

**NEHRU MEMORIAL COLLEGE [AUTONOMOUS]  
PUTHANAMPATTI – 621007**

# **B.Sc., PHYSICS**

## **SYLLABUS**

*UNDER CHOICE BASED CREDIT SYSTEM [CBCS]*

*[FOR THE CANDIDATES ADMITTED FROM THE YEAR 2015-  
2016 ONWARDS]*



**2015**

**B.Sc., PHYSICS Course structure for Revised CBCS (2015-16 onwards)**

SEM	Part	Course Title	Sub Code	Hrs/ Week	Credit	Ex Hr	Marks		Total	
							IA	EA		
I	I	Tamil	15T101	6	3	3	25	75	100	
	II	English	15H101	6	3	3	25	75	100	
	III	CC-I-Properties of Matter and Sound		15P101	4	4	3	25	75	100
		CC-II Major Practical-I		15P102L	3	-	-	-	-	-
		AC-I-Allied Mathematics-I		15P103A	5	4	3	25	75	100
		AC-II-Allied Mathematics –II		15P104A	4	4	3	25	75	100
IV	Value Education		15VED	2	1	3	-	100	100	
II	I	Tamil	15T202	6	3	3	25	75	100	
	II	English	15H202	6	3	3	25	75	100	
	III	CC-II*- Major Practical-I		15P102L	3	4	3	25	75	100
		CC-III- Mechanics		15P205	6	4	3	25	75	100
		AC-III- Allied Mathematics –III		15P206A	5	4	3	25	75	100
	IV	Environmental studies		15EVS	2	1	3	-	100	100
		SKBC-I-Scientific Computing in Physics (Theory and Practice)		15XP21	2	2	3	-	100	100
III	I	Tamil	15T303	6	3	3	25	75	100	
	II	English	15H303	6	3	3	25	75	100	
	III	CC-IV-Thermal Physics		15P307	5	4	3	25	75	100
		CC-V*- Major Practical-II		15P308L	3	-	-	-	-	-
		AC-IV-Allied Chemistry-I		15P309A	5	4	3	25	75	100
		AC-V*-Allied Chemistry Practical		15P310L	3	-	-	-	-	-
	IV	SKBC-II-Testing of Electronic Components Lab Only		15XP32L	2	2	3	-	100	100
V	GENDER STUDIES		15GS	-	1	-	-	100	100	
IV	I	Tamil	15T404	6	3	3	25	75	100	
	II	English	15H404	6	3	3	25	75	100	
	III	CC-V*- Major Practical-II		15P308L	3	4	3	25	75	100
		CC-VI-Optics		15P411	6	4	3	25	75	100
		AC-V*-Allied Chemistry Practical		15P310L	3	4	3	25	75	100
		AC-VI- Allied Chemistry-II		15P412A	4	4	3	25	75	100
	IV	SOFT SKILL		15SSC	2	2	3	-	100	100
V	III	CC-VII-Electricity and Magnetism		15P513	5	5	3	25	75	100
		CC-VIII-Atomic and Nuclear Physics		15P514	5	5	3	25	75	100
		CC-IX-Fundamentals of Electronics		15P515	5	5	3	25	75	100
		CC-X*- Major Practical-III		15P516L	3	-	-	-	-	-
		CC-XI*- Major Practical IV		15P517L	3	-	-	-	-	-
		EC-I –C Programming and Numerical Methods		15P518	5	5	3	25	75	100
		NMEC-I – Energy Physics		15P5N	4	4	3	-	100	100
VI	III	CC-X*- Major Practical-III		15P516L	3	5	6	25	75	100
		CC-XI*- Major Practical IV		15P517L	3	5	6	25	75	100
		CC-XII-Quantum Mechanics and Relativity		15P619	6	5	3	25	75	100
		CC-XIII-Solid State Physics		15P620	6	5	3	25	75	100
		CC-XIV-Digital Electronics		15P621	6	5	3	25	75	100
		EC-II-Microprocessor and Microcontroller		15P622	6	5	3	25	75	100
	IV	Comprehensive Physics		15PC	-	4	3	-	100	100
V	EXTENTION ACTIVITIES		15EA	-	1	-	-	-	-	
Grand total				180	140		750	2950	3800	

# **CORE COURSES**

Semester	I	CC-I PROPERTIES OF MATTER AND SOUND	Hours	4
Course Code	15P101		Credit	4

### Objectives

- To study the basics of Elasticity and its importance in beams
- To study the concepts of viscosity and surface tension and the various methods to determine the parameters experimentally
- To understand the concepts of sound

### UNIT – I ELASTICITY

Stress – Strain diagram – Elastic Moduli – Work done per unit volume strain –Relation between the elastic constants – Poisson’s ratio – Expression for Poisson’s ratio in terms of elastic constants–Twisting couple on a cylinder – Work done in stretching a wire – Torsional Pendulum–Determination of Rigidity modulus – Searle’s static torsion apparatus.

### UNIT – II BENDING OF BEAMS

Expression for bending moment cantilever – Expression for depression – Experiment to find Young’s Modulus –Non-uniform bending – Expression for depression –Experiment to find Young’s modulus using microscope – Uniform bending –Expression for elevation – Experiment to find Young’s modulus using scale and telescope.

### UNIT –III SURFACE TENSION

Definition and dimensions of surface tension – Excess of pressure over curved liquid surface –Synclastic and anti Clastic surface – Force between two plates separated by a thin layer of liquid – Experimental determination of surface tension – Jaegar’s method – Variation of surface tension with temperature.

### UNIT – IV VISCOSITY

Streamlined and turbulent motion – Coefficient of viscosity and its dimensions – Rate of flow of a liquid – Poisselle’s formula – Experimental determination of viscosity – Motion in a viscous medium – Stoke’s formula – Viscosity of highly viscous liquid

### UNIT – V SOUND

Equation of SHM – Period – Velocity – Energy – Composition of two SHMs along the same straight line and at right angles – Lissajous figures. Laws of Transverse waves in strings – Verification – Melde’s experiment.

Reverberation – Sabine’s Reverberation formula –Measurement of reverberation time – Ultrasonics – Production: Piezo-electric method, properties and uses of ultrasonics.

### Book for Study

1. R. Murugesan, Sivaprasath, *Properties of Matter and Acoustics*, S. Chand & Co., NewDelhi.

### Books for Reference

1. D. S. Mathur, *Properties of Matter*, S. Chand & Co., New Delhi.
2. Brijlal, Subramanyam, *Properties of Matter*, S. Chand & Co., New Delhi.

<b>Semester</b>	<b>II</b>	<b>CC-II MAJOR PRACTICAL-I</b>	<b>Hours</b>	<b>3</b>
<b>Course Code</b>	<b>15P102L</b>		<b>Credit</b>	<b>4</b>

1. Determination of Young's Modulus of the material of the bar by uniform bending method – Optic lever
2. Determination of Young's Modulus of the material of the bar by non-uniform bending method using Pin and Microscope
3. Determination of surface tension of the given liquid– Capillary rise method
4. Verification of laws of vibration of stretched string- Sonometer
5. Determination of frequency of the tuning fork by Melde's string experiment- Longitudinal and Transverse modes
6. Specific heat capacity of the given liquid – Newton's law of cooling method
7. Coefficient of thermal conductivity of a bad conductor by Lee's disc method
8. Determination of focal length of the given long focus convex lens – f, R and C
9. Determination of focal length of the given long focus concave lens – f, R and C
10. Determination of resistance of the given coil using) Metre bridge (series and parallel)
11. Determination of acceleration due to gravity and radius of gyration using compound pendulum
12. Determination of radius of curvature of the given lens by Newton's rings method
13. Determination of wavelength of monochromatic source by Newton's rings method
14. Determination of Young's Modulus of the material of the bar by cantilever arrangement – scale and telescope
15. Determination of refractive index of the material of the solid prism using spectrometer
16. Determination of Thickness of a given wire by air wedge method-using Pin and Microscope

<b>Semester</b>	<b>II</b>	<b>CC-III MECHANICS</b>	<b>Hours</b>	<b>6</b>
<b>Course Code</b>	<b>15P205</b>		<b>Credit</b>	<b>4</b>

### Objectives

- To study the basics of dynamics, hydrostatics, hydrodynamics and gravitation.

### UNIT – I PROJECTILE

Vertical motion under gravity – Motion of a particle projected horizontally from a point above the earth - Motion of a projectile - Path of the projectile is a parabola – Expression for time of flight, Range and Height of the projectile – Range of a projectile on a plane inclined to the surface of the earth.

Impulse and Impact: Impulse of a force – Laws of impact – Direct and oblique impact of two smooth spheres – Loss of kinetic energy due to direct and oblique impacts.

### UNIT – II MOMENT OF INERTIA

Expression for moment of inertia – Radius of gyration ( $k$ ) – Parallel and Perpendicular axes theorems – Moment of inertia of Rectangular Lamina, circular ring, circular lamina, solid sphere, solid cylinder and spherical shell – Angular moment and Angular impulse – Laws of conservation of angular momentum - Kinetic energy of Rotation – Acceleration of a body rolling down in an inclined plane.

### UNIT – III RIGID BODY

Center of mass of a system of particles – Motion of two particles under their mutual action – Reduced mass – Theory of Compound Pendulum – Equivalent Simple Pendulum – Reversibility of center of oscillation and suspension - Determination of acceleration due to gravity ( $g$ ) and radius of gyration ( $k$ ) of a bar pendulum.

Gyroscopic Motion: Gyroscopic Precession – Gyroscopic Top – Spinning Top.

### UNIT – IV HYDROSTATIC AND HYDRODYNAMICS

Expression for Centre of Pressure – Centre of Pressure of Vertical Rectangular Lamina, Vertical Triangular Lamina and Circular Lamina – Change of depth of Centre of pressure – Equilibrium of floating bodies – Stability of Equilibrium – Determination of metacentric height - Atmospheric pressure and its variation with altitude.

Hydrodynamics: Equation for continuity of flow – Energy of liquid in motion – Torricelli's Theorem – Bernoulli's Theorem – Venturimeter.

### UNIT – V GRAVITATION

Kepler's laws of planetary motions – Newton's law of Gravitation – Boy's method of determination of  $G$  – Gravitational potential and field due to solid sphere and spherical shell - Variation of  $g$  with latitude, altitude, and depth – Escape velocity of the Earth and Solar System.

### Book for Study

- M. Narayanamurti and N. Nagarathnam, “Dynamics”, National Publishing Company, Madras (2004).
- R. Murugesan, Properties of Matter and Acoustics, S. Chand & Co., NewDelhi (2012)

### Books for Reference:

- D. S. Mathur, “Mechanics”, S. Chand & Company Ltd., New Delhi (2003).

<b>Semester</b>	<b>III</b>	<b>CC-IV THERMAL PHYSICS</b>	<b>Hours</b>	<b>5</b>
<b>Course Code</b>	<b>15P307</b>		<b>Credit</b>	<b>4</b>

**Objectives:**

On successful completion of the course, the students will gain the knowledge of Kinetic theory of gases, thermodynamics and probability concepts

**Unit-1 KINETIC THEORY OF GASES**

Three states of matter – concept of ideal or perfect gas – postulates of kinetic theory of gases -Expression for the pressure exerted by a gas-Deduction of Boyles Law-Kinetic energy per unit volume of gas- derivation of ideal gas equation – derivation of gas Laws-Degrees of freedom–Maxwell’s law of equipartition of energy – van der Waal’s equation of state – Estimation of critical constant – Joule Thomson effect porous plug experiment - Mean free path-Transport phenomena-viscosity.

**UNIT-2 THERMODYNAMICS**

Thermodynamic system-Equation of state- Zeroth and first law of thermodynamics and its significances – specific heats of gas – Work done during an isothermal and adiabatic process- slopes of Adiabatic and isothermal processes - Relation between adiabatic and Isothermal Elasticities-Reversible and Irreversible Process-Carnot’s ideal heat engine – Carnot’s cycle – Second law of thermodynamics – Concept of entropy – Change of entropy in reversible process – Principle of increase of entropy – T-S diagram.

**UNIT-3 LOW TEMPERATURE & RADIATION**

Production of Low temperatures – adiabatic demagnetization-superconductivity-Meissner effect- Thermal radiation -Black body – Black body in practice – Stefan Boltzmann law – distribution of energy in block body spectrum -Wien’s displacement law – Rayleigh – Jeans law – Planck’s radiation law –radiation pyrometer – solar constant temperature of sun.

**UNIT-4 HEAT FLOW**

Specific heat – Newton’s law of cooling – Dulong & petit’s law – variation of specific heat with temperature – Einstein’s theory and its limitations – coefficient of thermal conductivity – Lee’s disc method for bad conductors.

**UNIT-5 STATISTICAL PHYSICS**

Statistical basis- basics of probability theory – permutations and combinations - Macro and Micro states - thermodynamical probability – Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac statistics – comparison of three statistics

**Book for Study:**

Brijlal, N. Subramanyam and P.S.Hemne, Heat Thermodynamics and Statistical Physics , (S.Chand & Company Ltd, New Delhi, 2010).

**Book for Reference:**

D.S. Mathur, Heat and Thermodynamics, (S.Chand and sons, New Dehi)

<b>Semester</b>	<b>IV</b>	<b>CC-V</b>	<b>Hours</b>	<b>3</b>
<b>Course Code</b>	<b>15P308L</b>	<b>MAJOR PRACTICAL-II</b>	<b>Credit</b>	<b>4</b>

1. Determination of rigidity modulus of the given rod using Static torsion apparatus
2. Determination of rigidity modulus of the given wire by Torsional pendulum – n and I
3. Determination of Coefficient of viscosity of the given liquid by Graduated burette method
4. Determination of Coefficient of viscosity of the given highly viscous liquid by Stokes method
5. Characteristics of PN junction diode and Zener diode
6. Determination of Emissive power of a surface – Spherical calorimeter method
7. Determination of Specific heat capacity of liquid using Joule’s calorimeter (Barton’s correction)
8. Calibration of the given low range ammeter using Potentiometer
9. Determination of resistance and specific resistance of the given wire using Potentiometer
10. Figure of merit of the mirror galvanometer
11. Determination of refractive index of the given liquid using hollow prism-Spectrometer
12. Experiment to draw i-d curve for a prism using Spectrometer
13. Comparison of the frequencies of oscillations produced by two AFO using Lissajous figures arrangement
14. Conversion of galvanometer into ammeter , voltmeter and ohmmeter
15. Field along the axis of a coil- determination of H
16. Characteristics of the given transistor in common emitter configuration



<b>Semester</b>	<b>IV</b>	<b>CC-VI OPTICS</b>	<b>Hours</b>	<b>6</b>
<b>Course Code</b>	<b>15P411</b>		<b>Credit</b>	<b>4</b>

### Objectives

- To study fundamentals of geometrical optics and physical optics

#### UNIT – I GEOMETRICAL OPTICS – I

Fermat's principle of least time and Extreme path– thin lens - lens equation - thick lens – Cardinal points of points – thick lens formula –spherical lens –combination of two thick lens –Application of lens combination- Eye pieces – Ramsden's eye piece – Huygen's eye piece

#### UNIT – II GEOMETRICAL OPTICS II

Lens aberrations - Spherical aberration – Astigmatism – Coma – Curvature of the field - Distortion – Chromatic aberration – Achromatic Combination of two lenses in contact and in separation-Dispersion – Dispersion in a prism – dispersion without deviation and deviation without dispersion – oil immersion objective

#### UNIT – III INTERFERENCE

Light waves and Superposition of waves – theory of interference - Interference in thin films - Wedge shaped film – Newton's rings – Michelson's interferometer – Fabry –Perot interferometer – Applications of interferometer for testing flatness and thickness of films – antireflection coating - interference filter.

#### UNIT – IV DIFFRACTION

Rectilinear propagation of light - Fresnel's and Fraunhofer diffraction – Fresnel's diffraction at a straight edge and circular aperture–Fraunhofer diffraction at a single slit – double slit and N slits – diffraction grating - resolving power – Rayleigh criterion for resolution – Resolving power of a telescope and microscope – Resolving power of a grating

#### UNIT – V POLARIZATION

Introduction - double refraction – theory of polarized light – elliptically and circularly polarized light – production and detection – Analysis of polarized light - quarter wave plate - half wave plate –optical activity – specific rotation - Laurents's half shade polarimeter – Babinet compensator

#### Book for Study

- Brijlal, Subramaniam, M.N. Avadhanulu, A text book of light, S.Chand & Co., New Delhi (2010).

#### Book for Reference

- Jenkins and White, Optics, Mc Graw Hill.(1981)
- Karl Dieter Moller, Optics, Springer International Edition, (2010)
- Germain Chartier, Introduction to Optics, Springer International Edition, (2005)
- Eugene Hecht, Optics, Pearson Education, (2006)

**Demonstration** – Diffraction and polarization with simple experiments

<b>Semester</b>	<b>V</b>	<b>CC-VII</b>	<b>Hours</b>	<b>5</b>
<b>Course Code</b>	<b>15P513</b>	<b>ELECTRICITY AND MAGNETISM</b>	<b>Credit</b>	<b>5</b>

### Objectives

- To understand the concepts of electrostatics, magneto-statics, electromagnetic induction, electromagnetic waves and transient and alternating currents

### UNIT- I ELECTROSTATICS

Charges and Fields: Basic concepts – coulomb’s law – Electric field – Electric field due to a point charge- electric dipole – lines of force.

Gauss’s law and its applications: Electric flux – Gauss’s law and its proof – differential form of Gauss’s law – Applications of Gauss’s law-electric field due to uniformly charged sphere, charged cylinder and parallel sheets.

Electric potential: Relation between electric field and electric potential– Equipotential surface-Electrical images- electric field at a point on the plane.

### UNIT- II CAPACITORS,CURRENT ELECTRICITY & THERMO ELECTRICITY

Capacitors: Capacitance of a conductor – Principle of a capacitor - capacitors in series and parallel – Energy stored in a charged capacitor.

Current Electricity: Current and current density – Ohm’s law – Kirchhoff’s laws and its applications: Wheatstone’s network, Carey Foster bridge – Potentiometer – calibration of ammeter and voltmeter.

Thermoelectricity: Seebeck effect – laws of thermo emf - Peltier effect and Thomson effect – comparison of Peltier and Joule effect.

### UNIT- III MAGNETOSTATICS

Introduction – Magnetic field – Biot’s Savart law and its applications: magnetic induction due to a current carrying straight conductor, circular coil, solenoid – Magnetic induction inside a long solenoid, endless solenoid.Ampere’s circuital law-statement and proof.

Force on a current carrying conductor in a magnetic field - force between two parallel current carrying conductor – Torque on a current loop in a uniform magnetic field – Moving coil ballistic galvanometer.

### UNIT- IV ELECTROMAGNETIC INDUCTION AND ELECTROMAGNETIC WAVES

Electromagnetic induction: Introduction – Faraday’s law and its differential form – Self induction – self inductance of a long solenoid – determination of self inductance by Anderson’s bridge method – Mutual induction – Mutual inductance between two coaxial solenoids – Experimental determination of mutual inductance – coefficient of coupling - eddy current and its uses.

Maxwell’s equation: Introduction-Plane electromagnetic waves in free space-velocity of light.

### UNIT- V TRANSIENT CURRENT AND ALTERNATING CURRENT

Transient current: Growth and decay of current in a circuit containing L & R – Discharge of a capacitor through an Inductor and Resistor in series (Decay of charge in LCR circuit)-Importance in wireless telegraphy.

Alternating current: Emf induced in a coil rotating in a magnetic field: Peak value of

A.C and emf- mean value of A.C - root mean square value of an A.C-Form factor-effective value of an A.C –Power in circuit containing resistance, inductance and capacitance- Wattless current –Choke coil – construction – Transformer construction & theory– uses of transformer.

**Book for study**

1. *R. Murugesan, Electricity and Magnetism, S. Chand and Co., New Delhi, (1995)*

**Books for Reference**

1. *Brijlal, Subramaniam, Electricity and Magnetism, Ratan Prakashan Mandir Education and University Publishers, Agra, (2000)*
2. *K.K.Tewari, Electricity and Magnetism, S. Chand and Co., New Delhi, (2005)*
3. *D.N.Vasudeva, Fundamentals of Magnetism and Electricity, S. Chand and Co., New Delhi, (1981)*
4. *N.Nagaratnam, N.Lakshminarayan, Electricity and Magnetism National Publishing Company, Madras, 1997.*

<b>Semester</b>	<b>V</b>	<b>CC-VIII ATOMIC AND NUCLEAR PHYSICS</b>	<b>Hours</b>	<b>5</b>
<b>Course Code</b>	<b>15P514</b>		<b>Credit</b>	<b>5</b>

### Objectives

- To learn structure of atom, atomic spectra and other phenomena
- To study the properties of nucleus, radioactivity, nuclear reactions and elementary particles

### UNIT – I STRUCTURE OF ATOM

Rutherford's atom model – theory of  $\alpha$  particle scattering – The Bohr atom model – Electronic structure – origin of spectral lines – critical potentials – Frank and Hertz experiment – Davis Gaucher's method – Sommerfeld's relativistic atom model – The selection rules – applications of the vector atom model – magnetic moments due to orbital motion – The Bohr Magneton-Stern Gerlach experiment

### UNIT –II FINE STRUCTURE OF SPECTRAL LINES

Spectral terms and the notation of atomic states – fine structure of sodium D line – Zeeman effect – normal and anomalous Zeeman effect – Theoretical explanation – Lande's 'g' factor – Larmor's theorem – Paschen Back effect – Stark effect

### UNIT-III POSITIVE RAYS

Sources of positive rays – Thomson's parabola method – determination of e/m – Aston's mass spectrograph - Dempster's mass spectrograph and its applications – Bainbridge's Mass spectrograph.

### UNIT-IV NUCLEAR PHYSICS

Introduction – Properties of Nucleus – size, charge, mass, spin – Nuclear magnetic dipole moment – electric quadra pole moment – binding energy – packing fraction  
*Nuclear reactions*: Induced radio activity – artificial transmutation – techniques – applications of radio isotopes – discovery production and detection of neutrons – basic properties of neutrons

### UNIT –V NUCLEAR FISSION, FUSION AND ELEMENTARY PARTICLES

Nuclear forces – Nuclear fission – Nuclear models – shell model – liquid drop model – Nuclear fusion – Hydrogen – Hydrogen cycle – Carbon-Nitrogen cycle – Steller energy – Plasma-containment of plasmas – magnetic bottling – Elementary particles – Baryons and Leptons – antiparticles – Mesons – Mu, Pi, K Mesons – Types of strange particles

### Books for Study

1. *R.Murugesan, Kiruthiga Sivaprasath, Modern Physics, S.Chand & Co., New Delhi (2010)*

### Books for Reference

1. *D.L.Seghal, K.L. Chopra and N.K.Seghal, Modern Physics, S.Chand & Co., New Delhi (1998)*
2. *J.B.Rajam, Atomic Physics, S.Chand & Co., New Delhi (2004)*
3. *B.L.Theraja, Modern Physics, S.Chand & Co., New Delhi (2004)*
4. *Brijlal and N.Subramaniam, Atomic and Nuclear Physics, S.Chand & Co., New Delhi (1996)*

<b>Semester</b>	<b>V</b>	<b>CC-IX FUNDAMENTALS OF ELECTRONICS</b>	<b>Hours</b>	<b>5</b>
<b>Course Code</b>	<b>15P515</b>		<b>Credit</b>	<b>5</b>

### Objectives

- To understand the basic electric circuits and law
- To know the principle of various types of diodes, transistor, FET and applications
- To know the concept of linear integrated circuits and applications

### Unit –I Circuit analysis techniques

Kirchoff's current and voltage laws – series and parallel connection of independent sources – R,L and C – Network Theorems–Thevenin, Superposition, Norton, Maximum power transfer and duality – star delta conversion

### Unit – II Semiconductor Physics and diode

Semiconductor – Intrinsic semiconductor – Extrinsic semiconductor – n-type semiconductor – p- type semiconductor –PN junction – Properties – Biasing a PN junction- V-I characteristics of PN junction – Full wave bridge rectifier – Efficiency of full wave rectifier – ripple factor - Zener diode – Zener diode as voltage stabilizer

### Unit – III Special Purpose Diodes and transistors

Light Emitting Diode – Photo diode –operation and characteristics - Optoisolator – Transistor – Transistor action – Transistor connections - Characteristics of Common base connection – Common emitter connection – Transistor as an amplifier in CE arrangement – Transistor load line analysis –Operating point – JFET- Principles and working – Difference between JFET and Bipolar transistor – Characteristics and Parameters

### Unit –IV Transistor biasing, amplifiers and Oscillators

Transistor biasing – Faithfull amplification – Inherent variations of transistor parameters – Base resistor method –Voltage divider bias method – RC coupled amplifier –Feed back – principles of negative voltage feedback – Gain of negative voltage feedback – Advantages of negative voltage feedback – Barkhausen criterion – Colpitt's oscillator – Hartley oscillator – Phase shift oscillator

### Unit – V Operational amplifier, Timer and Modulation

Operational amplifier – Characteristics – Applications of op-amps – Inverting amplifier – Non inverting amplifier – voltage follower – Summing amplifiers – Subtractor -Integrator – Differentiator – D/A converter – Binary weighted method – IC 555- Block diagram – Monostable multivibrator – Astable multivibrator

### Books for Study

1. *K.Padmanabhan, P.Swaminathan, S.Ananthi, Electric circuits and Electron devices, University Science Press, New Delhi, First Edition, 2010.*
2. *K.Mehta, Rohit Mehta, Principles of Electronics, S.Chand & Company, New Delhi, Eleventh Edition, 2008.*
3. *L.D.Roy Choudhury, Shail Jain, Linear Integrated Circuits, New Age International Pvt., Ltd., New Delhi, 1999.*

***Books for Reference***

1. *S.Salivahanan, N. Suresh Kumar, A.Vallavaraj, Electronic Devices and Circuits, Tata McGraw- Hill Publishing Company Limited, New Delhi, 2006*
2. *Ramkant A.Gayakward, Op-amps and Linear Integrated Circuits,Prentice Hall of India, New Delhi, Third Edition.*
3. *Schaum's Outline of Electric Circuits, Sixth Edition,McGraw-Hill Education, New Delhi, 2014.*

<b>Semester</b>	<b>VI</b>	<b>CC-X MAJOR PRACTICAL-III</b>	<b>Hours</b>	<b>3</b>
<b>Course Code</b>	<b>15P516L</b>		<b>Credit</b>	<b>5</b>

**GENERAL EXPERIMENTS (Any 10 experiments only)**

1. Spectrometer i-i' curve
2. Determination of dispersive power of the material of the prism using Spectrometer
3. Determination of wavelengths of prominent lines of Mercury spectrum by setting the grating in normal incidence position -Spectrometer
4. Determination of wavelengths of prominent lines of Mercury spectrum using the grating by minimum deviation method -Spectrometer
5. Determination of Cauchy's constants using spectrometer
6. Field along the axis of a coil- determination of Magnetic moment of a bar magnet
7. M and H – absolute determination using deflection and vibration magnetometer
8. Low range voltmeter calibration using Potentiometer
9. High range voltmeter calibration using Potentiometer
10. The temperature co-efficient of the resistance of the given coil using Potentiometer
11. Determination of resistance and specific resistance of a coil using Carey Foster bridge
12. Determination of Young's Modulus of the material of the bar Koenig's method
13. Verification of KVL and KCL in electronic circuits
14. Measuring the phase difference between current and voltage for RC and LR circuit using a CRO
15. Study of the growth and decay of current in a LR circuit
16. Determination of absolute capacity of condenser using BG
17. Determination of co-efficient of self inductance of a coil by BG
18. Determination of co-efficient of mutual inductance of a pair of coils by BG

**SECTION- B (Any Five experiments only)**

1. 'C' programme to find the of average of numbers
2. 'C' programme to convert temperature values from Celsius to Fahrenheit/Fahrenheit to Celsius
3. 'C' programme for the preparation of inventory report
4. 'C' programme to prepare pay bill of employees of a company
5. 'C' programme for finding the roots of the given quadratic equations
6. 'C' programme to evaluate a multiple choice test
7. 'C' programme for sorting the given set of strings in alphabetical order
8. 'C' programme to count the number of characters, words and lines in a given text
9. 'C' programme to determine the standard deviation of an array of values

**Reference Book for Section B:**

*E.Balagursamy, Programming in ANSI C, Tata McGraw- Hill Publishing Company Limited, NewDelhi, 992.*

<b>Semester</b>	<b>IV</b>	<b>CC-XI MAJOR PRACTICAL-IV</b>	<b>Hours</b>	<b>3</b>
<b>Course Code</b>	<b>15P517L</b>		<b>Credit</b>	<b>5</b>

**ELECTRONICS (Any 10 Experiments)**

1. Determination of Co-efficient of self inductance of a coil in series resonance circuit method
2. Determination of Co-efficient of self inductance of a coil in parallel resonance circuit method
3. Construction of dual regulated power supply using IC7805 and IC 7905
4. Construction of single stage RC coupled amplifier using transistor and frequency response study-bandwidth and amplification factor calculation
5. Construction of astable multivibrator using IC 555 timer and finding the frequency for various capacitor values
6. Construction of monostable multivibrator using IC 555 study of trigger response
7. FET Characteristics– CS configuration
8. Operational amplifier – inverting and non inverting amplifier (IC 741)
9. Construction of adder and subtractor circuits using Operational amplifier-IC 741
10. Construction of integrator and differentiator circuits using Operational amplifier- IC 741-tracing the input and output waveforms
11. Construction Hartley oscillator using transistor and determination of frequency for different values of capacitor
12. Construction Colpitt's oscillator using transistor and determination of frequency for different values of capacitor
13. Verification of Boolean algebra and Demerger's theorem using IC
14. Study of universality property of NAND and NOR gates
15. Construction and study of Half adder and Full adder circuits
16. Construction and study Half subtractor and Full subtractor
17. Construction and study Multiplexer and Demultiplexer circuits
18. Construction and study Flip flops (RS, JK, D)
19. Construction and study Modulo 3,5,7 and 10 counters

**8085 Microprocessors (Any Five experiments only)**

1. Writing and verification assembly language program for sum of N numbers
2. Writing and verification assembly language program for addition and subtraction of 8/16 bit data
3. Writing and verification assembly language program for multiplication and division 8 bit data
4. Writing assembly language program addition of two arrays of 8 bit data verification
5. Writing and verification assembly language program for biggest and smallest numbers in a given array
6. Writing and verification assembly language program for traffic light control system
7. Writing an assembly language program to interface a stepper motor to rotate in different angles
8. Writing an assembly language program to interface relay control system for ON and OFF
9. Interface D/A converter with 8085 kit
10. Interface A/D converter with 8085 kit
11. Writing an assembly language program to interface a LED



<b>Semester</b>	<b>VI</b>	<b>CC- XII QUANTUM MECHANICS AND RELATIVITY</b>	<b>Hours</b>	<b>6</b>
<b>Course Code</b>	<b>15P619</b>		<b>Credit</b>	<b>5</b>

### Objectives

- To understand the quantum behaviour of physical system by learning through the photo electric effect ,wave mechanics and relativity

### UNIT-I ORIGIN OF QUANTUM MECHANICS

Inadequacy of classical mechanics- Difficulties with classical theory of blackbody radiation – Planck’s quantum hypothesis and radiation law – quantum theory of radiation and photons – Important applications of quantum theory of radiation – Compton effect – Limits of applicability of classical theory – decline of old quantum theory

### UNIT-II PHOTOELECTRIC EFFECT

Introduction –Photo electrons – Lenard’s method to determine e/m for photo electron- Richardson and Compton experiment – Laws of photo electric emission – Einstein photo electric equation – photo electric cells

### UNIT –III DUAL NATURE OF MATTER

de Broglie’s concept of matter waves – the de Broglie wavelength – phase velocity and group velocity – Expression for group velocity related to velocity and phase velocity – experimental study – G P Thomson’s experiment – Davision and Germer Experiment – Heisenberg’s uncertainty principle

### UNIT –IV WAVE MECHANICS

Introduction – formulation of Schrödinger wave equation – time independent and dependent forms – properties of wave function – orthogonal and normalized wave functions – eigen functions and eigen values- application of Schrödinger’s equation time independent form – particle in a box – linear harmonic oscillator .

### UNIT – V RELATIVITY

Introduction – Concepts of space and time – frames of reference – Newtonian relativity – Galilean transformation equation – ether hypothesis – Michelson-Morley experiment – special theory of relativity – postulates – Lorenz transformation equations – length contraction – time dilation – addition of velocities – variation of mass with velocity – mass energy equivalence – relationship between the total energy- rest energy and the momentum.

### **Books for Study.**

- R.Murugesan, Kiruthiga Sivaprasath, Modern Physics, S.Chand & company Ltd., New Delhi, 2010.*

### **Books for Reference**

- P.M.Mathews and Venkatesan, Quantum Mechanics, Tata Mc Graw Hill Company, New Delhi.*
- Robert Resnick, Introduction to special theory of relativity, Wiley eastern limited, 1989.*
- B.L.Theraja, Modern Physics, S.Chand & company Ltd., New Delhi*
- Gupta, Kumar and Sharma, Quantum Mechanics, Jaiprakash Nath & Co., 23<sup>rd</sup> edition (2004).*

<b>Semester</b>	<b>VI</b>	<b>CC-XIII SOLID STATE PHYSICS</b>	<b>Hours</b>	<b>6</b>
<b>Course Code</b>	<b>15P620</b>		<b>Credit</b>	<b>5</b>

### Objectives

- To study the defects and structure of crystals and to study the theory of semiconductor, super conductors also to learn the basics of nanoscience

### UNIT- I DEFECTS AND DISLOCATIONS IN CRYSTALS

Lattice Defect – point, line and plane defect – Electrical and Transient imperfections Schottky and Frenkel defects – Extrinsic vacancies – Colour center – Different types-their formation and Properties – Slip and Plastic deformation – Edge and Screw Dislocation – Motion of dislocation – Burger vectors – Grain boundaries.

### UNIT- II CRYSTAL STRUCTURE AND CRYSTAL DIFFRACTION

Lattice planes and Miller Indices – Separation between lattice planes in simple FCC and BCC cubic lattice – Atomic Packing – Atomic radius – Lattice constant and density - Crystal Diffraction – Bragg’s law – Reciprocal lattice – Properties – Diffraction of X-rays by a crystal – Determination of Unit Cell dimension.

### UNIT- III MAGNETISM AND DIELECTRICS

Spontaneous Magnetization – Weiss Theory – Temperature dependence of Magnetization classical Theory of Diamagnetism – Weiss theory of Para magnetism – Ferromagnetic domains – Bloch wall – Basic ideas of anti ferromagnetism – Ferrimagnetisms – Ferrites in computer Memories – Dielectrics Polarization – Clausius Mosotti relation.

### UNIT- IV SEMICONDUCTORS, SUPER CONDUCTORS

Free Electron theory of solids –classification of insulators, Semi conductors, conductors – intrinsic and extrinsic semi conductor – Carrier concentration Barrier Potential Calculation – Rectifier Equation. Zero Resistance – Effect of Magnetic field – Meissner Effect and persistent current – Types of super conductors – Isotope Effect- Josephson Effect – London equations – BCS theory of Super Conductivity (Qualitative only)

### UNIT –V NANOSCIENCE

Introduction – definition-dimensions of nanotechnology-applications in industry, biology-nanopowders-preparation methods-plasma arc method-ball milling-applications of nanopowders- Carbon nanotubes-types of CNT- properties and uses of nanotubes.

### Books for Study

1. Gupta and Kumar K., *Solid State Physics – Nath & Co Meerut, 1985. (Unit I,III)*
2. R.L. Singhal, *Solid State Physics Kendarnath Ramnath & Co., Meerut, 1985. (Unit II)*
3. V. Arumugam, *Materials Science – Anuradha Agencies, Kumbakonam, 1990(Unit IV)*
4. M.Wilson, KKG Smith, B.Ragase, *Nanotechnology, Overseas Press, NewDelhi 2005.*

***Books for reference***

1. *A.J. Dekker, Solid State Physics, McMillan India Limited, Reprinted 1986.*
2. *Charles Kittel, Solid State Physics, Wiley Eastern, reprint, 1974.*
3. *S.O. Pillai, Solid State Physics, New Age International Pvt. Ltd., New Delhi, 6<sup>th</sup> edition.2005.*
4. *Mark Ratner, Daniel Ratner, Nanotechnology, Pearson Education 2003.*

emester	VI	CC-XIV DIGITAL ELECTRONICS	Hours	6
Course Code	15P621		Credit	5

### Objectives

- To study basics of digital systems
- To study the fundamentals and applications of sequential logical circuits

### UNIT – I BINARY SYSTEMS, BOOLEAN ALGEBRA

Binary numbers - Number base conversions - Octal and Hexa decimal numbers - Complements -1's and 2's complement addition and subtraction – 9's and 10's compliment subtraction - Binary codes - BCD code - Excess-3 code - Gray codes - Binary logic - Logic gates - Boolean algebra - Basic definitions - Basic theorems and properties of Boolean algebra

### UNIT – II DIGITAL LOGIC GATES AND BOOLEAN FUNCTIONS

Digital logic gates - IC digital logic families - Boolean functions - Demorgan's theorem - SOP - POS - Minterms and Maxterms.- Karnaugh Map method - Two and Three variable maps - Four variable map - Product of sums simplification - Don't care conditions

### UNIT – III COMBINATIONAL LOGIC

Introduction - Design procedure - Half and Full adders - Half and Full Subtractors - Code conversion, BCD-to-Excess-3 code - Universal gates - Ex-OR and Ex-NOR gate - Parallel binary adder - BCD adder - Magnitude comparator - Decoders - Demultiplexers - Encoders - Multiplexers

### UNIT – IV FLIP FLOPS AND MEMORY DEVICES

Introduction - Flip flops - Basic flip flop circuit - Clocked RS flip flop - D flip flop – master slave flip flops - JK flip flop - Timing diagram - Design procedure – Introduction to random access memory and read only memory IC - CCD basic operation.

### UNIT – V COUNTERS AND SHIFT REGISTERS

Design of counters - Registers - Shift registers - Serial transfer - Serial addition - Ripple counters - Binary ripple counter –design of modulo N counter - BCD Ripple counter - Synchronous counters - Binary up down counter.

### Book for Study

1. *M.Morris Mano, Digital Logic and Computer Design, Prentice Hall of India Private Limited, New Delhi, 1996.*
2. *S Salivahanan and S Arivazhagan, Digital Circuits and Design, Vikas Publishing House Pvt Ltd, New Delhi, 2002*

### Book for Reference

1. *Leach and Malvino, Digital Principles and Applications, Tata McGraw Hill Publishing Company Limited, New Delhi, Second reprint, 2002.*
2. *R.P.Jain, Digital Electronics and Systems, Tata Mc Graw Hill, New Delhi, 2004*
3. *Rajeev Ratan, Deepak Batra, Digital Electronics, Acme Learning Pvt., Ltd., New Delhi, First Edition, (2009)*

# ELECTIVE COURSES

(For B.Sc., Physics students)

<b>Semester</b>	<b>V</b>	<b>EC-I</b> <b>C Programming and Numerical Methods</b>	<b>Hours</b>	<b>5</b>
<b>Course Code</b>	<b>15P518</b>		<b>Credit</b>	<b>5</b>

### Objectives

- To acquire basic knowledge of numerical methods and C programming.
- To understand C programming for solving basic numerical problems.

### UNIT-I INTRODUCTION TO C LANGUAGE AND ITS FUNDAMENTALS

Importance of C – Basic structure of C Programs – Programming style - Executing a C program. Constants, Variables and Data types: Character set – Key words and Identifiers – Constants – Variables – Data types -Declaration of variables – Assigning values of variables. Operators and Expressions: Arithmetic, Relational, Logical, Increment/Decrement, conditional, Bit-wise, Comma operators – Arithmetic expressions – Procedures and Associativity.

### UNIT-II I/O FUNCTIONS, CONTROL STRUCTURE AND ARRAYS

Input/Output function: getchar, putchar, formatted input (scanf) and formatted output (printf). Control structures: Decision making with if, if...else, elseif...ladder – Switch – goto – while – do...while – for statements – break – continue. Arrays: One dimensional and two dimensional arrays – Declaring array – storing arrays in memory – initializing arrays.

### UNIT-III FUNCTIONS AND PREPROCESSOR

Functions: Need for user defined function – elements of user defined functions – definition of functions – Return values and their types – Function calls – Function declaration – Category of Functions – Nesting of Functions – Recursion. The scope, visibility and lifetime of variables.

Preprocessor: Macro substitution, Simple macro substitution, Argumented macro substitution, Nested macro substitution – File inclusion

### UNIT-IV NUMERICAL METHODS & C PROGRAMMING – I

Curve Fitting: Method of least squares – Fitting a straight line – Fitting a parabola.

Iterative methods: Bisection method – Newton–Raphson method – Secant method.

Programs: Bisection method, Newton-Raphson method, Secant method.

### UNIT-V NUMERICAL METHODS & C PROGRAMMING – II

Numerical integration and Differentiation: Trapezoidal rule – Simpson’s rule - Taylor’s series solution – Euler’s method – Runge-Kutta II & IV order method.

Programs: Trapezoidal rule, Simpson’s rule, Euler’s method, Runge-Kutta II and IV order method.

### Books for Study

1. *Programming in ANSI C* by E. Balagurusamy, Tata McGraw Hill Ltd., New Delhi, 2004. (Unit I,II,III)
2. *Computer Oriented Numerical Methods* by V. Rajaraman, Prentice-Hall of India Private Ltd. New Delhi (Unit IV).
3. *Lecture Notes for C Programming* by Department of Physics, Nehru Memorial College (Auto) Puthanampatti. (Unit V).

## **Books for Reference**

1. *C.S. Gottfried Schuam's Outline series theory and problems of programming McGraw Hill International Ltd., New York, 2003.*
2. *Yashavant Kanetkar, Exploring C, BPB Publishers, New Delhi, 1993.*
3. *Yashavant Kanetkar, Let Us C, BPB Publishers, New Delhi, 2002.*
4. *P. Kandasamy, K. Thilagavathy and K. Gunavathi, Numerical methods, S.Chand & Co. Ltd., New Delhi.*
5. *S.S. Sastry, Introductory methods of numerical analysis, Prentice-Hall of India Private Ltd. New Delhi*
6. *W.H. Press, S.A. Teukolsky, W.T. Vetterling and B.P. Flannery, Numerical Recipes in C, Cambridge University Press, New York.*

<b>Semester</b>	<b>VI</b>	<b>EC-II MICROPROCESSOR AND MICROCONTROLLER</b>	<b>Hours</b>	<b>6</b>
<b>Course Code</b>	<b>15P622</b>		<b>Credit</b>	<b>5</b>

### Objectives

- To learn the architecture, instructions, programming and applications of 8085 Microprocessors
- To know the fundamentals of 8051 microcontroller

### UNIT – I MICROPROCESSOR ARCHITECTURE

Intel 8085 Architecture –Instruction cycle – Instruction set of Intel 8085 – Instruction and data formats – Addressing modes – flags – 8085 instructions – Data transfer instruction – Arithmetic instructions – Logical instructions- Branch instructions – Stack, I/O and Machine control instructions- Interrupts of 8085.

### UNIT – II ASSEMBLY LANGUAGE PROGRAMS

Addition of two 8-bit numbers – 8-bit subtraction – Decimal addition – To find the **largest** number and smallest number in a data array – Sum of N numbers – Multiplication – Division – Multi byte addition

### UNIT – III PERIPHERAL DEVICES AND INTERFACING

I/O Ports – Programmable Peripheral Interface (IC 8255) – Architecture – control word – Programmable Communication interface (IC 8251) – Programmable Counter/Timer (IC 8253) – Microprocessor based data acquisition system- Interfacing of A/D converter – Interfacing of D/A converter.

### UNIT – IV MICROPROCESSOR APPLICATIONS

Blinking of LED - Interfacing of 7-Segment LED display (Display of decimal numbers) – Frequency measurement – Temperature measurement-Stepper motor interfacing.

### UNIT – V 8051 MICROCONTROLLER

Microcontroller – Overview of the 8051 - Architecture–Block diagram- Program counter and ROM space in the 8051 – 8051 data types and derivatives – 8051 flag bits and the PSW register – 8051 register banks and stack.

### Books for Study

1. B.Ram, *Fundamentals of Microprocessors and Microcomputers*, Dhanpat Rai Publications, New Delhi, Sixth Edition, 2005.
2. Muhammad Ali Mazidi, Janice Gillispie Mazidi and Rolin D. McKinlay, *The 8051 Microcontroller and Embedded Systems Using Assembly and C*, Prentice Hall of India Private Limited, New Delhi, 2007.

### Books of Reference

1. Ramesh. S. Gaonkar, *Microprocessor Architecture, Programming and Application with the 8085*, Penram International Publishers (India), Fourth Edition, 2000.
2. Kenneth J.Ayala, *The 8051 microcontroller, architecture, programming and applications*, Thomson, Delmar Learning (ISE). (2004).



# SKILL BASED COURSES

## Instrumentation

(For B.Sc., Physics students only)

<b>Semester</b>	<b>II</b>	<b>SKBC I Scientific Computing in Physics (Theory and practice)</b>	<b>Hours</b>	<b>2</b>
<b>Course Code</b>	<b>15XP21</b>		<b>Credit</b>	<b>2</b>

### Objectives

- To understand the basic concepts of computer, Operating System, office Automation, Plotting, Scientific tools for hands-on-computing

### Unit 1: Windows

Introduction - computer basics - concept of hardware and software - windows basic elements - parts of windows - working with windows – managing the file systems - window accessories - Internet and web basics - customizing windows - file management - downloading/Installing software

### Unit 2: MS Word

Basics – typing and editing – equation – formatting text – page design and layouts – moving around and viewing the document – page properties, previewing, and printing - Table handling – mail merging

### Unit 3: MS Excel

Introduction – Spreadsheets with Microsoft Excel - Editing of spread sheet - customizing work place – calculation in work sheet – tools for fixing formulae and functions - creating graphs - charts

### Unit 4: MS Power Point

Introduction - creating a presentation – adding and formatting text – adding graphics, charts and tables – adding action buttons, interactive controls and hyperlinks - customizing a slide show - Making small presentation

### Unit 5: Excel for hands-on-computing

Introduction – Making simple plots - Modeling of data - Data analysis: least squares fitting, bar chart, pie chart, statistical methods of error estimation – plotting data with Excel – 1D, 2D plot.

### Practical

**Physics based experiments will be given on which the practical has to be done.**

1. Basic skills for working with windows
2. Creating a separate log on and data base
3. e-format – physics concepts – book - journal
4. Prepare a instruction material - practical.
5. Plotting graph - Physics experiments-
6. Prepare slide show – paper presentation.
7. Prepare Animated presentations.
8. Create a front page – Incorporating basic physics concepts.

### Book for Study

1. Edward C. Willet, Steve Cummings, Office XP, Willey Dreamtech India(P) Ltd, New Delhi, 2001.

<b>Semester</b>	<b>III</b>	<b>SKBC – II TESTING OF ELECTRONIC COMPONENTS Lab only</b>	<b>Hours</b>	<b>2</b>
<b>Course Code</b>	<b>15XP32L</b>		<b>Credit</b>	<b>2</b>

### Objectives

- To study the fundamentals of various electronic components
- To acquire the skills in handling electronic instruments
- To get the basic skill of fabrication of PCB

### Unit 1: Resistors

Wires – Standard Wire gauge resistances – Values – Fuse wires – ampere ratings – Colour codes of fixed resistors – Variable resistor box checking.

### Unit 2: Capacitors and Inductors

Different types of capacitors – Value assignments – Different types of inductors – Value assignments - Checking of capacitors – Capacitors in series connection – Capacitors in parallel connection – Gang capacitor – Decade Condenser box – Checking – Charging & discharge curves.

### Unit 3: Familiarization of Instruments

**Multimeter:** Resistance measurements – Continuity checking – Voltage measurement – current measurement – diode, transistor checking – Capacitor measurement.

**CRO:** Various Control knobs – frequency measurements by Lissajou's figure method – time period and frequency measurement – external, internal trigger schemes.

**AFO:** Sine, Square, pulse wave forms – frequency ranges – amplitude variation.

### Unit 4: Checking of Active Components

Diode types – Zener diode – B.D. values – transistors – frequency, power types – general notation – AC, BC types – FET – types – checking – Checking with CRO.

### Unit 5: PCB design

PCB – basic ideas – layout drawing – preparation of PCB for LCR, transistor – 5V power supply.

### Book for Study

Study material on electronic components (Theory and practice), Department of Physics, NMC, Puthanampatti (2015)

**NON MAJOR ELECTIVE COURSE**  
(Course for other than B.Sc., Physics Students)

<b>Semester</b>	<b>IV</b>	<b>NMEC-I ENERGY PHYSICS</b>	<b>Hours</b>	<b>4</b>
<b>Course Code</b>	<b>15P5N</b>		<b>Credit</b>	<b>4</b>

### Objectives

- To learn the basics of solar energy and different utilization schemes and other energy sources

### Unit 1: THE SUN

The characteristics of sun-Solar constant - Electromagnetic Energy - Spectral distribution - Solar radiation on Earth's surface - Solar angles - Types of pyroheliometers - Estimation of average solar radiation.

### Unit 2: SOLAR COLLECTORS

Liquid flat plate collectors - General characteristics - Collection efficiency - Loss of coefficient - Evaluation - Temperature distribution and mean plat temperature - Focusing type solar collectors. General characteristics of focusing collectors - Optical losses - Construction of reflectors.

### Unit 3: SOLAR HEATER AND COOLER

Type of solar heaters - Description of solar water heater and their installation details - collectors and storage tanks - characteristics and performance - storage of Energy at high and low temperature - Solar coolers - Solar cooling system - vapour compression system and heat pump - open cycle cooling system - Natural method of air conditioning.

### Unit 4: SOLAR GENERATORS

Solar thermal power generation - solar still - solar pump - solar cooker - selective coating - Conversion of light into electrical energy - Photovoltaic power generation - Types of solar cells - solar energy in space.

### Unit 5: ALTERNATE ENERGY SOURCES

Need for alternative energy resources - Biological conversion - Biogas - Geothermal Energy conversion - Wind power - Tidal power - Nuclear power - Fusion and Fission - Basic principles of magnetic hydrodynamics - Solar production of Hydrogen - Liquid Hydrogen as a source in future.

### Book for Study

- M.P. Agarwal, Solar Energy -S.Chand & Company Ltd, New Delhi. (1989)
- G.D. Rai, Solar Energy Utilization -Khanna publishers, New Delhi. (1993)

### Book for Reference

- J.C. Meveigh, Sun power - An introduction to the Application of Solar Energy,- Bigton polytechnique, Pergamon Press, 1977.

<b>Semester</b>	<b>V</b>	<b>NMEC-II BIO PHYSICS</b>	<b>Hours</b>	<b>4</b>
<b>Course Code</b>			<b>Credit</b>	<b>4</b>

### Objectives

- To study the basics of bio-physics and to learn principles of biomechanics, biochemistry

### Unit 1: INTRODUCTION TO BIO-PHYSICS

Bio physics – Biophysics as a separate field – Branches of Bio physics – basic concepts of Bio physics. Energy Pathways in Biology. Bio potential – action potential nervous system

### Unit 2: SEPARATION TECHNIQUES

Introduction to chromatography classification of chromatography – paper and thin layer chromatography – column chromatography – Ion chromatography - high performance liquid chromatography – gas chromatography – electrophoresis – moving boundary electrophoresis method – low voltage thin sheet phoresis – High voltage electro phoresis

### Unit 3: PHYSICO CHEMICAL TECHNIQUES TO STUDY BIO MOLECULES

Introduction – hydration of macromolecules – role of friction – diffusion – sedimentation – in ultra fuge – applications of analytical ultra centrifuge – dichorism and bi rerigence – light scattering and turgidity – molecular shapes – small angle X-ray scattering – neutron diffraction.

### Unit 4: MODEL BUILDING

Fourier transform method – Casper & Kirschner’s method – Patterson’s synthesis– Free energy – high energy phosphate – bio energetic of coupled reactions – photo synthesis – respiration – chmiosmotic theory – membrane transport – membrane permeability – passive and active transport – glucose transport into intestinal epithelial cells.

### Unit 5: BIO MECHANICS

Introduction – muscle cells – properties and functions – various types – striated muscles – heart – heart beat and heart beat control – stroke volume – electrocardiogram – arterial blood pressure p electrical activity of the heart– pumping activity of heart.

### Book for Study

- G.R Chatwal –Bio Physics – Himalaya Publishing House, Bombay. (1<sup>st</sup> edition 2005)

### Book for Reference

- S.Palanisamy and Shanmugavelu, Principles of Biophysics, Palani Paramount Publication, 2002 Edition.
- Vasanta Pattabi and N.Gautam, Biophysics, Narosa Publishing House, 2005.
- S. Thiraviaraj, Biophysics, Saras Publication, 1993 Editor.

# ALLIED COURSES

**(For B.Sc., Chemistry, Computer Science and Mathematics Students)**

<b>Semester</b>	<b>III</b>	<b>AC-I APPLIED PHYSICS – I (For B.Sc., Computer Science Students)</b>	<b>Hours</b>	<b>5</b>
<b>Course Code</b>	<b>15S309A</b>		<b>Credit</b>	<b>4</b>

### Objectives

- To make the platform for hardware by understanding of electrostatics, magnetostatics, electromagnetic induction and alternating current

#### UNIT - I ELECTROSTATICS

Introduction – Coulomb’s law – Electric field – electric dipole – electric flux – Gauss’s law and its proof- Applications of Gauss’s law: uniformly charged sphere–charged cylinder–Electric potential – relation between electric field and electric potential.

Capacitance of a conductor – principles of capacitor - parallel plate capacitor-effect of dielectric- – capacitors in series and parallel – Energy stored in a charged capacitor.

#### UNIT – II CURRENT ELECTRICITY

Introduction-Current and current density – Ohm’s law – Kirchoff’s current law-Kirchoff’s voltage law- applications of Kirchoff’s laws Wheatstone’s network - Carey foster bridge – Potentiometer – calibration of ammeter and voltmeter.

#### UNIT- III MAGNETO STATICS

Introduction – Magnetic field – Biot’s Savart law and its applications: magnetic induction due to a current carrying straight conductor, circular coil, solenoid - Force on a current carrying conductor in a magnetic field - force between two parallel current carrying conductor.

#### UNIT – IV ELECTROMAGNETIC INDUCTION AND ELECTROMAGNETIC WAVES

Introduction – Faraday’s law– self induction – self inductance of a long solenoid – determination of self inductance by Raleigh’s method – Mutual induction – Mutual inductance between two coaxial solenoids – Experimental determination of mutual inductance – coefficient of coupling - eddy current and its uses.

#### UNIT - V ALTERNATING CURRENT

A.C: Peak value, mean value, form factor, effective value of an ac, r.m.s – LCR series and parallel resonant circuits – power in ac circuit containing R, L & C – Wattless current –choke coil – construction – Energy losses in a transformer – uses of transformer.

#### Books for study

- Electricity and Magnetism by R. Murugesan, S. Chand and Co. New Delhi, 1995.*

#### Books for Reference

- Brijlal, Subramaniam, Electricity and Magnetism, Ratan Prakashan Mandir Education and University Publishers, Agra, (2000)*
- K.K.Tewari, Electricity and Magnetism, S. Chand and Co., New Delhi, (2005)*



<b>Semester</b>	<b>III</b>	<b>AC-II</b> <b>APPLIED PHYSICS – I</b> <b>(For B.Sc., Computer Science Students)</b>	<b>Hours</b>	<b>3</b>
<b>Course Code</b>	<b>15S310L</b>		<b>Credit</b>	<b>4</b>

1. Potentiometer – Measurement of Resistance and Specific resistance of a wire
2. Carey Foster’s Bridge -- Measurement of Resistance and Specific resistance of a wire
3. Determination of Co-efficient of self inductance of a coil in series resonance circuit method
4. Verification of Kirchhoff’s laws in electronic circuits
5. Determination of Co-efficient of self inductance of a coil in parallel resonance circuit method
6. V-I characteristics of Semiconductor and Zener Diodes
7. Transistor Characteristics – CE configuration
8. FET characteristics – CS configuration
9. Construction and study of Inverting and Non-Inverting amplifier using operational amplifier
10. Construction of adder and subtractor circuits using Op-Amp
11. Construction and verification of Zener regulated power supply
12. Study of logic gates using ICs
13. Verification of DeMorgan’s theorem and Boolean algebra
14. Universality of NAND and NOR gates using IC
15. Construction and verification of Half and Full adder circuits
16. Construction and verification of Half and Full subtractor circuits
17. Study of Flip-flops (RS, JK and D )
18. Design of counter using IC 7490
19. Study of decoder and encoder using ICs
20. Study of multiplexer and demultiplexer circuits using ICs
21. D/A converter using operational amplifier ( Binary weighted method)

<b>Semester</b>	<b>IV</b>	<b>AC-III</b> <b>APPLIED PHYSICS – II</b> <b>(For B.Sc., Computer Science Students)</b>	<b>Hours</b>	<b>4</b>
<b>Course Code</b>	<b>15S412A</b>		<b>Credit</b>	<b>4</b>

### Objectives

- To explore hardware and computer architecture knowledge by understanding of semiconductor physics and digital fundamentals.

#### **UNIT – I SEMICONDUCTOR DIODE, SPECIAL DIODES**

Introduction-Semiconductor – Intrinsic semiconductor – Extrinsic semiconductor – V-I characteristics of PN junction diode – Half wave rectifier – Efficiency of Full wave bridge rectifier– Zener diode –V-I characteristics of Zener diode- Zener diode as voltage stabilizer - Light Emitting Diode – Photo diode.

#### **UNIT –II TRANSISTORS AND AMPLIFIER**

Introduction- Transistor – Transistor action – Transistor connections –relation between ‘ $\alpha$ ’ and ‘ $\beta$ ’-Transistor Characteristics – Common emitter configuration.

Transistor amplifier-stability-voltage divider method-single stage R-C coupled amplifier- JFET- Characteristics and Parameters.

#### **UNIT –III OPERATIONAL AMPLIFIER**

Introduction-Operational amplifier–IC 741 configuration- DC Characteristics – Applications of OP-amps – Inverting amplifier –Non inverting amplifier – Summing amplifier – Subtractor - Integrator – Differentiator.

#### **UNIT –IV BINARY SYSTEMS, BOOLEAN ALGEBRA**

Introduction-Binary numbers – Number base conversions – binary to decimal, hexadecimal and vice versa - Hexa decimal to decimal – decimal to hexadecimal – 1’s Complements subtraction – Binary codes - 8421code - gray code.

Boolean algebra – Basic definitions – Basic theorems and properties of Boolean algebra – Boolean functions- Demorgan’s thorem-basic logic gates – Universal gates.

#### **UNIT – V COMBINATIONAL AND SEQUENTIAL LOGIC**

Introduction-K-Map– Formation and simplification of two and three variables– Don’t care conditions.Half and Full adder – Half Subtractor – Decoders – Demultiplexers – Encoders – Multiplexers.Flip flops – Basic flip flop circuit – Clocked RS flip flop – D flip flop – JK flip flop – Registers – Shift registers – Counters –Ring counter.

#### **Book for Study**

- K.Mehta, Rohit Mehta, Principles of Electronics, S.Chand & Company, New Delhi, Eleventh Edition, 2008 ( Unit I &II).*
- L D.Roy Choudhury, Shail Jain, Linear Integrated Circuits, New Age International Pvt., Ltd., New Delhi, 1999 (Unit-III).*
- V.Vijayendran Digital Fundamentals, Vijay Nicole imprint Pvt., Ltd., Chennai, 2004(Unit IV & V).*

#### **Book for Reference**

- Leach and Malvino, Digital Principles and Applications, Tata McGraw Hill Publishing Company Limited, New Delhi, Second reprint, 2002.*
- S.Salivahanan, N. Suresh Kumar, A.Vallavaraj, Electronic Devices and Circuits, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2006.*

Semester	III	AC-I ALLIED PHYSICS –I (For B.Sc.,Chemistry Students)	Hours	4
Course Code	15Y309A		Credit	4

### Objectives

- To study the basic principles on properties of solid and liquid, waves and oscillations, mechanics, thermal and optical phenomenon.

### UNIT –I PROPERTIES OF MATTER

**Elasticity:** Stress-strain-Hook's law-different moduli of elasticity-Poisson's ratio – bending of beam – Young's modulus by non-uniform bending **Viscosity:** Coefficient of viscosity – Poiseuille's formula – comparison of viscosities: burette method– terminal velocity **Surface tension:** definition-unit and dimension-Molecular theory of surface tension – surface energy-Jaegar's method

### UNIT-II WAVES AND OSCILLATIONS

Simple harmonic motion – composition of two simple harmonic motions at right angles – Lissajou's figures – uses- Transverse vibration of a stretched string –Sonometer - ultrasonics-production: piezoelectric method- application and uses

### UNIT – III MECHANICS

Gravitation fields and potentials- Newton's law of gravitation – Experimental determination of G by Boy's method - variation of 'g' with altitude, depth and latitude–Gravitational field – intensity of the field – Gravitational potential and potential energy – Kepler's law – deduction of Newton's law of gravitation from Kepler's laws

### UNIT-IV THERMAL PHYSICS

Postulates of the kinetic theory of gases – Van der Walls equation of state – derivation of critical constants - Joule-Kelvin effect – Joule-Thomson porous plug experiment – liquefaction of gases: Linde's process - laws of thermodynamics –Heat engine-entropy – change of entropy in reversible and irreversible processes

### UNIT –V OPTICS

Physical optics: Introduction - Interference in thin films. Diffraction: determination of wavelength of light using transmission grating. Polarization: Introduction – polarization by reflection – optical activity – Laurent's Half shade polarimeter

### Books for study

- R.Murugesan, *Allied Physics*, S.Chand & Co., Ltd., New Delhi, Revised edition, 2005. (Unit I,II,IV and V)
- D. S. Mathur, "Mechanics", S. Chand & Company Ltd., New Delhi (2003).(Unit-III)

### Books for Reference

- D. S. Mathur, *Properties of Matter*, S. Chand & Co., New Delhi.
- P.K.Srivastava, *Mechanics*, New Age International Publishers, New Delhi, 1997

<b>Semester</b>	<b>I &amp; III</b>	<b>AC-II ALLIED PHYSICS –I</b> <b>(For B.Sc., Mathematics ( I Semester) and</b> <b>Chemistry ( III Semester) Students)</b>	<b>Hours</b>	<b>4</b>
<b>Course Code</b>	<b>15M104L</b> <b>/15Y310L</b>		<b>Credit</b>	<b>4</b>

(Any Fifteen experiments)

1. Young's Modulus – Non uniform bending
2. Surface tension – drop weight method
3. Comparison of viscosities of two liquids- Burette method
4. Specific heat capacity of a liquid- Newton's law of cooling
5. Sonometer- verification of laws
6. Newton's rings- Determination of radius of curvature
7. Spectrometer- Refractive index of prism
8. Spectrometer- Grating at normal incidence
9. Carey foster's bridge- specific resistance of a coil
10. Metre bridge- determination of resistance
11. Potentiometer – ammeter calibration
12. Characteristics of PN junction diode
13. Characteristics of Zener diode
14. Bridge rectifier
15. Transistor characteristics –CE configuration
16. Logic gates using IC'S
17. NAND gate as a Universal gate
18. NOR gate as a Universal gate
19. De Morgan's theorem
20. Verification of Boolean algebra

Semester	IV	AC-III ALLIED PHYSICS –II (For B.Sc.,Chemistry Students)	Hours	4
Course Code	15Y412A		Credit	4

### Objective

- To get the knowledge on electrostatics, current, atom, nuclear, basic and digital electronics

### UNIT - I ELECTROSTATIC

Basic concepts – coulomb’s law – Electric field – Electric field due to a point charge – lines of force – electric flux – gauss’s law and its proof- Applications of gauss law: uniformly charged sphere- Capacitance of a conductor – principle of capacitor - capacitors in series and parallel – Energy stored in a charged capacitor.

### UNIT – II CURRENT ELECTRICITY AND ELECTROMAGNETIC INDUCTION

Current and current density – ohm’s law – Kirchoff’s laws and its applications: Wheatstone’s network - Carey foster bridge. Introduction – Faraday’s law - self induction – self inductance of a long solenoid – determination of self inductance by Raleigh’s method – Mutual induction – Experimental determination of mutual inductance.

### UNIT-III ATOMIC PHYSICS AND NUCLEAR PHYSICS

Vector atom model – quantum numbers associated with the vector atom model– The Pauli Exclusion principle – Magnetic dipole moment due to orbital motion of the electron – The stern and Gerlach experiment

The liquid drop model – mass defect – binding energy – ionization chamber -uses–Nuclear fission – energy released in fission – chain reaction – atom bomb– Nuclear fusion – source of solar energy.

### UNIT IV BASIC ELECTRONICS

Zener diode – experiment to study the characteristics of zener diode – Light Emitting Diode – transistor –Characteristics –common emitter configuration – Transistor amplifier – oscillators – condition for oscillators- phase shift oscillators

### UNIT –V DIGITAL ELECTRONICS

Binary numbers – Number base conversions – Octal and Hexa decimal numbers – digital Logic gates –Boolean algebra – Basic definitions – Basic theorems and properties of Boolean algebra – Universality of NAND and NOR gate – De Morgan’s theorem – Half adder and Full adder – Half subtractor and Full subtractor

### Books for Study

1. R.Murugesan, *Electricity and Magnetism*, S.Chand and Co., New Delhi, 1995.(Unit I,II)
2. R.Murugesan, *Allied Physics*, S.Chand & Co., Ltd., New Delhi, Revised edition, 2005. (Unit III,IV and V)

### Books for Reference

1. Brijlal, Subramaniam, *Electricity and Magnetism*, Ratan Prakashan Mandir Education and University Publishers, Agra, (2000)
2. K.K.Tewari, *Electricity and Magnetism*, S. Chand and Co., New Delhi, (2005)
3. M.Morris Mano, *Digital Logic and Computer Design*, Prentice Hall of India Private Limited, New Delhi, 1996.
4. K.Mehta, Rohit Mehta, *Principles of Electronics*, S.Chand & Company, New Delhi, Eleventh Edition,2008.

<b>Semester</b>	<b>I</b>	<b>AC-I</b> <b>ALLIED PHYSICS –I</b> <b>(For B.Sc., Mathematics Students)</b>	<b>Hours</b>	<b>4</b>
<b>Course Code</b>	<b>15M103A</b>		<b>Credit</b>	<b>4</b>

## Objectives

- To study the basic principles on properties of solid and liquid, force, gravitation, thermal and optical phenomena.

### UNIT –I PROPERTIES OF MATTER

**Elasticity:** Stress-strain-Hook's law-different moduli of elasticity-Poisson's ratio – bending of beam – Young's modulus by non-uniform bending **Viscosity:** Coefficient of viscosity – Poiseuille's formula – comparison of viscosities: burette method– terminal velocity **Surface tension:** definition-unit and dimension-Molecular theory of surface tension – surface energy-Jaeger's method

### UNIT-II STATICS

Scalars and Vectors and force-Velocity vs. Speed- Forces as Vectors- Resultants of Force Systems-moment of a force- centre of gravity-centre of gravity of simple uniform bodies -centre of gravity of a solid hemisphere

### UNIT – III GRAVITATION

Gravitation fields and potentials- Newton's law of gravitation – Experimental determination of G by Boy's method - variation of 'g' with altitude, depth and latitude–Gravitational field – intensity of the field – Gravitational potential and potential energy – Kepler's law – deduction of Newton's law of gravitation from Kepler's laws

### UNIT-IV THERMAL PHYSICS

Postulates of the kinetic theory of gases – Van der Waals equation of state – derivation of critical constants - Joule-Kelvin effect – Joule-Thomson porous plug experiment – liquefaction of gases: Linde's process - laws of thermodynamics –Heat engine-entropy – change of entropy in reversible and irreversible processes

### UNIT –V OPTICS

Physical optics: Introduction - Interference in thin films. Diffraction: determination of wavelength of light using transmission grating. Polarization: Introduction – polarization by reflection – optical activity – Laurent's Half shade polarimeter

#### **Books for study**

- R.Murugesan, Allied Physics, S.Chand & Co., Ltd., New Delhi, Revised edition, 2005.*
- D. S. Mathur, "Mechanics", S. Chand & Company Ltd., New Delhi (2003).*

#### **Books for Reference**

- D. S. Mathur, Properties of Matter, S. Chand & Co., New Delhi.*
- P.K.Srivastava, Mechanics, New Age International Publishers, New Delhi, 1997*

<b>Semester</b>	<b>II</b>	<b>AC-III</b> <b>ALLIED PHYSICS –II</b> <b>(For B.Sc., Mathematics Students )</b>	<b>Hours</b>	<b>4</b>
<b>Course Code</b>	<b>15M206A</b>		<b>Credit</b>	<b>4</b>

### Objective

- To get the knowledge on dynamics, SHM, electrostatics, current electricity, electronics and digital electronics

### UNIT - I DYNAMICS AND SIMPLE HARMONIC MOTION

Velocity-acceleration-relative velocity-angular velocity-Newton's laws of motion-equation of motion--rectilinear motion under constant acceleration-Simple harmonic motion – composition of two simple harmonic motions at right angles – Lissajou's figures – uses.

### UNIT – II ELECTROSTATIC

Basic concepts – coulomb's law – Electric field – Electric field due to a point charge – lines of force – electric flux – gauss's law and its proof- Applications of gauss law: uniformly charged sphere- Capacitance of a conductor – principle of capacitor - capacitors in series and parallel – Energy stored in a charged capacitor.

### UNIT – III CURRENT ELECTRICITY AND ELECTROMAGNETIC INDUCTION

Current and current density – ohm's law – Kirchoff's laws and its applications: Wheatstone's network - Carey foster bridge. Introduction – Faraday's law - self induction – self inductance of a long solenoid – determination of self inductance by Raleigh's method – Mutual induction – Experimental determination of mutual inductance.

### UNIT IV BASIC ELECTRONICS

Zener diode – experiment to study the characteristics of zener diode – Light Emitting Diode – transistor –Characteristics –common emitter configuration – Transistor amplifier – oscillators – condition for oscillators- phase shift oscillators.

### UNIT –V DIGITAL ELECTRONICS

Binary numbers – Number base conversions – Octal and Hexa decimal numbers – digital Logic gates –Boolean algebra – Basic definitions – Basic theorems and properties of Boolean algebra – Universality of NAND and NOR gate – De Morgan's theorem – Half adder and Full adder – Half subtractor and Full subtractor

### Books for Study

- R.Murugesan, *Electricity and Magnetism*, S.Chand and Co., New Delhi, 1995.
- R.Murugesan, *Allied Physics*, S.Chand & Co., Ltd., New Delhi, Revised edition, 2005.

### Books for Reference

- Brijlal, Subramaniam, *Electricity and Magnetism*, Ratan Prakashan Mandir Education and University Publishers, Agra, (2000)
- K.K.Tewari, *Electricity and Magnetism*, S. Chand and Co., New Delhi, (2005)
- M.Morris Mano, *Digital Logic and Computer Design*, Prentice Hall of India Private Limited, New Delhi, 1996.
- K.Mehta, Rohit Mehta, *Principles of Electronics*, S.Chand & Company, New Delhi, Eleventh Edition, 2008