MEDI-CAPS UNIVERSITY

Faculty of Science

Credit Scheme for M. Sc. (Physics)

S. No.	Particulars	Credits
1	Maximum Credits that can be earned in a semester	30
2	Minimum Credits to be registered in a semester	04
3	Minimum Credits to be earned to pass out first year	36
4	Makeup Semester: Maximum credits which can be opted in Makeup semester out of the courses registered in that academic year (Previous odd and even semester)	18
5	Minimum total credits to be earned for awarding the degree	96
6	Maximum total credits which can be earned	120

MEDI-CAPS UNIVERSITY

DEPARTMENT OF PHYSICS

Master of Science

SEMESTER - I

Code	Course	L	T	P	Hrs.	Credits
PH5CO01	Mathematical Physics	4	0	0	4	4
PH5CO02	Classical Mechanics	4	0	0	4	4
PH5CO03	Quantum Mechanics-1	4	0	0	4	4
PH5CO04	Electronic Devices	4	0	0	4	4
PH5SE01	Application of Software Packages	2	0	0	2	2
PH5CO05	LAB - 1	0	0	4	4	2
PH5SE02	LAB - II	0	0	4	4	2
PH5SS01	Self Study	2	0	0	2	2
		20	**0**	**08**	**28**	**24**

PH5CO05	**LAB - I**	**Electronic Devices**
PH5SE02	**LAB - II**	**Applications of Software package – I (Office, Excel , Origin)**

SEMESTER - II

Code	Course	L	T	P	Hrs.	Credits
PH5CO06	Quantum Mechanics-II	4	0	0	4	4
PH5CO07	Statistical Mechanics	4	0	0	4	4
PH5CO08	Electrodynamics and Plasma Physics	4	0	0	4	4
PH5CO09	Atomic and Molecular Physics	4	0	0	4	4
PH5SE03	Professional Communication	2	0	0	2	2
PH5CO10	LAB – III	0	0	4	4	2
PH5SE04	LAB - IV	0	0	4	4	2
PH5SS02	Seminar -I	0	0	4	4	2
		18	**0**	**12**	**30**	**24**

PH5CO10	**LAB - III**	**Quantum Mechanics and Atomic Physics**
PH5SE04	**LAB - IV**	**Applications of Software package – II (MATLAB/Mathematica)**

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MEDI-CAPS UNIVERSITY

DEPARTMENT OF PHYSICS

Master of Science

SEMESTER - III

Code	Course	L	T	P	Hrs.	Credits
PH5CO11	Condensed Matter Physics	4	0	0	4	4
PH5CO12	Nuclear and Particle Physics	4	0	0	4	4
PH5EL**	**Departmental Specific - I**	4	0	0	4	4
PH5EL**	**Departmental Specific - II**	4	0	0	4	4
PH5CO13	LAB - V	0	0	4	4	2
PH5PC01	Mini Project	0	0	8	4	4
PH5SS03	Seminar -II	0	0	4	4	2
		16	**0**	**16**	**32**	**24**

PH5CO13	**LAB - V**	**Electronics / Nuclear Physics Laboratory**

SEMESTER - IV

Code	Course	L	T	P	Hrs.	Credits
PH5SE05	Computational Methods and Numerical techniques	4	0	0	4	5
PH5OE**	**Elective -I**	4	0	0	4	4
PH5EL**	**Departmental Specific-III**	4	0	0	4	4
PH5EL**	**Departmental Specific -IV**	4	0	0	4	4
PH5PC02	Project Report/Dissertation	0	0	16	16	8
		16	**0**	**16**	**32**	**24**

MEDI-CAPS UNIVERSITY

DEPARTMENT OF PHYSICS

Master of Science

Departmental Specific Course

Course Code	Course Name	Preferred Semester
PH5EL01	**Material Science**	**III**
PH5EL02	**Advanced Condensed Matter Physics**	**IV**
PH5EL03	Solid State Physics	III
PH5EL04	Advanced Solid State Physics	IV

Course Code	Course Name	Preferred Semester
PH5EL05	**Analog Electronics**	**III**
PH5EL06	**Digital Electronics**	**IV**
PH5EL07	Communication Electronics	III
PH5EL08	Microprocessor and Microcontroller	IV

Open Elective (OE) Paper

Course Code	Course Name	Preferred Semester
PH5OE01	**Nanomaterial and Nano science**	**IV**
PH5OE02	Optoelectronics	IV
PH5OE03	Nano electronics and Nanotechnology	IV
PH5OE04	Laser Physics and Applications	IV
PH5OE05	Fibre Optics and Applications	IV
PH5OE06	Material Synthesis and Characterization Techniques	IV

MEDI-CAPS UNIVERSITY

DEPARTMENT OF PHYSICS

Master of Science

Credit scheme for M.Sc. (Physics)

S. No.	Course Type	Range of total credit		Range of total credit		Model Scheme	
		Min.%	Max%	Min.	Max	%	Absolute
1.	Core (CO)	45	55	43	53	47.91	46
2.	Skill Enhancement (SE)	5	20	5	19	12.5	12
3.	Discipline Specific Elective (E*)	15	30	14	29	16.67	16
3.	Open Elective (E*)	1	10	1	10	4.16	04
4.	Project / Training (PC)	10	20	10	19	12.5	12
5.	Self study/Open learning/Seminar (SS)	1	8	1	8	6.25	06
					Total		96

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MEDI-CAPS UNIVERSITY

DEPARTMENT OF PHYSICS

Master of Science

Credit scheme for M.Sc. (Physics)

S.No.	Course Type	Total Credits (%) Model scheme	Range (in %)	Model Scheme (with suggested Additional)			I Semester			II Semester			III Semester			IV Semester		
			Credit	No. of courses	Credits	Hrs.	Course	Credits	Hrs.	Course	Credits	Hrs.	Course	Credits	Hrs.	Course	Credits	Hrs.
1.	Core(CO)	47.91	45-55	13	46	52	05	18	20	05	18	20	03	10	12	00	00	00
2.	Skill Enhancement (SE)	12.5	05-20	05	12	16	02	04	06	02	04	06	00	00	00	01	04	04
3.	Open Elective (O*)	4.16	01-10	01	04	04	00	00	00	00	00	00	00	00	00	01	04	04
4.	Discipline Specific Elective (E*)	16.67	15-30	04	16	16	00	00	00	00	00	00	02	08	08	02	08	08
5.	Project / Training (PC)	12.5	10-20	02	12	24	00	00	00	00	00	00	01	04	08	01	08	16
6.	Self-study / Open learning /MOOC (SS)	6.25	01-08	03	06	10	01	02	02	01	02	04	01	02	04	00	00	00
				28	96	122	08	24	28	08	24	30	07	24	32	05	24	32

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MEDI-CAPS UNIVERSITY

DEPARTMENT OF PHYSICS

Master of Science

Course Basket for M.Sc. (Physics) Program

Core Courses(CO)

S. No.	Course Code	Course Title	L	T	P	Credit	Hour	Preferred Semester
1.	PH5CO01	Mathematical Physics	4	0	0	4	4	I
2.	PH5CO02	Classical Mechanics	4	0	0	4	4	I
3.	PH5CO03	Quantum Mechanics-I	4	0	0	4	4	I
4.	PH5CO04	Basic Electronic Devices	4	0	0	4	4	I
5.	PH5CO05	LAB - I	0	0	4	2	4	I
6.	PH5CO06	Quantum Mechanics-II	4	0	0	4	4	II
7.	PH5CO07	Statistical Mechanics	4	0	0	4	4	II
8.	PH5CO08	Electrodynamics and Plasma Physics	4	0	0	4	4	II
9.	PH5CO09	Atomic and Molecular Physics	4	0	0	4	4	II
10.	PH5CO10	LAB – III	0	0	4	2	4	II
11.	PH5CO11	Condensed Matter Physics	4	0	0	4	4	III
12.	PH5CO12	Nuclear and Particle Physics	4	0	0	4	4	III
13.	PH5CO13	LAB - V	0	0	4	2	4	III
					Total	**46**	52	

Skill Enhancement Courses (SE)

S. No.	Course Code	Course Title	L	T	P	Credit	Hour	Preferred Semester
1.	PH5SE01	Application of Software Package	2	0	0	2	2	I
2.	PH5SE02	LAB - II	0	0	4	2	4	I
3.	PH5SE03	Professional Communication	2	0	0	2	2	II
4.	PH5SE04	LAB - IV	0	0	4	2	4	II
5.	PH5SE05	Computational Methods and Numerical Techniques	4	0	0	4	4	IV
					Total	**12**	16	

Open Elective Courses (OE)

S. No.	Course Code	Course Title	L	T	P	Credit	Hour	Preferred Semester
1.	PH5OE**	Elective -I	4	0	0	4	4	IV
					Total	**04**	04	

Project, Training , Dissertation courses (PC)

S. No.	Course Code	Course Title	L	T	P	Credit	Hour	Preferred Semester
1.	PH5PC01	Mini Project	0	0	8	4	08	III
2.	PH5PC02	Project Report/Dissertation	0	0	16	8	16	IV
					Total	**12**	24	

MEDI-CAPS UNIVERSITY

DEPARTMENT OF PHYSICS

Master of Science

Discipline Specific Elective Courses (E*)								
S. No.	Course Code	Course Title	L	T	P	Credit	Hour	Preferred Semester
1.	PH5EL**	Departmental Specific Course - I	4	0	0	4	4	III
2.	PH5EL**	Departmental Specific Course - II	4	0	0	4	4	III
3.	PH5EL**	Departmental Specific Course - III	4	0	0	4	4	IV
4.	PH5EL**	Departmental Specific Course - IV	4	0	0	4	4	IV
					Total	16	16	
Self-study/Open learning/MOOC(SS)								
1.	PH5SS01	Self Study	2	0	0	2	2	I
2.	PH5SS02	Seminar -I	0	0	4	2	4	II
3	PH5SS03	Seminar -II	0	0	4	2	4	III
					Total	06	10	
			Grand Total			96	122	

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MEDI-CAPS UNIVERSITY, INDORE

M.Sc. Physics

Scheme

Semester – I (ODD) **w. e. f. Nov 2020**

Code	Course	Core / Elective	Teaching Hours			Maximum Marks					Credits
						Theory		Practical		Total	
			L	T	P	Sessional	End Sem	Sessional	external		
PH5CO01	Mathematical Physics	Core	4	0	0	40	60	-	-	100	4
PH5CO02	Classical Mechanics	Core	4	0	0	40	60	-	-	100	4
PH5CO03	Quantum Mechanics-1	Core	4	0	0	40	60	-	-	100	4
PH5CO04	Electronic Devices	Core	4	0	0	40	60	-	-	100	4
PH5SE01	Application of Software Package	SE	2	0	0	40	60	-	-	100	2
PH5CO05	LAB - 1	Core	0	0	4	-	-	40	60	100	2
PH5SE02	LAB - II	SE	0	0	4	-	-	40	60	100	2
PH5SS01	Self Study	SS	2	0	0	-	-	-	-	100	2
			20	**0**	**8**	200	300	80	120	800	24

	LAB - I	**Electronic Devices**
	LAB - II	**Applications of Software package – I (Office and Excel and MATLAB Programming)**

MEDI-CAPS UNIVERSITY, INDORE

M.Sc. Physics

Scheme

Semester – II (EVEN)

Code	Course	Core / Elective	Teaching Hours			Maximum Marks					Credits
						Theory		Practical		Total	
			L	T	P	Sessional	End Sem	Sessional	external		
PH5CO06	Quantum Mechanics-II	Core	4	0	0	40	60	-	-	100	4
PH5CO07	Statistical Mechanics	Core	4	0	0	40	60	-	-	100	4
PH5CO08	Electrodynamics and Plasma Physics	Core	4	0	0	40	60	-	-	100	4
PH5CO09	Atomic and Molecular Physics	Core	4	0	0	40	60	-	-	100	4
PH5SE03	Professional Communication	SE	2	0	0	40	60	-	-	100	2
PH5CO10	LAB – III	Core	0	0	4	-	-	40	60	100	2
PH5SE04	LAB - IV	SE	0	0	4	-	-	40	60	100	2
PH5SS02	Seminar -I	SS	0	0	4	-	-	-	-	100	2
			18	0	12	200	300	80	120	800	24

	LAB – III	**Quantum Mechanics and Atomic Physics**
	LAB - IV	**Applications of Software package – II (Origin and Mathematica/ other basic research tool)**

MEDI-CAPS UNIVERSITY, INDORE

M.Sc. Physics

Scheme

Semester – III (ODD)

Code	Course	Core / Elective	Teaching Hours			Maximum Marks					Credits
						Theory		Practical		Total	
			L	T	P	Sessional	End Sem	Sessional	external		
PH5CO11	Condensed Matter Physics	Core	4	0	0	40	60	-	-	100	4
PH5CO12	Nuclear and Particle Physics	Core	4	0	0	40	60	-	-	100	4
PH5EL**	Departmental Specific Elective - I	DSE	4	0	0	40	60	-	-	100	4
PH5EL**	Departmental Specific Elective - II	DSE	4	0	0	40	60	-	-	100	4
PH5CO13	LAB - V	Core	0	0	4	-	-	40	60	100	2
PH5PC01	Mini Project	PC	0	0	8	-	-	40	60	100	4
PH5SS03	Seminar -II	SS	0	0	4	-	-	-	-	100	2
			16	**0**	**16**	160	240	80	120	700	24

	LAB - V	**Electronics / Nuclear Physics Laboratory**
	Mini Project	**Related to any topic which should be carrying forward to next semester for Major Project.**

MEDI-CAPS UNIVERSITY, INDORE

M.Sc. Physics

Scheme

Semester – IV (EVEN)

Code	Course	Core / Elective	Teaching Hours			Maximum Marks					Credits
						Theory		Practical		Total	
			L	T	P	Sessional	End Sem	Sessional	external		
PHSSE05	Computational Methods and Numerical Techniques	SE	4	0	0	40	60	-	-	100	4
PHSOE**	Elective Paper-4	OE	4	0	0	40	60	-	-	100	4
PHSEL**	Departmental Specific Elective - III	DSE	4	0	0	40	60	-	-	100	4
PHSEL**	Departmental Specific Elective - IV	DSE	4	0	0	40	60	-	-	100	4
PHSPC02	Major Project	PC	0	0	16	-	-	100	100	200	8
			16	0	16	160	240	100	100	600	24

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MEDI-CAPS UNIVERSITY, INDORE

M.Sc. Physics

Scheme

Departmental Specific Elective (DSE) Paper

PH5EL01	Material Science	PH5EL05	Analog Electronics
PH5EL02	Advanced Condensed Matter Physics	PH5EL06	Digital Electronics
PH5EL03	Solid State Physics	PH5EL07	Microprocessor and Microcontroller
PH5EL04	Advanced Solid State Physics	PH5EL08	Electronics Communication

Any four papers should be obtained as Departmental Specific Elective (DSE) Course.

Open Elective (OE) Paper

PH5OE01	Nanomaterial and Nano science
PH5OE02	Optoelectronics
PH5OE03	Nano electronics and Nanotechnology
PH5OE04	Laser Physics and Applications
PH5OE05	Fibre Optics and Applications
PH5OE06	Material Synthesis and Characterization techniques

MEDI-CAPS UNIVERSITY, INDORE

DEPARTMENT OF PHYSICS

M. Sc. Physics

Course Code	Course Name	Hours per week			Total Hrs	Total Credits
		L	T	P		
PH5CO01	**MATHEMATICAL PHYSICS**	4	0	0	4	4

UNIT -I Matrices: Definitions and types of matrices; Solution of linear algebraic equations; Characteristic equation and diagonal form; Eigen values and Eigen vectors; Cayley - Hamilton theorem; Functions of matrices; Application in solving linear differential equation.

UNIT –II Differential Equation: Linear Differential equation of first order; Linear differential equations with constant coefficient; Summary of Frobenius method, Exact equation, Inhomogeneous linear equation, Differential equation with exact solution.

UNIT-III Complex Analysis: Function of complex variables; Cauchy-Riemann differential equations; Cauchy"s integral theorem, Cauchy"s integral formula; Taylor"s Series, Laurent series; Cauchy residue theorem; Singular points of an analytical function; Evaluation of residues & definite integrals.

UNIT- IV Special Functions Differential Equations: Differential Equations and Special Functions, Beta and Gamma functions; Second ordered linear differential equations with variable coefficients; Solution of Hyper-geometric, Legendre, Bessel, Hermite and Laguerre equations; Physical applications; Generating functions; Recursion relations.

UNIT-V Fourier series and Transforms: Fourier series; Fourier integrals and transform; FT of Delta functions; Convolution theorem; Parseral"s identity; Applications to the solution of differential equations, Laplace Transform and its properties; Applications to the solution of differential equations

Text Book

1. Dass, H. K., Mathematical Physics; S. Chand New Delhi 1997 .
2. Rajput, B.S., Mathematical Physics; Pragati Meerut 2019
3. Gupta B D , Mathematical Physics; Vikas Pub New Delhi 2010
4. Kreyszig, Erwin, Advanced Engineering Mathematics; John Wiley Publication New Delhi 2001

Reference Book

1. Charlie Harper, Introduction To Mathematical Physics; Phi New Delhi 2010
2. Ghatak, A K , Mathematical Physics; Mcmillan India New Delhi 1995
3. Arfken & Weber, Mathematical Methods For Physicist, Academic Press- N.Y.
4. Riley, K. F., Mathematical Methods for Physics and Engineering; Cambridge University Press New Delhi, 2006
5. Brown, J. W., Fourier Series And Boundary Value Problems; TMH Singapore 2001
6. Brown, J. W., Complex Variables And Applications; TMH New Delhi. Tmh. 2014
7. Joshi, A. W. Matrices And Tensors In Physics; New Edge New Delhi 2000

MEDI-CAPS UNIVERSITY, INDORE

DEPARTMENT OF PHYSICS

M. Sc. Physics

Course Code	Course Name	Hours per week			Total	Total
		L	T	P	Hrs	Credits
PH5CO02	CLASSICAL MECHANICS	4	0	0	4	4

UNIT-I: Preliminaries of classical mechanics: Newtonian mechanics - one and many particle systems; Conservation laws; Work energy theorem; Open system (with variable system) constraints and their classification; D'Alembert principle; Generalized coordinates.

UNIT-II: Central Forces: Reduction to one body problem; equation of motion and first integral; one dimensional problem and classification of orbits; Kepler"s laws and planetary motion; Scattering in central force field; Transformation to laboratory frames.

UNIT–III: Rigid Body and Vibrating System: Euler angles; Tensor of inertia; Kinetic energy of a rotating body; Symmetric top and Applications; Vibrating string; Solution wave equation; Normal vibrations; Dispersion; Coupled vibrating system.

UNIT-IV: Hamiltonian Formulation: Legendre transformation; Hamiltonian equation of motion; cyclic coordinates; Phase space and Liouville's theorem; Poisson bracket.

UNIT-V: Special Theory of Relativity: Inertial and Non- inertial Frames, Michelson-Morley Experiment, Postulates of Special Theory of Relativity, Galilean and Lorentz Transformation, Length Contraction and Time Dilation, Addition of Velocities, Mass Energy Equivalence and Variation of Mass with Velocity.

Text Book

1. N C Rana And P S Joag, Classical Mechanics, Tata Mcgraw-Hill, 1991.
2. Takwale, Introduction To Classical Mechanics, TMH New Delhi, 1997.
3. Rao K Sankara, Classical Mechanics, PHI New Delhi, 2009.
4. R. N. Tiwari, Classical Mechanics, PHI New Delhi, 2009.
5. Gupta S. L., Classical Mechanics, Pragati Prakashan Meerut , 2011.

Reference Book

1. Goldstein, Classical Mechanics, Publication: Pearson Delhi, 2002.
2. Somerfield, Mechanics, Academic Press, 1952.
3. I Perceival And 0 Richards, Introduction To Dynamics, Cambridge Univ. Press, 1982.
4. Landau L. D., Mechanics, Butterworth Publication, 1998.

MEDI-CAPS UNIVERSITY, INDORE
DEPARTMENT OF PHYSICS
M. Sc. Physics

Course Code	Course Name	Hours per week			Total	Total
		L	T	P	Hrs	Credits
PHSCO 03	QUANTUM MECHANICS I	4	0	0	4	4

UNIT I: Schrödinger Equation: Empirical basis; de-Broglie hypothesis of matter waves; Heisenberg's uncertainty relation; Schrodinger's wave equation; Physical interpretation and conditions on wave function; Eigenvalues and Eigen-functions; Particle in a square-well potential; Tunneling through a barrier.

UNIT II: Operators and Eigen-functions: Linear operator; Orthogonal systems and Hilbert space; Expansion in Eigen-functions; Hermitian operators; Fundamental commutation rule; Commutations and uncertainty principle; state with minimum uncertainty.

UNIT III: Solvable Problems: Harmonic oscillator; Operator method; Schrödinger equation for spherically symmetric potentials; Angular momentum operator; condition on solutions and Eigen-values; Spherical harmonics; Rigid rotor; Radial equation of central potential; Hydrogen atom; Degenerate states

UNIT IV: Angular Momentum and Spin: Eigen-values of angular momentum J, Matrix representation of J; electron spin; Zeeman effect; Addition of angular momentum; Clebsch- Gordan coefficients; Identical particles with spin

UNIT V: Scattering Theory and Approximation Methods: Scattering cross-section; Born Approximation; partial wave analysis; Differential and total cross, sections; phase shifts; exactly soluble problems; Mutual scattering of two particles; Perturbation theory and variation method

Text Book

1. Griffiths, Introduction to Quantum Mechanics, Pearson New Delhi, 2005.
2. Ghatak Ajoy, Quantum Mechanics, Macmillan New Delhi, 2004.
3. Prakash Satya, Advanced Quantum Mechanics, Pragati Meerut, 1999.
4. R. K. Srivastava, Quantum Mechanics, PHI New Delhi, 2007.

Reference Book

1. Schiff L., Quantum Mechanics; TMH New Delhi, 2010.
2. Jain Mahesh C., Quantum Mechanics; PHI New Delhi, 2011.
3. Aruldas, Quantum Mechanics; PHI New Delhi, 2011.
4. Sakurai, Modern Quantum Mechanics; Pearson New Delhi, 2009.
5. Mathews P. M., Quantum Mechanics; TMH New Delhi, 2009.

MEDI-CAPS UNIVERSITY, INDORE

DEPARTMENT OF PHYSICS

M. Sc. Physics

Course Code	Course Name	Hours per week			Total Hrs	Total Credits
		L	T	P		
PH5CO 04	**ELECTRONIC DEVICES**	4	0	0	4	4

UNIT - I: Network Analysis: Kirchhoff's laws; Thevenin & Norton theorems; Superposition; Reciprocity; Compensation theorems; Source transformation; Delta and Star transformations; Laplace Transformation; Convolution integral.

UNIT – II: Semiconductor Devices: Basic principles of transistor operation; Biasing; Characteristics of BJT and JFET; MOSFET: Enhancement and depletion modes of operation.

UNIT –III: Amplifiers and Oscillators: Low frequency and high frequency and Power amplifiers using transistors; Sine wave generators; Wien bridge and phase shift oscillators; Multi-vibrator circuits; Triangle and square wave generation; NE 555timer and applications.

UNIT –IV: Operational Amplifiers: Ideal operational amplifier: Characteristics; Feedback types; Applications: Basic scaling circuits, current to voltage and voltage to current conversion; Sum and difference amplifiers; Integrating and differentiating circuits; A.C. Amplifiers; Filters.

UNIT –V: Digital Circuits: Logic gates; Half adder; Full adder; Comparators; Decoders; Multiplexers; Demultiplexers; Design of combinational circuits; Sequential circuits; Flip Flops; Counters; Registers; A/D and D/A conversion characteristics

Text Book

1. Millman J., Electronic Devices and Circuits, TMH New Delhi, 2008.
2. Boylestad R. L., Electronic Devices and Circuit Theory, PHI New Delhi, 2006.
3. Mehta V. K., Principles of Electronics, S Chand New Delhi, 2010.
4. Jain R. P., Modern Digital Electronics, TMH New Delhi, 2010.
5 Thareja B. L., A Textbook of Electrical Technology Volume I – Basic Electrical Engineering, S. Chand New Delhi, New Multi-colour Edition

Reference Book

1. Gaikwad, Op-Amps and Linear Integrated Circuits, PHI New Delhi, 2000.
2 Tocci, Ronald J., Principles and applications, Pearson New Delhi, 2013.
3. Albert Malvino, Problems and Solutions in Basic Electronics, TMH New Delhi, 2011.
4. Ryder, John D, Network Lines and Fields, PHI New Delhi, 2002.

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DEPARTMENT OF PHYSICS
M. Sc. Physics

Course Code	Course Name	Hours per week			Total	Total
		L	T	P	Hrs	Credits
PH5SE05	APPLICATION OF SOFTWARE PACKAGE	2	0	0	2	2

UNIT - I: Use of office for research purpose, formatting tools, formatting of a document, use of equation editor in word, Creating, editing, saving and printing text documents, Font and paragraph formatting, Simple character formatting, Inserting tables, smart art, page breaks, Using lists and styles, Working with images, Using Spelling and Grammar check, Understanding document properties, Mail Merge. details on open office.

UNIT – II: Spreadsheet basics, Creating, editing, saving and printing spreadsheets, Working with functions & formulas, Modifying worksheets with color & autoformats, Graphically representing data: Charts & Graphs, Speeding data entry: Using Data Forms, Analyzing data, Data Menu, Subtotal, Filtering Data, Formatting worksheets, Securing & Protecting spreadsheets

UNIT –III: Power point presentation: Getting acquainted with power point, creating basic presentation, using presentation views, using text, clip arts, smart art, slide show view, applying animation, drawing objects, inserting video and sound, using themes, setting up presentation, applying actions, inserting charts, tables and objects. PDF files, making of PDF

UNIT –IV: Origin: working with origin software, user interface, importing documents, data manipulation. Graphing: 2D, 3D plot, adding data to existing graph, Fitting, Peaks and baseline, statistics, automation.

UNIT –V: Getting start with Matlab, introduction, MATLAB basics, features, matrices and vectors, built in functions, plotting through MATLAB, M- files: script and functions, loops, polynomial in MATLAB, system of equations

Text Book

1. Saxena Sanjay, First Course in Computers, Vikas Pub. House, New Delhi, 2010.
2. Frye Curtis,Microsoft Step By Step, PHI New Delhi, 2010.
3. Rudra Pratap, MATLAB, Oxford New York, 2006.
4. Murray, Microsoft Office 2010 Plain Simple, PHI New Delhi, 2010.

Reference Book

1. Walkenbach John, Microsoft Office 2010 Bible, Wiley India New Delhi, 2010.
2. Walkenbach John, Microsoft Excel 2010 Bible, Wiley India New Delhi,2010.
3. Pratap,Rudra,Getting Started With Matlab 7, Oxford, New Delhi, 2004.
4. Mallick Partha S.Matlab And Simulink , Scitech Publication, 2006.
5. Joseph Manzo, How to use Microsoft excel, The Saylor foundation 2000.

Online link

https://www.originlab.com/doc

https://www.originlab.com/index.aspx?go=Support&pid=1046

MEDI-CAPS UNIVERSITY, INDORE

DEPARTMENT OF PHYSICS

M. Sc. Physics

Course Code	Course Name	Hours per week			Total Hrs	Total Credits
		L	T	P		
PH5CO05	LAB I	0	0	4	4	2

SEMESTER – I (ODD)

LAB I (Electronic Devices)

1. Design and study of regulated power supply.
2. Design and study of common emitter transistor amplifier.
3. Basics of p-n junction characteristics.
4. Zener diode characteristics and voltage regulation.
5. Design and study of Tunnel diode.
6. Design and study of diode and transistor switching behavior and their operating point.
7. Design and study of RC phase shift oscillator/ Wein bridge oscillator.
8. Design and study of Hartley oscillator.
9. Design and study of dc power supply with various filters and IC regulator.
10. RC Coupled CE amplifier – Two stages with feedback – Frequency response and voltage

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DEPARTMENT OF PHYSICS
M. Sc. Physics

Course Code	Course Name	Hours per week			Total Hrs	Total Credits
		L	T	P		
PH5SE02	LAB II	0	0	4	4	2

SEMESTER – I (ODD)

LAB II (Application of software package - I)

1. Exercise based on use of formatting tools in MS Word.
2. Exercise based on inserting figures, graphs and tables in Word document.
3. Arranging and formatting a document in Word.
4. Exercise based on use of Equation Editor.
5. Exercise based on how to use the Equation editor by using various functions.
6. Exercise on how to use References and how to arrange them.
7. Exercise based on use of formulas in MS Excel including mathematical functions
8. Exercise based on use of Statistical functions in MS Excel
9. Exercise based on creating graphs in ORIGIN.
10. Exercise based on formatting graphs in ORIGIN.
11. Exercise based on showing error bars on experimental data points in ORIGIN.

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DEPARTMENT OF PHYSICS

M. Sc. Syllabus

Course Code	Course Name	Hours per week			Total Hrs	Total Credits
		L	T	P		
PH5CO06	QUANTUM MECHANICS II	4	0	0	4	4

UNIT I

Variational method; WKB approximation; Time-dependent perturbation theory; Harmonic perturbation; Fermi's golden rule; Adiabatic and sudden approximations.

UNIT II

Collision in 3-D and scattering; Laboratory and CM reference frames; Scattering amplitude; differential scattering cross section and total scattering cross section; Scattering by spherically symmetric potentials; Partial waves and phase shifts; Scattering by a perfectly rigid sphere and by square well potential; Complex potential and absorption.

UNIT III

Identical particles; Symmetric and antisymmetric wave functions; Collision of identical particles; Spin angular momentum; Spin functions for a many-electron system.

UNIT IV

Semiclassical theory of radiation; Transition probability for absorption and induced emission; Electric dipole and forbidden transitions; Selection rules.

UNIT V

Klein-Gordon equation, Interpretation of Klein-Gordon equation, Particle in a Coulomb field, Dirac equation for a free particle, Dirac matrices, covariant form of Dirac equation, Probability density, Plane wave solution, Negative energy states, spin of Dirac particles

Text Books

1. Mathews and Venkatesan. Quantum Mechanics, McGraw Hill 2nd edition 2019
2. J J Sakurai, Modem Quantum Mechanics, Pearson Education India 2013
3. L I Schiff, Quantum Mechanics, McGraw-Hill 4th edition 2014

Reference Books

1. S Gasiorowicz, Quantum Physics, Wiley India 3rd edition 2003
2. B Craseman & J D Powell, Quantum Mechanics,Addison Wesley 2015
3. A P Messiah, Quantum Mechanics. Dover Publications, 2017

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Course Code	Course Name	Hours per week			Total Hrs	Total Credits
		L	T	P		
PH5CO07	**STATISTICAL MECHANICS**	4	0	0	4	4

UNIT I

Foundations of statistical mechanics; specification of states of a system, contact between statistics and thermodynamics, classical ideal gas, entropy of mixing and Gibb's paradox.

UNIT II

Microcanonical ensemble, phase space, trajectories and density of states, Liouville's theorem, canonical and grand canonical ensembles; partition function, calculation of statistical quantities, Energy and density fluctuations.

UNIT III

Density matrix, statistics of ensembles, statistics of indistinguishable particles, Maxwell-Boltzman, Fermi-Dirac and Bose Einstein statistics, properties of ideal Bose and Fermi gases, Bose-Einstein condensation.

UNIT IV

Cluster expansion for a classical gas, Virial equation of state, Ishing model, mean-field theories of the Ishing model in three, two and one dimensions Exact solutions in one-dimension. Landau theory of phase transition, critical indices, scale transformation and dimensional analysis.

UNIT V

Correlation of space-time dependent fluctuations, fluctuations and transport phenomena, Brownian motion, Langevin theory, fluctuation dissipation theorem. The Fokker-Planck equation.

Text Books

1. R K Pathria	Statistical Mechanics,	Academic Press 3rd edition	2011
3. R. Kubo	Statistical Mechanics,	North Holland Pub.	1990
2. Landau and Lifshitz	Statistical Physics,	Butterworth-Heinemann press	1996

Reference Books

1. F Reif	Statistical and Thermal Physics,	Sarat Book Distributors	2010
2. K Huang	Statistical Mechanics,	Wiley India Pub.	2008

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M. Sc. Syllabus

Course Code	Course Name	Hours per week			Total Hrs	Total Credits
		L	T	P		
PH05CO08	**ELECTRODYNAMICS AND PLASMA PHYSICS**	4	0	0	4	4

UNIT I

Review of Four-Vector and Lorentz Transformation in Four-Dimensional Space, Electromagnetic Field Tensor in Four Dimensions and Maxwell's Equations, Dual Field Tensor, Wave Equation for Vector and Scalar Potential and Solution Retarded Potential and Lenard-Wiechert Potential, Electric and Magnetic fields due to a Uniformly Moving Charge and An Accelerated Charge, Linear and Circular Acceleration and Angular Distribution of Power Radiated, Bremsstrahlung, Synchrotron Radiation and Cerenkov Radiation, Reaction Force of Radiation.

UNIT II

Motion of charged Particles in Electromagnetic Field: Uniform E and B Fields, Nonuniform Fields, Diffusion Across Magnetic Fields, Time Varying E and B Fields, Adiabatic Invariants: First, Second Third Adiabatic Invariants.

UNIT III

Elementary Concepts: Derivation of moment Equations from Boltzmann Equation, Plasma Oscillations, Debye Shielding, Plasma Parameters, Magnetoplasma, Plasma Confinement.

UNIT IV

Hydrodynamical Description of Plasma: Fundamental equations. Hydromagnetic Waves: Magnetosonic and Alfven Waves.

UNIT V

Wave Phenomena in Magnetoplasma: Polarization, Phase Velocity, Group Velocity, Cut-offs, Resonance for Electromagnetic Wave Propagating Parallel and Perpendicular to the Magnetic Field, Propagation at Finite Angle and CMA Diagram, Appleton - Hartee Formula and Propagation through Inosphere and Magnetosphere: Helicon, Whistler, Faraday Rotation.

Text Books

1. D. J. Griffiths	Introduction to Electrodynamics	Cambridge University Press	2017
2. Bittencourt	Fundamental of Plasma Physics	Springer, 3rd Edition	2004
3. F. F. Chen:	Introduction to Plasma Physics	Plenum Press, NY	1974
4. J. D. Jackson:	Classical Electrodynamics	Wiley India, 3rd Edition	2009

Reference Books

1. Panofsky & Phillips	Classical Electricity and Magnetism	Dover Pub., 2nd Edition	1990
2. M. Schwartz	Principle of Electrodynamics	Dover Pub., 2nd Edition	2012
3. Goldston,Rutherford	Introduction to Plasma Physics	Taylor & Francis	2020

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M. Sc. Syllabus

Course Code	Course Name	Hours per week			Total Hrs	Total Credits
		L	T	P		
PH5CO09	**ATOMIC AND MOLECULAR PHYSICS**	4	0	0	4	4

UNIT I

Quantum states of Electron in atoms; Hydrogen atom spectrum; Electron spin; Spin Orbit interaction; Lande interval rule; Two electron systems; LS – JJ coupling Schemes; Fine structure; Spectroscopic terms and selection rules; Hyperfine structure; Isotopic shift; Width of spectral lines; Exchange symmetry of wave function; Pauli's exclusion principle; Spectrum of Helium and Alkali atom.

UNIT II

Zeeman and Paschen Back Effect of one and two electron systems; Stark effect; X-ray – Auger transitions; Compton Effect; NMR – Basic principles; Classical and Quantum mechanical description; Magnetic dipole coupling; Chemical shift; Knight shift; ESR – Basic principles; Nuclear interaction and Hyperfine Structure; g-factor; Zero field splitting

UNIT III

Microwave Spectroscopy and IR Spectroscopy: Rotational spectra of diatomic molecules; Rigid rotator - Effect of isotropic substitution; Non rigid rotator – Rotation spectra of polyatomic molecules; Linear, symmetric top and asymmetric top molecules; Experimental Techniques; Diatomic vibrating rotator; Linear, Symmetric top molecule; Analysis by infrared techniques.

UNIT IV

Raman Spectroscopy: Raman Effect; Quantum theory of Raman effect; Electronic, rotational, vibrational and Raman spectra of diatomic molecules; Raman spectra of polyatomic molecules; Raman Spectrometer; Hyper Raman effect; Experimental techniques.

UNIT V

Electronic Spectroscopy: Electronic spectra of diatomic molecules; Frank-Condon principle; Dissociation energy and dissociation products; Rotational fine structure of electronic vibration transitions; Fortrat Diagram; Pre-dissociation

Text Books

1. H. E. White	Introduction to Atomic spectra	McGraw Hill,	1999
2. C. B. Banwell	Fundamentals of molecular spectroscopy	Tata McGraw Hill, 4th Edition	2008
3. Manas Chanda	Atomic Structure and Chemical Bond	Tata McGraw Hill.	1978
4. G .Aruldhas	Molecular Structure and Spectroscopy	PHI India Ltd., 2nd Edition	2004

Reference Books

1. Walker & Straughen	Spectroscopy Vol I, II & Ill	Halsted Press	1976
2. G. M. Barrow	Introduction to Molecular spectroscopy	McGraw Hill, Student Edition	1962
3. Herzberg	Spectra of diatomic molecules	Litton.Educational Publishing	1976
4. Jeanne L McHale	Molecular spectroscopy	CRC Press	2017
5. J. M. Brown	Molecular spectroscopy	Oxford University Press	2003
6. J. M. Holias	Modem spectroscopy	John Wiley & sons, 4th Edition	2004

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M. Sc. Syllabus

Course Code	Course Name	Hours per Week			Total Hrs	Total Credits
		L	T	P		
PH5SE03	Professional Communication	2	0	0	2	2

UNIT I

Building thoughts, Reading techniques – SQ3R, The 3-pass system,

UNIT II

How to make a synopsis, Chapterization, Paraphrasing, Plagiarism, Making a hypothesis

UNIT III

Writing abstract and Summary, Importance of syntax and semantics, Mechanics of writing, Proof reading, Formatting, How to make good ppts.

UNIT IV

Oral presentation, Audio visual aids, Viva voce/ interviews.

UNIT V

Report writing, various formats, writing research papers, writing project reports.

Text Books

1. C.R Kothari. Rarch Methodology. S. Chand & Sons, New Delhi 1990
2. Koneru Aruna Professional Communication. Mc Graw Hill, New Delhi 2015
3. Rizvi Ashraf. Effective Technical Communication. Tata Mc Graw Hill, New Delhi 2014.

Reference Books

1. Day R A. How to Write and Publish a Scientific Paper. Cambridge University Press, 1989.
2. Sharma RC and Krishna Mohan. Business correspondence and report writing. TMH New Delhi 2016
3. Murphy H A, H W Hildebrandt, J P Thomas. Effective Business Communication. TMH 1997

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Course Code	Course Name	Hours per week			Total Hrs	Total Credits
		L	T	P		
PH5CO10	**LAB III**	0	0	4	4	2

M. Sc. PHYSICS
SEMESTER – II (Even)

LAB III (QM and Atomic Physics)

1. Study of Photo-electric effect: photo current versus intensity and wavelength of light; maximum energy of photo-electrons versus frequency of light.
2. Determination of Planck's Constant using different type of LEDs.
3. To calculate eigen energy values and examine bound stationary state wave functions for the One Well and multiple well.
4. To verify Heisenberg's Uncertainty Principle by single slit diffraction
5. To determine the absorption lines in the rotational spectrum of Iodine vapour.
6. Study of spectra of hydrogen and deuterium. (Rydberg Constant).
7. Absorption spectrum of Iodine Vapour.
8. Determination of e/m Using Thomson's Method.
9. To study the Zeeman Effect.

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M. Sc. Syllabus

Course Code	Course Name	Hours per week			Total Hrs	Total Credits
		L	T	P		
PH5SE04	**LAB IV**	0	0	4	4	2

M. Sc. PHYSICS
SEMESTER – II (Even)

LAB IV (Application of software package – II)

Practical and topics including new other software can also consider in the list

1. Study of Introduction to Mathematica and MATLAB.
2. Study of basic matrix operations.
3. Exercise based on numerical calculations using Mathematica/ MATLAB.
4. Exercise based on symbolic computation using Mathematica/ MATLAB.
5. Exercise based on Solution of differential Equations using Mathematica/ MATLAB.
6. Exercise based on Solution of equations in one variable using Mathematica/ MATLAB.
7. Exercise based on creating 2-D graphs in Mathematica/ MATLAB.
8. Exercise based on creating 3-D graphs in Mathematica/ MATLAB.
9. Solution of differential equations using Euler method in MATLAB.

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DEPARTMENT OF PHYSICS

Master of Science

SEMESTER - III

Code	Course	L	T	P	Hrs.	Credits
PH5CO11	Condensed Matter Physics	4	0	0	4	4
PH5CO12	Nuclear and Particle Physics	4	0	0	4	4
PH5EC**	**Departmental Specific - I**	4	0	0	4	4
PH5EE**	**Departmental Specific - II**	4	0	0	4	4
PH5CO13	LAB - V	0	0	4	4	2
PH5PC01	Mini Project	0	0	8	4	4
PH5SS03	MOOC / NPTEL Course	0	0	2	2	1
		16	**0**	**14**	**28**	**23**

PH5CO13	**LAB - V**	**Electronics / Nuclear Physics Laboratory**

SEMESTER - IV

Code	Course	L	T	P	Hrs.	Credits
PH5SE05	Computational Methods and Numerical techniques	4	0	0	4	4
PH5OE**	**Elective -I**	4	0	0	4	4
PH5EC**	**Departmental Specific-III**	4	0	0	4	4
PH5EE**	**Departmental Specific -IV**	4	0	0	4	4
PH5PC02	Project Report/Dissertation	0	0	12	12	6
		16	**0**	**12**	**28**	**22**

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Course Code	Course Name	Hours per Week				
		L	T	P	Hrs.	Credits
PH5C011	Condensed Matter Physics	4	0	0	4	4

Unit-I

Electrons in Periodic Lattice Potential and Dielectrics: Nearly free electron model, Bloch theorem, Kronig Penney model, Metals–Semimetals–Semiconductors–Insulators, Tight binding approach, Fermi surface, Polarizability and dielectric function of the electron gas, de Haas Van Alfen effect, Magnetoresistance.

Unit-II

Free electrons in Metals: Collective excitations, Screening, polaritons, polarons, excitons, ferroelectric effects, Kondo effect, electron–electron interaction, Metal-Insulator Transition (MIT), concepts of quantum confinement effects. quantum Hall effects and Topological Insulators.

Unit-III

Magnetism-1: Langevin diamagnetic equation, diamagnetic response, Quantum mechanical formulation, core diamagnetism. Quantum Theory of Paramagnetism, Rare Earth Ions, Hund's Rule, Iron Group ions, Crystal Field Splitting and Quenching of orbital angular momentum; Paramagnetic susceptibility of conduction electrons; Adiabatic Demagnetization of a paramagnetic Salt.

Unit-IV

Magnetism-2: Ferromagnetic order- Exchange Integral, Saturation magnetization, Magnons, neutron magnetic scattering; Ferrimagnetic order, spinel's, Yttrium Iron Garnets, Anti Ferromagnetic order. Ferromagnetic Domains – Anisotropy energy, origin of domains, transition region between domains, Bloch wall, magnetic microscopy, Coercive force and hysteresis, Concept of Magnon.

Unit-V

Superconductivity & Superfluidity: Type-I and type-II superconductors, Macroscopic electromagnetic properties, Thermal properties, Isotope effect, Manifestations of energy gap, London theory, Two fluid model, Flux quantization. Single particle tunneling, *dc* and *ac* Josephson Effect, quantum interference, electron –phonon interaction, Cooper pair, BCS ground and excited states, High temperature superconductors. Concept of quantum liquids, Superfluidity, Properties of liquid Helium.

Text Books:

1. Solid State Physics, Adrianus J Dekker, Macmillan India Limited, 2000
2. Crystallography for Solid State Physics, A. R. Verma, and O. N. Srivastava, New AgeInternational (P) Ltd. 2001.
3. Introduction to Solid State Physics, C. Kittel, VIIIth Edition, John Wiley and Sons, NewYork, 2005.
4. Solid State Physics, N. W. Ashcroft, and N. D. Mermin, Harcourt Asia (P) Ltd. 2001
5. Physics of Magnetism, S. ChikazumiR.E.KriengerPublCo.Inc,Florida(1978)
6. Elementary Solid-State physics, M Ali Omar, Addison Wesley (LPE), New edition.

Reference Books:

1. Charles P. Poole, Jr. Horacio A. Farach, Richard J. Creswick and Ruslan Prozorov Academic Press is an imprint of Elsevier
2. Superconductivity, Superfluids, and Condensates (Oxford Master Series in Condensed Matter Physics 5) by James F. Annett (z-lib.org), Oxford University Press).

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Course Code	Course Name	Hours per Week				
		L	T	P	Hrs.	Credits
PH5C012	Nuclear and Particle Physics	4	0	0	4	4

Unit-I

Nuclear sizes and shapes. Experimental methods of determining nuclear radius. Two-nucleon problem: Deuteron problem. Central and non-central forces. Tensor forces.

Unit-II

Nuclear models: Semi empirical mass formula and isobaric stability. Nuclear shell structure. Magic numbers. Single particle model. Spin orbit coupling. Schmidt lines. Rotational and vibrational spectra and elementary idea of unified model.Nuclear reactions: Q value Compound nuclear reaction and direct reactions. Single level Breit-Wigner formula.

Unit-III

Nuclear fission: Liquid drop model. Multiplication factor and chain reaction. Concept of thermal, fast and breeder reactor. Elementary ideas of energy generation by fusion.Radiative transition in nuclei, multipole transitions and selection rules. Fermi theory of beta decay Kurie plot, ft value. Allowed and forbidden transitions.

Unit-IV

Beta activity & elementary particles :Determination of neutrino helicity. TheTau- Theta puzzle. Parity non conservation and its experimental verification. Fundamental interactions classifications and properties of elementary Particles. Conservation laws and its violation in different types of interactions.

Unit-V

Hadron-Hadron interaction: Isospin of two nucleon and □□nucleon systems. Strangeness. Gell-Mann-Nishigima formula quark models, Baryon decuplet and octet, Meson monet, Colour, Elementary ideas of Quantum chromodynamics

Text Books

1. Nuclear Physics: Tayal
2. Nuclear Physics: S. N. Ghoshal
3. Nuclear Physics: R.R.Roy& B.P.Nigam

Reference Books:

1. Concepts of nuclear physics: B. Cohen
2. Introduction to high energy physics: D.H. Parkins
3. Introduction to nuclear physics: H.A. Enge
4. Introductory nuclear theory: L.R. B. Elton

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Course Code	Course Name	Hours per Week				
		L	T	P	Hrs.	Credits
PH5OE01	Laser and Applications	4	0	0	4	4

Unit-I

Fundamental of Lasers : Stimulated emission, Population inversion, Laser amplification, Oscillation condition, Characteristic of laser light, Line broadening mechanism, Spectral narrowing in a laser, Gain clamping spatial and spectral hole burning and their consequences, Power in Laser Oscillator, Optimum coupling.

Unit-II

Theory of optical resonators: Concept of cavity models, Stability criterion, Gaussian beams and their propagation. Quality factor, Geometry of resonators, resonant frequency of resonators, Unstable resonators, Time dependence of laser emission, Rate equations for three and four level systems. Normal mode oscillations, Q-switching and mode locking techniques of laser pulse generation.

Unit -III

Introduction to Non-Linear optics: Basic Difference in Linear and Nonlinear optics, Wave propagation in non-linear media, Phase matched second harmonic generation, Optical parametric oscillator, Frequency mixing in gases and vapors, Self-focusing, Optical biostability and optical phase conjugation.

Unit -IV

Laser Applications-1: Some specific laser systems for applications: Ion lasers (Ar), Atomic and molecular gas lasers (He-Ne, CO_2), Solid State (Ruby, Nd: YAG&Nd: Glass). Semiconductor lasers (Ga-As). Chemical lasers (HF), Dye lasers (one example), Excimer laser (KrF).

Unit -V

Laser Applications-2: Holography, Optical communication, Laser isotope separation, Laser range finder, Laser in pollution detection. Lasers in Microscopy (LSCOM-Ar, He-Ne, Diode (Blue) excitations), Laser-Raman Spectroscopy, Laser Manufacturing and Machining, Laser Welding and melting, Pulsed laser deposition (PLD), Lasers in surgery (Ophthalmology), Laser cooling (reaching ultracold-only concept), lasers in metrology, particle size analyzers and in high pressure research (Ruby lines).

Text Books:

1. Lasers: Theory and Applications by Ghatak&Thyagrajan
2. Principles of Lasers: Svelto
3. Nonlinear Optics: Baldwin

Reference Books:

1. Laser Physics: Maitland & Dunn
2. Introduction to Quantum Electronic: A. Yariv
3 Applied nonlinear Optics: F. Zernike and Midwinter
4. Lasers: P.W. Miloni& J.H. Eberly

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Course Code	Course Name	Hours per Week				
		L	T	P	Hrs.	Credits
PH5EP01	Solid State Physics	4	0	0	4	4

Unit-I
Crystal Structure I: Crystalline state, Symmetry operations, point groups and crystal system, fundamental types of lattices, Unit cells and direct lattice. Two and three dimensional Bravais lattices. Closed packed Structures, NaCl, CsCl, Diamond and ZnS type structures.

Unit-II
Crystal Structure II: Diffraction of x-rays by crystals, the Laue, Powder and Rotating crystal methods, Bragg's law, Properties of reciprocal lattice, Brillouin zone, Ionic, Covalent, Molecular and Hydrogen bonded crystals, Lattice energy of ionic crystals.

Unit-III
Defects in Solids: Point defects, line defects and planer (stacking) faults, the role of dislocations in plastic deformation and crystal growth, the observation of imperfections in crystals, X-ray and electron microscopic techniques.

Unit-IV
Phonons: Vibrations of monoatomic and diatomic linear lattices, acoustical and optical phonons, dispersion relation for three-dimension crystals, inelastic neutron scattering, elastic properties of solids, specific heat of solids, Einstein and Debye theory of specific heat, anharmonic crystal interactions, thermal expansion, Raman effect, Mossbauer effect.

Unit-V
Electrical Properties: Drude Model, Electrical and thermal conductivity, Wiedemann–Franz Law, Lorentz theory, Sommerfeld theory of Metals, Boltzmann differential equation, Scattering Processes, Relaxation-time approximation, Solution of the Boltzmann equation for metals, electrical Conductivity, Peltier Coefficient, thermal conductivity, thermoelectric power, the transport and material properties.

Text Books:

1. Introduction to Solid State Physics, C. Kittel, VIIIth Edition, John Wiley and Sons, 2005.
2. Solid State Physics, N. W. Ashcroft, and N. D. Mermin, Harcourt Asia (P) Ltd. 2001

Reference Books:

1. Intermediate Quantum theory of Crystalline Solids, A. O. E. Animalu, Prentice–Hallof India private Limited, New Delhi 1977.
2. Introduction to Solid State Physics, C. Kittel, VIIIth Edition, John Wiley and Sons, 2005.
3. Solid State Physics, J. D. Patterson, and B. C. Bailey,Springer Berlin Heidelberg New York,2007
4. Solid State Physics, J. J. Quinn, K. S. Yi, Springer-Verlag Berlin Heidelberg 2009.

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Course Code	Course Name	Hours per Week				
		L	T	P	Hrs.	Credits
PH5CO13	Lab-V	0	0	4	4	2

Laser and Solid-State Physics Laboratory

List of Experiments

1. To determine the divergence of laser beam using He Ne Laser
2. To measure the thread angle, pitch and the diameter of given screw using He-Ne laser.
3. To find the thickness of thin wire using laser.
4. To study working of Laser using "PhET" Laser Module by Simulation.
5. To measure the numerical aperture of an optical fiber by scanning method.
6. To obtain the circular fringe pattern by Michelson Interferometer using He Ne laser.
7. To determine the velocity of Ultrasonic Waves in water
8. To determine the losses in optical fibres in dB due to macro bending of the fibre.

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rse Code	Course Name	Hours per Week				
		L	T	P	Hrs.	Credits
5SE05	Computational Methods and Numerical Techniques	4	0	0	4	4

Unit-I

Error Analysis: Mathematical preliminaries, computer representation of numbers, Computer arithmetic, zero in floating point number, its sources, Errors, different type of errors: Inherent, Round-off, Truncation, Absolute, Relative, Percentage and general formula for error, propagation of errors, Errors in summation, stability in numerical analysis.

Unit-II

Real roots of nonlinear equations:

Iterative methods: Introduction, Beginning an iterative method, Method of successive bisections, method of Regula false position, Newton-Raphson iterative method and the secant method. Fixed point iteration, The method of successive approximations, Solution of simultaneous nonlinear equations.

Unit-III

Interpolation and curve fitting: Introduction, Finite Differences, Effect of an Error in a Tabular value, Differences of a Polynomial, Newton formula for forward difference and Lagrange interpolation. Linear regression, Algorithm for linear regression, polynomial regression, Fitting exponential and trigonometric functions, data normalization.

Unit-IV

Numerical integration: The concept of numerical integration, integration as quadrature Trapezoidal rule, Simpson's 1/3 rule and 1/8 rule, Errors in integration formulae, Gaussian Quadrature, Particular Gaussian quadrature formula: Gauss-Jacobi, Gauss-Chebyshev, singular integrals, Formulas for numerical differentiation.

Unit-V

Numerical solutions of differential equations: Existence, uniqueness and stability theory, Euler's method, Taylor series method, Heuns method, Runge Kutta methods (second order, third order and fourth order methods). Numerical solutions of partial differential equations

Text Books :

1. Numerical Analysis by Prahlad Tiwari.

2. Computer oriented numerical methods: V.Rajaraman

Reference Books:

1. Numerical mathematical analysis: J.B. Scarborough

2. First course in numerical analysis: A. Ralston

3. Numerical methods for Science and Engineering: J.H. Mathews

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Course Code	Course Name	Hours per Week				
		L	T	P	Hrs.	Credits
PH5OE02	Optoelectronics	4	0	0	4	4

Unit I

Optoelectronics materials: Crystalline material, ceramic material, Semiconducting material (II -V, Si, Ge), Optical polymer material, Principal of material engineering of optical material (dopants, impurities, and defects) Electrical, Optical and Thermal properties of III-V and II-VI semiconductors required for optoelectronics devices for visible and IR range.

Unit II

Light Sources: Introduction, Intrinsic and extrinsic material- direct and indirect band gaps, LEDs, LED structure, power, quantum efficiency, types and structures of LEDs, characteristics and modulation, driver circuits, semiconductor lasers diodes, modes and threshold condition, Laser rate equation, external quantum efficiency, modulation characteristics.

Unit III

Fiber Optics: Introduction to optical fibers, structure of the optical fiber, Types of optical fibers: Single mode fiber, Multimode fiber, Graded index fiber, fiber fabrication and cabling, wave propagation in optical waveguides, ray transmission theory, total internal reflection, Acceptance angle, Numerical Aperture, Fiber optic sensors: Pressure, temperature, strain.

Unit IV

Optical Detectors: Device types, optical detection principle, Absorption: coefficient, direct and indirect absorption (Si and Ge), quantum efficiency, responsivity, low wavelength cutoff, semiconductor photodiodes without internal gain (p-n photodiode, p-i-n photodiode), semiconductor photodiodes with internal gain (Avalanche, Si and Ge avalanche), phototransistors, photoconductive detectors.

Unit V

Optical Instrument: Optical time domain reflectometer, optical low coherence reflectometer, optical power and energy meter, monochromator, CCD, optical spectrum analyzer, ellipsometer, Transducers, Lock-in-Amplifier.

Text Books

1. A. Ghatak & K. Thyagarajan, Optical electronics, (Cambridge Univ. Press, Cambridge) 1989
2. J.M. Senior, Optical fibre communications, Principles & Practice, (PHI), 2/e, 2004

Reference Books

1. G. Keiser, Optical fiber communication, 4th Ed. (Tata McGraw Hill, New Delhi) 2008.
2. B. P. Pal : Fundamentals of Fibre Optics in Telecommunication and Sensor Systems, New Age, New Delhi, 1992
3. P. N. Prasad, Nanophotonics, John-Wiley, New Jersey, 2004.

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rse Code	Course Name	Hours per Week				
		L	T	P	Hrs.	Credits
I5EL05	Digital Electronics and Microprocessor	4	0	0	4	4

Unit I

Number system (Binary, Octal, Decimal, Hexadecimal) and their interconversion, Boolean laws and theorem. Signed and unsigned binary numbers, Simple combinational circuits. Karnaugh map pairs, Quads, and octets. De Morgan's laws, Karnaugh simplifications. Don't care conditions, sum of products (SOP) and product of sums (POS) expressions.

Unit II

The ASCII code. Excess III code. Gray code. Binary Addition, Subtraction, Logic Gates: OR, AND, NOT, NOR, OR, NAND, XOR, XNOR, Circuits and Boolean identities associated with gates, 1's complement, 2's complement. Arithmetic building blocks, Adder and subtractor circuit design.

Unit III

Multiplexers, demultiplexer. 1-of-16 decoder. BCD to decimal decoder. Seven segment encoders, decoders, Exclusive OR gates. Parity generators-checkers.

Unit IV

7400 devices. A-01 gates. Positive and negative logic. 74C00 devices. CMOS logic gates. Flip-Flops: R-S, D, J-K, J-K master-slave flip-flop, race around condition, Shift registers, counters. A/D and D/A converters. A/D and D/A accuracy and resolution. Semiconductor memory (RAM, ROM & EPROM).

Unit V

Basic architecture of intel 8085 microprocessor. Microprocessor and its architecture-data, Address and control buses. ALU registers, program counters. Flow chart and assembly language. Writing some programs in assembly language for 8085 microprocessors.

Text Books

1. Digital Electronics: R.P. Jain
2. Digital Principles and Applications: Malvino & Leech
3. Digital computer electronics and introduction to microcomputers: Malvino

Reference Books

1. Introduction to microprocessors Software, hardware, programming: L.A.Leventhal
2. Microprocessor Architecture: Ramesh S. Gaonkar
3. Programming &Application with 8085 Microprocessors: B. Ram

Medi-Caps University, Indore
Faculty of Science
Department Of Physics
M.Sc. (Physics) IV Sem

Course Code	Course Name	Hours per Week				
		L	T	P	Hrs.	Credits
PH5EL06	Material Synthesis and Characterization techniques	4	0	0	4	4

Unit I

Nanomaterials and Structures: Introduction to Nanomaterials: Features of Nano systems, Characteristic length scales of materials and their properties, Density of states in 1-D, 2-D and 3-D bands, Variation of density of states and band gap with size of crystal.

Unit II

Synthesis Methods: Top-down and bottom-up approach, Chemical methods: co precipitation, sol – gel method, cluster beam evaporation, ion beam deposition, chemical bath deposition with capping techniques, mechanical milling.

Unit III

Diffraction Methods: Fundamental crystallography, Generation and detection of X-rays, Diffraction of X-rays, X-ray diffraction techniques, Electron diffraction. X-ray absorption fine structure (XAFS), Photoelectron spectroscopy: X-ray photoelectron spectroscopy.

Unit IV

Surface Analysis: Scanning Electron Microscope (SEM)-Atomic Force Microscopy (AFM), Transmission Electron Microscopy (TEM).

Transport measurements: Metal, Superconductors, Insulators and Semiconductors, four probe, Dielectric measurement.

Unit V

Spectroscopy techniques: Atomic absorption spectroscopy, UV/Visible spectroscopy, Fourier transform infrared spectroscopy, Raman spectroscopy. Photoluminescence (PL)

Text Books

1. Jan Korvink and Andreas Greiner, Semiconductors for Micro and Nanotechnology – an Introduction for Engineers, Weinheim Cambridge: Wiley-VCH (2001).
2. N John Dinardo and Weinheim Cambridge, Nanoscale Characterisation of Surfaces & Interfaces, 2 nd edition, Wiley-VCH (2000).
3. Introduction to Nanotechnology,C.P. Poole and F.J. Ownes, Wiley_India (2007).

Reference Books

1. G Timp (ed), Nanotechnology, AIP Press, Springer (1999).
2. Nano: The Essentials, T. Pradeep, Mc-Graw Hill India (2007).
3. Li, Lin, Ashok Kumar Materials Characterization Techniques Sam Zhang; CRC Press, (2008).
4. Cullity, B.D., and Stock, R.S., "Elements of X-Ray Diffraction", Prentice-Hall, (2001).