THIAGARAJAR COLLEGE (AUTONOMOUS) MADURAI – 9
Re-Accredited with 'A' Grade by NAAC
DEPARTMENT OF PHYSICS

BACHELOR OF PHYSICS

COURSE STRUCTURE
(w.e.f. 2011 – 2014 batch onwards)

Semester – I

Code	Subject	Contact hrs. / week	Credits	Total no. of hrs. allotted	Max Marks CA	Max Marks SE	Total
P111	Tamil / Other Language	6	3	90	25	75	100
P211	English	6	3	90	25	75	100
MP11	Properties of Matter	5	4	5	25	75	100
MP12	Heat and Thermodynamics	5	4	5	25	75	100
MPL21	Practicals – I	2	-	2	40	60	100
ESP 11	Medical Physics – I / Practical Electric Circuits –I	2	2	2	15	35	50
SE 2	Bio-Physics – I (Practicals)	2	2	2			
ES	Environmental Studies	2	2	2	15	35	50
	Total	30	20				

Semester – II

Code	Subject	Contact hrs. / week	Credits	Total no. of hrs. alotted	Max Marks CA	Max Marks SE	Total
P111	Tamil / Other Language	6	3	90	25	75	100
P211	English	6	3	90	25	75	100
MP21	Mechanics	5	4	5	25	75	100
MP22	Optics	5	4	5	25	75	100
MPL21	Practicals – I	2	3	2	40	60	100
ESP21	Medical Physics – II / Practical Electric Circuits –II	2	2	2	15	35	50
SE4	Bio-Physics – II (Practicals)	2	2	2			
VE	Value Education	2	2	2	15	35	50
	Total	30	23				

Semester – III

Code	Subject	Contact hrs. / week	Credits	Total no. of hrs. alotted	Max Marks CA	Max Marks SE	Total
P111	Tamil / Other Language	6	3	90	25	75	100
P211	English	6	3	90	25	75	100
MP31	Programming in C	4	4	4	25	75	100
MPL41	Practicals – II	2	-	2	40	60	100
AP31(C)	Allied Chemistry - I	4	3	–	25	75	100
APL31(C)	Allied Practicals – I	2	2	–	40	60	100
EMP31	Modern Optics / Material Science and Applied Physics	4	4	4	25	75	100
NME I ENP31	ULTRASONIC NON-DESTRUCTIVE TESTING	2	2	2	15	35	50
	Total	30	21				

Semester – IV

Code	Subject	Contact hrs. / week	Credits	Total no. of hrs. alotted	Max Marks CA	Max Marks SE	Total
P111	Tamil / Other Language	6	3	90	25	75	100
P211	English	6	3	90	25	75	100
MP41	Electricity and Magnetism	4	4	4	25	75	100
MPL41	Practicals – II	2	3	2	40	60	100
AP41(C)	Allied Chemistry - II	4	3	–	25	75	100
APL41(C)	Allied Practicals – I	2	2	–	40	60	100
EMP41	Non-Conventional Energy Sources / Numerical Methods	4	4	4	25	75	100
ENMP41	ULTRASONIC NON-DESTRUCTIVE TESTING-II	2	2	2	15	35	50
	Total	30	24				

Semester – V

Code	Subject	Contact hrs. / week	Credits	Total no. of hrs. alotted	Max Marks CA	Max Marks SE	Total
MP51	Elementary Solid State Physics	5	4	6	25	75	100
MP52	Analog Electronics	5	4	6	25	75	100
MP53	Modern Physics	5	4	6	25	75	100
MPL61	Practicals – III	2	-	3	40	60	100
MPL62	Practicals – IV	2	-	3	40	60	100
AP51(M)	Allied Mathematics – I	6	5	–	25	75	100
EMP51	Experimental Design/Optical Fibers and Communication Systems	3	3	4	25	75	100
ESP51	Environmental Physics – I / Mathematical Physics	2	2	2	15	35	50
Self Study	VISUAL ASTRONOMY						
	Total	30	22				

Semester – VI

Code	Subject	Contact hrs. / week	Credits	Total no. of hrs. allotted	Max Marks CA	Max Marks SE	Total
MP61	Molecular Spectroscopy	5	4	6	25	75	100
MP62	Industrial Physics and Instrumentation	5	4	6	25	75	100
MP63	Digital Principles & Applications	5	4	6	25	75	100
MPL61	Practicals – III	2	3	3	40	60	100
MPL62	Practicals – IV	2	3	3	40	60	100
AP61(M)	Allied Mathematics – II	6	5	–	25	75	100
EMP61	Applied Electronics / Introduction to Nanoscience	3	4	4	25	75	100
ESP61	Quantum Mechanics / Environmental Physics - II	2	2	2	15	35	50
	Part V		1				
	Total	30	30				

A) Consolidation of Contact Hours and Credits : UG

Semester	Contact Hour / Week	Credits
I	30	20
II	30	23
III	30	21
IV	30	24
V	30	22
VI	30	29
Part V		01
Total	180	140

B) Curriculum Credits : Partwise

PART	PAPER	CREDITS
I	TAMIL	12
II	ENGLISH	12
III	CORE	60
	ALLIED	20
	ELECTIVE	15
IV	NME	04
	SE	12
	ES	02
	VE	02
V	EA	01
TOTAL		**140**

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DEPARTMENT OF PHYSICS
(From 2011 – 14 batch onwards)

Course : B.Sc. Physics **Code : MP11**
Semester : I **No. of hrs. allotted : 5**
Paper : Core **No. of credits : 4**

PROPERTIES OF MATTER

Course Objectives :

- To interpret the concepts of elasticity, viscosity, surface tension and gravity.
- To discuss the measurement of parameters of respective physical properties through theory and experiments.
- To appreciate the importance of properties of matter in other sciences including engineering and space applications.

UNIT I ELASTICITY (15 Hours)

Introduction-different moduli of elasticity-relation between angle of shear and linear strain-relation between volume strain and linear strain-behaviour of a wire under progressive tension-relation between the elastic moduli-torsion of a body-determination of rigidity modulus(static torsion method)-work done in twisting a wire-torsional oscillations of a body-bending of beams-expression for bending moment depression at the midpoint of a beam loaded at the middle-uniform bending of a beam-measurement of Young's modulus.

UNIT II VISCOSITY (12 Hours)

Introduction-streamline flow and turbulent flow-Poiseuille's formula for the flow of liquid through a capillary tube-corrections to Poiseuille's formula-comparison of viscosities-Ostwald's viscometer-Poiseuille's method for determining the coefficient of viscosity of a liquid-terminal velocity and Stoke's formula-Stoke's method for the coefficient of viscosity of a viscous medium-variation of viscosity with temperature and pressure-friction and lubrication.

UNIT III SURFACE TENSION (15 Hours)

Introduction-explanation of surface tension on kinetic theory-work done in increasing the area of a surface-work done in blowing a bubble-forms of liquid drops-angle of contact-spreading of one liquid over another-pressure difference across a liquid surface-excess pressure inside a curved liquid surface-Jaegar's method of determining surface tension-variation of surface tension with temperature-Quinke's method- vapour pressure over flat and curved surfaces-drop weight method of determining the surface tension of a liquid-experiment to determine the interfacial tension between water and kerosene.

UNIT IV DIFFUSION AND OSMOSIS (10 Hours)

Introduction- Fick's law of diffusion- experimental determination of coefficient of diffusion- Graham's law of diffusion of gases-Introduction-experimental determination of osmotic pressure-laws of osmotic pressure-osmosis and vapour pressure of a solution-osmosis and boiling point of a solution- osmosis and freezing point of a solution – determination of molecular weight- determination of percentage of dissociation of an electrolyte.

UNIT V GRAVITATION (8 Hours)

Newton's law of gravitation- Kepler's law of planetary motion- determination of G-Boy's experiment-gravitational field and gravitational potential-gravitational potential and field due to a spherical shell- gravitational potential and field due to a solid sphere-variation of g with latitude- variation of g with altitude- variation of g with depth- the compound pendulum.

TEXTBOOK:

Properties of Matter, R.Murugeshan, S. Chand & Co., New Delhi, 2007.

REFERENCE BOOK:

1. Elements of Properties of Matter, D.S. Mathur, S.Chand & Co., New Delhi, 2005.
2. Properties of Matter, Brijlal & Subrahmanyam, S.Chand & Co., New Delhi, 2002

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Course : B.Sc. Physics **Code : MP12**
Semester : I **No. of hrs. allotted : 5**
Paper : Core **No. of credits : 4**

HEAT AND THERMODYNAMICS

Course Objectives :

- To explain the behavior of thermal expansion of solids, liquids and gases
- To throw light on the elementary aspects underlying changes of state
- To discuss the fundamental laws of thermodynamics, concept of phase transitions in matter and to the elements of statistical thermodynamics

UNIT – I EXPANSION (10 Hours)

Expansion of Solids – Coefficient of Linear Expansion – Relation between α & β – Coefficient of Cubical expansion – Relation between α and √ – Determination of coefficient of Linear expansion: Spherometer method, Optical lever method – Expansion of Liquids – Relation between $\sqrt{}_r$ and $\sqrt{}_a$ - Determination of coefficient of real expansion of liquid by Dulong and Petit's method – Anomalous expansion of water - Expansion of Gases – Determination of the Pressure coefficients of a gas – Determination of the volume coefficient of a gas.

UNIT – II CHANGE OF STATE (12 Hours)

Change of state – Latent heat of Fusion – Laws of Fusion – Determination of Latent heat of Fusion of ice – Vapourisation and Condensation – Latent heat of Vapourisation – Determination of Latent heat of steam – Cooling effect due to Vapourisation – Ammonia ice plant – Solid carbon dioxide – Gas and vapour - Saturated and un Saturated Vapours - Vapour pressure of liquids – Triple point - Gibbs Phase rule

UNIT – III ZEROTH AND FIRST LAW OF THERMODYNAMICS (8 Hours)

Thermodynamic system – Zeroth law of thermodynamics – Concept of heat – Heat – A path function – work – a path function – comparison of heat and work – First law of thermodynamics – Applications – Isothermal, Adiabatic, Isochoric, Isobaric process – Gas equation during adiabatic process – Slopes of adiabatic and isothermals – Reversible and Irreversible process.

UNIT – IV SECOND AND THIRD LAW OF THERMODYNAMICS (15 Hours)

Second law of thermodynamics – Carnot's reversible engine – Carnot's Theorem – Entropy and second law of thermodynamics – Change in entropy in a reversible process – Third law of thermodynamics – Temperature – entropy diagram – entropy of a perfect gas – zero point energy – Maxwell's thermo dynamical relations – Helmholtz function – thermo dynamic potentials - enthalpy – C_P, C_V and μ - Maxwell's equations – Joule Kelvin coefficient – First order Phase transition.

UNIT – V STATISTICAL THERMODYNAMICS (15 Hours)

Statistical Mechanics – Statistical equilibrium – Probability theorems in statistical thermodynamics – Maxwell - Boltzmann distribution law – Maxwell - Boltzmann distribution law in terms of temperature – Quantum Statistics – Phase space – Fermi - Dirac distribution law – Electron gas – Bose - Einstein distribution law Photon gas – Comparison of three statistics.

TEXT BOOK:

BRIJLAL & SUBRHAMANYAM, : *Heat and Thermodynamics*, S.Chand & Co., New Delhi, 2006 (ISBN: 81-219-0417-X).

REFERENCE BOOK:

1. P.K.NAG: *Basic and applied Thermodynamics,* Tata McGraw – Hill company Ltd., New Delhi, 2005.
2. M.W. ZEMANSKY, Heat and Thermodynamics (7^{th} ed.), McGraw-Hill, New York, 1996.

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Course	**:**	**B.Sc. Physics**	**Code :**	**ESP11(M)**
Semester	**:**	**I**	**No. of hrs. allotted :**	**2**
Paper	**:**	**Skill Based Elective**	**No. of credits :**	**2**

MEDICAL PHYSICS – I

Course Objectives:

- To introduce to the students the various medical equipments and the physics behind, their working.
- To provide a basic idea about X-Rays and the hazards of radiation on human health.
- To help the students appreciate the physical processes involved in the working of the equipments.

UNIT I (15 Hours)

Thermal expansion – clinical thermometer – Thermostats – Use in Incubators – elementary idea of gas pressure – Blood pressure measuring apparatus – Physics of hearing – working of hearing aid – Effect of Infra & Ultra sound effect.

UNIT II (15 Hours)

Transducers – definition –Transducers for Bio medical applications – Biological transducers – Bio medical transducers.- Doppler effect & Ultrasonics – Doppler Ultra sonography – Scanning – working of CT Scan – working of Betatron – Its medical applications –X – Rays – (Production & properties) – Soft & Hard X – Rays in medical diagnostics – Physiological consequences of nuclear radiations – Radiation therapy – Radiation diagnostics – Nuclear cardiogram.

TEXT BOOK;

Bio medical Instrumentation and measurements, L. Cromwell, F.J.Weibell and E.A. Pfeiffe, Prentice-Hall India, New Delhi, 2002.

REFERENCE BOOKS:

1. How thinks work Vol. 1 & Vol. 2 : Harpens Collins Publ. India. A joint venture with The India Today Group, New Delhi (2002).
2. A text book of bio physics : R.N.Roy, Books and Allied (P) Ltd. (2001).
3. Bio medical Instrumentation : M.Arumugam
4. Optics : Brijlal & Subramaniam S. Chand & Co (2002).
5. Bio medical electronics & Instrumentation : Prof.S.K.Venkatraman Galgotia Pub. Pvt. Ltd, 2002.

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Course	**:**	**B.Sc. Physics**	**Code :**	**ESP11(P)**
Semester	**:**	**I**	**No. of hrs. allotted :**	**2**
Paper	**:**	**Skill Based Elective**	**No. of credits :**	**2**

PRACTICAL ELECTRIC CIRCUITS - I

Course Objectives :

- To explain to the students the steps involved in power transmission.
- To discuss in detail the internal circuitry of various electrical instruments and the methods of troubleshooting.
- To inculcate in the students a scientific temper and to make them realize the importance of electric power.

UNIT I (15 Hours)

Magnetic effect of electric current – (Qualitatively) – self-inductance & mutual inductance – Design of a coil – transformer – Design of a step down transformer for a required parameter constructing a power supply for radio and tape recorder –electrical measuring instruments – galvanometer – ammeter –voltmeter – wattmeter – multimeter – fault finding in electrical measuring instruments.

UNIT II (15 Hours)

Working of an accumulator – short circuit – (fuses) – switches – generators –(dynamo) – water pumps(piston, centrifugal and diaphragm pumps, refrigerators – air conditioners – microphones – tape recorders – loud speakers –incandescent and fluorescent lamps.

REFERENCE BOOKS:

1. Electricity & Magnetism : Brijlal & Subramaniam, S. Chand & Co. (2002).
2. Electrical technology : Theraja S. Chand & Co. (2002).
3. How things Work Vol 1 & Vol 2: Harper Collins Publ. India a joint venture with The India Today Group, N. Delhi, (2002).

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Course	**:**	**B.Sc. Physics**	**Code :**	**ESP12(B)**
Semester	**:**	**I**	**No. of hrs. allotted :**	**2**
Paper	**:**	**Skill Based Elective**	**No. of credits :**	**2**

BIOPHYSICS PRACTICALS - I

Course Objectives :

i. To enable students understand the application of simple physical principles in biology.

ii. To expose students to the elementary principles of Biophysics through simple experiments.

1. Preparation of standard buffers and determination of pH of a solution.
2. Qualitative tests for a) Carbohydrates b) Proteins and amino acids c) Lipids.
3. Verification of Beer-Lambert's law.
4. Estimation of amino acids by ninhydrine method.
5. Effect of temperature on the viscosity of DNA using Ostwald's viscometer.
6. Determination of specific rotation of polarized light when passed through the glucose solution using polarimeter.
7. Determination of velocity and absorption of ultrasound in biofluids using ultrasonic interferometer.
8. Determine specific gravity or density of biochemicals
9. Measurement of blood pressure (Demonstration and Interpretation)
10. To determine the absorption spectrum of chlorophyll / cytochrome C solution by a colorimeter.
11. To determine the refractive index of different biofluids using a hollow prism.
12. To determine the relative sizes of nucleus and cytoplasm of squamous cells using a biological microscope.

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Course	**:**	**B.Sc. Physics**	**Code :**	**MP21**
Semester	**:**	**II**	**No. of hrs. allotted :**	**5**
Paper	**:**	**Core**	**No. of credits :**	**4**

MECHANICS

Course Objectives :

i. To discuss the laws of motion and the concept of central force
ii. To explain the principles of projectile motion and dynamics of rigid bodies.
iii. To interpret and understand oscillations of mechanical systems.

UNIT I: LAWS OF MOTION AND CENTRAL FORCE (10 Hours)

Newtons first law of motion-second law of motion-resistive force -constant force and resistive force -conservative force-motion in a plane –cylindrical polar coordinates-Spherical polar coordinates-Uniformly rotating frame of reference-Focault`s pendulum-Coriolis forces and motion relative to earth. Central force-central force motion confined to a single plane-angular momentum and energy.

UNIT II: SYSTEM OF PARTICLES (12 Hours)

Dynamics of a system of particles and concept of Rigid bodies-centre of mass coordinates – Centre of mass of a rigid body-motion of centre of mass and linear momentum-angular momentum and torque-angular momentum of a system and centre of mass –conservation of angular momentum-Collisions-Inelastic collision-coefficient of restitution-centre of mass system –rocket.

UNIT III DYNAMICS OF RIGID BODIES I (15 Hours)

Rigid bodies-rotational kinetic energy, moment of inertia and its physical significance-angular acceleration-angular momentum-law of conservation of angular momentum-torque-torque as a cross product of F & r –analogy between translatory motion and rotatory motion –work done by a torque.theorem of perpendicular axes-theorem of parallel axes.

UNIT IV: DYNAMICS OF RIGID BODIES II (15 Hours)

Theorem of perpendicular axes-theorem of parallel axes-Moment of inertia of thin uniform bar- Moment of inertia of a rectangular lamina- Moment of inertia of a uniform circular disc- Moment of inertia of an annular disc- Moment of inertia of a hollow cylinder - Moment of inertia of a solid sphere- Moment of inertia of a spherical shell- Moment of inertia of a solid cone-Routh`s rule-Kinetic energy of a body rolling on a horizontal plane-acceleration of a body rolling down an inclined plane.

UNIT V: OSCILLATIONS (8 Hours)

Linear harmonic oscillator-energy of a simple harmonic oscillator –simple harmonic oscillations of a loaded spring-Helmholtz resonator-Oscillations of two masses connected by a spring-Damped harmonic oscillators-energy of a damped harmonic oscillator-Forced oscillations.

TEXT BOOK :

BRIJLAL,N.SUBRAHMANYAM,J IVAN SESHAN, *Mechanics and Electrodynamics ,* S.Chand & Company ltd-2005 (ISBN:81-219-2591-6)]

REFERENCE BOOK:

Elements of Properties of Matter-D.S .Mathur[S.Chand & Company ltd-2005 (ISBN:81-219-0815-9)]

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Course	**:**	**B.Sc. Physics**	**Code :**	**MP22**
Semester	**:**	**II**	**No. of hrs. allotted :**	**5**
Paper	**:**	**Core**	**No. of credits :**	**4**

OPTICS

Course Objectives :

- To provide a broad overview of the elementary concepts of optics.
- To discuss in detail the three crucial phenomena in Optics viz. Interference, Diffraction and Polarization and their occurrence in day to day life.

UNIT I LIGHT AND LENS (14 HRS)

Introduction to light -Fermat's Principle of Least time-Rectilinear propagation of light-Laws of Reflection-Laws of Refraction- Total internal reflection- Lenses-terminology-conjugate points –planes and distances-image tracing-location of the image-sign convention-thin lens-lens equation-lens maker`s equation-power-equivalent focal length of two thin lenses.

UNIT II DISPERSION (14 HRS)

Dispersion by a prism-Refraction through a prism-Angular dispersion-Dispersive power-Angular and chromatic dispersions-Achromatic combination of prisms-Deviation without dispersion-dispersion without deviation-Direct vision spectroscope.

UNIT III INTERFERENCE (16HRS)

Coherence – Conditions for interference – Techniques of obtaining interference - Fresnel Biprism – Achromatic fringes – Interferometry – Thin film – Plane parallel film – Interference due to transmitted light – Haidinger fringes – Variable thickness (Wedge-shaped) film – Newton's rings- Michelson's interferometer

UNIT IV DIFFRACTION (15 HRS)

Huygen's – Fresnel theory - Zone plate – Distinction between interference and diffraction – fresnel, Fraunhoffer types of diffraction – Diffraction at a circular aperture– diffraction pattern due to a straight edge-Fraunhoffer diffraction at a single slit, circular aperture – Plane diffraction grating

UNIT V POLARIZATION (16 HRS)

Polarized light – Production of linearly polarized light – Polarizer and analyzer – Anisotropic crystals – Calcite crystal – Huygens' explanation of double refraction – Phase difference between e-ray and o-ray – Superposition of waves linearly at right angles – Types of polarized light – Effect of polarizer on transmission of polarized light – Retarders or wave plates – Production of elliptically and circularly polarized light – analysis of polarized light – Optical activity – Specific rotation – Laurent's half-shaded polarimeter.

TEXT BOOK:

N. SUBRAHMANYAM, BRIJLAL & M.N. AVADHANULU ; *A Text Book Of Optics ,* S.CHAND,2006(ISBN:81-219-2611-4)

REFERENCE BOOK:

F.A. JENKINS, H.E. WHITE, *Fundamentals Of Op*tics (4TH EDITION) MCGRAW- HILL BOOK COMPANY,1981(ISBN:0-07-032330-5)

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Course	**:**	**B.Sc. Physics**	**Code :**	**ESP21(M)**
Semester	**:**	**II**	**No. of hrs. allotted :**	**2**
Paper	**:**	**Skill Based Elective**	**No. of credits :**	**2**

MEDICAL PHYSICS-II

Course Objectives :

- To discuss in detail the working of various medical instruments and to provide practical knowledge regarding the same.
- To create an awareness in the students about the banes and boons of nuclear radiation.
- To help students appreciate the beneficial uses of radiation.

UNIT I (15 HRS)

Types of lenses – Focal length – Combination of lenses – Power (Diopter) of a lens Defects in eye – Intraocular pressure measurement – Glaucoma – Correction of defects using lenses – Sensing & Tracing of electric pulses – EEG & ECG – NMR – magnetic resonance imaging – MRI scanning Instrument – Working of heart and lung machine – Artificial kidney .

UNIT II (15 HRS)

Effect of UV, visible & IR radiations on human body – IR lamp & IR therapy – Biological effect of radiation – Radiation damage in embryo and fetus during pregnancy – demerits of different diagnostic and theraptic methods of nuclear medicine during pregnancy – Radiation hazards in man – radiation hazards in atmosphere and space.

REFERENCE BOOKS:

1. How things work Vol. 1 & Vol. 2 :Harpens Collins Publ. India. A joint venture with The India Today Group, New Delhi (2002).
2. A text book of bio physics : R.N.Roy, Books and Allied (P) Ltd. (2001).
3. Bio medical Instrumentation : M.Arumugam
4. Optics : Brijlal & Subramaniam S. Chand & Co (2002).
5. Bio medical electronics & Instrumentation : Prof.S.K.Venkatraman Galgotia Pub. Pvt. Ltd, 2002.
6. Bio medical Instrumentation & Measurements : Leslie Cromwell, Fred.J.Weibell and Erich A. Pfeiffer PHI (2002).

DEMONSTRATION AND FIELD VISIT:

1. ECG Recording – Demonstration
2. Field Visit – MRI Scanning center
3. Field Visit – Ultrasonograph – scanning center
4. Field Visit – EYE hospital to see instruments used for ophthalmic diagnosis & Laser therapy.

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Course	**:**	**B.Sc. Physics**	**Code :**	**ESP21(P)**
Semester	**:**	**II**	**No. of hrs. allotted :**	**2**
Paper	**:**	**Skill Based Elective**	**No. of credits :**	**2**

PRACTICAL ELECTRIC CIRCUITS - II

Course Objectives :

i. To discuss the heating effect of current and the principle behind electroplating.

ii. To explain to the students house wiring and also give practical training regarding the same.

iii. To help students apply the knowledge to correct simple electrical problems faced at home.

UNIT I (15 HRS)

Heating effect of current(qualitatively) – Joule's law – heaters and flat iron – automotic temperature control(thermostat) – chemical effect of current (qualitatively) – electrolysis – Faraday's law – electroplating.

UNIT II (15 HRS)

Single phase and three phase electrical power supply – delta, star and T connection – house wiring – switch board wiring – fan regulator connection – stair case switch connection fuse fixing – to attend to faults in a tube light circuit – to attend to flat iron connection(simple and automatic) – eliminator testing – multimeter – tester usage – lighting arrestor.

REFERENCE BOOKS:

1. Electricity & Magnetism : Brijlal & Subramaniam, S. Chand & Co. (2002).
2. Electrical technology : Theraja S. Chand & Co. (2002).
3. How things Work Vol 1 & Vol 2: Harper Collins Publ. India a joint venture with The India Today Group, N. Delhi, (2002).

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Course	**:**	**B.Sc. Physics**	**Code :**	**SBE(4)**
Semester	**:**	**II**	**No. of hrs. allotted :**	**2**
Paper	**:**	**Skill Based Elective**	**No. of credits :**	**2**

BIOPHYSICS PRACTICALS - II

Course Objectives :

i. To enable students interpret ECG, EEG.
ii. To interpret X-ray photographs of single and poly crystalline samples.
iii. To estimate the

1. E.C.G. (Demonstration & interpretation)
2. Interpretation of X-ray Photographs
3. Interpretation of ultra sonograms
4. Interpretation of EEG
5. Estimation of DNA by Diphenylamine method
6. Estimation of RNA by oricinol method.
7. Draw V-I characteristics of the given protein samples and determine electrical resistivity of the samples.
8. Determine dielectric parameters such as Dielectric constant, dissipation factor and Dielectric loss of the given protein samples using LCR meter.
9. Determine *relative viscosity, specific viscosity* and *intrinsic viscosity* of the given polymer solution using Ostwald viscometer. From the viscometric data, calculate the molecular weight of the given polymer.
10. Determination of unit cell dimension from X-ray photograph of some single crystal amino acid complexes.
11. Interpretation of powder x-ray pattern.

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Course	**:**	**B.Sc. Physics**	**Code :**	**MP31**
Semester	**:**	**III**	**No. of hrs. allotted :**	**4**
Paper	**:**	**Core**	**No. of credits :**	**4**

PROGRAMMING IN 'C'

Course Objectives :

i. To introduce to the students ,one of the fastest growing, versatile and much sought after language-C
ii. To explain the fundamentals of the language in a simple and lucid way.
iii. To inspire the students to delve into problem solving by the exercises at the end of the chapter

UNIT I INTRODUCTION (8 HRS)

Feature of C language – Form of C program – Key words – Operating systems Character set – Constants – Data types – Operations – Different types – Expression – scanf ( ) – printf ( ) – Functions.

UNIT II CONTROL STATEMENTS (10 HRS)

If statement – Various types – Nested Ifs – Looping – Break statement – Continue statement – Exit function- Switch statement – GOTO statement – Arrays – One dimensional – Two dimensional – Multidimensional

UNIT III FUNCTIONS (12 HRS)

C function – Return function – Calling a function – Different methods – Nesting functions – Recursion – Functions with arrays – Storage class - Modifiers – Different specifiers – Character declaration – Reading of strings – Writing strings – String handling functions – Array of strings

UNIT IV POINTERS AND STRUCTURE (12 HRS)

Pointers – Pointers use in arithmetic operator – Pointers and arrays – Pointers And arrays – Pointers and character strings – Structures – Initialization – Arrays and structures – Nested structures – Structures and functions – Structure and pointers – Comparison ofstructure variable – Unions – Bitfield – Typedef – Enumerated data type.

UNIT V FILES & OPERATION (18 HRS)

Preprocessor - # define – File inclusion – Operation – fopen – fclose – I/O Operations on files – Random file – Command line arguments – Low level Copy.

CASE STUDIES

1. Program to print first 100 prime numbers
2. Program to find arithmetic & standard deviations
3. Program to find Inverse of a matrix
4. Program to solve simultaneous equations
5. Program to find A.M.,G.M.,& H.M. of given 'n' numbers
6. Program to find factorial by recursion technique
7. Program to find and replace a string
8. Program to add 2 X 2 matrices by using pointer method
9. Program to print max. marks in each subject along with name of students by using structure method
10. Programs to illustrate the use of fprintf ( ) & fscanf ( )
11. Program for Random file organization
12. Program to implement command line arguments

TEXT BOOK:

P. RADHA GANESAN *& Ramasamy* , Programming in C, Scitech Publications, 2003.

[Unit I : Pages 1 –26 ; Unit II : Pages 27 – 45, 55 – 67 ; Unit III: Pages 84 –100, 108 – 120 ;

Unit IV : Pages 132 – 141, 148 – 162 ; Unit V: Pages 166 – 190]

CASE STUDIES

1) Page 53
2) Page 70
3) Page 78
4) Page 79
5) Page 80
6) Page 92
7) Page 123
8) Page 144
9) Page 163
10) Page 176 and 177
11) Page 182
12) Page 183

REFERENCE BOOKS:

1. E. BALAGURUSAMY, *Programming in ANSIC* (2nd Ed.), TMH Publications.
2. D. Ravichandran, *Programming in C*, New Age International Publications.

THIAGARAJAR COLLEGE – AUTONOMOUS, MADURAI – 625 009
(Re Accredited With 'A' Grade by NAAC)
DEPARTMENT OF PHYSICS
(From 2011 – 14 batch onwards)

Course	**:**	**B.Sc. Physics**	**Code :**	**EMP31(M)**
Semester	**:**	**III**	**No. of hrs. allotted :**	**4**
Paper	**:**	**Core Elective**	**No. of credits :**	**4**

MODERN OPTICS

Course Objectives :

- To provide a broad overview of the various optical instruments.
- An introduction to laser and the basis of holography is given.
- An emphasis is given to the fibre optics and nonlinear optical phenomena**.**

UNIT I: OPTICAL INSTRUMENTS (15 Hours)

The Eye – Camera – Size of an object – The Simple Magnifier – Field of view – Stops and Pupils – Objective and Eyepiece – Huygen's Eyepiece – Ramsden Eyepiece – Comparison of Ramsden Eyepiece with Huygen's Eyepiece – Compound Microscope – Telescopes – Reflecting Telescope – Constant Deviation Spectrometer – Abbe Refractrometer.

UNIT II: LASERS (10 Hours)

Attenuation of light in an optical medium – thermal equilibrium – Interaction of light with matter – Einstein`s relations-Light Amplification- Population inversion – Active medium – Pumping – Metastable states –Principal pumping schemes – Optical resonant cavity-Axial modes-Types of lasers – Ruby, He-Ne, CO_2 Laser – Laser beam characteristics-Applications.

UNIT III: HOLOGRAPHY (8 Hours)

Introduction - Principle of holography – Theory- Important properties of a hologram – Advances -Applications.

UNIT IV: FIBRE OPTICS (15 Hours)

Introduction – Optical Fiber – Critical Angle of Propagation – Modes of Propagation – Acceptance Angle – Fractional Refractive index change – Numerical Aperture – Types of Optical Fibers – Normalized Frequency – Pulse Dispersion – Attenuation – Applications – Fiber Optic Communication Systems – Advantages.

UNIT V: NON – LINEAR OPTICS (12 Hours)

Introduction – Wave Propagation and Momentum Conservation – Linear Medium – Nonlinear Polarization – Second Harmonic Generation – Phase Matching – Sum and Difference Frequency Generation – Parametric Oscillation – Self-Focussing of Light – Stimulated Raman Scattering.

TEXT BOOK:

N. Subrahmanyam, BrijLal & M.N. Avadhanulu; *A Text Book Of Optics, S*. CHAND, 2006 (ISBN:81-219-2611-4).

REFERENCE BOOK:

F.A. Jenkins, H.E. White, *Fundamentals Of Op*tics (4th Edition) Mcgraw- Hill Book Company,1981(ISBN:0-07-032330-5).

THIAGARAJAR COLLEGE – AUTONOMOUS, MADURAI – 625 009
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DEPARTMENT OF PHYSICS
(From 2011 – 14 batch onwards)

Course	**:**	**B.Sc. Physics**	**Code :**	**EMP31(M & A)**
Semester	**:**	**III**	**No. of hrs. allotted :**	**4**
Paper	**:**	**Elective**	**No. of credits :**	**4**

MATERIAL SCIENCE AND APPLIED PHYSICS

Course Objectives :

- To understand fundamentals of material science and engineering.
- A basic knowledge about biophysics, geophysics and astrophysics is provided.

MATERIAL SCIENCE

UNIT I INTRODUCTION

Material Science and engineering – Classification of engineering materials – Levels of structure – Structure-property relationships in materials. Fractures: Fractures in materials – Ductile fracture – Brittle fracture – Fracture toughness – The ductile-brittle transition – Methods of protection against fracture – Fatigue fracture .

UNIT II OXIDATION AND CORROSION

Oxidation and Corrosion – Mechanisms of oxidation – Oxidation resistant materials – The principles of corrosion – Protection against corrosion.

UNIT III MAGNETIC AND DIELECTRIC MATERIALS

Terminology and Classification – Magnetic moments due to electron spin – Ferromagnetism and related phenomena – The domain structure – The hysteresis loop – Soft magnetic materials – Hard magnetic materials – Polarization – Temperature and frequency effects – Electric breakdown – Ferroelectric materials.

APPLIED PHYSICS

UNIT IV BIOPHYSICS

The effects of size – conduction of nerve impulses – electrocardiographs & electro encephalographs – cardiac pace makers – electric shock – radioactive isotope as 'tracers' – medical uses of radiations – biological effects of radiation – radiation exposure.

UNIT V GEOPHYSICS

The structure of the atmossphere – circulation in the troposphere – cyclones & anticyclones – weather energies – the deeper – the hotter – Earth's interior – floating continents – terrestrial magnetism – fossil magnetism.

Astrophysics Inside the Sun – Energy production in the Sun – Solar fusion reactions – Sunspots & magnetism – the evolution of stars.

TEXT BOOKS:

MATERIAL SCIENCE:

1) Materials Science and Engineering (A First Course) IV Ed., V. Raghavan, PHI.
Unit I : Page (1 – 7); *Unit II* : Page (281-310); Page (363-392)

APPLIED PHYSICS:

2) Physics (Foundations & Frontiers) III Ed., Author:George Gamov & John M. Cleveland, PHI. *Unit III & IV* : Page (548-585);

REFERENCE BOOKS :

MATERIAL SCIENCE

1) Solid State Chemistry by N.B. Hannay. Prentice Hall of India Private Limited (1976).
2) Elements of Material Science & Engineering, by Lawrence H. John M. Cleveland, Prentice Hall of India Limited (1978).

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DEPARTMENT OF PHYSICS
(From 2011 – 14 batch onwards)

Course	**:**	**B.Sc. Physics**	**Code :**		**ENP31**
Semester	**:**	**III**	**No. of hrs. allotted :**		**2**
Paper	**:**	**Non Major Elective**	**No. of credits :**		**2**

ULTRASONIC NON-DESTRUCTIVE TESTING-I

Course Objectives:

i. To explain the basic principles of ultrasonics
ii. To provide a basic knowledge about non-destructive testing of materials

UNIT – I Ultrasonics

Classification of sound waves – Ultrasonic waves- Different modes of Ultrasonic waves- Characteristic properties of Ultrasonic waves- Attenuation of Ultrasonic waves- Production of Ultrasonic waves- Magnetostriction Method – Piezo-electric method- Application of Ultrasonic- industrial and Medical.

UNIT – II Ultrasonic Inspection Method

Direct method- Pulse echo method- Through transmission method- Time of Flight Diffraction method- Ultrasonic Flaw Detector- Data presentation A, B and C Scan display- standards and codes.

BOOKS FOR REFERENCE

1. Baldev Raj, V.Rajendran, P. Palanichamy Science and Technology of Ultrasonics, Narosa Publishing house, 2004

2. Baldevraj, Jeyakumar.T, Thavasimuthu.M, Practical Non- Destructive Testing, (3rd ed.) Narosa Publishing house, 2007.

THIAGARAJAR COLLEGE – AUTONOMOUS, MADURAI – 625 009
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DEPARTMENT OF PHYSICS
(From 2011 – 14 batch onwards)

Course : B.Sc. Physics **Code : MP41**

Semester : IV **No. of hrs. allotted : 4**

Paper : Core **No. of credits : 4**

ELECTRICITY AND MAGNETISM

Course Objectives :

i. To introduce to the students the basics of electricity and magnetism.
ii. To enhance the application skills by relating the phenomena of electricity and magnetism and daily activities.
iii. To inculcate in the students an aesthetic sense towards scientific happenings.

UNIT I: GAUSS'S LAW AND ITS APPLICATIONS

Flux of the electric field – Gauss's law – Differential form of Gauss's law – Applications of Gauss's law – Electric field due to a Uniformly charged sphere – an isolated uniformly charged conducting sphere – Uniform Infinite cylindrical charge – an infinite plane sheet of charge – two parallel sheets of charge – Coulomb's theorem .

UNIT II: ELECTRIC POTENTIAL

Electric Potential – Relation between Electric field and Electric potential – Potential at a point due to a uniformly charged conducting sphere – duo to a uniformly charged non conducting solid sphere – Potential and field due to an electric dipole – Electric Potential Energy . CAPACITANCE AND CAPACITORS

Introduction – Capacitance of a Spherical Capacitor - Outer Sphere Earthed – Inner Sphere Earthed – Cylindrical Capacitor – Parallel plate Capacitor – Effect of a Dielectric – Capacitors in Series and Parallel –Energy stored in a charged capacitor – Types of Capacitors.

UNIT III: CURRENT ELECTRICITY

Current and Current density Expression for current density – Equations of Continuity – Ohm's law and Electrical Conductivity - Kirchhoff's laws – Applications of Kirchhoff's laws to Wheatstone's network.

TRANSIENT CURRENTS

Growth of a current in a circuit containing a resistance and inductance – Decay of current in a circuit containing L and R – Charge and Discharge of a Capacitor through R – Measurement of High resistance by leakage – Growth of charge in LCR Circuit – Decay of charge in LCR circuit.

ALTERNATING CURRENTS

EMF induced in a coil rotating in a magnetic field – Peak, average and RMS values of Voltage and current – Series and Parallel resonant circuits – Power in an A.C. circuit – Wattless current – Choke coil – The transformer.

UNIT IV: MAGNETIC PROPERTIES OF MATERIALS

Magnetic induction – magnetization – Relation between the three magnetic vectors - Susceptibility, permeability – Properties of Dia, Para, Ferro magnetic materials – The Electron theory of Magnetism – Langevin's theory of Dia, Para magnetism – Weiss theory of Ferro Magnetism – Experiment to draw B-H Curve – Energy loss due to Hysteresis.

UNIT V: MAGNETOSTATICS

Magnetic vector potential – Magnetic field for a long straight current carrying wire – magnetic scalar potential – application of magnetic scalar potential: Equivalence of a small current loop and a magnetic dipole – Electric field vector in terms of scalar and vector potentials – Magnetic shell – Potential at any point due to a magnetic shell – Magnetic potential and field at a point on the axis of a flat circular magnetic shell – Equivalence of magnetic shell and current circuit – The Hall effect.

TEXT BOOK:

R.MURUGESHAN, *Electricity and Magnetism*, (3rd ed.), S.Chand & Company Ltd, New Delhi, 2001.

REFERENCE BOOK:

1. A.F. KIP, *Fundamentals of Electricity and Magnetism* (2nd ed.), McGraw-Hill, New York, 1969.
2. E.M. Purcell, Electricity and Magnetism (2nd ed.), McGraw-Hill, New York, 1984.

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DEPARTMENT OF PHYSICS
(From 2011 – 14 batch onwards)

Course : B.Sc. Physics **Code : EMP41(N)**

Semester : IV **No. of hrs. allotted : 4**

Paper : Elective **No. of credits : 4**

NON-CONVENTIONAL ENERGY SOURCES

Course Objectives :

i. To create an awareness among students about the growing energy needs, the conventional and non conventional sources of energy and the methods of proper utilization.

ii. To explain to the students the role of sun as a repository of energy and the methods of harnessing it.

iii. To help students visualize the concept of "waste" as an alternative to meet the growing demands for energy.

UNIT-I INTRODUCTION TO ENERGY SOURCES

Energy consumption as a measure of prosperity – World Energy Futures – Energy sources and their availability – Conventional Energy Sources – Non-Conventional Energy Sources.

UNIT-II SOLAR RADIATION AND ENERGY CONVERSION

Solar radiation outside the earth atmosphere – Solar radiation at the Earth's surface – Instrument for measuring solar radiation and sunshine. Physical principles of the conversion of solar radiation into heat – Flat plate collectors – Transmissivity of cover system – Energy balance and collector efficiency.

UNIT-III SOLAR CONCENTRATING COLLECTORS AND ENERGY STORAGE

Focusing Type – parabolic Type – non-focusing type – compound parabolic concentration – Performance analysis of a cylindrical parabolic concentrating collector – Selective absorber coating – Solar Energy Storage Systems – Solar pond.

UNIT-IV BIO-MASS ENERGY

Introduction – Biomass conversion Technologies – Biogas generation – Classification and Types of Biogas plants. Gasification of Biomass – Gasifier – Types of Gasifiers – Application of Gasifiers.

UNIT-V ENERGY CONSERVATION

An Economic concept of Energy – Principles of Energy conservation and Energy Audit – Energy Conservation Approach and Technologies – Co-generation – waste-heat utilization – Heat Exchanges – Heat Regenerators – Heat pipes.

TEXT BOOK:

Non-conventional Energy Sources – G.D. Rai, Khanna Publishers, 1997, First Reprint, Delhi.

REFERENCE BOOK:

Solar Energy – Principles of Thermal Collection and Energy Storage – S.P. Sukhatme TMH, 1997, Second Reprint New Delhi.

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DEPARTMENT OF PHYSICS
(From 2011 – 14 batch onwards)

Course	**:**	**B.Sc. Physics**	**Code :**	**EMP41(NM)**
Semester	**:**	**IV**	**No. of hrs. allotted :**	**4**
Paper	**:**	**Elective**	**No. of credits :**	**4**

NUMERICAL METHODS

Course Objectives :

i. To discuss in detail the various numerical methods used to solve differential equations.
ii. To introduce to the students the importance of extrapolation and intrapolation.
iii. To inculcate in the students problem solving skills and to discuss the association between mathematics and physics.

UNIT–I ITERATIVE METHODS

Newton-Raphson Iterative method – Secant method – Successive Approximations – Solutions of simultaneous algebraic equations – Gauss Elimination method – Gauss Seidal Iterative method – Curve Fitting for a straight line, parabola and exponential curves.

UNIT-II NUMERICAL DIFFERENTIATION

Newton's formula – Forward backward – Gauss's forward – backward interpolation formula – Bessel's ;formula - Lagrange's interpolation formula

UNIT-III NUMERICAL INTEGRATION

Trapezoidal rule – Simpson's $1/3^{rd}$ and $3/8^{th}$ rules – Euler's method – Modified Euler's method – Runge Kutta method II – Second order and Fourth order.

UNIT-IV INTERPOLATION

Linear interpolation – Gregory-Newton forward interpolation formula – Gregory Newton backward Interpolation Formula – Central Difference Interpolation formula – Gauss's forward interpolation formula (unequal intervals) - Gauss's backward interpolation formula (unequal intervals).

UNIT–V NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS

Power series approximation – Pointwise method – Solution by Taylor series - Taylor series method for simultaneous first order differential equations – Taylor series method for second order differential equations – Picard's method of successive approximations – Euler's Method.

TEXT BOOK :

Numerical Methods: P. Kandasamy, K. Thilagavathy, K. Gunavathy, S. Chand & Company 2003.

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DEPARTMENT OF PHYSICS
(From 2011 – 14 batch onwards)

Course	**:**	**B.Sc. Physics**	**Code :**	**ENMP41**
Semester	**:**	**IV**	**No. of hrs. allotted :**	**2**
Paper	**:**	**Non-Major Elective**	**No. of credits :**	**2**

ULTRASONIC NON – DESTRUCTIVE TESTING-II

UNIT – I LIQUID PENETRANT TEST

Physical Principles – Procedure for Penetrant testing - Penetrant testing materials - Penetrant test methods – Water washable method – Post emulsifiable Method – Solvent removal method – Application and limitations.

UNIT – II RADIOGRAPHY

Basic Principle – X-ray source generation and properties – radiation attenuation in the specimen – Radiograpic imaging – Geometrical factors – Radiographic films – Penetrameters – Inspection technique – Single wall single image- Double wall penetration technique.

BOOKS FOR REFERENCE

Baldevraj, Jeyakumar.T, Thavasimuthu.M, Practical Non- Destructive Testing, (3rd ed.) Narosa Publishing house, 2007.

THIAGARAJAR COLLEGE – AUTONOMOUS, MADURAI – 625 009
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DEPARTMENT OF PHYSICS
(From 2011 – 14 batch onwards)

Course	**:**	**B.Sc. Physics**	**Code :**	**MP51**
Semester	**:**	**V**	**No. of hrs. allotted :**	**5**
Paper	**:**	**Core**	**No. of credits :**	**4**

ELEMENTARY SOLID STATE PHYSICS

Course Objectives:

i. To help students understand the principles of condensed matter at the atomic level.
ii. To provide an insight into the electronic structure of solids especially metals, semiconductors and dielectrics.
iii. To provide insights on newer topics viz. superconductivity, magnetic properties of materials and the physics of semiconductors

CRYSTAL PHYSICS

UNIT I CRYSTAL PHYSICS – I (12 HRS)

Crystal Physics Lattice Points and Space Lattice – The Basis and Crystal Structure – Unit cells and Lattice parameters – Unit Cells versus Primitive cells – Crystal Systems – Crystal symmetry – Twenty three Symmetry elements in a Cubic Crystal – Five fold rotation axis is not compatible with a Lattice – Combination of Symmetry elements – Rotation-Inversion axis – Translation symmetry Elements – Space Groups – The Bravais Space Lattices – Metallic Crystal Structures – Relation Between the Density of Crystal Material and Lattice constant in a Cubic Lattice.

UNIT II CRYSTAL PHYSICS – II (12 HRS)

Other Cubic Structures Directions, Planes and Miller Indices – Important Features of Miller indices of Crystal Planes – Important planes and Directions in a Cubic crystal – Distribution of Atoms in the Atomic Planes of a Simple Cubic Crystal – Separation Between Lattice planes in a Cubic crystal – Allotrophy and Polymorphism – Imperfections in Crystals – Reciprocal Lattice.

Wave Nature of Matter and X-ray Diffraction The de Broglie Hypothesis – Relativistic Correction – experimental Study of Matter Waves – The Davisson-Germer Experiment – Heissenberg's Uncertainity Principle – X-ray Diffraction – Bragg's Law – Bragg's X-ray Spectrometer – Powder Crystal Method – Rotating Crystal Method – Correction for Bragg's Equation.

SUPER CONDUCTOR

UNIT III SUPERCONDUCTIVITY (10 HRS)

A survey of superconductivity – Mechanism of super conductors – Effects of magnetic field A.C. Resistivity – Critical currents – Flux exclusion – The meissner effect – Thermal properties – The Energy Gap – Isotpe Effect – Mechanical Effects – The Penetration Depth – Type I and Type II Superconductors – London equations – Electrodynamics – superconductors in A.C. Fields – Thermodynamics of Superconductors – A survey of B.C.S. Theory – B.C.S. Theory – Quantum Tunneling – Josephson's Tunneling – Theory of D.C. Josephson Effect – New Super conductors – Applications.

MATERIALS SCIENCE

UNIT IV FRACTURES, OXIDATION AND CORROSION (14 HRS)

Fractures in materials – Ductile fracture – Brittle fracture – Fracture toughness – The ductile-brittle transition – Methods of protection against fracture – Fatigue fracture – Oxidation and Corrosion – Mechanisms of oxidation – Oxidation resistant materials – The principles of corrosion – Protection against corrosion.

UNIT V MAGNETIC AND DIELECTRIC MATERIALS (12 HRS)

Terminology and Classification – Magnetic moments due to electron spin – Ferromagnetism and related phenomena – The domain structure – The hysteresis loop – Soft magnetic materials – Hard magnetic materials – Polarization – Temperature and frequency effects – Electric breakdown – Ferroelectric materials.

TEXT BOOKS:

1. S.O. PILLAI, *Solid State Physics* – (4th Ed.), New Age International Publisher, 1997, (ISBN:81-224-1048-0).

2. V. RAGHAVAN, *Materials Science and Engineering – A First Course* (4th Ed.), Prentice-Hall of India, 2003 (ISBN:81-203-1261-9)

BOOKS FOR REFERENCE

1. N.B. HANNAY, *Solid State Chemistry*, Prentice Hall of India Private Limited, 1976.

2. N. ARUMUGAM, *Materials Science* (3rd Ed.), Anuradha Agencies, 2002.

THIAGARAJAR COLLEGE – AUTONOMOUS, MADURAI – 625 009
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DEPARTMENT OF PHYSICS
(From 2011 – 14 batch onwards)

Course	**:**	**B.Sc. Physics**	**Code :**	**MP52**
Semester	**:**	**V**	**No. of hrs. allotted :**	**5**
Paper	**:**	**Core**	**No. of credits :**	**4**

Analog Electronics

Course Objective

To provide the fundamental aspects regarding the design of analog electronic circuits for various applications.

Unit I Semiconductor diodes and hybrid parameters (11 hrs)

Semiconductor diode- crystal diode- rectifiers-half and full –wave rectifiers-bridge rectifier-efficiency-ripple factor- filter circuits-Zener diode-crystal diode versus vacuum diode-hybrid parameters- determination of h parameters-transistor circuit performance in h parameters-experimental determination of h parameters-limitations of h parameters.

Unit II Transistor and transistor biasing (12 hrs)

Transistor action-CB, CE & CC modes-comparison-amplifier in CE arrangement-load line analysis-cut-off and saturation-power rating-application of CB amplifier-faithful amplification-transistor biasing-various methods of transistor biasing: base resistor, feedback resistor, voltage divider methods-instantaneous current and voltage wave forms.

Unit III Transistor voltage amplifiers (12)

Single stage amplifier-graphical demonstration-practical circuit-phase reversal-DC & AC equivalent circuits-load line analysis-voltage gain- input impedance of CE amplifier-classification of amplifiers-multistage transistor amplifier-RC, transformer and direct coupled amplifiers-comparison of different types of coupling-difference between transistor and tube amplifier.

Unit IV Transistor audio power amplifiers(15)

Transistor audio power amplifier-small signal and large signal amplifiers-difference between voltage and power amplifiers-performance quantities and classification of power amplifiers-expression for collector efficiency-maximum collector efficiency of class A amplifiers-thermal runaway- heat sink-push-pull amplifier-maximum efficiency for class B power amplifier.

Feedback in amplifiers

Feedback-principles and advantages of negative voltage feedback-gain of negative voltage feedback amplifier- principles of negative current feedback- current gain-effects of negative current feedback-emitter follower- D.C. analysis, voltage gain, input & output impedances and applications of emitter follower.

Unit V Oscillators (10)

Sinusoidal oscillator and its types-oscillatory circuit-positive feedback amplifier-essentials of transistor oscillator-Barkhausen criterion-types of transistor oscillators-tuned collector, Colpitt's, Hartley, Wien bridge and phase shift oscillators- limitations of LC and RC oscillators-transistor crystal oscillator.

Modulation and demodulation

Modulation-types of modulation-amplitude modulation-modulation factor- sideband frequencies in AM wave- transistor AM modulator-limitations of amplitude modulation-frequency modulation-theory of FM-comparison of FM AND AM- demodulation-essentials in demodulation-AM diode detector-types of AM radio receivers-stages of superhetrodyne radio receiver-FM receiver.

Text book

1. V. K. Mehta, R. Mehta, Principles of electronics, 11th ed., S. Chand & Co., New Delhi.

Reference books

1. D. A. Bell, Electronic devices and circuits, 4th ed., Prentice-Hall of India, New Delhi.
2. A. Malvino, D. J. Bates, Electronic principles, 7th ed., Tata McGraw-hill publishing Co. Ltd., New Delhi.

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DEPARTMENT OF PHYSICS
(From 2011 – 14 batch onwards)

Course	**:**	**B.Sc. Physics**	**Code :**	**MP53**
Semester	**:**	**V**	**No. of hrs. allotted :**	**5**
Paper	**:**	**Core**	**No. of credits :**	**4**

MODERN PHYSICS

Course Objectives :

- To develop in the students a sense of critical appreciation of the theory of relativity and to introduce to them the basic concepts of quantum mechanics.
- To help students differentiate between the atomic theory and nuclear physics.
- To impart to the students the know hows of radioactivity and the pros and cons behind it.

UNIT – I SPECIAL THEORY OF RELATIVITY

Galilean transformations – Electromagnetism and Galilean transformations – Michelson Morley experiment – Postulates of special theory of relativity – Lorentz transformations – Velocity transformation – Length contraction – Time dilation – Simultaneity – Relativistic mass – Mass and Energy – Space-Time diagrams – General relativity.

UNIT – II WAVE MECHANICAL CONCEPTS & GENERAL PRINCIPLES OF QUANTUM MECHANICS

de Broglie hypothesis – The Davisson-Germer experiment – Standing wave of an electron in a circular orbit – The Heissenberg's uncertainity principle – Some applications of uncertainity principle – Wave packets – Phase velocity and group velocity – Time-dependent Schrodinger equation – Physical interpretation of the wave function – Free particle in one dimension – Particle in an infinite square well – Particle in a box – The Barrier potential – Simple harmonic oscillator.

UNIT – III ATOMIC PHYSICS

Hydrogen atom spectrum – Orbital magnetic moment of hydrogen atom – Larmor precession – Stern-Gerlach experiment – Electron spin – The vector atom model – Spin-Orbit interaction and fine structure – Pauli's exclusion principle and electronic configuration – Total angular momentum in many electron atoms – Normal Zeeman effect – Anomalous Zeeman effect – Paschen-Bach effect – Stark effect.

UNIT – IV NUCLEAR PROPERTIES AND NUCLEAR REACTIONS, DETECTORS AND ACCELERATORS

Constituents of nuclei – Nuclear size – Binding energy – Angular momentum of the nucleus – magnetic moment – Nuclear quadrupole moment – Parity – General features of Nuclear forces – Nuclear reactions – Nuclear reaction kinetics – Reaction mechanisms – Nuclear Fission – Fission reactor – Nuclear fusion – Transuranium elements – Geiger-Muller Counter – Scintillation Counter – The Cloud Chamber – The Bubble Chamber – Cyclotron – Synchrotron – Linear Accelerator.

UNIT – V RADIOACTIVE DECAY AND ELEMENTARY PARTICLES

Discovery of radioactivity – Rate of decay, half-life and mean life – Conservation laws in radioactive decays – Decay series – Radioactive equilibrium – Radioactive dating – Alpha decay – Beta decay – Gamma decay – Radioisotopes – Fundamental interactions in nature – Dawn of elementary particle physics – Particles and antiparticles – Classification of elementary particles.

TEXT BOOK:

Modern Physics, G. ARULDHAS AND P. RAJAGOPAL, PHI Learning Private Limited, New Delhi, 2009.

BOOKS FOR REFERENCE :

1. *Modern Physics* (9th ed), N.K.Sehgal, K.L.Chopra & D.L.Sehgal, S.Chand & Sons, New Delhi, 2004.
2. *Concepts of Modern Physics* (6th ed.), McGraw Hill, New York, 2003.

THIAGARAJAR COLLEGE – AUTONOMOUS, MADURAI – 625 009
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DEPARTMENT OF PHYSICS
(From 2011 – 14 batch onwards)

Course	**:**	**B.Sc. Physics**	**Code :**	**EMP51(E)**
Semester	**:**	**V**	**No. of hrs. allotted :**	**3**
Paper	**:**	**Elective**	**No. of credits :**	**3**

EXPERIMENTAL DESIGN

Course Objectives :

- To know about the error analysis in measurement.
- To get the knowledge about various types of instruments and their design.
- To aware of radiation safety while in measurement.

UNIT I: PHYSICAL MEASUREMENT

Measurement-result of a measurement-sources of uncertainty and experimental error-systematic error-random error-definition of uncertainty-analysis of repeated measurements-mathematical description of data distribution functions-derivation and properties of distribution functions-propagation error-analysis of data-multiparameter experiments.

UNIT II: INSTRUMENTATION AND SYSTEM DESIGN

Experiment design-transducers-transducer characteristics-selection of an instrumentation transducer-transducer as an electrical element-modeling external circuit components-circuit calculations-instrument probes-power measurements-measurement methods-DC and AC bridge measurements.

UNIT III: TRANSDUCER PROPERTIES

Temperature measurements –definition of temperature –temperature transducers-thermal radiation temperature measurements-low temperature thermometry-optical measurements and the electromagnetic spectrum-linear position sensors-summary and conclusions.

UNIT IV: OPTICAL INSTRUMENTS

Spectroscopic instruments-visible and infra red spectroscopy-spectrometer design-refraction and diffraction –lenses and refractive optics-dispersive elements-spectrometer design-Lasers –Fibre optics.

UNIT V: RADIATION DETECTION,MEASUREMENT AND SAFETY

General principles of radiation detection –types of radiation detectors-radiation dose-occupational health and safety-chemical substances –radiation safety.

TEXT BOOK:

Measurement,Instrumentation and experiment design in physics and engineering,Sayer,M. &Mansingh,A. PHI,2005,ISBN:81-203-1269-4.

THIAGARAJAR COLLEGE – AUTONOMOUS, MADURAI – 625 009
(Re Accredited With 'A' Grade by NAAC)
DEPARTMENT OF PHYSICS
(From 2011 – 14 batch onwards)

Course	**:**	**B.Sc. Physics**	**Code**	**:**	**EMP51(O)**
Semester	**:**	**V**	**No. of hrs. allotted**	**:**	**3**
Paper	**:**	**Elective**	**No. of credits**	**:**	**3**

OPTICAL FIBRES AND COMMUNICATION SYSTEMS

Course Objectives

- To discuss the role played by optical fibers in conquering distance and time.
- To enable the students understand the various classification of optical fibres and the losses encountered while sending signals.
- To elaborate to the students the various sources, detectors and the fibre optic sensors used.

UNIT I INTRODUCTION TO OPTICAL FIBRES

What are optical fibres? –Importance-Generation of telephone system and optical fibre-Propagation of light in different media-Propagation of light in an optical fibre-Basic structure and optical path of an optcal fibre-Acceptance angle and acceptance cone-Numerical aperture(NA)-Modes of propagation-Meridional and skew rays-Number of modes and cutoff parameters of fibres-Single mode propagation-Comparison of step and graded index fibres-Application of fibres.

UNIT II CLASSIFICATION OF OPTICAL FIBRES

Fibres-Classification of stepped index fibre-Stepped index monomode fibre-Disadvantages of monomode fibre-Graded index monomode fibre-Plastic fibres-Other latest developed types of fibres-Mechanism of refractive index variation-Fibre strength-Mechanical strength measurement of optical fibres.

UNIT III FIBRE LOSSES

Attenuation in optic fibres-Material or impurity losses-Rayleigh scattering losses-Absorption losses-Leaky modes-Bending losses-Radiation induced losses-Inherent defect losses-Inverse square law losses-Transmission losses-Temperature dependence of fibre losses-Core and cladding losses.

UNIT IV DISPERSION IN OPTICAL FIBRES

Electrical vs optical bandwidth-Bandwidth length product-Dispersion in an optical fibre-Intermodal dispersion-Mixing of modes-Material chromatic dispersion-Waveguide dispersion-Dispersion power penalty-Total dispersion delay-Maximum transmission rate-Dispersion shifted fibres

UNIT V OPTICAL FIBRE SOURCES, DETECTORS AND TYPES OF FIBRE OPTIC SENSORS

SOURCES

Introduction-LED-Laser-Light emitting transistor-Organic LEDs-Power efficiency-OLED: structure and operation-Quantum efficiency.

PHOTODETECTORS

Introduction-Characteristic of photo-detectors-Photoemissive photo-detectors-Photoconductive devices-Photo voltaic devices-PN junction photo-detector-Pin photodiode-Avalanche photo diode-Photo transistor-bit error rate(BER).

SENSORS

Introduction-Fibre optic sensors-Intensity modulated sensors-Liquid level type hybrid sensor-Diffraction grating sensors-Sensors using single mode fibre-Interferometric sensor-Polarisation problem in interferometric sensor using SMF-Medical applications of fibre sensors-Fibre optic gyroscopes-Vibrations and displacement measurement sensors-Rotary position sensor-Linear position measuring sensor-Liquid level sensor-Acceleration measuring sensor-Multiplexing and distributed sensing.

TEXT BOOK

***Dr.Subir Kumar Sarkar*: OPTICAL FIBRES AND FIBRE OPTIC COMMUNICATION SYSTEMS**. S.CHAND &COMPANY LTD.(ISBN:81-219-1459-0)

BOOKS FOR REFERENCE:

1. ***John Crisp*: INTRODUCTION TO FIBRE OPTICS**
II EDITION (ISBN: 07506-50303)
2. ***Gerd Keiser*: OPTICAL FIBRE COMMUNICATION**
III edition-Mc Graw Hill Co. (ISBN: 07-232101-6)

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DEPARTMENT OF PHYSICS
(From 2011 – 14 batch onwards)

Course	**:**	**B.Sc. Physics**	**Code :**	**ESP51(E)**
Semester	**:**	**V**	**No. of hrs. allotted :**	**2**
Paper	**:**	**Skill Based Elective**	**No. of credits :**	**2**

ENVIRONMENTAL PHYSICS – I

Course Objectives :

i. To create awareness among students about the environment they live in and the physical principles involved.

ii. To describe the various forms of renewable energy and their uses.

iii. To interpret the factors that influence the earth's atmosphere and discuss the effect on climate changes.

UNIT – I RENEWABLE ENERGY

Renewable sources : Hydroelectric power and potential energy – Wind power – Tides and tidal power – Energy in waves and wave power – Photovoltaics – Energy storage – Energy use in transport : Energy efficiency in different transport modes – Comparison of specific energy use – Electric vehicles – Energy in the biosphere – Photosynthesis – Trophic levels – Other biological energy sources – Biomass energy

UNIT – II EARTH'S ATMOSPHERE AND CLIMATE

The atmosphere – General circulation of the atmosphere – Weather disturbances – Clouds – Ocean currents – Microclimates – The ozone layer – Climate change : The Earth's radiative balance, albedo and the 'greenhouse effect' – Greenhouse gases and greenhouse warming potentials – Greenhouse warming, feedbacks and climate impacts – Ice ages and colder climates? – Sea level – Climate modeling – Validation of models of climate change

TEXT BOOK

Smith, C. : Environmental Physics, Routledge, Taylor and Francis Group, London & New York, 2001

BOOKS FOR REFERENCE

1. Boeker, E. & van Grondelle, R. : Environmental Physics (2nd ed.), John Wiley & Sons, Chichester, 1999.
2. Guyot, G.: Physics of the Environment and Climate, John Wiley & Sons, Chichester, 1999.

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DEPARTMENT OF PHYSICS
(From 2011 – 14 batch onwards)

Course	**:**	**B.Sc. Physics**	**Code :**	**ESP51(M)**
Semester	**:**	**V**	**No. of hrs. allotted :**	**2**
Paper	**:**	**Skill Based Elective**	**No. of credits :**	**2**

MATHEMATICAL PHYSICS

COURSE OBJECTIVES:

- To discuss in detail the concept of div, curl and gradient.
- To enable the students to understand the concept of eigen vectors and eigen values.
- To enhance the mathematical skill of students by indulging them in problem solving.

UNIT – I VECTOR ANALYSIS AND CURVED COORDIANTES

Curvilinear Coordinates – Circular, Cylindrical and Spherical Polar Coordinate system – Gradient, Divergence and Curl in Cylindrical and Polar Coordinates**.**

UNIT – II SPECIAL MATRICES

Diagnol – Triangular – Symmetric and antisymmetric – Orthogonal – Hermitian, Skew Hermitian - Unitary Matrices. Eigen vectors and Eigen Values – Diagnoalisation of Matrices.

TEXT BOOK

Mathematical Physics (II ed.) Gupta, B.D : Vikas Publishing House, New Delhi, 1993.

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DEPARTMENT OF PHYSICS
(From 2011 – 14 batch onwards)

Course	**:**	**B.Sc. Physics**	**Code**	**:**	
Semester	**:**	**V**	**No. of hrs. allotted**	**:**	**2**
Paper	**:**	**Self-study**	**No. of credits**	**:**	**2**

VISUAL ASTRONOMY

Course Objectives :

i. To popularise Astronomy as a healthy hobby among students of all disciplines
ii. To identify the summer and winter constellations and record preliminary data on the movement of stars and planets
iii. To appreciate the night sky and understand the celestial phenomena with the help of naked eye observations

UNIT – I INTRODUCTION TO THE SKY

Star names – Astronomical Catalogues – Understanding Magnitudes – Seeing colour in the sky – Dark adaptation – Averted versus direct vision – Finding your way around the Sky – Apparent sizes and distances – Astronomical distances – Time in astronomy- How dark is your sky ? – Part under the Stars.

UNIT – II CHOOSING THE RIGHT EQUIPMENT AND VIEWING THE NAKED EYE SKY

Naked eye, Binocular or a telescope? - Binoculars – Types of telescope – Trick the light fantastics – Telescope mounts – Eye Pieces - Filters – Other accessories – Atmospheric effects on sun light – Sunrise & Sunsets – Conjunctions –Constellations and Asterisms – Auroral lights – meteors and fire balls – Treats of the zodiacs – The Milky way.

UNIT – III EXPLORE THE WINTER, SPRING SKIES

Learn the winter Constellation – Discovers the jewels in Taurus – Survey the wonders in orion – View the gems in Gemini – learn the Spring Constellation – View the Marvels in Leo – Scan the delights in Ursa Major – Go galaxy – Hunting in Virgo.

UNIT – IV EXPLORE THE SUMMER AND SKIES

Learn the Summer Constellation – Spy the glittering clusters in Scorpius – Encounter the Milkyway in Saggitarius – Survey bright gas clouds in Cygnus - Learn the Autumn Constellation – Detect a kings fortune in Cebheus – Observe Milkyway riches in Cassiopeia - Spot a grand galaxy in Andromeda

UNIT – V RECORD THE SKY

Sketch the Sky – Photograph the Sky – The 88 Constellations – The 25 Brightest star.

TEXT BOOK

Talcott, R.: Teach yourself visually astronomy, Wiley Publishing, New Jersey, 2009.

BOOKS FOR REFERENCE

Bely, P.Y, Christian, C.& Roy, J. R. : A question and answer guide to astronomy, Cambridge University Press, New York, 2010.

Software aid: www.stellarium.org

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DEPARTMENT OF PHYSICS
(From 2011 – 14 batch onwards)

Course	**:**	**B.Sc. Physics**	**Code :**	**MP61**
Semester	**:**	**VI**	**No. of hrs. allotted :**	**5**
Paper	**:**	**Core**	**No. of credits :**	**4**

MOLECULAR SPECTROSCOPY

Course Objectives :

i. To provide an overview of the principles of rotation, vibration and symmetry of molecules.

ii. To expose the students to the principles of IR, FTIR, Raman, NMR, ESR and Laser spectroscopic methods

iii. To distinguish between the various spectroscopic techniques, their principles, applications advantages and disadvantages.

UNIT – I FUNDAMENTALS OF SPECTROSCOPY

Electromagnetic spectrum - Types of molecular energies – Different spectroscopic methods - Spectral line width – Absorption and emission of radiation – Einstein's coefficients – Lasers – Molecular Symmetry: Symmetry operations – Symmetry elements.

UNIT – II ROTATION OF MOLECULES

Classification of molecules – Interaction of radiation with rotating molecule – Rotational spectra of rigid diatomic molecules - Isotope effect in rotational spectra – Intensity of rotational lines – Nonrigid rotator – Vibrational excitation effect – Linear polyatomic molecules – Symmetric top molecules – Asymmetric top molecules – information derived from rotational spectra.

UNIT – III INFRARED SPECTROSCOPY

Vibrational energy of diatomic molecule – Infrared selection rules- vibrating diatomic molecule – Diatomic vibrating rotator – Vibrations of polyatomic molecules- rotation vibration spectra of polyatomic molecules – IR spectrophotometer – Sample handling techniques – Fourier transform infrared spectroscopy – Applications.

UNIT – IV RAMAN SCATTERING AND NUCLEAR MAGNETIC RESONANCE

Theory of Raman scattering – rotational Raman spectra – Vibrational Raman Spectra – Mutual exclusion principle - Raman spectrometer – sample handling techniques – Magnetic properties of nuclei – Resonance condition – NMR instrumentation – Additional experimentation techniques – Relaxation processes – Chemical Shift - NMR imaging.

UNIT – V ELECTRON SPIN RESONANCE AND LASER SPECTROSCOPY

Principle of ESR – ESR Spectrometer - Nonlinear optical effects – frequency generation by nonlinear optical techniques – sources of Laser spectroscopy – Supersonic beams and jet cooling – Hyper Raman effect – Stimulated Raman scattering – Inverse Raman scattering – Coherent anti-stoke's Raman scattering – Photoacoustic Raman scattering – Circular dichroism spectroscopy

TEXT BOOK

Aruldhas, G. : *Molecular Spectroscopy*, PHI Learning Private Limited, New Delhi, 2009.

BOOKS FOR REFERENCE

1. Graybeal, J.D. : *Molecular spectroscopy*, Mc Graw-Hill, New York, 1988.
2. Hollas, M: *Modern spectroscopy*, 4th ed., John Wiley, New York, 2004.
3. Randhwa, H.S.: *Modern Molecular spectroscopy*, Macmillan, New Delhi, 2003.
4. Straughn, R.P. and walker, S., *Spectroscopy*, *Vols.I, II & III*, Chapman and Hall, London,1976.

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DEPARTMENT OF PHYSICS
(From 2011 – 14 batch onwards)

Course	**:**	**B.Sc. Physics**	**Code :**		**MP62**
Semester	**:**	**VI**	**No. of hrs. allotted :**		**5**
Paper	**:**	**Core**	**No. of credits :**		**4**

INDUSTRIAL PHYSICS AND INSTRUMENTATION

Course Objectives :

i. To provide an understanding of the principles and characteristics of Diodes, ICs and FETs.
ii. To discuss the applications of the diodes, ICs and FETs as voltage regulators, amplifiers
iii. To understand the design and construction of inverters, converters and bridges and their applications

UNIT I: DIODES

Zener diode –Schottky diode-PIN diode –LED -7 segmnent display-Photo diode-Field Effect Transistor-Introduction –Junction Field Effect Transistor-Operation of JFET – Characteristics-Drain Characteristics –Transfer Characteristics –JFET parameters-MOSFETs-Depletion type MOSFET-working of a depletion type MOSFET- Drain Characteristics –Transfer Characteristics-Advantages.

UNIT II: INTEGRATED CIRCUITS AND REGULATORS

Integrated circuit-advantages of IC`s –limitations of IC`s –Scale of Integration – Classification of IC`s –Monolithic IC`s –Thick and thin film IC`s-comparision among different IC`s –Linear IC`s –Non linear IC`s –IC terminology-Fabrication of monolithic IC`s –Fabrication : IC components – Bipolar transistors- FET`s –JFET`s –Diodes-Resistors-Capacitors. Voltage Regulators-various types-Uses of Zener diode as regulator-Disadvantages –Uses of transistor as voltage regulators-short circuit protection-Three pin IC regulators-adjustable voltage regulator.

UNIT III: FET AMPLIFIERS

Introduction-biasing the FET and JFET-Gate Bias-Self Bias-Setting a Q-point –Setting a Q-point using DC load line-Voltage divider bias-Source Bias-Current source bias- Biasing: Enhancement type MOSFET`s –Depletion type MOSFET`s-Small signal: FET models-Low frequency FET models-high frequency FET model-FET amplifier-Common source Amplifier-analysis-effect of A.C. load on amplifier parameters-Effect of external source on voltage gain- common drain amplifier-analysis-common gate amplifier –analysis.

UNIT IV: CONVERTERS AND INVERTERS

Inverters – Introduction – working principle – Choppers – DC Chopper – Single thyristor chopper – Dual Converers – Single Phase converter – Three Phase converter – Cyclo converters – Introduction and types of cyclo converters – Photo electric devices – Introduction – LDR – LED – photovoltaic cells – Photo conductive celle – Transducers – Introduction – classification – Transducers in instrumentation and control systems – selection of transducers – Types of transducers.

UNIT V: BRIDGES

Wheatstone bridge – Kelvin bridge –AC bridges-Maxwell-Hay –Scherring bridges-Unbalance conditions-Wein bridge-AC Voltmeters using rectifiers-True RMS responding voltmeter-Electronic multimeter.

Textbook

1. R.S.SEDHA, A Textbook on Applied Electronics, S.Chand & Co.,
   [Unit I, P 195 – 215, 248 – 266, Unit II P 285 – 300, 327 – 345, Unit III p 538 - 563]
2. S.K.Bhattacharya& S.Chatterjee, Industrial Electronics and Control, Tata-McGraw Hill, Ltd.[Unit IV, P 216 – 218, 234 – 239, 245 – 248, 250 – 252, 416 – 422, 425 – 427, 438 – 445]
3. Helfrick & Cooper, Modern Electronic Instrumentation and Measuring Techniques, Prentice Hall of India,[Unit V, P 101 – 111, 114 – 127, 135 – 145]

THIAGARAJAR COLLEGE – AUTONOMOUS, MADURAI – 625 009

(Re Accredited With 'A' Grade by NAAC)
DEPARTMENT OF PHYSICS
(From 2011 – 14 batch onwards)

Course	**:**	**B.Sc. Physics**	**Code :**	**MP63**
Semester	**:**	**VI**	**No. of hrs. allotted :**	**5**
Paper	**:**	**Core**	**No. of credits :**	**4**

DIGITAL PRINCIPLES AND APPLICATIONS

Course Objective :

i. To impart to the students the basic principles, theory and working of fundamental digital circuits which form the basis of modern communication systems.

ii. To explain to the students the necessity behind digitalization and the revolutionary breakthroughs associate with it.

iii. To throw light on the impacts of the digital analogs of discrete components on space and time.

UNIT I DIGITAL PRINCIPLES & DIGITAL LOGIC (13 HRS)

Definition of Digital Signals – Digital Wave forms – Digital Logic – Moving & Storing – Digital Information – Digital operation- Digital Components – Digital ICs – Digital IC signal levels - Binary – Basic Gates – Boolean Algebra – Gates with bubbles – Positive & Negative Logic.

UNIT II COMBINATIONAL LOGIC CIRCUIT & DATA PROCESSING CIRCUIT (13 HRS)

Boolean Laws – Sum Of Products – Truth Table to Karnaugh Map - Karnaugh Map Simplification – Product Of Sum – Multiplexer – Decoder – Encoder – XOR Gates – Parity Generator – ROM - PAL – PLA – Trouble Shooting.

UNIT III FLIP FLOPS, CLOCKS & TIMERS (10 HRS)

RS Flip Flop – Edge Triggered RS, D, JK Flip Flops – Flip Flop Timing – JK Master Slave – Switch Contact Bouncing Circuit – Clock Wave forms – TTL Clock – Schmidt Trigger – Circuits using 555 timer – Pulse forming Circuits.

UNIT IV REGISTERS & COUNTERS (12 HRS)

Types of Registers – SISO – SIPO – PISO – PIPO – Ring Counter – Various types of Counters - Asynchronous, Synchronous, Decade, Presettable, & Shift Counters – MOD 10 shift counter – Digital Clock.

UNIT V ARITHMETIC CIRCUITS, D/A & A/D CONVERSION (12 HRS)

Binary Addition – Subtraction – Unsigned Binary Numbers – 2's compliment – Arithmetic building block – Adder – Subtractor – Binary Multiplication & Division – Variables Resistor Networks – Binary Ladder – DAC – ADC – AD technique – Dual Slope – AD Accuracy & Resolution.

TEXT BOOK :

DONALD P. LEECH and ALBERT PAUL MALVINO, *Digital Principles and Applications* (5th Ed.), MALVINO, Tata-McGraw-Hill.

[Unit I : Pages: 2 – 43, 46 – 92 ; Unit II: Pages: 94 – 130, 132 – 180, Unit III: Pages: 282 – 310, 252 – 279 ; Unit IV: Pages 312 – 339, 342 – 395 ; Unit V: Pages 182 – 215, 398 – 440]

BOOKS FOR REFERENCE

1. Experiments in Digital Principles by Donald P. Leach, III Edition, Tata McGraw Hill.
2. Digital Fundamentals by Flyod, Universal Books Stall, New Delhi.

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DEPARTMENT OF PHYSICS
(From 2011 – 14 batch onwards)

Course	**:**	**B.Sc. Physics**	**Code :**	**EMP61(A)**
Semester	**:**	**VI**	**No. of hrs. allotted :**	**3**
Paper	**:**	**Elective**	**No. of credits :**	**4**

APPLIED ELECTRONICS

Course Objectives:

i. To enhance the application skills of the students by providing working knowledge of various electrical instruments.

ii. To provide an introduction to the basic concepts of microprocessors.

iii. To give first hand knowledge about the various electrical appliances used at home and hence to develop their scientific attitude.

UNIT I

Testing of instruments Galvanometer – Conversion of galvanometer into an ammeter, voltmeter and ohmmeter – Multimeter – CRO – Construction and Basic operation – CRO for measurements – Display and analysis – VTVM .

UNIT II

Electrical switches Switches – Fuses – Circuit breaker – Electromagnetic Relay – Principle and operation of SCR, UJT, DIAC, TRIAC – SCR as control devices

UNIT III

Electrical appliances Electric fans – Refrigerators – Air conditioner – Washing machine – Tape recorder – General principles and working

UNIT IV

Television Fascimile – Transmission – Receiption – Television – T.V. Channels – Interlaced Scanning (Simple idea only) – broadcasting – Interlaced scanning – VSB Transmission of T.V.signal –Image Orthicon – Vidicon – T.V. Transmission – Monochrome T.V. Receiver – Principle of Colour T.V. – PAL Colour receiver – Picture Tube

UNIT V

Microprocessor and microcomputer LSI chip – CPU – Instruction register – Decoders – ALU control and timing circuits – Address bus, Data bus and control bus – Basic idea of operating systems – An example – special purpose of microcomputers – (Block diagram)

REFERENCE BOOKS:

FOR UNIT I

1. ELECTRONIC INSTRUMENTATION & MEASUREMENT TECHNIQUES, WILIAM DAVID COOPER – PRENTICE HALL OF INDIA.
2. PRINCIPLES OF ELECTRONICS, V.K. MEHTA, S. CHAND & CO.

FOR UNIT II

3. APPLIED ELECTRONICS, SEDHA , S. CHAND & CO.
4. INDUSTRIAL ELECTRONICS, G.K. MITHAL

FOR UNIT III

5. HOW THINGS WORK VOL I & VOL II.

FOR UNIT IV

6. PRINCIPLES OF COMMUNICATION ENGINEERING, ANOKH SINGH, S. CHAND & CO.

FOR UNIT V

7. FUNDAMENTALS OF COMPUTER, V. RAJARAMAN PRENTICE HALL OF INDIA.

THIAGARAJAR COLLEGE – AUTONOMOUS, MADURAI – 625 009
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DEPARTMENT OF PHYSICS
(From 2011 – 14 batch onwards)

Course	**:**	**B.Sc. Physics**	**Code :**	**EMP61 (N)**
Semester	**:**	**VI**	**No. of hrs. allotted :**	**3**
Paper	**:**	**Elective**	**No. of credits :**	**4**

INTRODUCTION TO NANO SCIENCE

Course Objectives :

i. To enable the student understand the postulates and concepts of nanophysics with clarity.

ii. To help the students understand the principles, fabrication and design of Carbon Nano-Tubes and their application.

UNIT I: BASICS OF QUANTUM CONFINEMENT

Nano and nature - out technologies and the world we live – nano – the beginning. - General properties and growth of hetro structures, band engineering, dopped hetro structurtes, wires and dots, optical confinement, effective mass approximation, effective mass theory in hetro structures.

UNIT II: GENERAL METHODS OF PREPARATIONS

Self Assembled Minelayers: Introduction – monolayer on gold – growth process- phase transitions - patterning monolayer - mixed monolayer - SAMS and applications. Semiconductors Quantum Dots: Introduction – synthesis of quantum dots – electronic structure of nano crystals – quantum dots-core relation of properties with size - uses.

UNIT III: GENERAL CHARACTERIZATION

Experimental methods: Investigating and manipulating materials in nanoscales – introduction - electron microscopes - scanning probe microscopes - optical microscopes for nano science and technology – other kinds of microscopes – XRD - associated techniques.

UNIT VI: NANO SENSORS

Introductions - nano sensors - order from chaos - nano scale organization for sensors – characterization – perception - nano sensors based on optical properties - nano sensors based on quantum size effects - electrochemical sensors- sensors based on physical properties - nano biosensors - smart dust.

UNIT V: CARBON NANOTUBES

Introduction - synthesis and purification – filling of nano tubes – mechanism of growth - electronic structure – transport properties – mechanical properties – physical properties – applications – nano tubes of other materials.

TEXT BOOKS:

1. Huozhong Gao, Nanostructures & Nanomaterials, Imperial College Press (2004).
   Unit I – Chapter 7.
2. Pradeep, T. NANO: The essentials – Undeerstanding Nanoscience and nano technology, Tata McGraw-Hill Pubhilisng Company Ltd. New Delhi (2007).
   Unit I – Chapter 1.
   Unit II – Chaper 5 &7.
   Unit III – Chapetr 2.
   Unit VI – Chapter 12.
   Unit V – Chapter 4.

THIAGARAJAR COLLEGE – AUTONOMOUS, MADURAI – 625 009
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DEPARTMENT OF PHYSICS
(From 2011 – 11 batch onwards)

Course	**:**	**B.Sc. Physics**	**Code**	**:**	**ESP61 (Q)**
Semester	**:**	**VI**	**No. of hrs. allotted**	**:**	**2**
Paper	**:**	**Skill-Based Elective**	**No. of credits**	**:**	**2**

QUANTUM MECHANICS

COURSE OBJECTIVES:

i. To understand Basic concepts in Quantum Mechanics.
ii. To throw light on the formulation of Schrödinger equation.
iii. To have a glimpse of various matrices in quantum mechanics**.**

UNIT – I FOUNDATIONS OF QUANTUM MECHANICS

The Physical basis of Quantum Mechanics Experimental background – Inadequacy of classical physics-Summary of prinicpal experiments and inferences. Bohr – Sommerfield quantization rules – practical difficulti s and conceptual difficulties-uncertainty principle. Wave packets in space and time – wave formalism. TheSchrodinger wave equation: Development of the wave equation – Interpretation of wave equation – Energy Eigen functions – one dimensional square well potential – Linear Harmonic oscillator.

UNIT-II MATRIX FORMULATION

Matrix Formulation of Quantum Mechanics – Matrix algebra – types of matrices – Hermitian and unitary matrices – Hilbert space – Dirac's bra and Ket notation. Physical meaning of matrix elements.

TEXT BOOKS:

1. Quantum Mechanics - Satyaprakash & Swati Satya :
2. *Quantum Mechanics*, Kedar Nath Ram Nath & Co, 2006**.**

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DEPARTMENT OF PHYSICS
(From 2011 – 14 batch onwards)

Course	**:**	**B.Sc. Physics**	**Code :**	**ESP61(E)**
Semester	**:**	**VI**	**No. of hrs. allotted :**	**2**
Paper	**:**	**Skill-Based Elective**	**No. of credits :**	**2**

ENVIRONMENTAL PHYSICS – II

COURSE OBJECTIVES:

i. To discuss the effects on human health due to radiation and the principles involved in measuring and controlling noise.

ii. To elaborate on the biological impacts of ionizing and non-ionizing radiation

iii. To understand the potential and magnitude of nuclear energy and the risks involved in commissioning and decommissioning nuclear facilities.

UNIT – I RADIATION EFFECTS, SOUND AND NOISE

Transmission lines and human health – Entropy and the environment – Biological effects of non-ionising radiation – Remote sensing : Radiometry in remote sensing – Image interpretation and ground truthing – Noise and nuisance – Human perception of sound and noise – Noise levels – Noise measurement – Controlling noise – Noise contours.

UNIT – II RADIAOCTIVITY AND NUCLEAR PHYSICS

Biological impacts of ionizing radiation – Radiation doses and dose limits – Envorinmental pathways of radioisotopes – Risk analysis – Energy released by nuclear fission – Critical mass – Types of fission reactor – Control of nuclear reactors – Fast-breeder reactors – Nuclear safety and nuclear incidents – The nuclear fuel cycle and reprocessing – Radioactive discharges – Decommissioning of nuclear facilities – Nuclear waste – Fusion reactions : Energy in a fusion reaction.

TEXT BOOK

Smith, C. : Environmental Physics, Routledge, Taylor and Francis Group, London & New York, 2001

BOOKS FOR REFERENCE

1. Boeker, E. & van Grondelle, R. : Environmental Physics (2^{nd} ed.), John Wiley & Sons, Chichester, 1999.
2. Guyot, G.: Physics of the Environment and Climate, John Wiley & Sons, Chichester, 1999.

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(From 2011 – 14 batch onwards)

Course	**:**	**B.Sc. Physics**	**Code :**		**MPL21**
Semester	**:**	**I & II**	**No. of hrs. allotted :**		**2**
Paper	**:**	**Practical**	**No. of credits :**		**3**

1. "E" – Uniform bending
2. "E" – Cantilever Oscillations
3. "E" – Depression of Cantilever
4. "G" – Static torsion – scale and Telescope
5. Torsion Pendulum
6. Compound Pendulum
7. Viscosity – Burette, capillary tube
8. Surface tension – Quincke's drop
9. Surface tension and interfacial surface tension
10. Volume resonator
11. Melde's string
12. Lee's disc
13. Specific heat by cooling
14. Spectrometer – Dispersive power of a prism
15. M and B_H – Field along the axis of a coil
16. Current and voltage sensitiveness – MG
17. Thermo emf – Potentiometer
18. Potentiometer – Temperature coefficient of resistance
19. Calibration of Ammeter- Potentiometer
20. High range voltmeter calibration – Potentiometer
21. Carey-Foster Bridge BG – charge sensitiveness

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Course	**:**	**B.Sc. Physics**	**Code :**		**MPL41**
Semester	**:**	**III & IV**	**No. of hrs. allotted :**		**2**
Paper	**:**	**Practical**	**No. of credits :**		**3**

1. Determination of Capacity (absolutely)
2. Comparison of capacities – BG
3. Comparison of mutual inductances
4. Absolute determination of mutual inductance
5. LCR circuit – series resonance
6. LCR circuit – parallel resonance
7. Bridge rectifier
8. Comparison of resistance – BG
9. Logic gates – NAND, NOR, NOT using diodes and transistor
10. Newton's rings
11. Grating normal incidence N & λ for Hg spectrum
12. Grating – wavelength by minimum deviation method
13. Grating dispersive power
14. Narrow angle prism
15. Sonameter – frequency of AC mains
16. *i-d* curve
17. Low pass, High pass, Band Pass RC filters

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DEPARTMENT OF PHYSICS
(From 2011 – 14 batch onwards)

Course	**:**	**B.Sc. Physics**	**Code :**		**MPL61**
Semester	**:**	**V & VI**	**No. of hrs. allotted :**		**4**
Paper	**:**	**Practical**	**No. of credits :**		**3**

NON-ELECTRONICS

1. *i-i'* curve
2. Resolving power of Telescope
3. Air wedge
4. Biprism (using spectrometer)
5. Polarimeter
6. Cauchy's constant
7. Hartmann's constant
8. Conversion of galvanometer into voltmeter and milliammeter
9. e.m.f. of a thermocouple
10. Owen's bridge
11. Anderson bridge
12. Maxwell bridge
13. Schering's bridge
14. Desauty's bridge
15. Grating II order spectrum
16. High resistance by leakage
17. e.c.e. of Copper

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DEPARTMENT OF PHYSICS
(From 2011 – 14 batch onwards)

Course	**:**	**B.Sc. Physics**	**Code**	**:**	**MPL62**
Semester	**:**	**V & VI**	**No. of hrs. allotted**	**:**	**2**
Paper	**:**	**Practical**	**No. of credits**	**:**	**3**

ELECTRONICS

1. Transistor Characteristics (CE mode)
2. Transistor Characteristics (CB mode)
3. FET Characteristics
4. OP-Amp Characteristics
5. Single Stage Amplifier
6. Hartley Oscillator
7. Colpitts Oscillator
8. Voltage Doubler
9. Dual Power supply
10. Bridge rectifier with filters
11. Astable multivibrator (using transistor)
12. Monostable multivibrator (using 555)
13. Astable multivibrator (using 555)
14. Gates (using ICs)
15. Half Adder & full Adder (Construction using IC's)
16. Zener Characteristics
17. Zener voltage regulator
18. NAND as Universal gate

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DEPARTMENT OF PHYSICS
(From 2011 – 14 batch onwards)

Course : B.Sc. Chemistry / Mathematics **Code : AP11/AOP1**

Semester : I / III **No. of hrs. allotted : 4**

Paper : Allied **No. of credits : 4**

PHYSICS – I

Course Objective :

To explain the basic concepts of physics in mechanics, properties of matter and optics

UNIT- I MECHANICS

Force, Work, Power and Energy Conservative and nonconservative force with example- Friction – central forces - work done by a force – work done by a varying force – Expression for kinetic energy – Expression for potential energy - power. **Rotational motion_** Torque work and power in rotational motion - (derviations of expressions) – Torque and angular acceleration – Angular momentum and angular impulse – K.E. of rotation – motion along the inclined plane – diatomic molecule – reduced mass.

UNIT – II Impulse and Impact Impulse and momentum – Elastic and Inelastic impacts – Direct impact of two smooth spheres – Expressions of final velocities – Loss of energy due to impact

UNIT- III PROPERTIES OF MATTER

Viscosity Stokes law – Determination of a viscosity of liquid (theory and experiment) – Derivation of Peiseuille's formula (Analytical method) – Bernoullis' theorem proof and application. **Elasticity** Elastic moduli – Bending of beams – Expression for B.M – E by uniform bending (theory and experiment) – E by non –uniform bending (Theory and experiment) –I section girders – Torsion – Expression for couple per unit twist – work done in twisting – Torsion pendulum (Theory and Experiment).

Unit IV Geometrical Optics

Deviation produced by a thin lens – focal length of two thin lenses in contact – Equivalent focal length of two lenses separated by a distance – Principal points – Cardinal points – Dispersion of light – Dispersion through a prism – Dispersive power.

Unit V Physical Optics

INTERFERENCE : Interference in thin films – Air wedge – Newton's rings - Diffraction grating – Determination of wavelength of light using transmission grating (normal incidence) – POLARISATION : Double refraction – Huygens theory – Nicol prism – QWP – HWP – Optical activity – Biot's law – Specific rotator power – Laurent's halfshade polarimeter.

TEXT BOOK

R. Murugeshan, Optics and Spectroscpy, S.Chand & Co., New Delhi, 1998.

BOOKS FOR REFERENCE

1. Sears, Zemansky and Young, University Physics (6th ed.), Narosa Publishing House, New Delhi, 2005.
2. D.S. Mathur, Elements of Properties of Matter, S. Chand & Co. New Delhi, 2004.
3. N. Venkatachalam, Optics and Spectroscopy, CMN Publications, 1999.

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DEPARTMENT OF PHYSICS
(From 2011 – 14 batch onwards)

Course : B.Sc. Chemistry / Mathematics **Code : AP22/AOP2**

Semester : II / IV **No. of hrs. allotted : 4**

Paper : Allied **No. of credits : 4**

BASIC ELECTRONICS

COURSE OBJECTIVES:

To expose the students to the elements of semiconductor diodes and to throw light on the basics of transistors and their characteristics

ANALOG ELECTRONICS

UNIT I SEMICONDUCTOR (10 HRS)

Semiconductor Physics – intrinsic, extrinsic semiconductor – Band Energy Diagram - Energy Gap – Majority and Minority Carriers – Potential Barrier. Semi conductor diodes: Introduction – Types – PN junction – Biasing – Diode types – Characteristics – Rectifiers – Filters.

UNIT II TRANSISTORS (12 HRS)

Transistors – Biasing – Transistor as an amplifier – Current flow in a CE PNP transistor – Static characteristics – Single stage amplifier – Frequency response – Feedback in amplifier – Characteristics of negative feedback.

DIGITAL ELECTRONICS

UNIT III NUMBER SYSTEMS (14 HRS)

Binary number system: Conversion of decimal number into binary number – a Binary to decimal conversion – Binary addition – Binary subtraction – Binary multiplication and division – Hexadecimal numbers – Binary to hexadecimal conversion – Hexadecimal to decimal conversion – Decimal to hexadecimal conversion – Binary coded decimal – Application of BCD code.

UNIT IV LOGIC GATES (14 HRS)

Logic gates – Gate and switch – Basic logic gates and their implementation – Characteristics of logic gates – Calculation of output voltage in an OR logic gate &AND logic gate – The NOR logic gate – The NAND logic gate – The exclusive OR gate – Boolean equations of logic circuits.

UNIT V BOOLEAN ALGEBRA (10 HRS)

De Morgan's laws and its applications: Boolean algebra – De Morgan's laws – Applications – Binary adders – Karnaugh Map Simplification.

TEXTBOOKS:

1. A. AMBROSE AND T. VINCENT DEVARAJ, *Elements of Solid State Electronics,* Mera Publications, 1993. [Unit I, Sections 3.2.1, 3.3, 3.4, 3.5, 4.1-4.5; Unit II, Sections 5.1-5.4, 5.5.1, 5.6, 5.6.1, 6.9.1, 6.12, 7.1, 7.2, 7.3.1, 7.3.2]
2. G. Jose Robin and A. Ubald Raj, *Electronics II*, Indira Publication, 1994. [Units III, IV & V: Chapter 1, 2 (p.22-54) & Chapter 3]

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DEPARTMENT OF PHYSICS
(From 2011 – 14 batch onwards)

Course : B.Sc. **Code :**
Semester : **No. of hrs. allotted :**
Paper : CERTIFICATE **No. of credits :**

CRYSTAL PHYSICS - I

COURSE OBJECTIVES:

- To understand fundamentals of solid structure of materials.
- To give exposure to different techniques of XRD.

UNIT – I INTRODUCTION

An introduction to crystallography – Scope- Potential – Application of X- rays - Structure of Crystals – Classification of Crystals – Diffraction of X-rays – Laue - Powder – Single Crystal Methods – Moving crystal and moving film methods – The Rotation method – Diffractometers.

UNIT – II RECIPROCAL LATTICE

The reciprocal lattice – Fundamental laws of reciprocal lattice – Calculation of structure factor - Determination of Debye-Waller factors and Debye temperature using observed intensities - Close packed structures – Voids in close packed structures – Symmetry and Space group – Miller indices

UNIT – III X-RAY DIFFRACTION

Diffraction conditions in the reciprocal lattice – Examples of close packed structures - Elements – Inorganic structures – Anomalous dispersion of X-rays - Dispersion correction terms - Fluorescence – Use – Absorption of X-rays – Absorption corrections.

UNIT – IV CRYSTAL GROWTH

The fundamentals of crystal growth – Slow evaporation method – Quality of grown crystals – Gel technique – High temperature methods – Bridgmann method – CZ method.

UNIT – V EXPERIMENTAL TECHNIQUES

Preparation of samples for data collection. – Measurement of density of crystals – Determination of cell parameters – Interpretation of Oscillation photograph – Weissenberg photograph – Laue photograph – Powder Photograph - Determination of dislocation densities – Etch pit measurements.

TEXT BOOKS:

1. Introduction to Solid State Physics (VII ed.) ,Kittel, C. :, John Wiley & Sons, 1996. ISBN : 81 – 265 – 1045 – 5.
2. Elements of X-ray Crystallography – L.V.Azaroff.
3. Crystal Growth – Processes and Methods – P. Santhana Raghavan & P.Ramasamy.

REFERENCE BOOK :

An introduction to X-ray Crystallography , M.M.Woolfson.

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RE-ACCREDITED WITH 'A' GRADE BY NAAC
CHOICE BASED CREDIT SYSTEM::PG PHYSICS
(2011-2013 batch onwards)

Semester – I

Code No.	Subject	Contact Hrs./Week	Credits	Total No. of Hrs. Allotted	Max. Marks CA	Max. Marks SE	Total
1PP1	Classical Mechanics	5	5	75	25	75	100
1PP2	Statistical Mechanics	5	5	75	25	75	100
1PP3	Advanced Electronics	5	5	75	25	75	100
PGE1 +	Mathematical Physics I / Computer Simulations	5	4	75	25	75	100
1PPL1	Practical – I	9	2	75	40	60	100
Total		29	21				

SEMESTER -II

Code No.	Subject	Contact Hrs./Week	Credits	Total No. of Hrs. Allotted	Max. Marks CA	Max. Marks SE	Total
2PP1	Solid State Physics - I	5	5	75	25	75	100
2PP2	Electro Magnetic Theory	5	5	75	25	75	100
2PP3	Quantum Mechanics - I	5	5	75	25	75	100
PGE2^{+}	Mathematical Physics II / Molecular Bio-Physics	5	4	75	25	75	100
2PPL1	Practical – II	9	2	75	40	60	100
Total		29	21				

SEMESTER -III

Code No.	Subject	Contact Hrs./Week	Credits	Total No. of Hrs. Allotted	Max. Marks CA	Max. Marks SE	Total
3PP1	Solid State Physics II	5	5	75	25	75	100
3PP2	Quantum Mechanics II	5	5	75	25	75	100
3PP3	Nuclear Physics	5	5	75	25	75	100
PGE3 +	Micro Processor and Applications / Programming in C++ with Numerical Methods	5	4	75	25	75	100
NME	Basic astronomy	2	2	30	15	35	50
3PPL1	Practical - III*	5	-	75	40	60	100
PJ1	Project - I*	5	-	75	40	60	100
Total		32	21				

SEMESTER -IV

Code No.	Subject	Contact Hrs./Week	Credits	Total No. of Hrs. Allotted	Max. Marks CA	Max. Marks SE	Total
4PP1	Spectroscopy	5	5	75	25	75	100
4PP2	Nano Science	5	5	75	25	75	100
4PP3	Optical Communication And Networking	5	5	75	25	75	100
PGE4 +	Astro Physics / X-Ray Crystallography	5	4	75	25	75	100
3PPL1	Practical - III*	5	4	75	40	60	100
PJ1	Project – I*	5	4	75	40	60	100
Total		30	27				

* Credit will be given at the end of IV Semester

\+ Electives

(A) Consolidation of Contact Hours and Credits: PG

Semester	Contact Hrs. / Week	Credits
I	29	21
II	29	21
III	32	21
IV	30	27
Total	**120**	**90**

B) Curriculum Credits

Core	**72 Credits**
Major Elective	**16 Credits**
Non Major Elective	**02 Credits**
Total	**90 Credits**

Sem	Code	Title of the Papers	Hrs.	Cr.
I	1PP1	Classical Mechanics	5	5
	1PP2	Statistical Mechanics	5	5
	1PP3	Advanced Electronics	5	5
	1PPE1(M) / 1PPE1(C)	Mathematical Physics I / Computer Simulations	5	4
	1PPL1	Practical – I	9	2
			29	21
II	2PP1	Solid State Physics - I	5	5
	2PP2	Electro Magnetic Theory	5	5
	2PP3	Quantum Mechanics - I	5	5
	2PPE1(M)/ 2PPE1(MB)	Mathematical Physics II / Molecular Bio-Physics	5	4
	2PPL1	Practical – II	9	2
			29	21
III	3PP1	Solid State Physics II	5	5
	3PP2	Quantum Mechanics II	5	5
	3PP3	Nuclear Physics	5	5
	3PPE1(M)/ 3PPE1(P)	Micro Processor and Applications / Programming in C++ with Numerical Methods	5	4
	NME	Basic astronomy	2	2
	3PPL1	Practical - III*	5	-
	PJ1	Project - I*	5	-
			32	21
IV	4PP1	Spectroscopy	5	5
	4PP2	Nano Science	5	5
	4PP3	Optical Communication And Networking	5	5
	4PPE1(A)/ 4PPE1(X)	Astro Physics / X-Ray Crystallography	5	4
	3PPL1	Practical - III*	5	4
	PJ1	Project – I*	5	4
			30	27
TOTAL			120	90

* Credit will be given at the end of IV Semester

\+ Electives

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DEPARTMENT OF PHYSICS
(From 2011 – 13 batch onwards)

Course : M.Sc. Physics **Code : 1PP1**
Semester : I **No. of hrs. allotted : 5**
Paper : Core **No. of credits : 5**

CLASSICAL MECHANICS

COURSE OBJECTIVE:

i. To have acquaintance with the elementary concepts of mechanics, and acquire in-depth knowledge in Lagrangian and Hamiltonian Principles.
ii. To understand the classical theory behind two body problems and small oscillations.
iii. To acquire knowledge on different types of generating functions by means of canonical transformation.

UNIT I : SURVEY OF THE ELEMENTARY PRINCIPLES , VARIATIONAL PRINCIPLES AND LAGRANGE'S EQUATIONS

Mechanics of a particle – Mechanics of a system of particles – Constraints – D'Alemberts principle and Lagrange's equation – velocity dependent potentials and the dissipation function – Simple applications of the Lagrangian formulation.

Hamilton's principles – some techniques of the calculus of variations – Derivation of Lagrange's equations from Hamilton's principle – Extension of Hamilton's principle to non – conservative and non holonomic systems – conservation theorems and symmetry properties .

UNIT II THE TWO BODY CENTRAL FORCE PROBLEM

Reduction to the equivalent one – body problem the equations of motion and first integrals. The equivalent one – dimensional problem, and classification of orbits – The viral theorem – The Kepler problem – Inverse square law of force.

UNIT III SMALL OSCILLATIONS :

Formulation of the problem – The eigen value equation and principle axis transformation – frequencies of free vibration and normal coordinates – Free vibrations of linear triatomic molecule – forced vibrations and the effect of dissipative forces.

UNIT IV THE HAMILTON EQUATION OF MOTION

Legendre transformation and the Hamilton equation of motion – Cyclic coordinates and Routh procedure – conservation theorems and the physical significance of the Hamiltonian – Derivation from variational principle – The principle of least action.

UNIT V CANONICAL TRANSFORMATIONS

The equations of canonical transformation – Examples of canonical transformations – the integral invariants of Poincare – Lagrange and Poisson brackets as canonical invariants – The equations of motion in Poisson bracket notation – Infinitesimal/constant transformations, constants of the motion and symmetry properties.

TEXT BOOK:

Classical Mechanics(III ed.), Goldtsein, H., Poole, C. & Safko, J. : Pearson Education, 2002, ISBN 81 – 7808 – 566 – 6

REFERENCE BOOKS:

1. Mathematical Methods in Classical and Quantum Physics, Dass, T., & Sharma, S.K. : University Press, 198, ISBN 81-7371-089-9.
2. Classical Mechanics ,Sankara Rao, K.: Prentice-Hall of India, 2005, ISBN 81-203- 2676-8.
3. Classical Mechanics – With Introduction to Nonlinear Oscillations and Chaos, Bhatia, V.B. :, Narosa Publishing House, 1997, ISBN 81-7319-104-2.
4. Classical Mechanics – Systems of Particles and Hamiltonian Dynamics, Greiner, W: Springer, 2004, ISBN 81-8128-128-4.

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DEPARTMENT OF PHYSICS
(From 2011 – 13 batch onwards)

Course : M.Sc. Physics **Code : 1PP2**
Semester : I **No. of hrs. allotted : 5**
Paper : Core **No. of credits : 5**

STATISTICAL MECHANICS

COURSE OBJECTIVES:

- Fundamentals of Statistical mechanics; Statistical distribution laws; their applications.
- Theories of specific heat capacity of solids.
- Properties of liquid helium. Phase transitions -Ising model; discussed in detail.

UNIT I

Basis Of Classical Statistics -Phase space – Ensemble – average – Liouville theorem – Conservation of extension in phase – Equation of motion and Liouville theorem – Equal a priori probability – Statistical equilibrium – Micro canonical ensemble.

Quantum picture Micro canonical ensemble – Quantization of Phase space – Basic postulates – Classical limit – Symmetry of wave function – Effect of symmetry on counting – Various distributions using micro canonical ensemble – Density matrix.

UNIT II

Canonical And Grand Canonical Ensembles -Entropy of a system in contact with a heat reservoir – Ideal gas in canonical ensemble – Maxwell velocity distribution – Equipartition of energy – Grand canonical ensemble – Ideal gas in grand canonical ensemble – Comparison of various ensembles – Quantum distributions using other ensembles – Photons – Einstein's derivation of Planck's law: MASER and LASER – Equation of state for ideal quantum gases.

Partition Function Canonical partition function – Molecular partition function – Translational partition function – Rotational partition function – Vibrational partition function – Electronic and nuclear partition function – Homo nuclear molecules and nuclear spin – Application of vibrational partition function to solid – Vapour pressure.

UNIT III

Ideal Bose – Einstein Gas Bose – Einstein distribution - Bose – Einstein Condensation – Thermodynamic properties of an ideal Bose – Einstein gas – Liquid Helium – Two – Fluid model of Liquid Helium – Landau spectrum of phonons and rotons – ^{3}He – ^{4}He mixtures – Super fluid phases of ^{3}He.

UNIT IV

Ideal Fermi – Dirac Gas Fermi – dirac distribution – degeneracy – Electrons in metals – Thermionic emission – White Dwarfs – Semiconductor Statistics Statistical equilibrium of free electrons in semiconductors – Nondegenerate case – Impurity semiconductors – Degenerate semiconductors.

UNIT V

Cooperative Phenomena : Ising Model Phase transitions of the second kind – Ising model – Bragg – William approximation – Fowler – Guggenheim Approximation – Kirkwood method – One-dimensional Ising model

TEXT BOOK:

Statistical mechanics (II ed.) Agarwal, B.K. & Eisner, M.:, New Age International, 2006, ISBN-81-224-1157-6.

REFERENCE BOOKS:

1. Elementary Statistical Mechanics ,Gupta, S.I & Kumar, V.:, Pragati Prakashan, 2006
2. Heat And Thermodynamics (VI ed.), Zemansky, M.W. & Dittman, R.H.: McGraw Hill, 1989. ISBN 0-07-Y66647-4.
3. Statistical Mechanics, Huang, K.: Wiley Eastern, 1988. ISBN 0-85226-393-1.
4. Thermodynamics, Kinetic Theory and Statistical Thermodynamics, Sears, F.W. & Salinger, G.L.: Narosa Publishing House, 1991. ISBN 81-85015-71-6.

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DEPARTMENT OF PHYSICS
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Course	**:**	**M.Sc. Physics**	**Code :**	**1PP3**
Semester	**:**	**I**	**No. of hrs. allotted :**	**5**
Paper	**:**	**Core**	**No. of credits :**	**5**

ADVANCED ELECTRONICS

COURSE OBJECTIVES:

- To be familiar with the various uses of Op-amps.
- To relate the theory and experiments
- To be familiar with the combinational sequential circuits

UNIT I SEMICONDUCTOR DEVICES

Field effect transistor: The ideal voltage controlled current source – the Junction Field Effect transistor – the JFET volt – ampere characteristics – JFET transfer characteristics – The MOSFET – The enhancement MOSFET – volt – ampere characteristics – The depletion MOSFET – MOSFET circuit symbols – The DC analysis of FETS – The MOSFET as a resistance – switch – amplifier – small – signal FET models – CMOS devices.

UNIT II AMPLIFIER SYSTEMS

Op.amp – architectures – The gain stage with active load – The differential stage – DC level shifting – output stages – offset voltages and currents – Measurements of op – amp parameters – Frequency response and compensation – slew rate – BIFET and BIMOS circuits - Three stage Op.amp – MOS Op amp.

UNIT III DIGITAL CIRCUITS AND SYSTEMS

Combinatorial – Digital circuits: Standard Gate assembling Binary adders – Arithmetic functions – Digital comparators – Parity checker – Generators – Decoder - Demultiplexer – Data selector – multiplexer encoder – Read only Memory (ROM) - Two dimensional addressing of a ROM – ROM applications – programmable ROMs. – Erasable PROMS – programmable array logic – programmable logic arrays. Sequential circuits and systems: A1 Bit memory – The circuit properties of a Bistable Latch – The clocked SR Flip flops. J - K, – T -, and D - type Flip flops – shift registers – Ripple counters – Synchronous counters – Application of counters.

UNIT IV VERY LARGE SCALE INTEGRATED SYSTEMS

Dynamic MOS shift registers – Ratioless shift register stages – CMOS Domino logic - Random Access Memory (RAM) – Read - write memory cells – Bipolar RAM cells – Charge coupled device (CCD) – CCD structures – Integrated - Injection logic(I^2L) – Microprocessors and Micro computers.

UNIT V WAVE FORM GENERATORS AND WAVESHAPING

Wave form Generators and waveshaping : Sinusoidal oscillators – Phase shift: oscillator – Wien bridge oscillator – General form of oscillator configuration – crystal oscillators – multivibrators – comparator – square - wave generation from a sinusoid – Regenerative comparator – Square and triangle - wave generators – pulse generators – The 555 IC timer – voltage time - base generators – step generators – modulation of a square wave.

TEXT BOOK:

Micro Electronics (II ed.), Millman, J & Grabel, A.: Tata McGraw Hill, 2002, ISBN 0-07- 463736-3.

Unit – I Chapter- 4 ; Unit – II Chapter-14; Unit – III Chapter-7 & 8 Unit – IV Chapters-9 ; Unit – V Chapters-15

REFERENCE BOOK:

Digital Principles and application (VI ed.) Malvino, A.P. & Leech, D andGoutam Saha : Tata McGraw Hill, 2006, ISBN 0-07- 060175-5.

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DEPARTMENT OF PHYSICS
(From 2011 – 13 batch onwards)

Course : M.Sc. Physics **Code : 1PPE1(M)**

Semester : I **No. of hrs. allotted : 5**

Paper : Elective **No. of credits : 4**

MATHEMATICAL PHYSICS – I

COURSE OBJECTIVES:

- This paper deals with the fundamental principles of electrostatics, magnetostatics and electrodynamics.
- Mathematical applications to physical situations in various branches of Physics like mechanics, electrostatics, electrodynamics, fluid dynamics, etc are taught.
- Students will understand and learn the importance of application of Mathematics in solving Physical problems.

UNIT I CURVED COORDINATES, MATRICES CURVED COORDINATES:

Special coordinate systems – Circular cylindrical coordinates – Othogonal coordinates – Differential vector operators – Spherical polar coordinates – Matrices : Orthogonal matrices – Hermitian matrices and unitary matrices – Diagonalization of matrices.

UNIT II THE GAMMA FUNCTION, LEGENDRE POLYNOMIALS AND SPHERICAL HARMONICS

The Gamma function : Definition and simple properties – Digamma and polygamma functions – Legendre polynomials and spherical harmonics : Introduction – Recurence relation and special properties – Orthogonality – Alternate definitions of Legendre polynomials – Associated Legendre functions.

UNIT III BESSEL FUNCTIONS

Bessel functions of the First kind, $J_{\square}(x)$– Asymptotic expansions – Spherical Bessel functions.

UNIT IV HERMITE AND LAGUERRE FUNCTIONS

Hermite polynomials : Quantum mechanical simple harmonic oscillator – Raising and lowering operators – Recurrence relations and generating function – Laguerre functions : Differential equation – Laguerre polynomials – Associated Laguerre polynomials.

UNIT V INTEGRAL TRANSFORMS

Introduction and Definitions – Fourier transform – Development of the inverse Fourier transform – Inversion theorem – Fourier transform derivatives – Convolution theorem – Momentum representation – Laplace transforms – Laplace transform of derivatives – Other properties.

TEXT BOOK:

Essential Mathematical Methods for Physicists, Weber, H.J. & Arfken, G.B.: Academic Press, 2004, ISBN:0-12-059878-7.

Unit I – Chapter 2, p.96-136; Chapter 3, 193-228.; **Unit II** – Chaper 10, p.523-540; Chapter 11, p.552-588.; **Unit III** – Chapters 12, p.589-637; **Unit IV** – Chapter 13, p.638-662.; **Unit V** – Chapter 15, p.689-742.

REFERENCE BOOKS:

1. Mathematical Methods for Physics and Engineering (II ed.), Riley, K.F., Hobson, M.P. & Bence, S.J. : Cambridge, 2004, ISBN:0-521-61296-9.
2. S.J.: Mathematical Physics – Differential Equations and Transform Theory, Ghatak, A.K., Goyal, I.C. & Chua, Macmillan, 2002, ISBN:0-333-92548-3.
3. Mathematical Physics (II ed.) Gupta, B.D. : Vikas Publishing House, 1993, ISBN:0-7069-76-4.
4. Mathematical Physics (IV ed.) Satya Prakash: S. Chand & Sons, 2005, ISBN:81-7014-925-8.

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DEPARTMENT OF PHYSICS
(From 2011 – 13 batch onwards)

Course	**:**	**M.Sc. Physics**	**Code :**	**1PPE1(C)**
Semester	**:**	**I**	**No. of hrs. allotted :**	**5**
Paper	**:**	**Elective**	**No. of credits :**	**4**

COMPUTER SIMULATIONS

COURSE OBJECTIVES:

- To understand the importance of computers in physics.
- To give exposure to different numerical methods.

UNIT I

Importance of Computers in Physics – Nature of Computer Simulation – Importance of Graphics – Programming Languages – Euler Algorithm – Example Coffee Cooling problem – Accuracy and stability – Visualization – Nuclear decay – Simple Harmonic Motion Motion – Numerical solution to simple harmonic oscillator of falling objects – Simple pendulum – Dissipative systems – Response to external forces – Electrical circuit oscillations

UNIT II

Chaotic motion of dynamical systems – periodic doubling – measuring and controlling chaos – Forced damped pendulum – Hamiltonian chaos – Perspective – Order – disorder – Poisson distribution and nuclear decay - introduction to0 random walks – Problems in probability – method of least squares – Simple variational Monte Carlo method – Random walks and diffusion equations.

UNIT III

Random walks, modified random walks, application to polymers, diffusion controlled chemical Numerical integration and Monte Carlo methods, numerical integration one and multi dimensional integrals, Monte carlo error, non uniform probability distributions, neutron transport, importance sampling, Metropolis Montecarlo method, error estimates for numerical integration, acceptance-rejection method, al reactions random number sequences.

UNIT IV

Percolation, cluster labeling, critical exponents and finite size scaling, renormalisation group. Fractal dimension, Regular fractals and growth processes, fractala and chaos.

UNIT V

Micro canonical ensemble, Demon alogorithm, one dimensional classical ideal gas, the temperature and the canonical ensemble, Ising model, Heat flow, relation of the mean energy to the temperature. Monte carlo simulation of canonical ensemble, Metropolis algorithm, verification of Boltzman distribution, Ising model, Ising phase transition, applications of Ising model, simulation aof classical fluids, optimized Monte Carlo data analysis, other ensembles, fluctuation in the canonical ensemble, exact enumeration of the 2 x 2 Ising model.

TEXT BOOK:

An Introduction to Computer simulation methods (Application to Physical systems) – II edition , Harvey Gould and Jan Tobochnik, Addison-Wesley Publishing Company 1996.

Unit 1: Pages 1-36, 95-126 (67 Pages)
Unit 2: Pages 127-212 (85 Pages)
Unit 3: Pages 343-405 (63 Pages)
Unit 4: Pages 413-500 (87 Pages)
Unit 5: Pages 543-625 (82 Pages)

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DEPARTMENT OF PHYSICS
(From 2011 – 13 batch onwards)

Course	**:**	**M.Sc. Physics**	**Code :**	**2PP1**
Semester	**:**	**II**	**No. of hrs. allotted :**	**5**
Paper	**:**	**Core**	**No. of credits :**	**5**

SOLID STATE PHYSICS – I

COURSE OBJECTIVES:

- To understand fundamentals of solid structure of materials.
- To discuss the properties of phonons.
- To impart the knowledge of free electron Fermi gas.
- To give exposure to semiconductor energy bands and the methods of calculation.

UNIT I CRYSTAL PHYSICS

Periodic arrays of atoms: Lattice translation vectors – Primitive lattice cell – Fundamental types of lattices: Two and three dimensional lattice types – Miller indices of crystal planes – Simple crystal structures : NaCl, CsCl, hcp, Diamond, Cubic ZnS – Bragg law – Fourier analysis – Reciprocal lattice vectors – Diffraction conditions – Laue equations – Brillouin zones : Reciprocal lattice to sc, bcc, fcc lattices – Structure factor of the bcc, fcc lattice, Atomic form factor – Quasi crystals

UNIT II CRYSTAL BINDING AND ELASTIC CONSTANTS

Crystals of inert gases (van der Waals – London interaction) – Ionic crystals (Madelung constant) – Covalent crystals – Metals – Hydrogen bonds – Atomic radii – Analysis of Elastic constants – Elastic compliance and stiffness constants – Elastic waves in cubic crystals.

UNIT III PHONONS

Vibrations of crystals with mono atomic basis – Two atoms per primitive basis – Quantization of elastic waves (Phonons) – Phonon momentum – Inelastic scattering by phonons – Phonon heat capacity : Planck distribution, Density of states in one and three dimension – Debye and Einstein model of specific heat capacity – Anharmonic crystal interactions – Thermal conductivity – Umklapp process.

UNIT IV FREE ELECTRON FERMI GAS & ENERGY BANDS

Energy levels in one dimension – Fermi – Dirac distribution for a free electron gas – Free electron gas in three dimensions – Heat capacity of the electron gas – Electrical conductivity and Ohm's law: Mathieson's rule, Umklapp scattering – Hall effect – Wiedmann – Franz law. Nearly free selectron model: Origin and magnitude of energy gap – Bloch functions – Kronig – Penny model – Wave equation of an electron in a periodic potential: Bloch theorem, crystal momentum.

UNIT V SEMICONDUTORS, FERMI SURFACES AND METALS

Semiconductors: Band gap – Equations of motion – Holes and effective mass – Physical interpretation of the effective mass – Effective masses in semiconductors – Intrinsic carrier concentration, Impurity conductivity. Fermi Surfaces and Metals : Reduced zone scheme – Periodic zone scheme – Construction of Fermi surfaces – Electron orbits, hole orbits and open orbits – Calculation of energy bands: Tight binding method – Wigner – Seitz method – Cohesive energy – Pseudopotential methods – Experimetal methods: Quantization of orbits in a magnetic field – De Haas – van Alphen effect.

TEXT BOOK:

Introduction to Solid State Physics (VII ed.) ,Kittel, C. :, John Wiley & Sons, 1996. ISBN : 81 – 265 – 1045 – 5

Unit – I Chapter- 1 & 2;Unit – II Chapter- 3;Unit – III Chapters- 4 & 5
Unit – IV Chapters- 6 & 7; Unit – V Chapters- 8 & 9

REFERENCE BOOKS:

1. Introductory Solid State Physics (II ed.),Myers, H.P.:, Viva Low – priced Student Edition, Viva Books Pvt. Ltd, 1998.
2. Elementary Solid State Physics ,Omar, M. A.:, Pearson Education, 2006, ISBN 81-7758-377-8
3. Solid State Physics – An Introduction to Theory and Experiment, Ibach, H. & Luth, H.: Narosa Publishing House, 1991.
4. Solid State Physics, (revised VI Edition), Pillai, S.O.: New Age International, 2007.
5. Elements of Solid State Physics (II ed.) Srivatsava, J.P.: Phi Publishers, 2007, ISBN 978-81-203-2847-1.

THIAGARAJAR COLLEGE – AUTONOMOUS, MADURAI – 625 009
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DEPARTMENT OF PHYSICS
(From 2011 – 13 batch onwards)

Course	**:**	**M.Sc. Physics**	**Code :**	**2PP2**
Semester	**:**	**II**	**No. of hrs. allotted :**	**5**
Paper	**:**	**Core**	**No. of credits :**	**5**

ELECTROMAGNETIC THEORY

COURSE OBJECTIVES:

- This paper deals with the fundamental principles of electrostatics, magnetostatics and electrodynamics.
- Make the student familiarize with the application of Maxwell's equations to physical situations and propagation of electromagnetic waves in conducting media.
- Students will be taught the essential principles of electrodynamics and its applications.

UNIT I ELECTROSTATICS

Electric charge – Coulomb's law – Electric field – Electrostatic potential – Gauss law and its applications – The electric dipole – Multipole expansion of electric fields. Poisson's equation – Laplace's equation : Properties of solutions (Uniqueness theorem) – Solutions to Laplace's equation in spherical coordinates (Zonal harmonics) – Usefulness of zonal harmonics (conducting sphere in a uniform electric field) – Electrostatic images – Point charge and conducting sphere – Line charges and line images.

UNIT II MAGNETOSTATICS

Definition of magnetic induction – Forces on current carrying conductors – Biot – Savart Law – Elementary applications of Biot – Savart law – Ampere's circuital law – Magnetic vector potential – The magnetic field of a distant circuit – Magnetic scalar potential – Magnetic flux.

UNIT III MAXWELL'S EQUATIONS

Generalization of Ampere's law – Maxwell's equations, differential and integral forms – Electromagnetic energy (Poynting vector) – Plane monochromatic wave : in free space, conducting and non – conducting media.

UNIT IV APPLICATION OF MAXWELL'S EQUATIONS

Boundary conditions – Reflection and refraction of electromagnetic waves at normal and oblique incidence – Propagation between parallel conducting planes –Waveguides – TE waves in a rectangular waveguide – Cavity resonators.

UNIT V POTENTIALS AND RADIATION

Gauge transformation – Coulomb gauge and Lorentz gauge – Retarded potentials – The Lienard – Wiechert potentials – Radiation from a moving point charge – Electric dipole radiation – Magnetic dipole radiation – Radiation from an arbitrary source.

TEXT BOOKS:

1. Foundations of electromagnetic theory (III ed.), Reitz, J.R., Milford, F.J & Christy, R.W. Narosa Publishing House, 1998. ISBN 81-85015-79-1. (For units I & II).
2. Introduction to Electrodynamics (III ed.), David J. Griffiths, Prentice Hall of India, 2000. ISBN 81-203-1601-0. (For units III, IV & V).

REFERENCE BOOKS:

1. Electromagnetic Fields and Waves (II ed.), Lorrain, P. & Corson, D.R. : CBS Publishers & Distributors, 2000.
2. Electromagnetic Theory and Applications ,Mukhopadhyay, P. ,Tata McGraw Hill, 1993. ISBN 0-07-460244-6.
3. Engineering Electromagnetics (V ed.), Hayt Jr., W.H. : McGraw Hill, 2001. ISBN 97-8007-2524-956.
4. Introduction to Electrodynamics ,Capri, A.Z. & Panat, P.V. :, Narosa Publishing House, 2002. ISBN 81-7319-329-0.
5. Electromagnetic Waves and Radiating Systems ,Jordan, E.C. & Balmain, K.G. : (II ed.), Prentice – Hall of India, 2003. ISBN 81-203-0054-8.

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DEPARTMENT OF PHYSICS
(From 2011 – 13 batch onwards)

Course : M.Sc. Physics **Code : 2PP3**

Semester : II **No. of hrs. allotted : 5**

Paper : Core **No. of credits : 5**

QUANTUM MECHANICS – I

COURSE OBJECTIVES:

- To understand Basic concepts in Quantum Mechanics.
- To throw light on the formulation of Schrödinger,Dirac and Heissenberg mechanics
- To have a glimpse of perturbation theory and its applications.
- To study in detail, the effect of magnetic and electric field on quantum particles.

UNIT I EQUATION OF MOTION OF MATTER WAVES

Time independent Schrödinger equation – Schrödinger equation for a free particle – Time dependent Schrödinger equation – Physical interpretation of wave function – Normalized and orthogonal wave functions – Solution of Schrödinger equation – Stationary state solution – Expectation values – Probability current density – Superposition of plane waves – Formulation of Schrödinger equation in momentum representation – Uncertainty principle – one dimensional square well potential – Linear Harmonic oscillator – Hydrogen atom.

UNIT II MATRIX FORMULATION OF QUANTUM MECHANICS

Matrix algebra – types of matrices – Hermitian and unitary matrices – Hilbert space – Dirac's bra and Ket notation. Physical meaning of matrix elements – Equations of motion – Schrödinger picture – Heisenberg picture – Interaction picture – Poisson brackets and Commutator brackets – Matrix theory of Harmonic oscillator.

UNIT III SYMMETRY IN QUANTUM MECHANICS

Space and Time displacements – Unitary Displacement operator – Equation of Motion – symmetry and Degeneracy – Matrix Elements for Displaced states – Time displacement – Proper Rotation Group – Infinitesimal rotations – Spin of a vector particle.

UNIT IV ANGULAR MOMENTUM STATES

Commutation relations for the generators – Choice of representation, Values of m, f(j), and λ_m. Angular momentum matrices (j = ½, j = 1 only) – Combination of Angular momentum states – Eigen values of the total Angular momentum – Clebsch Gordan coefficients – Recursion relations – Construction procedure – $j_1 = ½$, $j_2 = ½$; and $j_1 = 1$, $j_2 = ½$ cases only.

UNIT V APPROXIMATION METHODS FOR BOUND STATES

Stationary perturbation theory – non degenerate case – First order perturbation – Evaluation of first order Energy – Evaluation of first order correction to wave function – Second order perturbation – Evaluation of second order Energy correction – Zeeman effect without electron spin – First order stark effect in hydrogen atom – Variation method : Expectation value of the energy – Application to excited states – Ground State of Helium atom – Variation of the parameter Z – Van der waals interaction – Variation calculation.

TEXT BOOKS:

3.Quantum Mechanics (III ed.), Schiff, L.I. : McGraw Hill, 1968, ISBN-0-07-085643-5.

4.Quantum Mechanics ,Satyaprakash & Swati Satya :, Kedar Nath Ram Nath & Co, 2006.

REFERENCE BOOKS:

1. A Text Book of Quantum Mechanics, Mathews, P.M. & Venkatesan, K., Tata McGraw Hill, 1978, ISBN 0-07-096510-2.
2. Quantum Mechanics Aruldhas, J. :, Prentice – Hall of India, 2002, ISBN81- 203-1962-1.
3. Quantum Mechanics (II ed.), Bransden, B.H. & Joachain, C.J. : Pearson Education, 2005. ISBN 81-297-0470-6.
4. Quantum Mechanics (III ed.), Merzbacher, E. : John Wiley, 2004, ISBN 9971- 51-281-5.
5. Introduction to Quantum Mechanics Ghatak, A. :, Macmillan, 1996, ISBN0333- 92419-

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DEPARTMENT OF PHYSICS
(From 2011 – 13 batch onwards)

Course	**:**	**M.Sc. Physics**	**Code :**	**2PPE1(M)**
Semester	**:**	**II**	**No. of hrs. allotted :**	**5**
Paper	**:**	**Elective**	**No. of credits :**	**4**

MATHEMATICAL PHYSICS – II

COURSE OBJECTIVES:

- To help students develop problem solving skills.
- To explain how mathematical concepts are applied in the solution of physical problems.
- To explain the basic concepts of group theory and to discuss its application to crystallography.

UNIT I COMPLEX VARIABLES-I

CR equations – Laplace's equation: Harmonic functions – Line integral of a complex function – Cauchy's integral theorem – Cauchy's Integral formula – Derivatives of an analytic function – Taylors series – Laurent's series

UNIT II COMPLEX VARIABLES-II

Singularities of an analytic function – Residues and their evaluation – Cauchy's residue theorem – Evaluation of definite integrals: integration round the unit circle – Evaluation of improper real integrals – evaluation of infinite integrals by Jordan's lemma – evaluation of infinite integrals when the integrand has poles on real axis – Conformal mapping.

UNIT III GROUP THEORY REPRESENTATION

Representation of groups – reducible and irreducible representations –some important theorems on representations – The orthogonality theorem – Character of a representation: character tables – The unitary group – Point groups.

UNIT IV PARTIAL DIFFERENTIAL EQUATIONS

Introduction – diffusion equation or Fourier equation of heat flow – solution of heat flow equation: method of separation of variables – two dimensional heat flow – heat flow in circular plate – Equation of motion for the vibrating string – D'Alembert's solution – Vibration of rectangular membrane.

UNIT V DIRAC DELTA AND GREEN'S FUNCTIONS

Dirac delta function – three dimensional delta function – green's function : an introduction – Greens function for one dimensional case – Eigen function; expansion of Green's function – Green's function for Poisson's equation and solution of Poisson's equation – Green's function for quantum mechanical scattering problem.

TEXT BOOKS:

1. Mathematical Physics (II ed.) Gupta, B.D : Vikas Publishing House, 1993, ISBN:0-7069-76-4.
2. Mathematical Physics (IV ed.) Satya Prakash: S. Chand & Sons, 2005, ISBN:81-7014-925-8.

REFERENCE BOOKS:

1. Essential Mathematical Methods for Physicists, Weber, H.J. & Arfken, G.B.: Academic Press, 2004, ISBN:0-12-059878-7.
2. Mathematical Methods for Physics and Engineering (II ed.), Riley, K.F., Hobson, M.P. & Bence, S.J. : Cambridge, 2004, ISBN:0-521-61296-9.
3. Mathematical Physics – Differential Equations and Transform Theory, Ghatak, A.K., Goyal, I.C. & Chua, S.J.: Macmillan, 2002, ISBN:0-333-92548-3.
4. Group Theory & Quantum Mechanics Tinkham, M. : Tata McGraw Hill.

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DEPARTMENT OF PHYSICS
(From 2011 – 13 batch onwards)

Course	**:**	**M.Sc. Physics**	**Code :**	**2PPE1(MB)**
Semester	**:**	**II**	**No. of hrs. allotted :**	**5**
Paper	**:**	**Elective**	**No. of credits :**	**4**

MOLECULAR BIOPHYSICS

COURSE OBJECTIVES :

- To introduce the students to the fundamentals of proteins and nucleic acids.
- To enable the students understand the spectroscopic techniques involved in the elucidation of structures of molecules.
- To help the students understand and appreciate techniques such as NMR, Laser and Holography.
- To expose the students to the principles and facts of the biological effects of radiation.

UNIT I PROTEINS

Proteins : Amino acids – Structural Organisation of Proteins – Globular and Fibrous Proteins – Dynamics of Protein-folding – Protein Engineering.

UNIT II NUCLEIC ACIDS

Nucleic Acids: Nucleic Acids – Principle of Base-pairing/Base stacking – Nucleic acid Families – Protein Ligand Interactions.

UNIT III SPECTROSCOPIC TECHNIQUES IN STRUCTURE DETERMINATION

Rayleigh Scattering – Diffusion – Sedimentation – Osmosis – Viscosity – Chromatography and Electrophoresis – Optical Activity – Absorption spectroscopy – UV, IR, Raman, ESR and Mossbauer Spectroscopy.

UNIT IV NUCLEAR MAGNETIC RESONANCE, LASERS AND HOLOGRAPHY

One-dimensional – Multidimensional NMR Spectroscopy – Applications – Biomedical NMR. Lasers – Holography.

UNIT V RADIATION BIOPHYSICS

Ionising Radiation – Interaction of Radiation with Matter – Measurement of Radiation (Dosimetry) Radioactive Isotopes – Biological Effects of Radiation – Radiation Protection and Therapy.

TEXT BOOK:

Essentials of Biophysics , P. NARAYANAN , New Age International Publishers, New Delhi, 1998.

THIAGARAJAR COLLEGE – AUTONOMOUS, MADURAI – 625 009
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DEPARTMENT OF PHYSICS
(From 2011 – 13 batch onwards)

Course : M.Sc. Physics **Code : 3PP1**
Semester : III **No. of hrs. allotted : 5**
Paper : Core **No. of credits : 5**

SOLID STATE PHYSICS – II

COURSE OBJECTIVES:

- To understand fundamentals of solid state particles viz., Plasmons, Polaritons, and Polarons.
- To explain Superconductivity in detail.
- To distinguish and understand between different types of magnetic and electric materials, classical and quantum mechanical treatment.
- To throw light on Magnetic Resonance and different types of defects in crystals.

UNIT I PLASMONS, POLARITONS, POLARONS, OPTICAL PROCESSES AND EXCITONS

Plasmons – Electrostatic screening: Screened Coulomb potential, Pseudopotential component U(O), Mott metal-insulator transition, Screening and phonons in metals. Polaritons – Lyddane-Sachs-Teller relation. Electron-electron interaction. Electron-phonon interaction: Polarons-Peierls instability of linear metals. Optical reflectance – Kramers-Kronig relations – Excitons: Frenkel excitons – Weakly bound (Mott-Wannier) excitons – Exciton condensation into electron-hole drops (EHD). Raman effect in crystals – Energy loss of fast particles in a solid.

UNIT II SUPER CONDUCTIVITY

Occurrence of superconductivity – Destruction of superconductivity by magnetic fields – Meissner effect – Heat capacity – Energy gap – Microwave and Infrared properties – Isotope effect – Thermodynamics of the superconducting transitions – London equation – Coherence length – BCS theory of superconductivity – Flux quantization in a superconducting ring – Duration of persistent currents – Type I and Type II superconductors – Vortex state – Estimation of H_{c1} and H_{c2} – Single particle tunneling – Josephson superconductor tunneling – Macroscopic quantum interference – High temperature superconductors: Critical fields and critical currents – Hall number – Fullerenes.

UNIT III DIELECTRICS AND FERROELECTRICS

Macroscopic electric field – Local electric field at an atom – Dielectric constant and polarizability (Clausius-Mossotti relation) – Electronic polarizability – Structural phase transition – Ferroelectric crystals – Classifications of ferroelectric crystals – Displacive transitions: Soft optical phonons – Landau theory of phase transition – Second and First order tsransitions – Antiferroelectricity – Ferroelectric domains – Piezoelectricity – Ferroelasticity – Optical ceramics.

UNIT IV PARAMAGNETISM AND FERROMAGNETISM

Paramagnetism – Quantum theory of paramagnetism: Rare earth ions – Hund rules – Iron group ions – Crystal field splitting – Quenching of the orbital angular momentum – Spectroscopic splitting factor – Van sVleck temperature independent paramagnetism – Cooling by isentropic demagnetization: Nuclear demagnetization – Paramagnetic susceptibility of conduction electrons – Ferromagnetic order – Curie-Weiss law, Heissenberg model, Exchange energy – Magnons: Quantization of spin waves – Thermal excitation of magnons (Bloch $T^{3/2}$ law) – Neutron magnetic scattering - Ferrimagnetic order – Ferromagnetic domains – Single domain particles – Magnetic bubble domains.

UNIT V MAGNETIC RESONANCE AND POINT DEFECTS:

Magnetic Resonance: Equations of motion – Line width – Motional narrowing – Hyperfine splitting – Examples: paramagnetic point defects – knight shift- Point defects: Lattice vacancies –Schottky and Frenkel defects – Color centers – F centers – Other centers in alkali halides.

TEXT BOOK:

Introduction to Solid State Physics (VII ed.), Kittel. C, John Wiley & Sons, 1996. ISBN: 81-265-1045-5.

Unit – I	Chapter- 10 & 11 ;	Unit – II	Chapter- 12
Unit – III	Chapters- 13;	Unit – IV	Chapters- 14 &15
Unit – V	Chapters- 16 (partly) & 18		

REFERENCE BOOKS:

1. Introductory Solid State Physics (II ed.), Myers, H.P.: Viva Low – priced Student Edition, Viva Books Pvt. Ltd, 1998.
2. Elementary Solid State Physics, Omar, M. A. :, Pearson Education, 2006, ISBN 81-7758-377-8.
3. Solid State Physics – An Introduction to Theory and Experiment, Ibach, H. & Luth, H.: Narosa Publishing House, 1991.
4. Solid State Physics, (revised VI Edition), Pillai, S.O.: New Age International, 2007.
5. Elements of Solid State Physics (II ed.) Srivatsava, J.P.: Phi Publishers, 2007, ISBN 978-81-203-2847-1.

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DEPARTMENT OF PHYSICS
(From 2011 – 13 batch onwards)

Course : M.Sc. Physics **Code : 3PP2**

Semester : III **No. of hrs. allotted : 5**

Paper : Core **No. of credits : 5**

QUANTUM MECHANICS – II

COURSE OBJECTIVES:

- To understand Advance level - Quantum Mechanics.
- To acquire knowledge on approximation methods employed in solving quantum mechanical problems.
- To throw light on relativistic mechanics and quantum theory of radiation.
- To have a glimpse of perturbation theory and its applications.

UNIT I TIME DEPENDENT QUANTUM APPROXIMATIONS

Time-Dependent perturbation theory – First order perturbation – Perturbation constant in time – Physical significance – Transition probability – Fermi's golden rule – Harmonic perturbation – Adiabatic approximation – Sudden approximation.

UNIT II QUANTUM THEORY OF SCATTERING

General Formulation of Scattering Theory Born Approximation – Condition for validity of Born Approximation – Scattering by a screened coulomb potential : Rutherford's scattering formula from Born approximation – Partial wave analysis (Theory only).

UNIT III IDENTICAL PARTICLES AND SPIN

Identical particles – Physical meaning of identify – Symmetric and antisymmetric wave functions – Construction from unsymmetrized function – Distinguishability of identical particles – Exclusion principle – Connection with statistical mechanics – Paulil's spin matrices for an electron and their properties – Electron spin matrices for an electron and their properties – Electron spin functions – Symmetric and antisymmetric wave function of a hydrogen molecule.

UNIT IV RELATIVISTIC WAVE EQUATIONS

Schrödinger's relativistic equation for a free particle – Klien-Gordon equation – E.M. potentials – Separation of the equation – Energy levels in a Coulomb field – Dirac's relativistic equation – Dirac matrices – Free particles solution – Charge and current densities – Magnetic moment of the electron – Spin angular momentum of the electron – Approximate reduction (spin-orbit energy) – Negative energy states.

UNIT V QUANTUM THEORY OF RADIATION

Transition probability for emission and absorption – Einstein's coefficients in a radiation field – Einstein's transition probabilities for absorption and emission in a radiation field.

TEXT BOOK:

Quantum Mechanics (III ed.), Schiff, L.I. :McGraw Hill, 1968, ISBN-0-07-085643-5.

REFERENCE BOOKS:

1.Quantum Mechanics, Satyaprakash & Swati Satya : Kedar Nath Ram Nath & Co, 2006.

2.A Text Book of Quantum Mechanics ,Mathews, P.M. & Venkatesan, K. :, Tata McGraw Hill, 1978, ISBN 0-07-096510-2.

3.Quantum Mechanics Aruldhas, J.- Prentice – Hall of India, 2002, ISBN 81-203-1962-1.

4.Quantum Mechanics (II ed.), Bransden, B.H. & Joachain, C.J. : Pearson Education, 2005. ISBN 81-297-0470-6.

5. Quantum Mechanics (III ed.), Merzbacher, E. : John Wiley, 2004, ISBN 9971-51-281-5.
6. Introduction to Quantum Mechanics ,Ghatak, A. :, Macmillan, 1996, SBN 0333-92419-3.

THIAGARAJAR COLLEGE – AUTONOMOUS, MADURAI – 625 009

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DEPARTMENT OF PHYSICS

(From 2011 – 13 batch onwards)

Course	**:**	**M.Sc. Physics**	**Code :**		**3PP3**
Semester	**:**	**III**	**No. of hrs. allotted :**		**5**
Paper	**:**	**Core**	**No. of credits :**		**5**

NUCLEAR PHYSICS

COURSE OBJECTIVES:

- This paper deals with the fundamental concepts in Nuclear Physics.
- Theories involved in the understanding of nuclear forces and reactions are taught.
- Students are exposed to the various theories and mechanisms of radioactive decay.
- An introduction to high energy neutron physics and elementary particles are made.

UNIT I NUCLEUS

Nuclear size – Mirror nuclei – Elastic scattering of electrons by nuclei – Muonic X-rays – Electric multipole moments – Spheroidal nuclei – Nuclear magnetic moment – The Schmidt model – Nuclear shell Model: Magic numbers – The independent particle model Nuclear ground state configurations and spins – Low-lying energy levels.

UNIT II NUCLEAR FORCE

The short range force – General form of the nucleon-nucleon potential –Exchange forces – Meson theory of nuclear forces – Experimental evidence – Low energy nucleon-nucleon scattering.

UNIT III α, β AND γ DECAY

One dimensional potential barrier problem in a decay – Theory of α-decay – α-particle energy spectrum – Fermi's theory of β-decay – Classification of nuclear transitions – Parity violation in β-decay – Electric & magnetic multipole radiation – Selection rules – Internal conversion – Nuclear isomers – Mossbauer effect.

UNIT IV NUCLEAR REACTIONS

The compound nucleus model – The optical model – The direct reaction model – Nuclear fission – Nuclear fusion – Heavy ion reactions: Stability of heavy nucleus – Recent trends in nuclear structure physics – Super heavy elements – Relativistic heavy ion collisions – quantum electrodynamics of strong fields.

UNIT V SUB-NUCLEAR PHYSICS

Proliferation and classification of elementary particles and their interactions – Short lived resonance states – Gellmann-Okuba mass formula – Quarks as building blocks of hadrons – Baryon magnetic moments – Discovery of heavier quarks – Colour degree of leptons freedom.

TEXT BOOK:

Nuclear Physics, Devanathan, V, Narosa Publishing House, 2006, ISBN: 10-81-7319-704-0.

Unit I - Chapter 2, p. 9-42, Chapter 3, p. 43-67, Chapter 6, p.129-141;

Unit II - Chapter 4, p. 68-105; Unit III - Chapter 8, 9 & 10, p. 194-246.

Unit IV - Chapter 12 & 13, p. 269-310; Unit V - Chapter 14, p. 311-329.

REFERENCE BOOKS:

1. Nuclear Physics – Theory and Experiment, Roy, R.R. & Nigam, B.P.: New Age International, 1996. ISBN 0-85226-788-6.
2. Introductory Nuclear Physics, Krane, K.S.: John Wiley & Sons, 1987, ISBN: 97-80471-80553-3.
3. Basic Ideas and Concepts in Nuclear Physics (II ed.), Heyde, K.: Overseas Press, 2005. ISBN 81-88689-08-4.
4. Nuclear Physics – Principles and Applications Lilley, J. :, John Wiley & Sons, 2001. ISBN 9-812-53004-5.
5. Introductory Nuclear Physics, Krane, K.S. : John Wiley & Sons, 1987. ISBN: 9780471805533.

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DEPARTMENT OF PHYSICS
(From 2011 – 13 batch onwards)

Course : M.Sc. Physics **Code : 3PPE1(M)**

Semester : III **No. of hrs. allotted : 5**

Paper : Elective **No. of credits : 4**

MICROPROCESSOR AND APPLICATION

COURSE OBJECTIVES:

- To enable the students to understand the architecture and assembly programming of 8085, 8086.
- To know the algorithms, Opcode for the basic microprocessor 8085
- To know the applications of the Peripheral devices.

UNIT I

Evolution of microprocessors – Various languages – Mnemonics – RAM – ROM – Main memory Secondary memory – Buses – Computers – Large small network – LAN –CAD – Voice recognition – AI – Block diagram of 8085 – Pin out diagram – Explanation – Registers – 8085 Instructions – Opcode – Operand – words.

UNIT II

Instruction cycle – Fetch cycle – Timing diagram – Machine cycle – T states – Opcode fetch operation – MVI, r data memory read – Memory write – Groups of instruction – Explanation of various groups with examples – various addressing modes – Stacks – PUSH operation – subroutine.

UNIT III

ALP – Simple program – 8-bit addition – 8-bit subtraction – sum 16 bits – 8 bit decimal subtraction – One's compliments of 16 bit number – Two's compliments of 16 bit number – Largest number in an array – smallest number in an array – Arrays in ascending order – Arrays in descending order – Square root of a number.

UNIT IV

Allocation of addresses – Memory mapped I/O scheme – I/O mapped I/O scheme – Differences – Data transfer schemes – Programmed data transfer – DMA – Burst mode – Cycle stealing – Shake hand mode – Interrupts – Hardware and software interrupts – Call locations – PPI 8255 – operating modes- DMA controller – PIC 8259 – 8251 – 8253 – operation – use of various modes.

UNIT V

A/D converter – ADC 8080 – interfacing 0800 – DAC 0800 – Realization of A/D to D/A – Mircroprocessor applications – Speed of motor – Stepper motor – Traffic control Generation of square wave or pulse – 8086 – operating modes – Status flags – Registers – Addressing modes.

TEXT BOOKS:

Microprocessor and its applications ,B. Ram, Dhanpat Rai Publications Ltd.,1993(IVth edition)

Unit I Ch. 1.1, 5.1 to 5.3; 1.6, 1.7, 1.10 to 1.23, 3.1 ;

Unit II Ch. 3.2, 3.3, 4.1 to 4.3, 5.5, 5.63;

Unit III Ch. 6.1 to 6.3, 6.5, 6.6, 6.10, 6.12, 6.21, 6.24, 6.22, 6.36;

Unit IV Ch. 7.1 to 7.11.3;

Unit V Ch. 8.1, 8.2, 8.6, 8.6.1, 8.12, 8.12.1, 8.12.2, 8.13, 9.6.5, 9.7 to 9.9, 11.1, 11.2.

1.Introduction to Microprocessors, Aditya P. Mathur Tata Mc Graw Hill Ltd., New Delhi, 2nd Editon 1985.

THIAGARAJAR COLLEGE – AUTONOMOUS, MADURAI – 625 009
(Re Accredited With 'A' Grade by NAAC)
DEPARTMENT OF PHYSICS
(From 2011 – 13 batch onwards)

Course : M.Sc. Physics **Code : 3PPE1(P)**
Semester : III **No. of hrs. allotted : 5**
Paper : Elective **No. of credits : 4**

PROGRAMMING IN C++ WITH NUMERICAL METHODS

COURSE OBJECTIVES:

- To become familiar with the features of C++.
- To understand different numerical methods.
- To appreciate and apply programming concepts to numerical methods.

UNIT I PRINCIPLES OF OBJECT ORIENTED PROGRAMMING

Identifiers and keywords – constant – C++ operators – Type conversion – Writing a program in C++ - Declaration of variables – Statements – Simple C++ program – Features of iostream.h – Manipulator functions – Input and output stream flags – Control statements –Conditional Expressions – Switch Statement - Loop statements – Breaking control statements – Arrays – Program to find largest no – Program to find sum & average – Program to find sum of even number.

UNIT II FUNCTIONS, CLASSES & OBJECTS IN C++

Defining a function, return statement – Types – Local & global variable – Storage class specifiers – Recursive function – Header files – Standard functions – Structures and classes – member functions -Array of class objects – Defining the object of a class – Accessing a member of class –Unions and classes – classes within classes – Constructors – Copy Constructor – Default Constructor - Destructors – Inline member functions - Static class members – Friend functions –Program to find factorial of a number – Program to find Matrix Multiplication – Programs using Constructors & Destructors

UNIT III POINTERS, INHERITANCE

Pointer Declaration – Pointer Arithmetic – Pointers & functions – Pointers and arrays – Pointers and Strings- Inheritance – Single inheritance – types of Base classes – public inheritance private inheritance – protected inheritance – Multiple inheritance – member acess control – Function overloading – operator overloading – overloading of Binary operators - overloading of unary operators – Programs using inheritance, Pointers, Operator overloading.

UNIT IV NUMERICAL DIFFERENTIATION

Successive approximation – Newton Raphson method – Gauss Jordan Elimination method – Gauss Seidal Iterartion method – Newton's Forward & backward Interpolation method - Newton's Forward & backward Interpolation Formula – Langrange's Interpolation Formula – Bessel's Formula.

UNIT V NUMERICAL INTEGRATION

Integration by Trapezoidal rule – Integration by Simpson's 1/3 rule – Fourth order Runge Kutta method.

TEXT BOOKS:

1.Programming with C++,Ravichandran, D. : Tata McGraw Hill, 1996, ISBN 0-07-463349-X.

2. Numerical Methods in Science & Engineering ,Venkatraman, M.K. :, The National Publishing & Co., 1993.

REFERENCE BOOKS:

1. Object Oriented Programming with C++, Balagurusamy, E.:(II ed),Tata Mc Graw Hill, 2004.

2.Object Oriented Programming with C++, Parsons, D. : BPB Publications, 2001.

3. Numerical methods (II ed.), Arumugam, S., Issac, A.T. & Somasundaram, A.: SCITECH Publications, 2007.

4.Numerical Methods (IV ed.), Singaravelu :, Meenakshi Publications, 2001.

THIAGARAJAR COLLEGE – AUTONOMOUS, MADURAI – 625 009
(Re Accredited With 'A' Grade by NAAC)
DEPARTMENT OF PHYSICS
(From 2011 – 13 batch onwards)

Course	**:**	**M.Sc. Physics**	**Code :**		
Semester	**:**	**III**	**No. of hrs. allotted :**		**2**
Paper	**:**	**Non-Major Elective**	**No. of credits :**		**2**

BASIC ASTRONOMY

UNIT – I: BASICS OF ASTRONOMY

Constellation – Star names – Brightness – Celestial coordinates – Location on the celestial sphere – Local reference lines – Celestial meridian – Latitude and star gazing – Apperant motion of the stars – Apparent annual motion of the stars – The ecliptic- Apperant annual motion of the sun – Earth's seasons – Equinoxes and solstices – Sun's altitude – The day – The precision.

UNIT – II: THE STARS AND STELLAR EVOLUTION

Distance of near by stars – Types of Spectra – Spectral lines- Spectra of Stars – Chemical composition – Spectral Classes –Temperature – Life cycle of Stars – Birth – Life times – Why Stars shine – Old age – Red giants – Synthesis of Heavier elements – Death – Mass loss – White dwarfs – Life cycle of Sun like Stars – Exploding Stars – Supernova remnants – Superdense stars – Black Holes.

UNIT – III: GALAXIES AND THE UNIVERSE

Star systems – Milky way Galaxy – Between the Stars – Great clouds – Classification of Galaxies – Universe : Eternal questions – The Expanding Universe – Red Shifts – Velocity – Distance Relations – Standard Big Bang Theory- Big Question- Steady state theory- Universal radiation.

UNIT – IV: COMETS, METEORS AND METEORITES

Comets – Significations of Comets- Comet Structure – The Nucleus – The coma – the tails – Disappearance – Origin of Comets – Comet fat – comet hunt – Interplanetary Remains – Shooting Stars – Meteor showers – Best Meteor displays – Rocky landing – Make up of Meteors – Impacts on Earth.

UNIT – V: LIFE ON OTHER WORLDS?

Promise – Cosmic Origins - Evidence – Evolutions – Near by Planets and Moons – The odds – Extra solar planetary system – A space travels – Star Probes – Communication – A Serious Search.

TEXT BOOK

Moche, D.L. :Astronomy – A Self – teaching Guide, 7th ed., John Wiley & Sons, New Jersey, 2009.

REFERENCES

Bely, P.Y, Christian, C. & Roy, J. R. : A question and answer guide to astronomy, Cambridge University Press, New York, 2010.

Software aid: www.stellarium.org

THIAGARAJAR COLLEGE – AUTONOMOUS, MADURAI – 625 009

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DEPARTMENT OF PHYSICS

(From 2011 – 13 batch onwards)

Course	**:**	**M.Sc. Physics**	**Code :**	**4PP1**
Semester	**:**	**IV**	**No. of hrs. allotted :**	**5**
Paper	**:**	**Core**	**No. of credits :**	**5**

SPECTROSCOPY

COURSE OBJECTIVES:

- To present the fundamental aspects of major areas of spectroscopy.viz., Infra red, Raman and NMR.
- Basic concepts and instrumentation techniques are discussed in detail.
- To provide necessary foundation for proceeding over to the elucidation of structural information of complex molecules from their spectra.

UNIT I INFRARED SPECTROSCOPY

Energy of a diatomic molecule – simple harmonic oscillator – Anharmonic oscillator – diatomic vibrating rotator – vibrations of polyatomic molecules – fundamental vibrations and their symmetry – influence of rotations on the spectra of polyatomic molecules – linear molecules – symmetric top molecules – skeletal vibrations-group frequencies-techniques and instrumentation – double and single beam operation.

UNIT II RAMAN SPECTROSCOPY

Pure rotation Raman spectra – linear molecules – symmetric top molecules – vibrational Raman spectra – Raman activity of vibrations – rules of mutual exclusion overtone and combination – vibrational Raman spectra – rotational fine structure – nature of polarized light – vibration of spherical top molecules – techniques and instrumentation- the Fourier transform spectroscopy.

UNIT III ELECTRONIC SPECTROSCOPY OF MOLECULES

Electronic spectra of diatomic molecules- the Born-Oppenheimer Approximation-vibrational Coarse Structure: Progressions- intensity of Vibrational-Electronic Spectra: the Franck-Condon Principle- Rotational fine structure of electronic-vibration transitions-electronic spectra of polyatomic molecules- change of shape of excitation-chemical analysis by electronic spectroscopy-the Re-emission of energy by an excited molecule-techniques and instrumentation-molecular photoelectron spectroscopy-Ultra-violet photoelectron spectroscopy-X-ray photoelectron spectroscopy

UNIT IV NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY

The nature of spinning particles – Interaction between spin and a magnetic field – population of energy levels – Larmor precession and relaxation time – Fourier Transform spectroscopy in NMR – Chemical shift.

UNIT V ELECTRON SPIN RESONANCE SPECTROSCOPY

Introduction- position of E.S.R absorptions: the g-factor-hyperfine structure of E.S.R absorptions- double resonance in E.S.R- fine structure in E.S.R spectra- technique of E.S.R spectroscopy

TEXT BOOK:

Fundamentals of molecular spectroscopy, c.n. Banwell, e. M. Mccash, tata mcgraw-hill publishing company limited, new delhi.

REFERENCE BOOKS:

1. Molecular structure and spectroscopy, G. Aruldhas, Prentice-Hall of India private Limited, New Delhi.
2. Molecular spectroscopy, P. S. Sindhu, Tata McGraw-Hill publishing company Limited, New Delhi.
3. Introduction to Molecular Spectroscopy, G.M. Borrow, McGraw-Hill Kogakusha Ltd, Tikyo. (for unit V)

THIAGARAJAR COLLEGE – AUTONOMOUS, MADURAI – 625 009

(Re Accredited With 'A' Grade by NAAC)
DEPARTMENT OF PHYSICS
(From 2011 – 13 batch onwards)

Course	**:**	**M.Sc. Physics**	**Code :**		**4PP2**
Semester	**:**	**IV**	**No. of hrs. allotted :**		**5**
Paper	**:**	**Core**	**No. of credits :**		**5**

NANO SCIENCE

COURSE OBJECTIVE:

- To enable the student understand the postulates and concepts of nanophysics with clarity.
- To help the students understand the principles, fabrication and design of Carbon Nano-Tubes and their application.
- To expose the students to the theoretical and experimental aspects of quantum wells, wires and dots.
- To introduce the student to the techniques of nanomachines and nanodevices.

UNIT I INTRODUCTION TO PHYSICS OF THE SOLID STATE AND PROPERTIES OF INDIVIDUAL NANO PARTICLES

Size dependence of Properties - Crystal structure – Face-centered cubic nanoparticles - Tetrahedrally bonded semiconductor crystals - Lattice vibrations.

Metal Nanoclusters: Magic Numbers-Theoretical Modeling Of Nanoparticles-Geometric Structure-Electronic Structure-Reactivity Fluctuations-Magnetic Clusters-Bulk To Nanotransition, Semiconducting Nanoparticles: Optical Properties- Photofragmentation-Coulombic Explosion

UNIT II CARBON NANOSTRUCTURES

Introduction – Carbon Molecules – Nature of the Carbon bond – New Carbon Structures – Small Carbon Clusters – Discovery of C60 Structure of C60 and its Crystal – Alkali doped C60 – Superconductivity in C60 Larger and Smaller Fullerenes – Other Buckyballs – Carbon nanotubes – Fabrication – Structure – Electric Properties – Vibrational Properties – Mechanical Properties.

UNIT III NANOSTRUCTURED FERROMAGNETISM

Basics of Ferromagnetism – Effect of Bulk Nanostructuring of Magnetic Properties – Dynamics of Nanomagnets – Nanopore containment of Magnetic particles – Nanocarbon Ferromagnets – Giant and Colossal Magnetoresistance – Ferrofluids.

UNIT IV APPLICATION OF CARBON NANOTUBES & QUANTUM WELLS, WIRES, AND DOTS

Field Emission and Shielding – Computers – Fuels – Chemical Sensors – Catalysis – Mechanical Reinforcement.

Quantum Wells, Wires and Dots: Preparation of Quantum nanostructures – Size and Dimensionality Effects – Excitons – Single Electron Tunneling – Applications – Infrared Detectors – Quantum Dot Lasers – Superconductivity.

UNIT V NANOMACHINES AND NANODEVICES

Microelectro mechanical systems (MEM) – Nanoelectromechanical Systems (NEMS): Fabrication – Nanodevices and Nanomachines – Molecular and Supramolecular Switches.

TEXT BOOK :

Introduction to Nanotechnology: Charles P. Poole Jr & Frank J. Owens, Wiley India II reprint, 2011.

REFERENCE BOOK:

Nano Technology, Richard Booker & Earl Baysen, wiley (2005).

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DEPARTMENT OF PHYSICS
(From 2011 – 13 batch onwards)

Course	**:**	**M.Sc. Physics**	**Code :**		**4PP3**
Semester	**:**	**IV**	**No. of hrs. allotted :**		**5**
Paper	**:**	**Core**	**No. of credits :**		**5**

OPTICAL COMMUNICATION AND NETWORKING

COURSE OBJECTIVE:

- To give an exposure to various types of fibers.
- To study the transmission characteristics of optical fibers.
- To know the sources and detectors; function of networks etc.,

UNIT I INTRODUCTION

Introduction**,** Ray theory transmission- Total internal reflection-Acceptance angle – Numerical aperture – Skew rays – Electromagnetic mode theory of optical propagation – EM waves – modes in Planar guide – phase and group velocity – cylindrical fibers –SM fibers.

UNIT II TRANSMISSION CHARACTERISTICS OF OPTICAL FIBERS Attenuation – Material absorption losses in silica glass fibers – Linear and Non linearScattering losses - Fiber Bend losses – Midband and farband infra red transmission –Intra and inter Modal Dispersion – Over all Fiber Dispersion – Polarization- non linearPhenomena. Optical fiber connectors**,** Fiber alignment and Joint Losses – Fiber Splices– Fiber connectors – Expanded Beam Connectors – Fiber Couplers.

UNIT III SOURCES AND DETECTORS

Optical sources: Light Emitting Diodes - LED structures - surface and edge emitters,mono and hetero structures - internal - quantum efficiency, injection laser diodestructures - comparison of LED and ILD

Optical Detectors: PIN Photo detectors, Avalanche photo diodes, construction,characteristics and properties, Comparison of performance, Photo detector noise -Noisesources , Signal to Noise ratio , Detector response time.

UNIT IV FIBER OPTIC RECEIVER AND MEASUREMENTS

Fundamental receiver operation, Pre amplifiers, Error sources – Receiver Configuration – Probability of Error – Quantum limit.Fiber Attenuation measurements- Dispersion measurements – Fiber Refractive indexprofile measurements – Fiber cut- off Wave length Measurements – Fiber NumericalAperture Measurements – Fiber diameter measurements.

UNIT V OPTICAL NETWORKS

Basic Networks – SONET / SDH – Broadcast – and –select WDM Networks –Wavelength Routed Networks – Non linear effects on Network performance –Performance of WDM + EDFA system – Solitons – Optical CDMA – Ultra High CapacityNetworks.

TEXT BOOKS:

1. Optical Fiber Communication – John M. Senior – Pearson Education – Second Edition. **2007**
2. Optical Fiber Communication – Gerd Keiser – Mc Graw Hill – Third Edition. **2000**

REFERENCE BOOKS:

1.J.Gower, "Optical Communication System", Prentice Hall of India, 2001
2. Rajiv Ramaswami, "Optical Networks " , Second Edition, Elsevier , 2004.
3. Govind P. Agrawal, " Fiber-optic communication systems", third edition, John Wiley & sons, 2004.
4. R.P. Khare, "Fiber Optics and Optoelectronics", Oxford University Press, 2007.

THIAGARAJAR COLLEGE – AUTONOMOUS, MADURAI – 625 009

(Re Accredited With 'A' Grade by NAAC)
DEPARTMENT OF PHYSICS
(From 2011 – 13 batch onwards)

Course	**:**	**M.Sc. Physics**	**Code :**	**4PPE1(A)**
Semester	**:**	**IV**	**No. of hrs. allotted :**	**5**
Paper	**:**	**Elective**	**No. of credits :**	**4**

ASTROPHYSICS

COURSE OBJECTIVES:

- To explain to the students the methods of collecting stellar data and how they are used in classifying the stars.
- To journey into the life of a star from its birth till its death.
- To discuss in elaboration the Astronomical Instruments.

UNIT I FUNDAMENTALS

Identification of stars – Spherical coordinates – The Altazimuth system – The local equatorial system – The Universal equatorial system – Conversion of coordinates – Magnitude scale – Measurement of apparent luminosity – Various magnitude systems – Corrections for observed magnitudes – Meausrement of terrestrial distances – Measurement of distances within the solar system – Trigonometric parallaxes of stars – Gemoetrical methods – The method of luminosity distance.

UNIT II STARS

Laws for radiation in thermodynamic equilibrium – Application of radiation law to stellar photospheres – Defining temperatures of stars by matter waves – Spectral classification of stars – Explanation of MK spectra – Peculiar stellar spectra – Kepler's third law – Binary stars – Discription of a binary system – Visual binaries – Spectroscopic binaries – Eclipsing binaries – Stellar radii – Important relations between stellar parameters.

UNIT III INTERNAL STRUCTURE OF STARS

Equation of stellar structure – Polytropic models – Temperature distribution in polytropes – Stellar energy sources – Stellar opacity – Preliminary models of main sequence stars – Models of real stars – Structure of white dwarfs.

UNIT IV STELLAR EVOLUTION

The virial theorem – Evolution near the main sequence – Star formation – Pre-main sequence contraction – Post-main sequence evolution – Nucleosynthesis – Superdense remnants – Evolution of close binary systems.

UNIT V ASTRONOMICAL INSTRUMENTS AND SPACE ASTRONOMY

Astronomical Instruments: Optical telescopes – Optical photometric instruments and techniques – Optical spectroscopy – Radio telescopes – Infrared Astronomy – Space Astronomies : Infrared Astronomy – Ultraviolet Astronomy – X-ray Astronomy – Gamma ray Astronomy – The Hubble space telescope.

TEXT BOOK:

Astrophysics : Stars and Galaxies Abhyankar, K.D., , University Press, 2007, ISBN: 8173713812.

REFERENCE BOOK:

Fundamentals of Astronomy ,Barbieri, C., , Taylor & Francis, 2007, ISBN: 0750308869.

THIAGARAJAR COLLEGE – AUTONOMOUS, MADURAI – 625 009
(Re Accredited With 'A' Grade by NAAC)
DEPARTMENT OF PHYSICS
(From 2011 – 13 batch onwards)

Course	**:**	**M.Sc. Physics**	**Code :**	**4PPE1(X)**
Semester	**:**	**IV**	**No. of hrs. allotted :**	**5**
Paper	**:**	**Elective**	**No. of credits :**	**4**

X-RAY CRYSTALLOGRAPHY

COURSE OBJECTIVES:

- To introduce the theoretical and experimental aspects involved in X-ray diffraction by single crystals.
- To enable the students understand the relationship between symmetry and scattering of X-rays.
- To help students understand the applications of crystallography to study the structures of small molecules and complex biological macromolecules such as proteins.
-

UNIT I CRYSTALS & SYMMETRY

Crystal shapes and habit – Unit cell – Crystal systems – Bravais lattice – Symmetry elements – Point group – Space group (P2, $P2_1$, $P2_12_12_1$, Pbca, $P2_1/c$, Pmmm, $Pna2_1$, C2) – Standard and Non-standard settings – Enantiomorphs

UNIT II DIFFRACTION OF X-RAYS AND EXPERIMENTAL METHODS

Braggs law – Miller indices – Concepts of real & reciprocal lattice – Ewald & limiting spheres – Scattering by an electron – Scattering by an atom – Scattering by a crystal – Structure factor – Systematic absences – Laue – Rotation/oscillation – Weissenberg techniques – The powder method – Recent techniques of experimental data collection.

UNIT III FACTORS AFFECTING X-RAY INTENSITIES

Lorentz and polarization factors – Absorption of X-rays – Primary extinction – Secondary extinction – Temperature factor – Anomalous scattering – Break down of Friedel's law.

UNIT IV CRYSTAL STRUCTURE DETERMINATION

Trial and error method – Phase problem – Fourier synthesis – The Patterson function – The heavy atom method – Isomorphous replacement – Inequality relationship – Sign relationships – Phase relationships – Absolute configuration – Conformational analysis – Hydrogen bonds – Structural databases.

UNIT V PROTEIN CRYSTALLOGRAPHY

Amino acids – Hydrophobic and hydrophilic amino acids – Peptides – Peptide bond – Ramachandran map – Proteins – Unit cell size – Molecular Weight determination – Structural organization of proteins – α-helix – β-sheet – β-strands – β-barrel – turns and loops – Protein folding – Data collection methods – Resolution of data – Space group frequencies – Structure solution methods – Structure-function relationships – Protein Data Bank.

TEXT BOOKS:

1. X-ray Diffraction – Its theory and Applications S.K. CHATTERJEE :, Prentice-Hall, New Delhi, 1999. (For Units I ,II, III & IV)
2. An Introduction to X-ray Crystallography M.M.WOOLFSON :, Cambridge University Press-Vikas Publishing House, New Delhi, 1980. (For Units III IV relevant pages)
3. Essentials of Biophysics, P. NARAYANAN: New Age International Publishers, New Delhi, 1998. (For Unit V).

REFERENCE BOOKS:

1. X-ray Structure Determination – A Practical Guide :G.H. STOUT & L.H. JENSEN, John Wiley & Sons, New York, 1989.
2. Crystal Structure Analysis – A Primer , J.P. GLUSKER & K.N. TRUEBLOOD, II ed. Oxford University Press, New York, 1985.
3. Elements of X-ray Diffraction, B.D. CULLITY, Addison-Wesley, 1956

THIAGARAJAR COLLEGE – AUTONOMOUS, MADURAI – 625 009
(Re Accredited With 'A' Grade by NAAC)
DEPARTMENT OF PHYSICS
(From 2011 – 13 batch onwards)

Course	**:**	**M.Sc. Physics**	**Code :**		**2PPL1**
Semester	**:**	**I & II**	**No. of hrs. allotted :**		**9**
Paper	**:**	**Core**	**No. of credits :**		**4**

NON ELECTRONICS (GENERAL EXPERIMENTS)

1. Elastic constants by Newton's rings
2. Thermal expansion by Newton's rings
3. G.M.Counter
4. Quincke's method
5. Gouy' method
6. M-H hysteresis
7. Error analysis and least squares –Programming
8. Least squares for the leakage resistance of a capacitor
9. Faraday optic rotation
10. Ultrasonics- solids
11. Ultrasonics- liquids
12. Dielectric constant and phase transition
13. Spectrum calibration
14. Band gap by Planck's orb UV absorption
15. Hall coefficient
16. Elliptical Fringes
17. Hyperbolic Fringes
18. Four probe method (Band energy gap)
19. Hartmann's interpolation formula (using powder spectrum)
20. Hartmann's interpolation formula (using spectrometer)
21. Comparison of wavelengths using CDS and spectrometer
22. Interpretation of powder photograph
23. Indexing a zero layer Weissenberg photograph
24. Fraunhoffer diffraction using Laser
25. Millikan's Oil drop expt.
26. Optic bench-biprism

Each experiment is planned for 9 hrs and esach of this experiment can be divided into many number depending on the hours of work

THIAGARAJAR COLLEGE – AUTONOMOUS, MADURAI – 625 009
(Re Accredited With 'A' Grade by NAAC)
DEPARTMENT OF PHYSICS
(From 2011 – 13 batch onwards)

Course	**:**	**M.Sc. Physics**	**Code :**	**2PPL2**
Semester	**:**	**I & II**	**No. of hrs. allotted :**	**9**
Paper	**:**	**Core**	**No. of credits :**	**4**

ELECTRONICS EXPERIMENTS

1. 741 amplifiers
2. 741 oscillators
3. 555 multivibrators
4. Series and shunt regulation with Zener
5. Regulated power supply with 7805 & 7812
6. 7400 and 7402 gates
7. Analog computation
8. Shift register
9. Decade counter
10. encoder and decoder
11. Multiplexer and demultiplexer
12. Differentiating, Integrating RC filter
13. Two Stage Amplifier with feedback
14. Two Stage Amplifier without feedback
15. Characteristics(UJT and SCR)
16. FET Amplifier
17. Phase shift oscillator
18. Amplitude modulation
19. Dual power supply
20. Oscillator(Hartley and colpitt)

Each experiment is planned for 9 hrs and each of this experiment can be subdivided depending on the hours of work

THIAGARAJAR COLLEGE – AUTONOMOUS, MADURAI – 625 009

(Re Accredited With 'A' Grade by NAAC)
DEPARTMENT OF PHYSICS
(From 2011 – 13 batch onwards)

Course	**:**	**M.Sc. Physics**	**Code :**	**4PPL1**
Semester	**:**	**III & IV**	**No. of hrs. allotted :**	**5**
Paper	**:**	**Core**	**No. of credits :**	**4**

ADVANCED EXPERIMENTS

1. Powder pattern
2. Band spectra
3. Fibre optic communication
4. Microprocessor – basic programming
5. Microprocessor with interfacing
6. Monte Carlo simulation-evaluation of pi and e
7. Monte Carlo simulation-evaluation of an integral
8. Fourier analysis of a complex waveform
9. Hall effect
10. Numerical integration and differentiation by programming
11. NMR
12. EPR
13. Piezo and pyro electric constants
14. Photoelectric effect- solar cell characteristics
15. Matlab
16. Excel for physics
17. Non linear dynamics- chaos
18. Random walk problem
19. Filters (I order, II order Low and high pass filters, Band pass filters)
20. Study of JK Flip-Flop.
21. Synchronous counter to count any desired sequence.
22. Shift Register (SISO, PIPO)
23. Half Adder, Full Adder, Half Subtractor, Full Subtractor.
24. Karnaugh map simplification
25. Differentiator, Integrator, Comparator, Triangular wave generator.
26. BCD to seven segment display.
27. Microprocessor problems (conversion of hexadecimal to binary, binary to hexadecimal, Octal conversions, 2's complement, 1's complement, Additon, subtraction, multiplication, division).
28. Simultaneous equations.
29. Schmidt Trigger (using 555)
30. UJT relaxation oscillator.

Each experiment is planned for 9 hrs and each of this experiment can be divided into many number depending on the hours of work

THIAGARAJAR COLLEGE (AUTONOMOUS)

(Re-Accredited with "A" Grade by NAAC)

Madurai – 625 009

DEPARTMENT OF PHYSICS

M. Phil., PHYSICS

(Self Finance)

UNITISED SYLLABUS

(With effect from the batches of June 2011 – May 2012)

THIAGARAJAR COLLEGE (AUTONOMOUS), MADURAI – 9
(Re – Accredited with 'A' Grade by NAAC)
DEPARTMENT OF MATHEMATICS

M.Phil. Physics
COURSE STRUCTURE (w.e.f. FROM 2011 – 2012 batch onwards)

Semester – I

Code No	Subject	Contact Hrs / Week	Credits	Total No of Hrs Allotted	Max Marks CA	Max Marks SE	Total
1MP1	Elements Of Research Methods In Physics	6		90	40	60	100
1MP2	Course Work	6		90	40	60	100
		12					

Semester – II

Code No	Subject	Contact Hrs / Week	Credits	Total No of Hrs Allotted	Max Marks CA	Max Marks SE	Total
2MP1	Indepth study	6		90	40	60	100
2MP2	Project	6		90	100	100	200
		12					

Consolidation of Contact Hrs & Credits

M.Phil.,

Semester	Contact Hrs / Week	Credits
I	**12**	
II	**12**	
	24	

THIAGARAJAR COLLEGE – AUTONOMOUS, MADURAI – 625 009

(Re Accredited With 'A' Grade by NAAC)
DEPARTMENT OF PHYSICS
(From 2011 – 12 batch onwards)

Course : M.Phil. Physics **Code : 1MP1**

Semester : I **No. of hrs. allotted :**

Paper : Core **No. of credits :**

ELEMENTS OF RESEARCH METHODS IN PHYSICS

COURSE OBJECTIVE:

- To know about various non energy systems.
- To understand the basic types of crystal and their structure.
- To get idea about symmetry on nature.
- To correlate the data to the methods.
- To expertise various non destructive testing methods.

UNIT I NONLINEAR DYNAMICS

Dynamical systems: Linear and Nonlinear forces – Mathematical implications of Nonlinearity – Working definition of Nonlinearity - Effects of Nonlinearity – Linear and Nonlinear Oscillators – Linear Oscillators and Predictability – Damped and Driven Nonlinear Oscillators – Secondary Resonances – Nonlinear Oscillations and Bifurcations – Autonomous and Nonautonomous Systems – Dynamical Systems as Coupled First-Order Differential Equations – Phase Space/Phase Plane and Phase Trajectories – Classification of Equilibrium Points – Limit Cycle Motion – Periodic Attractor – Dissipative and Conservative Systems.

Lakshmanan, M. & Rajasekar, S. : ***Nonlinear Dynamics : Integrability, Chaos and Patterns*****, Springer, 2003. [Chapters 1, 2 & 3].**

UNIT II ELEMENTS OF CRYSTALS

Symmetry of crystals : Modes of repetition – Symmetry elements – Classification of crystals – Notation of crystal faces – Projection of crystals : Perspective projections – Gnomonic projection – Stereographic projection – Crystal lattices : Periodicity in crystals – Lattice types – Transformation theory – Group theory applications : Space groups – Derivative symmetry.

Azaroff, L.V., ***Elements of X-ray Crystallography*****, McGraw Hill, 1968. [Chapters 1, 2, 3 & 4]**

UNIT III SYMMETRY

Introduction – Various types of symmetry operations – Point groups – Properties of point groups – How to determine the point group of a molecule? – Representations of Groups – The character – Some important theorems concerning the irreducible representations and their characters – Character table for point groups – Symmetry properties and quantum mechanics – Applications.

Chandra, A.K., ***Introduction to Quantum Chemistry*** **(3rd ed.), Tata McGraw Hill,1988. [Chapter 9].**

UNIT IV PROBABILITY AND STATISTICS FOR DATA ANALYSIS

Venn diagrams – Probability – Permutations and combinations – Random variables and distributions – Properties of distributions – Functions of random variables – Generating functions –Discrete distributions – Continuous distribution – The central limit theorem – Experiments, samples and population – Sample statistics – Estimators and sampling distributions – Some basic estimators – Maximu-likelihood method – The method of least squares – Hypothesis testing.

Riley, K.F., Hobson, M.P. & Bence, S.J., *Mathematical Methods for Physics and Engineering* (2nd ed.), Cambridge University Press, 2004. [Chapters 26 & 27].

UNIT V NON-DESTRUCTIVE TESTING

Liquid penetrant testing- principle – testing methods- Magnetic particle testing- principle – magnetizing techniques – testing methods- Eddy current testing – principles- instrumentation – Radiography – principles- Inspection techniques- Ultrasonic testing- principle- pulse-echo and through transmission technique- Ultrasonic flaw detector- Acoustic emission testing – principle- instrumentation - Thermography .

Baldevraj, Jayakumar.T, Thavasimuthu.M, Practical Non-Destructive Testing ,(3rd ed.) , Narosa publishing house, 2007.

THIAGARAJAR COLLEGE – AUTONOMOUS, MADURAI – 625 009
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DEPARTMENT OF PHYSICS
(From 2011 – 12 batch onwards)

Course : M.Phil. Physics **Code : 1MP2**
Semester : I & II **No. of hrs. allotted :**
Paper : Core **No. of credits :**

NANO MATERIALS SCIENCE: PROPERTIES OF MATERIALS AND CHARACTERIZATION METHODS

COURSE OBJECTIVE:

- To enable the student understand the postulates and concepts of nanophysics with clarity.
- To help the students understand the principles, fabrication and design of Carbon Nano-Tubes and their application.
- To expose the students to the theoretical and experimental aspects of quantum wells, wires and dots.
- To introduce the student to the techniques of nanomachines and nanodevices.

UNIT I BASIC QUANTUM CONCEPTS OF NANO STRUCTURES:

General properties and growth of hetero structures, Band engineering, doped hetero structures, wires and dots, optical confinement, effective mass approximation, effective mass theory in hetero structures (37 pages)

Unit II

Infinite well, finite wells, low dimensional systems, two-and three-dimensional potential wells, further confinement beyond two dimensions (31 pages)

UNIT III NANO STRUCTURES FROM PHYSICAL TECHNIQUES:

Introduction, Lithography, nano manipulation and nano Lithography, soft Lithography, assembly of nano particles and nano wires other methods (51 pages)

UNIT IV CHARACTERIZATION, PROPERTIES AND APPLICATIONS OF NANO MATERIALS-I

Introduction, structure characterization, chemical characterization, physical properties of nano materials, electrical conductivity, ferroelectrics and dielectrics, super paramagnetism (61 pages)

UNIT V CHARACTERIZATION, PROPERTIES AND APPLICATIONS OF NANO MATERIALS-II

Molecular and nano electronics, biological applications, band gap engineered quantum devices, nano mechanics, photonic crystals (50 pages) Total: 230 pages

TEXT BOOKS:

1. Nano structures & nanomaterials, Huozhong Gao*, Imperial college press (2004)*
Unit – I Chapter- 7
Unit – II Chapter- 8
Unit – III Chapter- 9
2. The Physics of low dimensional semiconductors , Hohn H. Davies*, Cambridge University Press (1998)*
Unit – IV Chapters- 3
Unit – V Chapters- 4

REFERENCE BOOK:

Nano Technology, Richard Booker & Earl Baysen, Wiley (2005)

THIAGARAJAR COLLEGE – AUTONOMOUS, MADURAI – 625 009
(Re Accredited With 'A' Grade by NAAC)
DEPARTMENT OF PHYSICS
(From 2011 – 12 batch onwards)

Course : M.Phil. Physics **Code : 1MPE1**

Semester : II **No. of hrs. allotted :**

Paper : Elective **No. of credits :**

Title of the paper: ADVANCED SPECTROSCOPY

COURSE OBJECTIVE:

- To present the fundamental aspects of major areas of spectroscopy. Viz., Infra red, Raman and NMR.
- Basic concepts and instrumentation techniques are discussed in detail.
- To provide necessary foundation for proceeding over to the elucidation of structural information of complex molecules from their spectra.

UNIT I RAMAN SPECTROSCOPY

Experimental spectroscopy – Classical theory of Raman effect and selection rule for Raman scattering - pure rotational Raman spectra of diatomic molecules - vibrational Raman spectra of polyatomic molecules - Raman vibrational studies of diatomic molecules- vibrational Raman spectra of polyatomic molecules, rotation - rotation – vibration Raman studies and applications of Raman spectroscopy.

UNIT II SURFACE ENHANCED RAMAN SCATTERING

Introduction – Surfaces for SERS study – Enhancement mechanisms – Surface selection rules – representative spectra – SERS Microscope – applications of SERS.

UNIT III PHOTOACOUSTICS

History of Photoacoustics – prehistory and modern history -Theory of PAS of gases – absorption of light – excitation of acoustic wave – energy transfer physics - Rosencwaig - Gersho theory – special cases – experimental verification – photoacoustic transport in a fluid.

UNIT IV PHOTOACOUSTIC SPECTROSCOPY

Photacoustic spectrometer for condensed surfaces – Gas microphone cell – simple cells- data acquisition – calibration – piezoelectric detection – the piezoelectric transducer – piezoelectric experiments – Photoacoustic experiments with liquids – gas microphone method – piezoelectric method – Thermal processes – thermal diffusivity – phase transitions.

UNIT V RESONANCE AND LASER SPECTROSCOPY

Electron Spin Resonance –principles of ESR spectrometer – total Hamiltonian - hyperfine structure – ESR spectra if free radicals in solution – anisotropic systems – systems in triplet state – EPR of transition metal ions – **Laser spectroscopy** - Nonlinear optical effects – Frequency generation by nonlinear optical techniques – Sources of Laser spectroscopy – Supersonic beams and jet cooling.

TEXT BOOKS:

UNIT I: Spectroscopy [Vol II] _ B.P. Straughan and S. Walker

John Wiley & Sons, New York – Chapter 4 – section 11 to 19

UNIT II Molecular structure and spectroscopy (2nd edition)

G. Aruldhass, Prentice – Hall of India (2007); ISBN-978-81-203-3215-7

Chapter 14

UNIT III Photoacoustics and Photoacoustic spectroscopy

Allan Rosencwaig, John Wiley (1980)

Chapter -2.1, 2.2, 3.2-3.5, 9.1-9.5

UNIT IV Photoacoustics and Photoacoustic spectroscopy

Allan Rosencwaig, John Wiley (1980)

Chapter -12 complete, Chapter – 13 & 20.

UNIT V Molecular structure and spectroscopy (2nd edition)

G. Aruldhass, Prentice – Hall of India (2007); ISBN-978-81-203-3215-7 Chapter 11, 15.1 – 15.4.

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DEPARTMENT OF PHYSICS

(From 2011 – 12 batch onwards)

Course	**:**	**M.Phil. Physics**	**Code :**	**1MPE2**
Semester	**:**	**II**	**No. of hrs. allotted :**	**9**
Paper	**:**	**Elective**	**No. of credits :**	**4**

THIN FILMS

COURSE OBJECTIVE:

- To know about the fabrication of thin films.
- To impart the knowledge about the instruments used for characterization of thin films.

UNIT I FABRICATION OF THIN FILMS

Film thickness uniformity and purity – Evaporation hardware and techniques – Glow discharges and plasmas – Sputtering – Sputtering processes – Hyrbrid and modified PVD processes – Chemical vapour deposition: Reaction types – Thermodynamics of CVD – Gas transport – Growth kinetics – CVD processes and systems.

UNIT II CHARACTERIZATION OF THIN FILMS

Film thickness: Optical and mechanical methods for measuring film thickness – Structural characterization : Scanning electron microscopy (SEM) – Transmission electron microscopy (TEM) – X-ray diffraction – Chemical characterization : Electron spectroscopy – X-ray Energy-Dispersive Analysis (EDX) – Auguer electron spectroscopy (AES) – X-ray photoelectron spectroscopy (XPS) – Rutherford backscattering (RBS) – Secondary Ion Mass Spectrometry.

UNIT III EPITAXY

Structural aspects of epitaxial films – Lattice misfit and imperfections in epitaxial films – Epitaxy of compound semiconductors – Methods for depositing epitaxial semiconductor films – Epitaxial film growth and characterization.

UNIT IV MECHANICAL AND OPTICAL PROPERTIES

Elasticity, Plasticity and Mechanical behavior of thin films – Internal stresses and their analysis – Stress in thin films – Relaxation effects in stressed films – Adhesion – Properties of optical film materials – Thin film optics – Multilayer optical film applications.

UNIT V ELECTRICAL AND MAGNETIC PROPERTIES

Electrical properties of thin films – Conduction in Metal films – Electrical transport in insulating films – Semiconductor contacts and MOS structures – Superconductivity in thin films – Ferromagnetism – Magnetic film size effects vs. thickness and temperature – Magnetic thin films for memory applications.

TEXT BOOKS:

1. Ohring, M., The Materials Science of Thin Films, Academic Press, 1992.
2. Chopra, K.L., Thin film Physics, Tata McGraw Hill, 1996.
3. Granquist, G., A Handbook of inorganic materials, Elsevier Publication,Amsterdam, 1998.
4. Willard, Meritt, Dean J.A. Settle, F.A., Instrumentation methods of analysis VI CBS published, 1986, India.Progress in intercalation Research, Kluwar Academic Publishes Dordlechet/London & Boston, Edited by W. Muller-Warmuth & R. Schollhorn.
5. Goswamy, Thin film fundamentals, New Age International, New Delhi – 1996.

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DEPARTMENT OF PHYSICS

(From 2011 – 12 batch onwards)

Course : M.Phil Physics **Code : 1MPE3**

Semester : II **No. of hrs. allotted :**

Paper : Elective **No. of credits :**

X-RAY CRYSTALLOGRAPHY

COURSE OBJECTIVE:

- To introduce the theoretical and experimental aspects involved in X-ray diffraction by single crystals.
- To enable the students understand the relationship between symmetry and scattering of X-rays.
- To help students understand the applications of crystallography to study the structures of small molecules and complex biological macromolecules such as proteins.

UNIT I GEOMETRY OF THE CRYSTALLINE STATE

The general features of crystals – The external symmetry of crystals – The seven crystal systems – The thirty-two crystal classes – The unit cell – Miller indices – Space lattices – The reciprocal lattice – Symmetry elements – Space groups – Space group and crystal class.

UNIT II X-RAY DIFFRACTION DATA

Conditions for diffraction to occur – Diffractometers – X-ray sources – Image plate systems – Diffraction from a rotating crystal – Absorption of X-rays – Primary extinction – Secondary extinction – The temperature factor – Anomalous scattering – Tests for lack of a centre of symmetry – The symmetry of X-ray photographs – Systematic absences – Detection of mirror plans and diad axes.

UNIT III DETERMINATION OF CRYSTAL STRUCTURES

Trial and error methods – The Patterson function – The heavy-atom method – sIsomorphous replacement – The application of anomalous scattering – Direct methods: Inequality relationships – Sign relationships – General phase relationships.

UNIT IV REFINEMENT AND ANALYSIS OF STRUCTURE

Absolute configuration – Conformational analysis – Hydrogen bonds – Cambridge Structural Database – WinGX : An Integrated System of Windows Programs for the Solution, Refinement and Analysis of Single Crystal X-ray Diffraction Data – The Rietveld technique.

UNIT V MACROMOLECULAR CRYSTALLOGRAPHY

Hydrophobic and hydrophilic amino acids – Peptides – Peptide bond – Ramachandran map – Structural organization of proteins – Protein folding – Data collection methods – Resolution of data – Structure solution methods – Protein Data Bank – DNA – Structural features of DNA – Macromolecular structure using Nuclear Magnetic Resonance

TEXT BOOKS:

1. Woolfson, M.M., *An Introduction to X-ray Crystallography* (II ed.), Cambridge University Press, **1997**. ISBN 0-521-42359-7
2. Ladd, M.F.C. & Palmer, R.A., *Structure Determination by X-ray Crystallography* (IV ed.), Springer, **2003**.
3. Pattabhi, V. & Gauttham, N., *Biophysics*, Kluwer Academic Publishers, **2002**.
4. Rhodes, G, *Crystallography Made Crystal Clear: A Guide for Users of Macromolecular Models* (III ed.), Elsevier, **2006**

5.Stout, G.H. & Jensen, L.H., *X-ray Structure Determination – A Practical Guide*, John Wiley & Sons, **1989**.

6. Glusker, J.P. & Trueblood, K.N., *Crystal Structure Analysis – A Primer* (II ed.), Oxford University Press, **1985**. ISBN 0-19-503543-7.

Summative Exam Question Pattern Under Unitized Syllabus

Details of Continuous Assessment Marks		
Test	:	40 marks (Four questions with alternate choice, 4 x 10 marks = 40 marks)
Seminar	:	30 marks
Assignment	:	30 marks (Two assignments x 15 marks = 30 marks)
Total	**:**	**100 marks**
Details of Summative Examination Marks		
Theory	:	100 marks (Five questions with internal choice from each of the five units, 5 x 20 = 100 marks)
Dissertation	:	200 marks (100 marks for dissertation + 100 marks for *viva voce*)
One Question with internal choice from each of the five units. Each question carries 20 marks.		

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DEPARTMENT OF PHYSICS

DIPLOMA IN COMPUTER APPLICATION

(From 2011 – 14 batch onwards)

Course	**: Diploma Course**	**Code :**	
Semester	**: III**	**No. of hrs. allotted :**	**2**
Paper	**: Programming in C**	**No. of credits :**	
Total.hrs	**:60**		

UNIT - I

C Language – Character set Tokens of C - tokens-constant-keywords and identifiers - variables- data types- declaration and assignment of variables-defining symbolic constants.- Operators and Expressions: Types of Operators- Arithmetic, Relational and Logical Operators Assignment, increment and decrement of operators - conditional bitwise and special operators - arithmetic expression and its evaluation - hierarchy of arithmetic operations - evaluations, precedence and associatively - mathematical functions. statement

UNIT – II

Control Branching and Decision-Making in C - If statement Switch statement -
GOTO statement - The ? : Operators.-
Decision - Making and Looping nesting in a loop, statements in C WHILE DO,
and FOR statements with variations. Arrays in C Single Two - dimensional and Multi-dimensional arrays

UNIT – III

Structures and Unions:
Definitions initialization and assigning values to members arrays of structures and arrays within structures structure with in structure- unions - size of structures.
Pointers:
Declaration and initialization of pointers - pointer expression - pointer and arrays .

UNIT - IV

File Maintenance in "C" :
Defining, Opening and closing a file - Input/Output operations on a file- random access to file - command line arguments

UNIT - V

User Defined Functions:
Form of "C" functions- calling a function - nesting of functions - recursion - functions with arrays.

TEXT BOOKS:

1. Programming in "C" E Balgurusamy Tata Mc Graw-Hill

REFERENCE BOOK

- The "C" Programming Language :Briain W. Kenigham & Dennis Ritchie
- The Spirit of "C"- Henrry Mulish, Herbert L. Cooper.
- Mastering "C" - Crain Bolon