As per NEP 2020

M.Sc. Physics

(Effective from Academic Year 2024-2025 onwards)

Pandit Deendayal Upadhyaya Shekhawati University

Sikar (Rajasthan) 332024

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Final Credit Summary

PG in Physics

Yr	Sem	Credits							Total
		DSC	DSE/ P/D	GEC	AEC	SEC	VAC	Seminar / Internship / Dissertation	
First	Pawas	16	4	---	---	---	2	---	22
	Vasant	16	4	---	---	---	2	---	22
Second	Pawas	8	14	---	---	---	2	---	24
	Vasant	---	---	---	---	---	---	20	20
		40	22	---	---	---	6	20	88

Proposed Distribution of Credits for PG Programme				
Courses	SEM I	SEM II	SEM III	SEM IV
Major DSC	DSC1(4) DSC2(4) DSC3(4) DSC4(2) DSC5(2)	DSC6(4) DSC7(4) DSC8(4) DSC9(2) DSC10(2)	DSC11(2) DSC12(3) DSC13(2) DSC14(1) DSC15(1)	---
DSE	DSE1(3) DSE2(1)	DSE3(3) DSE4(1)	DSE5(3) DSE6(3) DSE7(3) DSE8(3) DSE9(1)	---
GEC	---	---	---	---
AEC	---	---	---	---
SEC	---	---	---	---
VAC	VAC1(2)	VAC2(2)	VAC3(2)	---
Seminar / Internship / Dissertation	---	---	---	Dissertation(20)
Total	22	22	24	20
	44		44	
	88			

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Curriculum Structure

Session 2023-2024 onwards

Name of the Programme: M.Sc. Physics

Year: First

Semester: I (Pawas)

Pawas Semester I

Course Code	Course Title	Contact Hrs. per Week L	T	P	Credits	Weightage (%) CW$	MTE	ETE
Discipline Specific Core(DSC):								
24MPH9101 T	Classical mechanics	4	0	0	4	20	10	70
24MPH9102 T	Quantum mechanics	4	0	0	4	20	10	70
24MPH9103 T	Classical electrodynamics	4	0	0	4	20	10	70
24MPH9104 P	Practical	0	0	4	2	40	--	60
Value Added Course(VAC)								
		2	0	0	2	20	10	70
Discipline Specific Elective(DSE):								
24MPH9105 T	Numerical methods and computer fundamentals	4	0	0	4	20	10	70
	OR							
24MPH9106 T	Laser Physics	4	0	0	4	20	10	70
Seminar/Intership/Dissertation (S/I/D):								
--	--	--	--	--	--	--	--	--
	Total				22			

Summary: I Semester		
S.N.	**Particulars**	**Credits**
1.	Discipline Specific Core(DSC):	**16**
2.	Discipline Specific Elective(DSE):	**04**
3.	Value Added Course	**02**
4.	Seminar/Intership/Dissertation(S/I/D):	**--**
	Total	**22**
$CW (Class work): It would include attendance, assignments, class test/quiz test/assigenements, ppt, play, learn by fun activities etc.		

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Curriculum Structure

Session 2023-2024 onwards

Name of the Programme: M.Sc. Physics

Year: First

Semester: II (Vasant)

Vasant Semester II

Course Code	Course Title	Contact Hrs. per Week			Credits	Weightage (%)		
		L	T	P		CW$	MTE	ETE
Discipline Specific Core (DSC):								
24MPH9201 T	Research Methodology	4	0	0	4	20	10	70
24MPH9202 T	Electronics	4	0	0	4	20	10	70
24MPH9203 T	Atomic and molecular Physics	4	0	0	4	20	10	70
24MPH9204 P	Practical	0	0	8	4	40	--	60
Value Added Course(VAC)								
		2	0	0	2	20	10	70
Discipline Specific Elective (DSE):								
24MPH9205 T	Nanotechnology	4	0	0	4	20	10	70
	OR							
24MPH9206 T	Mathematical Physics	4	0	0	4	20	10	70
Seminar/Internship/Dissertation (S/I/D):								
--	--	--	--	--	--	--	--	--
	Total				**20**			

S.N.	Particulars	Credits
	Summary: II Semester	
1.	Discipline Specific Core(DSC):	**16**
2.	Discipline Specific Elective (DSE):	**04**
3.	Value Added Course	**02**
4.	Seminar/Internship/Dissertation(S/I/D):	**--**
	Total	**22**
	$CW (Class work): It would include attendance, assignments, class test/quiz test/assignments, ppt, play, learn by fun activities etc.	

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Master of Physics
(CBCS) As per the NEP 2020 (Semester I)
w.e.f. the Academic Session 2024-25
Discipline: Physics
Faculty: Science

Paper I Classical Mechanics

Learning Objectives: The objective of the course is to provide students with a comprehensive understanding of advanced classical mechanics. The course aims to develop their knowledge and skills in analyzing and solving problems related to these topics, using appropriate mathematical formalism and physical concepts.

Learning Outcomes: On completion of the course the student will be able to understand the Concepts of constraints, Lagrangian formulation with their applications. He get knowledge about Hamiltonian formulation with their applications as well as about canonical transformations and action angle variables.

Course Title:	Title of the Course: Classical Mechanics	Course Code: 24MPH9101T
Total Lecture hour 52		Hours
Unit I	**Holonomic and nonholonomic constraints**: D-Alembert's Principle, Generalized.coordinates,Lagrangian, Lagrange's equation and its applications, Velocity dependant potential in Lagaragian formulation. Generalized momentum, Legendre transformation, Hamiltonian, Hamilton's Canonical equation. Conservation principle and Noether's theorem. Conservation of energy, linear momentum and angular momentum as a consequence of homogeneity of time and scope and isotropy of space respectively.	13
Unit II	**Calculus of variations and its application** : simple problems, Hamilton's variational principle, Derivation of Lagrange's and Hamilton. Canonical equation from Hamilton's variational principle. Extension of Hamilton's Principle for nonconservative and nonholonomic systems. Method of Lagrange's multipliers	13
Unit III	**Canonical transformation:** integral in variants of Poincare: Lagrange's and Poisson brackets ascanonical invariants. Equation of motion in Poisson bracket formulation, Infinitesimal contact transformation and generators of symmetry, Liouville's theorem, Hamilton Jacobi equation and itsapplications.	13
Unit IV	**Action angle, variable adiabatic invariance of action variable :** The Kepler problem in action angle variables, theory of small oscillation in Lagrangian formulation, normal coordinates and its applications, Orthogonal transfonnation, Eulerian angles, Euler theorem, Eigen values of the inertia tensor,Euler equations. Force free motion of a rigid body.	13

Reference Books:

1	Classical Mechanics by Goldstein, Pearson Publications.

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2	Classical Mechanics by Landau and Lifshitz, Reed educational and Professional Publishing Ltd.
3	Classical Mechanics by A. Raichoudhary, Oxford University Press, USA.
4	Classical Mechanics by J.M. Finn, Laxmi Publications.
5	Classical Mechanics by J.C. Upadhyaya, Himalaya Publishing House.
6	Classical mechanics by T. Kibble &F.H. Berkshire, Imperial College Press.

Paper II Quantum Mechanics

Learning Objectives: The objective of the course is to provide students with a comprehensive understanding of Quantum mechanics. The course aims to develop their knowledge and skills in analyzing and solving problems related to these topics, using appropriate mathematical formalism and physical concepts with advanced problems in Quantum mechanics.

Learning Outcomes: On completion of the course the student will be able to understand the Dirac notations with postulates, essential relation of Quantum mechanics and how they are helpful in coordinate representation. Student will also understand about the the time independent perturbation, symmetries and angular momentum and also about the Hamiltonian matrix with different applications.

Course Title:	**Title of the Course: Quantum Mechanics**	**Course Code: 24MPH9102T**
Total Lecture hour 52		**Hours**
Unit I	Hilbert space and Wave functions: Bases, Dimension, Subspaces, Dual spaces, Inner product spaces. Dirac notation, Orthonormality and Completeness. Linear operators, Matrix representations, Change of basis, Eigenvalues and Eigen Kets, Degeneracy, Commutation relations, uncertainty relation, Position operator and position eigen Kets, momentum operator and momentum eigen Kets. Wave functions in position and momentum space.	**13**
Unit II	Time-Evolution of the System's state, Eigen Kets and Energy Value problems (particle in a box, harmonic oscillator), potential barrier, quantum mechanical tunnelling and alpha decay, the Hydrogen atom problem, the Ehrenfest theorem, coherent states, the classical limit.	**13**

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Unit III	Time independent perturbation theory: Non degenerate and degenerate and its applications (weak field and strong field cases), Variational method and its use in the calculation of ground state and excited state energy, time dependent perturbation theory and Fermi's golden rule, selection rules, System of identical Particles, Pauli exclusion principle, spin statistics, WKB approximation method for 1-D problems.	**13**

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Unit IV	Angular Momentum Operators and their Eigen Values, Matrix representations of the angular momentum operators and their eigenstates, Coordinate representations of the orbital angular momentum operators and their eigen states (spherical harmonics), Addition of angular momentum, Clebsch-Gordon coefficients,Pauli matrices and spinors.	13

Reference Books:

1	Quantum Mechanics: A Modern Approach by Ashok Das and A. C. Melissinos, Gordon and Breach Science Publishers.
2	Quantum Mechanics by P.A.M. Dirac, Oxford University Press.
3	Quantum Mechanics by E. Merzbacher, second Edition, John Wiley & Sons.
4	Quantum Mechanics: Relativistic theory by L.P.Landau and E.M. Lifshitz, Pergamon press.
5	Quantum Mechanics : Theory and Applications by A. Ghatak and S. Loknathan, Third edition, Mac. Millan India Ltd.
6	Nouredine Zettili, Quantum Mechanics Concepts and Applications, Wiley.
7	David J Griffiths, Introduction to Quantum Mechanics, Printice Hall.

Paper III Classical Electrodynamics

Learning Objectives: The objective of the course is to provide students with a comprehensive understanding of Classical electrodynamics. The course aims to develop their knowledge and skills in analyzing and solving problems related to these topics, using appropriate mathematical formalism and physical concepts with advanced problems in Classical electrodynamics.

Learning Outcomes: On completion of the course the student will be able to understand the basics of electrodynamics like method of point charges, Gauss law, Poisson' and Laplace equations. He will also get knowledge about multipole expansions, Maxwell equations, Propagation of EM waves in different mediums and about the EM radiation produced by moving charge, Electromagnetic field tensor.

Course Title:	**Title of the Course: Classical Electrodynamics**	**Course Code: 24 MPH9103T**
Total Lecture hour 52		
		Hours

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Unit I	Coulomb's law, concept of fields, Gauss's law and its applications, electrostatic energy, Poisson and Laplace equations, The Method of Images; Point charge in the presence of a grounded conducting sphere , point charge in the presence of a charged insulated conducting sphere, point charge near a conducting sphere at a fixed potential, conducting in a uniform electric field by method of images , Green's function method, boundary value problems	**13**

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Unit II	Multipole expansion, Biot-Savart law, differential equation for static magnetic field, vector potential, magnetic field from localized current distributions. Maxwell's equations in different mediums, boundary conditions on the fields at interfaces, Vector and Scalar potentials in electrodynamics, gauge invariance and gauge fixing, Coulomb and Lorentz gauges. Displacement current. Electromagnetic energy and momentum, Poynting Theorem. Conservation laws.	13
Unit III	Electromagnetic waves in free space, in dielectric medium; reflection and refraction at interfaces. Fresnel's Formula, Change of phase on reflection, Polarization on reflection and Brewster's law, Total Internal reflection. Wave equation in conducting medium, reflection and transmission at metallic surface, skin effect and skin depth. Frequency dispersion in dielectrics and metals. Dielectric constant and anomalous dispersion. Wave propagation in one dimension, group velocity. Wave guides, propagation modes in waveguides, resonant modes in cavities. Dielectric waveguides.	13
Unit IV	Dynamics of charged particles in static and uniform electromagnetic fields, EM Field of a localized oscillating source. Fields and radiation in dipole and quadrupole approximations. Antenna; Radiation by moving charges, Lienard-Wiechert potentials, total power radiated by an accelerated charge, Lorentz formula. Electromagnetic field tensor, transformation of four potentials and currents, tensor dissipation of Maxwell's equations.	13

Reference Books:

1	Classical Electrodynamics, by J.D. Jackson, Wiley India Pvt.
2	Introduction to Electrodynamics, by D.J. Griffiths, Cambridge University Press, Fourth Edition
3	Classical theory of Electrodynamics, by Landau and Lifshitz
4	Electrodynamics of continuous media, by Landau and Lifshitz
5	Electromagnetic Fields and Waves, by P. Lorrain, and D. Corson, CBS Publishers
6	Principles of Electromagnetism, by Matthew N. O. Sadiku, S.V. Kulkarni, Oxford University Press; Sixth edition
7	Electromagnetic Waves, by R K Shevgaonkar, McGraw Hill Education; first Edition

Paper IV Practical

Course Code: 24MPH9104P

Learning Objectives: The objective of the course in practical physics is to provide students with a comprehensive understanding of Practical Physics. The course aims to develop their knowledge and skills in developing experimental physics. This will help to improve their interests in experimental domain.

Learning Outcomes: Through the experiments, students will develop their practical skills in experimental techniques, data collection, analysis and interpretation. They will also enhance their understanding of fundamental concepts and principles in physics lab. The lab experience foster critical thinking, problem solving abilities and application of theoretical knowledge to real world scenarios.

The inclusion of new experiments should be approved by the Convener, Board of studies before starting the academic session. It is essential to have an experimental setup of at least ten experiments listed below.

In case of number of experiments performed is less than eight, his marks shall be scaled down in the final examination.Laboratory examination paper will be set by external examiner out of eight or more experiments available at the center.

List of Experiments (any Ten) :

1. To design a single stage amplifier of a given voltage gain and lower cut of frequencies.
2. To determine Lo. Co. and Rf of a given coil and to study the variations of Rf with frequency.
3. To design a RC coupled two stage amplifier of a given gain and the cut off frequencies.
4. To study Hartley oscillator.
5. To Study Transistor bias Stability.
6. To design a Multivibrator of given frequency and study its wave shape.
7. To study the characteristics of FET and use it 0 design an relaxation oscillator and measure itsfrequency.
8. To study the characteristics of an operational amplifier.
9. To study the characteristics of a UJT and use it to design a relaxation oscillator and measure itsfrequency.
10. To study the addition, integration and differentiation properties of an operational amplifier.
11. Determine Planck constant using solar Cell.
12. To determine Planck constant and work function by a photo-cell.
13. To study regulated power supply using (A) Zener diode only (b) Zener diode with a series transistor (c) Zener diode with a shunt transistor.
14. To verify Fresnel's formula;
15. To study the percentage regulation and variation of Ripple factor, with load for a full wave rectifier.
16. To study analog to digital and digital to analog conversion.
17. To study a driven mechanical oscillator.
18. To verify Hartmann's formula using constant deviation spectrograph.
19. To find e/m of electron using Zeeman effect.
20. To find Dissociation energy to I.
21. Study of CH Bands.
22. Salt Analysis / Raman effect (Atomic).
23. Design and study of pass filters.
24. Michelson Interferometer.
25. Fabry perot Interferometer.
26. Determination of velocity of Ultrasonic waves.
27. Study of Elliptically polarised light by Babinet Compensator.
28. Veafication of Cauchy's Dispersion relation.

Study of DC gate control characteristics and Anode current characteristics of SCR

Paper V Elective 01 Numerical Methods & Computer fundamentals

Learning Objectives: The objective of the course is to provide students with a comprehensive understanding of Numerical analysis and computer fundamentals. The course aims to develop their knowledge and skills in analyzing and solving problems related to these topics, using appropriate mathematical formalism and physical concepts with advanced problems in Numerical analysis and computer fundamentals.

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Learning Outcomes: On completion of the course the student will be able to understand about different errors in numerical analysis, different interpolations, direct and indirect iterative methods, solution of nonlinear equations, different approximation methods to solve problems and also about the basics of computer fundamentals which will be more helpful.

Course Title:	**Title of the Course:** Numerical Methods & Computer fundamentals	
Total Lecture hour 52		**Course Code: 24MPH9105T**
		Hours
Unit I	Errors in numerical analysis: Source of error, Round off error, Computer Arithmetic, Error Analysis,Condition and stability, Approximation, Functional and Error analysis, the method of undetermined coefficients. Use of interpolation formula, Iterated interpolation. Inverse interpolation, Hermite interpolation and Spline interpolation, Solution of Linear equations, Direct and Iterative methods, Calculation of eigen value and eigen vectors for symmetric matrices.	**13**
Unit II	Solution of Nonlinear equation: Bisection method, Newton's method, modified Newton's method, method of Iteration, Newton's method and method of iteration for a system of cosuation Newton'smethod for the case of complex roots.	**13**
Unit III	Integration of a function: Trapezoidal and Simpson's rules. Gaussian quadrature formula, Singularintegrals, Double integration. Integration of Ordinary differential equation: Predictor - corrector methods, Runga-Kutta method,Simultaneous and Higher order equations Numerical Integration and Differentiation of Data, Least-Squares Approximations, FastFourier Transform.	**13**
Unit IV	Some elementary information about Computer: CPU, Memory, Input/ Output devices, Super, Miniand Micro systems, MS-DOS operating system, High Level Languages, Interpreter and Compiler. Programming: Algorithm and Flowchart.	**13**

Reference Books:

1	A Ralston and P. Rabinowitz, A First Course in Numberical analysis Mc Graw Hill (1985)
2	S.S. Sastry, Introductory Methods of Numerical Analysis. Prentice hall of India (1979).
3	Numerical analysis by P.Kandasamy and et. Al., S. Chand and Company

Paper V Elective 02 Laser Physics

Learning Objectives: The objective of the course is to provide students with a comprehensive understanding of Lasers in Physics. The course aims to develop their knowledge and skills in analyzing and solving problems related to these topics, using appropriate mathematical formalism and physical concepts.

Learning Outcomes: On completion of the course the student will be able to understand about Laser and Laser rate equations. It also helps them to understand about the concepts and usefulness of optical fibres and different phenomena.

Course Title:	**Title of the Course**	**Course Code: 24MPH9106T**
Total Lecture hour 52		**Hours**
Unit I	Introduction, Physics of interaction between Radiation and Atomic systems including: Stimulated emission, emission line shapes and dispersion effects Einstein coefficients; Line shape function, Line-broadening mechanisms, Condition for amplification by stimulated emission, the meta-stable state and laser action. 3-level and 4-level pumping schemes.	**13**
Unit II	Laser Rate Equations: Two-, three- and four level laser systems, condition for population inversion, gain saturation;Carrier wave communication and necessity of communication at optical frequencies Introduction to optical fibers, concepts of core and cladding, necessity of cladding structure, Total internal reflections, evanescent wave, penetration depth and propagation concept of evanescent waves	**13**
Unit III	Type of optical fibers, glass fibers, plastic cladded silica fibers, single mode and multi-mode optical fibers, index Profiles of the optical fibers step index and graded index core optical fibers. Numerical aperture, Experimental technique to measure numerical aperture of the optical fiber ,Ray paths and pulse dispersion in optical waveguides, Ray paths in homogeneous and square law profiles	**13**
Unit IV	Calculation of dispersion in terms of relative core cladding refractive index parameter, Transit time calculation in step index and parabolic index waveguide, Material dispersion, material dispersion in pure and doped silica, Zero material dispersion wavelength (ZMDW)	**13**

Reference Books:

1	Principles of lasers by O. Svelto, Springer, Fifth Edition
2	Lasers by Anthony ESiegman, University Science Books; Revised Ed.
3	Lasers and Non-linear optics: B. B. Laud, Wiley
4	Lasers: Theory and Applications: K. Thyagarajan and A.K. Ghatak, Springer, First Edition (1981)
5	Introduction to Fiber Optics by John Crisp, Newnes, Third Edition (2007)
6	Fundamental of Photonics: B.E.A.Saleh and Teich, John Wiley & Sons; 1st edition

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Master of Physics

(CBCS) As per the NEP 2020 (Semester II)
w.e.f. the Academic Session 2024-25
Discipline: Physics
Faculty: Science

Paper I Research Methodology

Learning Objectives: The objective of the course is to provide basic understanding of how to pursue research and to learn research methods. It also provides understanding of methods of data collection and methods of analyzing them

Learning Outcomes: On completion of the course the student will be able to understand the basics of research which are very helpful for them for research purpose.

Course Title:	Title of the Course: Research methodology	CourseCode: 24MPH9201T
Total Lecture hour 52		Hours
Unit I	Introduction and definition of Research, characteristics of Research, Objectives of Research, Nature, and importance of Research, Research process, the difference between Research method and Research process, Scientific method, steps in Scientific method, Distinction between Scientific and Non-scientific method, Inductive and Deductive Logic.	13
Unit II	Types and methods of Research:- Introduction, Pure and Applied Research, Exploratory or Formulative Research, Descriptive Research, Diagnostic Research, Evaluation Studies, Action Research, Experimental Research, Historical Research, Surveys, Case study, Field studies, Research Design:- Introduction, Meaning & Definitions, Need and Importance, types of Research designs. Formulating of Research problem, Steps in Formulation of Research problem.	13
Unit III	Hypothesis:- Meaning, Significance of Hypothesis, types of Hypothesis, Sources of Hypothesis, Characteristics of Good Hypothesis. Sampling:- Basis, Advantages and Limitations of Sampling, Sampling Techniques, Probability, and Non- Probability Sampling methods.Sample design.	13
Unit IV	Methods and Techniques of Data collection:-Distinction between Primary and Secondary Data, Data Collection for Primary data. Processing of data.	13

Reference Books:

1	Srivastava, S. C.: Foundation of Social Research and Economics Techniques, Himalaya Publishing House
2	Sharma H.D. and Mukherji S. P.: Research Methods in Economics and Business, New York: The Macmillan Company.
3	Gerber R. and Verdoom, P.J.: Research Methods in Economics and Business, New York, The Macmillan Company, 1992.
4	Krishnaswami O.R.: Methodology of Research in Social Sciences, Himalaya Publishing House

5	Courtis J.K. (ed.) Research and Methodology in Accounting & Financial Management

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Paper II Electronics

Learning Objectives: The objective of the course is to provide students with a comprehensive understanding of advanced Electronics. The course aims to develop their knowledge and skills in analyzing and solving problems related to these topics, using appropriate mathematical formalism and physical concepts.

Learning Outcomes: On completion of the course the student will be able to understand the different applications of Semiconductor devices, Oscillators, Transistors, Operational amplifier, Differential amplifiers. He/She becomes able to understand about the multivibrators, Combinational circuits, Sequential circuits. This will help them a lot in research field of electronics and communication.

Course Title:	**Title of the Course:** Electronics	**Course Code:** 24MPH9202T
Total Lecture hour 52		**Hours**
Unit I	Semiconductor devices: p-n junction diodes and its I-V characteristics, clipper and clamper circuits, Field effect devices: JFET and MOSFET transistors, Bipolar Junction transistor: transistor as an amplifier, stability factor, Biasing of FET and BJT, switching action of a transistor, oscillator's devices using transistors: Colpitts, Hartley, RC phase shift, Wein bridge oscillators	13
Unit II	Differential amplifier: its structure and working, DC analysis, common mode- and differential-gain, CMRR, Operational amplifier (OP-amp): Block diagram of typical OP- amp, OP-amp characteristics, inverting and non-inverting amplifiers. OP- amp with negative feedback: voltage series feedback -effect of closed loop gain, input resistance, bandwidth, and output offset voltage, voltage follower. Practical OP-amp: input offset voltage – input bias current-input offset current, total output offset voltage. OP-amp applications including summer, subtractor, multiplier, divider, integrating and differential circuits, Instrumentation amplifier, log and antilog amplifiers, op-amp as comparator, Schmitt trigger.	13
Unit III	Multivibrators using transistors: Astable, Monostable and Bistable multivibrators, Basic idea of IC 555 timer and its applications as multivibrators and square wave generator. Boolean algebra, de-Morgan's theorem, Karnaugh mapping, Simplification of logical functions using K- Map, Minterm, Maxterm, Adder, Subtractor, Combinational circuits: Comparator, Multiplexers, Demultiplexers, Decoders, Encoders.	13
Unit IV	Sequential circuits: flip-flops; S-R, J-K, T, D, Master-Slave. Counters: synchronous-asynchronous binary, modulus counters (MOD-3, MOD -6, MOD -10), Shift Registers, Basic D to A conversion: weighted resistor, DAC binary R-2R ladder, basic A to D conversion.	13

Reference Books:

1	Electronic Devices and Circuit theory, R. L. Boylestad, L. Nashelsky, Pearson publication.
2	Electronic Principles, A. P. Malvino, McGraw Hill.

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3	Digital Principles and Applications, A. P. Malvino, D. P. Leach, McGraw Hill publication

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4	OP-AMP and Linear Integrated Circuits, Ramakanth. A. Gayakwad, PHI.
5	Digital Circuits and design, S. Salivahanan, S. Arivazhagan, VPH.

Paper III Atomic & Molecular Physics

Learning Objectives: The objective of the course is to provide students with a comprehensive understanding of advanced Atomic & Molecular Physics. The course aims to develop their knowledge and skills in analyzing and solving problems related to these topics, using appropriate mathematical formalism and physical concepts.

Learning Outcomes: On completion of the course the student will be able to understand the different approximation methods to find out stationary states or the solution of Schrodinger equation. It helps them to understand the concept of Zeeman, Stark, Raman effect and also about different spectroscopy branches like Infrared, Microwave etc. I also make an understanding about the effect of magnetic moment and spin also.

Course Title:	**Title of the Course: Atomic & Molecular Physics**	**Course Code: 24MPH9203T**
Total Lecture hour 52		**Hours**
Unit I	Hydrogen Atom : Gross structure energy spectrum, probability distribution of radial and angular (l=1,2) wave ,functions (no derivation), effect of spin, relativistic correction to energy levels and fine structure, magnetic dipole interaction and hyperfine structure, the Lamb shift (only an qualitative description). Fine structure in alkali Spectra, Equivalent and non equivalent electrons.	**13**
Unit II	Interaction with External Fields: Normal Zeeman Effect, Anomalous Zeeman Effect, Paschen back effect, Stark Effect, Two electron systems, LS and JJ coupling, determination of nuclear spin and nuclear g factors, transition probabilities and line width, Doppler, natural collision and stark broadening.	**13**
Unit III	Spectroscopy: General features of the spectra of one and two electron system-singlet, doublet and triplet characters of emission spectra, general features of Alkali spectra, rotation andvibration band spectrum of a molecule, P,Q and R branches, Raman spectra for rotational and vibrational transitions, comparison with infra red spectra. General features of electronic spectra. Frank and Condon's principle.	**13**
Unit IV	General features of electronic spectra. Frank and Condon's principle.Electronic Spectra of Diatomic molecules, Electronic Spectra of poly atomic molecules, Molecular Photoelectron Spectroscopy, General Introduction -Resonance Spectroscopy, NMR Spectroscopy, ESR Spectroscopy.	**13**

Reference Books:

1	Elementary Atomic Structure, G. K. Woodgate , Second Edition Clarendon Press, Oxford.
2	T.A. Littlefield- Atomic and Molecular Physics.
3	Quantum Physics of Atoms. Molecules, Solids and Nuclear Particles by Eisberg and Resnik, Wiley and Sons.
4	Atomic Spectra by White, Mcgraw Hill
5	Molecular Spectra by Herzberg, Read Books.
6	Atomic & Molecular spectra by Rajkumar, LASER, KNRN Publishers.
7	Colin N. Banwell and Elaine M McCash, Fundamentals of Molecular Spectroscopy.

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Paper IV Practical Lab I&II

Course Code: 24MPY9204P

Learning Objectives: The objective of the course in practical physics is to provide students with a comprehensive understanding of Practical Physics. The course aims to develop their knowledge and skills in developing experimental physics. This will help to improve their interests in experimental domain.

Learning Outcomes: Through the experiments, students will develop their practical skills in experimental techniques, data collection, analysis and interpretation. They will also enhance their understanding of fundamental concepts and principles in physics lab. The lab experience foster critical thinking, problem solving abilities and application of theoretical knowledge to real world scenarios.

The inclusion of new experiments should be approved by the Convener, Board of studies before starting the academic session. It is essential to have an experimental setup of at least ten experiments listed below. In case of number of experiments performed is less than eight, his marks shall be scaled down in the final examination.Laboratory examination paper will be set by external examiner out of eight or more experiments available at the center.The experiments performed in semester I should not be included in Semester II.

List of Experiments (Any Ten) :

1. To design a single stage amplifier of a given voltage gain and lower cut of frequencies.
2. To determine Lo. Co. and Rf of a given coil and to study the variations of Rf with frequency.
3. To design a RC coupled two stage amplifier of a given gain and the cutoff frequencies.
4. To study Hartley oscillator.
5. To Study Transistor bias Stability.
6. To design a Multivibrator of given frequency and study its wave shape.
7. To study the characteristics of FET and use it 0 design an relaxation oscillator and measure its frequency.
8. To study the characteristics of an operational amplifier.
9. To study the characteristics of a UJT and use it to design a relaxation oscillator and measure its frequency.
10. To study the addition, integration and differentiation properties of an operational amplifier.
11. Determine Planck constant using solar Cell.
12. To determine Planck constant and work function by a photo-cell.
13. To study regulated power supply using (A) Zener diode only (b) Zener diode with a series transistor (c) Zener diode with a shunt transistor.
14. To verify Fresnel's formula.
15. To study the percentage regulation and variation of Ripple factor, with load for a full wave rectifier.
16. To study analog to digital and digital to analog conversion.
17. To study a driven mechanical oscillator.
18. To verify Hartmann's formula using constant deviation spectrograph.
19. To find e/m of electron using Zeeman effect.
20. To find Dissociation energy to I.
21. Study of CH Bands.
22. Salt Analysis / Raman effect (Atomic).
23. Design and study of pass filters.

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24. Michelson Interferometer.
25. Fabry perot Interferometer.
26. Determination of velocity of Ultrasonic waves.
27. Study of Elliptically polarised light by Babinet Compensator.
28. Verification of Cauchy's Dispersion relation.
29. Study of DC gate control characteristics and Anode current characteristics of SCR.

Paper V Elective 01 Nanotechnology

Learning Objectives: The objective of the course is to provide students with a comprehensive understanding of Nanotechnology. The course aims to develop their knowledge and skills in analyzing and solving problems related to these topics, using appropriate mathematical formalism and physical concepts with advanced problems in Nanotechnology.

Learning Outcomes: On completion of the course the student will be able to understand the Classifications of nanostructures and about the nucleation and growth process of nanoparticles.He also get knowledge about different synthesis processes of nanostructure materials with their application in different fields

Course Title:	**Title of the Course:** Nanotechnology	**Course Code:** 24MPH9205T
Total Lecture hour 52		
Unit I	**Nanoscale Systems: Introduction and classification of nanostructures,** Length, energy, and time scales - Quantum confinement of electrons in semiconductor nanostructures: Quantum confinement in 3D, 2D, 1D and zero dimensional structures-Size effect and properties of nanostructures- Landauer - Buttiker formalism for conduction in confined geometries - Top down and Bottom up approach.	**Hours** 13
Unit II	**Basics & Synthesis process:** Excitons and excitonic Bohr radius – difference between nanoparticles and quantum dots - Preparation through colloidal methods - Epitaxial methods- Chemical vapour deposition (CVD. PECVD, MOCVD) **Synthesis process:** MBE growth of quantum dots spectroscopy of Quantum Dots: Absorption and emission spectra - photo luminescence spectrum -optical spectroscopy- linear and nonlinear optical spectroscopy	**13**
Unit III	**Synthesis of Nanostructure Materials:** Gas phase condensation –Vacuum deposition -Physical vapor deposition (PVD), Vacuum evaporation, e-beam evaporation, sputtering (DC, RF, Magnetron Sputtering) — laser ablation, Sol-Gel- Ball milling ,Electrodeposition electro less deposition, spray pyrolysis, hydrothermal synthesis.	**13**
Unit IV	**Nanotechnology Applications:** Applications of nanoparticles, quantum dots, nanotubes and nanowires for nanodevice fabrication – Single electron transistors, coulomb blockade effects in ultra-small metallic tunnel junctions - nanoparticles based solar cells and quantum dots based white LEDs – CNT based transistors	**13**
Reference Books:		

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1	Hand book of Nanoscience, Engineering and Technology (The Electrical Engineering handbook series), Kluwer Publishers.
2	"Sol-Gel Science", C.J. Brinker and G.W. Scherrer, Academic Press, Boston
3	Nanoscale characterization of surfaces & interfaces, N John Dinardo, Weinheim Cambridge: Wiley-VCH.

Paper V Elective 02 Mathematical Physics

Learning Objectives: The objective of the course is to provide students with a comprehensive understanding of advanced Mathematical methods in Physics. The course aims to develop their knowledge and skills in analyzing and solving problems related to these topics, using appropriate mathematical formalism and physical concepts.

Learning Outcomes: On completion of the course the student will be able to understand the Coordination transformation, covariant differentiation, Group transformation with crystallographic point groups. It also helps them to understand about the concepts and usefulness of Laplace and Fourier transformation.

Course Title:	**Title of the Course: Mathematical Physics**	**Course Code: 24 MPH9205T**
Total Lecture hour 52		**Hours**
Unit I	Coordinate transformation in N-dimensional space: Contravriant and covariant tensor, Jacobian. Relative tensor, pseudo tensors (Example: change density, angu1ar momentum) Algebra of tensors, Metric theorem,Covariant differentiation. Ricci's theorem, Divergence, Curl and Laplacian in tensor form. Stress-andStrain tensors. Hook's law in tensor form. Lorentz Covariance of Maxwell equation. Elements of complex analysis, Analytic functions, Residues and evaluation of integrals	**13**
Unit II	Group of transformations. (Example: symmetry transformation of square), Generators of a finite group, Normal subgroup, Direct product of groups.. Isomorphism and Homomorphism. Representation theory of finite groups, Invariant subspace and reducible representations, irreducible representation, Crystallo-graphic point groups. Irreducible representation of C_{4v} Translation group and the reciprocal lattice	**13**
Unit III	Fourier Transforms: Development of the Fourier integral from the Fourier series, Fourier and inverse Fourier transform: Simple applications: Finite wave train, wave train with Gaussian amplitude, Fourier transform of Derivatives, Solution of wave equation as an application, Convolution theorem, intensity in term of spectral density for quasi-monochromatic EM waves, momentum representation. Application of Hydrogen Atom and Harmonic Oscillator problems. Application of Fourier Transform to Diffraction Theory; Diffraction pattern of one two slits	**13**
Unit IV	Laplace transforms, and their properties, Laplace transform of derivatives and integrals of Laplace transform, Laplace, Convolution theorem, Impulsive function Application of Laplace transform in solving liner differential	**13**

	equations with constant coefficient with variable coefficient and liner partial differential equation	

Reference Books:

1	Mathematical Methods for Physicists: George Arkfen (Academic Press).
2	Applied Mathematics for Engineers and Physicists: L. A. Pipe (McGraw Hill)
3	Mathematical Methods-Potter and Goldberg (Prentice Hall).
4	Elements of Group Theory for Physicists: A. W. Joshi (Wiley Eastern Ltd.)
5	Vector Analysis (Schaum Series) (Mc Graw Hill).

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