Introduction to Mathematical Physics & Classical Mechanics
Minor Course I (MIC-1)

Course Title	Credit	Credit Distribution	
		Theory	Practical
Introduction to Mathematical Physics & Classical Mechanics	3	2	1

MIC -1 (T)-2 Credit

Introduction to Mathematical Physics & Classical Mechanics

Unit I-Introduction to Calculus & Vector **01 Credit (15 hrs)**

Differential calculus: Geometric Meaning of derivative; Maxima & Minima; Approximation of derivative; Partial Differentiation.

Integral Calculus: Geometric Meaning of integration, order and degree of differential equation, Solution of First order (homogeneous & Non-homogeneous), Integrating Factor, Exact and Inexact Differentials.

Recapitulation of Vectors, Vector Algebra involving two and three vectors, Introduction to Gradient, Divergence , Curl of Vectors with their physical significance.

Unit II-Fundamentals of Dynamics – **01 Credit (15 hrs)**

Inertial and Non-Inertial Frame of Reference, Rotating frame, Fictitious Forces-Centrifugal and Coriolis Forces with their applications (Effect on value of 'g', On path of freely falling body)

Introduction to special theory of relativity & its postulates

Suggested Books :

1. H. Goldstein, C. P. Poole and J. F. Safko, Classical Mechanics, Addison-Wesley
2. N. C. Rana and P. S. Joag, Classical Mechanics, Tata McGraw-Hill.
3. L. D. Landau and E. M. Lifshitz, Mechanics,Butterworth-Heinemann.
4. S. L. Gupta, V. Kumar and H. V. Sharma, Classical Mechanics, PragatiPrakashan.
5. R. D. Gregory, Classical Mechanics,Cambridge University Press.
6. Classical mechanics- J.C. Upadhyay
7. Classical mechanics-A.B Gupta

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MIC -I (P)-1 Credit

Introduction to Mathematical Physics & Classical Mechanics

The theory involved in the prescribed practical should be discussed in class and students should be made familiar with associated concepts.

1. Elementary measuring apparatus – Use of Vernier calliper, Screw guage and Spherometer.
2. To determine least Count of (i) Travelling Microscope (ii)Spectrometer (iii) Polarizer.
3. To Evaluate value of "g" using Bar Pendulum
4. To Evaluate value of "g" using Kater's Pendulum
5. To Verify Conservation of linear Momentum using curved track apparatus.
6. To Determine Young's modulus of Elasticity by Flexure of Beam
7. To Determine Elastic constants for the material of a wire by Searle's method
8. To Determine Surface Tension by method of ripples/use of Capillary tube
9. To Determine Co-efficient of Viscosity of liquid by Stokes method/Poiseuille's method of flow of water through Capillary.
10. To study the motion of spring-mass system and to evaluate spring constant/value of 'g'.

The CIA examination in Practical should be just as Mock test and it must be on the Pattern of proper 3hrs End- semester Examination.

Sl. No.	Component	CIA	End- Semester
1	Experiment Allotted	15	45
2	Continuous Pratical Record	05	10
3	Viva-Voce	10	15
		30	**70**
		Total = 100 Marks	

Suggested Books :

1. Advanced Practical Physics for students, B.L.Flint and H.T.Worsnop, 1971, Asia Publishing House
2. A Text Book of Practical Physics, I.Prakash& Ramakrishna, 11th Ed., 2011, Kitab Mahal
3. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition
4. A Laboratory Manual of Physics for undergraduate classes, D.P.Khandelwal, 1985, Vani Pub.
5. Properties of Matter- D. S. Mathur

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Minor Course II (MIC-2)

Course Title	Credit	Credit Distribution	
		Theory	Practical
Oscillations and Waves	3	2	1

MIC -II (T)-2 Credit

Oscillations and Waves

Course Outcomes

After completion of the course, the student will be able to-

CO 1-understand the concept of Periodic and Oscillatory motion with application of free , Damped and Forced Oscillation in Physical Situation.

CO2-learn application of Lissajou Figure in different Physical Problems

CO3-explore the working of various Musical Instrument.

CO4-understand the Physics behind Acoustics of Building.

CO5-know the technique of sound Recording and Reproduction

Unit I :- **01 Credit (15 hrs)**

Idea of S.H.M, Free, Damped & Forced Oscillation, Superpostion of two collinear and Perpendicular Simple Harmonic motion, Concept of Lissajou Figure & Stationary Waves.

Unit – II :- **01 Credit (15 hrs)**

Waves Characteristic of Wave Motion, Sound Wave, Equation of Plane Progressive Waves, Speed of sound (Newton's & Laplace Formula), Energy Transport & Intensity of Waves.

Suggested Books :

1. The Physics of Vibrations and Waves, H. J. Pain, john Wiley & Sons Ltd.
2. The Physics of Waves and Oscillations, N.K. Bajaj, 1998, Tata McGraw Hill
3. Waves and Oscillations, N Subrahmanyam, Brij Lal, Vikas Publishing House Pvt Ltd.
4. Waves & Oscillation – B.S. Agrawall
5. Waves & Oscillation – A.B Gupta

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MIC -II (P)-2 Credit

Oscillations and Waves

The theory involved in the prescribed practical should be discussed in class and students should be made familiar with associated concepts.

At least 6 experiments must be performed:-

1- To determine frequency of Tuning Fork Using Sonometer / verify laws of transverse vibration of stretched string
2- To determine frequency of Tuning Fork using Electrically maintained Melde's apparatus.
3- To determine the frequency of A. C. Mains using a sonometer and an electromagnet.
4- To find the speed of sound in the materials of given rod with a Kundt's tube / Quincke's tube.
5- To determine speed of ultrasonic waves in a given liquid (e.g. Kerosene)
6- To study motion of spring – mass system and find g.
7- To study the directional characteristic of Microphone using signal Generator, Amplifier, microphone, multimedia & C. R. O.
8- To determine the damping constant, relaxation time and quality factor of damped simple pendulum with bobs of different material (Aluminum, Brass, Wood, etc.)
9- To determine torsional constant using a Torsional Pendulum.
10- To determine speed of sound using Resonance column Apparatus.

The CIA examination in Practical should be just as Mock test and it must be on the Pattern of proper 3hrs End- semester Examination.

Sl. No.	Component	CIA	End- Semester
1	Experiment Allotted	15	45
2	Continuous Pratical Record	05	10
3	Viva-Voce	10	15
		30	**70**
		Total = 100 Marks	

Suggested Books:

1. Advanced Practical Physics for students, B. L. Flint and H. T. Worsnop, 1971, Asia Publishing House.
2. Engineering Practical Physics, S. Panigrahi& B. Mallick, 2015, Cengage Learning India Pvt. Ltd.
3. Practical Physics, G. L. Squires, 2015, 4/e, Cambridge University Press.
4. A Text Book of Practical Physics, I. Prakash & Ramakrishna, 11/e, 2011, Kitab Mahal.

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SEMESTER- III

MICPHY03: Thermal Physics &Thermodynamics

Course Title	Credit	Credit Distribution	
		Theory	Practical
Thermal Physics &Thermodynamics	3	2	1

Course Outcomes

After the completion of the course, the student will be able to:

CO1: Comprehended the basic concepts of thermodynamics, the first and the second law of thermodynamics.

CO2: Understand the concept of entropy and the associated theorems, the thermodynamic potentials and their physical interpretations.

CO3: Learn about Maxwell's relations and use them for solving many problems in Thermodynamics.

CO4: Learn the basic aspects of kinetic theory of gases, Maxwell-Boltzmann distribution law, equitation of energies, mean free path of molecular collisions, viscosity, thermal conductivity, diffusion and Brownian motion.

MICPHY03: Thermal Physics &Thermodynamics (T) -2 Credit		
Unit	**Topics to be covered**	**No. of Lectures**
1	**Kinetic Theory of Gases** Maxwell-Boltzmann Molecular Speed distribution Law for an Ideal Gas. Mean, RMS and Most Probable Speeds. Degrees of Freedom. Law of Equipartition of Energy (no derivation). Molecular Collisions: Mean Free Path. Estimation of Mean Free Path. Transport Phenomenon in Ideal Gases: (1) Viscosity, (2) Thermal Conductivity and (3) Diffusion. Brownian motion, Langevin and Einstein's theories and experimental determination of Avogadro's no., Rectilinear flow of heat in a metal rod, relation between thermal & electrical conductivities.	10
2	**Real Gases** Behavior of Real Gases. Van der Waal's Equation of State for Real Gases. Values of Critical Constants. Law of Corresponding States. Joule-Thomson Porous Plug Experiment. Joule-Thomson Effect for Real Gases. Joule-Thomson Cooling.	08
3	**Zeroth and First Law of Thermodynamics** Extensive and intensive Thermodynamic Variables, Thermodynamic Equilibrium, Zeroth Law of Thermodynamics and Concept of Temperature, Work, Heat, State Functions and path functions, First Law	05

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	of Thermodynamics, Internal Energy for ideal and real gases, Applications of First Law of thermodynamics in case of thin film, stretched wire, hydrostatics, and specific Molar Heat Capacity for gases, Specific heat General Relation between C_P and C_V.	
4	**Second Law of Thermodynamics** Cyclic ,reversible and irreversible process, Carnot engine, Carnot cycle, Principle of Refrigerator. Second Law of thermodynamics.Principal of heat engine and refrigerator Kelvin-Planck and Clausius Statements. Concept of Entropy, Clausius Inequality, Second Law in terms of Entropy, Temperature–Entropy diagrams. Third Law of thermodynamics, Thermodynamic Potentials: Internal Energy, Enthalpy, Helmholtz & Gibb's Functions, Maxwell's Relations, Co-efficient of performance, Clausius-Clapeyron equation and phase transition (1^{st} and 2^{nd})	07
	TOTAL	**30**

MICPHY03:	**Thermal Physics &Thermodynamics (P) -1 Credit**
1.	To determine Mechanical Equivalent of Heat, J, by Callender and Barne's constant flow method.
2.	To determine the Coefficient of Thermal Conductivity of good conductor (Cu) by Searle's Apparatus.
3.	To determine the Temperature Coefficient of Resistance by Platinum Resistance Thermometer (PRT).
4.	To study the variation of Thermo-emf of a Thermocouple with Difference of Temperature of its Two Junctions using a null method.
5.	To determine Mechanical Equivalent of Heat, J, with the help of Joule's calorimeter.
6.	To plot a graph between temperature and pressure at constant volume using Joly's apparatus and to find the coefficient of increase of pressure at constant volume.

Suggested Readings :

1. Thermal Physics, S. Garg, R. Bansal and C. Ghosh, 1993, Tata McGraw-Hill.
2. Heat and Thermodynamics, M.W. Zemansky, Richard Dittman, 1981, McGraw-Hill.
3. A Treatise on Heat, MeghnadSaha, and B.N. Srivastava, 1958, Indian Press
4. Classical and Quantum Thermal Physics, R. Prasad, 2016, Cambridge University Press
5. Modern Thermodynamics with Statistical Mechanics, Carl S. Helrich, 2009, Springer.
6. Thermodynamics, Kinetic Theory & Statistical Thermodynamics, Sears & Salinger. 1988,Narosa
7. Thermal Physics ,Thermodynamics S.C Garg, R.M Bansal& C. K .Ghosh
8. Theory and Experiment on Thermal Physics: P.K.Chakrabarti, New Central Book Agency (p) Ltd
9. Thermodynamics: J.P Aggrawal & Satya Prakash
10. Advanced Practical Physics for students: B. L. Flint and H.T.Worsnop (Little Hampton Book)
11. B.Sc. Practical Physics :C.L.Arora (S.Chand)
12. Practical Physics: G.L. Squires (Cambridge University Press)

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SEMESTER- IV

MICPHY04: Electricity & Magnetism

Course Title	Credit	Credit Distribution	
		Theory	Practical
Electricity & Magnetism	3	2	1

Course Outcomes

After the completion of the course, the student will be able to:

CO1: Understand the basic concepts of electrostatics.

CO2: Understand the dielectric properties of matter.

CO3: Understand the electromagnetic induction and electrical circuits.

MICPHY04: Electricity & Magnetism (T) -2 Credit		
Unit	**Topics to be covered**	**No. of Lectures**
1	**Electrostatics:** Coulomb's law. Electric Field and potential, Field due to a uniformly charged sphere, Gauss's Law and its application: Electric dipole, Field and potential due to an electric dipole, Electrostatic Energy of a uniformly charged sphere, Energy of a condenser.	08
2	**Dielectric Properties of Matter:** Electrical susceptibility and Dielectric constant, Polarization, Electronic polarization, Atomic or ionic Polarisation, Surface Charge and bound charge, Displacement Vector **D**, Relations between **E**, **P** and **D**	06
3	**Magnetism:** Magnetic field , Magnetic force on a current carrying conductor placed in a uniform magnetic field, Biot – Savart's Law and its simple applications: straight wire and circular loop, Magnetic Dipole, and Ampere's Circuital law. Gauss's law of magnetism (Integral and Differential Forms). Magnetization current. Relative Permeability of a Material. Magnetic Susceptibility. Magnetization Vector (**M**), Magnetic Intensity (**H**), Relation between **B**, **M** and **H**. **Electromagnetic Induction:** Faraday's and Lenz's Laws. Mutual and Self Induction and their determination for a solenoid. Energy stored in a Magnetic Field, Induced magnetic field (Time varying electric field).	10

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4	**Electrical Circuits:** AC Circuits: Kirchhoff's laws for AC circuits. Reactance and Complex Impedance. Series and parallel LCR Circuit: (1) Resonance, (2) Quality Factor, and (3) Band Width. Power in AC Circuits.	06
	TOTAL	**30**

MICPHY-04	**Electricity and magnetism (P)-1 Credit**
1.	Use of Multimeter for measuring (a) Resistance, (b) AC and DC Voltages, (c) DC Current, (d) Capacitance, and (e) Checking electrical fuses.
2.	To calibrate the ammeter and voltmeter by potentiometer.
3.	To find the low resistance by Carey Foster's bridge after calibrating the bridge wire.
4.	Measurement of low resistance using Potentiometer.
5.	Figure of merit of moving coil galvanometer.
6.	To determine the angle of dip in the laboratory using an earth inductor.
7.	Compare the capacities of capacitors by De Sauty' bridge.
8.	To verify the Thevenin and Norton theorems.
9.	To verify the Superposition, and Maximum power transfer theorems.
10.	To determine self inductance of a coil by Anderson□s bridge.
11.	To study the response curve of a Series LCR circuit and determine its

Suggested Readings:-

1. Electricity and Magnetism, Basudev Ghosh (Books And Allied (P) Ltd
2. Introduction to Electrodynamics, D.J. Griffiths, 3rd Edn., 1998, Benjamin Cummings.
3. Electricity ad Magnetism
4. Fundamentals of Electricity and Magnetism, Arthur F. Kip, 2nd Edn.1981, McGraw-Hill.
5. Electricity, Magnetism & Electromagnetic Theory, S. Mahajan and Choudhury, 2012, Tata McGraw-Hill
6. Fundamentals of Electricity and Magnetism D.N Vasudev (S. Chand & Co)
7. Electricity and Magnetism- R. Murugeshan (S. Chand)
8. Electricity and Magnetism-K.K. Tiwari (S. Chand)

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SEMESTER-V

MICPHY-05: Mathematical Physics-II and Introduction to Computational Methods

Course Title	Credit	Credit Distribution	
		Theory	Practical
Mathematical Physics-II and Introduction to Computational Methods	03	02	01

Course Outcomes

After the completion of the course, the student will be able to:

CO1: Master the basic elements of complex mathematical analysis.

CO2: Solve differential equations that are common in physical sciences.

CO3: Apply group theory and integral transforms to solve mathematical problems of interest in Physics.

CO4: Understanding how to use special functions in various physics problems

CO5: Provides background for further studies and research in different subject areas .

MICPHY05: Mathematical Physics and Introduction to Computational Methods (T) -2 Credit		
Unit	**Topics to be covered**	**No. of Lectures**
1	**Curvilinear Coordinates, Tensors and special functions:** Spherical and Cylindrical Coordinate Systems. Ordinary Integrals of Vectors, Line, surface and volume integrals of Vector fields. Second Order Linear Differential Equation and its solution using Frobenius method.	06
2	**Partial Differential Equations:** Solutions to partial differential equations using separation of variables: Laplace's Equation in problems of rectangular, cylindrical and spherical symmetry.	06
3	Introduction: Importance of Computers in Physics, Algorithms and Flow Charts: Algorithm Definition, properties and development. Flowchart:	06

	concept of flowchart , symbols , guidelines, types.	
4	Scientific Programming: Basic ideas of Linux, some fundamental Linux commands (Internal & External commands), FORTRAN: Basic ideas for development of FORTRAN Programming. Layout of FORTRAN programs, writing of simple FORTRAN programs and concept of coding.	06
5	Control statements :Introduction of Subscripted variables, Functions and Subroutines (Arithmetic statements, Function, Function subprogram and subroutine), and their usage in programs of simple Physics Problems.	06
	Total	**30**

MICPHY05: Mathematical Physics and Introduction to Computational Methods (P) -1 Credit
Practical
1. Errors & error Analysis: Truncation & rounding of errors, absolute & relative errors.
2. Differential equations: Solutions of ordinary differential equation, solution of first order differential equation, solution of quadratic equation.
3. **Programs:** Sum & average of a list of numbers, Largest of a given list of numbers, Familiarity with DOS commands, Linux Commands and FORTRAN commands.

Suggested Readings:-

1. Introduction to Numerical Analysis: S. S Sastry
2. Mathematical Methods for Scientists & Engineers: D.A. McQuarie (Pub. Viva Books)
3. An Introduction to Computational Physics: T. Pang (Cambridge University Press)
4. Numerical Recipes in C: The Art of Scientific Computing, W.H.Pressetal (Cambridge University)

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SEMESTER- V

MICPHY-06: Electrodynamics and Electromagnetism

Course Title	Credit	Credit Distribution	
		Theory	Practical
Electrodynamics and Electromagnetism	3	3	0

Course Outcomes

After completing the course, the students will be able to:

CO1: Establish and analyse four Maxwell's equations of electromagnetism.

CO2: Understand the propagation of electromagnetic waves in vacuum, dielectrics, conductors and also in guided media and the phenomenon of reflection and refraction of plane waves at different boundaries.

CO3: Understand the importance of energy flow(Poynting Theorem) and its usefulness.

MICPHY-06: Electrodynamics and Electromagnetism (T) -02 Credit		
Unit	**Topics to be covered**	**No. of Lectures**
1	**Equations:** Equation of continuity, Maxwell's equations in differential and Integral forms; Vector and scalar potentials.Poyinting Theorem and Poynting Vector. Electromagnetic (EM) Energy Density. Physical Concept of Electromagnetic Field Energy Density.	07
2	**Electromagnetic Wave Propagation in unbounded media:** Propagation of plane EM waves in free space Transverse nature of plane EM waves, refractive index and dielectric constant, wave impedance. Propagation of EM wave through conducting media.	07
3	**EM Wave Propagation in Bounded Media:** Boundary conditions at a plane interface between two media. Reflection & Refraction of plane waves at plane interface between two dielectric media — Laws of Reflection & Refraction, Total internal reflection.	06

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4	**Polarization of Electromagnetic Waves:** Description of Linear, Circular and Elliptical Polarization. **Wave Guides:** Condition of continuity at interface. Phase shift on total reflection. Solution of wave equation in Rectangular waveguide, Eigenvalue equations. Expressions for field components (TE and TM modes). Propagation properties, cutoff frequency, group & phase velocity of guided waves. **Optical Fibres:** Numerical Aperture. Step and Graded Indices (Definitions Only). Single and Multiple Mode Fibres (Concept and Definition Only).	10
	TOTAL	**30**

Suggested Readings:-

1. Introduction to Electrodynamics, D.J. Griffiths, 3rd Ed., 1998, Benjamin Cummings. ,
2. Elements of Electromagnetics, M.N.O. Sadiku, 2001, Oxford University Press.
3. Introduction to Electromagnetic Theory, T.L. Chow, 2006, Jones & Bartlett Learning
4. Fundamentals of Electromagnetics, M.A.W. Miah, 1982, Tata McGraw Hill
5. Electromagnetic field Theory, R. S. Kshetrimayun, 2012, Cengage Learning r
6. Electromagnetic Field Theory for Engineers & Physicists, G. Lehner, 2010, Springer
7. Electromagnetic Fields & Waves, P. Lorrain & D. Corson, 1970, W.H. Freeman & Co.
8. Electromagnetics, J. A. Edminster, Schaum Series, 2006, Tata McGraw Hill.

SEMESTER- VII

MICPHY 07: Optics

Course Title	Credit	Credit Distribution	
		Theory	Practical
Optics	3	2	1

Course Outcomes

After the completion of the course, the student will be able to:

CO1: Understand Interference as superposition of waves from coherent sources derived from same parent source.

CO2: Demonstrate basic concepts of Diffraction: Superposition of wavelets diffracted from aperture.

CO3: Understand Fraunhoffer and Fresnel Diffraction.

CO4: Gain experience of using various optical instruments and making finer measurements of wavelength of light using Newton's Rings experiment, Fresnel Biprism, etc.

MICPHY07:	**Optics (T) -2 Credit**	
Unit	**Topics to be covered**	**No. of Lectures**
1	**Interference:** Light as EM Wave(Historical Perspective),Superposition of waves, Conditions for interference, Interference by Division of Wavefront (Lloyd's single mirror) and by Division of Amplitude Newton's Ring, Stoke's treatment.	07
2	**Interferometer:** Michelson interferometer and its applications, Multiple beam interference in parallel film, Coherence – Spatial and Temporal.	06
3	**Fraunhofer Diffraction:** Conditions for diffraction, Fraunhofer diffraction due to single, Plane transmission grating. **Fresnel diffraction:** Fresnel half- period zones, Zone plate, Huygen's-Fresnel principle, Diffraction by a straight edge,Rayleigh's criterion for limit of resolution, Resolving power of Grating, Telescope.	08
4	**Polarization and Double Refraction:**	07

	Polarized light and its mathematical representation, Production of polarized light by reflection, refraction and scattering, Polarization by double refraction, Nicol prism, Quarter wave plate, Half wave plate, Babinet's compensator, Production and analysis of circularly and elliptically polarized light. Elementary ideas of LASERs, Population Inversion and Holography.	
	TOTAL	**30**

MICPHY 07	**Optics (P) -1 Credit**

1. To determine Magnifying Power of a telescope by the Linear Scale.
2. To find the height of an inaccessible object (altitude or angular diameter of the Sun) using Sextant.
3. To find angle of prism/ angle of minimum deviation and hence refractive index of material of prism using Spectrometer.
4. To determine diameter of a thin wire by studying the diffraction (and interference) pattern.
5. To determine wavelength of sodium light using a plane diffraction grating.
6. To determine Resolving Power of a plane transmission grating.
7. Simple experiment demonstrating different applications of LASER and Optical Fibre.
8. Determination of wavelength of light using biprism on optical bench.
9. To determine the wavelength of the monochromatic light by Newton's Ring

Suggested Readings :

1. Optics(Classical & Quantum)-Dr. R.K.Kar(Books & Allied).
2. Optics:(2017), 6th Edition, Ajoy Ghatak, McGraw-Hill Education, New Delhi
3. Fundamental of Optics:Jenkins & White (Mc Graw Hill)
4. Fundamental of optics: B. K. Mathur,
5. A TextBook of Optics : N. Subrahmanyam, Brij V. Lal, M.N. Avadhanulu, S. Chand & Co Ltd
6. Practical Physics :Geetu Sunon(R.Chand& Company); Harnam Singh & P.S. Hemne(S.Chand& Co.)
7. A Text Book of Practical Physics: Indu Prakash, Ramakrishna&A.K.Jha, 11th Ed., 2011, Kitab Mahal
8. Advanced level Physics Practicals: Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
9. A Laboratory Manual of Physics for undergraduate classes:D.P.Khandelwal, 1985, Vani Pub.
10. Practical Physics: G.L. Squires, Cambridge University Press.
11. A Laboratory Manual of Physics – D.P.Khandewal.
12. Optics- Eugene Hecht(Pearson).

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SEMESTER – VI

MICPHY08: Elements of Modern Physics

Course Title	Credit	Credit Distribution	
		Theory	Practical
Elements of Modern Physics	3	3	0

Course Outcomes

After the completion of the course, the student will be able to:

CO1: Main aspects of the inadequacies of classical mechanics as well as understanding of the historical development of quantum mechanics.

CO2: Formulation of Schrodinger equation and the idea of probability interpretation associated with wave-functions.

CO3: The spontaneous and stimulated emission of radiation, optical pumping and population inversion. Three level and four level lasers. Ruby laser and He-Ne laser in details. Basic lasing.

CO4: The properties of nuclei like density, size, binding energy, nuclear forces and structure of atomic nucleus, liquid drop model and nuclear shell model and mass formula.

MICPHY08:	Elements of Modern Physics (T) – 3 Credit	
Unit	**Topics to be covered**	**No. of Lectures**
1	**Wave-Particle Duality** Hertz Experiment and Discovery of Photoelectric effect;Explanation of Photoelectric effect by Einstein; Wave nature of particle ;Historical perspectives of de Broglie's Matter wave; Heisenberg's Uncertainty principle	12
2	**Understanding Atom** Different Atomic models; alpha particle scattering experiment performed by Geiger and Marsden, Rutherford's nuclear Model of atom; Bohr's Model and specrum of hydrogen atom, Limitations of Bohr's Theory; Fine structure of H-lines	12
3	**Basic properties of atomic nucleus** Mass number,Mass Defect, Binding Energy.Binding Energy per nucleon versusMass Number Curve;Concept of Nuclear forces;Stability of Nucleus Radioactivity, Law of RadioactiviteDisintegration.Application of radioactivity in Carbon -Dating and Therapy	12
	TOTAL	**36**

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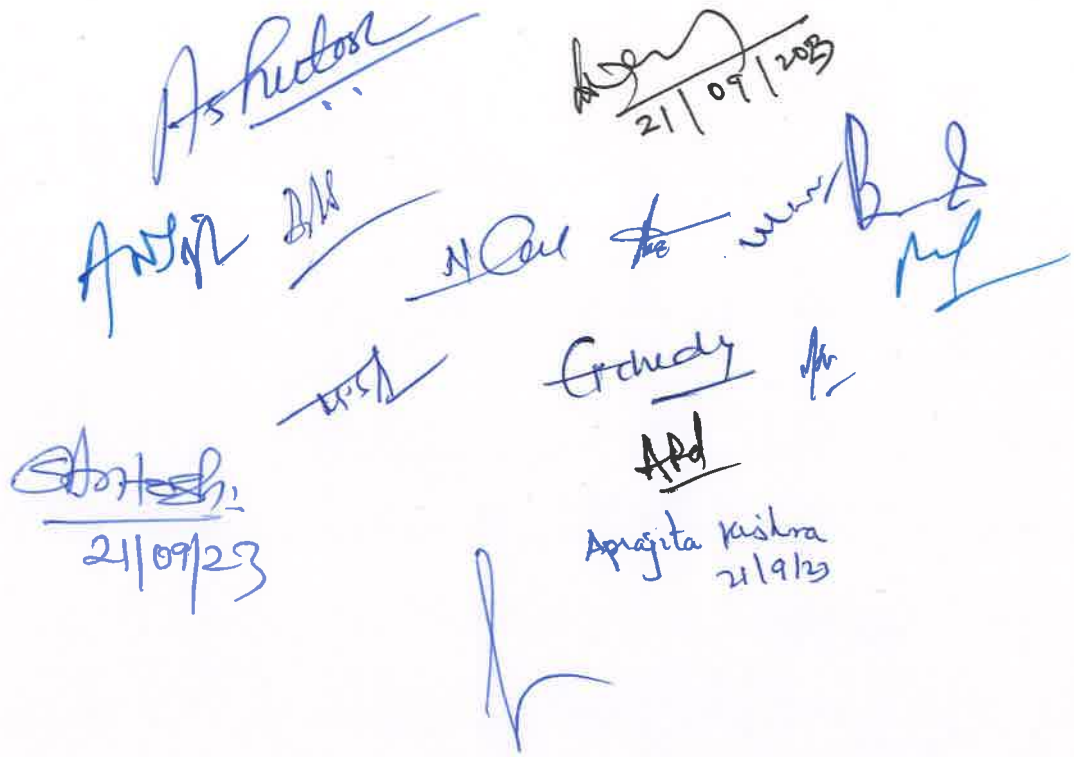
Suggested Readings :

1. Concepts of Modern Physics, Arthur Beiser, 2002, McGraw-Hill.
2. Modern Physics by R ASerway, C J Moses and C A Moyer, 3rd edition, Thomson Brooks Cole, 2012.
3. Modern Physics for Scientists and Engineers by S T Thornton and A Rex, 4th edition, Cengage Learning, 2013.
4. Concepts of Nuclear Physics by B L Cohen, Tata McGraw Hill Publication, 1974.
5. Quantum Mechanics, Robert Eisberg and Robert Resnick, 2ndEdn., 2002, Wiley.



SEMESTER – VII

MICPHY09: Basic Electronics

Course Title	Credit	Credit Distribution	
		Theory	Practical
Basic Electronics	4	3	1

Course Outcomes

After the completion of the course, the student will be able to:

CO1: Understand fundamental designing concepts of different types of Logic Gates, Minimization techniques etc.

CO2: Design of different types of the Digital circuits, and to give the computational details for Digital Circuits.

CO3: Draw characteristics of devices like PNP and NPN junction diode and truth tables of different logic gates.

CO4: Understand basic elements and measurement of their values with multimeter and their characteristic study.

MJCPHY 09	Basic Electronics (T) – 3 Credit	
Unit	**Topics to be covered**	**No. of Lectures**
1	**Digital Circuits:** Diffrence between Analog & Digital Circuits .BinaryNumbers.Decimal to Binary & vice-versa. AND,OR and NOT Gates(Realisation using Diodes & Transistors) NAND and NOR Gates as Universal gates.XOR Gates.	07
2	**Basic Circuit Operations:** De-Morgan's Theorem .Boolean Laws .Simplification of Logic Circuit using Boolean Algebra. Conversion of a Truth Table into an Equivalent Logic Circuit by (1) Sum of Products Method **Combinational circuits:** Basic Idea of Binary Addition. Binary Subtraction using 2's Complement. Half and Full Adders.	12
3	**Semiconductor Devices :** P-andN-type semiconductors. Energy Level Diagram. Barrier Formation in PN Junction Diode. Qualitative Idea of Current Flow Mechanism in Forward and Reverse Biased Diode.P-N junction & its characteristics.Static and Dynamic Resistance.Principle and structure of (1) LEDs (2) Photodiode (3) Zener Diode (4) Solar .Cell. **Electronic Devices and their Applications:** (1) Rectifier Diode: Half-wave Rectifiers. Full-wave Rectifiers (Centre-tapped and	10

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	Bridge), Calculation of Ripple Factor and Rectification Efficiency, (2) Voltage Regulation using Zener Diode. **Bipolar Junction transistors**:n-p-n and p-n-p Transistors, Characteristics of CB, CE and CC Configurations. Current gains α and β parameters, Relations between α and β parameters. Load Line analysis of Transistors. DC Load line and Q-point. Physical Mechanism of Current Flow: Active, Cutoff and Saturation Regions. **Amplifiers:** Transistor Biasing circuits and Stability. Fixed Bias and Voltage Divider Bias circuit for CE Amplifier. Input and Output Impedance. Current, Voltage and Power Gains. Class A	
4	**Sinusoidal Oscillations:** Feedback and Oscillation: Effects of Positive and Negative Feedback on Gain and Stability, Distortion and Noise. Sinusoidal Oscillators: Barkhausen's Criterion for self-sustained oscillations. RC andWien Bridge oscillator.	07
5	**Instrumentations:** Introduction to CRO:Block Diagram and Applications of CRO: (1) Study of Waveform (2) Measurement of Voltage ,Current ,Frequency and Phase Difference. **Power Supply:** Half Wave Rectifiers ,Centre-tapped and Full wave Rectifiers ,Calculation of Ripple Factor and Rectification Efficiency ,Basic Idea about capacitor filter , Zener Doide and Voltage Regulation.	09
	TOTAL	**45**

MICPHY 09	**Basic Electronics (P) – 1 Credit**
1.	To measure (a) Voltageand (b) Time period of a periodic waveform using CRO.
2.	To test a Diode and Transistor using a Multimeter.
3.	To design a switch (NOT gate) using a transistor.
4.	To verify and design AND, OR, NOT and XOR gates using NAND gates.
5.	Half Adder ,Half Subtractor and 4-bit Binary Adder
6.	To study V-I characteristics of P-N junction ,Zener and Light emitting diode.
7.	To study the characteristics of a Bipolar Junction Transistor in CE configuration.

Suggested Readings :

1. Electronic Principles & Applications: A.P.Malvino ,D.P.Leach and Saha(McGraw Hill).
2. Modern Digital Electronics- R.P.Jain ,Tata McGraw Hill,4th Edition.
3. Principles of Electronics:-V.K.Mehta& Rohit Mehta(s.Chand& Comp).
4. Basic Electronics Devices :-D.P.Kothari& I J Nagrath(McGraw Hill Educ).
5. Hand Book of Electronics-Gupta & Kumar.
6. Foundation of Electronics - Chattopadhyay; Rakshit;Saha;Purikait(Willey).

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Semester – VIII

MICPHY10: Analytical Mechanics & Special Theory of Relativity

Course Title	Credit	Credit Distribution	
		Theory	Practical
Introduction to Analytical Mechanics & Special Theory of Relativity	4	4	0

Course Outcomes

After completion of the course, the students will be able to:

CO1: Understand Physical Principle behind derivation of Lagranges and Hamiltonion Equation.

CO2: Understand problems in space science theoretical research

CO3: Analysis the Centre of mass and Laboratory frames of reference and their use in explaining elastic and inelastic collisions

CO4: Understand the Planetary motions and motions of satellites and Space science. Getting an idea of postulates of special theory of relativity and their implications.

MJCPHY10 Analytical Mechanics & Special Theory of Relativity (T) – 4 Credit		
Unit	**Topics to be covered**	**No. of Lectures**
1	**Rigid Body Motion:** Rigid body, Eulerian angles, Kinematics of rotation, Euler's equations of motion, Motion of a symmetrical top. **Variational Principle and Hamiltonian formalism:** Calculus of variation and its applications, Lagrange's equations of motion for non-holonomic system, Velocity-dependent potential, Cyclic coordinates, Symmetries and conservation laws, Legendre transformation.	14

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2	**Canonical Transformation:** Canonical transformation and its applications, Poisson Brackets, Jacobi identity, Hamilton-Jacobi equation.	08
3	**Collisions:** Elastic and inelastic collisions between particles. Centre of Mass and Laboratory frames.Elasticity: Review of relation between Elastic constants .	08
4	**Special Theory of Relativity:** Michelson-Morley Experiment and its outcome. Postulates of Special Theory of Relativity. Lorentz Transformations. Lorentz contraction. Time dilation. Relativistic addition of velocities. Variation of mass with velocity, mass energy equivalence	15
	TOTAL	**45**

Suggested Books :

1. Kleppner D., Kolenkow R. J. (1973).An introduction to mechanics,McGraw-Hill.
2. Kittel C, Knight W., et.al. (2007).Mechanics, Berkeley Physics, vol.1, Tata McGraw-Hill.
3. Resnick, Halliday and Walker (2008),Physics, Wiley, 8/e.
4. Fowles G. R. and CassidayG.L. (2005).Cengage Learning.
5. FeynmanR. P., Leighton R. B., Sands M. (2008). Feynman Lectures, Vol.I, Pearson Education.
6. MathurD. S. (2000). Mechanics,S. Chand and Company Limited.
7. SearsF. W, ZemanskyM. W., YoungH.D. (1986). University Physics. 13/e, Addison Wesley.
8. JewettJ. W., SerwayR. A. (2010). Physics for scientists and Engineers with Modern Phyε, Cengage Learning.
9. Spiegel M.R. (2006).Theoretical Mechanics, Tata McGraw Hill.
10. Special Theory of Relativity S.Chand
11. Gupta , kumar ,Pragati Prakashan

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