THIAGARAJAR COLLEGE MADURAI - 625009

(An Autonomous Institution, affiliated to Madurai Kamaraj University)

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

Department of Physics

B.Sc., Physics

M.Sc., Physics

M.Phil., Physics

THIAGARAJAR COLLEGE, MADURAI- 9

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

DEPARTMENT OF PHYSICS

(For those who join in 2017 and after)

BACHLOR OF PHYSICS

COURSE STRUCTURE (w.e.f 2017 -2020 batch onwards)

Semester – I

Course	Code No	Subject	Contact Hrs / Week	Credits	Total No of Hrs Allotted/ Semester	Max Marks CA	Max Marks SE	Total
Part I Tamil	P111	Ikkala Ilakkiyam	6	3	90	25	75	100
Part II English	P211	Communicative English - I	6	3	90	25	75	100
Core / Allied/ Elective	MP11	Properties of Matter	4	3	60	25	75	100
Core / Allied/ Elective	MP12	Heat and Thermodynamics	4	3	60	25	75	100
LAB	MPL21	Major Practical-I	2	-	30	-	-	-
Core / **Allied**/ Elective	AM11	Ancillary Mathematics-I	6	5	90	25	75	100
AECC	ES	Environmental Science	2	2	30	15	35	50
TOTAL			**30**	**19**	**450**	**140**	**410**	**550**

Semester – II

Course	Code No	Subject	Contact Hrs / Week	Credits	Total No of Hrs Allotted/ Semester	Max Marks CA	Max Marks SE	Total
Part I Tamil	P121	Tamil / Other Language	6	3	90	25	75	100
Part II English	P221	English	6	3	90	25	75	100
Core / Allied/ Elective	MP21	Mechanics	4	3	60	25	75	100
Core / Allied/ Elective	MP22	Optics	4	3	60	25	75	100
LAB	MPL21	Major Practical-I	2	3	30	40	60	100
Core / **Allied**/ Elective	AM21	Ancillary Mathematics-II	6	5	90	25	75	100
AECC	MPAEC 21	Data analysis and interpretation	2	2	30	15	35	50
TOTAL			**30**	**22**	**450**	**180**	**470**	**650**

Semester – III

Course	Code No	Subject		Contact Hrs / Week	Credits	Total No of Hrs Allotted	Max Marks CA	Max Marks SE	Total
Part I Tamil	P131	Tamil / Other Language		6	3	90	25	75	100
Part II English	P231	English		6	3	90	25	75	100
Core / Allied/ Elective	MP31	Electricity & Magnetism		4	4	60	25	75	100
Core / Allied/ Elective	MP32	Modern Optics		4	4	60	25	75	100
LAB	MPL41	Major Practical-II		2	-	30	-	-	-
Core / **Allied**/ Elective	AP31/APL41	Allied – I (Chemistry)	Theory	4	4	60	25	75	100
			Practical	2	-	30	-	-	-
Non Major Elective I	MPNME31	Solar energy		2	2	30	15	35	50
TOTAL				**30**	**20**	**450**	**140**	**420**	**550**

Semester – IV

Course	Code No	Subject		Contact Hrs / Week	Credits	Total No of Hrs Allotted	Max Marks CA	Max Marks SE	Total
Part I Tamil	P141	Tamil / Other Language		6	3	90	25	75	100
Part II English	P241	English		6	3	90	25	75	100
Core / Allied/ Elective	MP41	Materials Science		4	4	60	25	75	100
Core / Allied/ Elective	MP42	Fundamentals of Electronics		4	4	60	25	75	100
LAB	MPL41	Major Practical-II		2	3	30	40	60	100
Core / **Allied**/ Elective	AP41/ APL41	Allied – II (Chemistry)	Theory	4	4	60	25	75	100
			Practical	2	2	30	40	60	100
SEC 1	MPSEC41	Introduction to nanophysics-I/ Medical physics-I/Physics in everyday life		2	2	30	15	35	50
TOTAL				**30**	**25**	**450**	**220**	**530**	**750**

Semester – V

Course	Code No	Subject	Contact Hrs / Week	Credits	Total No of Hrs Allotted	Max Marks CA	Max Marks SE	Total
Core / Allied/ Elective	MP51	Elementary Solid State Physics	6	6	90	25	75	100
Core / Allied/ Elective	MP52	Analog Electronics	6	6	90	25	75	100
Core / Allied/ Elective	MP53	Modern Physics	6	6	90	25	75	100
Core / Allied/ **Elective**	MPE51	Numerical methods with Programming in C /Mathematical physics/Introduction to microprocessor	4	4	60	25	75	100
Non Major Elective II	MPNME51	Non conventional energy	2	2	30	15	35	50
LAB	MPL61	Major Practical-III (General)	2	-	30	-	-	-
LAB	MPL62	Major Practical-IV (Electronics)	2	-	30	-	-	-
Value Education	VE	Value Education	2	1	30	15	35	50
TOTAL			**30**	**25**	**450**	**130**	**370**	**500**

Semester – VI

Course	Code No	Subject	Contact Hrs / Week	Credits	Total No of Hrs Allotted	Max Marks CA	Max Marks SE	Total
Core / Allied/ Elective	MP61	Atomic and Molecular spectra	6	6	90	25	75	100
Core / Allied/ Elective	MP62	Nuclear and particle physics	6	6	90	25	75	100
Core / Allied/ Elective	MP63	Digital Electronics	6	6	90	25	75	100
Core / Allied/ **Elective**	MPE61	Introduction to Quantum mechanics/Optical fiber communication/ Electromagnetism	6	6	90	25	75	100
SEC2	MPSEC61	Practical electric circuits/ Introduction to nanophysics-II/ Medical physics-II	2	2	30	15	35	50
LAB	MPL61	Major Practical-III (General)	2	2	30	40	60	100
LAB	MPL62	Major Practical-IV (Electronics)	2	2	30	40	60	100
TOTAL			30	**30**	450	195	455	650
Part V		**NCC/ NSS/ PET**		**1**		50	50	100
TOTAL CREDITS FOR SEMESTERS I to VI				**140**				

THIAGARAJAR COLLEGE, MADURAI- 9

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DEPARTMENT OF PHYSICS

(For those who join in 2017 and after)

Course :Core **Int.Marks:25**
Class: I year **Ext.Marks:75**
Semester : I **Max.Marks: 100**
Sub. Code :MP11 **Hour/Week: 4**
Title of the paper : PROPERTIES OF MATTER **Credit : 3**

Course Outcomes:

On the successful completion of the course, students will be able to

1. Discuss the moduli of elasticity as a property of matter.
2. Understand the effect of properties of matter on day to day life activities.
3. Apply the properties of matter for the betterment of life.

Unit I: ELASTICITY

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.

Unir II: VISCOSITY

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

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

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

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:

1. Murugeshan,R. 2001.Properties of Matter, S.Chand & Company Ltd., New Delhi (ISBN: 81-219-0605-9)].

REFERENCE BOOKS:

1. Mathur, D.S. 2005.Elements of Properties of Matter, S.Chand & Company Ltd, New Delhi (ISBN:81-219-0815-9)]

Course designers:

1. Mrs.V.Rajni Swamy
2. Dr.S.Rajakarthihan

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DEPARTMENT OF PHYSICS
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Course :Core **Int.Marks:25**
Class: I year **Ext.Marks:75**
Semester : I **Max.Marks: 100**
Sub. Code :MP12 **Hour/Week: 4**
Title of the paper : HEAT AND THERMODYNAMICS **Credit : 3**

Course Outcomes:

On the successful completion of the course, students will be able to

1. Know the behavior of Ideal gas and real gas
2. Understand the transport phenomena of the gases
3. Understand elementary aspects underlying changes of state
4. Discuss the fundamental laws of thermodynamics and thermodynamical relations

Unit I: KINETIC THEORY OF MATTER

Ideal Gas and Behaviour of Real Gas: Three states of Matter – Concept of Ideal or Perfect Gas – Kinetic Model – Expression for the Pressure Exerted by a Gas – Estimation of r.m.s. Speeds of Molecules – Deduction of Boyle's law – Kinetic Energy per unit Volume of a Gas - Derivation of Gas Equation – Derivation of Gas Laws – Avogadro's Hypothesis – Change of State – Continuity of State – Critical constants – Boyle temperature – Differentiation between Gas and Vapour – Joule-Thomson Effect – Joule-Thomson Porous Plug Experiment.

Unit II: TRANSPORT PHENOMENA IN GASES

Molecular Collisions – Mean Free Path – Sphere of influence – Collision Cross-section – Expression for Mean Free Path – Variation of λ with Temperature and Pressure – Transport Phenomena – Viscosity: Transport of Momentum – Effect of Temperature on η - Effect of Pressure on η - Thermal Conductivity: Transport of Thermal Energy – Relation between η and K – Effect of Temperature on K - Effect of Pressure on K – Self Diffusion : Transport of Mass – Effect of Temperature and Pressure – Relation between η and D.

Unit III: THERMODYNAMICS

Laws of Thermodynamics: Zeroth Law of Thermodynamic – Concept of Heat – Thermodynamic Equilibrium – Work : A Path Dependent Function – Internal Energy (U) – First Law of Thermodynamics – Specific Heats of Gas – Application of First Law of Thermodynamics – Slope of Adiabatics and Isothermals – Reversible and Irreversible

Process – Heat Engines – Definition of Efficiency – Carnot's Ideal Heat Engine – Second law of Thermodynamics – Carnot's Theorem.

Unit IV: ENTROPY

Concept of Entropy – Change in Entropy – Change in Entropy in Adiabatic Process - Change of Entropy in Reversible Cycle – Principle of Increase of Entropy – Change of Entropy in Irreversible Cycle – The T-S Diagram – Physical Significance of Entropy – Entropy of a Perfect Gas – Third Law of Thermodynamics – Zero Point Energy – Negative Temperature – Heat Death of Universe.

Unit V: THERMODYNAMICAL RELATIONS

Thermodynamic Variables – Extensive and Intensive Variables – Maxwell's Thermodynamical Relations – Joule-Thomson Coefficient(μ) – Clausisus-Clapeyron's Equation - Thermodynamic Potentials – Relation Between c_p, c_v and μ - Entropy and the Second law of Thermodynamics – Joule-Kelvin Coefficient – Equilibrium Between Liquid and its Vapour – First order Phase Transitions – Second Order Phase Transitions.

TEXT BOOK:

1. Heat, Thermodynamics and Statistical Physics – Brijlal, Dr.N.Subrahmanyam, P.S.Hemne – ISBN 81-219-2813-3.
   Unit I : Chapter I & II : 1.1 – 1.10, 2.1, 2.2, 2.4 - 2.6, 2.19 - 2.21

   Unit II : Chapter III : 3.1 – 3.18

   Unit III : Chapter IV : 4.2 – 4.7, 4.9, 4.10, 4.14, 4.20 – 4.23, 4.28, 4.29

   Unit IV : Chapter V : 5.1 – 5.9, 5.15 – 5.18

   Unit V : Chapter VI : 6.1 – 6.3, 6.4.3, 6.4.7, 6.5, 6.8, 6.15 - 6.19

REFERENCE BOOK:

1. Nag, P.K. 2005, Basic and applied Thermodynamics, Tata McGraw – Hill company Ltd.,.

Course designers:

1. Mr.M.Venkatachalam
2. Mrs.R.Dhanalakshmi

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Course :Core **Int.Marks:25**
Class: I year **Ext.Marks:75**
Semester : II **Max.Marks: 100**
Sub. Code :MP21 **Hour/Week: 4**
Title of the paper : MECHANICS **Credit : 3**
Course Outcomes:

On the successful completion of the course, students will be able to

1. Discuss the laws of motion and the concept of central force
2. Explain the principles of projectile motion and dynamics of rigid bodies.
3. Interpret and understand oscillations of mechanical systems.

Unit I: LAWS OF MOTION AND CENTRAL FORCE

Newton's 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.

Unit II: SYSTEM OF PARTICLES

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.

Unit III: DYNAMICS OF RIGID BODIES I

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

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

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.

TEXT BOOK :

1. Brijlal, N.Subrahmanyam& Jivan Seshan. 2005, Mechanics and Electrodynamics, S.Chand & Company Ltd, New Delhi (ISBN:81-219-2591-6)]

   UNIT I: Chapter 4 [4.1-4.9, 4.11]

   UNIT II: Chapter 6 [6.1-6.10]

   UNIT III: Chapter 7 [7.1-7.11]

   UNIT IV: Chapter 7[7.12, 7.15, 7.18-7.21, 7.23, 7.26-7.29]

   UNIT V: Chapter 8[8.2-8.4, 8.10, 8.11, 8.15, 8.16]

REFERENCE BOOK:

1. Mathur, D.S. 2005, Elements of Properties of Matter, S.Chand & Company Ltd , New Delhi (ISBN:81-219-0815-9)]

Course designers:

1. Mrs.V.Rajni Swamy
2. Dr.S.Rajakarthihan

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Course :Core **Int.Marks:25**
Class: I year **Ext.Marks:75**
Semester : II **Max.Marks: 100**
Sub. Code :MP22 **Hour/Week: 4**
Title of the paper : OPTICS **Credit : 3**
Course Outcomes:

On the successful completion of the course, students will be able to

1. Know the broad overview of the elementary concepts of optics.
2. Discuss the three crucial phenomena in Optics viz. Interference, Diffraction and Polarization and their occurrence in day to day life.

Unit I: LIGHT AND LENS

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

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

Coherence – Conditions for interference – Techniques of obtaining interference - Fresnel Biprism – Achromatic fr
inges – 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

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

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:

1. Brijlal N Subrahmanyam., Avadhanulu M.N., 2006, A Text Book Of Optics, S.Chand & Company Ltd, New Delhi (ISBN:81-219-2611-4)

REFERENCE BOOK:

1. Jenkins, F.A., White H.E., 1981, Fundamentals Of Optics, 4th Edition, McGraw- Hill Book Company, (ISBN:0-07-032330-5)

Course designers:

1. Mr.M.Venkatachalam
2. Mrs.R.Sribala

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Course :AECC **Int.Marks:15**
Class: I year **Ext.Marks:35**
Semester : II **Max.Marks:50**
Sub. Code :MPAEC21 **Hour/Week: 2**
Title of the paper : DATA ANALYSIS AND INTERPRETATION **Credit :2**

Course Outcomes:

On the successful completion of the course, students will be able to

1. Gain knowledge on uncertainties in measurements
2. Understand the graphical representation of data
3. Interpret the graphs in physical terms
4. Enhance their mathematical skills

Unit I: ERROR ANALYSIS OF DATA

Significant figures – Discrepancy- comparison of two measured numbers- checking proportionality with a graph- fractional uncertainities-uncertainity in sums and differences:products and quotients:power-random and systematic errors- the mean and standard deviation

Unit II: REPERSENTATION OF DATA

Graphs of basic type of functions (linear, quadratic, power, polynomial, rational, exponential, logarithmic, sinusoidal) and their physical interpretation-Examples

TEXT BOOK:

1. John R. Taylor. 1982. An Introduction To Error Analysis The Study Of Uncertainties In Physical Measurements, United states of America, University Science Books.

REFERENCE BOOK:

1. N.C.Barford, 1969. Experimental Measurements: Precision, Error and Truth,Addison Wesley Publishing Company, London.

Course designers:

1. Dr.J.Suvetha Rani

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DEPARTMENT OF PHYSICS

(For those who join in 2017 and after)

Course :Core **Int.Marks:25**
Class: II year **Ext.Marks:75**
Semester : III **Max.Marks: 100**
Sub. Code :MP31 **Hour/Week: 4**
Title of the paper : ELECTRICITY & MAGNETISM **Credit :4**

Course Outcomes:

On the successful completion of the course, students will be able to

1. Know the basics of electricity and magnetism.
2. Enhance the application skills by relating the phenomena of electricity and magnetism with daily activities.
3. Appreciate 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 –an insulated conductor- 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 – due 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 Expression for current density – Equations of Continuity – Ohm's law and Electrical Conductivity – Drude –Lorentz theory of electrical cionduction-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:

1. Murugeshan, R. 2011,Electricity and Magnetism, Nineth revised edition., S.Chand & Company Ltd, New Delhi,.[ISBN:81-219-1705-0]

(Unit I Sec. 2.1 –2.6, 2.8- 2.11, Unit II Sec. 3.1 – 3.8, 4.1 – 4.6, 4.8, 4.9, 4.13, Unit III Sec. 6.1-6.6, 12.1-12.6, 13.1-13.7,Unit IV Sec. 15.1-15.13, 15.15, 15.16, Unit V Sec 22.1-22.10)

REFERENCE BOOK:

1. Kip, A.F. 1969, Fundamentals of Electricity and Magnetism, ,2nd edition., McGraw-Hill, New York.

Course designers:

1. Mrs.V.Rajni Swamy
2. Mrs.R.Dhanalakshmi

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Course :Core	**Int.Marks:25**
Class: II year	**Ext.Marks:75**
Semester : III	**Max.Marks: 100**
Sub. Code :MP32	**Hour/Week: 4**
Title of the paper : MODERN OPTICS	**Credit : 4**

Course Outcomes: On the successful completion of the course, students will be able to

1. Understand a broad overview of the various optical instruments.
2. Know about laser and the basis of holography
3. Appreciate the fibre optics and nonlinear optical phenomena**.**

Unit I: OPTICAL INSTRUMENTS

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

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, CO2 Laser – Laser beam characteristics-Applications.

Unit III: HOLOGRAPHY

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

Unit IV: FIBRE OPTICS

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

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:

1. Subrahmanyam, BrijLal N. & Avadhanulu, M.N. 2006, A Text Book Of Optics, S. Chand and Company Ltd, New Delhi (ISBN:81-219-2611-4).

REFERENCE BOOK:

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

Course designers:

1. Mr.M.Venkatachalam
2. Dr.S.Rajakarthihan

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DEPARTMENT OF PHYSICS
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Course :Non-major Elective I **Int.Marks:15**
Class: II year **Ext.Marks:35**
Semester : III **Max.Marks: 50**
Sub. Code :MPNME31 **Hour/Week: 2**
Title of the paper : SOLAR ENERGY **Credit : 2**

Course Outcomes:

On the successful completion of the course, students will be able to

1. Explain the available Non-conventional Energy sources
2. Understand the working various Solar devices

Unit I: SOLAR ENERGY

Conventional Energy sources – Renewable Energy sources- Solar Energy- Solar radiation and measurements- Solar constant- Solar radiation at the Earth's surface- Solar radiation measurements- Physical principle of the conversion of solar radiation into heat- Concentrating collectors - Storage of solar energy- Thermal storage.

Unit II: APPLICATION OF SOLAR ENERGY

Solar Water Heating- Solar cells- Basic Photovoltaic system for power generation- Solar distillation- solar pumping- solar cooking.

TEXT BOOK:

1. Rai G.D., 2011, Non-Conventional Energy Sources, Reprint, Khanna Publishers, New Delhi.

REFERENCE BOOK:

1. Sukhatme S.P. 1984. Solar Energy Principles thermal collection and storage, Tata McGraw Hill publications

Course designers:

1. Dr.S.Rajakarthihan

THIAGARAJAR COLLEGE, MADURAI- 9

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

DEPARTMENT OF PHYSICS

(For those who join in 2017 and after)

Course :Core **Int.Marks:25**
Class: II year **Ext.Marks:75**
Semester : IV **Max.Marks: 100**
Sub. Code :MP41 **Hour/Week: 4**
Title of the paper : MATERIALS SCIENCE **Credit : 4**

Course Outcomes: On the successful completion of the course, students will be able to

1. Understand the phase rule and phase transformation
2. Appreciate the applications of phase diagrams
3. Understand the mechanism of creep and corrosion
4. Know about the new materials

Unit I: PHASE DIAGRAMS

The phase rule- single component system- binary phase diagram- microstructural changes during cooling-the lever rule- some typical phase diagrams- other applications of phase diagrams

Unit II: PHASE TRANSFORMATIONS

Time scale for phase changes- the nucleation kinetics- the growth and the overall transformation kinetics- transformation in steel-precepitation processes- solidification and crystallization- the glass transition- recovery, recrystallization and grain growth

Unit III: PLASTIC DEFORMATION AND CREEP IN CRYSTALLINE MATERIALS

The tensile stress-strain curve- phase deformation by slip-the shear strength of perfect and real crystals- multiplication of dislocations during deformation-the effect of grain size on dislocation motion-the effect of solute atoms on dislocation motion- the effect of precipitate particles on dislocation motion- mechanism of creep-creep resistant materials

Unit IV: FRACTURES, OXIDATION AND CORROSION

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

Unit V: NEW MATERIALS

Introduction- Metallic glasses- fiber reinforced plastics and finer reinforced metals- metal matrix composites- surface acoustic wave materials-biomaterials- ceramics- cermets- high temperature materials- thermoelectric materials- electrets- nuclear engineering materials- nanophase materials- intermetallic compounds- shape memory alloys- SMART materials- conducting polymers

TEXT BOOK

1. Raghavan, V. 2003. Materials Science and Engineering – A First Course, 4th Ed., Prentice-Hall of India (ISBN: 81-203-1261-9)
2. Arumugam, M. 2002. Materials Science, 3rd Ed., Anuradha Agencies, India.

REFERENCE BOOKS

1. Manchandra VK. 1992.A text book of Materials Science, New India Publishing House

Course designers:

1. Mrs.R.Dhanalakshmi
2. Dr.S.Rajakarthihan

THIAGARAJAR COLLEGE, MADURAI- 9
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DEPARTMENT OF PHYSICS
(For those who join in 2017 and after)

Course :Core **Int.Marks:25**
Class: II year **Ext.Marks:75**
Semester : IV **Max.Marks: 100**
Sub. Code :MP42 **Hour/Week: 4**
Title of the paper : FUNDAMENTALS OF ELECTRONICS **Credit : 4**

Course Outcomes:

On the successful completion of the course, students will be able to

1. Appreciate the development of electronics in discrete components
2. Provide the fundamental aspects regarding the design of analog electronic circuits for various applications.
3. Evaluate the functioning of unipolar and bipolar junction transistors

Unit I: BASIC CIRCUIT ANALYSIS

Voltage source- constant voltage source- constant current source- conversion of voltage source into current source- maximum power transfer theorem- Thevenin's theorem- procedure for finding Thevinin equivalent circuit- Norton's theorem- Procedure for finding Norton equivalent circuit- Chassis and ground

Unit II: SEMICONDUCTOR DIODE

PN junction- properties of PN junction- biasing a PN junction-current flow in a forward biased PN junction- Volt- Ampere characteristics of PN junction- Semiconductor diode- crystal diode as a rectifier-Resistance of crystal diode- half wave rectifier- full –wave rectifiers-efficiency of HWR and FWR- bridge rectifier-efficiency-ripple factor

Unit III: FILTER CIRCUITS AND APPLICATIONS OF DIODES

Filter circuits- Capacitor filter- choke input filter- capacitor input filter- voltage multipliers- half-wave voltage doubler- Zener diode- equivalent circuit of zener diode- zener diode as voltage stabilizer- clipping circuits- positive clipper- biased clipper- combination clipper- Application of clippers- clamping circuits- Basic idea of a clamper- positive clamper- negative clamper

Unit IV: TRANSISTOR AND TRANSISTOR BIASING

Transistor connections and their characteristics: Common base connection- common emitter connection- common collector connection- transistor load line analysis-operating

point- cut-off and saturation points- methods of transistor biasing: base resistor method- emitter bias circuit- biasing with collector feedback resistor- voltage divider bias method

Unit V: FIELD EFFECT TRANSISTORS

Junction field effect transistor- principle and working of JFET- Difference between JFET and bipolar transistor- JFET as an amplifier- output characteristics of JFET- variation of transconductance of JFET- JFET biasing: bias battery- self-bias, potential divider, MOSFETs- E-MOSFET operation, D-MOSFET operation.

TEXT BOOK

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

REFERENCE BOOKS

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

Course designers:

1. Dr.J.Suvetha Rani

THIAGARAJAR COLLEGE, MADURAI- 9

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DEPARTMENT OF PHYSICS

(For those who join in 2017 and after)

Course : SEC I **Int.Marks:15**
Class: II year **Ext.Marks:35**
Semester : IV **Max.Marks: 50**
Sub. Code : MPSEC41 **Hour/Week: 2**
Title of the paper : INTRODUCTION TO NANOPHYSICS-I **Credit : 3**

Course Outcomes:

On the successful completion of the course, students will be able to

1. Know the postulates and concepts of nanophysics with clarity.
2. Understand the principles, fabrication and design of Carbon Nano-Tubes and their application.

Unit I: GENERAL METHODS OF PREPARATIONS

Introduction – Emergence of Nanotechnology – Bottom-Up and Top-Down Approaches-Challenges in Nanotechnology-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 II: 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, 2004. Nanostructures & Nanomaterials, Imperial College Press
2. Pradeep, T. 2007. NANO: The essentials – Undeerstanding Nanoscience and nano technology, Tata McGraw-Hill Publishing Company Ltd. New Delhi.

REFERENCE BOOKS:

1. Manasi karkare, 2008. Nanotechnology: Fundamentals and applications, I.K International Pvt.Ltd.

Course designers:

1. Mrs.R.Dhanalakshmi

THIAGARAJAR COLLEGE, MADURAI- 9
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DEPARTMENT OF PHYSICS
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Course : SEC I **Int.Marks:15**
Class: II year **Ext.Marks:35**
Semester : IV **Max.Marks: 50**
Sub. Code : MPSEC41 **Hour/Week: 2**
Title of the paper : MEDICAL PHYSICS-I **Credit :2**

Course Outcomes:
On the successful completion of the course, students will be able to

1. Know the various medical equipments and the physics behind, their working.
2. Understand the basic idea about X-Rays and the hazards of radiation on human health.
3. Appreciate the physical processes involved in the working of the equipments.

Unit I

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

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 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. Roy R.N. 2001.A text book of bio physics ,Books and Allied (P) Ltd.
3. Arumugam M. Bio medical Instrumentation

REFERENCE BOOKS:

1. Brijlal & Subramaniam, 2002. Optics : S. Chand & Co
2. Venkatraman S.K. 2002. Bio medical electronics & Instrumentation, Galgotia Pub. Pvt. Ltd.
3. Leslie Cromwell, Fred.J.Weibell and Erich A, 2002. Bio medical Instrumentation & Measurements: Pfeiffer PHI.

Course designers:

1. Mr.S.Alaguraja

THIAGARAJAR COLLEGE, MADURAI- 9
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DEPARTMENT OF PHYSICS
(For those who join in 2017 and after)

Course : SEC I **Int.Marks:15**
Class: II year **Ext.Marks:35**
Semester : IV **Max.Marks: 50**
Sub. Code : MPSEC41 **Hour/Week: 2**
Title of the paper : PHYSICS IN EVERYDAY LIFE **Credit : 2**

Course Outcomes:
On the successful completion of the course, students will be able to

1. Know the Physics principles used in many frequently used appliances
2. Appreciate the physics principles that are used in media and communication systems

Unit I: HOME APPLIANCES

Principle and working of electric lights, the electric fan, air cooler and air-conditioning unit - pressure cooker, refrigerator, washing machine, mixie, grinder, rice cooker, microwave oven.

Unit II: COMMUNICATION SYSTEMS

Principles of telephone, cell phone, fax, internet, intranet and LAN - working of a Xerox machine and computer printers.-Principles involved in the working of the radio, TV, the remote control- principle and working of the tape recorder-CD player and the DVD player - microphones, amplifiers and loud speakers- the cinema.

TEXT BOOKS:

1. Andrade, Physics for the Modern World, The English Language Book Society.
2. Sedov, E. Entertaining Electronics, University Publishers.
3. Leslie Cromwell, Biomedical Instrumentation and Measurements, Prentice Hall of India.

REFERENCE BOOK :

1. Ivar Utial, 101 Science Games, Pustak Mahal, Delhi.

Course designers:

1. Dr.J.Suvetha Rani

THIAGARAJAR COLLEGE, MADURAI- 9

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DEPARTMENT OF PHYSICS

(For those who join in 2017 and after)

Course :Core **Int.Marks:25**
Class: III year **Ext.Marks:75**
Semester : V **Max.Marks: 100**
Sub. Code :MP51 **Hour/Week: 6**
Title of the paper : ELEMENTARY SOLID STATE PHYSICS **Credit : 6**

Course Outcomes:

On the successful completion of the course, students will be able to

1. Know the fascinating subject of solid state physics.
2. Understand the electronic structure of solids especially metals semiconductors and dielectrics.
3. appreciate extensively on newer topics on superconductivity, dielectric and optical properties of materials

Unit I: CRYSTAL PHYSICS – I

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 – Fivefold 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

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.

Unit III: SUPERCONDUCTIVITY

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 – B.C.S. Theory – Josephson's Tunneling – Theory of D.C. Josephson Effect

Unit IV: DIELECTRIC MATERIALS

Introduction- fundamental definitions in dielectrics- different types of electric polarization- frequency and temperature effects on polarization- dielectric loss- local field or internal field- Clausius- Mosotti relation- determination of dielectric constant- dielectric breakdown- properties and different types of insulating materials- ferroelectric materials

Unit V: OPTICAL MATERIALS

Introduction- optical absorption in metals, semiconductors and insulators- Nonlinear optical materials and their applications- optical modulators- display devices and display materials- photoelectric electron emission- thermography and its materials

TEXT BOOKS:

1. Pillai, S.O. 1997, *Solid State Physics* 4th Ed., New Age International Publisher, (ISBN:81-224-1048-0).(Unit I : Pages 87 – 109; Unit II : Pages 110 -145, 157 – 170 ; Unit III : Pages 359 ,361 – 381 , 387 -389,392 -394)
2. Arumugam. M. 2002. *Materials Science* ,3rd Ed., Anuradha Agencies (Unit IV: Pages 6.1-6.42, Unit V: Pages 10.1-10.23, 10.36-10.70)

REFERENCE BOOKS:

1. Hannay, N.B. 1976. Solid State Chemistry, Prentice Hall of India Private Limited
2. Raghavan, V. 2003, Materials Science and Engineering – A First Course, 4th Ed., Prentice-Hall of India,(ISBN:81-203-1261-9)

Course designers:

1. Mrs.R.Dhanalakshmi
2. Mrs.R.Sribala

THIAGARAJAR COLLEGE, MADURAI- 9
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DEPARTMENT OF PHYSICS
(For those who join in 2017 and after)

Course :Core **Int.Marks:25**
Class: III year **Ext.Marks:75**
Semester : V **Max.Marks: 100**
Sub. Code :MP52 **Hour/Week: 6**
Title of the paper : ANALOG ELECTRONICS **Credit :6**

Course Outcomes: On the successful completion of the course, students will be able to

1. Know the fundamental aspects regarding the design of analog electronic circuits
2. Understand the various applications of analog electronic circuits.

Unit I: TRANSISTOR VOLTAGE AMPLIFIERS

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-important terms - RC, transformer and direct coupled amplifiers.

Unit II: TRANSISTOR AUDIO POWER AMPLIFIERS

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 series-fed class A amplifier-thermal runaway- heat sink-push-pull amplifier.

Unit III: OSCILLATORS

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

Unit IV: 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

Unit V: APPLICATIONS OF OP-AMPS

Inverting amplifier-noninverting amplifier-voltage follower-summing amplifiers-applications of summing amplifiers:as averaging amplifier, as subtractor-op-amp integrator-

critical frequency of integrators-op-amp differentiator-comparator circuits: as a square wave generator, zero-crossing detector and a level detector.

TEXT BOOK

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

REFERENCE BOOKS

1. Bell, D. A. Electronic devices and circuits, 4th ed., Prentice-Hall of India, New Delhi.
2. Malvino, A. Bates, D. J. Electronic principles, 7th ed., Tata McGraw-hill publishing Co. Ltd., New Delhi.
3. Chattopadhyay, D.. Rakshit, P. C. Electronics Fundamentals and applications, 12th ed., New Age International(P) Limited, New Delhi.

Course designers:

1. Dr.G.Arivazhagan
2. Dr.R.Srinivasan

THIAGARAJAR COLLEGE, MADURAI- 9
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DEPARTMENT OF PHYSICS
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Course :Core	**Int.Marks:25**
Class: III year	**Ext.Marks:75**
Semester : V	**Max.Marks: 100**
Sub. Code :MP53	**Hour/Week: 6**
Title of the paper : MODERN PHYSICS	**Credit : 6**

Course Outcomes: On the successful completion of the course, students will be able to

1. Know the essential principles of relativity
2. Understand the birth and final states of stars
3. Understand the theories of the origin and evolution of stars

Unit I: RELATIVITY – I

The experimental basis of relativity: Michelson-Morley experiment –Einstein's postulates – The Lorentz transformation : Calibrating the space-time axes – Time dilation – Length contraction – The Doppler effect.

Unit II: RELATIVITY – II

The twin paradox and ther consequences – Relativistic momentum – Relativistic energy – Mass/Energy conversion and binding energy – Invariant mass

Unit III: GENERAL RELATIVITY

General relativity – Deflection of light in a gravitational field – Gravitational red shift – Perhelion of Mercury's orbit – Delay of light in a gravitational field.

Unit IV: ASTROPHYSICS

The Sun : Is there life elsewhere? – The Stars : The celestial sphere – The evolution of stars – Cataclysmic Events – Final states of stars.

Unit V: COSMOLOGY

Cosmology and Gravitation – Cosmology and the Evolution of the Universe: "Natural" Planck units

TEXT BOOK:

1. Tipler, P.A. & Lewellyn, R.A., 2012. Modern Physics , 6th ed., W.H Freeman & Co.,
   Unit I – p.3-55
   Unit II – p.65-97
   Unit III – p.97-112
   Unit IV – p.639-673
   Unit V – p.673-696

REFERENCE BOOKS:

1. Thornton, S.T. & Rex, A., 2006. Modern Physics for Scientists and Engineers ,4th ed., Cengage Learning,
2. Serway, R.A., Moses, C.J. & Moyer, C.A., 2005. Modern Physics , 3rd ed., Thomson Learning Inc., [ISBN 0-534-40624-6]
3. Beiser, A., 2003.Concepts of Modern Physics , 6th ed., McGraw Hill
4. Krane, K.S. 2011. Modern Physics, 3rd ed., John Wiley & Sons

Course designers:

1. Dr. R.V.Krishnakumar
2. Mrs.V.Rajni Swamy

THIAGARAJAR COLLEGE, MADURAI- 9
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DEPARTMENT OF PHYSICS
(For those who join in 2017 and after)

Course :Major Elective **Int.Marks:25**
Class: III year **Ext.Marks:75**
Semester : V **Max.Marks: 100**
Sub. Code : MPE51(N) **Hour/Week: 4**
Title of the paper : NUMERICAL METHODS WITH PROGRAMMING IN C
Credit : 4

Course Outcomes:

On the successful completion of the course, students will be able to

1. Understand the use of numerical methods in solving physics problems
2. Appreciate the various methods in numerical integration
3. Understand the basic concepts of C language
4. Implement the numerical concepts in programming

Unit I: ALGEBRAIC AND TRANSCENDENTAL EQUATIONS

Introduction – Iteration method – Bisection method – Regula-falsi method – Newton-Raphson method.

Unit II: NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION

Derivatives using Newton's forward difference formula – Derivatives using Newton's backward difference formula - Derivatives using Newton's central difference formula – Numerical Integration – Trapezoidal rule – Simpson's one third rule.

Unit III: C FUNDAMENTALS

Identifiers and keywords – Data types – Constants – Variables – Declarations – Expressions – Symbolic constants – Library functions

Operators and Expressions: Arithmetic operators – Unary operators – Relational and Logical operator – Assignment operator – Conditional operator and Bitwise operator

Data input and output : The get char functions – the put char function – Scanf function – Printf function – Gets and puts function.

Unit IV: CONTROL STATEMENTS

Branching statement: The if and if-else statement – The while statement and the do-while statement

Looping statement : The for statement – Nested control statement – the switch statement – The break statement – The continue statement – The goto statement.

Unit V: ARRAYS, FUNCTIONS AND STRUCTURES

Arrays – one dimensional, two dimensional & multidimensional arrays – Defining a function – Accessing a function – function prototypes – passing Arguments to a function – Recursion – Structures – Initialization – comparison – Arrays of structures – Arrays within structures – structures within structures.

TEXTBOOK:

1. Arumugam Isaac, Numerical Analysis with Programming in C, New Gamma publications, India

REFERENCE BOOKS:

1. Brian W. Kernnigham and Dennis M. Ritchi, The C programming language, 2nd Ed. Prentice-Hall of India Pvt. Ltd.
2. Henry Mullish and Herbert L Cooper, The spirit of C, 15th Ed, Jaico Publishing house.
3. Kuo, 1966. Numerical methods and Computers: Addison Wesley, London,
4. Rajaraman, Computer Oriented Numerical Methods , 3rd Ed, Prentice Hall, New Delhi.

Course designers:

1. Mrs.R.Dhanalakshmi
2. Dr.J.Suvetha Rani

THIAGARAJAR COLLEGE, MADURAI- 9
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DEPARTMENT OF PHYSICS
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Course :Major Elective **Int.Marks:25**
Class: III year **Ext.Marks:75**
Semester : V **Max.Marks: 100**
Sub. Code : MPE51(M) **Hour/Week: 4**
Title of the paper : MATHEMATICAL PHYSICS **Credit : 4**

Course Outcomes: On the successful completion of the course, students will be able to

1. Discuss the basic concept of vectors and their applications in physical systems.
2. Understand the concept of eigen vectors and eigen values.
3. Know the basic concept of tensors and their applications in physical systems.
4. Understand the complex variables
5. Enhance their mathematical skills

Unit I: VECTOR ALGEBRA

Introduction- simple applications of vectors to mechanics-The scalar and vector fields- directional derivatives- level surfaces- the gradient of a scalar field- the divergence of a vector point function- the curl or rotation of a vector point function- The line integral- Gauss divergence theorem

Unit II: SPECIAL MATRICES

Introduction to matrices- Square , diagonal and constant matrices-real, symmetric and hermitian matrices-normal matrix- triangular matrix- the inverse matrix- inverse transformation- orthogonal matrix- unitary matrix and their transformations- cramer's rule- Eigen values -Eigen vectors; Diagonalizing a matrix

Unit III: TENSORS

Introduction- occurance of tensors in physics- Notation and conventions- contravariant vector- covariant vector- tensors of second rank- equality and null tensor- addition and subtraction- outer product and inner product of tensors- the metric tensor- contravariant metric tensor- associate tensor

Unit IV: COMPLEX VARIABLES

Introduction- definitions- operation of fundamental laws of algebra on complex numbers- Regular functions- Cachy's theorem- Cauchy's integral formula- Cauchy's residue theorem

Unit V: FOURIER SERIES AND INTEGRALS

Fourier series- Dirichlet's theorem- Complex form of Fourier series- Uses of Fourier series- Physical examples of Fourier series-Fourier integral

TEXT BOOKS:

1. Gupta, B.D . 1993. Mathematical Physics, II Ed., Vikas Publishing House.(ISBN:0-7069-76-4).
2. Joshi, A.W. Matrices and tesnors in Physics, New age international publishers (ISBN:81-224-0563-0)

REFERENCE BOOK:

1. Satyaprakash, Mathermatical physics with classical mechanics, Sultan chand & sons (ISBN 81-7014-925-8)

Course designers:

1. Mr.M.Venkatachalam
2. Dr.J.Suvetha Rani

THIAGARAJAR COLLEGE, MADURAI- 9
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DEPARTMENT OF PHYSICS
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Course :Major Elective **Int.Marks:25**
Class: III year **Ext.Marks:75**
Semester : V **Max.Marks: 100**
Sub. Code : MPE51(I) **Hour/Week: 4**
Title of the paper : INTRODUCTION TO MICROPROCESSOR- 8085
Credit : 4

Course Outcomes:
On the successful completion of the course, students will be able to

1. Understand the architecture of 8085 microprocessor
2. Write the programs using instruction sets
3. Understand the interrupts and interfacing of 8085 microprocessor

Unit I: ARCHITECTURE OF 8085

Architecture of 8085 microprocessor, registers, flags, ALU-Address bus and data bus - Demultiplexing address / data bus-Control and status signals-Control bus - Programmers model of 8085-Pin-out signal function diagram-Functions of different pins.

Unit II: INSTRUCTION SET

Instruction set of 8085-data transfer, arithmetic, logic, branching and machine control group of instructions-Addressing modes-register, register indirect, direct, immediate and implied addressing modes. Assembly language and machine language-Programming exercises-addition, subtraction, multiplication and division (all 8-bit binary), ascending order/descending order.

Unit III: INTERFACING-I

Memory interface - Interfacing 2Kx8 ROM and RAM interface -Timing diagram of 8085 instructions (MOV Rd, Rs - MVI data8)

Unit IV: INTERFACING-II

Interfacing input port and output port to 8085 - Programmable peripheral interface 8255 - flashing LEDs.

Unit V: INTERRUPTS

Interrupts in 8085 - hardware and software interrupts RIM, SIM instructions - priorities. Simpie-polled and interrupt controlled data transfer.

TEXT BOOKS:

1. Ramesh Gaonkar, Wiley Easteni, Microprocessor Architecture Programming and Application with 8085/ 8080A
2. Vijayendran V. Viswanathan S. Fundamentals of Microprocessor 8085

REFERENCE BOOKS:

1. Aditya Mathur, Introduction to Microprocessors
2. Lance A. Levanthal, Introduction to Microprocessors

Course designers:

1. Mr.M.Venkatachalam

THIAGARAJAR COLLEGE, MADURAI- 9

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DEPARTMENT OF PHYSICS

(For those who join in 2017 and after)

Course :Non- major Elective II **Int.Marks:15**
Class: III year **Ext.Marks:35**
Semester : V **Max.Marks: 50**
Sub. Code :MPNME51 **Hour/Week: 2**

Title of the paper : NON CONVENTIONAL ENERGY

Credit : 2

Course Outcomes:

On the successful completion of the course, students will be able to

1. Explain the available Bio and Wind Energy sources
2. Understand the working various Bio and Wind Energy devices

Unit I : BIO-MASS ENERGY

Biomass conversion Technologies – Biogas generation – Classification of bio-gas plant- Types- KVIC, Janta and Deena bandhu model biogas plant- Gasification of Biomass – Gasifier – Construction and operation of down draught and up draught gasifier – Application of Gasifiers

Unit II: WIND ENERGY

The nature of wind- Wind energy conversion- Basic Components of Wind Energy conversion Systems (WECS) - Classification of Wind Energy conversion Systems – Advantage and Disadvantage of WECS- Energy Storage- Application of Wind Energy.

TEXT BOOK:

1. Rai, G.D. 2011, Non-Conventional Energy Sources, Reprint, Khanna Publishers, New Delhi.

REFERENCE BOOK:

1. Sukhatme S.P. Solar Energy Principles thermal collection and storage, 1984, Tata McGraw Hill publications.

Course designers:

1. Dr.S.Rajakarthihan

THIAGARAJAR COLLEGE, MADURAI- 9

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DEPARTMENT OF PHYSICS

(For those who join in 2017 and after)

Course :Core **Int.Marks:25**
Class: III year **Ext.Marks:75**
Semester : VI **Max.Marks: 100**
Sub. Code :MP61 **Hour/Week: 6**
Title of the paper : ATOMIC AND MOLECULAR SPECTRA **Credit : 6**

Course Outcomes:

On the successful completion of the course, students will be able to

1. Appreciate the evolution of atom models
2. Explain the four quantum numbers and the various coupling schemes
3. Understand the various principles involved in understanding molecular structure.

Unit I: ATOMIC MODELS

Early atomic spectra – Thomson model – Alpha particle scattering – Rutherford's nuclear model – Bohr's model of the Hydrogen atom – The Hydrogen spectrum – Bohr's model-correction for nuclear motion – Hydrogen-like atom – General quantization rule – Sommerfeld's model – The correspondence principle – Deficiencies of the quantum theory

Unit II: ATOMIC SPECTRA – I

Hydrogen atom spectrum – Orbital magnetic moment of hydrogen atom – Larmor precession –Stern-Gerlach experiment – Electron spin – The vector atom model – Spin-orbit and fine structure – Pauli's exclusion principle and electronic configuration. Total angular momentum in many electron systems: L-S coupling or Russel Saunder's coupling – j-j coupling – Hund's rules.

Unit III: ATOMIC SPECTRA – II

Energy levels and transitions of Helium – Alkali spectra : Shielding by core electrons – Spectral terms of equivalent electrons – Normal Zeeman effect : Early experimental arrangement – Theory – Anomalous Zeeman effect – Paschen-Bach effect – Stark effect – Moseley's law – Width of spectral lines.

Unit IV: MOLECULAR SPECTRA – I

Electromagnetic spectrum – Molecular energies – Classification of molecules – Rotational spectra of diatomic molecules – Diatomic vibrational spectra – Rotation-vibration transitions – Vibrations of polyatomic molecules – Characteristic group frequencies – Infrared spectrometer – Electronic spectra – Frank-Condon principle.

Unit V: MOLECULAR SPECTRA – II

Raman scattering : Quantum theory of Raman scattering – Classical description of Raman scattering – Vibrational Raman scattering – Rotational Raman spectra – Raman spectrometer – Nuclear Magnetic Resonance : NMR principle – The NMR spectrometer – Chemical shifts – Indirect spin-spin interaction – Applications of NMR – Electron Spin Resonance : ESR Priniple – ESR spectrometer – Hyperfine interaction – Applications of ESR spectroscopy – Mossbauer Spectroscopy : Principle – Isomer shift.

TEXT BOOK:

1. Aruldhas G. Rajagopal P. 2005. Modern Physics, 7th print, PHI Learning Private Limited, Delhi [ISBN 978-81-203-2597-5]
   Unit I – Chapter 3, Secs.3.1 – 3.12
   Unit II – Chapter 7, Secs.7.1-7.9
   Unit III – Chapter 7, Secs.7.10 – 7.19
   Unit IV – Chapter 9, Secs.9.1 – 9.11
   Unit V – Chapter 9, Secs.9.12 – 9.15

REFERENCE BOOKS:

1. Graybeal, J.D. : *Molecular spectroscopy*, Mc Graw-Hill, New York, 1988.
2. Hollas, M: *Modern spectroscopy*, 4th ed., John Wiley, New York, 2004.

Course designers:

1. Dr. R.V.Krishnakumar
2. Mrs.V.Rajni Swamy

THIAGARAJAR COLLEGE, MADURAI- 9
(Re-Accredited with 'A' Grade by NAAC)
DEPARTMENT OF PHYSICS
(For those who join in 2017 and after)

Course :Core **Int.Marks:25**
Class: III year **Ext.Marks:75**
Semester : VI **Max.Marks: 100**
Sub. Code :MP62 **Hour/Week: 6**
Title of the paper : NUCLEAR AND PARTICLE PHYSICS **Credit : 6**

Course Outcomes:

On the successful completion of the course, students will be able to

1. Know the properties of nuclei.
2. Understand the principles of radioactivity, radioactive decay and nuclear reactions
3. Understand the classification and properties of elementary particles

Unit I: NUCLEAR PROPERTIES

Constituent of nuclei – Nuclear size – Mass spectrometer – Binding energy – Angular momentum of the nucleus – Magnetic moment – Nuclear quadrupole moment – Parity – Semi-emperical mass formula – Existence of magic numbers – Nuclear shell model – Predictions of the Shell model – Nuclear forces – Two nuclear system (Deuteron) – General features – Meson theory of nuclear forces.

Unit II: RADIOACTIVE DECAY

Discovery of radioactivity – Rate of decay, half-life and mean life – Conservation laws in radioactive decays – Decay series – Radioactive equilibrium – Secular equilibrium – Transient equilibrium – Radioactive dating – Alpha decay – Theory of Alpha decay – Beta decay – Electron emission – Positron emission – Electron capture – Theory of beta decay – Gamma decay – Radioisotopes – Applications.

Unit III: NUCLEAR REACTIONS

Nuclear reactions – Basics – Cross-section – Nuclear reaction kinetics – Q value of a nuclear reaction – Reaction mechanisms – The compound nucleus – Neutron activation – Direct reactions – Nuclear fission – Theory of nuclear fission – Chain reaction – Fission reactor – Breeder reactor – Nuclear fusion – Fusion reaction in stars – Fusion reactor – Transuranium elements

Unit IV:NUCLEAR RADIATION DETECTORS AND PARTICLE ACCELERATORS

Ionization chamber and Geiger counter – Geiger-Muller counter – Scintillation counter – Semiconductor junction detector – The cloud chamber – The bubble chamber – Other detectors : Spark chamber – Photographic emulsion – Cerenkov detector – Cyclotron – Synchrocyclotron – Synchrotron – Synchrotron radiation – Linear accelerator

Unit V: ELEMENTARY PARTICLES

Fundamental interactions in nature – Dawn of elementary particle physics – Mediator of an interaction – pi-mesons – Muons, Kaons and Hyperons – Particles and antiparticles – Classification of elementary particles – Conservation laws – Lepton conservation – Baryon conservation – Strangeness – Isospin – Hypercharge.

TEXT BOOK:

1. Aruldhas , G. Rajagopal, .P. 2005. Modern Physics, 7th print, PHI Learning Private Limited, Delhi. [ISBN 978-81-203-2597-5]
   Unit I – Chapter 17, Secs.17.1 – 17.13
   Unit II – Chapter 18, Secs.18.1 – 18.10
   Unit III – Chapter 19, Secs.19.1 – 19.7
   Unit IV – Chapter 20, Secs.20.1 – 20.9
   Unit V – Chapter 21, Secs.21.1 – 21.5

BOOKS FOR REFERENCE

1. Thornton, S.T. & Rex, A., 2006. Modern Physics for Scientists and Engineers, 4th ed., Cengage Learning.
2. Tipler, P.A & Llwellyn, R.A. 2008. Modern Physics , 5th ed., W.H. Freeman & Co., New York,
3. Serway, R.A., Moses, C.J. & Moyer, C.A., 2005. Modern Physics ,3rd ed., Thomson Learning Inc., [ISBN 0-534-40624-6]
4. Beiser, A., 2003.Concepts of Modern Physics , 6th ed., McGraw Hill.
5. Krane, K.S. 2011. Modern Physics , 3rd ed., John Wiley & Sons,

Course designers:

1. Dr. R.V.Krishnakumar
2. Mrs.V.Rajni Swamy

THIAGARAJAR COLLEGE, MADURAI- 9
(Re-Accredited with 'A' Grade by NAAC)
DEPARTMENT OF PHYSICS
(For those who join in 2017 and after)

Course :Core **Int.Marks:25**
Class: III year **Ext.Marks:75**
Semester : VI **Max.Marks: 100**
Sub. Code :MP63 **Hour/Week: 6**
Title of the paper : DIGITAL ELECTRONICS **Credit : 6**

Course Outcomes:

On the successful completion of the course, students will be able to

1. Know the basic principles, theory and working of fundamental digital circuits
2. Appreciate the basis of modern communication systems.

Unit I: DIGITAL PRINCIPLES & DIGITAL LOGIC

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

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

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

Types of Registers – SISO – SIPO – PISO – PIPO – Ring Counter – Various types of Counters - Asynchronous, Synchronous, MOD – 5, Presettable, & Shift Counters – MOD 10 shift counter – Digital Clock.

Unit V: ARITHMETIC CIRCUITS, D/A & A/D CONVERSION

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 :

1. Donald P. Leech , Albert Paul Malvino, Digital Principles and Applications, 5th Ed., Tata-McGraw-Hill.

REFERENCE BOOKS:

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

Course designers:

1. Dr.G.Arivazhagan
2. Dr.R.Srinivasan

THIAGARAJAR COLLEGE, MADURAI- 9
(Re-Accredited with 'A' Grade by NAAC)
DEPARTMENT OF PHYSICS
(For those who join in 2017 and after)

Course :Major Elective **Int.Marks:25**
Class: III year **Ext.Marks:75**
Semester : VI **Max.Marks: 100**
Sub. Code : MPE61(I) **Hour/Week: 6**
Title of the paper : INTRODUCTION TO QUANTUM MECHANICS Credit : 6

Course Outcomes: On the successful completion of the course, students will be able to

1. Know the basic concepts of Quantum mechanics
2. Compare and contrast Newton's classical mechanics and Planck's QM

Unit I: ORIGIN OF QUANTUM THEORY

Black body radiation-Failure of classical physics to explain energy distribution in the spectrum of a black body – Planck`s quantum theory – Photoelectric effect – Einstein`s explanation of the photoelectric effect – The Ritz combination principle in spectra – Stability of an atom – Bohr`s quantization of angular momentum and its application to the hydrogen atom.

Unit II: WAVE PROPERTIES OF MATTER

Wave particle duality – de Broglie hypothesis for matter waves – concept of wave velocity –Concept of Group velocity – Velocity of de Broglie wave –diffraction of particles – Interference of electrons – Consequences of de Broglie`s concepts –wave packet.

Unit III: HEISSENBERG`S UNCERTAINTY PRINCIPLE

Uncertainty principle – Elementary proof of Heisenberg`s uncertainty relation - Elementary proof of uncertainty relation between energy and time – Illustration of Heisenberg`s uncertainty principle by thought – Experiments – Consequences of uncertainty relation.

Unit IV: SCHRODINGER`S WAVE EQUATION

Schrodinger`s one dimensional time dependent wave equation- one dimensional time independent Schrodinger`s wave equation – Physical interpretation of the wave function □ - Operators in quantum mechanics, Eigen function , Eigen value and Eigen value equation – Expectation values – Postulates of quantum mechanics – transition probability.

Unit V: APPLICATIONS OF QUANTUM MECHANICS

Particle in a one dimensional box – Particle in a rectangular three dimensional box – Simple Harmonic Oscillator – Reflection at a step potential – Transmission across a potential barrier: the Tunnel effect.

TEXT BOOK:

1. Kamal Singh , S.P. Singh**:** S. 2005. Elements of Quantum Mechanics, S. Chand & Company, New Delhi [ISBN:81 -219-2539-8]
   UNIT I Chapter 1 [Sec. 1.1 – 1.8]
   UNIT II Chapter 2 [Sec. 2.1 – 2.9]
   UNIT III Chapter 3 [Sec. 3.1 – 3.5]
   UNIT IV Chapter 4 [Sec. 4.1 – 4.7]
   UNIT V Chapter 5 [Sec.5.1 – 5.5]

REFERENCE BOOK:

1. Aruldhas, G. 2002. Quantum Mechanics, Prentice – Hall of India, [ISBN81- 203-1962. 667]

Course designers:

1. Mrs.V.Rajni Swamy
2. Mrs.R.Sribala

THIAGARAJAR COLLEGE, MADURAI- 9
(Re-Accredited with 'A' Grade by NAAC)
DEPARTMENT OF PHYSICS
(For those who join in 2017 and after)

Course :Major Elective **Int.Marks:25**
Class: III year **Ext.Marks:75**
Semester : VI **Max.Marks: 100**
Sub. Code : MPE61(O) **Hour/Week : 6**
Title of the paper : OPTICAL FIBER COMMUNICATION SYSTEMS Credit : 6

Course Outcomes:

On the successful completion of the course, students will be able to

1. Know the role played by optical fibers in conquering distance and time.
2. Understand the various classifications of optical fibres and the losses encountered while sending signals.
3. Elaborate 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

1. Subir Kumar Sarkar, Optical fibres and fibre optic communication systems. S.chand &company Ltd.(ISBN:81-219-1459-0)

REFERENCE BOOKS:

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)

Course designers:

1. Mrs.V.Rajni Swamy
2. Mrs.R.Sribala

THIAGARAJAR COLLEGE, MADURAI- 9
(Re-Accredited with 'A' Grade by NAAC)
DEPARTMENT OF PHYSICS
(For those who join in 2017 and after)

Course :Major Elective **Int.Marks:25**
Class: III year **Ext.Marks:75**
Semester : VI **Max.Marks: 100**
Sub. Code : MPE61(E) **Hour/Week: 6**
Title of the paper : ELECTROMAGNETISM **Credit : 6**

Course Outcomes:

On the successful completion of the course, students will be able to

1. Know the basics of electromagnetic theory
2. Understand the motion of charged particle in electric and magnetic fields
3. Understand the fundamental principles of magneto statics

Unit I: MAGNETIC EFFECT OF ELECTRIC CURRENT

Introduction- The Biot-Savert law- Magnetic induction at a point due to a straight conductor carrying current- Magnetic induction at a point on the axis of a circular coil carrying current- Magnetic induction at a point on the axis of a solenoid

Unit II: FORCE ON CURRENT BY MAGNETIC FIELD

Force on a current carrying conductor in a magnetic field- Force between two parallel current carrying conductors- Force experienced by an electron moving in a magnetic field- Moving coil Ballistic galvanometer- current and voltage sensitivities of a moving coil galvanometer- Uses of Ballistic galvanometer

Unit III: ELECTROMAGNETIC INDUCTION

Faraday's laws of Electromagnetic induction- Faraday's law of electromagnetic induction in vector form- self- induction- self inductance of a long solenoid- Determination of self inductance by Rayleigh's method- Determination of self- inductance by Anderson's bridge method- Mutual induction- Mutual inductance between two coaxial solenoids- Experimental determination of mutual inductance- coefficient of coupling- Earth inductor- Eddy currents- uses of eddy currents

Unit IV: MAXWELL'S EQUATIONS AND ELECTROMAGNETIC WAVES

Introduction- Displacement current- Maxwell's equations in material media- Plane Electromagnetic waves in free space: Velocity of light- Poynting vector-Hertz experiment for production and detection of electromagnetic wave-Motion of charged particle in uniform electric field(Longitudinal)- Motion of charged particle in uniform electric field(Transverse)- Motion of charged particle in alternating electric field- Motion of charged particle in uniform constant magnetic field- Motion of charged particle in crossed electric and magnetic fields

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:

1. Murugeshan, R. 2011.*Electricity and Magnetism*,,Nineth revised edition., S.Chand & Company Ltd, New Delhi [ISBN:81-219-1705-0]

REFERENCE BOOKS:

1. Reitz, J.R., Milford, F.J & Christy, R.W. 1998. Foundations of electromagnetic theory III ed., Narosa Publishing House, ISBN 81-85015-79-1.
2. Chopra, K. K. Agarwal, G. C. 2010. Electromagnetic theory, V ed., K. Nath & Co.
3. David J. 2000. Griffiths. Introduction to Electrodynamics, III ed., Prentice Hall of India, ISBN 81-203-1601-0.

Course designers:

1. Mrs.V.Rajni Swamy
2. Mrs.R.Dhanalakshmi

THIAGARAJAR COLLEGE, MADURAI- 9

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

DEPARTMENT OF PHYSICS

(For those who join in 2017 and after)

Course : SEC II **Int.Marks:15**
Class: III year **Ext.Marks:35**
Semester : VI **Max.Marks: 50**
Sub. Code : MPSEC61 **Hour/Week: 2**
Title of the paper : PRACTICAL ELECTRIC CIRCUITS **Credit : 2**

Course Outcomes:

On the successful completion of the course, students will be able to

1. Gain knowledge on house wiring.
2. Apply the knowledge to rectify simple electrical problems faced at home.

Unit I: BASIC PRINCIPLES

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: HOUSE WIRING

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.

TEXT BOOK

1. How things Work Vol 1 & Vol 2: 2002,Harper Collins Publ. India a joint venture with The India Today Group, N. Delhi.

REFERENCE BOOKS:

1. Brijlal & Subramaniam, 2002. Electricity & Magnetism ,S. Chand & Co.
2. Theraja, 2002. Electrical technology, S. Chand & Co.

Course designers:

1. Mr.S.Alaguraja

THIAGARAJAR COLLEGE, MADURAI- 9
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DEPARTMENT OF PHYSICS
(For those who join in 2017 and after)

Course : SEC II **Int.Marks:15**
Class: III year **Ext.Marks:35**
Semester : VI **Max.Marks: 50**
Sub. Code : MPSEC61 **Hour/Week: 2**
Title of the paper : INTRODUCTION TO NANOPHYSICS-II **Credit : 2**

Course Outcomes:

On the successful completion of the course, students will be able to

1. Know the general characterization of nano materials
2. Understand the nano sensors and their applications

Unit I: 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 II: 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.

TEXT BOOKS:

1. Huozhong Gao, 2004. Nanostructures & Nanomaterials, Imperial College Press.
2. Pradeep, T. 2007.NANO: The essentials – Undeerstanding Nanoscience and nano technology, Tata McGraw-Hill Pubhilisng Company Ltd. New Delhi.

REFERENCE BOOK:

1. Manasi karkare, 2008. Nanotechnology: Fundamentals and applications, I.K International Pvt.Ltd.

Course designers:

1. Mrs.R.Dhanalakshmi

THIAGARAJAR COLLEGE, MADURAI- 9

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DEPARTMENT OF PHYSICS

(For those who join in 2017 and after)

Course : SEC II **Int.Marks:15**
Class: III year **Ext.Marks:35**
Semester : VI **Max.Marks: 50**
Sub. Code : MPSEC61 **Hour/Week: 2**
Title of the paper : MEDICAL PHYSICS-II **Credit : 2**

Course Outcomes:

On the successful completion of the course, students will be able to

1. Understand the working of various medical instruments
2. Gain practical knowledge on various instruments
3. Get awareness about the banes and boons of nuclear radiation.

Unit I : MEDICAL INSTRUMENTS

Types of lenses – Focal length – Combination of lenses – Power (Diopter) of a lens - Defects in eye – Intraocular pressure measureument – 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: RADIATION

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.

TEXT BOOKS:

1. Brijlal & Subramaniam, 2002. Optics, S. Chand & Co , New Delhi.
2. Venkatraman. S.K. 2002. Bio medical electronics ,Galgotia Pub. Instrumentation Pvt. Ltd,

REFERENCE BOOKS:

1. How things work Vol. 1 & Vol. 2 : 2002. Harpens Collins Publ. India. A joint venture with The India Today Group, New Delhi .
2. Roy R.N. 2001. A text book of bio physics : Books and Allied (P) Ltd.
3. Arumugam M. Bio medical Instrumentation
4. Leslie Cromwell, Fred.J.Weibell, Erich A. 2002. Bio medical Instrumentation and Measurements, Pfeiffer PHI .

Course designers:

1. Mr.S.Alaguraja

THIAGARAJAR COLLEGE, MADURAI- 9

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DEPARTMENT OF PHYSICS

(For those who join in 2017 and after)

Course : LAB **Int.Marks:40**
Class: I year **Ext.Marks:60**
Semester : I &II **Max.Marks: 100**
Sub. Code : MPL11 **Hour/Week: 2**
Title of the paper : MAJOR PRACTICAL-I **Credit :**

Course Outcomes:

On the successful completion of the course, students will be able to

1. Understand the experimental ideas related with matter, laws of heat
2. Identify the link between theory and practical
3. Analyze observations and make meaningful conclusions

1. Young's modulus – Uniform bending
2. Young's modulus- Non-Uniform bending
3. Melde's string
4. Viscosity – Poiseuille's flow
5. Surface tension – Quincke's drop
6. Surface tension and interfacial surface tension
7. Lee's disc
8. Specific heat by Newton's law of cooling
9. Thermo emf – Potentiometer
10. Thermocouple-emf
11. Torsion Pendulum
12. Compound Pendulum
13. Lee's disc
14. Specific heat capacity of solids
15. Spectrometer – Dispersive power of a prism
16. Calibration of Ammeter- Potentiometer
17. Voltmeter calibration – Potentiometer
18. Volume resonator
19. M and B_H – Field along the axis of a coil
20. Current and voltage sensitiveness – MG

THIAGARAJAR COLLEGE, MADURAI- 9

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DEPARTMENT OF PHYSICS

(For those who join in 2017 and after)

Course : LAB **Int.Marks:40**
Class: I year **Ext.Marks:60**
Semester : II &III **Max.Marks: 100**
Sub. Code : MPL21 **Hour/Week: 2**
Title of the paper : MAJOR PRACTICAL-II **Credit : 3**

Course Outcomes:

On the successful completion of the course, students will be able to

1. Understand the experimental ideas related with mechanics and optics.
2. Identify the link between theory and practical
3. Appreciate the applications of transistors and diodes
4. Analyze observations and make meaningful conclusions

1. Spectrometer – Angle of the prism
2. Newton's rings
3. Grating normal incidence N & λ for Hg spectrum
4. Comparison of capacities – BG
5. LCR circuit – series resonance
6. LCR circuit – parallel resonance
7. i-d curve
8. Sonameter – frequency of AC mains
9. Comparison of mutual inductances
10. Absolute determination of mutual inductance
11. Verification of Thevenin's/Norton's theorem
12. Half wave rectifier
13. Bridge rectifier
14. Zener diode characteristics
15. Determination of Capacity (absolute)
16. Low pass, High pass, Band Pass RC filters
17. Comparison of resistance – BG
18. Transistor characteristics-CB mode
19. Transistor characteristics-CE mode
20. Logic gates – NAND, NOR, NOT using diodes and transistor

THIAGARAJAR COLLEGE, MADURAI- 9

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DEPARTMENT OF PHYSICS

(For those who join in 2017 and after)

Course : LAB **Int.Marks:40**
Class: III year **Ext.Marks:60**
Semester : V &VI **Max.Marks: 100**
Sub. Code : MPL61 **Hour/Week: 2**
Title of the paper : MAJOR PRACTICAL-III **Credit :**

Course Outcomes:

On the successful completion of the course, students will be able to

1. Understand the experimental ideas related with matter, optics, electricity and magnetism.
2. Analyze observations and make meaningful conclusions
    1. i-i' curve
    2. Air wedge
    3. Polarimeter
    4. Cachy's constant
    5. Hartmann's constant
    6. Conversion of Galvanometer in to voltmeter
    7. Conversion of Galvanometer into ammeter
    8. Owen's bridge
    9. Maxwell's bridge
    10. Grating II order spectrum
    11. High resistance by leakage
    12. Electrochemical equivalence of copper
    13. Determination of Planck's constant
    14. Determination of dielectric constant
    15. Hall probe method for measurement of magnetic field
    16. Abbe's refractometer
    17. Find roots of equation by using Newton Raphson method
    18. Find roots of equation by using Bisection method
    19. Find roots of equation by using False position method
    20. Defect detection-Ultrasonic flaw detector

THIAGARAJAR COLLEGE, MADURAI- 9

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DEPARTMENT OF PHYSICS

(For those who join in 2017 and after)

Course : LAB **Int.Marks:40**
Class: III year **Ext.Marks:60**
Semester : V&VI **Max.Marks: 100**
Sub. Code : MPL62 **Hour/Week: 2**
Title of the paper : MAJOR PRACTICAL-IV

Course Outcomes:

On the successful completion of the course, students will be able to

1. Identify the link between theory and designing workable circuits
2. Troubleshoot any simple electronic circuits
3. Appreciate the applications of diodes, transistors and op-amps
4. Report observations and analyses in a scientific manner

1. Single Stage Amplifier
2. Hartley Oscillator
3. Colpitts Oscillator
4. Phase shift oscillator
5. Voltage Doubler
6. Dual Power supply
7. Astable multivibrator (using transistor)
8. Inverting and non-inverting amplifiers using Op-amp.
9. Op-Amp integrator and differentiator.
10. Adder and subtractor using Op-amp.
11. Monostable multivibrator (using 555)
12. Astable multivibrator (using 555)
13. Logic Gates (using ICs)
14. Half Adder & full Adder (Construction using IC's)
15. Zener voltage regulator
16. NAND as Universal gate
17. R-S flip flop.

Allied Papers

THIAGARAJAR COLLEGE, MADURAI- 9
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DEPARTMENT OF PHYSICS
(For those who join in 2017 and after)

Course : LAB **Int.Marks:40**
Class: I & II/ III year **Ext.Marks:60**
Semester : VI **Max.Marks: 100**
Sub. Code : APL21(C)/APL41(M) **Hour/Week: 2**
Title of the paper : ALLIED PRACTICAL

Course Outcomes:

On the successful completion of the course, students will be able to

1. Identify the link between theory and practical
2. Develop the skill of performing experiments accurately
3. Report observations and analyses in a scientific manner

1. Compound pendulum
2. Torsion pendulum
3. Sonometer I and II laws
4. Uniform bending using microscope
5. Non –uniform bending using microscope
6. Melde‟s string
7. Surface tension using capillary rise
8. Surface and interfacial tension- drop weight method
9. Co-efficient of viscosity- using burrette
10. N and λ-Grating
11. Gates- discrete components
12. Zener diode characteristics
13. Dispersive power
14. Newton's rings
15. Air wedge
16. Sonometer AC mains
17. Carey Foster's bridge
18. Bridge rectifier
19. Conversion of galvanometer into voltmeter
20. Gates using ICs

THIAGARAJAR COLLEGE, MADURAI- 9

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

DEPARTMENT OF PHYSICS

(For those who join in 2017 and after)

Course :Allied **Int.Marks:25**
Class: I year /II year **Ext.Marks:75**
Semester : I / III **Max.Marks: 100**
Sub. Code : AP11(C)/AP31(M) **Hour/Week: 4**
Title of the paper : PHYSICS – I

Course Outcomes:

On the successful completion of the course, students will be able to

1. Understand the basic concepts of physics in mechanics, properties of matter and optics
2. Appreciate the laws of reflection and refraction

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:

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

REFERENCE BOOKS:

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

Course designers:

1. Mrs.R.Sribala
2. Dr.J.Suvetha Rani
3. Mr.S.Alaguraja

THIAGARAJAR COLLEGE, MADURAI- 9
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DEPARTMENT OF PHYSICS
(For those who join in 2017 and after)

Course :Allied **Int.Marks:25**
Class: I year /II year **Ext.Marks:75**
Semester : II / IV **Max.Marks: 100**
Sub. Code : AP21(C)/AP41(M) **Hour/Week: 4**
Title of the paper : BASIC ELECTRONICS

Course Outcomes:
On the successful completion of the course, students will be able to
1. Know the elements of semiconductor diodes
2. Understand the basics of transistors and their characteristics

ANALOG ELECTRONICS

Unit I: SEMICONDUCTOR

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

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

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

Unit IV: LOGIC GATES

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

De Morgan‟s laws and its applications: Boolean algebra – De Morgan‟s laws – Applications – Binary adders

TEXTBOOK:

1. Ambrose , A. Vincent Devaraj, T. 1993. Elements of Solid State Electronics, Mera Publications [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. Jose Robin G. , Ubald Raj, A. 1994. Electronics II, Indira Publication [Units III, IV & V: Chapter 1, 2 (p.22-54) & Chapter 3]

Course designers:

1. Mrs.R.Sribala
2. Dr.J.Suvetha Rani
3. Mr.S.Alaguraja

M.Sc., Physics

THIAGARAJAR COLLEGE, MADURAI- 9

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DEPARTMENT OF PHYSICS

(For those who join in 2017 and after)

M.Sc., Physics

COURSE STRUCTURE (w.e.f. 2017 – 2019 batch onwards)

Semester – I

Course	Code	Title of the Paper	Hrs. ++	Credits.	Total No. of Hours	Max. Marks CA	Max. Marks SE	Total Marks
Core -1	1PP1	Classical Mechanics	5	4	75	25	75	100
Core -2	1PP2	Statistical Mechanics	5	4	75	25	75	100
Core 3	1PP3	Advanced Electronics	5	4	75	25	75	100
Elective 1	1PPE1	Mathematical Physics – I / Computer simulations	5	5	75	25	75	100
Lab	2PPL1	Electronics Experiments	5	-	75	-	-	-
Lab	2PPL2	Electronics Experiments	5	-	75	-	-	-
		Total	**30**	**17**	**450**	**100**	**300**	**400**

Semester – II

Course	Code	Title of the Paper	Hrs. ++	Credits.	Total No. of Hours	Max. Marks CA	Max. Marks SE	Total Marks
Core 4	2PP1	Solid state physics -I	5	4	75	25	75	100
Core -5	2PP2	Electromagnetic theory	5	4	75	25	75	100
Core - 6	2PP3	Quantum mechanics-I	5	4	75	25	75	100
Elective -2	2PPE1	Mathematical physics II/ Molecular biophysics	5	5	75	25	75	100
Lab -I	2PPL1	Electronics Experiments	5	5	75	40	60	100
Lab -II	2PPL2	Electronics Experiments	5	5	75	40	60	100
		Total	**30**	**27**	**450**	180	**420**	**600**

Semester – III

Course	Code	Title of the Paper	Hrs. ++	Credits.	Total No. of Hours	Max. Marks CA	Max. Marks SE	Total Marks
Core 7	3PP1	Solid state physics -II	5	4	75	25	75	100
Core -8	3PP2	Quantum mechanics II	5	4	75	25	75	100
Core - 9	3PP3	Nuclear physics	5	4	75	25	75	100
Core - 10	3PP4	Microprocessor and Micro Controllers	5	4	75	25	75	100
Lab	4PPL1	Electronics	5	-	75	-	-	-
PJ	PJ	Electronics	5		75	-	-	-
		Total	**30**	**16**	**450**	**100**	**300**	**400**

Semester – IV

Course	Code	Title of the Paper	Hrs. ++	Credits.	Total No. of Hours	Max. Marks CA	Max. Marks SE	Total Marks
Core 11	4PP1	Spectroscopy	5	4	75	25	75	100
Core -12	4PP2	Nanoscience	5	4	75	25	75	100
Core - 13	4PP3	Optical communication and networking	5	4	75	25	75	100
Elective - 3	4PPE1	X-ray crystallography/ Astrophysics	5	5	75	25	75	100
Lab	4PPL1	Electronics	5	6	75	40	60	100
PJ	PJ	Electronics	5	7	75	40	60	100
		Total	**30**	**30**	**450**	**180**	**420**	**600**

* Credit will be awarded at the end of II/IV Semester

++ 1 Hour for Class Test.

A. Consolidation of contact hours and credits: PG

Semester	Contact Hrs/week	Credits
I	30	17
II	30	27
III	30	16
IV	30	30
Total	**120**	**90**

B) Curriculum Credits

Core --- 75Credits

Elective ---15 Credits

Total 90 Credits

THIAGARAJAR COLLEGE, MADURAI- 9

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DEPARTMENT OF PHYSICS

(For those who join in 2017 and after)

Course :Core **Int.Marks:25**
Class: I year **Ext.Marks:75**
Semester : I **Max.Marks: 100**
Sub. Code : 1PP1 **Hour/Week: 5**
Title of the paper : CLASSICAL MECHANICS **Credit : 4**

Course Outcomes:

On the successful completion of the course, students will be able to

1. Get an acquaintance with the elementary concepts of mechanics, and acquire in-depth knowledge in Lagrangian and Hamiltonian Principles.
2. Understand the classical theory behind two body problems and small oscillations.
3. 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

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:

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

REFERENCE BOOKS:

1. Dass, T., & Sharma, S.K. , 1998. Mathematical Methods in Classical and Quantum Physics, University Press ISBN 81-7371-089-9.
2. Sankara Rao, K .Classical Mechanics, 2005. Prentice-Hall of India, ISBN 81-203-2676-8.
3. Bhatia,V.B. Classical Mechanics – With Introduction to Nonlinear Oscillations and Chaos, 1997. Narosa Publishing House, ISBN 81-7319-104-2.
4. Greiner, W. 2004. Classical Mechanics – Systems of Particles and Hamiltonian Dynamics, Springer, ISBN 81-8128-128-4.

Course designers:

1. Dr.N.Srinivasan
2. Mrs.R.Sribala

THIAGARAJAR COLLEGE, MADURAI- 9
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DEPARTMENT OF PHYSICS
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Course :Core **Int.Marks:25**
Class: I year **Ext.Marks:75**
Semester : I **Max.Marks: 100**
Sub. Code : 1PP2 **Hour/Week: 5**
Title of the paper : STATISTICAL MECHANICS **Credit : 4**

Course Outcomes:

On the successful completion of the course, students will be able to

1. Know the Fundamentals of Statistical mechanics; Statistical distribution laws; their applications.
2. Understand the Theories of specific heat capacity of solids.
3. Discuss the properties of liquid helium. Phase transitions -Ising model

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 - 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 –- Partition Function - Canonical partition function – Molecular partition function – Translational partition function – Rotational partition function – Vibrational partition function – Homo nuclear molecules and nuclear spin.

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 – 3He – 4He mixtures.

Unit IV:

Ideal Fermi – Dirac Gas Fermi – dirac distribution – 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:

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

REFERENCE BOOKS:

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

Course designers:

1. Dr. G.Arivazhagan
2. Mr.M.Venkatachalam

THIAGARAJAR COLLEGE, MADURAI- 9
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DEPARTMENT OF PHYSICS
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Course :Core **Int.Marks:25**
Class: I year **Ext.Marks:75**
Semester : I **Max.Marks: 100**
Sub. Code : 1PP3 **Hour/Week: 5**
Title of the paper : ADVANCED ELECTRONICS **Credit : 4**

Course Outcomes:

On the successful completion of the course, students will be able to

1. Familiar with the various uses of Op-amps.
2. Relate the theory and experiments
3. 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(I2L) – 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:

1. Millman, J & Grabel, A. 2002. Micro Electronics, II ed., Tata McGraw Hill, 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:

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

Course designers:

1. Dr. R.Vijayalakshmi
2. Dr.R.Srinivasan

THIAGARAJAR COLLEGE, MADURAI- 9
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DEPARTMENT OF PHYSICS
(For those who join in 2017 and after)

Course :Major Elective **Int.Marks:25**
Class: I year **Ext.Marks:75**
Semester : I **Max.Marks: 100**
Sub. Code : 1PPE1(M) **Hour/Week: 5**
Title of the paper : MATHEMATICAL PHYSICS – I **Credit : 5**

Course Outcomes:

On the successful completion of the course, students will be able to

1. Understand the mathematical principles
2. Appreciate the application of mathematical principles to practical problems in various branches of Physics.

Unit I: CURVILINEAR COORDINATES :

Transformation of coordinates – Jacobian of transformations - Orthogonal curvilinear coordinates – Coordinate surfaces and coordinate curves – Scale factors and unit vectors in curvilinear systems – Arc length and volume elements – Gradient, divergence and curl in orthogonal curvilinear systems – Special orthogonal coordinate systems – Cylindrical and spherical coordinate systems – Position vector, velocity, acceleration, Gradient, Divergence, Curl and Laplacian.

Unit II: DETERMINANTS AND MATRICES :

Linear, homogeneous and inhomogeneous equations – Examples – Solving linear equations (Gauss elimination) – Matrix inversion (Gauss-Jordan) – Orthogonal matrices, direction cosines, applications to vectors, orthogonality conditions (two-dimensional case) – Symmetry property and similarity transformations – Hermitian and unitary matrices – Pauli matrices – Eigenvalues and eigenvectors - Diagonalisation of matrices.

Unit III: THE BETA AND GAMMA FUNCTIONS : Definitions-symmetry property of Beta Functions-evaluation of Beta Functions - transformation of Beta Functions - evaluation of Gamma Function- transformation of Gamma Functions- relation between Beta and Gamma Functions-evaluation of miscellaneous integrals-miscellaneous important prepositions.

Unit IV: SPECIAL FUNCTIONS-I : Legendre's differential equation and Legendre Functions – Generating function of Legendre Polynomial-Rodrigue's formula for Legendre Polynomials–orthogonal properties of Legendre's polynomial- – Recurrence Formulae for $P_n(x)$

Unit V: SPECIAL FUNCTIONS-II : Bessel's differential equation: Bessel's polynomial – Recurrence Formulae for $J_n(x)$– generating function for $J_n(x)$–Jacobi series-Bessel's integrals-

Orthonormality of Bessel's functions-spherical Bessel's function-Recurrence relation-Orthogonality of Spherical Bessel's functions.

TEXT BOOK

1. SPIEGEL, M.R., 1959, Schaum's outline of theory and problems of vector analysis and an introduction to tensor analysis, McGraw Hill, ISBN:07-060228-X. (Unit I : Chapter 7)
2. WEBER, H.J. & ARFKEN, G.B. 2003.Essential mathematical methods for physicists, Academic Press, ISBN:0-12-059877-9 (Unit II : Chapter 3)
3. Satya Prakash, 2005. Mathematical Physics with Classical Mechanics, Sultan Chand & Sons, ISBN:81-7014-925-8
   UNIT III: Chapter 4 (sec 4.1-4.9)
   UNIT IV: Chapter 6 (sec 6.7-6.11)
   UNIT V: Chapter 6 (sec 6.17, 6.21-6.25,6,28,6.28a,6.28b)

REFERENCE BOOKS:

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

Course designers:

1. Mrs.V.Rajni Swamy
2. Dr.S.Rajakarthihan

THIAGARAJAR COLLEGE, MADURAI- 9
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DEPARTMENT OF PHYSICS
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Course :Major Elective **Int.Marks:25**
Class: I year **Ext.Marks:75**
Semester : I **Max.Marks: 100**
Sub. Code : 1PPE1(C) **Hour/Week: 5**
Title of the paper : COMPUTER SIMULATIONS **Credit : 5**

Course Outcomes:

On the successful completion of the course, students will be able to

1. Understand the importance of computers in physics.
2. Know 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, renormalization 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:

1. Harvey Gould and Jan Tobochnik, 1996. An Introduction to Computer simulation methods (Application to Physical systems) – II edition , Addison-Wesley Publishing Company
   Unit 1: Pages 1-36, 95-126 , Unit 2: Pages 127-212 , Unit 3: Pages 343-405

   Unit 4: Pages 413-500, Unit 5: Pages 543-625

Course designers:

1. Dr.R.V.Krishna Kumar

THIAGARAJAR COLLEGE, MADURAI- 9
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DEPARTMENT OF PHYSICS
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Course :Core **Int.Marks:25**
Class: I year **Ext.Marks:75**
Semester : II **Max.Marks: 100**
Sub. Code : 2PP1 **Hour/Week: 5**
Title of the paper : SOLID STATE PHYSICS - I **Credit : 4**

Course Outcomes:

On the successful completion of the course, students will be able to

1. Understand fundamentals of solid structure of materials.
2. Discuss the properties of phonons.
3. Impart the knowledge of free electron Fermi gas.
4. Get exposed 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.

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.

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 - Nearly free electron 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- Calculation of energy bands: Tight binding method – Wigner – Seitz method – Cohesive energy – Pseudopotential methods – Experimental methods: Quantization of orbits in a magnetic field – De Haas – van Alphen effect.

TEXT BOOK:

1. Kittel, C. 1996.Introduction to Solid State Physics ,VII ed, John Wiley & Sons, 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. Myers, H.P. 1998.Introductory Solid State Physics , II ed., Viva Low – priced Student Edition, Viva Books Pvt. Ltd,
2. Omar, M. A. 2006. Elementary Solid State Physics , Pearson Education, , ISBN 81-7758-377-8
3. Ibach, H. & Luth, H. 1991.Solid State Physics – An Introduction to Theory and Experiment, Narosa Publishing House,
4. Pillai, S.O. 2007. Solid State Physics, ,revised VI Edition ,New Age International.
5. Srivatsava, J.P. 200 7Elements of Solid State Physics , II ed, Phi Publishers, ISBN 978-81-203-2847-1.

Course designers:

1. Mr.M.Venkatachalam
2. Dr.R.Srinivasan

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DEPARTMENT OF PHYSICS
(For those who join in 2017 and after)

Course :Core **Int.Marks:25**
Class: I year **Ext.Marks:75**
Semester : II **Max.Marks: 100**
Sub. Code : 2PP2 **Hour/Week: 5**
Title of the paper : ELECTROMAGNETIC THEORY **Credit : 4**

Course Outcomes:

On the successful completion of the course, students will be able to

1. Deal with the fundamental principles of electrostatics, magnetostatics and electrodynamics.
2. Get familiarize with the application of Maxwell's equations to physical situations and propagation of electromagnetic waves in conducting media.
3. Understand 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

Displacement current – Maxwell's equations: equation, derivation of differential and integral forms – Poynting theorem – Poynting vector - electromagnetic waves in free space, isotropic dielectrics and conducting media.

Unit IV: ELECTROMAGNETIC WAVES

Boundary conditions: reflection and transmission - Reflection and transmission of electromagnetic waves at normal and oblique incidence – Guided waves: Waveguides – TE waves in a rectangular waveguide.

Unit V: POTENTIALS AND RADIATION

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

TEXT BOOKS:

1 Reitz, J.R., Milford, F.J & Christy, R.W. 1998. Foundations of electromagnetic theory III ed., Narosa Publishing House, ISBN 81-85015-79-1. (For units I & II).
2 Chopra, K. K. Agarwal, G. C. 2010. Electromagnetic theory, V ed., K. Nath & Co., (For unit III)
3 David J. 2000. Griffiths. Introduction to Electrodynamics, III ed., Prentice Hall of India, ISBN 81-203-1601-0. (For units IV & V).

REFERENCE BOOKS:

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

Course designers:

1. Dr.R.V.Krishna Kumar
2. Dr. G.Arivazhagan

THIAGARAJAR COLLEGE, MADURAI- 9
(Re-Accredited with 'A' Grade by NAAC)
DEPARTMENT OF PHYSICS
(For those who join in 2017 and after)

Course :Core **Int.Marks:25**
Class: I year **Ext.Marks:75**
Semester : II **Max.Marks: 100**
Sub. Code : 2PP3 **Hour/Week: 5**
Title of the paper : QUANTUM MECHANICS – I **Credit : 4**

Course Outcomes:

On the successful completion of the course, students will be able to

1. Understand Basic concepts in Quantum Mechanics.
2. Throw light on the formulation of Schrodinger,Dirac and Heissenberg mechanics
3. Have a glimpse of perturbation theory and its applications.
4. Study in detail the effect of magnetic and electric field on quantum particles.

Unit I: EQUATION OF MOTION OF MATTER WAVES

Time independent Schrodinger equation – Schrodinger equation for a free particle – Time dependent Schrodinger equation – Physical interpretation of wave function – Normalized and orthogonal wave functions – Solution of Schrodinger equation – Stationary state solution – Expectation values – Probability current density – Superposition of plane waves – Formulation of Schrodinger 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 – Schrodinger picture – Heisenberg picture – Interaction picture – Poisson brackets and Commutator brackets – Matrix theory of Harmonic oscillator.

Unit III : GENERAL FORMALISM OF QUANTUM MECHANICS

Linear operator-Eigen functions and Eigen values- Hermitian Operator-postulates of quantum mechanics- Dirac's notation- Equations of motion.

Unit IV: ANGULAR MOMENTUM STATES

Commutation relations for the generators – Choice of representation, Values of m, f(j), and □m. Angular momentum matrices (j = ., j = 1 only) – Combination of Angular momentum states – Eigen values of the total Angular momentum – Clebsch Gordan coefficients – Recursion relations – Construction procedure – $j_1 = 1/2$, $j_2 = 1/2$

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 – 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.

TEXT BOOKS:

1. Schiff, L.I. 1968. Quantum Mechanics , III ed., McGraw Hill, ISBN-0-07-085643-5.
2. Satyaprakash & Swati Satya. 2006. Quantum Mechanics , Kedar Nath Ram Nath & Co,
3. Aruldhas, J Quantum Mechanics. , Prentice – Hall of India, 2002, ISBN81- 203-1962.

REFERENCE BOOKS:

1. Mathews, P.M. & Venkatesan, K., 1978. A Text Book of Quantum Mechanics, Tata McGrawHill, ISBN 0-07-096510-2.
2. Bransden, B.H. & Joachain, C.J. 2005. Quantum Mechanics , II ed., Pearson Education, ISBN 81-297-0470-6.
3. Merzbacher, E. 2004. Quantum Mechanics, III ed., John Wiley, ISBN9971- 51-281-5.
4. Ghatak, A. 1996. Introduction to Quantum Mechanics :, Macmillan, ISBN0333-92419

Course designers:

1. Dr. R.Vijayalakshmi
2. Dr.N.Srinivasan

THIAGARAJAR COLLEGE, MADURAI- 9
(Re-Accredited with 'A' Grade by NAAC)
DEPARTMENT OF PHYSICS
(For those who join in 2017 and after)

Course :Major Elective **Int.Marks:25**
Class: I year **Ext.Marks:75**
Semester : II **Max.Marks: 100**
Sub. Code : 2PPE1(M) **Hour/Week: 5**
Title of the paper : MATHEMATICAL PHYSICS – II **Credit : 5**

Course Outcomes:

On the successful completion of the course, students will be able to

1. Develop problem solving skills.
2. Explain how mathematical concepts are applied in the solution of physical problems.
3. Explain the basic concepts of group theory and to discuss its application to crystallography.

Unit I: COMPLEX VARIABLES-I

Function of a complex variable-analytic functions-Necessary and sufficient condition for a function to be analytic (CR equations) – Laplace's equation: Harmonic functions – Line integral of a complex function – Cauchy's integral theorem (elementary proof and Goursat's proof: lemma I) – 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.

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: LAPLACE TRANSFORMS

Laplace transforms-Properties of Laplace transforms – Laplace transform of derivative of a function- Laplace transform of integrals -Inverse Laplace theorem-properties of LT- Convolution or Faltung theorem

Unit V: FOURIER SERIES AND FOURIER TRANSFORM

Fourier series- Dirichlet's theorem and Dirichlet's conditions--change of interval from $(-\pi,\pi)$ to (-l, l)-Complex form of Fourier series-Fourier series in the interval (0,T)-change of interval from (0, T) to (0, 2l)-Physical examples of Fourier series (Full wave rectifier, square wave and saw tooth wave). Fourier transform-Properties of Fourier transform(properties 1 to

7 and property 9)-Fourier transform of a derivative-Fourier sine and cosine transforms-Finite Fourier transforms-Applications of Fourier transforms

TEXT BOOK:

1. Satya Prakash, 2005. Mathematical Physics with Classical mechanics , IV ed., S. Chand & Sons, ISBN:81-7014-925-8.
   UNIT I: Chapter 5 [sec 5.7, 5.9-5.12, 5.14, 5.16, 5.17, 5.20, 5.21]
   UNIT II: Chapter 5[5.22-5.24, 5.25(a), 5.25(b), 5.25(c), 5.25(d)]
   UNIT III: Chapter 12[12.18-12.24]
   UNIT IV: Chapter 9 [9.9-9.12, 9.15, 9.17]
   UNIT V: Chapter 7[7.1-7.6, 7.8] and Chapter 9 [9.2-9.5, 9.7, 9.8]

REFERENCE BOOKS:

1. Gupta, B.D, 1993. Mathematical Physics, II ed.,Vikas Publishing House, ISBN:0-7069-76-4.
2. Weber, H.J. & Arfken, G.B. 2004. Essential Mathematical Methods for Physicists, Academic Press, ISBN: 0-12-059878-7.
3. Riley, K.F., Hobson, M.P.& Bence, S.J. 2004. Mathematical Methods for Physics and Engineering , II ed, Cambridge, ISBN:0-521-61296-9.
4. Ghatak, A.K.,Goyal, I.C. & Chua, S.J. 2002. Mathematical Physics – Differential Equations and Transform Theory, Macmillan, ISBN:0-333-92548-3.
5. Tinkham, M. Group Theory & Quantum Mechanics, Tata McGraw Hill.

Course designers:

1. Mrs.V.Rajni Swamy
2. Dr.S.Rajakarthihan

THIAGARAJAR COLLEGE, MADURAI- 9

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

DEPARTMENT OF PHYSICS

(For those who join in 2017 and after)

Course :Major Elective **Int.Marks:25**
Class: I year **Ext.Marks:75**
Semester : II **Max.Marks: 100**
Sub. Code : 2PPE1(MB) **Hour/Week: 5**
Title of the paper : MOLECULAR BIOPHYSICS **Credit :5**

Course Outcomes:

On the successful completion of the course, students will be able to

1. Know the fundamentals of proteins and nucleic acids.
2. Understand the spectroscopic techniques involved in the elucidation of structures of molecules.
3. Appreciate techniques such as NMR, Laser and Holography.
4. Know 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:

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

Course designers:

1. Dr.R.V.Krishna Kumar

THIAGARAJAR COLLEGE, MADURAI- 9
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DEPARTMENT OF PHYSICS
(For those who join in 2017 and after)

Course :Core **Int.Marks:25**
Class: II year **Ext.Marks:75**
Semester :III **Max.Marks: 100**
Sub. Code : 3PP1 **Hour/Week: 5**
Title of the paper : SOLID STATE PHYSICS – II **Credit : 4**

Course Outcomes:
On the successful completion of the course, students will be able to

1. Understand different types of magnetic materials and Magnetic Resonance
2. Know the fundamentals of solid state particles viz., Plasmons, Polaritons, Polarons and excitons.
3. Understand dielectrics and ferroelectrics by classical and quantum treatment
4. Know different types of defects and dislocations in crystals.

Unit I: DIAMAGNETISM AND PARAMAGNETISM

Diamagnetism: Langevin diamagnetism equation –Quantum theory of diamagnetism of mononuclear systems –**Paramagnetism**: Quantum theory of paramagnetism: Rare earth ions – Hund rules – Iron group ions – Crystal field splitting – Quenching of the orbital angular momentum –Cooling by isentropic demagnetization: Nuclear demagnetization – Paramagnetic susceptibility of conduction electrons.

Unit II: FERROMAGNETISM AND MAGNETIC RESONANCE

Ferromagnetism: Ferromagnetic order: Curie point and the exchange integral (Curie-Weiss law, Heisenberg model, Exchange energy) –Magnons: Quantization of spin waves– Thermal excitation of magnons – Ferromagnetic domains: Anisotropy energy – Transition region between domains – Origin of domains – Coercivity and Hysteresis – **Magnetic Resonance:**Nuclear magnetic resonance: Equations of motion – Line width – Motional narrowing – Hyperfine splitting – Examples: paramagnetic point defects – knight shift

Unit III: PLASMONS, POLARITONS, POLARONS 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 (LST) relation. Electron-electron interaction: Fermi liquid – Electron – electron collisions –Electron – phonon interactions: **Polarons.Excitons:** Frenkel excitons – Alkali halides – Molecular crystals – Weakly bound (Mott-Wannier) excitons – Exciton condensation into electron-hole drops (EHD). Raman effect in crystals.

Unit IV: DIELECTRICS AND FERROELECTRICS

Dielectrics: Macroscopic electric field:Depolarization field E_1 – Localelectric field at an atom – Dielectric constant and polarizability (Clausius-Mossotti relation) – Electronic polarizability – Structural phase transition – **Ferroelectrics:**Ferroelectric crystals – Classifications of ferroelectric crystals – Displacive transitions – Softoptical phonons – Anti-ferro electricity – Ferroelectric domains – Piezoelectricity.

Unit V: POINT DEFECTS AND DISLOCATIONS:

Point defects: Lattice vacancies (Schottky and Frenkel defects) – Diffusion – Color centers – F centers – Other centers in alkali halides.**Dislocations:**(Edge dislocation, Screw dislocation) – Burgers vectors – stress fields of dislocations – Low-angle grain boundaries – dislocation densities – dislocation multiplication and slip. Dislocation and crystal growth – Whiskers. Hardness of materials.

TEXT BOOK:

1. Kittel. C, 1996. Introduction to Solid State Physics, VII ed., John Wiley & Sons, ISBN: 81-265-1045-5.
   Unit – I Chapter- 11 ; Unit – II Chapter- 12 &13;
   Unit – III Chapters- 14 &15; Unit – IV Chapter- 16
   Unit – V Chapters- 20 &21

REFERENCE BOOKS:

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

Course designers:

1. Mr.M.Venkatachalam
2. Dr.R.Srinivasan

THIAGARAJAR COLLEGE, MADURAI- 9
(Re-Accredited with 'A' Grade by NAAC)
DEPARTMENT OF PHYSICS
(For those who join in 2017 and after)

Course :Core **Int.Marks:25**
Class: II year **Ext.Marks:75**
Semester :III **Max.Marks: 100**
Sub. Code : 3PP2 **Hour/Week: 5**
Title of the paper : QUANTUM MECHANICS – II **Credit : 4**

Course Outcomes:

On the successful completion of the course, students will be able to

1 Understand Advance level - Quantum Mechanics.
2 Acquire knowledge on approximation methods employed in solving quantum mechanical problems.
3 Know relativistic mechanics and quantum theory of radiation.
4 Understand the 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

Schrodinger'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:

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

REFERENCE BOOKS:

1. Satyaprakash & Swati Satya 2006.Quantum Mechanics, Kedar Nath Ram Nath & Co
2. Mathews, P.M. & Venkatesan, K 1978. A Text Book of Quantum Mechanics , Tata McGraw Hill, ISBN 0-07-096510-2.
3. Aruldhas, J, 2002.Quantum Mechanics. Prentice – Hall of India, ISBN 81-203-1962-1.
4. Bransden, B.H. & Joachain, C.J. 2005. Quantum Mechanics ,II ed, Pearson Education, ISBN 81-297-0470-6.
5. Merzbacher, E. 2004. Quantum Mechanics , III ed., John Wiley, ISBN 9971-51-281-5.
6. Ghatak, A. 1996. Introduction to Quantum Mechanics , Macmillan, SBN 0333-92419-3.

Course designers:

1. Dr.N.Srinivasan
2. Mrs. R.Dhanalakshmi

THIAGARAJAR COLLEGE, MADURAI- 9
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DEPARTMENT OF PHYSICS
(For those who join in 2017 and after)

Course :Core **Int.Marks:25**
Class: II year **Ext.Marks:75**
Semester :III **Max.Marks: 100**
Sub. Code : 3PP3 **Hour/Week: 5**
Title of the paper : NUCLEAR PHYSICS **Credit :4**

Course Outcomes:
On the successful completion of the course, students will be able to
1. Know the fundamental concepts in Nuclear Physics.
2. Understand the Theories involved in the nuclear forces and reactions
3. Understand various theories and mechanisms of radioactive decay.
4. Appreciate the high energy neutron physics and elementary particles

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: RADIOACTIVE DECAY

The Q-value for alpha decay- Coulomb potential barrier - One dimensional potential barrier problem – Gamow's theory of α-decay –alpha particle energy spectrum – Fermi's theory of beta decay – Classification of nuclear transitions – Parity violation in beta decay – Electric & magnetic multipole radiation – Selection rules for multipole radiation – Internal conversion – Nuclear isomers.

Unit IV: NUCLEAR REACTIONS

The compound nucleus model – The optical model – The direct reaction model: Deuteron pick-up reaction – Nuclear fission – Heavy ion reactions: Stability of heavy nuclei – the shell effects – quantum electrodynamics of strong fields.

Unit V: SUB-NUCLEAR PHYSICS

Proliferation of elementary particles - 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 freedom.

TEXT BOOK:

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

REFERENCE BOOKS:

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

Course designers:

1. Dr.R.V.Krishna Kumar
2. Dr. G.Arivazhagan

THIAGARAJAR COLLEGE, MADURAI- 9
(Re-Accredited with 'A' Grade by NAAC)
DEPARTMENT OF PHYSICS
(For those who join in 2017 and after)

Course :Core **Int.Marks:25**
Class: II year **Ext.Marks:75**
Semester :III **Max.Marks: 100**
Sub. Code : 3PP4 **Hour/Week: 5**
Credit : 4

Title of the paper : MICROPROCESSOR AND MICROCONTROLLERS

Course Outcomes:

On the successful completion of the course, students will be able to

1. Understand the architecture and assembly programming of 8085, 8086
2. Know the algorithms, Opcode for the basic microprocessor 8085
3. Know the concept and types of microcontrollers

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 and instruction- explanation of various groups with examples- various addressing modes- stacks –PUSH operation- subroutine

Unit III:

ALP-simple program- 8 bit addition- timing diagram- 8 bit subtraction- sum 16 bits- 8bit decimal subtraction- one's complement of 16 bit number- Two's complement 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:

Single chip microcontrollers- intel 8051 series microcontrollers(MCS-51) –MCS151 and MCS 251 high performanceCHMOS microcontrollers- Intel 8096 series microcontrollers (MCS96) –Brief description of Intel 8096 family members- 32 bit microcontrollers- Rupi44 family microcontroller with on-chip communication controller- I/O processor- co-processor

Unit V:

Microprocessor applications- speed of motor- stepper motor- traffic control- 8086 operating modes- status flags- registers-addressing modes- 8085/8-086 CPU architecture-

Execution unit- general registers-arithmetic and logic unit- flag registers- bus interface unit- instruction queue- instruction pointer- segment registers

TEXT BOOKS:

1. Ram, B. 1993. Microprocessor and its applications, IV edition, Dhanpat Rai publicationsLtd.
   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., 3.3, 4.1 to 4.3, 5.5, 5.63
   Unit III Ch. 6.1to 6.3, 6.5, 6.6, 6.10, 6.12, 6.21, 6.22, 6.24, 6.36
2. Badri Ram, 2001. Advanced Microprocessors and interfacing, Tata McGraw Hill Publishing Ltd., New Delhi ISBN: 0-07-043448-4
   Unit IV Ch. 6.1, 6.3 and 6.4
3. Srinath, N.K. 2012, 8085 Microprocessor programming and interfacing, PHI learning private limited, New Delhi.
   Unit V Ch.13

REFERENCE BOOK:

1. Aditya P. Mathur, 1985. Introduction to Microprocessors, 2nd Edition, Tata McGraw Hill Ltd., New Delhi.

Course designers:

1. Dr. R.Vijayalakshmi
2. Dr.S.Rajakarthihan

THIAGARAJAR COLLEGE, MADURAI- 9
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DEPARTMENT OF PHYSICS
(For those who join in 2017 and after)

Course :Core **Int.Marks:25**
Class: II year **Ext.Marks:75**
Semester :IV **Max.Marks: 100**
Sub. Code : 4PP1 **Hour/Week: 5**
Title of the paper : SPECTROSCOPY **Credit : 4**

Course Outcomes: On the successful completion of the course, students will be able to

1. Understand the basis of various spectroscopy
2. Derive the 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.

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:

1. Banwell, C. N. Mccash, E. M.Fundamentals of molecular spectroscopy, IV ed., Tata Mcgraw-Hill Education(India) Private Limited, New Delhi.

REFERENCE BOOKS:

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

Course designers:

1. Dr. G.Arivazhagan
2. Mrs.R.Sribala

THIAGARAJAR COLLEGE, MADURAI- 9

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DEPARTMENT OF PHYSICS

(For those who join in 2017 and after)

Course :Core **Int.Marks:25**
Class: II year **Ext.Marks:75**
Semester :IV **Max.Marks: 100**
Sub. Code : 4PP2 **Hour/Week: 5**
Title of the paper : NANO SCIENCE **Credit : 4**

Course Outcomes:

On the successful completion of the course, students will be able to

1. Understand the postulates and concepts of nanophysics with clarity.
2. Understand the principles, fabrication and design of Carbon Nano-Tubes and their application.
3. Appreciate the theoretical and experimental aspects of quantum wells, wires and dots.
4. Understand 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 :

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

REFERENCE BOOK:

1. Richard Booker & Earl Baysen, 2005.Nano Technology, wiley.

Course designers:

1. Dr.R.Srinivasan
2. Mrs. R.Dhanalakshmi

THIAGARAJAR COLLEGE, MADURAI- 9
(Re-Accredited with 'A' Grade by NAAC)
DEPARTMENT OF PHYSICS
(For those who join in 2017 and after)

Course :Core **Int.Marks:25**
Class: II year **Ext.Marks:75**
Semester :IV **Max.Marks: 100**
Sub. Code : 4PP3 **Hour/Week: 5**
Credit : 4

Title of the paper :OPTICAL COMMUNICATION AND NETWORKING

Course Outcomes:

On the successful completion of the course, students will be able to

1. Know about various types of fibers.
2. Understand the transmission characteristics of optical fibers.
3. Appreciate the sources and detectors; function of networks etc.,

Unit I: OPTICAL FIBER MODES

Fiber types-rays and modes-Step index fiber structure-Ray optics representation –Mode theory for circular waveguides-Key modal concepts-cutoff wavelength and v number-wave equation for step index fiber-modes in step index fibers-single mode fibers-propagation modes in single mode fiber-graded index fiber-core index-graded index numerical aperture-cutoff condition in graded index fibers

Unit II: ATTEUNATION AND DISPERSION

Attenuation– Attenuation units- absorption- scattering losses-Bending losses- core and clasdding losses- signal dispersion in fibers-overview of dispersion origins –factors contributing to dispersion-Material Dispersion –Waveguide dispersion – dispersion in single mode fibers.

Unit III: SOURCES AND DETECTORS

Optical sources: Light Emitting Diodes - LED structures – light source materials - quantum efficiency and LED power - laser diodes – laser diode modes and threshold conditions – external quantum efficiency - Optical Detectors: PIN Photo detectors - Avalanche photo diodes - Photo detector noise – Noise sources , Signal to Noise ratio

Unit IV: FIBER OPTIC RECEIVER, MEASUREMENTS AND AMPLIFIERS

Fundamental receiver operation – digital signal operation – error sources – front end amplifier – digital reciver performance – probability of error – receiver sensitivity – quantum limit – eye diagram – eye pattern features – BER and Q-factor measurements – burst mode receivers – analog receivers – Optical amplifiers – basic applications and types of optical amplifiers – general applications – amplifier types – Erbium doped fiber amplifiers – amplification mechanism - EDFA architecture – amplifier noise – optical SNR.

Unit V: OPTICAL NETWORKS

Optical Networks - network concepts – network terminology – network categories – network layers – optic layers - SONET / SDH Transmission formats and speeds – Optical interfaces – SONET / SDH – RINGS - SONET / SDH networks - Optical switching – optical cross connect – wavelength conversion – wavelength routing – optical packet switching – optical burst switching - WDM Network examples – wideband Long-haul WDM Networks – Narrow band metro WDM Networks

TEXT BOOK:

1. Gerd Keiser. 2013.Optical Fiber Communications, Fifth Edition**.** Mc Graw Hill ISBN-13: 978-1-25-900687-6; ISBN-10: 1-25-900687-5

REFERENCE BOOKS:

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

Course designers:

1. Dr. R.Vijayalakshmi
2. Mr.M.Venkatachalam

THIAGARAJAR COLLEGE, MADURAI- 9
(Re-Accredited with 'A' Grade by NAAC)
DEPARTMENT OF PHYSICS
(For those who join in 2017 and after)

Course :Major Elective **Int.Marks:25**
Class: II year **Ext.Marks:75**
Semester :IV **Max.Marks: 100**
Sub. Code : 4PPE1(X) **Hour/Week: 5**
Title of the paper : X-RAY CRYSTALLOGRAPHY **Credit : 5**

Course Outcomes:

On the successful completion of the course, students will be able to

1. Know the theoretical and experimental aspects involved in X-ray diffraction by single crystals.
2. Understand the relationship between symmetry and scattering of X-rays.
3. 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, P21, P212121, Pbca, P21/c, Pmmm, Pna21, 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 – □-helix – □-sheet – □-strands – □-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. Chatterjee S.K. 1999. X-ray Diffraction – Its theory and Applications Prentice-Hall, New Delhi, (For Units I ,II, III & IV)
2. Woolfson, M.M. 1980. An Introduction to X-ray Crystallography Cambridge University Press-Vikas Publishing House, New Delhi, (For Units III IV relevant pages)
3. Narayanan P. 1998. Essentials of Biophysics, New Age International Publishers, New Delhi, (For Unit V).

REFERENCE BOOKS:

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

Course designers:

1. Dr.N.Srinivasan
2. Dr.R.V.Krishna Kumar

THIAGARAJAR COLLEGE, MADURAI- 9
(Re-Accredited with 'A' Grade by NAAC)
DEPARTMENT OF PHYSICS
(For those who join in 2017 and after)

Course :Major Elective **Int.Marks:25**
Class: II year **Ext.Marks:75**
Semester :IV **Max.Marks: 100**
Sub. Code : 4PPE2(A) **Hour/Week: 5**
Title of the paper : ASTROPHYSICS **Credit :5**

Course Outcomes:

On the successful completion of the course, students will be able to

1 Understand the methods of collecting stellar data and appreciate how they are used in classifying the stars.
2 Know the life of a star from its birth till its death.
3 Elaborate 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:

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

REFERENCE BOOK:

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

Course designers:

1. Dr.R.V.Krishna Kumar

THIAGARAJAR COLLEGE, MADURAI- 9

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

DEPARTMENT OF PHYSICS

(For those who join in 2017 and after)

Course :LAB **Int.Marks:40**
Class: I year **Ext.Marks:60**
Semester :I & II **Max.Marks: 100**
Sub. Code :2PPL1 **Hour/Week: 5**
Title of the paper : GENERAL EXPERIMENTS **Credit : 5**

Course Outcomes:

On the successful completion of the course, students will be able to

1. Identify the link between theory and practical
2. Develop the skill of performing experiments accurately
3. Report observations and analyses in a scientific manner

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. Refractive index using abbes refract meter and hollow prism
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, MADURAI- 9

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DEPARTMENT OF PHYSICS

(For those who join in 2017 and after)

Course :LAB **Int.Marks:40**
Class: I year **Ext.Marks:60**
Semester :I & II **Max.Marks: 100**
Sub. Code :2PPL2 **Hour/Week: 5**
Title of the paper : ELECTRONICS EXPERIMENTS **Credit :5**

Course Outcomes:

On the successful completion of the course, students will be able to

1. Identify the link between theory and designing workable circuits
2. Troubleshoot any simple electronic circuits
3. Report observations and analyses in a scientific manner

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, MADURAI- 9
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DEPARTMENT OF PHYSICS
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Course :LAB **Int.Marks:40**
Class: II year **Ext.Marks:60**
Semester :III & IV **Max.Marks: 100**
Sub. Code :4PPL1 **Hour/Week: 5**
Title of the paper : ADVANCED EXPERIMENTS **Credit : 6**

Course Outcomes:

On the successful completion of the course, students will be able to

1. Identify the link between theory and designing workable circuits
2. Troubleshoot any simple electronic circuits
3. Appreciate the applications of OP-AMPs, Microprocessor
4. Report observations and analyses in a scientific manner

1. Filters (I order, II order Low and high pass filters, Band pass filters)
2. Study of JK Flip-Flop.
3. Synchronous counter to count any desired sequence.
4. Shift Register (SISO, PIPO)
5. Half Adder, Full Adder, Half Subtractor, Full Subtractor.
6. Karnaugh map simplification
7. Differentiator, Integrator, Comparator, Triangular wave generator.
8. BCD to seven segment display.
9. Simultaneous equation
10. Schmidt Trigger (using 555)
11. UJT relaxation oscillator.
12. Fibre optic communication

MICROPROCESSOR

1. Microprocessor problems for 8 bit addition
2. Microprocessor problems for 8 bit subtraction(binary)
3. Microprocessor problems for 8 bit subtraction(decimal)
4. Microprocessor problems for 8 bit multiplication(binary)
5. Finding a largest number in an array of data
6. Finding a smallest number in an array of data
7. Sorting an array of data in ascending order
8. Sorting an array of data in descending order
9. Finding 1's complement of data
10. Finding 2's complement of data
11. Microprocessor with interfacing

C and C ++ programming and MS EXCEL- Relevant programmes

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, MADURAI- 9

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DEPARTMENT OF PHYSICS

(For those who join in 2017 and after)

Course :PROJECT	**Int.Marks:40**
Class: II year	**Ext.Marks:60**
Semester : III & IV	**Max.Marks: 100**
Sub. Code : PJ	**Hour/Week: 5**
Title of the paper : PROJECT	**Credit : 7**

Individual projects done by the students under the guidance of faculty members.

M.Phil., Physics

THIAGARAJAR COLLEGE, MADURAI- 9

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DEPARTMENT OF PHYSICS

(For those who join in 2017 and after)

M.Phil Physics

COURSE STRUCTURE (w.e.f 2017 -18 batch onwards)

Semester – I

Course	Code No	Subject	Contact Hrs / Week	Credits	Total No of Hrs Allotted/ Semester	Max Marks CA	Max Marks SE	Total
CORE	1SMP1	Elements of Research Methods in Physics	6	6	90	100	100	200
CORE	1SMP2	Advanced Physics	6	6	90	100	100	200
*Core Elective	1SMPE1	Elective	6	6	Nil*	100	100	200

Semester – II

Course	Code No	Subject	Contact Hrs / Week	Credits	Total No of Hrs Allotted/ Semester	Max Marks CA	Max Marks SE	Total
Core	2SMP2	Dissertation Viva-Voce	-	6	-	100	100	200

List of Elective Papers

- Spectroscopy -2SMPE1(S)
- Thin Films -2SMPE2(T)
- X-Ray Crystallography-2SMPE2(X)
- Ultrasonics- 2SMPE2(U)

THIAGARAJAR COLLEGE, MADURAI- 9
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DEPARTMENT OF PHYSICS
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Course :Core **Int.Marks:100**
Class: M.Phil Physics **Ext.Marks:100**
Semester :I **Max.Marks:200**
Sub. Code : 1SMP1
Title of the paper : ELEMENTS OF RESEARCH METHODS IN PHYSICS
Credit : 6

Course Outcomes:
On the successful completion of the course, students will be able to
1. Understand the fundamental principles and concepts involved in the methods of research in Physics
2. Appreciate the analytical methods involved in research in Physics

Unit I: 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

Unit II:SYMMETRY

Symmetry in nature – Symmetry in a molecule – Symmetry elements – Various types of symmetry operations – Point groups – Properties of point groups – Determination of the point group of a molecule – Representations of Groups – The character – Character table for point groups.

Unit III: ANALYTICAL METHODS

UV-Vis spectroscopy: Fundamental laws of photometry, deviations from Beer's law - **IR spectroscopy:** Introduction, correlation of IR spectra with molecular structure, instrumentation, sample handling - **Raman spectroscopy:** theory, resonance Raman spectroscopy, instrumentation, sampling techniques - **NMR spectroscopy:** Basic principles, pulsed Fourier transform NMR spectrometer – **Thermal analysis:**

DSC and DTA - instrumentation, thermogravimetry, methodology of TG, DSC and DTA.

Unit IV: QUANTUM CHEMICAL COMPUTATIONS

Fundamental principles: energy, electrostatics, atomic units, thermodynamics, quantum mechanics, statistical mechanics, Hartree - Fock approximation, semiempirical methods, density functional theory: basic theory, linear scaling techniques, practical considerations.

Unit V:NON-DESTRUCTIVE TESTING

Liquid penetrant testing- principle – testing methods- – Radiography – principles- Inspection techniques- Ultrasonic testing principle- pulse-echo and through

transmission technique- Ultrasonic flaw detector- Acoustic emission testing – principle-instrumentation.

TEXT BOOKS:

1. Azaroff, L. V. 1968. Elements of X-ray Crystallography, McGraw Hill, **[Unit I]**

2. Chandra, A. K. 1988. Introduction to Quantum Chemistry, 3rd ed., Tata McGraw Hill, **[Unit II]**

3. Willard, H. H. Merritt, L. L. Dean, J. A. Settle, F. A. 1986.Instrumental methods of analysis 7th ed., CBS Publishers & Distributors **[Unit III]**

4. Young, D. C. 2001. Computational chemistry: A practical guide for applying techniques to real-world problems, John Wiley & Sons, Inc **[Unit IV]**

5. Baldevraj, Jayakumar, , T. Thavasimuthu, M. 2007., Practical Non-Destructive Testing,3rd ed., Narosa publishing house **[Unit V]**

Course designers:

1. Dr. R.Vijayalakshmi
2. Dr.N.Srinivasan
3. Dr.R.V.Krishna Kumar
4. Dr. G.Arivazhagan
5. Dr.R.Srinivasan
6. Dr.S.Rajakarthihan
7. Dr.J.Suvetha Rani

THIAGARAJAR COLLEGE, MADURAI- 9
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DEPARTMENT OF PHYSICS
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Course :Core **Int.Marks:100**
Class: M.Phil Physics **Ext.Marks:100**
Semester :I **Max.Marks:200**
Sub. Code : 1SMP2
Title of the paper : ADVANCED PHYSICS **Credit : 6**

Course Outcomes:
On the successful completion of the course, students will be able to
1. Gain theoretical knowledge in some of the major areas of research in materials science
2. Understand the advanced techniques involved in the research field

Unit I:BASIC QUANTUM CONCEPTS OF NANO STRUCTURES:

Heterostructures – General properties and growth of hetero structures – Band engineering Doped heterostructures – Wires and dots – Optical confinement

Unit II : CHARACTERIZATION, PROPERTIES AND APPLICATIONS OF NANO MATERIALS.

Introduction, structure characterization, chemical characterization, physical properties of nano materials, electrical conductivity, ferroelectrics and dielectrics, super paramagnetism.

Unit III: THIN FILMS

Introduction, fundamentals of film growth, vacuum science, physical vapor deposition, chemical vapor deposition, atomic layer deposition, Langmuir-Blodgett films, Electrochemical deposition, Sol-gel films.

Unit IV:ADVANCED NMR TECHNIQUES

Pulse sequences, pulse widths, spins and magnetization vectors, pulsed field gradients, the DEPT experiment, determining the number of attached hydrogens, Introduction to two dimensional spectroscopic methods: the COSY and the HETCOR techniques, an overview of the COSY and HETCOR experiments, inverse detection methods, the NOESY experiment.

Unit V: 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 thermal storage – Solar pond- Construction and operation of Solar pond.

TEXT BOOKS:

1. Hohn H. Davies, 1998. The Physics of low dimensional semiconductors , Cambridge University Press (Unit I)

2. Gao, H. 2004. Nano structures & nanomaterials, Imperial college press (Unit II & III)

3. Pavia, D. L. Lampman, G. M. Kiez G. S., Vyvyan J. R., Introduction to spectroscopy, IV ed., Brooks/Cole Cengage learning, USA. (Unit IV)

4. Rai, G. D. 1997. Non-conventional Energy Sources, Khanna Publishers (Unit V)

Course designers:

1. Dr. R.Vijayalakshmi
2. Dr.N.Srinivasan
3. Dr.R.V.Krishna Kumar
4. Dr. G.Arivazhagan
5. Dr.R.Srinivasan
6. Dr.S.Rajakarthihan
7. Dr.J.Suvetha Rani

THIAGARAJAR COLLEGE, MADURAI- 9

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DEPARTMENT OF PHYSICS

(For those who join in 2017 and after)

Course :Core **Int.Marks:100**
Class: M.Phil Physics **Ext.Marks:100**
Semester :II **Max.Marks:200**
Sub. Code : 1SMPE1(S)
Title of the paper : SPECTROSCOPY

Course Outcomes:

On the successful completion of the course, students will be able to

1. Understand the principles involved in various spectroscopy
2. Elucidate structural information of complex molecules from their spectra.

Unit I: INFRARED SPECTROSCOPY

Units of frequency, wavelength and wavenumber, molecular vibration: calculation of vibrational frequencies, modes of vibration, quantum restrictions, factors influencing vibrational frequencies, absorbance and transmittance scale, applications of infrared spectroscopy: identity by fingerprinting and identification of functional groups.

Unit II: NMR SPECTROSCOPY

Proton NMR: The NMR phenomenon, theory of nuclear magnetic resonance, chemical shift and its measurement, internal standards, units used in NMR spectroscopy, the splitting of NMR signals in proton NMR spectra, theory of spin-spin splitting, magnitude of the coupling - coupling constants.

Unit III: ULTRAVIOLET AND VISIBLE SPECTROSCOPY

The chromophore concept, theory of electronic spectroscopy: orbitals involved in electronic transitions, Beer's and Lambert's law, conventions, instrumentation and sampling, solvents and solutions, solvent effects.

Unit IV: MASS SPECTROMETRY

Basic principles, instrumentation: sample insertion - inlet systems, ion production in the ionization chamber, separation of ions in the analyzer, the detector - recorder, data handling, isotope abundances, the molecular ion: structure of the molecular ion, recognition of the molecular ion, molecular formula from the molecular ion, metastable ions: the nature of metastable ions, ion tube regions. calculation of metastable ion $\frac{m}{z}$ values.

Unit V: 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.

TEXT BOOKS:

1. Kemp, W. 1991. Organic spectroscopy ,3rd ed., Macmillan press Ltd., (Units I - IV)
2. Rosencwaig, A. 1980. Photoacoustics and Photoacoustic spectroscopy, John Wiley, (Unit V)

REFERENCE BOOKS:

1. Straughan, B.P. Walker, S. 1996.Spectroscopy [Vol. II], John Wiley & Sons, New York.
2. Aruldhass, G. 2007. Molecular structure and spectroscopy, 2nd ed., Prentice – Hall of India,
3. Banwell, C. N. McCash, E. M. 2000. Fundamentals of spectroscopy, Tata McGraw-Hill

Course designers:

1. Dr. G.Arivazhagan
2. Dr.R.Srinivasan
3. Dr.J.Suvetha Rani

THIAGARAJAR COLLEGE, MADURAI- 9
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DEPARTMENT OF PHYSICS
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Course :Core **Int.Marks:100**
Class: M.Phil Physics **Ext.Marks:100**
Semester :II **Max.Marks:200**
Sub. Code : 1SMPE1(T)
Title of the paper : THIN FILMS

Course Outcomes: On the successful completion of the course, students will be able to

1. Know about the fabrication of thin films.
2. Understand 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. Granquist, G., 1998. A Handbook of inorganic materials, ElsevierPublication, Amsterdam,
2. Willard, Meritt, Dean J.A. Settle, F.A., 1986. Instrumentation methods of analysis VI CBS published, India.Progress in intercalation Research, Kluwar Academic Publishes Dordlechet/London & Boston, Edited by W. Muller-Warmuth & R.Schollhorn.
3. Goswamy, 1996.Thin film fundamentals, New Age International, New Delhi.

Course designers:

1. Dr. R.Vijayalakshmi

THIAGARAJAR COLLEGE, MADURAI- 9
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DEPARTMENT OF PHYSICS
(For those who join in 2017 and after)

Course :Core **Int.Marks:100**
Class: M.Phil Physics **Ext.Marks:100**
Semester :II **Max.Marks:200**
Sub. Code : 1SMPE1(X)
Title of the paper : X-RAY CRYSTALLOGRAPHY

Course Outcomes:

On the successful completion of the course, students will be able to

1. Understand the principles involved in the application of X-ray crystallography
2. Determine the structure of crystals

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

Unit III :FACTORS AFFECTING X-RAY INTENSITIES

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 IV: 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 V: 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.

TEXT BOOKS:

1. Woolfson, M.M., 1997.An Introduction to X-ray Crystallography (II ed.), Cambridge University Press, ISBN 0-521-42359-7
2. Ladd, M.F.C. & Palmer, R.A., 2003. Structure Determination by X-ray Crystallography , IV Ed., Springer.
3. Pattabhi, V. & Gauttham, N., 2002. Biophysics, Kluwer Academic Publishers
4. Rhodes, G, 2006. Crystallography Made Crystal Clear: A Guide for Users ofMacromolecular Models, III ed., Elsevier
5. Stout, G.H. & Jensen, L.H., 1989. X-ray Structure Determination – A Practical Guide, JohnWiley & Sons
6. Glusker, J.P. & Trueblood, K.N., 1985. Crystal Structure Analysis – A Primer , II ed., Oxford University Press, ISBN 0-19-503543-7.

Course designers:

1. Dr.N.Srinivasan
2. Dr.R.V.Krishna Kumar

THIAGARAJAR COLLEGE, MADURAI- 9
(Re-Accredited with 'A' Grade by NAAC)
DEPARTMENT OF PHYSICS
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Course :Core **Int.Marks:100**
Class: M.Phil Physics **Ext.Marks:100**
Semester :II **Max.Marks:200**
Sub. Code : 1SMPE1(U)
Title of the paper : ULTRASONICS

Course Outcomes:

On the successful completion of the course, students will be able to

1. Understand the basic concept of ultrasonics
2. Know the generation and transducers of ultrasonics
3. Acquire the measurement techniques of ultrasound
4. Appreciate the application of ultrasonic in liquids and solid systems.

Unit I: FUNDAMENTALS OF ULTRASONICS

Ultrasonic waves – Different modes of ultrasonic waves- Characteristic properties of ultrasonic waves- behaviour of ultrasonic waves - reflection and transmission at normal incidence, mode conversion, critical angle and attenuation.

Unit II: ULTRASONIC GENERATIONS AND TRANSDUCERS

Ultrasonic generation- mechanical method- magnetostrictive method- piezoelectric method- transducer materials- types of transducers- normal beam, twin crystal and angle beam transducer.

Unit III: MEASUREMENT TECHNIQUES OF ULTRASOUND

Pulse technique- sing around method- pulse superposition method- pulse echo overlap method- cross-correlation method- direct method- attenuation measurement methods.

Unit IV: ULTRASONIC STUDY OF LIQUID MIXTURES

Types of molecular interactions- ultrasonic study of molecular interactions- preparation of multi component liquid mixtures- measurement techniques- behaviour of ultrasonic waves in pure liquids, mixtures and gases- theories of ultrasonic velocity in mixtures and solutions- acoustical parameters obtained from velocity and other data.

Unit V: ULTRASONIC NON-DESTRUCTIVE TESTING

Classification of ultrasonic testing- pulse echo and through transmission method- different types of technique in pulse echo method- ultrasonic flaw detector- types of scan- A, B and C scan techniques- ultrasonic inspection of welds by angle beam probes- synthetic aperture focussing technique- time of flight diffraction technique.

TEXT BOOK:

Baldev Raj, Rajendran V., Palanichamy, P. 2004. Science and technology of ultrasonic, Narosa Publishing House, New Delhi. ISBN 81-7319-202-2.

REFERENCE BOOKS:

1. Subramanian, C.V 2011. Practical Ultrasonics, Narosa Publishing House, New Delhi ISBN 978-81-7319-646-1.
2. Baldev Raj, Jayakumar T Thavasimuthu,. T. 2007. Practical Non-destructive testing-, and Narosa Publishing House, New Delhi, I SBN 978-81-7319-797-0.
3. Blitz J. 1971. Ultrasonic methods and applications, Butter worth Public.& co

Course designer:

1. Dr.S.Rajakarthihan