NATIONAL COLLEGE (AUTONOMOUS), TIRUCHIRAPALLI – 1

M.Sc., PHYSICS – Course Structure under CBCS

(Applicable to the candidates admitted from the academic year 2013-2014 onwards)

Semester	Paper No.	Title of the Paper	Instr Hrs/ Week	Credit	Exam Hrs.	Marks			Total
						Internal	External		
							W	O	
I	CC I	Mathematical Physics	6	5	3	25	75		100
	CC II	Classical Mechanics	6	5	3	25	75		100
	CC III	Statistical Mechanics	6	5	3	25	75		100
	CC IV P	Physics Practicals- I (General & Electronics)	6	5	4	25	70	5	100
	EC I	Special Electronics - I	6	4	3	25	75		100
		Total	30	24					500
II	CC V	Atomic And Molecular Physics	6	5	3	25	75		100
	CC VI	Quantum Mechanics	6	5	3	25	75		100
	CC VII	Nuclear And Particle Physics	6	5	3	25	75		100
	CC VIII P	Physics Practicals - II (General & Electronics)	6	5	4	25	70	5	100
	EC II	Special Electronics - II Microprocessor and Communication Electronics	6	4	3	25	75		100
		Total	30	24					500
III	CC IX	Electromagnetic Theory	6	5	3	25	75		100
	CC X	Crystal Growth And Thin Film Physics	6	5	3	25	75		100
	CC XI P	Physics Practicals-III Advanced Electronics	6	5	4	25	70	5	100
	EC III	Numerical Methods and Programming	6	4	3	25	75		100
	EC IV	Elements of Nanoscience And Its Applications	6	4	3	25	75		100
		Total	30	23					500
IV	CC XII	Condensed Matter Physics	6	5	3	25	75		100
	CC XIII P	Advanced Electronics	6	5	4	25	70	5	100
	EC V	Advanced Optics	6	4	3	25	75		100
		Project (Dissertation 75 marks & Viva Voice – 25 Marks)	12	5	-	75	-	25	100
		Total	30	19					400
				90					1900

There will be oral test for all practical examinations. The oral test will carry 5 marks in the external component.

MATHEMATICAL PHYSICS – P13PH1

Semester : I **Core Course: I**

Instruction Hours/Week: 6 **Credit: 5**

Objectives:

To aim at providing extensive mathematical formalism for understanding and interpreting various physical problems.

UNIT 1: VECTOR ANALYSIS

Concept of vector and scalar fields – Gradient, divergence, curl and Laplacian – Line integral, surface integral and volume integral – Gauss Divergence theorem, Green's Theorem, Stoke's theorem – Orthogonal curvilinear coordinates: Expression for gradient, divergence, curl in spherical co-ordinates.

UNIT 2: VECTOR SPACE AND MATRICES

Vector Space: Definitions – Linear independence of vectors – Schmidt's orthogonalisation process – Schwartz inequality.

Matrices: Transpose of a Matrix-Inverse matrix-Adjoint Matrix-Unitary&Hermitian matrix-Characteristic equation-Eigen values and Eigen vectors-Cayley Hamilton theorem-Diagonalization of a matrix.

UNIT 3: COMPLEX ANALYSIS

Functions of complex variables – Differentiability - Cauchy-Riemann conditions –Cauchy's integral theorem and integral formula – Taylor's and Laurent's series – Residues and singularities - Cauchy's residue theorem – Evaluation of definite integrals (Trignometric functions around the unit circles).

UNIT 4: SPECIAL FUNCTIONS

Gamma and Beta functions – Legendre, Hermite differential equations: series solution – Rodrigue's formula – Generating functions – Orthogonality relations – Important recurrence relations.

UNIT 5: GROUP THEORY

Basic definition –Multiplication table – Subgroups, cosets and classes -Point groups and space groups-Homomorphism and Isomorphism –Reducible and Irreducible representations – Schur's lemma I and II -The great Orthogonality Theorem-C_2V and C_3V Character table.

BOOK FOR STUDY

1. Satya Prakash, Mathematical Physics, Sulthan, Chand & Sons., New Delhi (2006).

BOOKS FOR REFERENCE

1. B.D.Gupta, Mathematical Physics, Vikas Publishing House Pvt Ltd., New Delhi (2006).

2. L. A. Pipes and L. R. Harvill, Applied Mathematics for Engineers and Physicists – Mc Graw-Hill (1987).
3. A. K. Ghatak, I.C. Goyal and S. J. Chua, Mathematical Physics, Mac Millan India Ltd., (1995).

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CLASSICAL MECHANICS – P13PH2

Semester : I **Core Course: II**

Instruction Hours/Week: 6 **Credit: 5**

Objectives:

To learn about the fundamentals of classical generalized coordinates and Formation

To learn about both Lagrangian and Hamiltonian formalisms

To apply both the formalism to certain examples

Fundamentals of small oscillations

UNIT-I: FUNDAMENTALS AND LAGRANGIAN FORMALISM

Principle of Virtual work-Generalized Co-ordinates – Generalized momentum – Generalized kinetic energy – D'Alembert's principle (D.A.P) –Lagrangian's equation of motion from D.A.P – Cyclic co-ordinates – Conservation of Angular momentum and total energy.

UNIT-II: HAMILTONIAN FORMALISM

Hamilton as total energy operator – Hamilton's variational principle – Deduction of Hamilton's principle from D.A.P – Deduction of Lagrangian equation of motion from Hamilton's principle – Hamilton's equation of motion – Hamilton's equation of motion from Hamilton's variational principle.

UNIT-III: APPLICATIONS AND CANONICAL TRANSFORMATIONS

Application of Lagrangian formalism a)Atwood's machine b)Simple pendulum – Transformations a)point or contact b)Canonical – Generating function of canonical transformation – Four types of canonical transformations - Δ Variation – Principle of Least Action.

UNIT-IV : BRACKETS AND HAMILTON – JACOBI THEORY

Lagrangian and Poisson's brackets – invariance of poisson bracket under Canonical transformation – Hamilton's characteristic function – Hamilton-Jacobi equation – Physical significance of S – Action – Angle formalism.

UNIT-V: LINEAR/SMALL OSCILLATIONS

Theory of small oscillations – Normal modes of oscillations (frequencies) – Double pendulum and its normal modes – CO_2 as linear symmetrical molecule, its normal frequencies and its normal modes.

BOOK FOR STUDY

1. G. Aruldhas – Classical Mechanics – PHI Learning Pvt. New Delhi (2009).

Unit	Chapter	Sections
I	3	3.3, 3.2, 3.7, 3.6, 3.4, 3.5, 3.8, 3.9
II	4, 6	4.1, 4.2, 4.3, 6.2, 6.3
III	3, 6	3.12, 6.5, 6.10, 6.11
IV	6, 7	6.9, 6.8, 7.2, 7.1, 7.4, 7.6
V	9	9.2, 9.3, 9.4, 9.5

BOOK FOR REFERENCE

1. Gupta-Kumar-Sharma-Classical Mechanics - S. Chand & Co.,
2. H. Goldstein –Classical Mechanics – Mc Graw Hill Pvt. New Delhi.

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STATISTICAL MECHANICS – P13PH3

Semester : I **Core Course: III**

Instruction Hours/Week: 6 **Credit: 5**

Objectives:

To understand the fundamental principles of Statistical mechanics.

To apply the quantum mechanical ideas to Statistical mechanics.

UNIT – I: REVIEW OF THERMODYNAMICS

First Law –Entropy and Second Law - Principle of degradation of energy-Thermodynamic Potentials and its reciprocity relations-Gibb's-Helmholtz relation- Thermodynamic equilibria - Nernst Heat theorem-Chemical Potential-Phase transitions-first order and Second order.

UNIT – II: KINETIC THEORY

Distribution function-Boltzmann transport equation for Homogeneous and Heterogeneous medium and its validity.

Kinetic theory of Gases-Maxwell Boltzmann distribution Law of velocities-Mean free path-Expression and Experimental determination-viscosity.

UNIT – III: INTRODUCTION TO STATISTICAL MECHANICS

Macro and micro states – Stirling's Approximation –classical Maxwell- Boltzmann distribution law - principle of equipartition of energy- Phase space and ensembles - Characteristics of Micro, Macro and Grand canonical ensemble - Liouville's theorem-Statistical equilibrium- Partition

function - Relation between partition function and thermodynamic quantities-B.E Statistics, F.D Statistics.

UNIT – IV: QUANTUM STATISTICAL MECHANICS

Black body and Planck's radiation - Specific heat of solids-Dulong and Petit's Law- Einstein's theory- Debye's Theory.

Ideal Bose gas - Energy, pressure of a Gas-gas Degeneracy-Bose-Einstein condensation - Liquid helium.

UNIT – V: ADVANCED STATISTICAL MECHANICS

Ideal Fermi gas- Energy, pressure of a Gas - Degeneracy - Electron gas - Free electron model and thermionic emission – One-Dimensional Ising Model- -Wiener-Khinchine theorem and its correlation function.

BOOK FOR STUDY

1. Gupta, Kumar, Sharma , Statistical Mechanics, Pragati Prakasam Publications(2005).

Unit	Sections
I	A-1 to A-7, 13.1, 13.2.
II	10, 10.1, k-1, k-2, k-3.
III	2.1, 2.2, 2.7, 2.12, 1.1, 1.3, 1.7, 1.10, 3.0-4, 6.2, 6.3.
IV	6.10, 7.2-1 to 7.2-3, 8.0 to 8.2, 8.4.
V	9.0, 9.3, 9.4, 13.7, 12.9.

BOOKS FOR REFERENCE

1. Statistical Mechanics, Sathya Prakash, Pragati Prakasam publications (2004).
2. Statistical Mechanics, K Huang, Wiley Eastern Ltd., New Delhi (1986).
3. F. Reif, Statistical and Thermal Physics, Mc Graw Hill, International Edition, Singapore (1975).
4. B.K Agarwal and N. Eisnor, Statistiacal Mechanics, Wiley Eastern Limited, New Delhi, 2nd edn (1989).
5. Mayer Joseph Edward, Statistical Mechanics, John Wiley & Son, New York(1949).

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PHYSICS PRACTICALS- I (GENERAL & ELECTRONICS) – P13PH4P

(Any Twelve Expts.)

Semester : I **Core Course: IV**

Instruction Hours/Week: 6 **Credit: 5**

1. Determination of q, n, b by elliptical fringes method
2. Determination of q, n, b by hyperbolic fringes method
3. Determination of bulk modulus of a liquid by ultrasonic wave propagation

4. Identification of prominent lines by spectrum photography – Copper spectrum
5. Identification of prominent lines by spectrum photography – Iron spectrum
6. Determination of dielectric constant at high frequency by Lecher wire
7. Design and study of Wein bridge Oscillator (Op-amp)
8. Design and study of Phase Shift Oscillator (Op-amp)
9. Characteristics of UJT
10. Characteristics of SCR
11. Characteristics of LDR
12. Relaxation oscillator using UJT (or) Op-amp
13. Charge of an electron by spectrometer.
14. Polarizability of liquids by finding the refractive indices at different wavelengths.
15. Study of Fibre Optic cable parameters.

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ELECTIVE COURSE I : SPECIAL ELECTRONICS I – P13PH5E

Semester : I **Elective Course: I**

Instruction Hours/Week: 6 **Credit: 4**

Objectives:

To understand various techniques and concepts in Electronics.

To learn about the working diodes.

To develop IC fabrications.

UNIT- I: SEMI CONDUCTOR DIODES:

Junction Diode-PN junction under forward and reverse bias – V-I Characteristics- Tunnel diode -Varactor diode – PIN diode-Schottky diode -Optoelectronic diodes - LED and photo diode.

UNIT -II: SPECIAL SEMICONDUCTOR DEVICES:

JFET- Structure and working – I -V Characteristics under different conditions – biasing of JFET-DC load line-CS amplifier design--MOSFET: Depletion and Enhancement type MOSFFT – UJT characteristics – relaxation oscillator – SCR characteristics – application in power control DIAC, TRIAC.

UNIT – III: OPERATIONAL AMPLIFIERS:

Operational amplifier characteristics – inverting and non-inverting amplifier –voltage follower –differential amplifier–instrumentation amplifier- Voltage to current and current to voltage conversions- log and antilog amplifiers Integrating and differential circuits.

UNIT-IV: OP-AMP APPLICATIONS (OSCILLATORS AND CONVERTORS):

Oscillators: Schmitt's trigger –square (Astable multivibrator)- Triangular—Sine wave generators-Phase shift and Wien bridge oscillator.

Convertors: Triangular, Basic D to A conversion: weighted resistor DAC – Binary R-2R ladder DAC –Basic A to D conversion: counter type ADC – successive approximation converter – dual slope ADC.

UNIT – V: IC FABRICATIONS AND IC TIMER:

Fabrications: Basic monolithic ICs – epitaxial growth – masking –etching impurity diffusion-fabricating monolithic resistors, diodes, transistors, inductors and capacitors – circuit layout – contacts and inter connections

555 Timer – Description of the functional diagram – mono stable operation – applications-Missing pulse detector- – astable operation-application-Pulse position modulator.

BOOKS FOR STUDY:

1.Foundations of Electronics- D Chattopadhyay, P C Rakshit B Saha, N N Purkait, New Age. International Publishers, New Delhi,(2006)

2. Operational Amplifier and Integrated Electronics – Roy Choudry, New Age. International Publishers, New Delhi (2006)

3. Basic Electronics- B.L. Theraja, S.Chand & Co - New Delhi(2006).

Unit	Book	Section
I	1	5.1, 5.4, 5.5, 5.6
	3	15.6,1 5.8 -15.10, 16.3, 16.8
II	3	26.1 - 26.2, 26.4, 26.5, 26.8-26.10
		26.13 – 26.18, 27.1 – 27.4, 27.7 – 27.8
III	2	2.3, 2.3.3 -2.3.7,4.3-4.5, 4.8, 4.10
IV	2	5.3, 5.4, 5.6, 5.7, 10.2, 10.2.1, 10.2.2, 10.3,10.3.2, 10.3.4, 10.3.6
V	3	31.1-31.16 (selected portions)
	2	8.1-8.3, 8.3.1(selected portion)
		8.4, 8.4.1(selected portion)

BOOKS FOR REFERENCES:

1. Principles of Electronics- V. K. Mehta, Rohit Mehta, S.Chand & Co, New Delhi 2008

2. Integrated Electronics - J.Milman and C.C. Halkias, Mc Graw Hill , New Delhi

3. Semiconductor Devices and Applications - A. Mottershed, New Age Int Pub, New Delhi .

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ATOMIC AND MOLECULAR PHYSICS – P13PH6

Semester : II **Core Course: V**

Instruction Hours/Week: 6 **Credit: 5**

Objectives:

To understand the basic Concept to Atomic Spectra

To learn Atoms in External Fields and Quantum Chemistry

To study Microwave and IR Spectroscopy, Raman Spectroscopy and Electronic Spectroscopy and Resonance Spectroscopy of Molecules.

UNIT I : ATOMIC SPECTRA

Concept of Vector Atom model and its quantum numbers-Stern –Gerlach experiments – fine structure of Hydrogen lines – Spin orbit interaction – LS-JJ coupling schemes –selection rules-hyperfine structure-exchange symmetry of wave functions-Pauli's exclusion principle and its physical significance-periodic table-alkali type spectra-equivalent electrons-Hund's rule

UNIT II: ATOMS IN EXTERNAL FIELDS AND QUANTUM CHEMISTRY

A. Atoms in external fields: Zeeman effect-Paschen-Back effect-and its quantum mechanical treatment- Zeeman effect-Paschen-Back effect in two electron systems-selection rules-stark effect

B. Quantum Chemistry of Molecules: Born-oppenheimer approximation-Heitler-London and molecular orbital theories of Hydrogen molecule-Bonding and anti-bonding MOs-Huckel's molecular approximation-Application to butadiene molecule.

UNIT III-MICROWAVE AND IR SPECTROSCOPY

Classification of molecules-Rotational Spectra of Diatomic Molecules-Effect of isotropic substitution-the non- Rigid Rotator-Rotational spectra of polyatomic molecules-Linear, symmetric top and asymmetric top molecules-Experimental techniques-Vibrating diatomic molecule-Diatomic vibrating rotator-Linear and symmetric top molecules-Analysis of infrared techniques-Characteristic and group frequencies-IR spectrophoto meter:Instrumentation and sample handling.

UNIT IV-RAMAN AND ELECTRONIC SPECTROSCOPY

Raman effect: Classical and Quantum theory of Raman effect- Pure Rotational and Vibrational Raman Spectra of Diatomic Molecules-Raman Spectrometer.

Electronic spectroscopy of diatomic molecules: Vibrational Coarse Structure-progressions and sequences-The Franck-Condon principle-Dissociation energy and

Dissociation products-Rotational fine structure of electronic vibration transitions-the Fortrat parabolae.

UNIT V-RESONANCE SPECTROSCOPY

Nuclear Magnetic Resonance: Magnetic properties of nuclei-Resonance condition-NMR instrumentation-Additional techniques-Relaxation processes-Bloch equation-Dipolar Interaction-Chemical Shift.

Electron Spin Resonance: Principle-ESR spectrometer-Total Hamiltonian-Hyperfine Structure-Spectra of Free Radicals in Solution.

BOOKS FOR STUDY

Book1: Molecular Structure and Spectroscopy, G. Aruldhas, PHI Learning Private Limited, New Delhi (2009).

Book2: Gupta, S.L.Kumar, Sharma, Elements of Spectroscopy, Pragati Prakasham Publication, Meerut(2009).

UNIT	**SECTIONS**
I	3.6-3.11 in Book1 and relevant topics in Book2.
II A	3.12-3.16 in Book1 and relevant topics in Book2
II B	4.1-4.3,4.6-4.8 in Book1 and relevant topics in Book2
III	6.1-6.10,6.14,6.15,7.1-7.6,7.11,7.14,7.16,7.17 in Book1
IV	8.2-8.6,9.2,9.4,9.6-9.9 in Book1.
V	10.1-10.8,11.2-11.5(11.5.1 only),11.6(11.6.1-11.6.3 only) in Book1.

BOOKS FOR REFERENCE

1. P.S.Sindhu, Elements of Molecular Spectroscopy, New Age International 2007.
2. A.K.Chandra, Introductory Quantum Chemistry, Mc Graw Hill, New Delhi 2003
3. C.N.Banwell, Elaine M.Mc Cash, Fundamental of Molecular Spectroscopy (Mc Graw Hill, New Delhi 2010).

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QUANTUM MECHANICS – P13PH7

Semester : II **Core Course: VI**

Instruction Hours/Week: 6 **Credit: 5**

Objectives:

To learn about the fundamentals of quantum mechanical formalism

To learn about Hamiltonian operator formalisms

To apply certain exactly solvable examples

Fundamentals of approximations

UNIT – 1 - INTRODUCTION

Wave – Particle - Dual Nature of Electron – De-Broglie Wave Length Derivation – Wave (Eigen)Function – Normalization Technique – Orthonormal Technique – Operator Formalism – Total Energy, Momentum, Kinetic and Potential Energy Operators – Ehrenfest Theorem - Derivation of Schrodinger's Equation – Time Dependant and Independent.

UNIT – 2 EXACTLY SOLVABLE PROBLEMS

Hydrogen Atom – Ground State of Deuteron – Linear Harmonic Oscillator – Particle in a Box – Kronig-Penney Square-Well Periodic Potential.

UNIT – 3 APPROXIMATIONS

Time dependant – Time independent perturbation theories - Stark effect - W.K.B approximation and its validity – transition to continuum states "Fermi's Golden rule" – Adiabatic approximation.

UNIT - 4 REPRESENTATION THEORY

Variation technique – Secular determinant – Hydrogen atom ion - Bracket notation - Schrodinger's, Heisenberg's and Interaction Pictures – Harmonic oscillator in matrix theory.

UNIT - 5 ANGULAR MOMENTUM AND RELATIVISTIC QUANTUM MECH.

Angular momentum formulation , L and J – operator formulation of L and J – commutation properties – C-G coefficient (only qualitative treatment) – Klein-Gordon equation – Pauli's spin matrices.

BOOKS FOR STUDY

1. Gupta, Kumar and Sharma – Quantum Mechanics – S. Chand publications
2. G. Aruldhas - Quantum Mechanics – PHI publications - 2008
3. Puranik – Quantum Particle Dynamics

BOOKS FOR REFERENCES

1. Schiff – Quantum Mechanics – Mc Graw Hill publications

UNIT	BOOK	CHAPTER/SECTION
I	1	1 (1.1,1.2,1.3,2.1—2.9)
II	1	2 /5 (5.1—5.13)
III	2/1	9.1,9.2,9.7,11.1,12.1 / 11,12
IV	2	3,3.9, 6.8,10.1,10.6
V	2/3	8.1,8.2,8.6, 14.1,14.2,14.3

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NUCLEAR AND PARTICLE PHYSICS – P13PH8

Semester : II **Core Course: VII**

Instruction Hours/Week: 6 **Credit: 5**

Objectives:

To understand the basic Structure and properties of the nucleus.

To know the mechanism of the natural Radioactivity.

To learn the different types of Nuclear reactions.

To understand the properties of various fundamental particles.

UNIT 1: PROPERTIES OF ATOMIC NUCLEI

Nuclear size and shape – Semi empirical mass formula -parity- nuclear forces –properties of Deuteron-simple theory of Ground state of deuteron– Spin dependence of nuclear forces– singlet and triplet states in deuteron ground state-Properties of Nuclear forces- Meson theory of nuclear forces.

UNIT 2: RADIOACTIVE DECAYS

Range of Alpha particles and Geiger-Nuttal law – Gamow's theory – Neutrino Hypothesis – Fermi theory of beta decay – Selection rules –parity violation – Selection rules of Gamma radiation – Gas filled detectors –G.M counters -Scintillation counter.

UNIT 3: NUCLEAR REACTIONS AND NUCLEAR MODELS

Reaction Energetics-Q-Value-Threshold Energy – Level Width- Types of Nuclear Reactions-Compound Nucleus Theory – Breit - Wigner Formula– Liquid Drop Model-Shell Model-Optical Model.

UNIT 4: ACCELERATORS REACTORS AND PLASMA PHYSICS

Linear accelerator-Cyclotron – Synchrocyclotron – Betatron–Nuclear fission –distribution of Mass of fission products –Bohr-Wheeler's theory of nuclear fission – chain reaction-four factor formula-nuclear reactor-nuclear fusion-The Plasma-Fusion reactions in the Plasma-conditions for maintained Fusion Reactions-stellar energy.

UNIT 5: ELEMENTARY PARTICLES

Classification of Elementary Particles–Fundamental Interactions Among Particles-Quantum Numbers Specifying States of Particles-Discovery of Antiparticles- Conservation Laws in Production and Decay Processes– Symmetry and Conservation Laws–Quark Model-Unification Of Fundamental Interactions.

BOOK FOR STUDY:

1. Sathya Prakash, Text Book of Nuclear and particle Physics, Sulthan Chand and Sons, New Delhi (2005).

Units	Sections
I	1.5,1.6,1.17,1.18,7.4,1.25,2.1 to 2.4,,2.20.
II	4.4, 4.7, 5.5, 5.7, 5.9, 5.11, 6.5, 10.12, 10.15, 10.16.
III	8.1, 8.4, 8.5, 8.10 to 8.13, 7.3, 7.6, 7.11.
IV	10.5 to 10.8, 9.2, 9.3, 9.10 to 9.13, 9.17 to 9.21.
V	11.5 to 11.8, 11.10, 11.11, 11.14, 11.16.

BOOKS FOR REFERENCE:

1. V. Devanathan, Nuclear Physics, Naroso Publishing House (2006).
2. S. B. Patel, *An Introduction to Nuclear Physics* (Wiley-Eastern, New Delhi, 2008).
3. B. L. Cohen*, Concepts of Nuclear Physics* Tata McGraw Hill, New Delhi, (1993).
4. D. Griffiths, *Introduction to Elementary Particles* Wiley International, New York,1987
5. Arora. C. L, Nuclear Physics,S.Chand & Co, New Delhi (1999).
6. Sharma.R. C, Nuclear Physics, K. Nath & Co, Meerut (1997).

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PHYSICS PRACTICALS - II (General & Electronics) – P13PH9P

(Any Twelve Expts.)

Semester : II **Core Course: VIII**

Instruction Hours/Week: 6 **Credit: 5**

1. Determination of L of a coil by Anderson's method
2. Determination of Stefan's constant
3. Determination of Rydberg's constant
4. Determination of thermal conductivity of a good conductor – Forbe's method.
5. Determination of e/m of an electron by Thomson's method
6. Determinations of wavelength of a laser source and thickness of a wire using Plane diffraction grating.
7. Active 2^{nd} order filter circuits
8. OP AMP – Current to Voltage to current converters
9. Solving simultaneous equations using OPAMP.
10. Design and study of Monostable Multivibrator
11. Design and study of Bistable Multivibrator
12. Determination of wavelength of monochromatic source using Biprism.
13. Determination of refractive index of liquids using Biprism (by Scale & Telescope method).
14. Determination of Specific rotatory power of a liquid using Polarimeter.

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ELECTIVE COURSE – II : SPECIAL ELECTRONICS II

MICROPROCESSOR AND COMMUNICATION ELECTRONICS – P13PH10E

Semester : II **Elective Course: II**

Instruction Hours/Week: 6 **Credit: 4**

UNIT I: MICROPROCESSOR ARCHITECTURE AND PROGRAMMING

Intel 8085 microprocessor architecture –Various registers-central processing unit of micro computers-timing and control unit-Instruction and dataflow- Instruction set-Addressing modes-8-bit addition, sum 16-bit-8 bit subtraction-8 bit multiplication-8 bit division-choosing the largest and smallest numbers from a list-Ascending and descending order-square root of a number.

UNIT II: IN TERFACING MEMORY,I/O DEVICES AND APPLICATIONDS

Memory mapped I/O scheme-I/O mapped I/O scheme-Memory and I/O interfacing data transfer schemes-I/O ports-programmable peripheral Interface(8255A)-programmable DMA controller(8257)-programmable interrupt controller(8259)-Temperature measurement and control- water level indicator.

UNIT III: ANTENNAS AND MICROWAVES

Antennas-power gain-Effective parameters of an antenna-Hertzian dipole-half wave Dipole-VHF,UHF and microwave antennas-TV- types of scanning-TV receiver-TV transmitter-colour picture tubes-microwave generation and application, Klystron –Magnetron-wave guides-Rectangular wave guide-mode of propagation-circular wave guide-Riged and flexible wave guides

UNIT IV: COMMUNICATION SYSTEMS

Amplitude modulation-AM transmitter-single side band principle-balanced modulator-SSB generation and reception-Independent side band system-frequency modulation-FM transmitted-FM detector-pulse modulation-PAM-pulse-time modulation-pulse width modulation-pulse code modulation-Frequency shift keying-,pulse shift keying-telemetry.

UNIT V: OPTIC FIBER AND SATELLITE COMMUNICATIONS

Principles a light transmission a fiber-step index fiber-graded index fibre-modes of propagation-losses in fiber.

Kepler's laws-orbits-Geostationary orbit-Altitude and Attitude Control-satellite station keeping-transponders uplink-power budget calculation-down link power budget calculations-multiple access methods.

BOOKS FOR STUDY

1. B.Ram, Fundamentals of microprocessors and microcomputers (Dhanpat Rai publication(P) Ltd, New Delhi, Fifth Reprint 1998
2. G.Kennedy,Electronic communication systems (TATA Mc Graw Hill publications, New Delhi (2003)
3. Dennis Roddy-John Coolen, Electronic Communications-IV Edition-Prentice Hall of India (2004)

Unit1 Book-1 chapters-3.1,3.2,2.4.2,4.3,4.6,6.3,6.4,6.5,6.21,6.24,6.25,6.29,6.30,6.36

Unit2 Book-2 chapters-7.3,7.4,7.7,7.8,7.9,7.10,7.11,9.2,9.5.1,9.6.1,9.6.4,9.8

Unit3 Book-3 chapters-16.2,16.4,16.5,16.6,16.7,16.8,16.9,16.10,16.18
Book-2 chapters-11.2,11.4
Book-3 chapters-14.1,14.2,14.3,13.2.1,13.2.2,213.2.3,13.2.4,13.3.1,13.3.2.

Unit4 Book-2 chapters-4.1,4.2.1,4.2.2,4.3.1,4.3.2,4.3.3,4.43,
Book-3 chapters-10.2,10.13,10.14
Book-4 chapters-10.1,10.2,11.14,11.18,11.20

Unit5 Book-3 chapters-20.1,20.2,20.3,19.2,19.3,19.4,19.5,19.6,19.8,19.9,19.13, 19.14,19.15,19.18.

BOOKS FOR REFERENCE

1. Ramesh Gaonkar,Microcessor Architecture, Programming and Applications with the 8085 (Penram Internationl Publishing (India) Private Limited, Fifth Edition.
2. Hand book of Electronics,Gupta S.L and Kumar, Pragati Prakasan Publications.

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ELECTROMAGNETIC THEORY – P13PH11

Semester : III **Core Course: IX**

Instruction Hours/Week: 6 **Credit: 5**

Objectives:

To understand the basic concepts of Electrostatics, Magnetostatics and Maxwell's equations.

To learn Electrostatics of Macroscopic Media.

To study the propagation of plane electromagnetic waves..

UNIT I: INTRODUCTION TO ELECTROSTATICS

Coulomb's law – Electric field –Electrostatic Potential- Electric field and potential of a Dipole- Gauss Law – applied to determination of electric field intensity due to infinite line charge distribution - Poisson and Laplace Equations in differential form–Method

of Images – Illustration: Point charge in the presence of (i) a grounded conducting Sphere – Boundary condition for D vector and E vector.

UNIT II: MAGNETOSTATICS

Amphere's Force Law-Biot and Savart law and its Applications-Long straight wire- Ampere's Circuital Law – Amperian loop - application to Magnetic flux density due to infinite current carrying sheet - Magnetic scalar potential-Magnetic Vector potential – Boundary conditions on B and H – Drichlet and Newmann conditions.

UNIT III: ELECTRODYNAMICS

Equation of Continuity- Maxwell's displacement current – Maxwell's equations –differential and integral forms - Poynting's theorem-diffrential form of Poynting's theorem -Electromagnetic Potential (A&Φ)– Maxwell's equations in terms of Electromagnetic Potential- Gauge transformations – Lorentz gauge.

UNIT IV: PLANE ELECTRO MAGNETIC WAVES AND WAVE PROPAGATION

Plane wave equation – Propagation of e.m. waves in free space - in a nonconducting isotropic medium – in a conducting medium- Reflection and refraction of electromagnetic waves (Snell's Law) – Propagation of electromagnetic waves in a rectangular wave guide -TM and TE modes.

UNIT V INTRODUCTION TO ANTENNAS

Radiation by an oscillating dipole – Skip distance – Radiation patterns of antennas – Directional characteristics – Gain of an antenna – Linear Array of Antennas (N-arrays) –
Qualitative analysis of a dipole antenna.

BOOKS FOR STUDY:

1. S.L.Gupta and V.Kumar, Electrodynamics,Pragati Prakashan Publications(2004).
2. K.K.Chopra and G.C.Agarwal,Electromagnteic Theory,K.Nath & Co(1993).
3. Sathya Prakash,Electromagnetic Theory, Sulthan Chand and Sons, New Delhi (2005).
4. S.K. Dash and S.R.Khunita – Fundamentals of Electromagnetic Theory, PHI publications – New Delhi – 2011.

Unit	Books
I	Relevant chapters in Book 1&3
II	Relevant chapters in Book 2
III	Relevant chapters in Book 2
IV	Relevant chapters in Book 2&3
V	Relevant chapters in Book 2 & 4

BOOKS FOR REFERENCE:

1. J. D. Jackson, *Classical Electrodynamics* (Wiley Eastern Ltd., New Delhi, 1993).
2. D. Griffiths, *Introduction to Electrodynamics* (Prentice-Hall, New Delhi, 1995).

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CRYSTAL GROWTH AND THIN FILM PHYSICS – P13PH12

Semester : III **Core Course: X**

Instruction Hours/Week: 6 **Credit: 5**

Objectives:

To study the Nucleation and Growth

To learn Solution Growth Techniques and Melt and Vapour Growth Techniques

To learn X-ray Crystallography

To learn Thin Film Deposition Techniques and its applications.

UNIT 1: NUCLEATION AND GROWTH

Nucleation – Different kinds of nucleation - Concept of formation of critical nucleus – Classical theory of nucleation - Spherical and cylindrical nucleus - Growth Kinetics of Thin Films – Thin Film Structure – Crystal System and Symmetry.

UNIT II: LOW TEMPERATURE GROWTH TECHNIQUES

Solution Growth Technique:

Low temperature solution growth: Solution - Solubility and super solubility – Expression of super saturation – Mier's T-C diagram - Constant Temperature Bath and Crystallizer – Seed preparation and mounting - Slow cooling and solvent evaporation methods.

Gel Growth Technique:

Principle – Various types – Structure of gel – Importance of gel – Experimental procedure –Chemical reaction method – Single and double diffusion method – Chemical reduction method –Complex and decomplexion method – Advantages of gel method.

UNIT III: MELT AND VAPOUR GROWTH TECHNIQUES

Melt technique:

Bridgman technique - Basic process – Various crucibles design - Thermal consideration – Vertical Bridgman technique - Czochralski technique – Experimental arrangement – Growth process.

Vapour technique:

Physical vapour deposition – Chemical vapour deposition (CVD) – Chemical Vapour Transport.

UNIT IV: THIN FILM DEPOSITION TECHNIQUES

Thin Films – Introduction to Vacuum Technology - Deposition Techniques - Physical Methods –Resistive Heating, Electron Beam Gun, Laser Gun Evaporation and Flash Evaporations, Sputtering - Reactive Sputtering, Radio-Frequency Sputtering - Chemical Methods – Spray Pyrolysis – Preparation of Transparent Conducting Oxides.

UNIT V: CHARACTERIZATION TECHNIQUES

X – Ray Diffraction (XRD) – Powder and single crystal - Fourier Transform Infrared Analysis (FT-IR) – Elemental Analysis – Elemental Dispersive X-ray Analysis (EDAX) - Scanning Electron Microscopy (SEM) – UV-Vis-NIR Spectrometer – Etching (Chemical) – Vicker's Micro hardness.

BOOKS FOR STUDY AND REFERENCE:

Relevant Chapters In

1. J.C. Brice, Crystal Growth Processes, John Wiley and Sons, New York (1986).
2. P. Santhana Ragavan and P. Ramasamy, Crystal Growth Processes and Methods,KRU Publications, Kumbakonam (2006).
3. A. Goswami, Thin Film Fundamentals, New Age International (P) Limited, New Delhi (1996).
4. H.H. Willard, L.L. Merritt, J.A. Dean, F.A. Settle, Thin Film Fundamentals, CBS, Publishers and Distributors, NewDelhi.
5. Kasturi L. Chopra, Thin film Phenomena, Mc Graw Hill Book Company (1969).
6. Smith Donald.L, Thin Film Deposition, Mac Graw Hill, London (1995).

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PHYSICS PRACTICALS III : ADVANCED ELECTRONICS - P13PH13P

(Any Twelve Expts.)

Semester : III **Core Course: XI**

Instruction Hours/Week: 6 **Credit: 5**

1. Logic gates – Universality of NAND / NOR gates Using IC's
2. Verification of Demorgans theorems and Boolean Expressions
3. Astable and Monostable multivibrator using IC 555
4. FET Amplifier (CD and CS configuration)
5. Phase Shift Network and Oscillator using IC 741
6. Wien Bridge Oscillator using IC 741
7. Construction of Dual Regulated Power Supply
8. Half and Full wave precision rectifier using IC 741
9. Characteristics of LVDT
10. Characteristics of LDR
11. Calibration of Thermistor
12. Calibration of Thermocouple
13. Study of the characteristics of Strain Gauge
14. Design of Mod 'n' Counters.
15. Study of the characteristics of Torque Transducer
16. Digital to Analog Converter - R-2R and Weighted methods

17. Study the function of Multiplexer and Demultiplexer
18. Study the function of Decoder and Encoder
19. Flip Flops
20. Half adder and Full Adder (using only NAND & NOR gates)
21. Half subtractor and Full Subtractor (using only NAND & NOR gates)
22. Digital comparator using XOR and NAND gates
23. BCD to seven segment display
24. Study of counter using IC 7490 (0-9 and 00-99)
25. Low pass & High pass filters using IC 741.

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ELECTIVE COURSE – III : NUMERICAL METHODS AND PROGRAMMING – P13PH14E

Semester - III **Elective Course : III**

Instruction hrs /week: 6 hrs. **Credit : 4**

Objectives:

To study the Errors and Measurements

To learn Algebraic, Transcendental equations and Interpolation

To study Numerical Differentiation and Integration

To program Computer programming

UNIT I: ERRORS AND MEASUREMENTS

General formula for Errors-Errors and its Types-Empirical formula-Graphical Method-Principle of Least Squares-Curve Fitting-Fitting a Parabola-Fitting Exponential Curves ($y=ae^{bx}$ and $y=ax^{b}$).

UNIT II: ALGEBRAIC AND TRANSCENDENTAL EQUATIONS

The Iteration Method-Method of False position-Newton-Raphson method –Convergence of Newton-Raphson Method.

Linear Algebraic Equations

Gauss Elimination method- Jordan's modification-Gauss-Seidel method of Iteration.

UNIT III: INTERPOLATION

Linear Interpolation-Gregory-Newton forward and Backward Interpolation formula-Central difference formula-Gauss forward and backward interpolation formula- Lagrange's interpolation formula.

UNIT IV: NUMERICAL DIFFERENTIATION AND INTEGRATION

Numerical Differentiation:-Euler's method-Improved Euler's method-Modified Euler's method-Runge-Kutta second and fourth order method for solving first order differential equations.

Numerical Integration: Trapezoidal rule-Simpson's $1/3^{rd}$ rule .

UNIT V: COMPUTER PROGRAMMING

C Program for the following:

1) Fit the straight line(y=ax+b) 2) Newton-Raphson Method 3) Simpson's $1/3^{rd}$ rule 4) Trapezoidal rule 5) Lagrange's interpolation 6) Euler's method 7) Runge - Kutta Second order method

BOOKS FOR STUDY:

1) M.K.Venkataraman, Numerical methods in Science and Engineering, National Publishing Company, Chennai (2004).Unit I to Unit IV.
2) Program Materials given by the Department of Physics, National College, Tiruchirappalli. Unit V.

BOOKS FOR REFERENCE:

1) S.S.Sastry, Introductory Methods of Numerical Analysis, PHI,New Delhi (2003).
2) Numerical Methods in Science and Engineering – The National Publishing Co. Madras (2001).
3) Numerical Recipes in C, W.H. Press, B.P.Flannery, S.A.Teukolsky, W.T. Vetterling, Cambridge University (1996).
4) Monte Carlo: Basics, K.P.N. Murthy, ISRP, Kalpakkam, 2000.
5) Numerical Methods in C and C++, Veerarajan, S.Chand, New Delhi (2006).

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ELECTIVE COURSE – IV : ELEMENTS OF NANOSCIENCE AND ITS APPLICATIONS – P13PH15E

Semester : III **Elective Course: IV**

Instruction Hours/Week: 6 **Credit: 4**

Objective:

To make students familiar with the important concepts in Nanotechnology and to learn the basics of it.

UNIT 1: HISTORY AND SCOPE AND CLASSES OF NANOMATERIALS

Pre-nanotechnology- origins of concepts of Nano- Basics and basis of Nanotechnology- Generations and Development- Molecular aspects- Top down and Bottom up approaches- fullerenes- properties of fullerenes-Carbon Nano Tubes (CNTs)- Types, properties, synthesis and applications of CNTs.

UNIT 2: ZERO DIMENSIONAL AND ONE DIMENSIONAL NANO STRUCTURES

Synthesis of Metallic Nano Particles, Semiconductor Nano Particles and Oxide Nano Particles (homogeneous nucleation). Nano Particles by Heterogeneous Nucleus: Aero Sol Synthesis – Spray Pyrolysis.

Nanorods: Evaporation, Condensation Growth, Vapor-Liquid-Solid Growth, Electro Spinning – Lithography.

UNIT 3: TWO DIMENSIONAL AND SPECIAL NANO MATERIALS

Thin films: Physical Vapor Deposition, Molecular Beam Epitaxy, Sputtering, Comparison of Evaporation and Sputtering, Self Assembly, Langmuir- Blodgett films- Zeolites, Core Shell Structures, Nano Composites and Nano Grained Materials.

UNIT 4: NANOMATERIAL CHARACTERIZATION

Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), and Scanning Probe Microscopy (SPM) techniques-(Principle, Experimental set up, procedure and utility for the all the techniques)

UNIT 5: APPLICATIONS

Molecular Electronics and Nanoelectronics – Nanobots- Biological applications of Nanoparticles- catalysis by gold Nanoparticles- band gap engineered quantum devices- Nanomechanics- CNT emitters- Photoelectrochemical Cells- Photonic Crystals- Plasmon Waveguides.

BOOKS FOR STUDY:

Book 1. Nanotechnology by S. Shanmugam (2010), MJP Publishers, Chennai.

Book 2. Nanostructures and Nanomaterials by Guozhong Cao (2004) Imperial College Press, London.

Book 3. Nano: The Essentials by T. Pradeep (2009), TMGH, New Delhi.

SECTIONS

Unit I : Relevant topics in Chapters 1 and 2. (Book 1)

Unit II : In chapter 3, Sections 3.2.3, 3.2.4, 3.2.5, 3.4.2, 3.4.4.
In chapter 4, Sections 4.2.1, 4.2.2.1, 4.2.2.2, 4.4. 4.5 (Book 2)

Unit III: In chapter 5, sections 5.4, 5.4.2,5.4.3, 5.4.4, 5. 8,5.9.
In chapter 6, sections 6.3.3, 6.4, 6.7. (Book 2)

Unit IV: In Chapter 2, Sections 2.1 to 2.4 (Book 3)

Unit V : In Chapter 9. Sections 9.2 to 9.10 (Book 2)

BOOKS FOR REFERENCE:

1. Hari Singh Nalwa, "*Nanostructured Materials and Nanotechnology*", Academic Press, 2002
2. M. Wilson, K. Kannangara, G Smith, M. Simmons, B. Raguse, Nanotechnology: Basic science and Emerging technologies, Overseas Press India Pvt Ltd, New Delhi, First Edition, 2005.
3. Kenneth J. Klabunde (Eds), *Nanoscale Materials Science*, John Wiley & Sons, InC, 2001.

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CONDENSED MATTER PHYSICS – P13PH16

Semester : IV **Core Course: XII**

Instruction Hours/Week: 6 **Credit: 5**

Objectives:

To study the Crystal structure, Lattice Vibrations and Thermal Properties.

To learn Free Electron Theory, Energy Bands and Semiconductor Cystals

To learn Diamagnetism, Paramagnetism, Ferro magnetism and Antiferromagnetism

To study Dielectrics and Ferroelectrics and Superconductivity.

UNIT 1: CRYSTAL STRUCTURE

Crystal classes and symmetry – 2D, 3D lattices – Bravais lattices – Point groups – Space groups –– Ewald's sphere construction – Bragg's law – Laue theory of X-ray diffraction, Geometrical structure factor, Atomic scattering factor, calculations for diamond structure BCC, FCC & hcp structure - Powder and Single Crystal Diffraction methods -Diffractometers.

UNIT II: LATTICE VIBRATIONS AND THERMAL PROPERTIES

Vibration of monoatomic lattices – Lattices with two atoms per primitive cell – Phonon momentum – Inelastic scattering of neutrons by phonons –Dulong & Petit's Law– Einstein model – Density of modes in one-dimension and three-dimension – Debye model of the lattice heat capacity – Thermal conductivity – Umklapp process.

UNIT III: FREE ELECTRON THEORY, ENERGY BANDS AND SEMICONDUCTOR CRYSTALS

Free electron gas- Ohm's law- Electrical conductivity and Thermal conductivity-Wiedemann & Franz ratio- Free electron gas in one dimension and three-dimension –Fermi- Dirac distribution– Hall effect-experimental determination of Hall coefficient –Nearly free electron model and origin of energy gap(basic idea only) – Semiconductors –Intrinsic Semiconductor-Carrier concentration in Intrinsic Semiconductor.

UNIT IV: DIAMAGNETISM, PARAMAGNETISM, FERRO MAGNETISM

Langevin Classical Theory of Diamagnetism and Paramagnetism – Weiss theory -Quantum theory of Paramagnetism –Ferromagnetism-classical theory of Ferromagnetism- Temperature dependence of Spontaneous Magnetisation – Ferromagnetic Domains-Anisotropic energy.

UNIT-V:DIELECTRICS AND FERROELECTRICS AND SUPER CONDUCTIVITY

Macroscopic electric field – Local electric field at an atom –Clausius-Mossotti equation - Occurrence of Superconductivity – Meissner effect – London equation – Coherence length – BCS theory –Type I and Type II Superconductors – Application of superconductors-Josephson superconductor tunneling – DC and AC Josephson effect–– Flux quantization –– SQUID.

BOOKS FOR STUDY:

Relevant Chapters in

1. C. Kittel, Introduction to Solid State Physics (Wiley Eastern, New Delhi, 2008).
2. M. M. Woolfson, An Introduction to X-ray Crystallography (Cambridge University Press, Cambridge, 1970).
3. S. O. Pillai, Solid State Physics , New Age International, New Delhi (2007).

BOOKS FOR REFERENCE:

1. N. W. Ashcrof and N. D. Mermin, Solid State Physics (Holt, Rinehart and Winston, Philadelphia,1976).
2. J. S. Blakemore, Solid State Physics (Cambridge University Press, Cambridge,1974).
3. A. J. Dekker, Solid State Physics (Mc Millan, Madras, 1998).
4. A Compendium based on Introductory Solid State Physics by HP Myers, Cambridge University Press.

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PHYSICS PRACTICAL IV : ADVANCED ELECTRONICS – P13PH17P

Semester : IV **Core Course: XIII**

Instruction Hours/Week: 6 **Credit: 5**

MICROPROCESSORS AND COMPUTER LABORATORY

(Any twelve only -- Choosing a minimum of six experiments from each part)

A. Microprocessor Practicals

1. 8 bit addition, subtraction, multiplication and division using 8085/Z80.
2. 16 bit addition, 2's complement and 1's complement subtraction (8086/8088).
3. Conversion from decimal to octal and hexa systems.
4. Conversion from octal, hexa to decimal systems.
5. Largest& Smallest number in a given array.
6. Interfacing hexa key board (IC 8212).
7. Study of DAC interfacing (DAC 0900).
8. Study of ADC interfacing (ADC 0809).
9. Study of timer interfacing (IC 8253).
10. Study of programmable interrupt controller (IC 8259).
11. Traffic control system using microprocessor.
12. Microprocessor as digital clock.
13. Generation of square, triangular, saw-tooth staircase and sine waves using DAC 0800.
14. Microprocessor as digital thermometer (temperature controller).

15. Control of stepper motor using microprocessor.

B. Computer Practicals (By C Language)

1. Roots of algebraic equations -- Newton-Raphson method.
2. Least-squares curve fitting – Straight-line fit.
3. Least-squares curve fitting – Exponential fit.
4. Solution of simultaneous linear algebraic equations – Gauss elimination method.
5. Solution of simultaneous linear algebraic equations – Gauss-Seidal method.
6. Interpolation – Lagrange method.
7. Numerical integration –Trapezoidal rule.
8. Numerical integration –Simpson's $1/3^{rd}$ rule.
9. Numerical differentiation – Euler method.
10. Solution of ordinary differential equations – Runge-Kutta 2^{nd} order method.
11. Solution of ordinary differential equations – Runge-Kutta 4^{th} order method.
12. Uniform random number generation – Park and Miller method.
13. Gaussian random number generation – Box and Muller method.
14. Evaluation of definite integrals – Monte Carlo method.
15. Calculation of mean, standard deviation and probability distribution of a set of random numbers.

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ELECTIVE COURSE V : ADVANCED OPTICS – P13PH18E

Semester : IV **Elective Course: V**

Instruction Hours/Week: 6 **Credit: 4**

UNIT I: INTRODUCTION TO PHOTONICS

Description: Photonics and its Properties-Speed-Energy-Frequency-Wavelength-Moments-Mass-Timing-Uncertainity of Field Strength-Gaussian Beams-Ray Matrices-Deriving Ray Matrices-Ray Matrices of Some Optical Elements.

UNIT II: LASERS

Spontaneous Emission – Stimulated Emission – Einstein Coefficients – Population Inversion – Pumping Action – Laser Characteristics.

Solid state Laser: Nd-YAG- Ruby Laser- Gas Lasers: Helium – Neon –CO_2 Laser –Argon-Ion laser- Semiconductor Laser-Dye Laser.

UNIT III: FIBER OPTICS

Introduction-Principle of Optical Fiber-Acceptance Angle-Numerical Aperture-Types of Optical Fibres-Single Mode and Multimode Optical Fibres-Characteristics of Step Index and Graded Index Fibres Characteristics-Fiber Attenuation-Dispersion and its Types-Bandwidth- Distance

Product-Light Sources-LED-Detectors-Photo Diode-Optic Fiber Communication System-Advantages of Optic Fiber Communication.

UNIT IV: INTRODUCTION TO NON-LINEAR OPTICS

Introduction -Harmonic Generation-Second Harmonic Generation- Phase Matching-Third Harmonic Generation-Optical Mixing: Sum And Difference Frequencies-Parametric Generation of Light-Self-Focusing of Intense Light Beams-Phase Matching-Optical Matching-Parametric Generation of Light-Self Focussing of Light-Multi Quantum Photo Electric Effect-Two Photon Process and its theory.

UNIT V: NON LINEAR OPTICAL MATERIALS

Basic requirements-Inorganics-Borates-Organics-Urea-Nitroaniline-Semi Organics-Thiourea complex-Laser Induced Surface Damage Threshold-Kurtz and Perry Powder Technique.

BOOKS FOR STUDY:

Book 1. Govind, P. Agarwal, Fiber-Optics Communication Systems, 3rd Edn. John Wiley and Sons, Singapore (2003).

Book 2. B. B. Laud, Lasers and Non-Linear Optics, New Age International Publishers, New Delhi(2008).

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PROJECT WORK - P13PHP19

Semester : IV **Project**

Instruction Hours/Week: 12 **Credit: 5**

PROJECT WORK

(Dissertation 75 marks & Viva Voice – 25 Marks)

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