Department	Physics	
Course	MSc Physics	Effective from the year: 2016
Subject Code : 16 PPS 101 Title : Core I: Classical Dynamics		Semester: I
Hrs/Week:	5	Credit: 4
Objectives	➢ To understand the Lagrangian and Hamiltonian formulations of Mechanics and to apply them to simple systems. ➢ To learn how does the Canonical transformation lead to Hamilton Jacobi theory. ➢ To understand the concepts of Rigid body dynamics, Small oscillations and Nonlinear dynamics.	

Unit	Content	Hrs
I	**LAGRANGIAN FORMALISM** Constraints and Degrees of freedom - Generalized coordinates: Generalized Displacement, Velocity, Acceleration, Momentum, Force & Potential - Variational techniques and Euler's Lagrange differential equation - Hamilton's Variational principle - Lagrange's equation of motion from Hamilton's principle - Deduction of Newton's second law of motion from Hamilton's principle - Applications of Lagrange's equation of motion**:** Linear harmonic oscillator - Simple pendulum - Isotropic oscillator - Particle moving under central force - Conservation theorems: Cyclic coordinates - Conservation of Linear momentum - Conservation of energy	13
II	**HAMILTONIAN FORMALISM** Phase space - Hamiltonian - Hamilton's canonical equation of motion -Significance of H - Deduction of canonical equation from Variational principle -Applications of Hamilton's equation of motion**:** Simple pendulum - Particle in a central field of force - Hamiltonian of a Charged particle in an electromagnetic field - Principle of least action and proof - Canonical transformations - Generating function and different forms - Poisson brackets**:** Definition - Equation of motion in Poisson bracket form - Angular momentum and Poisson bracket relations	13
III	**HAMILTON JACOBI THEORY** Hamilton Jacobi method**:** H J partial differential equation - Solution of H J equation - Discussion on Hamilton's principle function - Solution of harmonic oscillator problem by H J method - Particle falling freely - H J equation for Hamilton's characteristic function - Kepler's problem solution by H J method - Action and Angle variables - Solution of harmonic oscillator problem by action angle variable method	13

(CONTD…….2)

IV	**RIGID BODY DYNAMICS & SMALL OSCILLATIONS** Euler's theorem - Euler's angles - Rotational kinetic energy of a rigid body - Equations of motion for a rigid body - The motion of symmetric top under the action of gravity - Types of equilibria : Stable & Unstable equilibrium - Formulation of the problem : Lagrange's equations for small oscillations - Properties of T,V and ω - Normal coordinates & normal frequencies of vibration - Systems with few degrees of freedom : Free vibrations of linear triatomic molecule	13
V	**NONLINEAR DYNAMICS** Dynamical systems: Linear & Nonlinear forces - Mathematical Implications of nonlinearity: Linear & Nonlinear systems, Linear superposition principle - Working definition of nonlinearity - Effects of Nonlinearity - Linear Oscillators: Linear Oscillators and Predictability: Free Oscillations, Damped Oscillations, Damped & Forced Oscillations – Nonlinear Oscillators : Damped and Driven nonlinear oscillators : Free Oscillations, Damped Oscillations, Primary Resonance & Jump Phenomenon, Secondary Resonances - Nonlinear Oscillations and Bifurcations	13

Text Books

- Herbert Goldstein, (2001). *Classical Mechanics.* Addison Wesley Publishing Company, (Units I - IV).
- Gupta S.L. Kumar V. Sharma R.C. (2010). *Classical Mechanics.* Pragati Prakashan, Meeret, (Units I - IV).
- Laxmanan M. Rajasekar S. (1978). *Nonlinear Dynamics.* Springer - Verlag, Distributors: Prism Books Pvt Ltd, Berlin, (Unit - V).

Reference Books

- Rana N.C. Joag P.S. (2001). *Classical Mechanics.* Tata McGraw Hill, New Delhi.

Unit	Content	Hrs

Course	MSc Physics	Effective from the year: 2016
Subject Code : 16 PPS 102 Title : Core II : Quantum Mechanics-I		Semester: I
Hrs/Week:	5	Credit: 4
Objectives	➢ To understand the basic concepts and formalisms in Quantum mechanics. ➢ To solving Schrödinger wave equation to simple systems. ➢ To understand and apply various approximate methods to solve time independent problem. ➢ To understand the quantum mechanical treatment of angular momentum and systems of identical particles. ➢ To analyse scattering problems using Born-approximation and Partial wave techniques.	
I	**MATRIX FORMULATION OF QUANTUM THEORY** Matrix algebra – Linear vector space – Hilbert space – orthonormality property of basis vectors – Schwartz inequality – Linear operator – Eigen functions and Eigen values – Hermitian operator – Schmidt orthogonalisation procedure – Postulates of Quantum mechanics – Matrix representation of an operator – Column representation of the wave function – Normalisation and orthogonality of wavefunctin in matrix form – Product of two linear transformations - Dual space – Change of basis, similarity and unitary transformations.	13
II	**STATIONARY STATES** Schrödinger's equation in Cartesian and Spherical coordinates - Three dimensional harmonic oscillator – The rigid rotator with free axis – Eigen function for the rotator – Rigid rotator in a fixed plane - Motion of a particle in a three dimensional square well Potential – The hydrogen atom: Equations and Solutions of ϕ, θ and R -Heisenberg, Schrödinger and Interaction pictures.	13
III	**TIME INDEPENDENT PERTURBATION THEORY** Perturbation theory for a system with Non-degenerate and Degenerate levels - Stark effects in Hydrogen and two electron atoms - The variation method and its application to Hydrogen molecule - WKB approximation and its validity – Application to barrier penetration.	13
IV	**ANGULAR MOMENTUM AND IDENTICAL PARTICLES** Algebra of the angular momentum vector components - Ladder operators - Eigen value spectrum and Matrix representation - Angular momentum operator - Addition of two angular momenta and CG coefficients - Application to two electron systems - Parity operator, Symmetric and Antisymmetric wave functions for a system of **n** identical particles - Pauli's	13

	exclusion principle	

(CONTD…….2)

V	**SCATTERING THEORY** Scattering amplitude and scattering cross section - Integral equation in terms of Green's function - Born approximation and its validity - Application to screened coulomb potential - Partial wave analysis - Optical theorem - Application to low energy two nucleon scattering	13

Text Books

- Gupta, Kumar, Sharma, *Quantum Mechanics*. Pragathi Prakash Publications, Meerut, (Unit I).
- Satya Prakash, (2007). *Advanced Quantum Mechanics*. Kedar nath Ram Nath, Fifth revised edition, Meerut, (Unit -II).
- Aruldhas, (2002). *Quantum Mechanics*. Prentice Hall India Company Pvt Ltd, New Delhi, (Units I, III & V).
- Gupta S.L. Gupta I.D. (1982). *Advanced Quantum Theory And Fields*. S Chand and Company Ltd, New Delhi, (Unit - IV).

Reference Books

- Mathews, Venkatesan, (2002). *A Text Book Of Quantum Mechanics*. Tata McGraw Hill Company Ltd, New Delhi.
- Atkins P.W. (1984). *Quantum Mechanics*. Oxford University Press, Oxford.

Department	Physics	
Course	MSc Physics	Effective from the year: 2016
Subject Code : 16 PPS 103 Title : Core III: Mathematical Physics		Semester: I
Hrs/Week:	5	Credit: 4
Objectives	➢ To become familiar with the evaluation of residues of complex functions and definite integrals. ➢ To understand the concepts of special functions as solutions of linear differential equations. ➢ To provide mathematical foundation in Partial differential equations, Fourier transforms and Dirac delta functions	

Unit	Content	Hrs
I	**SPECIAL FUNCTIONS** Legendre differential equations and Legendre functions - Generating function of Legendre polynomial - Orthogonal properties of Legendre's polynomials - Recurrence formulae for $P_n(x)$ - Bessel's differential equations**:** Bessel's functions of first kind - To solve $J_{1/2}(x)$, $J_{-1/2}(x)$, $J_{3/2}(x)$ and $J_{-3/2}(x)$ - Recurrence formulae for $J_n(x)$ - Generating function of $J_n(x)$ - Hermite differential equation & Hermite polynomials - Generating function of Hermite polynomials - Recurrence formulae for Hermite polynomials	13
II	**COMPLEX VARIABLES** Analytic function – The necessary and sufficient conditions for f(z) to be analytic: Cauchy Riemann Differential equations in polar form – Cauchy's integral theorem(Cauchy proof only) - Cauchy's integral formula - Taylor's series and Laurent's series - Singularities of an analytic function - Residues and their evaluation - Cauchy Residue theorem - Evaluation of definite integrals of Trignometric functions of $\cos\theta$ and $\sin\theta$.	13
III	**LAPLACE & WAVE EQUATIONS** Solution of Laplace's equation in Cartesian coordinates - Examples of Two dimensional steady flow of heat - Solution of Laplace's equation in two dimensional cylindrical coordinates – Problems - Solution of Laplace's equation in Spherical polar coordinates – Problems – Diffusion equation or Fourier equation of heat flow - Solution of heat flow equation – Problems.	13
IV	**FOURIER INTEGRAL AND TRANSFORMATIONS** Fourier Integral – Problems **–** Fourier's Transform: Infinite Fourier sine and cosine transforms - Properties of Fourier's Transform: Addition theorem, Similarity theorem, Shifting property, Convolution theorem and Parseval's theorem – Problems – Finite Fourier sine and cosine transforms -	13

	Problems	

(CONTD …….2)

(16 PPS 103)

V	**TENSORS, BETA AND GAMMA FUNCTIONS** Transformation of co-ordinates - Summation convention - Kronecker delta symbol - Generalised Kronecker delta - Scalars,contravariant and covariant vectors- Tensors of higher ranks - Algebraic operations of tensors – Quotient law - Symmetric and skew symmetric tensors - Beta and Gamma functions: Symmetry property of beta function – Evaluation of beta function – Transformation of beta function - Evaluation of Gamma function - Transformation of Gamma function – Relation between beta and gamma function – Evaluation of Miscellaneous integrals	13

Text Books

- Sathyaprakash, (2013). *Mathematical Physics.* Sultan chand & sons, New Delhi, (Units I – V).

Reference Books

- Gupta B.D. (1989). *Mathematical Physics.* Vikas publication house, Noida, U.P.
- Louis A.Pipes, Lawrence R. Harvill, (1970). *Applied Mathematics For Engineers & Physicsts.* McGraw Hill Kogakusha Ltd, New Delhi.
- Chattopadhyay P.K. (1990). *Mathematical Physics.* Wiley Eastern Limited, New Delhi.
- Bose R.K. Joshi M.C. (1984). *Methods Of Mathematical Physics*. Tata McGraw-Hill, New Delhi.

Department	Physics	
Course	MSc Physics	Effective from the year: 2016
Subject Code : 16 PPS 1E1 Title : Major Elective I: Electronics		Semester: I
Hrs/Week:	5	Credit: 5
Objectives	➢ To understand the action of semiconductor devices, amplifiers and oscillators. ➢ To know the construction, action and applications of operational amplifier	

Unit	Content	Hrs
I	**SEMICONDUCTOR DEVICES** Semiconductor and Energy bands - PN Junction diode and Zener diode - Characteristics - Zener diode as a voltage regulator - Regulated power supply - Transistor & Action - Characteristics - CE, CB and CC configurations - Relation between **α, β** and **γ** - Load line & Operating point - Stability - Voltage divider Self bias - JFET, Depletion MOSFET and Enhancement MOSFET - Characteristics - UJT and Relaxation Oscillator - SCR & SCR as a switch - Triac - Tunnel diode - Varactor diode	13
II	**AMPLIFIERS** Principle of amplification - Classification of amplifiers - Common base, Common emitter RC coupled amplifiers and Frequency response - Hybrid parameters and Small signal analysis - Emitter follower - Concept of Power amplification - Classification of Power amplifiers - Transformer coupled class A Power amplifier –Calculation of Efficiency - Class B Push pull amplifier - Complementary symmetry Push pull amplifier – Efficiency calculation - Biasing of FET amplifier - Common source FET amplifier - Common drain FET amplifier	13
III	**FEEDBACK AMPLIFIER & OSCILLATORS** Concept of Feedback - Negative feedback - Forms of negative feedback - Effect of negative feedback on bandwidth, distortion, noise and stability - Positive feedback - Barkhausen criterion - Generation of sinusoidal waves by a tuned LC circuit - Classification of oscillators - Hartley oscillator - Colpitts oscillator - Phase shift oscillator - Weinbridge oscillator – Frequency calculation - Astable, Monostable and Bistable Multivibrators	13
IV	**OPERATIONAL AMPLIFIER** Typical stages of an Op Amp - Differential amplifier (using transistor) and Classification - Common mode and Differential	13

	mode operations - CMRR - Realization of constant current source - Integrated circuit of operational amplifier - Ideal Op Amp and characteristics - Parameters of Op Amp (Input offset voltage, offset current, bias current and slew rate) - Inverting Op Amp - Non inverting Op Amp - Differential Op Amp - A/D converter - D/A converter	

(CONTD…….2)

V	**OPERATIONAL AMPLIFIER** Phase changer - Scale changer - Adder - Averager - Subtractor-Integrator - Differentiator - Solving differential equation - Comparator - Window detector - Schmitt trigger - Voltage follower - Voltage to current converter - Sample and hold circuit - Logarithmic amplifier - Constant current source	13

Text Books

- Norman Lurch, (1981). *Fundamentals Of Electronics.* John Wiley & Sons, New York, (Units I - V).
- Swaminathan Mathu, (1985). *Electronics Circuits And Systems.* 1st Edition, Howard W.Sams & Co, (Units I, IV & V).
- Bhargowa N.N. Kulshreshtha D.C. Gupta S.C. (2001). *Basic Electronics & Linear Circuits.* 32nd Reprint, Tata Mc Graw-Hill Publishing Company Limited, New Delhi, (Units I - III).

Reference Books

- Salivahanan S. Suresh kumar N. Vallavaraj A. (2003). *Electronic Devices & Circuits.* 10th Reprint, Tata McGraw Hill Publishing Company Limited, New Delhi.
- Robert F.Coughilin, (2001). *Operational Amplifiers & Linear Integrated Circuits.* 6th Edition, Pearson Education Inc, New Delhi.

Department	Physics	
Course	MSc Physics	Effective from the year: 2016
Subject Code : 16 PPS 204 Title : Core IV: Statistical Mechanics		Semester: II
Hrs/Week:	5	Credit: 4
Objectives	➢ To understand the concepts of Statistical Mechanics and to apply these concepts to various physical phenomena	

Unit	Content	Hrs
I	**CONCEPTS OF STATISTICAL MECHANICS** Phase space – Volume in Phase space – Ensembles – Micro, Canonical ensemble – Canonical ensemble – Grand canonical – ensemble – Uses of ensemble – Liouvilles theorem - Postulate of equal a priori probability – Statistical equilibrium – Thermal equilibrium - Mechanical equilibrium – Particle equilibrium – Thermo dynamical quantities : entropy – enthalpy – Helmholtz free energy – Gibb's free energy - Chemical potential - Connection between statistical and thermo dynamical quantities	13
II	**CLASSICAL STATISTICS** Microstates and Macro states – Classical Maxwell Boltzmann distribution law – Most probable speed , Mean speed , Mean square speed , Root mean square speed - Principle of equipartition energy – Gibbs paradox – Partition function and its correlation with thermodynamic quantities. Partition function and their properties, effect of shifting zero level of energy on partition function, mean energy, specific heat, entropy -comparison of ensemble – Equipartition theorem - Partition function for real gas.	13
III	**QUANTUM STATISTICS** Transition from classical statistical Mechanics to Quantum Statistical Mechanics – Indistinguishability in quantum statistics – Statistical weight or a priori probability – Matrices – The density matrix – Postulates – Condition for statistical equilibrium – Identical particles and symmetry requirement – Bose - Einstein distribution law – Fermi – dirac distribution law - Evaluation of Constant α & β - Results of all three statistics.	13
IV	**APPLICATION OF QUANTUM STATISTICS** Photon gas - Black body radiation and Planck radiation – Specific heat of solids – Einstein theory – Debye theory – Bose Einstein condensation – Liquid Helium - Electron Gas – Free electron model and electronic emission – Pauli's theory of Para magnetism – White dwarfs.	13

(CONTD……2)

V	**TRANSPORT PROPERTIES** Boltzmann transport equation – Thermal conductivity – Viscosity – Brownian movement – Onsager solutions – Fluctuation : Energy, Pressure – Ising model – Bragg William approximation – One dimensional Ising model.	13

Text Book

- Gupta, Kumar, (2003). *Statistical Mechanics.* Twentieth edition, Pragati Prakasahan Meerut, Begam Bridge Meerut, (Units I - V).

Reference Books

- Keiser Huang, *Fundamentals of Statistical Mechanics*. Revised edition.
- Agarwal K. Eisner, (1998). *Statistical Mechanics*. Second edition, New Age International Publishers, New Delhi.

Department	Physics	
Course	MSc Physics	Effective from the year: 2016
Subject Code : 16 PPS 205 Title : Core V: Quantum Mechanics-II		Semester: II
Hrs/Week:	5	Credit: 4

Objectives	➢ To familiarize with advanced concepts and methodology of quantum mechanics such as perturbation theory of time evaluation problems, relativistic quantum theory, quantization of fields and central force problems. ➢ To understand the basic approximate methods in molecular quantum mechanics	

Unit	Content	Hrs
I	**TIME DEPENDENT PERTURBATION** Schrodinger equation and general solution - Propagator- Alteration of Hamiltonian, transitions and sudden approximation - Perturbation solution for transition amplitude - First order perturbation - Second order perturbation – Harmonic perturbation – Transition to continuum states : Fermi Golden rule -Scattering of a particle by a potential – Absorption and Emission of Radiation	13
II	**RELATIVISTIC QUANTUM MECHANICS** Klein Gordon equation - Plane wave solutions - Position probability density and current density - Applications to the study of energy levels of electron in a coulomb field - Dirac equation - Probability and Current densities - Alpha **,** Beta matrices and their properties - Plane wave solutions for Dirac equation - Negative energy	13
III	**RELATIVISTIC QUANTUM MECHANICS** Electromagnetic potentials: Magnetic moment of the electron – Existence of electron spin - Spin-orbit energy - Zitterbewegung – Dirac's equation of a central field force (H-Atom) – Solution of Dirac's equation of a central field force (H-Atom) –Hydrogen spectrum according to Dirac equation – Covariant formulation of Dirac equation - Properties of Gamma matrices	13
IV	**QUANTIZATION OF FIELDS** Field - Quantization procedure for particles - Classical formulation of Lagrangian and Hamiltonian equations of motions - Quantum equation of the field - Quantization of the Schrodinger equation - Klein Gordon field - The Dirac field - Creation, annihilation and number operators	13

(CONTD……2)

V	**MANY ELECTRON SYSTEMS** One particle central force problem - Non interacting particles and separation of variables - Reduction of the two particles problems - Two particles rigid rotor - Hydrogen atom - Bound state Hydrogen atom wave functions -Hydrogen like orbitals – LCAO - V.B Theory – Hartree Method - Hartree Fock, SCF method.	13

Text Books

- Mathews P.M. Venkatesan, *A Text Book Of Quantum Mechanics*. Tata McGraw Hill Company Ltd, New Delhi, (Unit - I).
- Gupta, Kumar, Sharma, *Quantum Mechanics*. Pragathi Prakash Publications , Meerut, (Unit - I).
- Aruldhas G. *Quantum Mechanics.* Prentice Hall India Company Pvt Ltd, New Delhi, (Units - II & III).
- Satya Prakash R. (2007). *Advanced Quantum Mechanics*. Kedar Nath Ram Nath, Fifth revised edition, Meerut, (Unit -II).
- Chatwal G.R. Anand S.K. (2006). *Quantum Mechanics*. Himalaya Publishing Company, New Delhi, (Unit - IV).
- Ira. N. Levine, *Quantum Chemistry*. Prentice Hall Company Ltd, New Delhi, (Unit - V).

Reference Books

- Gupta S.L. Gupta I.D. *Advanced Quantum Theory And Fields*. SChand and Company Ltd, New Delhi.
- Atkins P.W. *Quantum Mechanics*. Oxford University Press, Oxford.
- Walter. A. Harrison, *Applied Quantum Mechanics*. Applied Publishers Ltd, Mumbai.
- Wu T.Y. Pauchy Hwang W.Y. *Relativistic Quantum Mechanics & Quantum Fields*. Allied Publishers Ltd, New Delhi.

Department	Physics	
Course	MSc Physics	Effective from the year: 2016
Subject Code : 16 PPS 206 Title : Core VI: Electromagnetic Theory & Plasma Physics		Semester: II
Hrs/Week:	5	Credit: 4
Objectives	➢ To become familiar with the determination of electric and magnetic fields ➢ To study the importance of Maxwell's equation and the propagation of electromagnetic waves in different media ➢ To understand the fundamentals of plasma	

Unit	Content	Hrs
I	**ELECTROSTATICS AND MAGNETOSTATICS** Concept of charge - Coulomb's law - Gauss law - Multipole expansion of charge distribution - Dielectric and its polarization - Electric displacement D - Polarization of non-polar molecules – Lorentz equation for molecular field -	13

	Claussius Mossotti relation - Polarisation of polar molecules- Langevin equation-Debye relation and molecular structure - Current density - Ampere's law of force - Biot Savart law - Ampere's circuital law - Magnetic scalar and vector potential - Application to magnetic dipole	
II	**FIELD EQUATION AND CONSERVATION LAWS** Equation of continuity - Displacement current **D** - Maxwell's equations - Energy in electromagnetic field - Poynting vector - Momentum in electromagnetic fields - Electromagnetic potential **A** and ϕ - Maxwell's equations in terms of electromagnetic potential - Concept of Gauge - Lorentz Gauge - Coulomb Gauge - Retarded potential - Lienard Wiechart potentials	13
III	**PROPAGATION AND INTERACTION OF PLANE ELECTROMAGNETIC WAVES** EM waves in free space –Propagation of E.M waves in Isotropic dielectrics - Anisotropic dielectrics in conducting media and in ionized media - Boundary conditions - Reflection and Refraction of EM waves - Fresnel's formula - Brewster's law and polarization of E.M.W - Total internal reflection - Reflection from a metallic surface - Propagation of EM waves between conducting planes	13

(CONTD……2)

IV	**RELATIVISTIC ELECTRODYNAMICS** Four vectors and tensors - Transformation equations for ρ and J - Transformation equation for A and φ - Electromagnetic field tensor - Transformation equation for E and B - Covariance of Maxwell's equations : Four vector form & four tensor form - Covariance and transformation law of Lorentz force	13
V	**FUNDAMENTALS OF PLASMA** Occurrence of Plasma in nature - Definition of Plasma - Concept of Temperature - Debye shielding - Plasma parameter - Criteria for Plasma - Relation of Plasma physics to ordinary EM waves - Plasma Oscillations - Fluid equation of motion – Convective derivative – The stress tensor – Collisions – Equation of continuity – Equation of state – Complete set of fluid equations – Fluid drifts perpendicular to B - Fluid drifts parallel to B – Plasma approximation – Applications of Plasma Physics(Simple ideas).	13

Text Books

- Chopra K.K. Agarwal G. C. (1989). *Electromagnetic Theory*. 5th edition K. Nath & Co, Meerut, (Units I – IV).

- Chen F.F. *Introduction To Plasma Physics And Controlled Fusion*. 3rd edition, Plenium press, Newyork , (Unit V).

Reference Books

- David. J. Griffiths, *Introduction To Electrodynamics.* 2nd edition, Prentice Hall of India Private Ltd, New Delhi.
- Gupta Kumar Singh, (1998). *Electrodynamics*. 13th edition, Pragati Prakasam, Meerut.
- Sen S. N. (1999). *Plasma Physics*. 3rd edition, Pragati Prakasam, Meerut.

Department	Physics	
Course	MSc Physics	Effective from the year: 2016
Subject Code : 16 PPS 207 Title : Core VII: Electronic Communications		Semester: II
Hrs/Week:	5	Credit: 4
Objectives	➢ To understand the various modulation techniques. ➢ To understand the generation of microwaves. ➢ To understand the basics of satellite communication. ➢ To understand RADAR communication systems. ➢ To understand the building blocks of internet and e - mail communication systems.	

Unit	Content	Hrs
I	**ANALOG COMMUNICATION** Power and energy in a signal-model of communication system-modulation and frequency translation - Amplitude Modulation**:** DSB-SC, SSB, VSB and conventional AM - Superhetrodyne AM receiver - Frequency Modulation**:** Modulation index, spectrum and bandwidth, direct generation and demodulation, superhetrodyne FM receiver - Noise**:** noise power spectral density, white, thermal and shot noise, equivalent noise temperature - Signal to noise ratio and noise figure	13
II	**PULSE MODULATION AND DIGITAL COMMUNICATION** Pulse Modulation: Sampling theorem, informal justification, pulse amplitude modulation, time division multiplexing and pulse time modulation - Pulse code Modulation: Quantization Error, bandwidth, companding and delta modulation - Data Transmission: Base band and radio frequency transmission, FSK	13

	and PSK - Information Theory: Rate and measurement, channel capacity, Noisy and noiseless channel - Shannon's theorem	
III	**MICROWAVE SYSTEMS** Microwaves - Multicavity klystron - Reflex klystron - Magnetron - Travelling wave tube **SATELLITE SYSTEMS** Kepler's law - Orbits - Geostationary orbits - Power systems - Altitude control- Satellite station keeping - Antenna look angles - Limits of visibility- Frequency plans and polarization - Transponder	13

IV	**RADAR SYSTEMS** Fundamentals - Radar performance factors - Pulsed radar systems - Antennas and Scanning - Display methods - Search radar systems and tracking radar systems - Moving target indication - Radar beacons - CW Doppler radar - Frequency modulated CW radar - Phased array radars - Planar array radars	13
V	**INTERNET SYSTEMS (ELEMENTARY IDEAS ONLY)** The wired world of the Internet - Information through the Internet -Linking net works to the Internet - TCP/IP - Internet addresses and domains - Anatomy of web connection - Internet file types – DNS - Routers - Client/Server Architecture - Connectivity between Computer and Internet - ISDN **E-MAIL SYSTEMS (ELEMENTARY IDEAS ONLY)** Anatomy of mail message - E mail through Internet - E mail software and E-mail between networks	13

Text Books

- Swaminathan Madhu, (1985). *Electronic Circuits And Systems.* 1st Edition, H.W.Sams, (Units I & II).
- Kennedy, Davis, (2002). *Electronic Communication Systems*. 16th Edition, Tata McGraw-Hill, New Delhi, (Units III & IV).
- Dennis Roddy, John Coolen, (2000). *Electronic Communications*. 18th Edition, Prentice-Hall of India, New Delhi, (Unit - III).
- Preston Gralla, (1996). *How The Internet Works.* 1st Edition, Ziff- Davis press, (Unit - V).

Reference Books

- Louis E.Frenzel, (2001). *Communication Electronics*. 3rd Edition, Tata McGraw Hill Publishing Company Ltd, New Delhi.
- Wayne Tomasi, (1998). *Electronic Communication Systems*. 3rd Edition, Pearson Education Asia, New Delhi.
- Robert J. Schoenbeck, (1992). *Electronic Communication Systems.*3rd Edition Universal Book Stall.
- Wayne Tomasi, Vincent F.Alisouskas, (1988). *Telecommunications.* Printice- Hall International, New Delhi.

Department	Physics	
Course	MSc Physics	Effective from the year: 2016
Subject Code : 16 PPS 2N1 Title : Non Major Elective : Non Conventional Energy Sources		Semester: II
Hrs/Week:	1	Credit: 2
Objectives	➢ To give awareness on the utilization of solar energy, wind energy & ocean energy. ➢ To give a knowledge on Biomass gasifiers. ➢ To study the nature of geothermal fields and its significance and drawbacks.	

Unit	Content	Hrs
I	**SOLAR ENERGY** Solar radiation at the earth surface – Physical principles of the conversion of solar radiation into heat – Solar water heating – Solar cooking.	3
II	**WIND ENERGY** Nature of the wind – Power in the wind – Site selection consideration – Types of wind mechanics: Horizontal – Axial machines – Vertical axis mechanics – Advantages and disadvantages of WESS.	2
III	**OCEAN ENERGY** Tidal energy – Ocean thermal energy conversion (OTEC) – Methods of ocean thermal electric power generation – Closed cycle OTEC system – Open cycle OTEC system.	2
IV	**ENERGY FROM BIOMASS** Biomass – Biofuels – Biomass Conversion Technologies: Wet processes – Dry processes – Thermal gasification of Biomass – Classification of Biomass gasifiers.	3
V	**GEOTHERMAL ENERGY** A typical geothermal field – Estimates of Geothermal power – Nature of Geothermal fields – Geothermal sources – Advantages and disadvantages of Geothermal energy – Applications of Geothermal Energy.	3

Text Books

- G.D.Rai, (2002). *Non-Conventional Energy Sources*. Khanna Publishers, Delhi, (Units I-V).

Reference Books

- G.D.Rai, (1980). *Solar Energy Utilization.* Khanna Publishers, Delhi, 1st edition.
- S.P. Sukhatme, (2000). *Solar Energy Principles of Thermal Collection and Storage.* Tata McGraw Hill, New Delhi, 2st edition.

Department	Physics	
Course	MSc Physics	Effective from the year: 2016
Subject Code : 16 PPS 2N2 Title : Non Major Elective: Communication Systems		Semester: II
Hrs/Week:	1	Credit: 2
Objectives	➢ To gain knowledge on Digital and data communication systems. ➢ To understand the functions of Modem, Networking, Telemetry and Facsimile.	

Unit	Content	Hrs
I	**DIGITAL AND DATA COMMUNICATION** Elements of Digital and Data Communication - Digital information in communication - Basic block diagram of data communication system – Coding - ASCII coding.	3
II	**DATA TRANSMISSION CIRCUITS** Data communication system – data communication Topology – Transmission types – Transmission modes – Characteristics of data transmission circuits.	2
III	**MODEM** Need and Function of modem – Modem for non telephone links - Modem for interconnection – Modem transmission speed – Modem modulation method.	2
IV	**NETWORK** Network application – Network organization – Gateways routers and bridges – LAN, MAN, WAN.	3
V	**TELEMETRY AND ELECTRONIC EXCHANGE, FACSIMILE** Basic telemetry system – Classification phone system – Local loop on hook and off hook – Trunk - Super trunk - Hierarchy of a telephone network - Pulse delay – Phone dialing – Phone dialing - Ring back – Operation the central office and loop supervision- pulse dialing and mechanical switching – Facsimile – Basic facsimile operation.	3

Text Books

- Gautam. A.K, (2004).*Communication systems II*. 2nd Revised edition, S.K. Kataria and Sons, Delhi.

Reference Books

- Kennedy, Davis, (2002). *Electronic Communication Systems*. 16th Edition, Tata McGraw-Hill, New Delhi.

Department	Physics	
Course	MSc Physics	Effective from the year: 2016
Subject Code : 16 PPS 208 Title : Core XIII: General Physics Lab I		Semester: I & II
Hrs/Week:	4	Credit: 4
Objectives	➢ To become familiar with the techniques of advanced General Experiments.	

Cycle	Content	Hrs
I	1. Young's modulus - Elliptical fringes - Cornu's method 2. Viscosity of a liquid - Mayor's oscillating disc 3. Thermal conductivity - Forbe's method 4. Temperature coefficient and band gap energy of a Thermistor 5. Measurement of Spot size, Divergence & Wavelength of a Laser beam	24
II	1. Young's modulus - Hyperbolic fringes - Cornu's method 2. Specific heat of a liquid - Ferguson's method 3. **λ**, **d λ** & Thickness of FP etalon – Fabryperot Interferometer 4. Rydberg's constant - Hydrogen spectrum 5. Refractive index of a liquid & Absorption coefficient of transparent Material –Laser Source	24
III	1. Rydberg's constant - Solar spectrum 2. Hall effect in Semiconductors 3. Study of Birefringence – Channel spectrum method or Diffraction – Hartmann's Interpolation 4. Stefan's constant 5. Biprism – Determination of **λ** of monochromatic source & thickness of a transparent sheet	24

Reference Books

- Worsnop, Flint, (1971). *Advanced Practical Physics.* Asia Publishing house.
- Singh S.P. (Vol. I & Vol. II), (1998). *Advanced Practical Physics.* 11th Edition Pragati Prakashan, Meerut.

Department	Physics	
Course	MSc Physics	Effective from the year: 2016
Subject Code : 16 PPS 209 Title : Core IX: Electronics Lab I		Semester: I & II
Hrs/Week:	4	Credit: 4
Objectives	➢ To understand the action of semiconductor devices, amplifiers and oscillators.	

Cycle	Content	Hrs
I	1. CRO - Familiarization**:** Lissajous figures, Measurement of Voltage, Phase and Frequency 2. I.C - Regulated power supply 3. RC coupled amplifier - Double stage 4. Feedback amplifier 5. FET amplifier - Common Source	24
II	1. Emitter follower 2. UJT - Characteristics 3. FET amplifier - Common Drain 4. Phase shift Oscillator using opamp 5. Power amplifier - Push Pull	24
III	1**.** SCR characteristics 2. Astable Multivibrator using 555 timer IC and Op amp 3. Power amplifier - Complementary symmetry 4. UJT - Relaxation Oscillator 5. Wave shaping circuits - Differentiator, Integrator, Clipper and Clamper	24

Reference Books

- Paul B. Zbar, Joseph Sloop, (1983). *Electricity & Electronics Fundamentals A Text-Lab Manual.* McGraw Hill, New Delhi.
- Paul B.Zbar, Malvino, Miller, (1997). *Electronics: A Text- Lab Manual.* Mc.Graw Hill, New Delhi.
- Woollard G. (1984). *Practical Electronics*. 2nd Edition, McGraw Hill, New Delhi.
- Subramaniyan S.V. (1983). *Experiments In Electronics*. Macmillan India Ltd, New Delhi.
- Bhargowa N.N. (1984). *Basic Electronics And Linear Circuits.* McGraw Hill, New Delhi.

Department	Physics	
Course	MSc Physics	Effective from the year: 2016
Subject Code : 16 PPS 310 Title : Core X : Molecular Spectroscopy		Semester: III
Hrs/Week:	5	Credit: 4
Objectives	➢ To familiarize with Symmetry operations and Group theory. ➢ To understand the origin of Microwave, Raman and IR spectroscopy. ➢ To learn the conditions for resonance, theory and applications of NMR, ESR, NQR and Mossbaurer Spectroscopy.	

Unit	Content	Hrs
I	**MOLECULAR SYMMETRY & GROUP THEORY** Group - Group Multiplication table - Classes - Symmetry elements, Symmetry operations & Point groups - Symmetry operations on molecular motions Reducible & Irreducible representations - The Great orthogonality theorem - Symmetry species & Character tables - C_{2V} & C_{3V} Representations of a group - Number of normal modes of various symmetry types - Symmetry of group vibrations	13
II	**MICROWAVE SPECTROSCOPY** Theory of Microwave Spectroscopy - Classification of molecules - Diatomic molecule and the measurement of internuclear distance - Linear triatomic molecules and the determination of the bond lengths - Microwave spectra of Symmetric top molecules - Experimental technique	13
III	**RAMAN SPECTROSCOPY** Quantum theory of Raman effect - Classical theory of Raman effect - Pure Rotational Raman spectra - Vibrational Raman spectra - Structure determination from Raman & IR spectroscopy - Techniques & Instrumentation **IR SPECTROSCOPY** Vibrating diatomic molecule - Diatomic Vibrating Rotator - Vibrations of Polyatomic molecules - Fourier transform IR spectroscopy	13
IV	**RESONANCE SPECTROSCOPY** Theory of Nuclear Magnetic Resonance - Conditions for Resonance - Bloch equation and their Steady State solutions - Chemical shift - Experimental techniques: Continuous & Pulse method - Applications - Concept and theory of Electron Spin Resonance - Relaxation phenomenon - Experimental technique - Applications	13

V	**NQR & MOSSBAUER SPECTROSCOPY** Theory of NQR - Energy levels for molecules of axial and non axial symmetry - Experimental techniques and applications - Principle and theory of Mossbauer effect - Mossbauer instrumentation - Applications - Electronic spectroscopy - Frank Condon principle - Vibrational coarse structure of electronic spectra - Fortrat diagram - Applications of electronic spectra to transition metal complexes	13

Text Books

- Albert Cotton F. (1971). *Chemical Application Of Group Theory*. 2nd edition, Wiley Interscience, New York, (Unit - I).
- Banwell C.N. Mccash E.M. (2001). *Fundamental Of Molecular Spectroscopy*. TataMcGraw Hill Publishing Company Ltd.,New Delhi, (Units II & III).
- Aruldhas G. (2001). *Molecular Structure And Spectroscopy*. Prentice Hall of India Pvt Ltd New Delhi, (Units IV & V).

Reference Books

- Barrow G.M. *Introduction To Molecular Spectroscopy*. Prentice Hall of India Pvt Ltd, New Delhi.
- Chatwal and Anand, *A Text Book Of Spectroscopy*. Prentice Hall of India Pvt Ltd, New Delhi.
- Manas Chanda, *Atomic Structure And The Chemical Bond*. 2nd edition, Tata McGraw Hill Publishing Company, New Delhi.

Department	Physics	
Course	MSc Physics	Effective from the year: 2016
Subject Code : 16 PPS 311 Title : Core XI: Condensed Matter Physics		Semester: III
Hrs/Week:	5	Credit: 4
Objectives	➢ To provide coherent perspective of the physical concepts and theories related with the characterization of materials	

Unit	Content	Hrs
I	**GEOMETRY OF CRYSTALS** Basis of Crystal structure – Unit cell – Primitive cell – Symmetry operations – Translation operations, Point operations & Hybrid operations – Crystal types – Two and three dimensional crystal lattices – Common crystal structures – Indices of a lattice direction and a lattice plane – Crystal bonding – Primary bonds – Covalent, Metallic, Ionic bonding - van der Waals bond – Hydrogen bond (formation & properties) – Bond energy of NaCl molecule – Calculation of Lattice energy of ionic crystal – Calculation of Madelung constant of ionic crystals – Reciprocal lattice – Geometrical construction of Reciprocal lattice – Bragg's law – Laue's interpretation of X ray diffraction by crystals – Measurement of diffraction patterns of crystals – Ewald construction – Experimental methods – Point defects, Dislocations and Color centers(Basic ideas only)	13
II	**THERMAL PROPERTIES & LATTICE VIBRATIONS OF SOLIDS** The specific heat – Lattice specific heat – Classical theory - Einstein theory – The Debye theory – Born's modification – Thermal conductivity – Lattice thermal conductivity – Phonon mean free path – The umklapp processes – One line of atoms – the linear diatomic lattice – Quantization of lattice vibrations – Experimental determination of dispersion relation - Inelastic scattering of neutrons	13
III	**FREE ELECTRON THEORY AND BAND THEORY OF SOLIDS** Classical free electron theory of Drude-Lorentz – Sommerfeld quantum theory (Energy levels in one and three dimensions) – Fermi Dirac distribution – Density of states – Fermi energy – Wave functions in a periodic lattice and the Bloch theorem – Behaviour of an electron in a periodic potential (Kronig Penney model) – Brillouin zone – Number of possible wave functions in a band - Motion of electrons in one dimensional periodic potential (crystal momentum, velocity, effective mass, negative effective mass and holes)	13
IV	**FERRO ELECTRIC AND MAGNETIC PROPERTIES OF SOLIDS** Ferroelectric crystals – Properties of Rochelle salt and $BaTiO_3$ - Polarization Catastrophe – Ferroelectric domains – Piezoelectricity – Langevin's theory of Diamagnetism and Paramagnetism – Quantum theory of Diamagnetism and	13

	Paramagnetism – Cooling by adiabatic demagnetization - Weiss theory of Ferromagnetism - Ferromagnetic domains – Neel model of Antiferromagnetism – Neel model of Ferrimagnetism	
V	**SUPERCONDUCTORS** Mechanism of Superconductors – Effects of magnetic field – Critical current – Meissner effect – Type I and Type II Superconductors - London equations - Thermodynamics of Superconductors - BCS theory - Quantum tunneling - Josephson's tunneling - Theory of AC & DC Josephson effect - High temperature Superconductors	13

Text Books

- Kittel C. (2004). *Introduction to Solid State Physics.* Revised 7th edition, John Wiley & sons, New York, (Unit-I).
- Srivastava J.P. (2001). *Elements of Solid State Physics*. 6th Edition, Prentice hall of India, , New Delhi, (Unit-I).
- Singhal R.L. (1989). *Solid State Physics*. 4th edition, Kedarnath Ramnath & Co, Meerut, (Unit-II).
- Pillai S.O. (2001). *Solid State Physics*. 4th Edition, New Age international (P) Ltd, NewDelhi, (Units III - V).

Reference Books

- Richard Christman J. (1998). *Fundamentals Of Solid State Physics*. 1st Edition, Library of congress cataloguing.
- Decker A. J. (1963). *Solid State Physics.* 1st Edition, Macmillan & Co, Madras.

Department	Physics	
Course	MSc Physics	Effective from the year: 2016
Subject Code : 16 PPS 412 Title : Core XII: Lasers & Non-Linear Optics		Semester: IV
Hrs/Week:	5	Credit: 4
Objectives	➢ To study the basic principle and characteristics of Lasers. ➢ To gain knowledge about the action of various types of Lasers, performance improvement and their applications. ➢ To become familiar with the ideas and concepts of Non-linear optics and Laser Spectroscopy.	

Unit	Content	Hrs
I	**BASIC PRINCIPLES OF LASERS** Energy levels - Thermal equilibrium - Relationship between Einstein's coefficients - Condition for large Stimulated emissions - Condition for light amplification - Line shape function - Population inversion - Pumping methods - Threshold condition - Critical population inversion - Line broadening - Cavity configurations - Modes - Laser rate equations for two, three & four level systems	13
II	**LASER CHARACTERISTICS** Spatial & Temporal coherence - Directionality - Monochromaticity - Intensity **TYPES OF LASERS** Ruby laser - Nd YAG laser - Helium Neon laser - Carbondioxide laser - Semiconductor diode laser - Excimer laser - Dye laser - Chemical laser - X ray laser - Free electron laser - Fiber laser - Color center laser	13
III	**PERFORMANCE IMPROVEMENT OF LASER** Q switching - Methods of Q switching - Peak power - Laser amplifiers - Mode locking - Distributed feedback laser **APPLICATIONS OF LASER** Material working - Isotope separation - Holography - Measurement of distance - Laser in medicine	13
IV	**NON-LINEAR OPTICS** Harmonic generation - Second harmonic generation - Phase matching Third harmonic generation - Optical mixing - Parametric generation of light - Self focusing of light **MULTIPHOTON PROCESSES** Multiquantum Photoelectriceffect - Twophoton processes (Experiments) - Three photon processes - Second harmonic generation - Parametric generation - Parametric light Oscillator - Frequency up conversion - Phase conjugate optics	13

(CONTD……..2)

V	**LASER SPECTROSCOPY**	13

	Rayleigh and Raman scattering - Stimulated Raman effect - Hyper Raman effect (Classical treatment) - Coherent Anti Stokes Raman Scattering - Spin flip Raman Laser - Photo acoustic Raman Spectroscopy - Saturation absorption Spectroscopy - Doppler free two photon Spectroscopy - Multi photon ionization - Single atom detection with lasers - Laser cooling and Trapping of neutral atoms	

Text Books

- Avadhanulu M.N. (2001). *Lasers Theory And Applications*. S.Chand and Company Ltd, New Delhi, (Units I – III).
- Laud B.B. (2001). *Lasers And Nonlinear Optics*. 2nd Edition, New age international private Ltd, New Delhi, (Units III - V).

Reference Books

- William T. Silfvast, (1998). *Laser Fundamentals.* (Cambridge University Press), First South Asian paperback Edition.
- Ghatak, Thyagarajan, *Lasers Theory And Applications.* Macmillan India Ltd.
- Ralf Menzel, (2001). *Photonics.* Springer International Edition.
- Abbi S.C. Ahmad S.A. (2001). *Non Linear Optics And Laser Spectroscopy.* Narosa publishing house, Narosa.

Department	Physics	
Course	MSc Physics	Effective from the year: 2016
Subject Code : 16 PPS 413 Title : Core XIII: Nuclear & Particle Physics		Semester: IV
Hrs/Week:	5	Credit: 4
Objectives	➢ To study the nuclear structure and properties of nuclei through nuclear models. ➢ To understand the nuclear reactions and to get an insight into the elementary particles.	

Unit	Content	Hrs

I	**TWO BODY PROBLEM AND NUCLEAR FORCES** Deutron - Properties - Ground state of Deutron - Neutron Proton scattering at low energies - Scattering length and effective range - Spin dependence of n p forces - Tensor forces - Exchange forces - Nuclear forces - Properties of nuclear forces - Yukawa theory of nuclear forces	13
II	**NUCLEAR MODELS** Liquid drop model - Bohr Wheeler's theory - Shell model - Magic numbers - Magnetic moments and the Shell model - Prediction of angular momenta of nuclear ground states by Shell model - Collective model - Vibrational and Rotational states - Elementary ideas of Unified and Superconductivity model	13
III	**NUCLEAR DISINTEGRATION** Law of radioactive decay - Alpha ray emission - Gamow's theory of alpha decay - Alpha ray energies and fine structure - Alpha disintegration energy - Beta theory - Fermi's theory of beta decay - Fermi and G.T Selection rules - Parity in beta decay - Helicity - Electron capture - Gamma decay - Theory of angular correlation of successive radiation - Internal conversion - Angular momentum and Parity of excited levels	13
IV	**NUCLEAR FISSION AND FUSION REACTORS** Fission and Nuclear structure - Controlled fission reactions - Fission reactors - Radioactive fission products - A natural fission reactor - Basic fusion processes - Characteristics of fusion - Solar fusion - Controlled fusion reactors	13
V	**ELEMENTARY PARTICLES** General classification of Elementary particles - Conservation law and selection rules for production and decay of particles - CPT theorem - Hadron classification according to Eight foldway - Gellmann Okuba mass formula for Baryons - Quarks - Quantum numbers - Quark content of Baryons and Mesons - Unification of fundamental forces of nature - Unification of Weak and E.M Interactions - Qualitative ideas of Salam and Weinberg model	13

(CONTD……..2)

Text Books

- Tayal D.C. (2008). *Nuclear Physics*. 5th edition, Himalaya Publishing house,Mumbai, (Units I - IV).
- Pandya M.L. Yadav R.P.S. (1989). *Elements Of Nuclear Physics*. 5th Edition, Kedar Nath Ram Nath, Meerut,(Units I - IV).
- Atam P.Arya, (1974). *Elementary Modern Physics*. Addison - Wesley Publishing Co, (Units III & IV).
- Raymond A.Serway, Clement J.Moses, Curt A. Moyer, *Modern Physics*. 2nd Edition, Saunders College publishing (Harcourt Brace College publishers), (Units IV & V).

Reference Books

- Srivastava B.N. (1971). *Basic Nuclear Physics*. 12th edition, Pragathi Prakashan, Meerut.

- Kenneth S.Krane, (1988). *Introductory Nuclear Physics*. 2nd edition, John Wiley & sons, New York.

Department	Physics	
Course	MSc Physics	Effective from the year: 2016
Subject Code : 16 PPS 4E3 Title : Major Elective III: Microprocessor & Object-Oriented Programming With C++		Semester: IV
Hrs/Week:	5	Credit: 5
Objectives	➢ To know the architecture and instruction set of the Microprocessor Intel 8085. ➢ To familiarize the method of interfacing of different programmable devices. ➢ To become familiar with the C++ programming language. ➢ To apply the C++ language to solve problems in Physics.	

Unit	Content	Hrs
I	**MICROPROCESSOR FUNDAMENTALS** 8085 Microprocessor pin diagram & functions - Architecture - Addressing modes - Instruction set - Data transfer instructions - Arithmetic instructions - Logical and Branch instructions - Stack, I/O & Machine control instructions - Subroutine ,Conditional &	13

	Call instructions	
II	**MICROPROCESSOR PROGRAMMING & INTERFACING** Steps involved in Microprocessor programming - Straight line programs -Looping programs - Mathematical programs - Interfacing with ROM & RAM - I/O interfacing basics - Interfacing with practical I/O ports - Synchronizing I/O data transfers using Interrupts - Address decoding	13
III	**PRINCIPLES OF OBJECT-ORIENTED PROGRAMMING** Object Oriented Programming Paradigm - Basic concepts of Object Oriented Programming - Benefits of OOP **CLASSES & OBJECTS** Specifying a Class - Defining Member functions - Nesting of Member functions - Private Member functions - Arrays within a class - Memory allocation for objects- Static data members & Member functions - Arrays of Objects - Objects as function arguments - Friendly functions – Returning objects	13

(CONTD……..2)

IV	**CONSTRUCTORS & DESTRUCTORS** Constructors - Parameterized Constructors - Multiple Constructors in a Class - Copy Constructor -Dynamic Constructor- Destructors **OPERATOR OVERLOADING** Defining Operator Overloading - Overloading Unary & Binary Operators - Overloading Binary Operators using Friends - Rules for Overloading Operators	13
V	**INHERITANCE: EXTENDING CLASSES** Defining Derived classes - Single inheritance - Making a Private Member inheritable - Multilevel inheritance - Multiple inheritance - Hierarchical inheritance - Hybrid inheritance - Virtual base classes **POINTERS &VIRTUAL FUNCTIONS** Pointers to Objects - **this** Pointer - Pointers to Derived Classes - Virtual functions - Pure virtual functions	13

Text Books

- Roger L.Tokheim, (1987). *Microprocessor Fundamentals.* 3rd Edition, Schaum's Outline Series, McGraw Hill Book Company, New Delhi, (Units I & II).
- Balagurusamy E. (2004). *Object Oriented.Programming With C++*. Tata Mc Graw Hill Publication, New Delhi, (Units III - V).

Reference Books

- Ramesh S.Gaonkar, (1997). *Microprocessor Architecture Programming & Applications With The 8085*. 3rd Edition, Penram International Publishing, New Delhi.
- Venugopal K.P. Rajkumar, Ravishankar T. (2001). *Mastering C++*. Tata Mc Graw Hill Publication, New Delhi.
- Ravichandran D. (2003). *Programming With C++*. Tata Mc Graw Hill Publication, New Delhi.

Department	Physics	
Course	MSc Physics	Effective from the year: 2016
Subject Code : 16 PPS 417 Title : Core XVII: Project		Semester: III & IV
Credit : 8		

Department	Physics	
Course	MSc Physics	Effective from the year: 2016
Subject Code : 16PPS 414 Title : Core XIV: General Physics Lab II		Semester: III & IV
Hrs/Week:	4	Credit: 5
Objectives	➢ To become familiar with the techniques of advanced General Experiments.	

Cycle	Content	Hrs
I	1. Copper Arc Spectra - CDS 2. λ, dλ of a Monochromatic source and Thickness of a Mica sheet - Michelson's Interferometer 3. Zeeman effect 4. Magnetic Susceptibility - Quincke's Method 5. Resistance of a Semiconductor – Four Probe Method	24
II	1. Iron Arc Spectra – CDS 2. Velocity of Sound in liquid- Ultrasonic Diffraction 3. Magnetic Susceptibility- Guoy's Method 4. Magnetoresistance 5. BH Curve – Hysterisis - Standard Solenoid	24
III	1. Brass Arc Spectra - CDS 2. e/m - Millikan's oil drop method 3. Polarimeter – Specific rotation of optically active substances 4. Planck's constant – Photovoltaic cell and VI characteristics of solar cell 5. Optical Fibre – Numerical aperture, Attenuation, Particle size and λ	24

Reference Books

- Worsnop, Flint, (1971). *Advanced Practical Physics.* Asia Publishing house.
- Singh S.P. (Vol. I & Vol. II), (1998). *Advanced Practical Physics.* 11th Edition Pragati Prakashan, Meerut.

Department	Physics	
Course	MSc Physics	Effective from the year: 2016
Subject Code : 16 PPS 415 Title : Core XV: Electronics Lab II		Semester: III & IV
Hrs/Week:	4	Credit: 5
Objectives	➢ To know the action and applications of operational amplifier. ➢ To familiarize the method of interfacing of different programmable devices	

Cycle	Content	Hrs
I	1. Parameters of Operational amplifier 2. Inverting, Non Inverting, Differential amplifier, Integrator and Differentiator- Op Amp 3. Schmitt trigger, Scale changer, Phase changer - Op Amp 4. Constant current source - Op Amp 5. Microprocessor - Addition, Subtraction, Multiplication, Division & Conversion of Number systems	24
II	1. Simple and Regenerative Comparators – Op Amp 2. Digital to Analog converter - Op Amp 3. Adder, Subtractor, Current to Voltage converter and Voltage to Current converter-Op Amp 4. Low pass, Band pass & High pass filters - Op Amp 5. Microprocessor - Interfacing I	24
III	1. Window Detector – Op Amp 2. Analog to Digital converter - Op Amp 3. Solving first order simultaneous equations of two variables- Op Amp 4. Function Generator - Op Amp 5. Microprocessor - Interfacing II	24

Reference Books

- Paul B. Zbar, Joseph Sloop, (1983). *Electricity & Electronics Fundamentals A Text-Lab Manual*. McGraw Hill, New Delhi.
- Paul B.Zbar, Malvino, Miller, (1997). *Electronics: A Text- Lab Manual*. Mc.Graw Hill, New Delhi.
- Woollard G. (1984). *Practical Electronics*. 2nd Edition, McGraw Hill, New Delhi.
- Subramaniyan S.V. (1983). *Experiments In Electronics*. Macmillan India Ltd.
- Gayakwad, (1988). *Operational Amplifier And Linear Integrated Systems*. 2nd Edition, Prentice hall of India pvt Ltd, New Delhi.
- 8085 - μp Trainer kit Manual, Version 4.0 Microsystems Pvt Ltd.

Department	Physics	
Course	MSc Physics	Effective from the year: 2016
Subject Code : 16 PPS 416 Title : Core XVI: Computer Lab in C++		Semester: IV
Hrs/Week:	2	Credit: 3
Objectives	➢ To become familiar with the C++ programming language. ➢ To apply the C++ language to solve problems in Physics.	

Content	Hrs
1. Class implementation. 2. Arrays within a Class. 3. Static data members and member function. 4. Arrays of Objects 5. Friend function. 6. A function friendly to two classes. 7. Overloaded Constructors. 8. Implementation of Destructors. 9. Overloading Unary operator. 10. Overloading Binary operator. 11. Single Inheritance. 12. Hybrid inheritance. 13. Virtual base class. 14. Pointers to derived objects. 15. Virtual functions.	36

Reference Books

- Balagurusamy E. (2004).*Object Oriented.Programming With C++*. Tata Mc Graw Hill Publication, New Delhi.
- Venugopal K.P. Rajkumar, Ravishankar T. (2001). *Mastering C++*. Tata Mc Graw Hill Publication, New Delhi.
- Ravichandran D. (2003). *Programming With C++*. Tata Mc Graw Hill Publication, New Delhi.