**

PHY 222V *Physics of Medical Equipment* *2Hr / 2 Cr*

To measure biological signals and to design a medical instrument, concepts of electronics and measurement techniques are needed.This course gives an introduction on the electronic principles used medical equipment. It enables them to gain knowledge on the functioning of various medical equipment involving diagnosis and treatment of disease in human.

At the end of the course, students will be able to

i. explain the basics of human physiology
ii. describe the principles of sensing and processing of biosignals in medical equipment
iii. explain the functioning of various monitoring equipment
iv. illustrate the working principles of various imaging equipment
v. elucidate the functions of therapeutic equipment

Unit 1Biosignals

Introduction – importance of bioinstrumentation – human body – bio signals – measurands – temperature – blood pressure – heart beat rate (ECG) – respiration – muscle tension (EMG) – blood volume pulse (BVP) – galvanic skin response (GSR) – brain activity (EEG)

Unit 2 Biosignal processing

Sensors – transducers – types – bio amplifiers – displays and recorders – telemetric systems

Unit 3Monitoring equipments

Blood flow and cardiac output measurement – oximeters – Pulmonary function measurements – Blood cell counters

Unit 4Imaging equipments

X – ray – Magnetic resonance imaging – 3D ultrasonic imaging systems – Thermographic equipment

Unit 5 Therapeutic equipments

Cardiac defibrillators – Heart-lung machine – Kidney machine – Drug delivery devices – Electrotherapy equipments

Text Book

M. Arumugam, Bio-medical Instrumentation, Ed.2, Anuradha Publications, 2003

Reference

1. Willard, Merritt, Dean and Settle, Instrumental methods of analysis, Ed.6 hill valley, California, 1996.
2. R.S. Khandpur,Handbook of Medical Instrumentation, Tata McgrawHill, 1999

Bloom's Taxonomy	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**
K1: Remembering	**1**				
K2: Understanding		**2**			
K3: Applying			**3**	**3**	**3**
K4: Analyzing			**4**	**4**	**4**
K5: Evaluating					
K6: Creating					
Mean					4

PHY 321V *CCTV Installation and Maintenance* *2Hrs / 2Cr*

This program is aimed at training candidates for the job of a "CCTV Installation Technician", in the Electronics sector/Industry and aims at building the following key competencies amongst the learner.

After completing the course the students will be able to,

i. understand and explain the concept in quality tools and apply such in day to day work to improve productivity & quality.
ii. install and Repair dysfunctional system.
iii. understand CCTV camera installation requirement in terms of equipment, system, tools, applications appropriate for a particular site.
iv. select suitable cameras and DVR to provide the better solution to the customers.
v. perform Trouble shootings and maintenance. Perform Testing and Commissioning.

Unit1 CCTV Camera Introduction

Constructing a video surveillance system.Explain functional of blocks and equipment required to implement a video surveillance system. Understanding types of CCTV Camera and their functionality. Site sketches and drawings.

Unit 2 CCTV Camera Installation

Safety and usage of the tools and components for CCTV installation. RJ45, BNC Connector Crimping - Camera Mounting Assembly – Power supply unit Connection - Network Cable Connection - Lens Adjustment– Safety – Site tidiness. Network Switch Installation and Configuration. Wireless Communication device Installation and configuration.

Unit3 CCTV Camera Configuration

Understanding the Configuration procedure-Create User Access- Assign IP Address- Assign Video Compression- Set Frame Rate- Set bandwidth- Set PTZ Preset - Set Time and Date, Time Zone – Set Recording mode – Set Privacy marking/Zone - Set OSD Name.

Unit4 Video Recorder Configuration

Recording & retrieving process of previously recorded footage to the controller of the system.DVR as interface to view and record the image transmitted by a camera.Explain the function of various blocks of DVR. Understand the recording format of a DVR - Create User Name and Password- Set Date and Time, Time Zone
– Initialize hard Disk – Add Camera – Assign Recording type – Assign Frame Rate – Assign Video Compression – Set Bandwidth – Create Backup - Video Playback – Audio Integration.

Unit5 CCTV System warranty and troubleshooting

Warranty associated with the hardware product–documents for the hardware equipments– types of electronic surveillance products and functionalities. Company's policy on product's warranty and other terms and conditions– customer support and

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service policy – camera specifications such as focus, lens type, zoom –hardware equipments before taking to the installation site –replace the hardware

Textbook

CCTV Camera Installation Training English Book. Paper pack, Mr.Prabhu, Jan 2017, CHIP SYSYEMS.

Bloom's Taxonomy	CO1	CO2	CO3	CO4	CO5
K1: Remembering	**1**				
K2: Understanding	**2**				
K3: Applying		**3**	**3**		
K4: Analyzing			**4**	**4**	
K5: Evaluating					**5**
K6: Creating					
Mean					**3.6**

References

CCTV camera equipment Installation, Servie& Maintenance, Govt of India, Ministry of skill development and Entrepreneurship directorate general of training