CHOICE BASED CREDIT SYSTEM – STRUCTURE

FOR THOSE WHO HAVE JOINED IN THE ACADEMIC YEAR 2017–18 ONWARDS

M.Sc PHYSICS

Part	Subject	CODE	Hrs.	Cr.	Adl. Cr.	Exam (Hrs)	Marks	
							Int.	Ext.
Core	Mathematical Physics–I	172104101	6	5		3	25	75
Core	Classical and Statistical Mechanics	172104102	6	5		3	25	75
Core	Electromagnetic Theory	172104103	6	5		3	25	75
Core Lab	Non–Electronics Practical	–	3			–	–	–
Core Lab	Electronics Practical	–	3			–	–	–
Elective	Numerical Methods	172104104	6	5		3	25	75
SLC	In Plant Training *Report;@Viva	178004121	–	–	3	–	40 30+10	60 50+10
Core	Mathematical Physics–II	172104201	6	5		3	25	75
Core	Quantum mechanics – I	172104202	6	5		3	25	75
Core	Applied Electronics	172104203	6	5		3	25	75
Core Lab	Non–Electronics Practical	172104204	3	2		4	40	60
Core Lab	Electronics Practical	172104205	3	2		4	40	60
NME	Energy Physics	174604221	6	4		3	25	75
SLC	Object Oriented Programming With C++	178004221			3	3	–	100
Part – III Core	Solid State Physics – I	172104301	6	5		3	25	75
Core	Quantum Mechanics – II	172104302	6	5		3	25	75
Core	Nuclear Physics	172104303	6	5		3	25	75
Core Lab	Electronics Practical	–	3	-		–	–	–
Core Lab	Project	–	3	-		–	–	–
Elective	Microprocessor	172104304	6	5		3	25	75
SLC	Bio–Physics	178004321	–	–	3	3	–	100
Core	Solid State Physics – II	172104401	5	5		3	25	75
Core	Applied Optics and non linear Dynamics	172104402	5	5		3	25	75
Core	Molecular Spectroscopy	172104403	5	5		3	25	75
Core Lab	Advanced Physics Experiment	172104404	3	3		4	40	60
Elective	Nano Science	172104405	6	5		3	25	75
Elective	Project *Report;@Viva	172104406	3	4		–	40 [24:16]	60 [36:24]
SLC	Information Technology	178004421			3	3	–	100
		TOTAL	**120**	**90**	**12**			

M.Sc Physics: Those Who Have Joined In The Academic Year 2017–18 Onwards Under CBCS System

Core Subject **MATHEMATICAL PHYSICS – I** **Code: 172104101**

SEMESTER I

6 Hrs / Week
Credits 5

Objective:

- ✍ ***To give a through understanding of mathematical concepts in physics to the students and to train them in solving physics problems***

UNIT – I: [**18 Hrs]**

Vectors:

Introduction – Gauss Divergence Theorem – Deductions from Gauss Divergence Theorem – Gauss's Law – Gauss's Law in Differential Form – Poisson's Equation and Laplace's Equation – Problems – Stokes theorem and related problems – Orthogonal Curvilinear Coordinates – Differential Operators in Terms of Orthogonal Curvilinear Co–ordinates – Spherical Polar Coordinates and Differential Operators – Cylindrical Co–ordinates and Differential Operators – Applications of Vectors to Hydrodynamics – Equation of Continuity – Euler's Equation of Motion – Bernoulli's Equation.

UNIT – II: **[18 Hrs]**

Matrices:

Introduction – Eigen Values – Eigen Vectors and their Properties – Diagonalization of a Matrix – Eigen Vectors of Commuting Matrices – Reduction of Coupled Differential Equations to Eigen Value Problems – Cayley Hamilton Theorem – Minimal Polynomial – Condition for Diagonalizability – Matrix Polynomials.

UNIT – III: **[18 Hrs]**

Fourier Transform: Introduction – Infinite Fourier Sine and Cosine Transforms. Properties of Fourier Transform: Addition Theorem – Similarity Theorem – Shifting Property – Modulation Theorem – Convolution Theorem – Parseval's Theorem – Derivative of Fourier Transform – Fourier Transform of Derivative – Fourier Sine and Cosine Transforms of Derivatives – Problems.

UNIT – IV: **[18 Hrs]**

Special functions – I:

Bessel's Differential Equation – Solution (with derivation for first kind only) – Recurrence Formulae for Jn(x) – Generating Function – Jacobi Series – Problems – Hermite Differential Equation – Solution (No derivation) – Hermite Polynomials – Generating Function – Recurrence Formulae – Rodrigue's Formula – Orthogonality of Hermite Polynomials.

UNIT – V: **[18 Hrs]**

Special Functions – II:

Legendre's Differential Equation – Solution – Generating Function – Rodrigue's Formula – Orthogonal Properties – Recurrence Formulae – Problems.

The Beta and Gamma Functions: Definitions – 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 Functions – Problems.

TEXT BOOKS:

01. Satya Prakash, Mathematical Physics (with classical mechanics), Sultan Chand and Sons, New Delhi,
    UNIT – I: 1.7–1.11, 1.15, 1.17a
    UNIT – III: 9.1–9.8
    UNIT – IV: 6.17, 6.21–6.23, 6.29–6.33
    UNIT – V: 6.7–6.11, 4.1–4.7
02. Joshi A.W., Matrices and Tensors in Physics, 3rd Edition, New Age International Pvt. Ltd.,
    UNIT – II: Chapters 9, 10.

REFERENCES:

01. Arfke and Weber, Mathematical Methods for Physicists, 6th Edition, Academic Press.
02. Pipes and Harvill, Applied Mathematics for Engineers and Physicists, 3rd Edition, McGraw-Hill International Book Company.

Core Subject **CLASSICAL AND STATISTICAL MECHANICS**

SEMESTER I **Code: 172104102**

6 Hrs / Week

Credits 5

Objectives:

- ***To understand the basics of classical and statistical mechanics***

UNIT – I: **[18 Hrs]**

Hamiltonian Formulation:

Introduction – Hamiltonian – Hamilton's Equations of Motion – Physical Significance of H – Advantage of Hamiltonian Approach – Deduction of Canonical Equations from a Variational Principle . Applications of Hamilton's Equations of Motion: Simple Pendulum – Compound Pendulum – 2–D Isotropic Harmonic Oscillator – Particle Moving Near the Surface of the Earth – Particle in a Central Field of Force. Procedure to Eliminate Consideration of Ignorable Coordinates: The Routhian Function – Principle of Least Action.

UNIT – II: **[18 Hrs]**

Canonical Transformations: Transformation – Point Transformation – Canonical Transformation – Generating Function – Advantage of Canonical Transformations – Examples – Condition for a Transformation to be Canonical – Bilinear Invariant Condition –

Poisson brackets – Properties – Invariance of Poisson Brackets with respect to Canonical Transformation – Equation of Motion in Poisson Bracket Form – Jacobe's Identity – The Angular Momentum and Poisson's Brackets – Poisson's Brackets in Quantum Mechanics – Lagrange's Brackets – Properties – Relation between Lagrange and Poisson Brackets – Problems.

UNIT – III: **[18 Hrs]**

Statistical Mechanics:

Introduction – Ideal Gas – Gibb's Paradox – Equipartition Theorem. Quantum Statistics: Symmetry of Wavefunctions – Distribution Functions – Boltzmann's Limit of Boson and Fermion Gases. Evaluation of Partition – Function Partition Function for Diatomic Molecules: Translational Partition Function – Rotational Partition Function – Vibrational Partition Function – Electronic Partition Function – Equation of State for an Ideal Gas – the Quantum Mechanical Paramagnetic Susceptibility.

UNIT – IV: **[18 Hrs]**

Ideal Bose Systems:

Photon Gas – Radiation Pressure – Radiation Density – Emissivity – Equilibrium Number of Photons in the Radiation Cavity – Einstein's Derivation of Planck's Law – Bose Einstein Condensation – Specific Heat from Lattice Vibrations – Debye's Model of Solids–Phonon Gas.

UNIT – V: **[18 Hrs]**

Ideal Fermi Systems:

Fermi Energy – Fermi Energy using Uncertainty Principle – Mean Energy of Fermions at 'O' K – Fermi Gas in Metals – Atomic Nucleus as an Ideal Fermion Gas – Fermi Energy as a Function of Temperature – Electronic Specific Heat – Compressibility of Fermi Gas – Pauli's Paramagnetism – Relativistic Degenerate Electron Gas – White Dwarfs.

TEXT BOOKS:

01. Gupta S.L., Kumar V., and Sharma H.V., Classical Mechanics 22nd Edition, Pragati Prakashan, Meerut,
    UNIT – I: 3.1–3.7, 3.9, 3.10, 2.12
    UNIT – II: 3.11–3.12, 3.21–3.24, 3.26–3.29
02. Laud B.B., Fundamentals of Statistical Mechanics, New Age International Pvt. Ltd., 1998.
    UNIT – III: Chapter 6.8–6.10, Chapter 8
    UNIT – IV: Chapter 9
    UNIT – V: Chapter 10

REFERENCES:
01. Herbert Goldstein, Classical Mechanics, Addition Wesley Publishing Company, New Delhi.
02. Gupta S.L., and Kumar V., Statistical Mechanics, Pragate Prakashan, 22nd Edition, 2008.
03. Agarwal B.K., Melvin Eisner, Statistical Mechanics, 2nd Edition, New Age International Pvt. Ltd.,

Core Subject **ELECTROMAGNETIC THEORY** **Code: 172104103**
SEMESTER I

6 Hrs / Week
Credits 5

Objectives:

- ***To understand the concepts of electromagnetism and to study about the fields and their treatise.***

UNIT – I: **[18 Hrs]**

Electrostatic Fields:

Electric Charge – Coulomb's Law – The electric field – The electrostatic potential – Conductors and Insulators – Gauss law – Application of Gauss law – The electric dipole – Multipole expansion of electric field – The Dirac delta function – Poisson's Equation – Laplace's equation – Laplace's equation in one independent variable – Solution to Laplace's equation in spherical coordinates – zone harmonics – conducting sphere in a uniform electric field.

UNIT – II: **[18 Hrs]**

The Electro Static Field in dielectric media:

Polarization – field outside of a dielectric medium – electric field inside a dielectric – Gauss law in a dielectric – the electric displacement – electric susceptibility and dielectric constant – point charge in a dielectric fluid – boundary conditions on the field vectors – boundary value problems involving dielectrics – dielectric sphere in a uniform electric field – force on a point charge embedded in a dielectric – molecular field in a dielectric – polar molecules – Langevin-Debye formula – permanent polarization- Ferroelectricity.

UNIT – III: **[18 Hrs]**

Magnetic Field of Steady Current:

Magnetic Induction – Forces on Current Carrying Conductors – Biot and Savart Law and its Applications (long straight wire, circular loop, solenoid) – Ampere's Circuital Law – The Magnetic Vector Potential – Magnetic Scalar Potential – Magnetic Flux.

Magnetization – The Magnetic Field Produced by Magnetized Material – Magnetic Scalar Potential and Magnetic Pole Density –

Magnetic Energy of Coupled Circuit – Energy Density in the Magnetic Field – Hysteresis Loss.

UNIT – IV: **[18 Hrs]**

Electromagnetic Fields:

Electromagnetic Induction – Self Inductance – Mutual Inductance – The Neumann Formula – Inductance in Series and in Parallel.

The Generalization of Ampere's Law, Displacement Current – Maxwell Equation and their Empirical Basis – EM Energy – The Wave Equation – The Wave Equation with Sources.

UNIT – V: **[18 Hrs]**

Plane Electromagnetic Waves and Propagation:

Plane Monochromatic Waves in Non Conducting Media – Energy Density and Flux – Plane Monochromatic Wave in Conducting Media – Propagation between Parallel Conducting Plates – Wave Guides – Cavity Resonators.

Radiation from an Oscillating Dipole – Radiation from a Group of Moving Charges – Radiation Damping – Thomson Cross Section.

TEXT BOOKS:

01. John Reitz R., Frederick Milford J., and Robert Christy W., Foundations of Electro Magnetic Theory, 3rd Edition, Narosa Publishing House, New Delhi.

UNIT I:

Chapter 2

Chapter 3: Sections 3.1 – 3.5

UNIT II

Chapter 4: Sections 4.1-4.2, 4.4-4.10

Chapter 5: Sections 5.1, 5.3, 5.4

UNIT – III:

Chapter 8: Sections: 8.1–8.6, 8.8–8.9

Chapter 9: Sections: 9.1–9.3

Chapter 12: Sections: 12.1–12.2, 12.4

UNIT – IV:

Chapter 11: Sections: 11.1–11.5

Chapter 16: Sections: 16.1–16.4. 16.6

UNIT – V:

Chapter 17: Sections: 17.1, 17.3–17.4

Chapter 18: Sections: 18.6–18.8

Chapter 20: Sections: 20.1, 20.3, 20.5

REFERENCES:

01. Edward Jordan C., and Keith Balmain G., Electromagnetic Waves and Radiating Systems, 2nd Edition, Prentice Hall of India, New Delhi.
02. Uma Mukherji, Electromagnetic Field Theory and Wave Propagation, Narosa Publishing House.

SEMESTER I

6 Hrs / Week
Credits 5

Objective:

- ***To implement mathematical concepts in problem solving in quantum physics and numerical methods.***

UNIT – I: **[18 Hrs]**

Iterative Methods:

Introduction – Beginning an Iterative Method – The Method of Successive Bisection – Newton – Raphson Iterative Method – The Secant Method – The Method of Successive Approximations – Comparison of Iterative Methods – Algorithm – Problems.

UNIT – II: **[18 Hrs]**

Solution of Simultaneous Algebraic Equations:

Introduction – The Gauss Elimination Method – Pivoting – Ill Conditioned Equations – Refinement of the Solution obtained by Gauss Elimination – The Gauss – Seidel Iterative Method – An Algorithm to Implement the Gauss – Seidel Method – Comparison of Direct and Iterative Methods – Problems.

UNIT – III: **[18 Hrs]**

Least Squares Approximation of Functions:

Introduction – Linear Regression – Algorithm for Linear Regression – Polynomial Regression.

Fitting Exponential and Trigonometric Functions:

Fitting an Exponential Curve – Fitting a Hyperbola – Fitting a Trigonometric Function – A Geometric Curve – Problems.

UNIT – IV: **[18 Hrs]**

Differentiation and Integration:

Introduction – Formulae for Numerical Differentiation – Numerical Integration – Simpson's Rule – Errors in Integration Formulae – Gaussian Quatrative Formulae – Comparison of Integration Formulae – Algorithm – Problems.

UNIT – V: **[18 Hrs]**

Numerical Solution of Differential Equations:

Introduction – Euler's Method – Taylor Series Method – Runge – Kutta Methods – Runge – Kutta Fourth Order Formula – Predictor – Corrector Method – Higher Order Differential Equations – R.K Second Order and R.K Fourth Order Method – Comparison of Predictor – Corrector and Runge – Kutta Methods – Problems.

TEXT BOOK:

01. Rajaraman V., Computer Oriented Numerical Methods, 3rd Edition, PHI Learning Pvt. Ltd., New Delhi, 2009.

UNIT – I: Chapter 3: Sections: 3.1–3.8
UNIT – II: Chapter 4: Sections: 4.1–4.8
UNIT – III: Chapter 6: Sections: 6.1–6.5
UNIT – IV: Chapter 8: Sections: 8.1–8.5, 8.8–8.9
UNIT – V: Chapter 9: Sections: 9.1–9.8

REFERENCES:

01. Conet S.D., and Carl De Boor, Elementary Numerical Analysis – An Algorithm Approach, 3rd Edition, McGraw-Hill International Company, 1983.
02. Krishnamurthy E.V., and Sen S.K., Numerical Algorithms – Computations in Science and Engineering, Affiliated East – West Press Pvt. Ltd., New Delhi, 1993.
03. Steven C. Chapra, Raymond P. Canale, Numerical Methods of Engineering, 2nd Edition, McGraw-Hill International Editions, 1990.

Self–Learning Course **IN PLANT TRAINING** **Code: 178004121**

[Common for all PG Course except MBA and M.Com(CA)]

SEMESTER I

Addl. Credits 3

Objectives of Training:

- ***To apply creative skills***
- ***To develop critical thinking skills***
- ***Working model for the solution of a real time problem***
- ***To improve practical working skills***
- ***To develop life long learning skills***

- Short term in plant industrial training of 15 days.
- Students must select their own industrial unit of their choice for training.
- The training includes process, product and viva–voce or class room presentation.
- Process must include working file.
- Working file includes draft copies of work, a working log, work schedule and resources used.
- Product includes actual design and development of training.
- Components required in the viva–voce or class room presentation.
    - Information about the topic
    - Personal relevance
    - Presentation skills
    - Power point presentation (must)
    - Findings

- ☞ Conclusions

Evaluation:

	Total	Internal	External
Project	80	30	50
Viva	20	10	10
Total	100	40	60

Core Subject **MATHEMATICAL PHYSICS – II** **Code: 172104201**

SEMESTER II

6 Hrs / Week
Credits 5

Objective:

- ✍ ***To give a thorough understanding of mathematical concepts in physics to the students and to train them in solving physics problems***

UNIT – I: **[18 Hrs]**

Analytic Function – The Necessary and Sufficient Conditions for f(z) to be analytic – C.R. Differential Equation – Laplace's Equation – Harmonic Functions – Problems – Cauchy's Integral Theorem – Cauchy's Proof – Extension to Multiply Connected Domain – Cauchys Integral Formula – Derivative of an Analytic Function (no Proof) – Taylor's Series Laurents Series.

UNIT – II: **[18 Hrs]**

Singularities of an Analytic Function – Residues and their Evaluation – Cauchy's Residue Theorem, Evaluation of Definite Integrals – Definite Integrals of Trigonometric Functions of Cos θ and Sin θ. Integration round the Unit Circle – Evaluation of Certain Improper Real Integrals – Jordan's Lemma (no proof) – Evaluation of Infinite Integrals by Jordan's Lemma – Evaluation of Infinite Integrals when Integrand has poles on real axis.

UNIT – III: Green's Function **[18 Hrs]**

Dirac – Delta Function – Derivative of Delta Function – Three Dimensional Delta Function. Green's Function – Introduction – Green's Function for one – Dimensional Case – General Proof of Symmetry Property of Green's Function – Eigen Function; Expansion of Green's Function – Green's Function for Poisson's Equation and Solution of Poisson's Equation.

UNIT – IV: Tensor Analysis **[18 Hrs]**

Introduction – Algebra of Tensors – Quotient Law – fundamental Tensor – Cartesian Tensors – Four Vectors in Special Relativity – Covariant Formulation of Electro Dynamics – Christoffel Symbols of I and II Kinds Transform.

UNIT – V: **[18 Hrs]**

Group Theory:

Concept of a Group – Abelian Group – The Cyclic Group – The Group Multiplication Table – The Rearrangement Theorem – Subgroups – Cosets – Conjugate Elements and Classes – Product of Classes – Conjugate Subgroups, Normal Subgroups and Factor Groups – Isomorphism and Homomorphism – The Group of Symmetry of an Equilateral Triangle – Group of Symmetry of a Square – Representation of Groups – Important Theorems of Representations – The Greats Orthognality Theorem (no proof) – The Character of a Representation – Character Tables.

TEXT BOOK:

01. Satya Prakash, Mathematical Physics, Sultan Chand and Sons, Reprint 2005.
    - UNIT I and II : 5.9–5.11, 5.14, 5.16–5.17, 5.20–5.21, 5.25
    - UNIT II : 5.22, 5.23–5.24, 5.25a, 5.25b, 5.25c, 5.25d (Eg 37 and 38 only),
    - UNIT III : 10.0–10.6
02. Joshi A.W., Matrices and Tensors in Physics, 3rd Edition, New Age International Pvt. Ltd.,
    - UNIT IV : 15–18, 19.1–19.3, 20.1–20.3, 21.1–21.3, 22.2.
03. Satya Prakash, Mathematical Physics, 4th Edition, Sultan Chand and Sons, New Delhi.
    - UNIT V : 12.1–12.2, 12.4–12.10, 12.12–12.13, 12.16–12.22.

REFERENCES:

01. Arfke and Weber, Mathematical Methods for Physicists, 6th Edition, Academic Press.
02. Pipes and Harvill, Applied Mathematics for Engineers and Physicists, 3rd Edition, McGraw-Hill International Book Company.

Core Subject **QUANTUM MECHANICS – I** **Code: 172104202**

SEMESTER II

6 Hrs / Week
Credits 5

Objectives:

- ***To introduce quantum mechanical conceptions and applications of quantum methods in solving various physics problems***

UNIT – I: **[18 Hrs]**

Schrodinger's Equation:

Introduction – Time Dependent Schrodinger's Equation – The Commutator – Physical Interpretation of 'psi' and the Probability Current Density – Expectation Value – Ehrenfest's Theorem – Exact Statement and Proof of Uncertainty Principle – The General Solution of I – D Schrodinger Equation for a Free Particle – Group Velocity of a Wave Packet – Stationary States – Boundary and Continuity Condition – Degeneracy – Orthogonality of Eigen Functions – Parity – 3D Schrodinger's Equation.

UNIT – II: **[18 Hrs]**

Application of Schrodinger's Equation:

Introduction – Solution of the Time Dependent Schrodinger's Equation Applied to a Linear Harmonic Oscillator – Eigen Values and Eigen Functions of a Linear Harmonic Oscillator. The Rectangular Potential Barrier – Spherically Symmetric Potentials – The Hydrogen Like Problem – Discussion of Energy Eigen Values and Eigen Functions.

UNIT – III: **[18 Hrs]**

Angular Momentum – Spherical Harmonics:

Introduction – The Angular Momentum and its Representation in Cartesian and Spherical Polar Co–ordinates – Eigen Values and Eigen Function of L^2 for $m = 0$ and $m \neq 0$ – The Commutation Relations – Expressions for Spherical Harmonics.

UNIT – IV: **[18 Hrs]**

Dirac's Bra and Ket Algebra:

Introduction – The Bra and Ket Notation – Linear Operators – The Eigen Value Equation – Solution of the Eigen Value Problem (Linear Harmonic Oscillator) using Ket Algebra – Uncertainty Product – Harmonic Oscillator Wave Functions – The Coherent States.

Time Independent Perturbation Theory: Introduction – Non–Degenerate Case – First Order Perturbation – Second Order Perturbation – Examples – Almost Degenerate Perturbation Theory – Dalgarno's Method.

UNIT – V: **[18 Hrs]**

The Variational Method:

Introduction – Basic Principle – The Hydrogen Atom as an Example The Helium atom – Application to Excited States – Linear Variational Functions – Hydrogen Molecule – Exchange Interaction – The JWKB Approximation – JWKB Solutions – The Connection

Formulae – Application of JWKB Solutions (JWKB quantization condition).

TEXT BOOK:

01. Ajoy Ghatak and Lokaathan S., Quantum Mechanics Theory of Applications, 5th Edition, Macmillan India Ltd.,

UNIT – I: 4.1–4.6, 5.2, 5.5, 6.1–6.5, 6.7
UNIT – II: 7.2–7.3, 8.3, 10.1–10.2, 10.4
UNIT – III: 9.1–9.4, 15.3
UNIT – IV: 11.1–11.4, 12.1–12.5, 19.1, 19.2, 19.6–19.7
UNIT – V: 17.1–17.4, 21.1–21.7

REFERENCES:

01. Chatwal G.R., and Anand S.K., Quantum Mechanics, 2nd Edition Himalaya Publishing House.
02. Kakani S.L. Chandalia, Quantum Mechanics, Sultan Chand and Sons, New Delhi.
03. Schiff L.I., Quantum Mechanics, 2nd Edition, McGraw–Hill Book Company, New Delhi.

Core Subject **APPLIED ELECTRONICS** **Code: 172104203**

SEMESTER II

6 Hrs / Week
Credits 5

Objectives:

- ***To know about the advancement of electronics, modulation theories used in modern communication systems***

UNIT – I: **[18 Hrs]**

Communication Systems:

Amplitude Modulation Theory-Frequency Spectrum of AM Wave-Representation of AM-Power Relations in AM Wave-Generation of AM - Basic Requirements-Grid and Plate Modulated Class C Amplifiers, Modulated Transistor Amplifiers, Single Side Band Techniques, Evolution and Description of SSB, Suppression of Carrier, Suppression of Side Band, Extensions of SSB.

UNIT – II: **[18 Hrs]**

Frequency Modulation:

Description of Frequency and Phase Modulation – Mathematical Representation of FM – Frequency Spectrum of FM Wave – Phase Modulation – Inter System Comparisons – Effects of Noise on Carrier – Pre–emphasis and De–emphasis – Other forms of Interference – Comparison of Wideband and Narrowband FM – Generation of FM – Direct and Indirect Methods – Stabilized Reactance Modulator AFC – Indirect Method – Telegraphy – Frequency Shift Keying (FSK) – Other Transmission Methods – Multiplexing Telegraph Speeds.

UNIT – III: **[18 Hrs]**

Pulse Modulation:

Types of Pulse Modulation – Pulse Width, Pulse Positions and Pulse Code Modulation.

Operational Amplifier: Basic Operational Amplifier – The Differential Amplifier – The Emitter Coupled Differential Amplifier – Offset Error Voltages and Currents – Temperature Drift of Input Offset Voltage and Current – Measurement of Operational Amplifiers – Dominant Pole, Pole–Zero and Lead Compensation.

UNIT – IV: **[18 Hrs]**

Semi Conductor Devices:

FET, UJT and SCR: Pinch – Off Voltage, V-I Characteristics of FET, FET Small Signal Model – MOSFET – Common Source Amplifier – Source Follower – Generalized FET Amplifier – Biasing the FET, UJT as a Relaxation Oscillator – Four Layer Diode – V-I Characteristics – Silicon Controlled Rectifier.

UNIT – V: **[18 Hrs]**

Digital Electronics:

Simplification of Boolean Functions – K Map Method – Four Variable Map – Product of Sums Simplifications – NAND and NOR Implementation, Don't Care Conditions – Flip–Flops – Analysis of Clocked Sequential Circuits, Design Procedure – Design of Counters – Design with State Equations.

TEXT BOOKS:

01. Kennedy G. Electronic Communication System, 3rd Edition, McGraw–Hill, New Delhi. [for UNITS – I, II and III – Pulsemoduation only]
02. Millman and Halkias, Electronic Devices and Circuits, McGraw–Hill, 1997, New Delhi. [UNIT – III and IV]
03. Morrismano M., Digital Logic and Computer Design, Prentice Hall of India, 1st Edition, 1997, New Delhi. [UNIT – V]

UNIT – I:
Chapter 3: All Sections
Chapter 4: All Sections
UNIT – II:
Chapter 5–5.1: All Sections: 5.2.1, 5.2.2, 5.2.3, 5.2.4, 5.3 all sections
UNIT – III:
Chapter 13–13.5: All Sections
Chapter 15–15.1–15.3, 15.6–15.8, 15.10, 15.11, 15.12
UNIT – IV:
Chapter 10–10.10.5, 10.7–10.9
Chapter 14–14.12
Chapter 18 –18.12–18.4
UNIT – V:

Chapter 3 – 3.1, 3.2, 3.3, 3.5, 3.6, 3.8
Chapter 6 –6.2–6.4, 6.7–6.9

REFERENCES:

01. Millman and Halkias, Integrated Electronics – Tata McGraw–Hill Publishing, 1972, New Delhi.

Core Lab **NON–ELECTRONICS PRACTICAL** **Code: 172104204**
SEMESTER I & II **3 Hrs / Week**
Credits 2

Objectives:

- ***To demonstrate the fundamental concepts in basic electricity, materials science and optics***

01. Error Analysis of experimental data
02. Least square and curve fitting
03. Determination of young's modulus and Poisson's ratio of a plastic scale by forming hyperbolic fringes.
04. Determination of Young's modulus and Poisson's ratio of a plastic scale by forming elliptical fringes.
05. Determination of
    a. Self inductance of the given coils
    b. Mutual inductance of a pair of coils
    c. The coefficient of coupling between the pair of coils using Anderson's Bridge
06. Determination of mutual inductance of a pair of coils by Carey – Foster's method
07. Determination of the mutual inductance of a pair of coils by forming Maxwell's Bridge
08. Determination of Cauchy's constant
09. Spectrum calibration – Hg and Cu lines
10. Refractive indices of ordinary and Extraordinary rays
11. Polarization by Reflection (Brewster angle) determination
12. Edser and Butler Fringes – Thickness of mica sheet.

Core Lab **ELECTRONICS PRACTICAL** **Code: 172104205**
SEMESTER I & II **3 Hrs/Week**
Credits 2

Objectives:

- ***To demonstrate the skills and understanding of electronics concepts in designing basic electronic circuits***

01. IC Regulated Power Supply [Single (5v) and Dual (12–0–12)]
02. FET amplifier
03. Emitter follower
04. UJT characteristics
05. Sawtooth wave generator
06. UJT relaxation oscillator
07. Astable multivibrator using IC 555

08. Schmitt Trigger using IC 555
09. Wien's bridge oscillator using IC 741
10. Phase shift oscillator using IC741
11. Multiplexer and Demultiplexer circuits
12. Karnaugh map reduction and logic circuit implementation

Non–Major Elective **ENERGY PHYSICS** **Code: 174604221**
SEMESTER II **6 Hrs / Week**
Credits 4

Objectives:

- ***To enlighten the students about the alternative energy sources and a sustainable future for energy.***

UNIT – I: **[18 Hrs]**

General Introduction and Measuring Equipments:

The Structure of the Sun – The Solar Constant – The Electromagnetic Energy Spectrum – Solar Radiation Outside the Earth's Atmosphere – Solar Radiation at the Earth's Atmosphere – Solar Energy Measuring Equipments – Classification – Pyroheliometers – Pyranometers – Sun Shine Recorders.

UNIT – II: **[18 Hrs]**

Solar Collectors and Storage Systems:

Introduction – Physical Principles of the Conversion of Solar Radiation into Heat – General Description of Flat Plate Collectors. A Typical Liquid Collector – Typical Air Collector – Types of Energy Storage – Thermal Storage – Electrical Storage – Storage in the form of Fuel – Storage in the form of Potential Hydraulic Energy.

UNIT – III: **[18 Hrs]**

Solar Thermal Power Generation Solar Photovoltaics:

Principles of Solar Thermal Power Generation - Low Temperature Systems – Medium Temperature Systems with Concentrating Collectors – Stirlling Cycle Solar Thermal Power Generation – Solar Thermal Power Generation using Brayton Cycle – Photovoltaic Principles. A Basic Photovoltaic system for Power Generation – Application of Solar Photovoltaic System.

UNIT – IV: **[18 Hrs]**

Some Additional Methods of Solar Energy Utilization:

Solar Furnaces – Solar Pumping – Solar Green Houses – Application of Solar Energy in Space – Thermo–Electric Conversion.

UNIT – V: **[18 Hrs]**

Indirect Sources of Solar Energy Conversion Wind Energy:

Introduction – Wind Mills Types and Performances – Bio Conversion and Biomass – Bio Gas Generation – Digesters and their Designs – Applications.

TEXT BOOK:

01. Rai G.D., Solar Energy Utilisation, Khanna Publishers, 5th Edition, New Delhi, 2005.

UNIT – I:

Chapter 3:	Sections	3.1–3.5
Chapter 4:	Sections	4.1–4.4

UNIT – II:

Chapter 5:	Sections	5.1–5.3
Chapter 9:	All Sections	

UNIT – III:

Chapter 14:	Sections	14.2.1, 14.2.2
Chapter 15:	Sections	15.3, 15.5, 15.10

UNIT – IV:

Chapter 16:	Sections	16.1–16.2, 16.6, 16.8–16.9

UNIT – V:

Chapter 18:	Sections	18.1.1, 18.1.3, 18.2.1, 18.2.3, 18.2.4, 18.2.7

REFERENCES:

01. Rai G.D., Non–Conventional Sources of Energy, Khanna Publishers, 4th Edition, New Delhi, July 1996.
02. Sukhatme S.P., Solar Energy, Tata McGraw-Hill Publishing Company, 2nd Edition, New Delhi, 1996.

Self–Learning Course **OBJECT ORIENTED PROGRAMMING WITH C++**

SEMESTER II **Code: 178004221**

Addl. Credits 3

Objectives:

- ***To know the object oriented language C++ and to handle it efficiently for scientific calculation purposes***

UNIT – I:

Principles of Object Oriented Programming (OOP):

Software Evolution – OOP Paradigm – Basic Concepts of OOP – Benefits of OOP – Object Oriented Languages – Applications of OOP.

Introduction to C++:

Tokens, Keywords, Identifiers, Variables, Operators, Manipulators, Expressions and Control Structures in C++.

UNIT – II:

Functions:

Main Function – Function Prototyping – Call, Return by Reference – Inline Functions – Function Overloading – Friend and Virtual Functions.

UNIT – III:

Classes and Objects; Constructors and Destructors; Operator Overloading and Type Conversions.

UNIT – IV:

Inheritance:

Single Inheritance – Multilevel Inheritance – Multiple Inheritance–Hierarchical Inheritance – Hybrid Inheritance – Virtual Functions and Polymorphism; Managing I/O Operations.

UNIT – V:

Pointers and Polymorphism:

Pointers – Pointers to objects – pointers to Derived classes – Virtual functions – Pure Virtual functions – polymorphism – using objects and classes in polymorphism.

TEXT BOOK:

01. Balagurusamy, Object Oriented Programming with C++, 3rd Edition, Tata McGraw–Hill, New Delhi, 2006.
    - UNIT I: Chapters 1, 3, 4
    - UNIT II: Chapter 5
    - UNIT III: Chapter 6, 7.
    - UNIT IV: Chapter 8, 9, 10
    - UNIT V: Chapter 11, 12, 13.

REFERENCES:

01. Stanley Lippman B., C++ Primer, Addison Wesley, New Delhi, 2000.
02. Stevens A.L., C++ Programming, 7th Edition, Wiley Dream Tech India Pvt. Ltd., 2003.

M.Sc PHYSICS: Those who have joined in the academic year 2017–18 onwards under CBCS System

EVALUATION PATTERN

Internal : 25 Marks

External : 75 Marks

INTERNAL:

Test –15 (average of the better two of the three tests conducted)

Assignment – 5

Seminar – 5

Question Paper Pattern:

INTERNAL	**EXTERNAL**
Part – A : 4 × 1 = 4	Part – A :5/7 × 2 = 10
Part – B : 3 × 4 = 12	Part – B : 5 × 7 = 35
(Either/ Or)	(Either /Or)
Part – C : 2/3 ×7 = 14	Part – C : 3/5×10 = 30
*30	75

* Internal test mark 30 will be converted to 15.