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	Equivalent Course
I	I	TAM / HIN / FRE 12XX		3	2	30	
	II	ENG12XX		3	2	30	
	IIIC	PHY/PHS1373	Physics Lab - I	3	3	45	PHY1371
	IIIC	PHY/PHS1551	Physics of Motion	5	5	75	PHY1453
	IIIC	PHY/PHS1557	Energy Physics	5	5	75	PHY 1553 /PHY2455
	IIIS	MAT14XX		5	4	60	
	IVE	TAM12XX / NME12XX	Basic Tamil / Advance Tamil / 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	PHY/PHS1374	Physics Lab - II	3	3	45	PHY1372
	IIIC	PHY/PHS1552	Geometrical & Physical Optics	5	5	75	PHY1454
	IIIC	PHY/PHS1558	Electrodynamics	5	5	75	PHY1554/ PHY 2453
	IIIS	MAT14XX		5	4	60	
	IVE	TAM12XX / NME12XX	Basic Tamil / Advance Tamil / 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	PHY/PHS 2671	Physics Lab - III	6	6	90	
	IIIC	PHY/PHS 2573	Analog Electronics	5	5	75	
	IIIC	PHY/PHS 2475	Mathematical Physics	4	4	60	
	IIIC	PHY/PHS 2477	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	PHY/PHS 2672	Physics Lab - IV	6	6	90	
	IIIC	PHY/PHS 2574	Digital Electronics	5	5	75	
	IIIC	PHY/PHS 2476	Classical Mechanics	4	4	60	
	IIIC	PHY/PHS 2480	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	Equivalent Course
V	IIIC	PHY/PHS 3671	Physics Lab - V	6	6	90	
	IIIC	PHY/PHS 3673	Thermodynamics & Statistical Physics	6	6	90	
	IIIC	PHY/PHS 3575	Solid State Physics	5	5	75	
	IIIC	PHY/PHS 3677	Microprocessor & Communication Systems	6	6	90	
	IVLS	LSC32XX	Life Skill Course - III	3	2	30	
	IVEVS	PHY/PHS 3200	Environmental Studies	4	2	30	
			Total	**30**	**27**		
VI	IIIC	PHY/PHS 3672	Physics Project	6	6	90	
	IIIC	PHY/PHS 3674	Atomic Physics & Spectroscopy	6	6	90	
	IIIC	PHY/PHS 3576	Nuclear Physics	5	5	75	
	IIIC	PHY/PHS 3680	Astronomy & Astrophysics	6	6	90	
	IVLS	LSC32XX	Life Skill Course - IV	3	2	30	
	IV VAL	VAL32XX	Value Education	4	2	30	
			Total	**30**	**27**		

Part III Supportive Courses offered to Non-Major Students:

Semester	Course No.	Course Title	Hours	Credits	Marks	Equivalent Course
I	PHY1381 PHY1101	Physics for Chemists – I Physics Lab for Chemists - I	3 2	3 1	45 15	
II	PHY1382 PHY1102	Physics for Chemists - II Physics Lab for Chemists - II	3 2	3 1	45 15	
III	PHY2381 PHY2101	Physics for Mathematics - I Physics Lab for Mathematics - I	3 2	3 1	45 15	
IV	PHY2382 PHY2102	Physics for Mathematics – II Physics Lab 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	Equivalent Course
I	PHY/PHS 1291	Handling of Tools & Machines	3	2	30	
II	PHY/PHS 1292 / PHY/PHS 1294	Physics of Music / Photography & Digital Editing	3	2	30	
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**		

Part IV NME Non-Major Elective Courses:

Semester	Course No.	Course Title	Hours	Credits	Marks	Equivalent Course
I	PHY/PHS 1201	Basic Electricity &Electronics	3	2	30	
II	PHY/PHS 1202	Wonders of Sky	3	2	30	
		Total	**6**	**4**		

Programme Specific Outcome

Upon completion of the program, graduates will be able to

PSO1 : Attain coherent understanding of the academic field of Physics, and secure foundation in physics for their future courses;

PSO2 : Develop experimental and data analysis skills through a wide range of physics experiments;

PSO3 : Demonstrate the systematic understanding of basic concepts of Physics of motion, the fundamentals of geometrical and physical optics, and electro dynamic principles and their simple applications;

PSO4 : Elucidate the design and applications of analog and digital electronics circuits and communication systems;

PSO5 : Apply mathematical techniques with emphasis on applications in physics;

PSO6 : Explain the basics of classical, thermodynamic, statistical and quantum physics and their simple applications in solid state, atomic, nuclear, and astrophysics;

PSO7 : Recognize the importance of mathematical modeling and computing, and the role of approximation and mathematical approaches to describe the physical systems;

PSO8 : Perform independent and group activities of mini projects to experience the aspects of research and to develop their presentation / communication skills;

PSO9 : Acquire subject knowledge and skills of the calibre sought by industry, professional career and public service, as well as providing academic teachers.

PSO10 : Demonstrate professional behaviour and promoting safe learning and work environment;

PSO to PO Mapping for UG Physics

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
PSO1	X	X	X		X		X		X	
PSO2	X	X	X		X	X		X		
PSO3	X	X	X	X	X		X			
PSO4	X	X	X	X	X			X		
PSO5	X	X	X	X	X		X			
PSO6	X	X	X	X	X			X		
PSO7	X	X		X	X	X		X		
PSO8	X		X	X		X			X	
PSO9	X				X		X		X	X
PSO10	X		X	X	X		X		X	

Mapping of Courses with Programme Specific Outcomes (PSOs)

Courses	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10
PHY/PHS 1373	X	X			X		X		X	X
PHY/PHS 1551	X		X		X		X		X	X
PHY/PHS 1557	X		X		X		X		X	X
PHY1381	X		X		X		X		X	X
PHY1101	X	X	X		X				X	X
PHY/PHS 1291	X	X	X						X	X
PHY/PHS 1201	X	X	X						X	X
PHY/PHS 1374	X	X			X		X		X	X
PHY/PHS 1552	X		X		X		X		X	X
PHY/PHS 1558	X		X		X		X		X	X
PHY1382	X		X	X	X		X		X	X
PHY 1102	X	X			X		X		X	X
PHY/PHS 1292	X	X							X	X
PHY/PHS 1294	X	X	X						X	X
PHY/PHS 1202	X	X							X	X
PHY/PHS 2671	X	X			X		X		X	X
PHY/PHS 2573	X			X	X		X		X	X
PHY/PHS 2475	X				X		X		X	X
PHY/PHS 2477	X		X		X		X		X	X
PHY 2381	X				X		X		X	X
PHY 2101	X	X			X		X		X	X
PHY/PHS 2672	X	X			X		X		X	X
PHY/PHS 2574	X			X	X		X		X	X
PHY/PHS 2476	X				X	X	X		X	X
PHY/PHS 2478	X				X	X	X		X	X
PHY 2382	X			X	X		X		X	X
PHY 2102	X	X			X		X		X	X
PHY/PHS 3671	X	X			X		X		X	X
PHY/PHS 3673	X				X	X	X		X	X
PHY/PHS 3575	X				X	X	X		X	X
PHY/PHS 3677	X			X	X		X		X	X
PHY/PHS 3200	X				X		X		X	X
PHY/PHS 3291	X	X		X					X	X
PHY/PHS 3293	X	X		X					X	X
PHY/PHS 3672	X				X		X	X	X	X
PHY/PHS 3674	X				X	X	X		X	X
PHY/PHS 3576	X				X	X	X		X	X
PHY/PHS 3680	X				X	X	X		X	X
PHY/PHS 3292	X	X		X					X	X
PHY/PHS 3294	X	X		X					X	X

PHY/PHS 1551 Physics of Motion 5 Hr/ 5 Cr

The aim of this course is to enable the students to have a thorough understanding of the basic concepts of physics of linear, rotational, and oscillatory motions in different dimensions and wave propagation in elastic media.

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

i. describe two and three dimensional motions and conservation of momentum in a system of particles;
ii. apply law of conservation angular momentum appropriately in rigid body rotations, relate the rotational and translational parameters based on rotational kinematic;
iii. explain the rotational kinematics and evaluate the inter-relationship between work and energy;
iv. explain the concept of fluid dynamics and its applications;
v. describe SHM and list the wave types and its properties; and analyze the properties of sound waves and Doppler Effect.

Unit 1 Linear Motion

Force and Newton's laws - weight and mass - motion in three dimensions - projectile motion, uniform circular motion - types of forces. Momentum - conservation of momentum, two-body collisions, one-dimensional collisions in centre of mass frame of reference, two particle systems, many particle systems, conservation of momentum in a system of particles

Unit 2 Rotational Motion

Rotational kinematics – variables - rotation with constant acceleration - relationship with linear and angular variables – torque - angular momentum of particles - conservation of angular momentum - spinning top - Work and energy, power, kinetic energy and work-energy theorem and proof

Unit 3 Fluid Dynamics

Pressure and density in a fluid, variation of pressure in atmosphere, Pascals and Archimedes' principle, measurement of pressure, surface tension, fluid flow, equation of continuity, Bernoulli's equation and its applications, Venturi meter, Pitot tube

Unit 4 Oscillations

Simple harmonic oscillations, Energy of simple harmonic motion, torsional oscillator, simple pendulum, physical pendulum, Waves and its types, traveling waves, sinusoidal waves, speed of a wave, Energy of a wave, principle of superposition, interference, standing waves and resonance

Unit 5 Wave propagation in Elastic Media

Sound waves and its properties, travelling sound waves, speed of sound, power and intensity, interference, vibrating systems, beats, Doppler Effect

Textbook

1. Halliday, Resnick and Krane, *Physics Vol.I*, Vthedition, Wiley India, (2002)

Reference

1. R. P. Feynman, R. B. Leighton, M. Sands**,** *Feynman lectures on physics*, Vol.I and II, Addison-Wesley (1963), Narosa Publishing (2008).

Bloom's Taxonomy	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**
K1: Remembering	**1**				
K2: Understanding		**2**	**2**		
K3: Applying			**3**	**3**	
K4: Analyzing					**4**
K5: Evaluating		**5**		**5**	
K6: Creating					
				Mean	3.12

PHY/PHS 1557 Energy Physics 5 Hr/5 Cr

The aim of this course is to enable the Students to know the abundance of solar radiation and to understand the principle of conversion solar energy into thermal conversion and electrical energy. Students get exposed to various types of non-conventional energy sources and know the methods of energy storage.

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

i. identify the renewable and non-renewable energy sources and describe their applications;
ii. classify the types of solar energy collectors and cells;
iii. describe the various thermal and electrical applications;
iv. identify various non-conventional energy sources and their uses; and
v. devise methods for energy storage systems.

Unit 1 Energy Sources, Solar Radiations and its Measurements

Energy sources- Resources and availability - Energy consumption - renewable and nonrenewable energy systems - fossil fuel availability - merits and demerits – Applications - solar radiation geometry - solar constant - solar radiation measurements - Solar radiation data

Unit 2 Solar Energy Collectors and Cells

Flat plate collectors- working principles – collector efficiency and thermal losses- Evacuated tubular collectors- types of evacuated tube collector – working principle – thermal characteristics – concentrating collector –

advantage and disadvantage over flat plate collector – Solar cell – working principle – types of solar cell – efficiency of solar cell(No derivation)

Unit 3 **Solar Electrical and Thermal Applications**

Solar electrical applications – lighting applications – other electrical applications - Solar water heating systems - Solar dryers - Solar cooker - Solar still - Solar refrigeration - Solar thermal electric conversion (Low, Medium, High)

Unit4 **Non - Conventional Energy Sources**

Wind energy - type of wind mills - Total, Maximum power & forces on the blades - advantage and disadvantage - Open & Closed OTEC system - energy & power from waves single pool and modulated single pool tidal systems -Geothermal energy – vapour and liquid dominated systems - Advantages and disadvantages of Geothermal energy

Unit 5 **Energy Storage and Energy Conservation**

Solar energy storage – thermal storage electrical storage – chemical storage – mechanical storage – storage of energy in solar pond and its extraction – principle of energy conservation – energy and their conservation.

Text Books

1. S.P. Sukhatme, *Solar energy principles of thermal collection and storage*, II Ed. McGraw Hill Publications, New Delhi (2004).
2. G. D. Rai,*Solar Energy Utilizations*, Khanna Publication (1996).

References

1. G. N. Tiwari, Solar Energy, *Fundamentals, Design, Modeling and Applications*, Narosa Publishing House, New Delhi (2004).
2. G. D. Rai, *Non-conventional sources of Energy* (IV Ed) –Khanna Publications, New Delhi (2004).

Bloom's Taxonomy	CO1	CO2	CO3	CO4	CO5
K1: Remembering	**1**				
K2: Understanding		**2**	**2**		
K3: Applying			**3**	**3**	
K4: Analyzing		**4**			
K5: Evaluating				**5**	**5**
K6: Creating					
				Mean	**3.13**

PHY/PHS 1373 Physics Lab - I 3 Hr/ 3 Cr

This course is introduced to revise the basic measurements and to verify the basic laws of mechanics. The students will familiarize themselves with the theoretical concepts. They are also exposed to hands on training in the lab.

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

i. experience hands-on training in the measurements;
ii. perform data and error analysis;
iii. relate with the respective theoretical concepts;
iv. record and process the measurements; and
v. arrive at conclusionsfor 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	Rigidity Modulus – Torsion Pendulum
5	Spectrometer – Refractive Index
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	Moment of Inertia – Fly Wheel
11	Measurement of viscosity of liquids at different temperatures
12	Measurement of ultrasonic velocity in binary liquids

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

PHY/PHS 1554 Geometrical & Physical Optics 5 Hr/ 5 Cr

This Course is to learn and understand the Properties of lenses and principles of image formation. Student's gets comprehend the physics of aberrations and Optical instruments. They are familiarizing with the interference phenomena of light and the diffraction of light. Also they know the fundamental concept of polarization.

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

i. design lenses of required focal length and magnification;
ii. identify and reduce optical aberrations and design some basic optical instruments;
iii. describe interference patterns and design basic interferometers;
iv. explain Fraunhofer diffraction pattern and its effect on Optical instruments; and
v. elucidate Fresnel diffraction pattern and use Fresnel's Integrals in Solve Diffraction Problems.

Unit 1 **Spherical Surfaces and Lenses**

Properties of Light – Speed of Light – Laws of Reflection and Refraction – Graphical Construction for Refraction – Color Dispersion – Critical Angle and Total Reflection – Refraction by a Prism – Minimum Deviation – Focal Point and Focal Length – Image Formation – Conjugate Points and Planes – Gaussian Formula (Derivation) - Lateral Magnification – Virtual Images – Lens Makers' Formula – Thin Lens Combination – Thin Lenses in Contact – Thick Lens Formula – Nodal Point – Cardinal Points

Unit 2 **Aberrations and Optical Instruments**

Field Stop and Aperture Stop – Entrance and Exit Pupils – Ray Tracing Formula (Calculations) - First and Second Theory of Aberrations – Spherical Aberration – Coma – Astigmatism – Chromatic Aberration – Human Eye – Cameras and Photographic objectives – Speed of Lenses – Magnifiers – Microscopes – Astronomical Telescopes – Huygens and Ramsden Eyepiece – Binoculars

Unit 3 **Interference**

Huygens' Principle – Young's Experiment – Interference from Double Source – Fresnel's Biprism – Lloyd's Mirror – Michelson Interferometer – Circular Fringes – Localized Fringes – White Light Fringes – Visibility of Fringes – Reflection from Plane Parallel Film – Newton's Rings – Fabry-Perot Interferometer – Brewster's Fringes

Unit 4 **Far-field diffraction**

Fraunhofer Diffraction – Diffraction by Single Slit – Rectangular and Circular Aperture – Resolving Power of Telescope and Microscope – Double Slit – Distinction Between Interference and Diffraction – Positions of the Maxima and Minima – Michelson's Stellar Interferometer – Diffraction Grating – Spectra by Grating – Resolving Power

Unit 5 **Near-field diffraction**

Fresnel Diffraction – – Fresnel's Half-Period Zones – Diffraction by a Circular Aperture-Diffraction by a Circular Obstacle-Zone Plate- Vibration Curvefor Circular Division of the Wave Front-Apertures and Obstacleswith Straight Edges- Strip Division of the Wave Front-Cornu's Spiral- Fresnel's Integrals-The Straight Edge- RectilinearPropagation of Light-SingleSlit-Use of Fresnel's Integrals in SolvingDiffraction Problems- Diffraction by an Opaque Strip

Text Book

1. F. A. Jenkins and H. White, *Fundamentals of Optics*, 4th Edition, McGraw Hill, International Editions, New Delhi (2011).

Reference

1. David Halliday, Robert Resnick and Kenneth S. Krane,*Physics Volume 2*, Fifth Edition, John Wiley and Sons Inc., India (2012).
2. AjoyGhatak,*Optics,* 3rd Edition, Tata McGraw Hill Limited, New Delhi (2005).

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	3.14

PHY/PHS 1558 Electrodynamics 5 Hr/ 5 Cr

This course apprises the students regarding the concepts of electrostatics, electrodynamics and Maxwell equations and enables their use in various situations.

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

i. explain the concept of Coulomb's and Gauss' laws and their applications;
ii. diagnose the electric circuits;
iii. compare and relate electricity and magnetism;
iv. interpret the concepts of magnetic induction and classify magnetic materials; and
v. construct the basic equations of electro-magnetism and describe the propagation of electromagnetic waves.

Unit 1 Electrostatics

Electric charge – Coulomb's law – charge and matter – electric field – lines of force – calculation of electric field due to a dipole, ring of charge and line of charge – a point charge, a dipole in an electric field – Gauss' law and applications – electric potential - potential due to a point charge, a dipole, a group of charges – electric potential energy - calculations of electric field and electric potential

Unit 2 Electric Circuits

Capacitors and dielectrics – parallel plate capacitor with dielectric – dielectrics and Gauss's law – three electric vectors – energy storage in an electric field -

Current and current density – resistance, resistivity, and conductivity – Ohm's law - energy transfers in an electric circuits – electromotive force – calculating current – potential differences – single-loop and multi-loop circuits – potentiometer – RC circuits

Unit 3 **Electrodynamics**

Magnetic field – Magnetic induction (B) – magnetic force on a current – torque on a current loop – Hall effect – circulating charges – cyclotron – Thomson experiment – Ampere's law – B near a long wire applications of Ampere's law – magnetic lines of induction – two parallel currents -B for a solenoid – Biot-Savart law

Unit 4 **Magnetic Induction & Magnetic Properties of Matter**

Electromagnetic induction – motional emf - Faraday's law of induction – Lenz's law – time-varying magnetic fields - inductance – energy in magnetic fields – Betatron – induction and relative motion – magnetic properties of matter - magnetic dipoles – paramagnetism - diamagnetism – ferromagnetism – nuclear magnetism – three magnetic vectors

Unit 5 **Electromagnetic waves**

Electromagnetic oscillations – LC oscillations – analogy to simple harmonic motion - forced oscillations and resonance - electromagnetic cavity oscillator – displacement current – Maxwell's equations – Poynting vector - Maxwell's equations and cavity oscillations – transmission lines – coaxial cable – waveguide – radiation – traveling waves and Maxwell's equations

Textbook

1. Halliday, Resnick and Krane, *Physics Vol II*, Vth edition, John Wiley (2002).

Reference

1. David J. Griffiths, *Introduction to Electrodynamics*, Prentice-Hall of India, New Delhi (2003).

Bloom's Taxonomy	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**
K1: Remembering	**1**				
K2: Understanding	**2**				**2**
K3: Applying	**3**			**3**	
K4: Analyzing		**4**			
K5: Evaluating			**5**		**5**
K6: Creating					
				Mean	**3.13**

PHY/PHS1374 Physics Lab - II 3 Hr/ 3 Cr

This course is introduced to revise the basic measurements and to verify the basic laws of mechanics. The students will familiarize themselves with the theoretical concepts. They are also exposed to hands on training in the lab.

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

i. experience hands-on training in the measurements;
ii. perform data and error analysis;
iii. relate with the respective theoretical concepts;
iv. record and process the measurements; and
v. arrive at conclusions for significance of the experiments.

S. No.	Experiment
1	Coefficient of Viscosity – Poiseuille's Method
2	Surface Tension – Capillary Rise
3	Young's Modulus - Uniform bending
4	Usage of Multimeter& CRO
5	Melde's Apparatus
6	Specific heat Capacity – Method of mixtures
7	Potentiometer – Measurement of resistance
8	Spectrometer – Grating
9	Spectrometer – (i-d) Curve
10	Lloyd's mirror
11	Measurement of adiabatic compressibility, free volume using ultrasonic interferometer
12	Verification of Lorentz-Lorentz mixing rule for binary liquids for the calculation of refractive indices

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

PHY1381 Physics for Chemists - I 3 Hr/ 3 Cr

This course will enable the students to understand the laws of thermodynamics, atomic and molecular spectroscopy and the nature of light.

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

i. describe the concept of temperature and molecular properties of gases;
ii. discuss the applications of first and second law of thermodynamics;
iii. elucidate the working principle of LASER and the basics of molecular spectroscopy;
iv. explain the image formation in lenses and mirrors; and
v. describe interference, diffraction and polarization of light.

Unit 1 Temperature & Molecular properties of gases

Molecular properties of gases – The atomic nature of matter – A molecular view of pressure – Mean free path – Distribution of molecular speeds and molecular energies – Temperature and thermal equilibrium

Unit 2 Heat & Thermodynamics

Heat – First law of thermodynamics – Heat capacity and Specific heat – Heat capacity of an ideal gas – Applications of first law – Entropy – Second law of thermodynamics – Performance of engines and refrigerators – Efficiencies of real engines

Unit 3 LASERs and Spectroscopy

Nuclear atom – Electron orbits – Atomic Spectra – Bohr atom – Energy levels and Spectra –Atomic Excitation – Laser – Ruby laser – Helium Neon laser – Carbon dioxide laser - Molecules – Molecular bond – The H_2^+ molecular ion - The hydrogen molecule - Complex molecules – Rotational energy levels – Vibrational energy levels – Electronic spectra of molecules

Unit 4 Light & Ray Optics

Electromagnetic spectrum – Reflection and refraction of light waves – Image formation by mirrors and lenses – plane mirrors – spherical mirrors – optical instruments

Unit 5 Physical Optics

Interference – Double slit interference – Interference from thin films – Diffraction – Single slit diffraction – Diffraction grating – Dispersion and resolving power – X-ray diffraction – Polarization – Polarization by reflection – Double refraction – Circular polarization.

Text books

1. Resnick, Halliday, Krane, *Physics – Volume I*, John Wiley and Sons, Fifth Edition (2004).
2. Arthur Beiser, *Concepts of Modern Physics,* Tata McGraw Hill, New Delhi, (2008).

3. Resnick, Halliday, Krane, *Physics – Volume II*, John Wiley and Sons, Fifth Edition (2002).

References

1. Jenkins & White, *Fundamentals of optics*, Tata McGraw Hill, New Delhi, Fourth edition, (1976)
2. Jerold Touger, *Introductory Physics*, Wiley Student Edition, New Delhi, 2006
3. Serway&Faugher, *College Physics*, Thomson Brooks, Sixth Edition, (2005)

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

PHY1101 Physics Lab for Chemists - I 2 Hr/ 1 Cr

This course is introduced to revise the basic measurements and to verify the basic laws of mechanics. The students will familiarize themselves with the theoretical concepts. They are also exposed to hands on training in the lab.

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

i. have hands-on experience in the measurements;
ii. record and process the measurements;
iii. correlate with the respective theoretical concepts; and
iv. explain the significance of the experiment.

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	Thermocouple – Thermo EMF
11	Measurement of viscosity of liquids at different temperatures
12	Measurement of ultrasonic velocity in binary liquids

Bloom's Taxonomy	CO1	CO2	CO3	CO4	CO5
K1: Remembering		**1**			
K2: Understanding	**2**				
K3: Applying	**3**		**3**		
K4: Analyzing			**4**		
K5: Evaluating		**5**		**5**	
K6: Creating				6	
Mean					3.38

PHY1382 Physics for Chemists - II 3 Hr/ 3 Cr

This course will enable the students to understand the basic laws of electrostatics, magnetostatics and the basic principles of electronics.

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

i. describe the laws governing electric field and evaluate the electric field for various charge distribution;
ii. discuss the electric potential in different configurations;
iii. describe the laws governing magnetic field and classify the magnetic materials;
iv. explain the operation of electronic devices and their simple applications; and
v. design logic circuits using gates.

Unit 1 **Electric charge and Electric field**

Electric charge - Coulomb's law – Continuous Charge distributions – Electric field – Electric field lines - Dipole in an electric field - Flux – Gauss law – Applications of Gauss law

Unit2 **Electric potential and Capacitors**

Electric potential – Electric potential of continuous charge distributions – Capacitors – Parallel plate capacitor – Capacitor with dielectrics – Electric current – resistors in series and parallel

Unit 3 **Magnetostatics**

Magnetic field –Magnetic force on a moving charge – Hall effect – Biot-Savart law – Magnetic field due to a solenoid – Ampere's law – Applications of Ampere's law – Faraday's law of induction – Lenz's law – Magnetization – Magnetic materials

Unit 4 **Analog Electronics**

Semiconductor – Intrinsic and Extrinsic, n and p – type – PN junction diode – Rectifier Transistor configurations – CE amplifier and its uses – Oscillator – Hartley oscillator – Colpitt's oscillator - Introduction to op-amps – characteristics – Unity follower – Adder – Subtractor – Integrator and Differentiator

Unit 5 Digital Electronics

Number Systems - Logic gates – Boolean algebra – NAND and NOR as universal gates – Sequential logic circuits – Half and full adder

Text books

1. Resnick, Halliday,Krane, *Physics – Volume II*, John Wiley and Sons, Fifth Edition (2002).
2. B.L. Theraja, *Basic Electronics*, S. Chand and Company, New Delhi (1989).

Bloom's Taxonomy	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**
K1: Remembering		**1**			
K2: Understanding	**2**	**2**			
K3: Applying			**3**		
K4: Analyzing				**4**	**4**
K5: Evaluating	**5**				
K6: Creating					
Mean					**3.0**

PHY1102 Physics Lab for Chemists -II 2 Hr/ 1 Cr

This course imparts skills in measurement, design and experimental procedures. It enables the students to record and process the results to reach non-trivial conclusions and correlate with the respective theoretical concepts. It also helps the students to have hands on experience with modern instrumentation.

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

i. attain hands-on experience in the measurements;
ii. record and process the measurements;
iii. correlate with the respective theoretical concepts; and
iv. 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
9	OP-AMP – Inverting & Non-inverting
10	Lee's Disc – Thermal conductivity
11	Measurement of adiabatic compressibility, free volume using ultrasonic

	interferometer
12	Verification of Lorentz-Lorentz mixing rule for binary liquids for the calculation of refractive indices

Bloom's Taxonomy	CO1	CO2	CO3	CO4	CO5
K1: Remembering		**1**			
K2: Understanding	**2**				
K3: Applying			**3**		
K4: Analyzing			**4**		
K5: Evaluating	**5**			**5**	
K6: Creating				6	
Mean					3.71

PHY/PHS 1291 Handling of Tools & Machines 3 Hr/ 2 Cr

This course enables the students to understand the principle, uses and safety handling of hand tools and power tools. It provides hands on experience to handle the tools.

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

i. identify the common tools and select the right tool for a given job;
ii. classify the different types of holding and cleaning tools;
iii. list the safety rules and uses of power tools;
iv. explain the principle, working and uses of machine tools; and
v. discuss about shaper, planer machine and house hold wiring.

Unit 1 Basic Hand Tools

Basic hand tools: Wrenches – Screw drivers - Pliers and Wire cutters – Hammers- Spanners – Chisels and Punches – Hand reamers - Files – Ripping bars and Nail pullers – Shovel - Hack saw – basic safety rules for hand tools

Unit 2 Holding tools and cleaning tools

Holding tools: Vise – Clamp – Jigs and fixtures - Measuring tools: Rulers – Levels – Plumb bob - spirit level - Cleaning tools – Scrapers – Brushes – Probe and pick up tools

Unit 3 Power Tools and Equipments

Power tools and Equipment:Pneumatic tools: Air wrenches – Air hammer – Blow gun - Hydraulic tools: Floor Jack – hydraulic engine crane – Tire changer – Jack stand – Steam cleaner and high pressure washer – Basic safety rules for power tools

Unit 4 Machine Tools I

Machine tools: Principle, working, types and uses of drilling machine, Lathe, Milling machine, Grinding machine

Unit 5 **Machine Tools II**

Principle and working of coil winding machine, Shaper machine and Planer machine - House hold wiring and plumbing

Text book

1. C. Elanchezhian and M. Vijayan, *Machine Tools*, Anuradha Publishers, 2005.

References

2. Albert. M. Wagner and Harlan. R. Arthur, *Machine Shop, Theory and Practice*, Van Nostrand Company, New York, Second Edition.
3. Frank. H. Habicht,D., Modern Machine *Tools*, Van Nostrand Company, New York.

Bloom's Taxonomy	CO1	CO2	CO3	CO4	CO5
K1: Remembering		1		1	
K2: Understanding	2				2
K3: Applying	3		3		
K4: Analyzing				4	4
K5: Evaluating		5	5		
K6: Creating					
Mean					3.0

PHY/PHS1292 **Physics of Music** **3 Hr/ 2 Cr**

The objective of this course is to understand and appreciate the nature and production of musical sound associated with musical instruments, in terms of basic physical principles. A physical understanding of sound will enable to make meaningful comparisons among music and toappreciate how the characteristics of a sound depend on the way it is created, designed andplayed.

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

i. explain the sound terminology and usage in music;
ii. illustrate the basic physics of music production;
iii. analyze the quality of sound;
iv. demonstrate the working of certain sound producing instruments; and
v. discuss the acoustics of buildings.

Unit 1 **Sound terminology**

Introduction- Difference between Noise (sound) and music. Units and basic definitions - Frequency-Period-Pitches - Musical Notes, Chords, and Scales

Unit 2 **Physics of music production**

Pythagorean scale –construction. Circle of fifths-Musical Intervals, major and minor notes with frequency. Dissonance, Beats- Logarithmic scales

Unit 3 **Quality of sound**

Combinations of Modes – Superposition - Overtones, Harmonics, Complex Tones. Spectra - Pitch perception - simple mechanics and periodic motion. Chladni patterns - Strings standing waves and harmonics - Sound spectrum - Decibels - Resonance – dissonance - Quality factor

Unit 4 **Some Sound producing instruments**

Helmholtz resonator, Vibrating Strings, air columns.Flute acoustics-construction theory - hole position calculation& making a flute with PVC pipe

Unit 5 **Room Acoustics**

Reverberation time - Sabine's Formula (Derivation not required), - Reflection/Absorption-Auditoriums vs. Recording Studios-Corner Reflectors-acoustic diffusers

Text book

1. Frank S. Crawford Jr., *Waves: Berkeley Physics course Vol-3*, McGraw Hill, International Editions, New Delhi (2011).

References

1. Brijlal and Subramaniam*, Text book of sound*.
2. R.Murugeshan&Kiruthiga*, Properties of Matter and Acoustics*, Sivaprasath 2005
3. Khanna. D. R. &Bedi. R. S, *Text book of Sound*.

Bloom's Taxonomy	CO1	CO2	CO3	CO4	CO5
K1: Remembering	1				
K2: Understanding	2		2		2
K3: Applying		3		3	
K4: Analyzing			4		4
K5: Evaluating					
K6: Creating				6	
Mean					3.0

PHY/PHS 1294 Photography and Digital Editing 3 Hr/ 2 Cr

This course is intended to utilize the unique and unlimited power of Digital Photography and to become proficient at the technical aspect of photographing with a digital camera. They will be working with those images in post processing including digital editing, saving, sizing, and posting of those images.

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

i. identify different cameras and their potential uses from early days to modern day photography;
ii. discuss the fundamentals of digital photography of lenses focus modes;

iii. describe the digital fundamentals of optics of lenses and its compositions and file formats
iv. use various digital editing tools and techniques;
v. apply software's basics tools for digital editing;

Unit I: Basics of Photography

Camera - Obscura, Pin hole camera, Different types of camera, Dark room, dark room accessories, Developer, Fixer, Printing machine, Developing film and paper.

Unit II:Digital Photography fundamentals-I

Lenses, Light and Magnification, The power of lenses, Brightness and f-ratios, Magnification and Field of View, Aperture and stops, Shutter speed, ISO, Exposure triangle, Focus modes,

Unit III: Digital Photography fundamentals-II

Lenses and optics, Light, Flash, Composition , Framing and Layering , Landscapes, Wild life, People and Relationships, Post processing and workflow, white balance, File formats.

Unit IV:Digital Editing-I

Basic tools and techniques, images and graphic design, to open images from multiple sources, panels and menus, work with layers, masking, combine effects, other nondestructive edits ,

Unit V: Digital Editing-II

Cropping and straightening images, adjusting the luminance, correcting color, retouching and healing. Sharpening images, Preparing for print and web use.

References

1. Bruce Barnbaum,*The Art of Photography*.
2. Scott Kelby, *The Digital Photography*, 2008.
3. Scott Kelby,*The Photoshop CS Book for Digital Photographers*, 2003.

Bloom's Taxonomy	CO1	CO2	CO3	CO4	CO5
K1: Remembering	**1**				
K2: Understanding		**2**	**2**		
K3: Applying				**3**	
K4: Analyzing		**4**	**4**		**4**
K5: Evaluating					**5**
K6: Creating					
Mean					3.13

PHY/PHS 1201 Basic Electricity & Electronics 3 Hr/ 2 Cr

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

i. explain the basics of electricity;
ii. identify the basic electrical components and its uses;
iii. describe the principle and working of electrical devices;
iv. elucidate the digital logic and number systems; and
v. design simple digital logic circuits.

Unit 1 **Fundamentals of Electricity**

Static electricity: static electricity between silk, woolen, glass and paper - Conductor and Insulator with examples - Current electricity: electron flow – energy transfer - voltage-current-charge-resistance-wire-battery and power explained with water flow analogy

Unit 2 **Electrical Components I**

Units of measurement - Measuring current, voltage and resistance – Ohms law – resistor – capacitor – inductor (coil)

Unit 3 **Electrical components II**

Fuse - types of switches and their use - Electromagnet – Transformer - speaker-microphone working - Diodes and its uses

Unit 4 **Number Systems**

Number systems - Binary to Decimal and Decimal to binary conversion – Demorgan's theorem - simple Boolean expressions

Unit 5 **Basic Digital Electronics**

Basic Logic gates – Ex-OR gate - NAND and NOR as universal logic gate – sequential logic circuits

Text book

1. J.B Gupta, Rajiv and Rohit,*Basic Electricity -Paperback,*SK Kataria and Sons; 2011 edition –2012.

References

1. Milton Gussow*, Basic Electricity*, Schaum's Outline Series. 2 Ed. (2009)
2. Malvino Leach, *Digital principles and applications*,7th Ed. (2005)

Bloom's Taxonomy	CO1	CO2	CO3	CO4	CO5
K1: Remembering		**1**			
K2: Understanding	**2**				
K3: Applying		**3**			
K4: Analyzing			**4**		
K5: Evaluating				**5**	**5**
K6: Creating					
Mean					**3.33**

PHY/PHS 1202 Wonders of Sky 3 Hr/ 2 Cr

This course enable the students to understand the omnipresent Gravitation, motion, distance, size, mass, luminosity of the heavenly bodies. Quantitative discussion with physics involved is also given. An overall view of the structure and organization of the universe is picturised.

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

i. describe the development of early astronomy and coordinate systems;
ii. elucidate occurrence of seasons, eclipses and the solar system;
iii. interpret stellar magnitudes and explain the evolution and final stages of star;
iv. classify types of telescopes and their uses; and
v. discuss the origin of universe and laws governing it.

Unit 1 History of Astronomy

Early history of Astronomy - Development of nature philosophy - constellations – celestial sphere – coordinate systems – birth of Modern Astronomy

Unit 2 Basics of Astronomy

Kepler's laws –-Newtonian laws and universal law of gravitation – seasons – eclipses – tides - precession – solar family - terrestrial planets and Jovian planets.

Unit 3 Spectral Classes and Stellar Evolution

Stellar distance – magnitudes of star light—stellar classification - evolution stages of stars – main sequence stars – end stages of stars - other mysterious objects –Comets.

Unit 4 Observational Astronomy

Astronomical observations – Light and telescopes -Types of telescopes - reflector type -refractor type – IR and UV telescopes - classes of galaxies.

Unit 5 Origin of Universe

Cosmological principle – Hubble's law - the big bang – expanding universe – steady state universe – evidences for Einstein's gravitation.

Text books

1. William Kaufmann, *Astronomy: The Structure of the Universe,* McMillan Publishing Co.inc, New York. (1999).
2. Pasachoff, Brooks/Cole, *Astronomy: From the earth to the Universe,* Thomson Learning.(2002).

Reference

1. George O. Abell, *Exploration of the Universe,* Saunders College Publishing. (1986).

Bloom's Taxonomy	CO1	CO2	CO3	CO4	CO5
K1: Remembering	**1**				
K2: Understanding	**2**			**2**	
K3: Applying		**3**	**3**		
K4: Analyzing			**4**	**4**	
K5: Evaluating					**5**
K6: Creating					
Mean					**3.0**

PHY/PHS 2573 Analog Electronics 5 Hr/ 5 Cr

Enable the Students to understand the characteristics and applications of semiconductor devices and to analyze, verify their functions.

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

i. interpret the basics circuit laws;
ii. characterize the semiconductor devices and circuits;
iii. describe the theoretical modelsof transistor amplifier circuits;
iv. design and explain oscillator circuits; and
v. explain the characteristics of operational amplifier and apply it for constructing amplifiers and oscillators.

Unit 1 Basic theorems and circuits

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 BJT properties and biasing

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 **Transistor Amplifiers**

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 **Transistor Oscillators**

Feedback &Oscillator Circuits: Feedback- 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 **OP-AMP Characteristics and applications**

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&RohitMetha, *Principles of Electronics,* S Chand Publications, 2005.

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					3.0

PHY/PHS 2475 **Mathematical Physics** **4 Hr/ 4 Cr**

This course enables the students to gain knowledge in differential equations which are essential to solve advanced problems in physics, to understand special functions in mathematical methods and too learn the essentials of matrices.

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

i. formulate and solve the partial differential equations in physics;
ii. describe the special polynomials and their properties;
iii. apply special functions to describe physical systems;
iv. classify the types of matrices and determine Eigenvalues and Eigenvectors; and
v. explain the Fourier and Laplace transforms and their uses.

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.

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.

Bloom's Taxonomy	CO1	CO2	CO3	CO4	CO5
K1: Remembering	**1**				
K2: Understanding		**2**	**2**		
K3: Applying	**3**			**3**	
K4: Analyzing				**4**	
K5: Evaluating			**5**		**5**
K6: Creating					
Mean					3.13

PHY/PHS 2477 Modern Optics Hr/ 4 Cr

This Course is to understand the fundamentals of propagation of light waves. Students familiarize with the working principles of LASERS. They gain knowledge about Fourier Optics and Crystal Optics. Also this course applies the theories in optics to fiber optics communication.

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

i. calculate the intensity change and phase differences of light waves upon reflection from dielectric and metallic surfaces;
ii. explain the working of lasers and its applications;
iii. describe the characteristics of two dimensional Fourier transform and explain the diffraction effects in optical systems;
iv. elucidate the concepts of Crystal Optics; and
v. use the theories in optics to explain fiber optics communication.

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

1. Jenkins and White, *Fundamentals of Optics*, 4th Edition, McGraw Hill, International Editions, New Delhi (2011).
2. Ghatak A and K Thyagarajan,*Optical Electronics*, Cambridge University Press, Cambridge (1988).

Reference

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

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/PHS 2671 Physics Lab – III 6 Hr/ 6 Cr

The Course is to have hands-on experience in the measurements. Students make known with the record and process the measurements. They correlate with the respective theoretical concepts anddraw non-trivial conclusions of the significance of the experiments.

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

i. get hands-on experience in the measurements;
ii. construct experiments on optics and electricity and illustrate the related theoretical concepts;
iii. compute observed values and compare with the standards;
iv. examine the measurements to draw valid conclusions; and
v. work cooperatively in a small group environment.

Minimum of 16 Experiments should be completed.

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	Measuring sugar content of a liquid using laser pointer
10	Potentiometer – Calibration of Voltmeter / Ammeter
11	Verification of Nomoto's relation for ultrasonic velocity for binary liquid mixtures.
12	De Sauty Bridge – Capacitance of a Capacitor
13	Determination of Laser wavelength using metal ruler / metal screw spacing
14	Measurement of e/m ratio of electron – using CRT
15	Bandgap measurement - Semiconductors
16	Determination of index of refraction using diffraction & Laser
17	Measurement of Hall Coefficient
18	Michelson Interferometer – Wavelength separation
19	Measurement Planck's constant – Photoelectric Effect
20	Spectral Analysis
21	Verification of Nomoto's relation for ultrasonic velocity for binary liquid mixtures.
22	Diffraction pattern of small spring using Laser and correlating with DNA pattern

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

PHY/PHS 2574 Digital Electronics 5 Hr/ 5 Cr

This course enables students to understand the fundamentals of digital electronics, different number systems and codes used in it. Students gain knowledge about logic gates and Boolean algebra and learn about the combinational and sequential logic systems. This course helps them to understand the function of D/A, A/D converters and various memory devices.

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

i. apply digital logic for designing combinational logic circuits;
ii. explain various number systems and their applications;
iii. describe data processing circuits;
iv. classify and realize various sequential circuits; and
v. elucidate various timing circuits, D/A and A/D conversion techniques and memory devices.

Unit 1 Digital Logic and Combinational Logic Circuits

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 Number Systems and Codes

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, Programmable Array Logic, Programmable Logic Arrays

Unit 4 **Flip-flops, Registers and Counters**

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 **Timing Circuits, D/A and A/D Conversions**

Schmitt Trigger, Astable, Monostable and Bistablemultivibrators, 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 Books

1. Donald P Leach, Albert Paul Malvino and GoutamSaha,*Digital Principles and Applications,* 6th Edition, The McGraw-Hill Companies 2006.
2. Thomas L Floyd,*Digital Fundamentals*, 8th Edition, Pearson Education 2003.

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.

Bloom's Taxonomy	CO1	CO2	CO3	CO4	CO5
K1: Remembering	**1**				
K2: Understanding		**2**			**2**
K3: Applying	**3**	**3**	**3**	**3**	**3**
K4: Analyzing			**4**	**4**	
K5: Evaluating					
K6: Creating				6	
Mean					3.09

PHY/PHS 2476 **Classical Mechanics** **4 Hr/ 4 Cr**

This course is intended to review the concepts of Newtonian mechanics. The students will be introduced the formalisms of Lagrangian and Hamilton. They are exposed to small amplitude oscillations.

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

i. classify the types of constraints and describe the constrained motion;

ii. formulate the Lagrange's equations of motion and describe Hamilton's principle;
iii. articulate the Kepler's laws and arrive at equations of motion using Hamilton's equations;
iv. explain Poisson and Lagrange's brackets and describe rigid body dynamics; and
v. apply the theory of small oscillations and find normal modes of coupled 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.

References:

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

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/PHS2480 Quantum Mechanics and Relativity 4 Hr/ 4 Cr

This course enable the Students to understand the concepts of Special theory of relativity, the inadequacies of classical physics, the fundamentals of quantum mechanics, and to learn the skills of quantum mechanics and its applications to free state and bound states.

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

i. explain the special theory of relativity and its consequences;
ii. discuss and establish the dual nature of matter;
iii. describe the wave mechanical concepts of quantum systems;
iv. elucidate the basic formalism of quantum mechanics; and
v. devise and explain exactly solvable quantum systems.

Unit 1 Relativity

Special relativity - Lorentz transformation – Time Dilation – Doppler effect – Length Contraction – Twin paradox – Relativistic momentum – Mass and Energy – Energy and momentum

Unit 2 Dual Nature

Blackbody radiation – Photoelectric effect – Light – Compton effect – Pair production – Photons & Gravity – de Broglie waves – Waves of Probability – Particle diffraction

Unit 3 Wave mechanical concepts

The Uncertainty principle, The principle of superposition, Wave packet, Time-dependent Schrodinger equation, Interpretation of the wave functions - Ehrenfest's theorem – Time-independent Schrodinger equation – Stationary States – Admissibility conditions on the wave function

Unit 4 General Formalism of Quantum Mechanics

Linear vector space, linear operator, Eigenfunctions and Eigenvalues, Hermitian operator, Postulates of Quantum Mechanics, Simultaneous Measurability of observables – General uncertainty relation, Dirac's notation, Equations of motion, Momentum Representation

Unit 5 **Exactly Solvable problems**

Free particle, Step potential, Potential barrier, Infinite potential well, Particle in a box, Finite square well, Linear harmonic oscillator (No derivation), Particle moving in a spherically symmetric potential- Hydrogen atom(No derivation)

Text Book:

1. Arthur Beiser, *Concepts of Modern Physics*, 6th Ed, McGraw Hill (India) Pvt. Ltd., 2009.
2. G.Aruldhas, *Quantum Mechanics,* 2nd Edition, PHI Learning Private limited, 2012.

References:

1. P.M.Mathews&K.Venkatesan, *A textbook of Quantum Mechanics*, 2nd Ed, McGraw Hill Education, 2010.
2. L. I. Schiff, *Quantum Mechanics,* 3rd Ed., McGraw Hill New York (1968).
3. J. J. Sakurai, *Modern Quantum Mechanics*, Addition-Wiley (1999).

Bloom's Taxonomy	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**
K1: Remembering	**1**				
K2: Understanding		**2**	**2**		
K3: Applying			**3**	**3**	**3**
K4: Analyzing				**4**	**4**
K5: Evaluating					**5**
K6: Creating					
Mean					3.0

PHY/PHS2672 Physics Lab-IV 6 Hr/ 6 Cr

The course is to have hands-on experience in the design and fabrication of electronics experiments. Students make known with the record and process the measurements. They correlate with the respective theoretical concepts anddraw non-trivial conclusions of the significance of the experiments.

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

i. get hands-on experience in the measurements;
ii. record and process the measurements;
iii. troubleshoot electronic circuits;
iv. correlate with the respective theoretical concepts; and
v. draw non-trivial conclusions of the significance of the experiments.

Minimum of 16 Experiments should be completed.

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

Bloom's Taxonomy	CO1	CO2	CO3	CO4	CO5
K1: Remembering	**1**				
K2: Understanding		**2**			
K3: Applying			**3**		
K4: Analyzing				**4**	
K5: Evaluating					
K6: Creating					**6**
Mean					**3.20**

PHY2381 Physics for Mathematics-I 3 Hr/ 3 Cr

This course enables the students to understand the fundamental of Mechanics & energy in a system of particles. It helps to gain knowledge about the properties of gravitation which is one of the fundamental and universal forces of natureThis course also helps them to understand the motion under free, damped and forced conditions & propagation of mechanical waves in elastic media.

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

i. describe linear and angular motion in 1D and 2D systems;
ii. evaluate the energy in a system of particles;
iii. explain the mechanics of particles under gravitation;
iv. distinguish harmonic motion under free, damped and forced conditions; and
v. ascertain the propagation of mechanical waves in elastic media.

Unit 1 **Motion in 1D and 2D systems**

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 **Energy**

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 **Gravitation**

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 **Oscillations**

Simple harmonic oscillator, Simple harmonic motion, Energy in simple harmonic motion, Applications of simple harmonic motion, Damped harmonic motion, Forced oscillations

Unit 5 **Wave propagation in elastic media**

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.

References

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

Bloom's Taxonomy	CO1	CO2	CO3	CO4	CO5
K1: Remembering	**1**				
K2: Understanding	**2**				
K3: Applying			**3**		**3**
K4: Analyzing				**4**	
K5: Evaluating		**5**		**5**	
K6: Creating					
Mean					3.14

PHY2101 Physics Lab for Mathematics - I 2 Hr/ 1 Cr

This course imparts skills in measurement, design and experimental procedures. It enables the students to record and process the results to reach non-trivial conclusions and correlate with the respective theoretical concepts.. It also helps the students to have hands on experience with modern instrumentation.

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

i. attain hands-on experience in the measurements;
ii. record and process the measurements;
iii. correlate with the respective theoretical concepts; and
iv. 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

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

K6: Creating					
Mean					3.13

PHY2382 Physics for Mathematics-II 3 Hr/ 3 Cr

This course intends to provide knowledge on Electrostatics, electric potential in different configurations&laws governing magnetic field and resonance. It also deals with electronic devices and their simple applications and logic circuits.

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

i. explain the basics of Electrostatics;
ii. discuss the electric potential in different configurations;
iii. describe the laws governing magnetic field and resonance;
iv. explain the operation of electronic devices and their simple applications; and
v. design logic circuits using gates.

Unit 1 Electrostatics I

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 Electrostatics II

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 Magnetostatics and resonance circuits

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 Analog electronics

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 Digital electronics

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 Books

1. David Halliday, Robert Resnick and Kenneth S Krane, *Physics-Vol II*, 5th Edition, John Wiley & Sons, Inc 2002.
2. B.L.Theraja, *Basic Electronics-Solid State*, 5th Edition, S.Chand& Company Ltd, 2005.

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.

Bloom's Taxonomy	CO1	CO2	CO3	CO4	CO5
K1: Remembering	**1**				
K2: Understanding	**2**			**2**	
K3: Applying			**3**	**3**	
K4: Analyzing		**4**		**4**	
K5: Evaluating		**5**	**5**		
K6: Creating					
Mean					3.12

PHY2102 Physics Lab forMathematics - II 2 Hr/ 1 Cr

This course imparts skills in measurement, design and experimental procedures. It enables the students to record and process the results to reach non-trivial conclusions and correlate with the respective theoretical concepts. It also helps the students to have hands on experience with modern instrumentation.

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

i. attain hands-on experience in the measurements;
ii. record and process the measurements;
iii. correlate with the respective theoretical concepts;
iv. apply the analytical techniques and graphical analysis to the experimental data; and
v. 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

Bloom's Taxonomy	CO1	CO2	CO3	CO4	CO5
K1: Remembering		**1**			
K2: Understanding	**2**			**2**	
K3: Applying	**3**		**3**		
K4: Analyzing		**4**	**4**		
K5: Evaluating		**5**		**5**	
K6: Creating					
Mean					3.0

PHY 3575 Solid State Physics 5 Hr/ 5 Cr

This course deals with the basic concepts like crystal structures, various diffraction techniques. It also deals with the theory of crystal binding and the theory of band structure and phonon. It also discuss the Physics of semiconductors and superconductivity.

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

i. determine the structure factors of fundamental crystal lattices;
ii. analyze the X-ray diffraction patterns of simple crystal structures;
iii. classify the different crystal binding forces and explain the vibrations of lattice structures;
iv. describe the quantum theories of energy bands and their consequences;
v. classify the materials based on their electrical properties; and
vi. explain the basics of superconductivity based on experimental facts.

Unit 1 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 2 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 3 **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 4 **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 5 **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 Book

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

References

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

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					3.14

PHY 3673 **Thermodynamics & Statistical Physics** **6Hr/ 6 Cr**

This course enablesstudents to understand the fundamentals of thermodynamics and the concepts of entropy and enthalpy. It helps students to gain knowledge in kinetic theory and transport phenomena. This course elucidates simple applications of statistical Physics to gases.

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

i. explain the basic concepts of thermodynamicsand applications of first law of thermodynamics;
ii. apply first and second laws of thermodynamics and derive thermodynamic relations;
iii. implement laws of thermodynamics to elucidate simple thermodynamic systems;
iv. distinguish the properties of different statistical distributions; and
v. employ the principles of statistical mechanics to solve simple problems.

Unit 1 **Equations of state and First law of thermodynamics**

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 2 **Thermodynamic relations**

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 3 **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 4 **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 – partition function

Unit 5 **Applications of statistical physics**

The Monatomic ideal gas - The distribution molecular velocities – Ideal gas in gravitational field – The quantized linear oscillator

Text Book

1. 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).

Bloom's Taxonomy	CO1	CO2	CO3	CO4	CO5
K1: Remembering	**1**				
K2: Understanding	**2**			**2**	
K3: Applying	**3**	**3**	**3**		**3**
K4: Analyzing		**4**	**4**	**4**	
K5: Evaluating					**5**
K6: Creating					
Mean					3.09

PHY 3677 Microprocessor & Communication Systems 6 Hr/ 6 Cr

This course enables the students to understand the architecture of microprocessor and to apply it for interfacing techniques. Also to understand the basic principle of modulation and demodulation and to gain knowledge in satellite communication.

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

i. explain the architecture of microprocessor and its coding scheme;
ii. implement simple programs using assembly language;
iii. classify different types of modulation and demodulation techniques;
iv. describe various types of receiver systems; and
v. elucidate the satellite communication.

Unit 1 **Internal architecture of 8088 microprocessor**

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 2 **8088 hardware and simple programs**

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 3 **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 – 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 4 **Receivers**

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 5 **Satellite communication**

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

1. Barry.B. Brey, *Intel Microprocessors – Architecture programming and interfacing* – Fourth edition – Prentice Hall of India Pvt Ltd, 1997
2. Walter. A. Tribal &Avtar Singh, *The 8088 and 8086 microprocessors programming, interfacing, software, hardware and applications* – Prentice Hall of India Pvt Ltd, 2005.
3. George Kennedy, Bernard Davis, *Electronic Communication Systems*, Fourth Edition, Tata McGraw – Hill Publishing Company, New Delhi, (2003).
4. Anil. K.Maini, VarshaAgarwal, *Satellite Communications*, Wiley India Pvt. Ltd, New Delhi, (2011).

References

1. Simon Haykin, *Communication system*, Fourth Edition, Wiley India Pvt. Ltd, New Delhi, (2013).
2. Martin. S. Roden, *Analog and Digital Communication Systems*, Third Edition, Prentice Hall, India, 1999
3. S.P. Chowdhury and SunetraChowdhury, *Microprocessors and Peripherals*, Chancellor Press 2004.

Bloom's Taxonomy	CO1	CO2	CO3	CO4	CO5
K1: Remembering	1				
K2: Understanding	2		2		
K3: Applying		3			3
K4: Analyzing		4	4	4	
K5: Evaluating				5	
K6: Creating					
Mean					3.11

PHY 3671 Physics Lab-V 6 Hr/ 6 Cr

This course enables the Students to have hands-on experience in the experiments and record the process of measurements. He will also learn to correlate with the respective theoretical concepts anddraw non-trivial conclusions of the significance of the experiments.

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

i. get hands-on experience in the measurements;
ii. record and process the measurements;
iii. troubleshoot electronic circuits;
iv. correlate with the respective theoretical concepts; and
v. draw non-trivial conclusions of the significance of the experiments.

Minimum of 16 Experiments should be completed

S. No	Experiment
1	Arithmetic Circuit- Half adder and Full adder.
2	Combinational logic circuit design using 74xxICs. (For a given problem using POS or SOP)
3	Design of odd/even parity checkers - using 74180
4	Encoders - using logic gates
5	Decoders -using logic gates
6	Circuits Implementation using Software
7	Multiplexer - using logic gates
8	Demultiplexer. - using logic gates
9	Arithmetic Logic Unit (ALU) using IC 74181.
10	Construction of 1- bit comparator using 74xxICs and study of 4-bit comparator IC 7485.
11	Code converters – Binary to gray and Gray to binary.
12	Verification of basic flip flops using 74xxICs
13	Master- slave JK flip-flop using IC 7476
14	Asynchronous counter design
15	Mod-n counter. using decade counter 7490
16	3-Bit synchronous counter design
17	Shift register- SIPO/SISO
18	Shift register -PISO/PIPO.
19	Timer 555 - Construction of monostable, astable for a given frequency.
20	Storing and retrieving data (Ex-3code) - using RAM - IC 7489 or 2114.

Bloom's Taxonomy	CO1	CO2	CO3	CO4	CO5
K1: Remembering					
K2: Understanding	2				
K3: Applying		3			
K4: Analyzing			4	4	
K5: Evaluating				5	5
K6: Creating					
Mean					3.83

PHY3674 Atomic Physics & Spectroscopy 6 Hr/ 6 Cr

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 and to understand the Raman spectroscopy

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

i. explain basic atomic models and their related phenomena;
ii. describe interaction of atoms with external fields, and spectrum of many-electron atoms;
iii. elucidate the rotational spectra of molecules;
iv. interpret the vibrational spectra of molecules; and
v. explain Raman spectroscopy and its applications.

Unit 1 Basic atomic models

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 2 Interactions with external fields and many-electron atoms

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 3 Rotational spectroscopy

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 4 **Vibrational spectroscopy**

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 5 **Raman spectroscopy**

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

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

References

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

Bloom's Taxonomy	CO1	CO2	CO3	CO4	CO5
K1: Remembering	**1**				
K2: Understanding	**2**	**2**			
K3: Applying		**3**		**3**	
K4: Analyzing			**4**		**4**
K5: Evaluating				**5**	
K6: Creating					
Mean					3.0

PHY 3576 **Nuclear and Particle Physics** **5 Hr/ 5 Cr**

This course enables students to know about the properties of nucleus and the rudimentary theories of restricted validity. It helps to acquire knowledge about radiation detectors and nuclear reactors. Students are exposed to the phenomenon of radioactivity. Besides these, it helps students to know about the basics of elementary particles.

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

i. explain the stability of the nucleus and the signatures of nuclear models;
ii. classify various types of nuclear decay processes;
iii. describe the functions and characteristics of detectors and accelerators;
iv. illustrate the key features of nuclear fission and fusion and their applications; and

v. categorize the elementary particles and their symmetries.

Unit 1 **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 2 **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 3 **Radiation detectors and accelerators**

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

Unit 4 **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 5 **Elementary particles**

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

Text Book

1. D.C.Tayal , *Nuclear Physics*, Himalaya Publishing House, Mumbai, 2017

References

1. Herald Enge, *Introduction to nuclear physics*, McGraw Hill, 1981
2. R. R Roy and B. P. Nigam, *Nuclear Physics*, New Age International Ltd, 2001.
3. H.S Hans, *Nuclear Physics*, New Age International publishers, 2001.
4. S. B. Patel,*Nuclear Physics an Introduction*, Wiley Eastern Ltd, 2012

Bloom's Taxonomy	CO1	CO2	CO3	CO4	CO5
K1: Remembering	**1**				
K2: Understanding	**2**		**2**		**2**
K3: Applying		**3**		**3**	
K4: Analyzing		**4**	**4**		**4**
K5: Evaluating				**5**	
K6: Creating					
Mean					3.0

PHY 3680 Astronomy &Astrophysics 6 Hr/ 6 Cr

This course is planned to introduce the basic concepts of astronomy. The students will familiarize themselves with instrumentation used for analyzing starlight. They are introduced to the models of universe and theories of cosmology.

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

i. summarize the birth of modern astronomy, solar system and also define basic measurements in astronomy;
ii. describe the functioning of refractor, reflector, UV and gamma ray telescopes and their extension towards spectral analysis;
iii. identify the spectral classification of stars, its magnitudes and also illustrate the birth and death of stars and to estimate the stellar magnitudes;
iv. explain types of Galaxy and Milky way galaxy and comprehend the extragalactic events; and
v. elucidate the origin of universe and various models based on cosmological principles.

Unit 1 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 2 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 3 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, efficiencyof 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 4 **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 5 **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 nuclear synthesis; microwave background

Text Books

1. A. RaiChoudhuri, *Astrophysics for Physicists*, Cambridge University Press, New York, 2010
2. Carroll B. W. &Ostle, D. A, *An introduction to Modern Astrophysics*, Pearson Education- Addison Wesley, 2007
3. Shu, F, *The Physical Universe*, University of California, 1982
4. Harwit, M, *Astrophysical Concepts*, 3rd ed, Springer-verlag, 2006
5. Maoz, D, *Astrophysics in a nutshell*, Princeton University Press, 2006
6. Padmanabhan,**T**, *Invitation to Astrophysics*, World Scientific, 2006.

Bloom's Taxonomy	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**
K1: Remembering	**1**				
K2: Understanding		**2**			
K3: Applying					**3**
K4: Analyzing			**4**		
K5: Evaluating				**5**	
K6: Creating					
Mean					3.0

PHY3200 Environmental Studies 4 Hr/ 2 Cr

This course enables the studentsto understand the importance of conservation energy, the physical nature of the eco system, biodiversity, various sources of pollution, and the cause of global warming.

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

i. identify renewable and non-renewable energy resources;
ii. preserve the ecosystem for future generation;
iii. classify the bio-geography at global, national and local levels;
iv. examine various types of pollutions and their impacts; and
v. ascertain human health from environmental problems.

Unit 1 **Renewable energy and no- renewable energy resources**

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**

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 3 **Bio-geographical classification**

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 4 **Pollution**

Pollution and environmental impacts: Fossil fuels and the environment – impacts due to non-conventional energy sources – Greenhouse 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 5 **Environmental ethics**

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

1. Dr.RamanSivakumar, Introduction to environmental science and engineering, 2005.
2. ErachBharucha, Text Book of Environmental studies for under Graduate Courses, Universities Press, 2005.

References

1. S.P.Sukhatme, Solar Energy, 2nd edn, Tata McGraw-Hill Publishing Company Limited, 2004.
2. M.N.Rao, H.V.N.Rao, Air Pollution, McGraw-Hill Publishing Company Limited, 1993.
3. Gilbert. M. Masters, Introduction to Environmental Engineering and Science, Prentice Hall of India Private Limited, New Delhi, 1994.
4. P.D.Sharma, Ecology and Environment, 7thEdn, Rastogi Publications, 2005.

Bloom's Taxonomy	CO1	CO2	CO3	CO4	CO5
K1: Remembering	**1**				
K2: Understanding	**2**				
K3: Applying				**3**	**3**
K4: Analyzing		**4**	**4**		**4**
K5: Evaluating					
K6: Creating					
Mean					3.0

PHY 3672 Physics Project 6 Hr/ 6 Cr

This course enables the Students to have hands-on experience in the design experiments/methodologies and record the process of measurements. He will also learn to correlate with the respective theoretical concepts anddraw non-trivial conclusions of the significance of the observations.

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

i. extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems;

ii. plan, execute and report the results of an experiment or investigation;

iii. work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group;

iv. use ICT in a variety of learning situations;

v. express thoughts and ideas effectively in writing and orally.

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%

Bloom's Taxonomy	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**
K1: Remembering	**1**				
K2: Understanding	**2**				
K3: Applying	**3**	**3**	**3**	**3**	**3**
K4: Analyzing		**4**		**4**	
K5: Evaluating				**5**	
K6: Creating			6		
Mean					3.37

PHY 3291 PC Management and Maintenance 3 Hr/ 2 Cr

The main objective of this course is to introduce PC, maintenance, upgrading and troubleshooting. To that end, this course helps to fully understand the family of computers including all PC-compatible systems. This course discusses most areas of system improvements, such as motherboards, processors, memory and power supply.

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

i. identify different parts of a computer;
ii. enumerate various typesof computers and troubleshoot booting problems;
iii. install operating systems and hard disk partition;
iv. perform basic maintenance operations using DOS commands; and
v. explain various tools in networking.

Unit 1 **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 2 **PC Hardware – II**

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

Unit 3 **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 4 **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 5 **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 Book

1. 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.

Bloom's Taxonomy	CO1	CO2	CO3	CO4	CO5
K1: Remembering	**1**				
K2: Understanding		**2**	**2**		
K3: Applying			**3**	**3**	
K4: Analyzing	**4**				**4**
K5: Evaluating				**5**	
K6: Creating					
Mean					3.0

PHY3293 Bio- Medical Instrumentation 3 Hr/ 2 Cr

This course introduces Bio- Medical Instrumentation to the students and enables them to understand the basic principles of Instrument design and to gain knowledge of the various diagnostic and therapeutic instruments used in medical industry.

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

i. explain the basic components of medical instruments;
ii. illustrate the usage of popular diagnostic instruments;
iii. describe the principles of imaging diagnostic instruments; and
iv. elucidate the functions of popular therapeutic instruments.

Unit 1 Instrument design

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

Unit 2 Diagnostic instruments I

Blood flow meters - Blood cell counters - Radiography - Angiography - Endoscopy

Unit 3 Diagnostic instruments II

X-ray - MRI scan - Ultrasonic imaging - Medical thermography

Unit 4 Therapeutic instruments I

Pace maker - Batteries - Artificial heart valves - Heart-lung machine

Unit 5 Therapeutic instruments II

Kidney machine - Physiotherapy and electrotherapy equipment

Text Book

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

References

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					3.0

PHY 3292 HAM Radio & Practice 3 Hr/ 2 Cr

This course introduces Ham radio communication to the students and enablesthemto understand the basic principles of radio communication and to gain knowledge of the various components involved in radio electronics.

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

i. state the rules and regulations involved in HAM radio communication;
ii. explain the origin of electricity and magnetism;
iii. describe the elementary theory of alternating currents in capacitors and inductors;
iv. theoretically design a basic radio receiver and transmitter; and
v. explain radio propagation and safety measures.

Unit 1 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) Rule

Unit 2 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 3 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 4 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 5 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

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

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					3.0

PHY 3294 Consumer Electronics 3 Hr/ 2 Cr

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

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

i. learn the basic components used in day today electronics;
ii. explain the basic measuring devices;
iii. troubleshoot and learn the maintenance of electronic gadgets;
iv. describe the operation of house hold appliances; and
v. explain the theory and applications of various audio communication systems.

Unit 1 **Basic components and their usage**

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 2 **Basic measuring instruments**

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 3 **House wiring and its circuits**

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 4 **Common house hold electrical appliances**

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 5 **Communication gadgets and their functions**

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. Theraja, *A text book in Electrical Technology*, S Chand & Co., 2005
2. M G Say, *Performance and design of AC machines*, ELBS Edn.
3. S.P. Bali, *Consumer electronics*, Pearson education - 2005.

Bloom's Taxonomy	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**
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K2: Understanding		2			
K3: Applying			3	3	3
K4: Analyzing			4	4	4
K5: Evaluating					
K6: Creating					
Mean					3.0