

DEPARTMENT OF PHYSICS
B.Sc. Physics
U.G. PROGRAMME
SYLLABUS

Effective from the Academic Year 2012-2013



Loyola College (Autonomous)
Chennai- 600 034



Sem	Cate	Code	Title	Hrs	Crs
I	MC	PH 1503	PROPERTIES OF MATTER AND ACOUSTICS	6	6
I	MC	PH 1504	PHYSICS PRACTICAL - I	3	3
I	MC	PH 1101	PHYSICS FOR MATHEMATICS - I	4	3
I	AR	PH 1102	PHYSICS FOR MATHEMATICS - PRACTICAL - I	2	1
II	MC	PH 2505	MECHAICS AND STATISTICAL PHYSICS	6	6
II	MC	PH 2505	PHYSICS PRACTICAL	3	3
II	AR	PH 2105	PHYSICS FOR CHEMISTRY - I	4	3
II	AR	PH 2106	PHYSICS FOR CHEMISTRY - PRACTICAL - I	2	1
II	AR	PH 2107	MICROPROCESSOR	4	3
II	AR	PH 2108	MICROPROCESSOR PRACTICAL	2	1
III	MC	PH 3506	MATHEMATICAL PHYSICS	6	6
III	MC	PH 3507	PHYSICS PRACTICAL - III	3	3
IV	MC	PH 4506	ELECTRONICS - I	6	6
IV	MC	PH 4507	PHYSICS PRACTICAL - IV	3	3
V	MC	PH 5510	QUANTUM MECHANICS AND RELATIVITY	6	6
V	MC	PH 5511	OPTICS	6	6
V	MC	PH 5512	ELECTRICITY AND MAGNETISM	6	6
V	ES	PH 5406	FUNDAMENTALS OF NANOSCIENCE	3	2
V	ES	PH 5407	ELECTRONICS - II	3	2
V	ES	PH 5408	MATERIALS SCIENCE	3	2
V	ES	PH 5409	ENERGY PHYSICS	3	2
V	ES	PH 5410	GEOPHYSICS	3	2
V	MC	PH 5513	PHYSICS PRACTICAL - V	3	3
V	MC	PH 5514	PHYSICS PRACTICAL - VI	3	3
VI	MS	PH 6611	ATOMIC AND NUCLEAR PHYSICS	6	8
VI	MS	PH 6612	SOLID STATE PHYSICS	3	4
VI	MS	PH 6613	PHYSICS PRACTICAL - VII	3	4
VI	MS	PH 6614	PHYSICS PRACTICAL - VIII	3	4
VI	SK	PH 6654	ELECTRICAL AND ELECTRONICS SCIENCE & APPLIANCES	15	15
VI	SK	PH 6655	ELECTRICAL AND ELECTRONIC SCIENCE & MACHINE SHOP TECHNOLOGY	15	15
III	AO	PH 3206	PHYSICS FOR BIOLOGY	4	3
III	AO	PH 3207	PHYSICS PRACTICAL FOR BIOLOGY	2	1
III	AO	PH 3208	MICROPROCESSOR 8085	4	3
III	AO	PH 3209	MICROPROCESSOR 8085 PRACTICAL	2	1
II	EG	PH 3302	WORKSHOP PRACTICE	3	1
IV	AO	PH 4209	APPLIED PHYSICS PRACTICAL	2	1
IV	EG	PH 4304	ELECTRICAL AND ELECTROIC APPLIANCES	3	1



PH1503 - PROPERTIES OF MATTER AND ACOUSTICS

SEMESTER : I
HRS/WEEK : 6

CATEGORY : MC
CREDITS : 6

Objectives:

1. To expose the undergraduate students to the basic concept of properties of matter
2. This Course also offers an insight into wave motion and ultrasonics

Unit 1. ELASTICITY:- Modulus of elasticity- Poisson's ratio- Relation between elastic constants and Poisson's ratio-Energy stored- Twisting couple on a cylinder- Torsional pendulum (with and without weights)- Bending of beams- Bending moment- Cantilever loading- Transverse vibrations of cantilever-Non-uniform and uniform bending of a beam-Koenig's method – Determination of Y and n for the material of the spring.

Unit 2. VISCOSITY AND LOW PRESSURE: - Newton's law- Poiseuille's flow- Stoke's fall- Rotation viscometer- Ostwald viscometer- Meyer's formula for viscosity of gas-Rankine's method- Effect of temperature and pressure on viscosity- Air pump- Rotary oil pump-Mercury diffusion pump- McLeod gauge-Pirani gauge-Knudsen Gauge.

Unit 3. SURFACE TENSION :- Molecular interpretation- surface energy- Pressure difference across a curved surface- Excess pressure in liquid drops and air bubbles-Molecular forces- Shape of liquid meniscus in capillary tube-Angle of contact- Capillary rise and energy consideration- Jaeger's method- Quincke's drop-Vapour pressure over flat and curved surfaces.

Unit 4. WAVES AND OSCILLATIONS :- Transverse and longitudinal waves- Equation of Wave motion- Plane progressive wave- speed of transverse wave on a string- Energy in wave motion- Superposition of waves- Interference, reflection and transmission of wave- Standing waves-Normal modes of a string- Resonance- Sound Waves in gases- Organ pipes- Beats- Doppler effect.



Unit 5. ULTRASONICS AND ACOUSTICS :- Ultrasonics- Piezo-electric effect-Piezo-electric generator- Magnetostriction effect- Magnetostriction oscillator-Detection and application of ultrasonics-Acoustics- Reverberation time and its measurement- Sabine's formula-Absorption coefficient and its determination- Condition for good acoustical design of an auditorium- Noise and its measurement- Noise reduction- sound insulation

TEXT BOOKS:

1. D.S MATHUR- ELEMENTS OF PROPERTIES OF MATTER: S.CHAND AND CO. (11th Edition) (2005)
2. BRIJ LAL AND N. SUBRAHMANYAM- PROPERTIES OF MATTER :- S.CHAND AND CO (2003)
3. N.SUBRAHMANYAM AND BRIJ LAL- A TEXT BOOK OF SOUND: VIKAS PUBLISHING HOUSE (SECOND REVISED EDITION- 1995)

BOOKS FOR REFERENCE:

1. H.R GULATI- FUNDAMENTAL OF GENERAL PROPERTIES OF MATTER- R.CHAND AND CO- FIFTH EDITION (1977)
2. N.K BAJAJ- THE PHYSICS OF WAVES AND OSCILLATIONS- TATA MCGRAW-HILL (1988)
3. A.P FRENCH- VIBRATION AND WAVES- MIT INTRODUCTORY PHYSICS- ARNOLD-HEINMANN INDIA (1973)
4. SATYA PRAKASH AND AKASH SALUJA- OSCILLATIONS AND WAVES- PRAGATI PRAKASHAN (2002)

PH1504 - PHYSICS PRACTICAL - I

SEMESTER : I
HRS/WEEK : 3

CATEGORY : MC
CREDITS : 3

Objectives:

1. The course aims at exposing the under graduate students to the technique of handling simple measuring instruments.
2. Provide the students the required training to determine some of the mechanical and thermal properties of matter.



List Of Expos:

- 1) Cantilever loading-Pin and Microscope- Transverse vibrations – Young's Modulus
- 2) Torsional Pendulum (Without weights) – Rigidity Modulus
- 3) Graduated burette- Viscosity of liquid
- 4) Joly's Bulb- Pressure Coefficient of Air
- 5) Sonometer- Verification of Laws of Transverse vibration in a stretched string
- 6) Convex lens- Focal length
- 7) Spectrometer- Solid Prism- A , D and μ .
- 8) Logic Gates- OR, AND and NOT
- 9) Potentiometer- Calibration of Ammeter

BOOKS FOR STUDY:

1. Arul Thalpathi M., Practical Physics, Comptek Publishers, (2002)
2. C.C Ouseph, G.Rangarajan, A Text Book of Practical Physics, S. Viswanathan Publisher-Part I (1990)
3. C.C Ouseph, C.Rangarajan, R.Balakrishnan, A Text Book of Practical Physics, S.Viswanathan Publisher-Part II (1996)

BOOKS FOR REFERENCE:

1. S.L Gupta and V.Kumar, Practical Physics, PragatiPrakashan – 25th Edition (2002)

PH1101 - PHYSICS FOR MATHEMATICS – I

SEMESTER : I

CATEGORY : MC

HRS/WEEK : 4

CREDITS : 3

Objective:

This paper is offered to the students of mathematics as allied required. Most of the mathematics learnt by the students has immediate application to many physical problems. The logical



reasoning behind the description of the physics problem and obtaining the solution to such problems are taught in this paper.

Unit 1: Classical mechanics

- a) **Particle dynamics:** Displacement, velocity and acceleration-distance –time graph-velocity – time graph – projectile motion – uniform circular motion – tangential acceleration in circular motion – relative velocity and acceleration
- b) **Lagrangian formulation :** Generalised coordinates – holonomic and non-holonomic constraints – Lagrange's equations – simple applications- Atwood's machine – simple pendulum

Unit 2: Gravitation

- a) **Classical theory of gravitation :** Kepler's laws - Newton's law of gravitation – G and measurement – Earth –moon system – weightlessness – earth satellites – parking orbit – earth density – mass of the Sun – gravitational potential – velocity of escape – satellite potential and kinetic energy.
- b) **Einstein's theory of gravitation :** Introduction – the principle of equivalence – experimental tests of general theory of relativity – gravitational red shift – bending of light – perihelion of mercury.

Unit 3: Properties of matter

- a) **Elastic properties :** Elastic limit – Hooke's law – moduli of elasticity – Poisson's ratio –relation between ν, n, k – force in a bar due to contraction or expansion – energy stored in a wire – rigidity modulus – torsion in a wire – static torsion and torsional oscillations method.
- b) **Viscosity and surface tension :** Newton's formula – Stoke's formula – Poiseuille's flow – molecular theory of surface tension – excess pressure over curved surface – spherical and cylindrical drops – surface energy – capillary rise – Quincke's method for mercury.

Unit 4: Electronics

- a) Operational amplifier: ideal operational amplifier – inverting and non- inverting amplifiers – summing amplifier – differential amplifier



– integrator – differentiator – CMRR – solving simultaneous equations.

- b) Digital circuits: J-K-Flip-Flop – combinational circuits – application of Karnaugh map- Full and half binary adders - counters

Unit 5 : Special theory of relativity

Frames of reference – inertial frames and non- inertial frames - Galilean transformations – Michelson- Morley experiment – interpretation of results – postulates of special theory of relativity – Lorentz transformation equations – length contraction – time dilation – transformation of velocities– variation of mass with velocity – Mass –energy equation

TEXT BOOKS:-

1. Nelkon and Parker Advanced level Physics – Arnold Publishers – 7th edition (1995)
2. M.Narayanamurthy and N.Nagarathnam Dynamics – (The national publishers) 8th edition (2002)
3. D.S.Mathur, Properties of Matter, S.Chand and Co., New Delhi 11th edition (2005)
4. R.S.Sedha, A text book of applied electronics, S.Chand and Co., New Delhi, 1st edition, (1998)
5. Robert Resnick , Introduction to special relativity, Wiley Eastern (1968)

BOOKS FOR REFERENCE:-

1. D.Halliday and R.Resnick , Physics, Part 1 (Wiley eastern) 1st edition (1990)
2. Richard P. Feynman, Robert B. Leighton & Mathew Sands, Feynman Lectures on Physics Series, vol. 1, 2 & 3, Narosa Publishing, New Delhi, 8th reprint, (1995)



PH1102 - PHYSICS FOR MATHEMATICS - PRACTICALS – I

SEMESTER : I
HRS/WEEK : 2

CATEGORY : AR
CREDITS : 1

LIST OF EXPERIMENTS

1. Young's modulus by stretching - vernier microscope
2. Rigidity modulus - torsional pendulum
3. Surface tension and interfacial tension - method of drops
4. Viscosity - capillary flow
5. Specific heat of liquid - electrical heating
6. Sonometer - verification of laws
7. Compound bar pendulum - determination of g and radius of gyration
8. Basic Gates – AND, OR, NOT, NAND, NOR
9. NAND, NOR as Universal Building Blocks

BOOKS FOR STUDY:

1. Arul Thalpathi M., Practical Physics, Comptek Publishers, (2002)
2. C.C Ouseph, G.Rangarajan, A Text Book of Practical Physics- S. Viswanathan Publisher-Part I (1990)
3. C.C Ouseph, C.Rangarajan, R.Balakrishnan- A Text Book of Practical Physics- S.Viswanathan Publisher-Part II (1996)

BOOKS FOR REFERENCE:

1. S.L Gupta and V.Kumar- Practical Physics- PragatiPrakashan – 25th Edition (2002)



PH2505 - MECHANICS AND STATISTICAL PHYSICS

SEMESTER : I
HRS/WEEK : 6

CATEGORY : MC
CREDITS : 6

Objectives:

1. This course offers the basic concepts of classical mechanics
2. This course also offers an indepth knowledge about classical statistics

Unit 1: RIGID BODY AND FLUID DYNAMICS:

Compound pendulum - Centers of oscillation and suspension - Determination of g and k - Bifilar pendulum - Parallel and non parallel threads – Centre of mass - Conservation of linear and angular momentum - Variable mass-Rocket propulsion.

Equation of continuity-Bernoulli's theorem and its applications - Toricelli's theorem - Velocity of efflux – Venturimeter - Pitot's tube-Diffusion - Fick's law - Relation between the time of diffusion and length of column -Graham's law for diffusion of gases

Unit 2: LAGRANGIAN AND HAMILTONIAN MECHANICS:

Mechanics of system of particles - Constraints of motion-Generalized coordinates and the transformation equation-simple illustration for the transformation equation

Configuration space - principle of virtual work - D'Alembert's principle - Lagrange's equations – Applications: Atwood's machine – Bead sliding on a uniformly rotating wire

Phase space- Hamilton's equations of motion- Physical significance of the Hamiltonian function- Applications : Motion of a particle in a central force field- Motion of a charged particle in an electromagnetic field

Unit 3 : TRANSPORT PHENOMENA

Molecular collisions – Mean free path – Sphere of influence – Collision cross section – Expression for mean free path – Variation



of mean free path with temperature and pressure– viscosity - effect of temperature and pressure on viscosity – thermal conductivity – effect of temperature and pressure on thermal conductivity – relation between viscosity and thermal conductivity – largest thermal conductivity in Hydrogen – Transport of mass and diffusion – effect of temperature and pressure – relation between viscosity and diffusion

Unit 4: THERMODYNAMIC RELATIONS:

Extensive and intensive variables- Thermodynamic potentials and Maxwell's relations- Applications of Maxwell's relations: Specific heat equation and Joule- Thomson cooling- T-ds equations- Clapeyron's latent heat equations – Internal energy of ideal and real gases- Clausius inequality- Entropy and second law of thermodynamics – First and second order phase transitions- Gibbs-Helmholtz equation of a reversible cell

Unit 5 : MAXWELL- BOLTZMANN STATISTICS :

Macro and microstates-Thermodynamic probability-Equilibrium state-Momentum and phase space-Entropy and probability-Maxwell-Boltzmann energy and momentum distribution law-Applications of M-B distribution law :Total internal energy and specific heat at constant volume of an ideal gas-M-B distribution of speed-Mean, rms and most probable speeds- Doppler broadening of spectral lines- Limitations of M-B statistics.

TEXT BOOKS:-

- 1) M.Narayanamurti and Nagarajan, Dynamics, National Publishing Company, 8th Edition, 2002.(For Chapter 1 (partly) and Chapter 2)
- 2) D.S. Mathur, Elements of Properties of Matter, S.Chand and Co., 11th Edition,2000. (For Chapter 1 (partly))
- 3) Brij Lal, N.Subrahmanyam and P.S Hemne- Heat Thermodynamics and Statistical Mechanics, S.Chand and C Ltd- Revised Edition 2007 (For Chapter 3,4 and 5)

REFERENCE BOOKS

- 1) H.Goldstein, C.Pole and J.Scifko, Classical Mechanics, Pearson Education Asia, 3rd Edition, 2004.



- 2) Sears.F.W, Thermodynamics, Kinetic theory of gases and statistical Mechanics.
- 3) Zemansky.M.W, and Dittman R.H, Heat and Thermodynamics, 6th edition (1989)
- 4) R.P.Feynman, R.B.Leighton and M.Sands, The Feynman Lectures on Physics, Volumes 1 & 1, Narosa Publishing House, (1998)
- 5) Murray R. Speigal, Theoretical Mechanics, Schaum's Outline Series, McGraw-Hill Book Co, SI(Metric) Edition, (1987)

PH2505 - PHYSICS PRACTICAL - II

SEMESTER : II
HRS/WEEK : 3

CATEGORY : MC
CREDITS : 3

Objectives:

1. The course aims at exposing the under graduate students to the technique of handling simple measuring instruments.
2. Provide the students the required training to determine some of the mechanical and thermal properties of matter.

List of Experiments:

- 1) Compound bar pendulum- g and k
- 2) Capillary Rise- Surface Tension of liquid
- 3) Method of Mixtures- Latent Heat of vaporisation of Steam.
- 4) Deflection magnetometer- Tan C position- Moment of a bar Magnet
- 5) Spectrometer- Grating-Normal incidence
- 6) Carey-Foster Bridge- Specific Resistance
- 7) Table Galvanometer- Figure of Merit
- 8) Transistor Characteristics (Static)
- 9) Unregulated and Zener regulated power supply.

BOOKS FOR STUDY:

1. Arul Thalpathi M., Practical Physics, Comptech Publishers, 2002.



2. C.C Ouseph, G.Rangarajan- A Text Book of Practical Physics- S. Viswanathan Publisher-Part I (1990)
3. C.C Ouseph, C.Rangarajan, R.Balakrishnan- A Text Book of Practical Physics- S.Viswanathan Publisher-Part II (1996)

BOOK FOR REFERENCE:

1. S.L Gupta and V.Kumar- Practical Physics- PragatiPrakashan – 25th Edition (2002)

PH2105 - PHYSICS FOR CHEMISTRY – I

SEMESTER : II
HRS/WEEK : 4

CATEGORY : AR
CREDITS : 3

Objective: *This paper is offered to the students of chemistry as allied required. While the chemical properties are learnt in the major, the study of physical properties will compliment their studies.*

Unit 1: Classical mechanics

- a) Particle dynamics:** Displacement, velocity and acceleration-distance –time graph-velocity – time graph – projectile motion – uniform circular motion – tangential acceleration in circular motion – relative velocity and acceleration
- b) Lagrangian formulation :** Generalised coordinates – holonomic and non-holonomic constraints – Lagrange’s equations – simple applications- Atwood’s machine – simple pendulum

Unit 2: Gravitation

- a) Classical theory of gravitation :** Kepler’s laws, Newton’s law of gravitation – G and measurement – Earth –moon system – weightlessness – earth satellites – parking orbit – earth density – mass of the Sun – gravitational potential – velocity of escape – satellite potential and kinetic energy.
- b) Einstein’s theory of gravitation :** Introduction – the principle of equivalence – experimental tests of general theory of relativity – gravitational red shift – bending of light – perihelion of mercury.



Unit 3: Properties of matter

- a) **Elastic properties** : Elastic limit – Hooke's law – moduli of elasticity – Poisson's ratio – relation between q, n, k – force in a bar due to contraction or expansion – energy stored in a wire – rigidity modulus – torsion in a wire – static torsion and torsional oscillations method.
- b) **Viscosity and surface tension** : Newton's formula – Stoke's formula – Poiseuille's flow – molecular theory of surface tension – excess pressure over curved surface – spherical and cylindrical drops – surface energy – capillary rise – Quincke's method for mercury.

Unit 4: Optics

- a) **Diffraction**: Fresnel and Fraunhofer diffractions – Fraunhofer diffraction at a single slit- diffraction at multiple slits- plane diffraction grating – determination of wavelength of a spectral line.
- b) **Polarisation**: Double refraction of crystals– geometry of Nicol prism – Huygen's theory – Polaroid – circular and elliptical polarization – quarter and half wave plates – production and analysis of polarized beams – optical activity.

Unit 5 : Crystal Physics

- a) **Crystal structures**: Introduction – periodic array of atoms – crystal lattice – unit cell – basis – symmetry considerations – classification of crystals – Bravais lattices in three dimensions – crystal planes and Miller indices – simple crystal structures.
- b) **Crystal diffraction**: Bragg's law – experimental X-ray diffraction methods :- Laue method – rotating crystal method – powder method – neutron diffraction.

TEXT BOOKS:-

1. Nelkon and Parker - Advanced level physics - Arnold Publishers- 7th edition. (1995)
2. M.Narayanamurthy and N.Nagarathnam - Dynamics - (The national publishers) 8th edition (2004)



3. D.S.Mathur, Properties of matter, S.Chand and Co., New Delhi 11th edition (1974)
4. Subrahmanyam and Brijlal and M.N. Avadhanulu - A text book of optics, S.Chand and Co. 25th edition (2012)
5. C.Kittel , Introduction to solid state physics - Wiley eastern 8th edition (2012)

BOOK FOR REFERENCE:-

1. D.Halliday and R.Resnick , Physics, Part 1 (Wiley eastern) 1st edition (1990)

**PH2106 - PHYSICS FOR CHEMISTRY -
PRACTICAL – I**

SEMESTER : II
HRS/WEEK : 2

CATEGORY : AR
CREDITS : 1

LIST OF EXPERIMENTS

1. Young's modulus by stretching - vernier microscope
2. Rigidity modulus - torsional pendulum
3. Surface tension and interfacial tension - method of drops
4. Surface tension - capillary rise
5. Viscosity - capillary flow
6. Specific heat of liquid - method of mixtures (approximate radiation correction)
7. Specific heat of liquid - electrical heating
8. Sonometer - verification of laws
9. Compound bar pendulum - determination of 'g' and radius of gyration

BOOKS FOR STUDY:

1. Arul Thalpathi M., Practical Physics, Comptek Publishers, (2002)
2. C.C Ouseph, G.Rangarajan- A Text Book of Practical Physics- S.



Viswanathan Publisher-Part I (1990)

3. C.C Ouseph, C.Rangarajan, R.Balakrishnan- A Text Book of Practical Physics- S.Viswanathan Publisher-Part II (1996)

BOOK FOR REFERENCE:

1. S.L Gupta and V.Kumar- Practical Physics- PragatiPrakashan – 25th Edition (2002)

PH2107 - MICROPROCESSOR

SEMESTER : II

CATEGORY : AR

HRS/WEEK : 4

CREDITS : 3

Objective : This paper aims at providing the students with an in depth exposure to the sixteen bit microprocessor Intel 8086.

UNIT 1 : Intel 8086 Architecture and Instruction set

CPU architecture-addressing modes-instruction formats-instruction set-execution timing.

UNIT 2 : Introduction to Macro Assembler (MASM)

Assembler directives-assembler operators-assembly process-translation of assembler instructions-simple programs.

UNIT 3 : Modular Programming and Multiprogramming

Linking and relocation-access to external identifiers-procedures-interrupts and their routines-macros-process management and IRMX86-semaphore operations-common procedure sharing.

UNIT 4 : I/O consideration and System bus structure

Programmed I/O-Interrupt I/O-block transfer and DMA-basic 8086 bus configuration-minimum and maximum modes-system bus timings.

UNIT 5 : Interrupt system

Software Interrupts – hardware interrupts – vectored and non - vectored interrupts – hardware - Interrupt priority management - Daisy chain - single and multiple interrupt controllers 8259



BOOKS FOR STUDY:

1. Yu-cheng Liu, Glen A. Gibson, "Microcomputer Systems : 8086/8088 Family", Prentice-Hall of India, (2006)
2. Douglas V. Hall, "Microprocessor interfacing, Programming and Hardware", Tata McGraw-Hill, (2005)
3. Vijayendran V., "Fundamentals of Microprocessor-8086", S.Visvanathan PVT.,LTD., 3rd Edition (2005)
4. Muhammad Ali Mazidi, Janice Gillipsie Mazidi, "The 8051 Microcontroller and Embedded Systems", Pearson Prentice Hall, First Impression, (2006)

BOOKS FOR REFERENCES :

1. Barry B. Brey, "The Intel Microprocessors 8086/8088, 80186, 80286, 80386 and 80486, Prentice-Hall of India, New Delhi, 3rd Edition,(1995)
2. Uffenbeck J., "The 8086/8088 Family-Design, Programming and Interfacing, Software, Hardware and Applications", Prentice-Hall of India, New Delhi. 1st edition (2007)
3. Tribel W.A., Avtar Singh, "The 8086/8088 Microprocessors: Programming, Interfacing, Software, Hardware and Applications", Prentice-Hall of India, New Delhi.

PH2108 - MICROPROCESSOR PRACTICAL

SEMESTER : II

CATEGORY : AR

HRS/WEEK : 2

CREDITS : 1

Objective : This paper aims at providing the students with hands on experience of developing assembly language programs for the 16 bit microprocessor 8086.

List of Experiments:

1. Microprocessor 8086 - Introduction I (arithmetic - immediate mode)
2. Microprocessor 8086 - Introduction II (arithmetic and logical - all modes)



3. Microprocessor 8086 - Code conversions and arrays manipulation
4. Microprocessor 8086 - Solving equations
5. Microprocessor 8086 - Subroutines
6. Microprocessor 8086 - Interface I (LEDs & switches)
7. Microprocessor 8086 - Interface II (Freq. generation)
8. Microprocessor 8086 - Interface III (Waveform generation)
9. Microprocessor 8086 - Interface IV (Traffic lights simulation)

BOOKS FOR STUDY:

1. Yu-cheng Liu, Glen A. Gibson, "Microcomputer Systems : 8086/8088 Family", Prentice-Hall of India, (2006)
2. Douglas V. Hall, "Microprocessor interfacing, Programming and Hardware", Tata McGraw-Hill, (2005)
3. Vijayendran V., "Fundamentals of Microprocessor-8086", S.Visvanathan PVT.,LTD., 3rd Edition (2005)
4. Muhammad Ali Mazidi, Janice Gillipsie Mazidi, "The 8051 Microcontroller and Embedded Systems", Pearson Prentice Hall, First Impression, (2006)

BOOKS FOR REFERENCES :

1. Barry B. Brey, "The Intel Microprocessors 8086/8088, 80186, 80286, 80386 and 80486, Prentice-Hall of India, New Delhi, 3rd Edition, (1995)
2. Uffenbeck J., "The 8086/8088 Family-Design, Programming and Interfacing, Software, Hardware and Applications", Prentice-Hall of India, New Delhi. 1st edition (2007)
3. Tribel W.A., Avtar Singh, "The 8086/8088 Microprocessors: Programming, Interfacing, Software, Hardware and Applications", Prentice-Hall of India, New Delhi.

PH3506 - MATHEMATICAL PHYSICS

SEMESTER : III

HRS/WEEK : 6

17

CATEGORY : MC

CREDITS : 6



Objectives:

1. To help the student to understand the applications of Complex analysis (to electrical circuits or mechanical vibrating system,) Vector calculus in electromagnetism, Fourier Analysis for periodic functions in physics such as sound waves etc.
2. To provide an insight to the use of Numerical methods for solving real time physics problems and an exposure to matrices to grasp the fundamental principles of quantum mechanics

Unit 1 - COMPLEX ANALYSIS:

Powers and roots of complex numbers- Derivative- Analytic function-Cauchy- Riemann equation- Laplace equation and harmonic function-Exponential, trigonometric and hyperbolic functions-Logarithm and general powers- Line integral in the complex plane- Parametric representation- Cauchy integral theorem- Independence of path-Multiply connected domain-Cauchy integral formula- Derivative of analytic function.

Unit 2 - VECTOR CALCULUS:

Vector and scalar functions and fields- Gradient of a scalar field- Directional derivatives- Divergence and curl of a vector field: rotation of a rigid body- Line integrals and independence of path - Double integrals- Green's theorem in the plane: area of plane region-surfaces for surface integrals-Surface integrals: moment of inertia-Triple integrals- Divergence theorem of Gauss - Applications of divergence theorem: Modelling of heat flow and potential theory-Stokes's theorem.

Unit 3 - FOURIER ANALYSIS:

Periodic functions- Trigonometric series- Fourier series: Rectangular wave- Orthogonality of trigonometric system- Functions of any period: Periodic square wave and Half-wave rectifier-Even and odd functions: Rectangular pulse and sawtooth wave-Half range expansions- Fourier integrals- Square wave-Fourier cosine and sine integrals: Laplace integral

Unit 4 - MATRIX THEORY:

Basic algebraic operations¹⁸real, symmetric and hermitian



matrices-normal matrix- triangular matrix- Independent matrices and linear combinations-trace of a matrix-Determinants- Inverse matrix- Inverse transformation-Orthogonal matrix -Unitary matrix- Orthogonal and unitary transformations-Transformation of vectors and matrices-Partitioning of matrices-Rank of a matrix-System of linear equations-Eigenvalue problems- Eigenvectors- Diagonalisation of matrix - Cayley-Hamilton theorem - Power and roots of a matrix

Unit 5 - NUMERICAL METHODS:

Lagrange interpolation formula for unequally spaced data- Newton forward interpolation formula for equally spaced data -Numerical integration: Trapezoidal rule, Simpson 1/3 rule , Gauss integration formula-Numerical differentiation- System of linear equations: Gauss- Seidel iteration method- Curve fitting by the method of least squares-First order differential equation by Euler's method and the improved Euler method

BOOKS FOR STUDY:

- 1) Erwin Kreyszig, Advanced Engineering Mathematics, Wiley Student Edition-8th Ed.-(2005) (Units I, II, III & V)
- 2) A.W. Joshi, Matrices and Tensors in Physics, New Age International Publishers, 3rd Ed., (1995) (Unit-IV)

BOOKS FOR REFERENCE:

- 1) Tulsi Dass and Satish K.Sharma, Mathematical Methods in Classical and Quantum Physics, Universities Press- (1998) (Units I, II & IV)
- 2) Louis Albert Pipes & Lawrence R. Harville, Applied mathematics for Engineers and Physicists (3rd Ed.), International Student Edition (1970) (Units III & IV)
- 3) B.D. Gupta, Numerical Analysis- - Konark Publishers Pvt. Ltd.- (1989)
- 4) Schaum's Outline Series, Theory and Problems of Complex variables, McGraw-Hill-(1981)
- 5) Schaum's Outline series, Theory and Problems of matrices, Frank Ayres- McGraw hill- (1983)



- 6) Dr M.K Venkataraman, Engineering Mathematics, The national Publishing company- vol II- 3rd Ed.
- 7) H.K. Dass, Mathematical Physics, S. Chand & Co. Ltd.- (2010) (for unit V)
- 8) George Arfken, Hans Jurgen Weber, Mathematical methods for Physicists, 6th Ed.- Academic Press -(2003)
- 9) Mary L. Boas, Mathematical methods in Physical sciences, 3rd Ed. - Wiley -(2006)
- 10) Riley & Hobson - Foundation Mathematics for Physical Sciences - Cambridge University Press - (2011)
- 11) Introductory methods of Numerical Analysis - 3rd Ed - S S Sastry - PHI - (2004)

PH3507 - PHYSICS PRACTICAL - III

SEMESTER : III

CATEGORY : MC

HRS/WEEK : 3

CREDITS : 3

Objectives: *The course aims at exposing the under graduate students to the technique of handling simple measuring instruments and also make them measure certain mechanical and thermal properties of matter*

List of Experiments:

- 1) Non-uniform and uniform bending-Pin and microscope- Young's modulus.
- 2) Torsional Pendulum (With weights)- Rigidity modulus.
- 3) Thermal conductivity of bad conductor- Lee's disc
- 4) Deflection and Vibration magnetometers- M and B_H .
- 5) Air wedge- Thickness of insulation.
- 6) Spectrometer- Hollow prism- Refractive index of liquid.
- 7) Newton's law of cooling- Specific heat of liquid.
- 8) Ballistic galvanometer- Figure of merit.



BOOKS FOR STUDY:

1. Arul Thalapati M., Practical Physics, Comptech Publishers, 2002.
2. C.C Ouseph, G.Rangarajan- A Text Book of Practical Physics- S. Viswanathan Publisher-Part I (1990)
3. C.C Ouseph, C.Rangarajan, R.Balakrishnan- A Text Book of Practical Physics- S.Viswanathan Publisher-Part II (1996)

BOOKS FOR REFERENCE:

1. S.L Gupta and V.Kumar- Practical Physics- PragatiPrakashan – 25th Edition (2002)

PH4506 - ELECTRONICS – I

SEMESTER : IV

CATEGORY : MC

HRS/WEEK : 6

CREDITS : 6

Objectives:

1. To expose the undergraduate students to the fundamentals of analog and digital electronics.
2. *The various topics augment the electronics experiment they will be doing in their practical sessions.*

Unit 1 - Circuit Analysis:

DC circuits - Voltage and current sources – transformations - maximum power transfer theorem - superposition, Thevenin and Norton's theorems - hybrid parameters – determination of h-parameters – equivalent circuit – linear circuit - transistor h parameters – CE mode.

Unit 2 - Amplifiers and Oscillators:

Single stage amplifier - load line - operating point stability – Introduction to biasing – Voltage divider biasing - multistage amplifier, RC and direct coupled amplifiers - Power amplifier - Class A - Frequency response - Feedback requirements for oscillators – Colpitt's oscillator - Phase Shift and Wien Bridge oscillators - Multivibrators - Astable, Monostable, Bistable.



Unit 3 - Operational amplifier and special devices:

Ideal operational amplifier parameters - inverting and non inverting
- common mode rejection ratio - summing and difference amplifiers
- Solving simultaneous equations - FET, MOSFET, UJT, SCR –
Structure and working and I-V characteristics. Application - SCR
as half and full wave rectifiers.

Unit 4 - Digital Electronics:

Boolean Algebra - K-maps - Parallel binary adder -. Multiplexing
and demultiplexing. Flip-flop - RS - clocked RS - D flip-flop - T flip-
flop - JK flip-flop and Master Slave flip-flop - Truth tables - BCD
code to 7 segment decoder.

Counters - Binary ripple counter - modulus counter - decade
counter - up counter – down counter - Registers - Shift registers -
Shift counter circuits and their working - An introduction to memory
devices - ROM, RAM.

Unit 5 - Integrated Circuit technology:

Scale of integration - VLSI - monolithic, thick, thin film and hybrid
integrated circuits – bipolar and MOS technology comparison -
fabrication of monolithic I.C. - fabrication of integrated components
like resistors, capacitors, transistors and diodes - linear and
nonlinear I.C's.

BOOKS FOR STUDY:

1. Millman J. and Halkias C.C., Integrated Electronics, Analog & Digital Circuits and systems, McGraw-Hill 2nd edition (2009)
2. Mehtha VK., Principles of Electronics, S.Chand & Co., 11th Ed. (2010)
3. B. L. Theraja, A. K. Theraja, A Text book of Electrical Technology. S.Chand (2004)
4. Chattopadhyay D. and Rakshit, Electronics Fundamental and applications, New age publishers, 11 Ed., (2010)
5. A.P Malvino, D.P. Leach, Gautam Saha Digital Principles and Applications 7th Edition Tata McGraw-Hill Education -(2011)



BOOKS FOR REFERENCE:

1. John D. Ryder- Electronic fundamentals and applications, Prentice Hall, 5th ED. (2009)
2. Ben G. Streetman, Sanjay Banerjee, Solid State Electronic Devices, 6th Edition, PHI Learning, (2009)
3. M. Morris Mano, Michael D. Ciletti, Digital Design, 4th Edition, Pearson, (2008)
4. Malvino, Electronic principles, Tata McGraw Hill, Ed., (1995)

PH4507 - PHYSICS PRACTICAL - IV

SEMESTER : IV

CATEGORY : MC

HRS/WEEK : 3

CREDITS : 3

Objectives: *The course aims at exposing the under graduate students to the technique of handling simple measuring instruments and also make them measure certain mechanical and thermal properties of matter*

- 1) Searle's viscometer- Viscosity of highly viscous liquid.
- 2) Focal length – concave lens and convex mirror.
- 3) Saturated vapour pressure- Joly's bulb
- 4) Liquid lens- Refractive index of glass and liquid.
- 5) Spectrometer - grating - minimum deviation.
- 6) Carey-Foster bridge- Temperature coefficient of resistance.
- 7) Transistor- RC coupled amplifier.
- 8) IC regulated dual power supply.

BOOKS FOR STUDY:

1. Arul Thalpathi M., Practical Physics, Comptech Publishers, (2002)
2. C.C Ouseph, G.Rangarajan- A Text Book of Practical Physics- S. Viswanathan Publisher-Part I (1990)
3. C.C Ouseph, C.Rangarajan, R.Balakrishnan- A Text Book of



Practical Physics- S.Viswanathan Publisher-Part II (1996)

BOOKS FOR REFERENCE:

1. S.L Gupta and V.Kumar- Practical Physics- PragatiPrakashan – 25th Edition (2002)

PH5510 - QUANTUM MECHANICS AND RELATIVITY

SEMESTER : V

CATEGORY : MC

HRS/WEEK : 6

CREDITS : 6

Objective:

1. To expose the UG students to the basic concepts of quantum mechanics and apply it to various simple problems.
2. Also to give a basic understanding of the laws of special and general theory of relativity.

UNIT 1 - Introduction to quantum mechanics:

Inadequacy of classical concepts:- Black body radiation- Planck's quantum hypothesis- Photo-electric effect- Compton effect- matter waves: De Broglie's hypothesis- Davisson and Germer experiment- G.P.Thompson experiment – electron microscope- Bohr's quantisation of angular momentum- Heisenberg's uncertainty principle- applications of uncertainty relation: binding energy of hydrogen atom, Bohr radius, nuclear binding energy and absence of electron inside the nucleus.

UNIT 2 - Formulation of Quantum mechanics:

Wave mechanics- particle velocity and group velocity- operator correspondence and Schroedinger equation- admissibility conditions on wave function - normalisation and probability interpretation for one and N-particle system – conservation of probability - postulates of quantum mechanics – Operators : self adjoint operators(Hermitian operators)- eigenvalues and eigen functions of self adjoint operators-- expectation values – Ehrenfest's theorems - commutator algebra.



UNIT 3 - Exactly solvable eigenvalue problems:

Time independent Schrodinger equation- particle in a square potential well – square potential barrier- alpha decay – simple harmonic oscillator(1D): Schroedinger equation and energy eigenvalues- energy eigenfunctions (qualitative) – properties of stationary states- - Angular momentum operators L^2 and L_z – eigenvalues and eigenfunctions (qualitative) for L^2 and L_z – Quantum approach to central potential – hydrogen atom – separation of variables – solution of radial equation (qualitative)- eigenvalues and properties of stationary states- selection rules for allowed and forbidden transitions.(qualitative)

Unit 4 - Relativistic Kinematics

Classical relativity - Galilean transformation - non-existence of ether - Michelson-Morley experiment - Lorentz transformation - consequences of Lorentz transformation - length contraction - time dilation- relativity of simultaneity - pion decay - aberration and Doppler effect - velocity transformation - transformation of acceleration - four-dimensional Euclidean space-time.

Unit 5 - Relativistic Dynamics

Mass and momentum in relativity - equation of force and mass-energy relation - variation of mass with velocity - momentum transformation - transformation of force - invariance of Newton's law of motion.

General Relativity(Qualitative): non-inertial frames - principle of equivalence - some applications of principle of equivalence - equality of inertial and gravitational mass - gravitational red shift - bending of light and gravitational lensing - clock paradox - precision of perihelion of mercury.

BOOKS FOR STUDY:

1. P.M.Mathews and K.Venkatesan, A Textbook of QUANTUM MECHANICS, 2nd Ed, Tata McGraw Hill PVT. (2010) (Units 1-3)
2. Arthur Beiser, Shobhit Mahajan and S.Rai choudhury, Concepts of MODERN PHYSICS, (special Ind.Ed) 6th edition Tata McGraw Hill(2009)(units 1-3)



3. K D Krori, Fundamentals of Special and General Relativity, PHI (2012) (units 4-5)
4. Robert Resnick First edition, Introduction to special relativity, Wiley Eastern, New Delhi (1968)(units 4-5)

BOOKS FOR REFERENCE:

1. A.B. Gupta and Dipak Ghosh, Atomic and Nuclear Physics, Books and Allied (P) Ltd, Calcutta (1997)
2. Ghatak A, Introduction to Quantum mechanics, MacMillan India Ltd, Madras (2002)
3. Powell J.L and Craseman.B, Quantum mechanics, Narosa publishing, Madras (1995)
4. R.Murugesan and Kiruthiga Sivaprasath, Modern Physics, 14th Ed., S.Chand and Company Ltd (2009)
5. Berkeley Series - Sie - Eyvind Wichman -Quantum Physics - 1st Ed - Tata McGraw Hill -(2010)
6. David Griffiths - Introduction to Quantum Mechanics- 2nd Ed - PHI - (2004)
7. G Aruldas - Quantum Mechanics - 2nd Ed - PHI - (2008)
8. Mani H S and G K Mehta -Introduction to Modern Physics - Afiliated East and West - (1988)

WEB SITES:

http://www.hi.is/~quantum_mechanics/quantum.html

<http://newton.ex.ac.uk/research/qsystems/people/jenkins/mbody/mbody2.html>

http://en.wikipedia.org/wiki/quantum_mechanics

<http://www2.slac.stanford.edu/vvc/theory/relativity.html>

PH5511 - OPTICS

SEMESTER : V

CATEGORY : MC

HRS/WEEK : 6

CREDITS : 6

Objectives: To expose the students to the fundamentals of optics



and to provide the student with knowledge of the applications of optics.

Unit 1 - Geometrical Optics

Matrix method in ray optics - Effect of translation and refraction - Thick and thin lens formulae - Unit planes - Nodal planes - System of two thin lenses.

Dispersive power of a prism – Cauchy's formula – Combination of prisms to produce dispersion without deviation and deviation without dispersion - Direct vision spectroscope.

Lens aberrations – monochromatic aberration - spherical aberration – coma – astigmatism- curvature of the field – distortion- chromatic aberrations- methods of minimizing aberrations- Huygen's eyepiece – Ramsden's eyepiece.

Unit 2 - Interference

Fresnel's biprism – determination of wavelength of light and thickness of thin sheet of transparent material - Fresnel's mirrors and Lloyd's single mirror experiments - achromatic fringes - Interference in thin films due to reflected and transmitted light - fringes in wedge shaped films - reflective and antireflective coatings - Michelson's interferometer - determination of wavelength of light and thickness of thin transparent sheet.

Unit 3 - Diffraction

Rectilinear propagation of light - zone plate - Fresnel diffraction - diffraction at circular aperture, circular disc and a straight edge - Fraunhofer diffraction - diffraction at a single and double slit - missing orders in double slit - theory of diffraction grating - determination of wavelength - dispersive power - Rayleigh's criterion for resolution and resolving power of a telescope, microscope, prism and grating.

Unit 4 - Polarization

Plane of polarization - polarization by reflection - Brewster's law - Pile of plates- polarization by refraction - Malu's law -double refraction - Nicol prism - Huygen's explanation of double refraction



in uniaxial crystals - elliptically and circularly polarized light - Quarter and half wave plates - Production and determination of plane, elliptically and circularly polarized light - optical activity - Fresnel's theory - specific rotation - Laurent's half shade polarimeter.

Unit 5 - Applied Optics

Lasers - spontaneous and stimulated emission - Einstein's coefficients - carbon dioxide and Nd-YAG lasers. **Non-linear optics** – harmonic Generation, sum and difference frequency generation, wave mixing - Pockel and Kerr effect. **Optical Fibres** – principle - configurations - wave propagation in multimode and single - mode optical fibres.

BOOKS FOR STUDY:

1. Ajoy Ghatak, Optics, Tata McGraw Hill Co. 3rd edition- (2005) (For Matrix methods)
2. Jenkins and White, Fundamental of Optics, McGraw Hill 4th edition - (1981)
3. Subrahmanyam, Brijlal and M. N. Avadhanulu, A Text Book of Optics, 25th edition, S. Chand and Co. (2012)
4. Khanna D.R. & Gulati H.R., fundamentals of Optics, Chand & Co., Pvt. Ltd., New Delhi. 15th edition (1991)
5. R. Menzel, Photonics, Springer, (2001)

BOOKS FOR REFERENCE:

1. H. Lipson and D. S. Tannhauser, Optical Physics, S.G. Lipson, (3rd edition) Cambridge University Press 3rd edition (1996)
2. Miles V. Klein and Thomas E. Furtak, Optics, (2nd edition) John Wiley & Sons (1986)
3. R. Murugesan and Kiruthiga Sivaprasath, Optics and Spectroscopy, S. Chand Co, New Delhi. (2008)
4. T.P. Pearsall, Photonics Essentials: An introduction with experiments, McGraw- Hill, (2002)
5. Gerd Keiser, "Optical Fiber Communication" McGraw -Hill



International, Singapore, 3rd Ed., (2000)

6. Pedrotti and Pedrotti - Introduction to Optics, 3rd Ed - Addison - Wesley - (2006)
7. Eugene Hecht - Optics - 4th Ed - Pearson Publication -(2008)

PH5512 - ELECTRICITY AND MAGNETISM

SEMESTER : V

CATEGORY : MC

HRS/WEEK : 6

CREDITS : 6

Objectives:

1. To make the students understand the basic concepts of Electricity and Magnetism.
2. To expose the students to the applications of Electricity and Magnetism.

Unit 1 - ELECTROSTATICS: Gauss's Law and its applications – Gauss Divergence theorem differential form of Gauss's Law – Poisson's and Laplace's equations. electric potential – potential as line integral of the electric field – relation between electric field and electric potential - potential and field due to a dipole – quadrupole – potential energy of a dipole in an electric field.

DIELECTRICS: An atomic view of dielectrics – Polarization and charge density – Gauss Law for dielectric medium – Relation between D, E & P. Dielectric constant, susceptibility and relation between them – Clausius – Mossotti equation - boundary conditions at the dielectric surface.

Unit 2 - CURRENT ELECTRICITY: Current and current density – Equation of continuity – Ohms law and electrical conductivity. Drude – Lawrence theory of electrical conduction. Kirchhoff's Laws and analysis of multi loop circuits – Carey Foster bridge – Potentiometer and its uses

THERMOELECTRICITY: Seebeck and Peltier effect – Thermo emf – Laws of thermoelectricity – Peltier Coefficient – Determination of thermo emf – Thompson effect and Thompson Coefficient – Application of Thermodynamics – thermoelectric power and



thermo electric diagrams.

Unit 3 - MAGNETIC EFFECT OF ELECTRIC CURRENT: Biot–Savart’s rule – application to straight conductor, circular coil – Helmholtz Galvanometer. Amperes circuital law and its applications.

Force on current element by magnetic field – force between two long conductors – ampere – Theory of a Moving Coil Ballistic Galvanometer – Damping correction – Determination of absolute capacitance of a capacitor.

ELECTROMAGNETIC INDUCTION: Faraday and Lenz’s laws – Integral and differential forms of Faraday’s law – Mutual and Self Inductance - Experimental determination of self inductance and Mutual inductance .

Unit 4 - TRANSIENT CURRENT: Rise and decay of current in LR and CR circuits, decay constants – Determination of high resistance by leakage – Transients in LCR circuits.

ALTERNATING CURRENT: Peak, average and RMS value of alternating current – j operator method – Series and parallel resonance circuits – Power consumed by an AC circuit – power factor – Transformers.

Unit 5 - MAGNETISM: Magnetic susceptibility and permeability – Dia, Para, Ferro magnetic materials – Langevin’s theory for dia and para magnetism – Domain theory for Ferromagnetism – Hysteresis.

EM WAVES IN FREE SPACE: Maxwell’s equation – Displacement current – Transverse nature of EM waves - Plane EM waves in free space – Velocity of light – Poynting vector – Boundary conditions at an interface – Reflection and refraction of EM waves at the interface of non conducting media – Snell’s Law.

BOOKS FOR STUDY:

1. R Murugesan, Electricity and Magnetism, (2008) S Chand & CO New Delhi
2. Brijlal and Subrahmanyam, Electricity and Magnetism, (2005) Ratan Prakashan Mandir Publishers ,Agra

BOOKS FOR REFERENCE:

1. David J.Griffith, Introduction to Electro Dynamics, (2012) PHI, New Delhi



2. Navina Wadhvani, Electricity and Magnetism, (2010)PHI, New Delhi
3. A.K Tiwari, Electricity and Magnetism, (2007), S Chand & Co, New Delhi
4. Halliday-Resnick and Walker, Fundamentals of Physics – Electricity and Magnetism, (2011), Wiley India Pvt Ltd.

PH5406 - FUNDAMENTALS OF NANOSCIENCE

SEMESTER : V

CATEGORY : ES

HRS/WEEK : 3

CREDITS : 2

Objectives:

1. To make the students understand the importance, relevance and potentialities of this emerging field
2. To make them recognize the rules and applications of nano science from the Physics perspectives.

Unit 1 - Introduction to Nanotechnology

Scientific revolution - Historical milestones - Emergence of Nanotechnology - Definition of nanotechnology - Bohr radius - Quantum confinement - Nanosized effects - Challenges in Nanotechnology

Unit 2 - Synthesis of Nanomaterials

Physical method: Ball Milling - Sputter deposition - electric arc deposition - Ion beam technique. Chemical method: Wet chemical synthesis – sol-gel processing, co-precipitation - hydrothermal, chemical vapor condensation - chemical bath deposition

Unit 3 - Types of Nanostructures

Definition of a Nano system - Types of Nanocrystals-One Dimensional (1D)-Two Dimensional (2D) -Three Dimensional (3D) nanostructured materials - Quantum dots - Quantum wire - Core/Shell structures



Unit 4 - Functional Nanomaterials

Carbon (CNT, graphene) - Noble Metals (Au, Ag) - Metal oxides (TiO₂, SnO₂, ZnO) - Semiconductors (CdS, CdSe, CdTe), Magnetic nanoparticles - Semiconductor Nanocomposites

Unit 5 - Applications of nanomaterials

Applications in Physics: Nanoelectronics - Quantum dot and Dye sensitized solar cells - Photovoltaics - Hydrogen Production - Quantum electronic devices - CNT based transistor and Field Emission Display - Other applications: Nanosensors, Nanomedicine, Nanorobotics.

BOOKS FOR STUDY:

1. B. Viswanathan, Structure and properties of solid state materials, Oxford: Alpha Science International, II Edition (2006)
2. T.Pradeep, Nano the essentials Tata McGraw-Hill publishing company limited (2007)

BOOKS FOR REFERENCE:

1. M. Wilson, K. Kannangara, G Smith, M. Simmons, B. Raguse, Nanotechnology: Basic science and Emerging technologies, Overseas Press India Pvt Ltd, New Delhi, First Edition, (2005)
2. Editor Hari Singh Nalwa, Nanostructured Materials and nanotechnology, (Concise Edition) Academic Press, (2002)

PH5407 - ELECTRONICS – II

SEMESTER : V

CATEGORY : ES

HRS/WEEK : 3

CREDITS : 2

Objectives:

1. To expose the students to the principles and design of non-linear circuits and A/D & D/A convertors.
2. To provide the students with a thorough understanding of the functioning of the microprocessor 8085.
3. To introduce the students to the applications of 555 timer and



Phase Locked Loops.



Unit 1 - Operational amplifiers (non-linear circuits)

Integrator - Differentiator - solving differential equations - logarithmic amplifiers- II order high pass and low pass filters - astable and monostable multivibrators - instrumentation amplifiers.

Unit 2 - Digital to analog and analog to digital conversion:

Weighted resistor D/A converter - R-2R ladder D/A converter - parallel A/D converter - A/D conversion by counter method - A/D conversion using voltage to frequency converter.

Unit 3 - Architecture of μ P 8085:

Architecture of 8085 - the instruction set - data addressing modes – Introduction to I/O devices and interfacing Simple assembly language programs - addition, subtraction, multiplication, division

Unit 4 - Assembly language programming - μ P 8085

Assembly language programs: square, square root, picking largest/smallest of an array - Subroutines - Hand assembling programs.

Unit 5 - Timer & Phase Locked Loop

555 Timer architecture and working – astable and monostable operations. Phase Locked Loops – 567 PLL – internal architecture and working – Lock-in-range.

BOOKS FOR STUDY:

1. S. L. Gupta, V. Kumar, A Handbook of Electronics, Pragati Prakashan (2008)
2. Gaykwad. A, Operational Amplifier and Linear Integrated Circuits Prentice Hall, 11 Ed. (1991)
3. R.P.Jain, Modern Digital Electronics, Tata McGraw-Hill Education, (2003)
4. Ramesh S. Gaonkar, Microprocessor Architecture, Programming, and Applications with the 8085 Penram International, IV Ed., (2000)
5. Adithya R Mathur, Microprocessors, Tata McGraw-Hill, III Ed., (2001)



6. Allen Mottershead, Electronic Devices and Circuits, Prentice-Hall, (1993)

BOOKS FOR REFERENCE:

7. B. L. Theraja, A. K. Theraja, A Text book of Electrical Technology, S Chand (2004)
8. Krishnamurthy - Ten days with 8085 microprocessor, PHI LEARNING PVT. LTD-NEW DELHI (2010)
9. A. Malvino, D. J. Bates, Electronics Principles, Tata McGraw-Hill Education, 2006.

PH5408 - MATERIALS SCIENCE

SEMESTER : V

CATEGORY : ES

HRS/WEEK : 3

CREDITS : 2

Objectives:

1. To introduce the concepts of materials science and motivate the students to a research career in it.
2. To focus on the relationship of structure of materials with its properties and
3. To throw light into the latest developments in the field.

Unit 1 - Engineering materials and chemical bonding

Classification of engineering materials – levels of structure – structure-property relationship in materials – stability and metastability – bond energy – bond type and bond length – ionic and covalent bonding – variation in bonding character and properties.

Unit 2 - Mechanical behavior of materials

Elastic behavior – atomic model of elastic behavior – Young's modulus – Poisson's ratio – shear modulus – bulk modulus – the modulus as a parameter of design – rubber like elasticity – plastic deformation – tensile stress - strain curve.



Unit 3 - Magnetic materials and dielectric materials

Terminology and classification – magnetic moment due to electron spin – ferromagnetism and the domain structure – soft and hard magnetic materials.

Polarization – electronic, ionic, orientation and space charge polarization – temperature and frequency effects – electric breakdown – ferroelectric materials.

Unit 4 - Smart Materials

Definition of smart materials - Types- Piezoelectric materials- Materials for MEMS and NEMS- Ferrofluid-Magnetic shape-memory alloys (MSMAs)- Shape memory alloy (SMA)- One way and Two way memory effect- Dielectric elastomers (DEs)- Light sensitive materials- Smart catalysts

Unit 5 - Non-destructive testing

Radiographic methods – photo-elastic methods – magnetic methods – electrical method – ultrasonic method. Equipments used for NDT – metallurgical microscope - electron microscope – scanning electron microscope (SEM)

BOOKS FOR STUDY:

1. Raghavan V – Materials Science and engineering – a first course, IIIEd, PHI (1990)
2. Arumugam - Materials Science - Anuradha agencies & publishers, (1990)
3. Gandhi M V and Thompson B S - Smart Materials and Structures, Chapman & Hall (1992)

BOOKS FOR REFERENCE:

1. Kittel C – Introduction to Solid State Physics – VII Ed – Wiley Eastern, 8th edition, (2012)
2. Manchandra V K – A text book of Materials Science – New India Publishing House – 1992
3. Myer Kutz - Mechanical Engineers' Handbook: Materials and Mechanical Design, Volume 1, Third Edition. John Wiley & Sons, Inc - (2006)



4. Culshaw B Smart Structures & Materials. Artech House, (1996)

PH5409 - ENERGY PHYSICS

SEMESTER : V

CATEGORY : ES

HRS/WEEK : 3

CREDITS : 2

Objective:

1. The paper aims at providing to students the perspectives of energy sources, their availability and demand.
2. To expose the students to the basic principles of energy conversions, conservation and alternate energy resources.

Unit 1 - Introduction to Energy Sources

World Energy Reserves and Future - Various forms of energy - Conventional energy Sources - Fossil fuels - Coal, Oil and Natural Gas - impact of conventional energy sources on environment - global warming - climate change - non-conventional energy sources - Prospects in the energy sector.

Unit 2 - Solar Energy

Solar Radiation at the Earth's surface - Physical Principles of the Solar Energy Conversion - Solar pond - Applications: Solar Water Heating, Space Cooling, Distillation, Green Houses – Solar Photovoltaics – Solar Cells – Principles, types and power generation– Merits and Demerits

Unit 3 - Wind Energy and Biomass Energy

The Nature of the Wind –Wind Data and Energy Estimation – Basic Components of a Wind Energy Conversion System(WECS) – Classification of WECS – Applications - Merits and Demerits. Biomass Conversion Technologies – Photosynthesis – Photosynthetic Efficiency - Biogas Generation – Applications - Advantages and Disadvantages

Unit 4 - Emerging Sources of Renewable Energy

Geothermal energy – Ocean Thermal Energy Conversion (OTEC) – Tidal Energy – Micro Hydel Systems – Chemical Energy Sources



– Fuel Cells, Hydrogen Energy - Magneto Hydro Dynamic Power Generation – (*Basic Principles, Applications, Advantages and Disadvantages*)

Unit 5 - Energy Consumption, Conservation and Options

Patterns of energy consumption in domestic, industrial, transportation and agricultural sectors - Principles of Energy Conservation and Energy Audit – energy crisis and possible solutions - energy options for the developing countries

BOOKS FOR STUDY:

1. G.D. Rai, Non Conventional Energy Sources, 4thEd., Khanna Publishers, (2007)
2. D.S. Chauhan and S. K. Srivastava, Non-conventional Energy Resources, New Age Int. Pvt. Ltd., (2004)

BOOKS FOR REFERENCE:

1. B.H. Khan, Non-conventional Energy Resources, 2nd Ed., Tata McGraw Hill, (2009)
2. G.D. Rai, Solar Energy Utilization, Khanna Publishers, 5thEd. (1995)
3. S.P. Sukhatme, Solar energy, Tata McGraw-Hill Publishing Company, 2ndEd., (1997)
4. S. Rao and Dr. B.B. Parulekar, Energy Technology, 2nd Edition, (1997)
5. Godfrey Boyle, Renewable Energy: Power for a sustainable Future, Oxford Univ. Press, 2nd Ed., (2004)
6. Jyoti K. Parikh, Energy models for 2000 and Beyond, Tata McGraw Hill, (1997)
7. A.K. Wahil, Power Plant technology, Tata McGraw Hill, 1st Ed., 2nd Reprint, (2010)
8. C S Solanki - Renewable energy resources - PHI - (2008)



PH5410 - GEOPHYSICS

SEMESTER : V
HRS/WEEK : 3

CATEGORY : ES
CREDITS : 2

Objectives: To provide a qualitative idea on the fundamentals of seismology and theoretical understanding of various physical properties of earth.

Unit 1 - Seismology

Introduction-Seismology- P- waves-S waves, their velocities- the location of epicenters-Effect of Boundaries-Major discontinuities-.Seismic energy sources-Detectors-Interpretation of time and distance curves.-Derivation of properties from the velocities.

Unit 2 - Internal structure of earth

Introduction-Seismic waves-Rayleigh waves and love waves-Study of earth by seismic waves-Earthquake seismology-Horizontal and vertical seismograph-Seismograph equation-Internal structure of earth.

Unit 3 - Earthquakes and gravity

Earthquakes: Focus, Magnitude, Frequency –Detection and prediction –Gravity –Absolute and relative measurements of gravity- Worden gravimeter-Application of gravity methods

Unit 4 - Geomagnetism

Geomagnetism-Definitions, magnetic field - Measurements :Proton precession magnetometer - Alkali vapour magnetometer - Theory of Earth magnetism - Dynamo theory of earth magnetism - Magnetic surveying - application.

Unit 5 - Geochronology and Geothermal Physics

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

Geothermal Physics: Flow of heat to the surface of earth - Sources of heat within earth - Process of heat transport - Internal temperature of earth.

BOOKS FOR STUDY:

1. Cook,A.H., Physics of the Earth and Planets ,I Ed, McMillan Press, London ,(1973)
2. William Lourie, Fundamentals of Geophysics, II Ed, Cambridge University Press, (1982)
3. Garland .G.D., Introduction to Geophysics 11 Ed, WB Saunder company, London. (1979)

BOOKS FOR REFERENCE:

1. Ramachandra Rao M.B. Outlines of Geophysical prospecting-A manual for Geologists, Prasarauga University of Mysore, Mysore, (1975)
2. Telford ,W.M. Geldart, L. P. Sheriff R.E. and Keys .D.A., Applied Geophysics, Oxford –IBH Publishing Co.Pvt.Ltd. New Delhi. (1976)
3. Rama Rao.B.S., Murthy I.V.R., Gravity and magnetic methods of prospecting, Arnold Heinemann Publishers, New Delhi, (1978)

PH5513 - PHYSICS PRACTICAL – V

SEMESTER : V

CATEGORY : MC

HRS/WEEK : 3

CREDITS : 3

Objectives: It is aimed at exposing the under graduate students of the Physics department to the techniques of handling equipments, making error free measurements and error analysis.

List of Experiments:

1. Spectrometer- i-d curve-Refractive index.
2. Newton's Rings- Radius of curvature of lens.
3. EMF of a thermocouple- Potentiometer.
4. Field along the axis of a circular coil- Determination of B_H .
5. Field along the axis of a circular coil- Moment of a bar magnet.
6. Spectrometer- Small angled prism- Refractive index.
7. Potentiometer- Calibration of low range Voltmeter.
8. Absolute determination of capacitance- BG.

BOOKS FOR STUDY:

1. Arul Thalpathi M., Practical Physics, Comptech Publishers, (2002)
2. C.C Ouseph, G.Rangarajan- A Text Book of Practical Physics- S. Viswanathan Publisher-Part I (1990)
3. C.C Ouseph, C.Rangarajan, R.Balakrishnan- A Text Book of Practical Physics- S.Viswanathan Publisher-Part II (1996)

BOOKS FOR REFERENCE:

1. S.L Gupta and V.Kumar- Practical Physics- PragatiPrakashan – 25th Edition (2002)

PH5514 -PHYSICS PRACTICAL – VI

SEMESTER : V

CATEGORY : MC

HRS/WEEK : 3

CREDITS : 3

Objective : It is aimed at exposing the under graduate students of the Physics department to the techniques of handling equipments, making error free measurements and error analysis.

List of Experiments:

1. Inverting and Non-inverting amplifier – Op-amp.
2. Summing and Difference amplifier – Op-amp
3. Solving simultaneous equations – Op-amp
4. Low and High pass filters (2nd order) – Op-amp
5. Astable multivibrator – Op-amp
6. Light to frequency converter – 555 timer
7. Mod n counter using 7493
8. ASM programs – Add & subtract (all modes of addressing) - μ P 8085

BOOKS FOR STUDY:

1. C.C Ouseph, G.Rangarajan- A Text Book of Practical Physics- S. Viswanathan Publisher-Part I (1990)

2. C.C Ouseph, C.Rangarajan, R.Balakrishnan- A Text Book of Practical Physics- S.Viswanathan Publisher-Part II (1996)

BOOKS FOR REFERENCE:

1. S.L Gupta and V.Kumar- Practical Physics- PragatiPrakashan – 25th Edition (2002)

PH6611 - ATOMIC AND NUCLEAR PHYSICS

SEMESTER : VI

CATEGORY : MS

HRS/WEEK : 6

CREDITS : 8

Objectives:

1. To enable the students understand the laws that govern the structure and properties of the atom, molecules and the nucleus.
2. Also to provide an introduction to the elementary particles.

UNIT1 - Ions, electrons and atomic structure

Detection of charged particles in electric and magnetic fields- Dunnington's method for e/m- positive ray analysis: Thomson's parabola method - Bohr's atom model - Sommerfeld's relativistic atom model- the Vector atom model and the quantum numbers- comparison with quantum model.

Coupling schemes: L-S coupling and j-j coupling – Pauli's exclusion principle - Magnetic moment due to (i) orbital motion of the electron (ii) due to spin- Stern and Gerlach experiment

UNIT 2 - Atomic and molecular spectra

Spin-orbit interaction in atomic spectra - fine structure and sodium doublet - Zeeman effect: experiment - classical result - Quantum mechanical explanation- anomalous Zeeman effect - Paschen Back effect- Stark effect (qualitative)

Origin of a pure rotational spectra of a rigid linear molecule- vibrating diatomic molecule as a quantum harmonic oscillator- pure vibrational spectra- Spectroscopy (Schematic) : Ultraviolet - Infrared-absorption- Raman

UNIT 3 - Properties of nuclei and Radioactivity

Isobars, isotopes, mirror nuclei -Nuclear mass and binding energy
-Parity-Nuclear spin –Mass defect and packing fraction-Stable nuclei –Nuclear size, Nuclear magnetic moment-Electric quadrupole moment-Nuclear energy levels.

Radioactivity: Range and stopping power of alpha particles.-Geiger-Nuttall law-Feature of alpha decay Tunnelling –Beta ray spectrum- Energetic of beta decay-Detection of neutrino-Gamma ray absorption in matter.

Unit 4 – Nuclear models, Fission and Fusion

Neutron: Discovery, Mass, Half life, Magnetic Moment, sources and detection–Shell model, Liquid drop theory -Nuclear fission – Spontaneous fission and potential barrier-Self sustaining Chain Reaction –Neutron balance in Nuclear Reactor-Uncontrolled chain reaction -Nuclear Fusion – radiation hazards and safety measures - Controlled fusion-Fusion in stars.

Unit 5 - Elementary particle physics

Discovery of cosmic rays- primary and secondary rays- cosmic ray showers- discovery of positron – the mesons – origin of cosmic rays- the Big-Bang theory- thermal history of the Universe- Hubble's law – the future of the universe- dark matter. Particles and anti-particles- antimatter- the fundamental interactions – elementary – particle quantum numbers – conservation laws and symmetry – the Quark model – quantum chromodynamics- the standard model – unification of interactions – Grand unified theories.(qualitative)

BOOKS FOR STUDY:

1. R.Murugeshan and Kiruthiga Sivaprasath, Modern Physics 14th Ed, S.Chand and Company Ltd, 2009 (Units 1, 2 & 5)
2. A.B. Gupta and Dipak Ghosh, Atomic and Nuclear Physics Books and Allied(P)Ltd, Calcutta, (1997)(units 3&4)
3. Ronald Gautreau and William Savin, Modern Physics, Schaum's outline series, 2nd Ed., Tata McGraw Hill P.Ltd, (2004) (for problems)

BOOKS FOR REFERENCE:

1. K.Gopla Krishnan, Atomic and Nuclear Physics, 3rd Ed. ,MacMillan India Ltd. (1994)
2. H.S.Mani and Mehta (G.K) , Introduction to Modern Physics, Affiliated East-West Press, (1989)
3. R.P.Feynmann, R.B. Leighton and M.Sands , The Feynmann Lectures on Physics, Vol III, 7th Indian reprint, Narosa Pub. Ltd, (1992)

PH6612 - SOLID STATE PHYSICS

SEMESTER : VI

CATEGORY : MS

HRS/WEEK : 3

CREDITS : 4

Objectives:

1. To give the students a firm understanding of the basics of Solid State Physics.
2. *To introduce the students to the applications of Solid State Physics and the physical properties of solids.*

Unit 1 - Crystal Structure: Periodic array of atoms – Crystal lattice – Unit cell _ Basis – Symmetry considerations – Classification of crystals – Bravais lattices in three dimensions – Crystal Planes and Miller indices – crystal imperfections: zero and one dimensions – Burger's vector

Unit 2 - Crystal diffraction: Bragg's law – Laue equations - Experimental X-ray diffraction methods- Laue method – Rotating crystal method – Powder method – Neutron diffraction.

Unit 3 - Thermal properties: Heat capacity – Classical theory – Einstein model – Debye model – Density of modes (3d) – Debye model – Anharmonicity and thermal expansion of crystals – Principal coefficients – Gruneisen relation – Thermal conductivity.

Unit 4 - Free electron theory of metals: Introduction – Free electron model – Free electron gas in 3-dimensions – Density of states – Thermal capacity of free electron system – Paramagnetism of free electrons – Sommerfeld theory of electrical conductivity –

Thermal conductivity – Wiedemann Franz law – Hall effect – Failure of free electron theory.

Unit 5 - Superconductivity: Introduction – Meissner effect – Levitation – Type I and Type II super-conductivity – Vortex states – BCS theory (qualitative treatment only) – Josephson's effect – Cooper pair tunneling.

BOOKS FOR STUDY:

1. Kittel. C, An Introduction to Solid State Physics, (5th edition) Wiley Eastern Ltd. (1988)
2. Hall H. E, Solid State Physics, E.L.B.S Manchester Physics series, 2nd ed. (1991)

BOOKS FOR REFERENCE:

1. Kakani, Hemarajani, Solid State Physics, 3rd ed. Sultan Chand & Co., (2005)
2. Dekker A.N., Solid State Physics, MacMillan India Ltd, (1995)
3. Mandiratta, Sawhney, Fundamentals of Electricity and Magnetism, Affiliated East-west press, (1976)
4. R. Asokamani, Solid state physics, principles and applications, 1st ed. Anamaya publishers, (2006)
5. Elementary Solid state Physics - 4th Ed - Ali Omar - Pearson - (1999)

PH6613 - PHYSICS PRACTICAL – VII

SEMESTER : VI
HRS/WEEK : 3

CATEGORY : MS
CREDITS : 4

Objectives: *It is aimed at exposing the under graduate students of the Physics department to the techniques of handling equipments, making error free measurements and error analysis.*

List of Experiments:

1. Spectrometer- i-i' curve- Refractive index.
2. Spectrometer- Dispersive power of a grating-normal incidence.

3. EMF of a thermocouple- Moving Coil galvanometer.
4. Field along the axis of a circular coil- Searle's Vibration magnetometer- BH.
5. Searle's vibration magnetometer- Magnetic moment.
6. Mutual Inductance- BG.
7. High resistance by leakage- BG.
8. Potentiometer- Calibration of High range voltmeter.

BOOKS FOR STUDY:

1. Arul Thalpathi M., Practical Physics, Comptech Publishers, (2002)
2. C.C Ouseph, G.Rangarajan- A Text Book of Practical Physics- S. Viswanathan Publisher-Part I (1990)
3. C.C Ouseph, C.Rangarajan, R.Balakrishnan- A Text Book of Practical Physics- S.Viswanathan Publisher-Part II (1996)

BOOKS FOR REFERENCE:

1. S.L Gupta and V.Kumar- Practical Physics- PragatiPrakashan – 25th Edition (2002)

PH6614 - PHYSICS PRACTICAL – VIII

SEMESTER : VI

CATEGORY : MS

HRS/WEEK : 3

CREDITS : 4

Objective : It is aimed at exposing the under graduate students of the Physics department to the techniques of handling equipments, making error free measurements and error analysis.

List of Experiments:

1. Wein's bridge oscillator – Op-amp
2. R-2R D/A converter – Op-amp
3. Temperature to voltage converter – Op-amp
4. Colpit's oscillator – transistor

5. Double digit seconds counter – 7 segment
6. Flasher using relay – 555 timer
7. ASM programs – multiply & divide (all modes of addressing) - μ P 8085
8. ASM programs – factorial & square root (all modes of addressing) - μ P 8085

BOOKS FOR STUDY:

1. Arul Thalpathi M., Practical Physics, Comptek Publishers, (2002)
2. C.C Ouseph, G.Rangarajan- A Text Book of Practical Physics- S. Viswanathan Publisher-Part I (1990)
3. C.C Ouseph, C.Rangarajan, R.Balakrishnan- A Text Book of Practical Physics- S.Viswanathan Publisher-Part II (1996)

BOOKS FOR REFERENCE:

1. S.L Gupta and V.Kumar- Practical Physics- PragatiPrakashan – 25th Edition (2002)

PH6654 - ELECTRICAL AND ELECTRONICS SCIENCE & APPLIANCES

SEMESTER : VI
HRS/WEEK : 15

CATEGORY : SK
CREDITS : 15

Objectives:

1. This course has been designed to provide an introduction to electrical machines and electronic instruments.
2. To enable students to acquire knowledge on the basic working principles and troubleshooting of everyday household appliances.

ELECTRICAL AND ELECTRONICS SCIENCE

Unit 1 - Electrical Machines

D.C. Machines - constructional details - D.C. Generators- principle of working-types - emf equation D.C. motor -principle of working-

types- back emf, torque equation-starting of motors using 3pt.and 4 pt. Starters – speed control of D.C. motors - applications. Transformer - Ideal transformer - principle of working, Construction details - emf equation, transformation ratio - core loss - copper loss - losses and efficiency - regulation - OC and SC tests on transformer - application. Synchronous machines - principles of working and constructional details - induction motors-principle of working of 3 phase induction motor (Simple problems)

Unit 2 - Power Supplies and Regulators

Half-wave, full-wave and bridge rectifiers-efficiency and ripple factor for the above circuits- filters capacitors, inductors, L-section and Pi-section and RC filters - Voltage multipliers – Half-wave – Full-wave doublers - triplers and quadruplers - Voltage regulators- zener regulator - Emitter follower regulators - Series regulators –Switched mode power supply(SMPS) - Uninterrupted power supply (UPS) (Block diagrams only) -Transformerless power supplies

Unit 3 - Instrumentation

Bio-medical instrumentation: Transducers - electrodes and Bio-amplifiers - physiological transducer - pressure transducer - temperature transducers - pulse sensors - respiration sensors - Bio-chemical transducers. Micro controllers - Intel 8031/8051 - Internal architecture - Addressing modes - Instruction set –Software examples.

ELECTRICAL & ELECTRONIC APPLIANCES

Unit 4 - Electromechanical Components used in Electronic Equipment

Switches – Types - Mechanical, Electromechanical & Electronic Switches, characteristics and performance – connectors and relays - types and applications - panel components

Testing and Measuring Instruments: Digital Multimeter – Basics – Measurement and Troubleshooting - Cathode Ray Oscilloscope (CRO) - Viewing Signal - Calibration and measurement of frequency, time period and voltage with CRO - Block Diagram of CRO - Function Generator (FG) - Generating Signals with FG -

Basics of Trouble Shooting

Tools used for repairing of electronic equipments – Soldering/de-soldering techniques – Basic Troubleshooting techniques - General safety considerations in Trouble Shooting – Practical troubleshooting problems

Unit 5 - House Wiring and Home Appliance Accessories

Simple house wiring circuit – Types of wiring – wiring methods – electrical panel – cable type - Earthing – Introduction – Need for earthing – principle – types - hazards – advantages - Stabilizer - Working principle – Types – Repair – Inverter – Introduction – Block Diagram – DC to AC Converter/Inverter – Designing an Inverter – Troubleshooting and Repair – Battery – Types – Factors affecting charging – Cause of battery failure – diagnosis and testing - visual inspection.

Home appliances

Electric iron - mixer grinder - ceiling and table fan - electric heater – kettle - washing machine – Installation Procedure – working principle - circuit description - fault identification – trouble shooting - removal and replacement of faulty components– Assembling and installation of a fluorescent lamp – various components – working principle – troubleshooting – Decorative serial lamps – working and maintenance.

PRACTICALS

For units 1 to 3 (Any Eight to be selected by the course teacher)

1. Shift Registers - shift left, right and parallel load using JK flip-flop.
2. Counters- to design mod counters (of any sequence) using JK flip-flop.
3. Astable Multivibrator - using 555 timer, to study the Frequency response for different values of resistances and capacitances and to find the unknown resistance and capacitance.
4. Solving Boolean Expressions using K-map and implementing the logic circuit.

5. Switching mode power supply – design and testing.
6. Transformer - to find the efficiency of a single- phase transformer by conducting o.c. and s.c. tests.
7. Induction motor - to find the power input to a 3-phase induction motor using two watt meter method at no load and any other load.
8. DC motors-speed control.
9. Microcontroller Intel 8051 - Software programs – I
10. Micro controller Intel 8051-Software programs – II
11. Microcontroller Intel 8051- Interfacing – I
12. Microcontroller Intel 8051-Interfacing-II

For units 4 and 5 (Any Four to be selected by the course teacher)

1. Digital Multimeter – Basics and Troubleshooting
2. CRO – Calibration, Measurements and Troubleshooting
3. Function Generator – Basic tuning, measuring and troubleshooting techniques.
4. Introduction to Soldering /De-soldering
5. Stabilizers – Working and Troubleshooting soldering techniques
6. House Wiring – single phase
7. House Wiring – three phase
8. Inverters – Circuit design and Troubleshooting.
9. Fluorescent lamps and Decorative Serial lamps – Basics and maintenance techniques
10. Home appliances servicing – I (Electric iron/Electric kettle/ mixer grinder)
11. Home appliances servicing – II (Ceiling Fan/table fan)

BOOKS FOR STUDY:

FOR UNITS 1 to 3

1. B. L. Theraja and A.K.Theraja, A Text book of Electrical Technology – Vol. II & IV, S. Chand & Co. (2005)

2. Paul P. John, Electronic Devices and Circuits, New Age Intl., (2003)
3. M. Arumugam, Biomedical instrumentation, Anuradha Publications, 2nd Ed., (2003)
4. 8051 Manual and Student Work Book

FOR UNITS 4 and 5

1. K. Sudeep Singh, Troubleshooting and Maintenance of Electronic Equipments, Publishers S.K. Kataria & Sons, (2010)
2. Eric Kleinert, Troubleshooting and Repairing Major Appliances, Mc Graw Hill, 3rd Edition, (2012)

BOOKS FOR REFERENCE:

1. S.K. Bhattacharya, Electrical Machines, (TTTI Chandigarh) – TMH, (1998)
2. Mottershead and Allen, Electronic Devices and Circuits – An introduction, Prentice Hall of India, (1998)
3. G.K. Mittal, Electronic Devices and Circuits, Khanna Publishers, (1994)
4. B. L. Theraja, Basic Electronics: Solid-State, S. Chand & Co., (2008)
5. V. K. Mehta, Principles of Electronics, S. Chand & Co., (2000)
6. R.S. Khandpur, Handbook of Bio-Medical instrumentation, Tata Mc Graw Hill, 2nd Ed., (2003)
7. Kenneth J. Ayala, The 8051 Microcontroller 3E, Cengage Learning, 3rd Ed., (2004)
8. George Meyerink, Appliances Service Handbook, Prentice Hall, 2nd Ed., (1984)
9. R. S. Khandpur, Troubleshooting Electronic Equipment, Mc Grw Hill, 1st Ed., (2006)

PH6655 - ELECTRICAL AND ELECTRONIC SCIENCE & MACHINE SHOP TECHNOLOGY

SEMESTER : VI
HRS/WEEK : 15

CATEGORY : SK
CREDITS : 15

Objectives: This course has been designed to provide an introduction to electrical machines and the basics of machine shop technology as well as devices for production technology.

ELECTRICAL AND ELECTRONIC SCIENCE

Unit 1 - Electrical Machines

D.C. Machines - constructional details - D.C. Generators- principle of working-types - emf equation D.C. motor -principle of working-types- back emf, torque equation-starting of motors using 3pt. and 4 pt. Starters – speed control of D.C. motors - applications. Transformer - Ideal transformer - principle of working, Construction details - emf equation, transformation ratio - core loss - copper loss - losses and efficiency - regulation - OC and SC tests on transformer - application. Synchronous machines - principles of working and constructional details - induction motors-principle of working of 3 phase induction motor (Simple problems)

Unit 2 - Power Supplies and Regulators

Half-wave, full-wave and bridge rectifiers-efficiency and ripple factor for the above circuits- filters capacitors, inductors, L-section and Pi-section and RC filters - Voltage multipliers – Half-wave – Full-wave doublers - triplers and quadruplers - Voltage regulators- zener regulator - Emitter follower regulators - Series regulators –Switched mode power supply (SMPS) - Uninterrupted power supply (UPS) (Block diagrams only) - Transformerless power supplies

Unit 3 - Instrumentation

Bio-medical instrumentation: Transducers - electrodes and Bio-amplifiers - physiological transducer - pressure transducer - temperature transducers - pulse sensors - respiration sensors - Bio-chemical transducers. Micro controllers - Intel 8031/8051 - Internal architecture - Addressing modes - Instruction set –Software examples.

MACHINE SHOP TECHNOLOGY

Unit 4 - Planer, Shaper, Drilling Machines

Types of planers (Description only)-specifications-Principles of operation-Drives-Quick return mechanism-feed mechanism-Types, work holding devices and special fixtures-Types of tools -various operations.

Shaper

Types of shapers-specifications-standard plain-universal-draw cut -principles of operation- drives quick return mechanism-crank and slotted link-feed mechanism work holding devices- tools and fixtures.

Drilling Machines

Drills -Flat drills- Twist drills- Nomenclature-Types of Drilling Machines-Bench type- Floor type-Radial Type-Gang Drill-Multi spindle type-Principle of operation in drilling-speeds and feeds for various materials -drilling holes-methods of holding drill bit-drill chucks- Regrinding of Drill bits and Drill jigs.

Unit 5 - Milling, Grinding and Broaching Machines

Types –Column and knee type - plain-universal milling machine-vertical milling machine- plano miller –specification of milling machines- Principles of operation work and tool holding devices.

Grinding: Types and classification-specifications –Rough Grinders-Floor mounted band grinders- portable grinders

Broaching: Types of broaching machine-Horizontal, vertical and continuous broaching –principles of operation.

PRACTICALS

For units 1 to 3 (Any eight to be selected by the course teacher)

1. Shift Registers-to shift left, right and parallel load using JK flip-flop.
2. Counters- to design modern counters (of any -sequence) using JK flip-flop.
3. Astable multivibrators-using 555 timer, to study the Frequency response for different values of resistances and capacitances and to find the unknown resistance and capacitance.

4. Solving Boolean Expressions using K-map and implementing the logic circuit.
5. Switching mode power supply – design and testing.
6. Transformer-to find the efficiency of a single-phase transformer by conducting o.c. and s.c. tests.
7. Induction motor-to find the power input to a 3-phase induction motor using two watt meter method at no load and any other load.
8. DC motors-speed control.
9. Microcontroller Intel 8051-Software programs -I
10. Microcontroller Intel 8051-Software programs-II
11. Microcontroller Intel 8051-Interfacing-I
12. Microcontroller Intel 8051-Interfacing-II

For units 4 and 5 (Any Four to be selected by the course teacher)

1. Shaping to the planned dimensions.
2. Cutting and bending.
3. Using drilling machines for various requirements.
4. Different types of welding.
5. Boxes of different sizes.
6. Wood work.
7. Experiments using lathe.

BOOKS FOR STUDY:

FOR UNITS 1 to 3

1. B. L. Theraja and A.K. Theraja, A Text book of Electrical Technology – Vol. I,II, S. Chand & Co. 2005
2. Paul P. John, Electronic Devices and Circuits, New Age Intl., 2003
3. M. Arumugam, Biomedical instrumentation, Anuradha Publications, 2nd Ed., 2003
4. 8051 Manual and Student Work Book

FOR UNITS 4 and 5

1. K. Hajra Choudhury, A. K. Kajra Choudhury, Nirjhar Roy , Workshop technology (2010) SMedia Promoters and Publishers Private Ltd, Mumbai
2. Chapman, Work shop technology, Vol. I, II, III, (2011) Viva books pvt. Ltd, New Delhi

BOOKS FOR REFERENCE:

1. S.K. Bhattacharya, Electrical Machines, (TTTI Chandigarh) – TMH, (1998)
2. Mottershead and Allen, Electronic Devices and Circuits – An introduction, Prentice Hall of India, (1998)
3. G.K. Mittal, Electronic Devices and Circuits, Khanna Publishers, (1994)
4. B. L. Theraja, Basic Electronics: Solid-State, S. Chand & Co., (2008)
5. V. K. Mehta, Principles of Electronics, S. Chand & Co., (2000)
6. R.S. Khandpur, Handbook of Bio-Medical instrumentation, Tata Mc Graw Hill, 2nd Ed., (2003)
7. Kenneth J. Ayala, The 8051 Microcontroller 3E, Cengage Learning, 3rd Ed., (2004)
8. Myron L. Begeman , Manufacturing process, Asia publishing House, (1964)

PH3206 - PHYSICS FOR BIOLOGY

SEMESTER : III

CATEGORY : AO

HRS/WEEK : 4

CREDITS : 3

To Whom : PB & Bio Tech / Adv. Zoo

Objective: To expose the students of biology to some fundamental physics required for study of the measurements of physical properties related to biological systems.

Unit 1 Properties of matter

Viscosity - Newton's formula - coefficient of viscosity- Factors affecting viscosity- capillary flow method – Stokes method – Biological significance of viscosity- Surface tension – Kinetic theory of surface tension – Factors affecting surface tension – Capillary rise method – Drop weight method – Interfacial surface tension – Biological significance of surface tension

Unit 2 Laser Physics

Absorption, spontaneous emission and stimulated emission- characteristics of laser light- Einstein's A and B coefficients – principle of laser action – He-Ne laser – CO₂ laser – Ruby laser – Nd-YAG Laser – semiconductor laser – applications of laser.

Unit 3 Microscopes

Characteristics of light – magnification – Compound microscope – Phase contrast microscope - interference microscope – ultraviolet microscope – Fluorescent microscope – electron microscope – Transmission Electron microscope – Scanning electron microscope - Uses.

Unit 4 Radiation Biology

Radioactivity - Natural radioactivity – induced radioactivity Half life – mean life – Radioactive disintegration – units of radioactivity – GM counter – Proportional counter – Scintillation counter - uses of radio isotopes: diagnostic and therapeutic – archeological dating by C¹⁴ method – Biological effects of radiation

Unit 5 Biological transducers

Bio-medical instrumentation – transducers – electrodes and bio amplifiers – physiological transducer – pressure transducer – temperature transducer – pulse sensors – respiration sensors- bio-chemical transducers.

BOOKS FOR STUDY:

1. M. A. Subramaniam, Biophysics – Principles and Techniques, MJP publishers, (2005)

2. S. Armugam, Biomedical Instrumentation, Anuratha Agencies, 2nd Ed., (2006)
3. J. Kumar, S. Moorthy Babu, S. Vasudevan, Engineering Physics, Vijay Nicole Imprints Pvt. Ltd, (2006)

BOOKS FOR REFERENCE:

1. Vasantha Pattabhi, N. Gautham, Biophysics, Narosa Publishing House, (2002)
2. Vatsala Piramal, Biophysics, Dominant Publishers and Distributors, (2006)
3. D.S.Mathur, Properties of matter, S.Chand Publishing, 11th Ed. (2005)
4. P. Narayanan, Essentials of Biophysics, New Age International, 2nd Ed. (2007)

PH3207 - PHYSICS PRACTICAL FOR BIOLOGY

SEMESTER : III

CATEGORY : AO

HRS/WEEK : 2

CREDITS : 1

To Whom : PB & Bio Tech / Adv. Zoo

Objective: *To expose the students of biology to some measurements of physical properties.*

EXPERIMENTS:

1. Surface tension- capillary rise
2. Surface tension by method of drops
3. Viscosity by graduated burette
4. Focal length of a convex and concave lens
5. Melde's string – longitudinal and transverse vibrations.
6. Temperature transducer.
7. Light Transducer.

PH3208 - MICROPROCESSOR 8085

SEMESTER : III

CATEGORY : AO

HRS/WEEK : 4

CREDITS : 3

To Whom : CS / CA

Objectives:

1. This paper aims at providing an in depth knowledge of the eight bit microprocessor 8085.
2. The students will also get the opportunity to practically work out the assembly language programs during the lab sessions.

Unit 1 - Architecture

Architecture of 8085 – registers – flags – ALU – address and data bus – demultiplexing address/data bus – control and status signals – control bus – pin out diagram – functions of different pins

Unit 2 - Instructions in 8085

Instruction set – data transfer, arithmetic, logic, branching and machine control group of instructions – addressing modes – immediate, direct, register indirect, register and implied

Unit 3 - ASM programs

Assembly language programs: addition – subtraction – multiplication – division (by all modes of programming) – square – square root – sorting in ascending and descending order – picking largest/smallest in an array – subroutines – hand assembling programs

Unit 4 - Interfacing I/O devices

Types of interfacing devices – address decoding for I/O – input/output ports – Programmable peripheral interface 8255 – Features of 8255 – programming 8255

Unit 5 - Interrupts

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

BOOKS FOR STUDY:

1. Ramesh Gaonkar, Microprocessor Architecture Programming and Application with 8085/8080A, CBS Publishers, 5th Edition, (2011)
2. Aditya P Mathur, Introduction to Microprocessors, Tata McGraw-Hill Education, 3rd Edition, (2001)

BOOKS FOR REFERENCE:

1. V. Vijayendran, Fundamentals of Microprocessor 8085, Viswanathan S. Printers & Publishers Pvt.Ltd., (2009)
2. Lance A. Levanthal, Introduction to Microprocessors, Prentice Hall, (1978)

PH3209 - MICROPROCESSOR 8085 PRACTICAL

SEMESTER : III

CATEGORY : AO

HRS/WEEK : 2

CREDITS : 1

To Whom : CS / CA

Objectives:

1. This paper aims at providing an in depth knowledge of the eight bit microprocessor 8085.
2. The students will also get the opportunity to practically work out the assembly language programs during the lab sessions.

EXPERIMENTS:

1. ASM programs – Add & subtract (all modes of addressing) – microprocessor 8085
2. ASM programs – multiplication & division (all modes of addressing) – microprocessor 8085
3. ASM programs – factorial & square root (all modes of addressing) – microprocessor 8085
4. ASM programs – sorting & determining largest and smallest in an array – microprocessor 8085
5. ASM programs – code conversion - microprocessor 8085

6. Microprocessor 8085 – Interface I (LEDs & switches)
7. Microprocessor 8085 – Interface II (waveform generation)
8. Microprocessor 8085 – Interface III (frequency generation)
9. Microprocessor 8085 – Interface IV (Traffic light simulator)

BOOKS FOR REFERENCE:

1. V. Vijayendran, Fundamentals of Microprocessor 8085, Viswanathan S. Printers & Publishers Pvt.Ltd., (2009)
2. Lance A. Levanthal, Introduction to Microprocessors, Prentice Hall, (1978)

PH4208 - APPLIED PHYSICS

SEMESTER : IV
HRS/WEEK : 4

CATEGORY : AO
CREDITS : 3

To Whom : CH / MT / CS / CA

Objective:

1. This paper provides an in depth knowledge to the students about semiconductor devices & integrated circuits and their functioning.
2. The students will also experimentally implement the theory they study through in practical sessions.

Unit 1 - Semiconductor Devices

Semiconductors – Intrinsic and Extrinsic Semiconductors – Fermi level (no derivation) – Mechanism of current conduction – PN junction diode – Zener diode – Transistor: Structure – Mechanism of amplification – Current components – Modes of operation – Transistor CE amplifier.

Unit 2 - Optoelectronic Devices

Principles, operation and characteristics of opto-electronic devices: LDR – Photo diode – Photo Transistor – Photo Voltaic cell – Solar Cell – Photo Emissive sensors – Vacuum Photo tube – Gas filled photo tube – Photo Multiplier – LED – IR Emitter – LCD – Opto-couplers.

Unit 3 - Operational amplifiers

Ideal Op-amp – Inverting and non-inverting amplifiers – Unity follower – Summing amplifier – Difference amplifier – Integrator – Differentiator – Solving simultaneous equations.

Unit 4 - A/D and D/A convertors

Introduction – Weighted resistor D/A convertor – R-2R ladder D/A converter – Parallel A/D converter – Successive approximation converter – Dual slope A/D converter

Unit 5 - Timer and applications:

555 timer – Internal block diagram and working – Applications of 555 timer – Schmitt trigger – Astable and monostable operations

BOOKS FOR STUDY:

1. Gupta S.L, Kumar V, Hand book of Electronics, Pragati Prakashan, (2012)
2. Chattopadhyay D and Rakshit, Electronics Fundamental and applications, New Age International, 11th Edition, (2010)
3. Ramakant A Gayakwad, Op-Amps and Linear Integrated circuits, PHI Learning, 4th Edition, (2009)
4. R.P. Jain, Modern Digital Electronics, Tata McGraw-Hill Education, 4th Edition, (2009)

BOOKS FOR REFERENCE:

1. V. K Mehta, Rohit Mehta, Principles of Electronics, S. Chand Publisher, 11th Edition, (2010)
2. V. Vijayendran, Introduction to Integrated Electronics, Viswanathan S., Printers & Publishers Pvt. Ltd., (2009)
3. Gordon J. Deboo, Clifford N Burrow, Integrated Circuits and Semiconductor Devices: Theory and applications, McGraw-hill Education, 2nd Edition, (1978)

PH4209 - APPLIED PHYSICS PRACTICAL

SEMESTER : IV

CATEGORY : AO

HRS/WEEK : 2

CREDITS : 1

To Whom : CH / MT / CS / CA

Objective:

1. This paper provides an in depth knowledge to the students about semiconductor devices & integrated circuits and their functioning.
2. The students will also experimentally implement the theory they study through in practical sessions.

EXPERIMENTS:

1. Zener diode – Forward and Reverse Bias
2. Zener diode – regulated and unregulated power supply
3. Transistor Characteristics – CE mode
4. Inverting and non inverting amplifier – OPAMP
5. Summing and Difference amplifier – OPAMP
6. Solving simultaneous equations – OPAMP
7. R-2R D/A converter – OPAMP
8. Astable multivibrator – 555 timer
9. Light to frequency converter – 555 timer

BOOKS FOR STUDY:

1. Arul Thalpathi M., Practical Physics, Comptech Publishers, (2002)

BOOKS FOR REFERENCE:

1. V. K Mehta, Rohit Mehta, Principles of Electronics, S. Chand Publisher, 11th Edition, (2010)
2. V. Vijayendran, Introduction to Integrated Electronics, Viswanathan S., Printers & Publishers Pvt. Ltd., (2009)
3. Gordon J. Deboo, Clifford N Burrow, Integrated Circuits and Semiconductor Devices: Theory and applications, Mcgraw-hill Education, 2nd Edition, (1978)

PH3302 - WORKSHOP PRACTICE

SEMESTER : III
HRS/WEEK : 3

CATEGORY : EG
CREDITS : 1

To Whom : Other Than Physics Students

Objectives:

1. This course has been designed to provide an introduction to machines
2. The students will acquire knowledge on the basic working principles and manufacturing technology.

Unit 1: Manufacturing process – classification- types of production systems-plant layout-objectives of plant layout- manufacturing – automation, mechanization – Introduction to Engineering drawing - CAD-CAM- CIM- industrial safety.

Unit 2: Properties, testing and inspection of metals – stress and strain-mechanical properties- destructive testing – comprehensive test-hardness test

Unit 3: Instruments for measurements- steels scale- scribes- punches-callipers-devices – tri square- height – gauge – hammers- surface plate- vices- hacksaw- files -chisels

Unit 4: Lathe- types of lathe-centering- turning- tapers and taper turning-grooving- filing-spinning-reaming- boring

Unit 5: Drilling – types of drilling machines- portable drilling- radial drilling- spindle drilling – machine time in drilling – boring – grinding

EXPERIMENTS:

Any eight to be selected by the course teacher

1. Marking out and filling plane surfaces. Use of surface plates, Angle plate, marking block, Height gauge, marking the centre of a round bar.
2. Hack sawing, chiselling.
3. Marking for drilling holes.

4. Threading- external, Internal. Filing-Cham.
5. Filing right angles and open fitting, Use of vernier callipers.
6. Filing. Use of micrometer -fitting.
7. Grinding Lathe tools. Facing, plane turning, taper turning.
8. Engineering Drawing, workshop calculations.
9. Soldering, Sheet metal work.
10. Welding- fabrication.

BOOKS FOR STUDY:

1. S. K. Hajra Choudhury, A. K. Kajra Choudhury, Nirjhar Roy, Workshop technology, (2010), Media Promoters and Publishers Private Ltd, Mumbai
2. Chapman, Work shop technology, Vol. I, II, III, 2011 Viva books pvt. Ltd, New Delhi

BOOKS FOR REFERENCE:

1. Myron L. Begeman , (1964), Asia publishing house, Bombay
2. Rajinder Singh, Introduction to basic manufacturing technology, (2010), New age publishers' internationals publishers pvt. Ltd'

PH4304 - ELECTRICAL AND ELECTRONIC APPLIANCES

SEMESTER : IV

CATEGORY : EG

HRS/WEEK : 3

CREDITS : 1

To Whom : Other Than Physics Students

Objectives:

1. This paper is designed to make the students aware of the latest type of appliances and gadgets available and to know how they work.
2. The paper also aims at helping them to know how to make the best use of these appliances.

3. The students will further be exposed to essential maintenance and how to avoid potential health hazards if any

Unit 1 Test and Measurement:

Digital callipers – digital screw gauge – digital balance – digital clock – digital thermometer - digital multimeters – digital oscilloscopes.

Unit 2 Home appliances:

Air conditioner – refrigerator – microwave oven – induction cooker – washing machines – inverters – solar powered appliances – digital cameras.

Unit 3 Communication:

Fibre optics – cellular phones – cellular phone jammers – Bluetooth – global positioning system – RFID security systems.

Unit 4 Robotics:

Basics – robotic arm – mobile robots – autonomous robots - **Honda's ASIMO robot.**

Unit 5 Computers:

Basic components – Motherboards – Memory – I/O devices – assembling – operating systems.

BOOKS FOR STUDY:

1. Gottapu Sasibhushana Rao, Mobile Cellular Communication, 1st Edition, Pearson (2012).
2. S K Saha, Introduction to Robotics, 1st Edition, Tata McGraw-Hill Education (2008).
3. Alok Kumar, Computer General Awareness 1st Edition, Upkar Prakashan (2008)

REFERENCES:

1. howstuffworks.com
2. wikipedia.com

Study material to be provided by the department.