

UNIVERSITY OF KERALA

**REVISED SYLLABI FOR
FIRST DEGREE PROGRAMME IN**

PHYSICS

UNDER

**CHOICE BASED-CREDIT & SEMESTER-
SYSTEM (CBCSS)**

(2014 admission onwards)

A handwritten signature in black ink, appearing to be 'R. S. S.', written diagonally across the page.

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I. General Structure for the First Degree Programme in Physics

Sem. No.	Course title	Instructional hours/week		Credit	Uty.Exam duration	Evaluation		Total credit
		L	P			Internal	Uty. exam	
I	EN1111 English Lang I	5		4	3 hours			16
	1111 Addl Lang I	4		3	„			
	EN1121 Foun Course I	4		2	„	25%	75%	
	PY1141 Core Course I	2		2	„			
	Core pract. I	-	2	-	-			
	MM1131.1 Compl. Course I	4		3	3 hours			
	Compl. Course II (CH1131.1/ST1131.2/EL1131)	2	2	2	„			
II	EN1211 Eng Lang. II	5		4	3 hours			17
	EN1212 Eng Lang. III	4		3	„			
	1211 Addl Lang. II	4		3	„	25%	75%	
	PY1221 Foun Course II	2	2	2	„			
	MM1231.1 Compl. Course III	4	-	3	„			
	Compl. Course IV (CH1231.1/ST1231.2/EL1231)	2	2	2	„			
III	EN1311 Eng Lang. IV	5		4	3 hours			18
	1311 Addl Lang. III	5		4	„			
	PY1341 Core Course II	3	-	3	„	25%	75%	
	Core Pract I	-	2	-	-			
	MM1331.1 Compl. Course V	5	-	4	3 hours			
	Compl. Course VI (CH1331.1/ST1331.2/EL1331)	3	2	3	„			

IV	EN1411 Eng Lang. V	5		4	3 hours			
	1411 Addl Lang. IV	5		4	„			
	PY1441 Core Course III	3		3	„	25%	75%	25
	PY1442 Core (Pract I) IV	-	2	3	„			
	MM1431.1 Compl. Course VII	5	-	4	3 hours			
	Compl. Course VIII (CH1431.1/ST1431.2/EL1431)	3	-	3	„			
	Compl. (Practical) IX (CH1432.1/ST1432.2/EL1432)	-	2	4	„			
V	PY1541 Core Course V	4	-	4	3 hours			
	PY1542 Core Course VI	4	-	4	„			
	PY1543 Core Course VII	4	-	4	„	25%	75%	18
	PY1544 Core Course VIII	4	-	4	„			
	Core (PracticalII)	-	4	-	-			
	Open Course (PY1551.1/PY1551.2/ PY1551.3/PY1551.4/ PY1551.5)	3	-	2	3 hours			
	Project	-	2	-	-			
VI	PY1641 Core Course IX	4	-	4	3 hours			
	PY1642 Core Course X	4	-	4	„			
	PY1643 Core Course XI	4	-	4	„	25%	75%	26
	PY1644 Core Course XII	4	-	3	„			
	PY1645 Core (Pract II) XIII	-	2	2	„			
	PY1646 Core (Pract III) XIV	-	2	3	„			
	Elective Course (PY1661.1/PY1661.2/ PY1661.3/PY1661.4/ PY1661.5)	3	-	2	„			
	PY1647 Project	-	2	4	-			

II. Course structure:(1a). Core Courses (theory)

Sem.	Title of paper	Number of hours per week	Number of credits	Total hours/ semester	UE Duration	Weightage	
						IA	UE
1	PY1141 – Basic mechanics & Properties of matter	2	2	36	3 hrs	1	3
2	PY1221- Classical Mechanics (Foundation course 2)	2	2	36	3	1	3
3	PY1341–Thermodynamics & Statistical Physics	3	3	54	3	1	3
4	PY1441-Electrodynamics	3	3	54	3	1	3
5	PY1541– Methodology in Physics & Relativistic Mechanics	4	4	72	3	1	3
	PY1542–Quantum Mechanics	4	4	72	3	1	3
	PY1543–Electronics	4	4	72	3	1	3
	PY1544–Atomic & Molecular Physics	4	4	72	3	1	3
	PY1551– Open course	3	2	54	3	1	3
	PY1641-Solid State Physics	4	4	72	3	1	3
	PY1642–Nuclear & Particle Physics	4	4	72	3	1	3
6	PY1643- Classical & Modern Optics	4	4	72	3	1	3
	PY1644- Computer Science	4	3	72	3	1	3
	PY1661– Elective Course	3	2	54	3	1	3

(1b). COURSE STRUCTURE FOR PRACTICALS AND PROJECT WORK**FOR THE CORE COURSE:**

Sem	Title of Paper	Duration of Exam	Number of credits	Weightage IA	Weightage UE	Allotted hours	
						Per week	Per year
4	PY1442- Mechanics, Properties of matter, Error measurements, Heat and Acoustics	3	3	1	3	S1---2 S2---2 S3---2 S4---2	144
6	PY1645-Optics, Electricity and magnetism	3	2	1	3	S5---2 S6---2	72
6	PY1646-Electronics and Computer science	3	3	1	3	S5---2 S6---2	72
6	PY-1647-Project	-	4	-	4	S5-2 S6-2	72

2(a). Complementary Courses (General structure)

Semester	Theory			Practical		Weightage (For both theory & practical)	
	Number of hours/week	Number of credits	Total hours/sem	number of hours/week	Number of credits	IA	UE
1	2	2	36	2	-	1	3
2	2	2	36	2	-	1	3
3	3	3	54	2	-	1	3
4	3	3	54	2	4	1	3

(2b). COMPLEMENTARY COURSES (Theory and Practical)**1. Physics for Mathematics B.Sc Programme**

Semester	Title of the course	No. of hours/week	No. of credits	Total credits	Total hours per sem.	UE duration	weightage	
							CE	UE
1	PY1131.1- Mechanics & properties of matter	2	2	2	36	3	1	3
	Practical	2			36			
2	PY1231.1- Heat and Thermodynamics	2	2	2	36	3	1	3
	Practical	2			36			
3	PY1331.1- Optics, magnetism & electricity	3	3	3	54	3	1	3
	Practical	2			36			
4	PY1431-Modern Physics & Electronics	3	3	7	54	3	1	3
	PY1432-Practical	2	4		36			

2. Physics for Chemistry and Polymer Chemistry B.Sc Programmes

Semester	Title of the course	No. of hours/week	No. of credits	Total credits	Total hours per sem.	UE duration	weightage	
							IA	UE
1	PY1131.2-Rotational dynamics & properties of matter	2	2	2	36	3	1	3
	Practical	2			36			
2	PY1231.2- Thermal Physics	2	2	2	36	3	1	3
	Practical	2			36			
3	PY1331.2- Optics, Magnetism & Electricity	3	3	3	54	3	1	3
	Practical	2			36			
4	PY1431.2-Atomic physics, Quantum mechanics & Electronics	3	3	7	54	3	1	3
	PY1432- Practical	2	4		36	3	1	3

3. Physics for Statistics B.Sc Programme

Semester	Title of the course	No. of hours/week	No. of credits	Total credits	Total hours per sem.	UE duration	weightage	
							IA	UE
1	PY1131.3- Mechanics & properties of matter	2	2	2	36	3	1	3
	Practical	2			36			
2	PY1231.3- Thermal Physics & statistical mechanics	2	2	2	36	3	1	3
	Practical	2			36			
3	PY1331.3- Physical and modern optics & electricity	3	3	3	54	3	1	3
	Practical	2			36			
4	PY1431.3- Modern physics & Electronics	3	3	7	54	3	1	3
	PY1432- Practical	2	4		36	3	1	3

4. Physics for Geology B.Sc Programme

Semester	Title of the course	No. of hours/week	No. of credits	Total credits	Total hours per sem.	UE duration	weightage	
							IA	UE
1	PY1131.4 Mechanics & properties of matter	2	2	2	36	3	1	3
	Practical	2			36			
2	PY1231.4 Thermal Physics & Physics of the Earth	2	2	2	36	3	1	3
	Practical	2			36			

3	PY1331.4 Optics and electrodynamics	3	3	3	54	3	1	3
	Practical	2			36			
4	PY1431.4 Modern Physics, Electronics & crystallography	3	3	7	54	3	1	3
	PY1432- Practical	2	4		36	3	1	3

5. Physics for Home Science B.Sc Programme

Semester	Title of the course	No. of hours/week	No. of credits	Total credits	Total hours per sem.	UE duration	weightage	
							IA	UE
1	PY1131.5- Mechanics & properties of matter	2	2	2	36	3	1	3
	Practical	2			36			
2	PY1231.5- Thermal Physics	2	2	2	36	3	1	3
	Practical	2			36			

3	PY1331.5- Optics and electricity	3	3	3	54	3	1	3
	Practical	2			36			
4	PY1431.5- Atomic physics & Electronics	3	3	7	54	3	1	3
	PY1432- Practical	2	4		36	3	1	3

6. Electronics for Physics B.Sc Programme

Semester	Title of the course	No. of hours/week	No. of credits	Total credits	Total hours per sem.	UE duration	Weightage	
							IA	UE
1	EL1131- Electronics I	2	2	2	36	3	1	3
	Practical	2			36			
2	EL1231- Electronics II	2	2	2	36	3	1	3
	Practical	2			36			
3	EL1331- Electronics III	3	3	3	54	3	1	3
	Practical	2			36			
4	EL1431- Electronics IV	3	3	7	54	3	1	3
	EL1432- Practical	2	4		36	3	1	3

AIM AND OBJECTIVES OF THE PROGRAMME

In this programme, we aim to provide a solid foundation in all aspects of physics and to show a broad spectrum of modern trends in physics and to develop experimental, computational and mathematical skills of students. The syllabi are framed in such a way that it bridges the gap between the plus two and post graduate levels of physics by providing a more complete and logical framework in almost all areas of basic physics.

The programme also aims

- (i) to provide education in physics of the highest quality at the undergraduate level and generate graduates of the caliber sought by industries and public service as well as academic teachers and researchers of the future.
- (ii) to attract outstanding students from all backgrounds.
- (iii) to provide an intellectually stimulating environment in which the students have the opportunity to develop their skills and enthusiasms to the best of their potential.
- (iv) to maintain the highest academic standards in undergraduate teaching.
- (v) to impart the skills required to gather information from resources and use them.
- (vi) to equip the students in methodology related to physics.

Objectives

By the end of the first year (2nd semester), the students should have,

- (i) attained a common level in basic mechanics and properties of matter and laid a secure foundation in mathematics for their future courses.
- (ii) developed their experimental and data analysis skills through a wide range of experiments in the practical laboratories.

By the end of the fourth semester, the students should have

- (i) been introduced to powerful tools for tackling a wide range of topics in Thermodynamics, Statistical Mechanics and Electrodynamics.
- (ii) Become familiar with additional relevant mathematical techniques.
- (iii) Further developed their experimental skills through a series of experiments which also illustrate major themes of the lecture courses.

By the end of the sixth semester, the students should have

- (i) covered a range of topics in almost all areas of physics including quantum physics, solid state physics,

computational physics, electronics etc.

(ii) had experience of independent work such as projects, seminars etc. (iii) developed their understanding of core physics.

PY1141: BASIC MECHANICS & PROPERTIES OF MATTER
(36 HOURS-2 CREDITS)

MECHANICS (22 hrs.)

Unit 1- Dynamics of Rigid Bodies (7 hrs)

Equations of motion for rotating rigid bodies-angular momentum and M.I-Theorems on M.I- calculation of M.I of bodies of regular shapes- uniform rod, ring, disc, annular ring, solid cylinder, hollow cylinder and solid sphere-KE of rotating and rolling bodies-torque-Determination of M.I of a fly wheel (theory, experiment and applications).

Unit 2- Conservation of energy (3 hrs)

Conservation laws-Work –power- Kinetic Energy – Work Energy theorem- Conservative Forces -potential energy – Conservation of energy for a particle– energy function- Non Conservative forces- Friction- types of friction.

Unit 3-Oscillations (12 hrs)

Simple harmonic motion – Energy of harmonic oscillators-simple pendulum-mass on a spring-oscillation of two particles connected by a spring- compound bar pendulum - interchange ability of suspension and oscillation-four points collinear with C.G about which the time period is the same-conditions for maximum and minimum periods - Determination of g using symmetric bar pendulum.Mechanical and electromagnetic wave motion- General equation of a wave motion-expression for a plane progressive harmonic wave- energy density for a plane progressive wave- transverse waves in stretched string (expression)- longitudinal waves in rods- longitudinal waves in gas. Acoustics-reverberation-Sabines reverberation formula-Determination of absorption coefficient-acoustic Intensity-Factors affecting acoustics of buildings.

PROPERTIES OF MATTER (14hrs)

Unit 4- Elasticity (8 hours)

Modulus of elasticity (revision)-Relations connecting the three elastic moduli- poisson's ratio- bending of beams- bending moment-cantilever-centrally loaded beams and uniformly bent beams-I section girders-torsion of a cylinder-expression for torsional couple -work done in twisting a wire-torsion pendulum-static torsion-theory and experiment.

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Unit 5– Surface Tension (3 hrs)

Surface tension-molecular explanation of S.T-angle of contact (revision)-shapes of drops -expression for excess of pressure on a curved liquid surface -determination of surface tension by Jaeger's method-capillary rise method-variation of S.T with temperature.

Unit 6 – Fluid Dynamics (3 hours)

Streamline and turbulent flow-equation of continuity-Bernoulli's theorem-venturimeter-viscosity-Newton's law- Poiseuille's equation-derivation-flow of blood in human body-Stoke's formula-theory and experiment.

Books for Study

1. Mechanics – Hans H.S and Puri S.P, TMH: second edition.
2. Mechanics – J.C Upadhyaya (Ramaprasad)
3. Properties of matter – D.S.Mathur
4. Fundamentals of Physics- Halliday and Resnick

References

1. Properties of matter- Brijlal and Subramaniam
2. Principles of Physics- P.V.Naik, PHI.
3. Mechanics and Properties of matter – P.Vivekanandan

Topics for assignments /discussion in the tutorial session (sample)

1. Physics-The fundamental science-historical development of mechanics-some implications of the principle of mechanics-The scope of mechanics.
2. Life of eminent physicists- Newton, Einstein, C.V.Raman, Edison.
3. Study of Young's modulus for different types of wood.
4. Study of variation of surface tension for different detergents.

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5. Study of viscosity of different types of ink and to arrive at knowledge of its fluidity.
6. Wide applications of Bernoulli's equation.
7. Variation of surface tension with temperature by Jaeger's method

PY1221-CLASSICAL MECHANICS
(36 HRS-2 CREDITS)

Unit 1 - Particle Dynamics (5 hrs): Book 2; Chapter 3

Newton's laws of motion – mechanics of a particle – equation of motion of a particle – Motion of a charged particle in electromagnetic field – mechanics of a system of particles.

Unit 2-Conservation laws and properties of space and time (6 hrs): Book 1; Ch. 5

Linear uniformities of space and conservation of linear momentum – rotational invariance of space and law of conservation of angular momentum – homogeneity of flow of time and conservation of energy.

Unit 3- Motion in central force field (10 hrs): Book 2; Chapter 5 & Book 3; Ch. 4

Equivalent one body problem – motion in central force field – general features of motion – motion in an inverse square law force field – equation of the orbit – Kepler's laws of planetary motion and their deduction.

Unit 4 - Collisions (6 hrs): Book 1; Chapter 7

Conservation laws – laboratory and centre of mass systems – kinetic energies in the lab and CM systems – Cross-section of elastic scattering.

Unit 5 - Lagrangian Dynamics (9 hrs): Book 3; Chapter 2

Constraints – generalized coordinates – principle of virtual work – D' Alembert's principle, Lagrange's equation from D' Alembert's principle, – applications of Lagrange's equation in simple pendulum, Atwood's machine and compound pendulum (comparison of Lagrangian approach with Newtonian approach).

Books for study :

1. Mechanics – H.S.Hans and S.P.Puri (Tata-McGraw Hill).
2. Introduction to classical mechanics – R.G.Thakwale and P.S.Puranik (Tata-McGraw Hill).
3. Classical Mechanics – J C Upadhyaya (Himalaya Publishing House)

Books for reference:

1. Classical Mechanics – Goldstein.
2. Classical Mechanics- Vimal Kumar Jain (Ane Books Pvt Ltd)
3. Modern Physics – (Schaum's outlines)

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4. Classical Mechanics - Systems of Particles & Hamiltonian Dynamics – Walter Greiner.
5. Concepts of Modern physics-Arther Bieser (Tata-McGraw Hill).
6. Classical Mechanics – N.C Rana and P.S.Joag

PY1341-THERMODYNAMICS AND STATISTICAL PHYSICS
(54 HOURS-3 CREDITS)

Unit 1.Transference of heat (8 hrs) chapter 8 Ref 3

Thermal conductivity - determination by Lee's Disc method for bad conductor radial flow of heat, cylindrical flow ,thermal conductivity of rubber, Wiedmann-Franz law.Radiation of heat, Stefan's law, determination of Stefan's constant, solar constant, determination of solar temperature

Unit 2 Thermodynamics (18 hrs) Ref 2

Zereth Law & First law of Thermodynamics, differential form-Thermodynamic processes-Expression for work done in isothermal and adiabatic processes. Application of first law to specific heat and latent heat. Reversible and irreversible processes.

Second law of thermodynamics- Clausius and Kelvin statements-Carnot engine - Principle refrigerator, working and efficiency Otto engine and Diesel engine – working and efficiency.

Unit 3 Entropy (1 2 hrs .) chapter 6, Ref 3 & Ref 1

Definition of entropy, change of entropy in reversible and irreversible cycle, Clausius inequality and second law of thermodynamics, entropy and available energy,. Entropy, probability and disorder. Nernst theorem and third law of thermodynamics. phase transition, phase diagram ,first order phase transition Clausius-Clepe yron Equation ,higher order phase transition (qualitative study) Liquid Helium, Gibb's Helmhol's

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Functions Maxwell's Equations

Unit 4 Statistical Physics (16hrs) chapter 9,Ref 4

Statistical probability, Macro & Microstates, Phase space, Statistical ensemble, Postulate of equal probability, Maxwell Boltzmann distribution, Velocity distribution. Indistinguishability of identical particles, Bose Einstein and Fermi Dirac distribution functions, comparison of three statistics, Application of BE & FD statistics, Bose-Einstein condensation.

Books for study

1. Thermal and Statistical Mechanics- S.K. Roy (NewAge International)
2. Heat and Thermodynamics –D. S. Mathur (S. Chand &Co)
3. Heat and Thermodynamics- Brijlal & Subrahmanyam (S. Chand &Co)
4. Concepts of Modern Physics – Arthur Beiser (TMH)

Books for reference

1. Elements of Statistical Mechanics- Kamal Singh & S. P. Singh (S. Chand & Co)
2. Thermal Physics, Statistical Physics and Solid state Physics – C. J. Babu (Calicut University Press)
3. Statistical mechanics – Sinha (TMH)
4. Heat and Thermodynamics- Zemansky, McGraw-Hill

PY1441 – ELECTRODYNAMICS (54 HOURS-3 CREDITS)

Unit 1-Electrostatic Field (10hrs)

Electric field*: Introduction*, Coulomb's Law*, Electric field*, continuous charge distribution* Divergence and curl of electrostatic fields; Field lines, flux and Gauss' law, the divergence of E, applications of Gauss's law, the Curl of E Electric potential: Introduction to potential, Comments on potential, Poisson's and Laplace's equations, Potential of a localized charge distribution, electrostatic boundary

Work and energy in Electrostatics: The work done to move a charge, the energy of a point charge distribution, The energy of a continuous charge distribution.

Unit 2-Electrostatic fields in matter (10 hrs)

Polarization: Dielectrics, induced dipoles, Polarization, The field of a polarized object: Bound charges, Physical interpretation of bound charges, and the field inside a dielectric

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Electric displacement: Gauss's law in the presence of dielectrics, Boundary conditions

Unit 3-Magnetostatics (8hrs)

Introduction*, The Biot-Savart law*, Ampere's force law*, Magnetic torque, Magnetic flux and Gauss's law for magnetic fields, Magnetic vector potential, Magnetic intensity and Ampere's circuital law, Magnetic materials.

Unit 4-Electromagnetic Induction (8hrs)

Electromotive force: Ohm's law

Electromagnetic induction: Faraday's law, the induced electric field Maxwell's Equations: Electrodynamics before Maxwell, How Maxwell fixed Ampere's law, Maxwell's equations, Magnetic charge, Maxwell's equations in matter, Boundary conditions

Unit 5-Electromagnetic waves (6hrs)

Waves in one dimension: The wave equation Electromagnetic waves in vacuum: The wave equation for E and B, Monochromatic plane waves, Energy and momentum in electromagnetic waves

Unit 6-Transient currents(4hrs)

Growth and decay of current in LR and CR circuits-Measurement of high resistance by leakage-Charging and discharging of a capacitor through LCR circuit.

Unit 7-Alternating current (4 hrs)

AC through series LCR (acceptor circuit) and parallel LCR circuit (rejecter circuit)- Q- factor, Power in AC-power factor - AC bridges Maxwell's L/C bridge and Owens's bridge.

Unit 8-Circuit Theory (4 hrs)

Ideal voltage and current sources- Thevenin's and Norton's theorems, Maximum power transfer theorem, h parameters applied to two port networks

* Revision topics

Books for study

1. Electrodynamics - David J Griffith (PHI 3rd edition)
2. Electricity and Magnetism-Murugesan (S.Chand & Co.)
3. Electricity and Magnetism -_K.K.Tiwari (S.Chand & Co.)

Reference Books

1. Electromagnetic theory fundamentals- Bhag Guru and Huseyin Hiziroglu (Cambridge University Press 2nd edition)
2. Electricity and Magnetism -E.M. Purcell, Berkeley Physics course, Vol.2 (MGH)
3. Electricity and Magnetism - J.H. Fewkes & John Yarwood (University tutorial press)
4. Electricity and Magnetism- D.C.Tayal (Himalaya Publishing Co)
5. Electricity and Magnetism_ - Muneer H. Nayfeh & Norton K. Bressel (John Wiley & Sons)
6. Classical Electrodynamics- Walter Greiner (Springer International Edition)

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7. Electromagnetic waves and radiating systems-Jordan & Balmain (PHI)
8. Electromagnetics, B.B.Laud (Wiley Eastern Ltd.2nd edition)
9. Introduction to electrodynamics-Reitz &Milford (Addison Wesley)

Topics for discussion in Tutorial session/Assignments (sample)

1. Comment on how electrostatic energy is stored in a field
2. Discuss the electrostatic properties of conductors
3. What is meant by electrostatic shielding? In what way it help us?
4. Discuss the peculiarities of electric displacement D and electric field E. How they are incorporated in Maxwell's Equations
5. Discuss the properties of linear dielectrics. What differentiates a dielectric to be linear or not
6. Discuss applications of Ampere's circuital law
7. Compare electrostatics and magnetostatics
8. Why magnetic forces cannot do work
9. Discuss about cyclotron motion & cycloid motion
10. Discuss whether there existed any stand-off between ohm's law and Newton's second law
11. A battery has an *emf*. Can this *emf*. is a 'force' ? How will you interpret electromotive force?
12. Discuss the role of motional *emf* in power generation
13. Discuss the orthogonality of E, B and propagation vector k
14. A wave function can have a sinusoidal representation. Solve the wave equation for this function and discuss the various terms related to a wave such as amplitude, frequency, phase, wave number, frequency etc.
15. Complex representation of wave function has good advantage. Why? Discuss the linearity of wave function. (use complex notation)
16. Discuss AC through LC, LR and CR circuits
17. Show that sharpness of resonance is equal to Q- factor
18. What is a choke coil? Discuss the advantage of using a choke coil instead of a resistor

PY1541: METHODOLOGY IN PHYSICS & RELATIVISTIC MECHANICS

(72 HRS.- 4 CREDITS)

Unit 1 Introduction (10 hrs)

Objectives and motivation in research, research approaches, significance of research, different methods of research, characteristic features of scientific method, different steps of scientific research, literature survey, purposes of literature survey, criteria of good research, features for selecting a problem, scientific researches in India.

Unit 2 Experimentation & Analysis (12 hrs)

Design of an experiment; experimentation; observation; data collection; interpretation and deduction, repeatability and replication; Documentation of experiments, Types of experiments. Types of analysis, Statistical testing of hypothesis, null hypothesis, Significance test; Statistics based acceptance or rejection of a hypothesis. Deduction of scientific correlation, patterns and trends.

Unit 3 Error Analysis (10 hrs)

Basic ideas of error measurement, uncertainties of measurement, importance of estimating errors, dominant errors, random errors, systematic errors, rejection of spurious measurements

Estimating and reporting errors, errors with reading scales, number of significant digits, absolute and relative errors, standard deviation, error bars and graphical representation.

Unit 4 Familiarization in Thesis/dissertation writing and Publication of results in a Journal (8 hrs) (Book 1, 2 and 6)

Thesis/dissertation writing:- Preliminary section (title page, declaration of author, certificate of supervisor, table of contents, list of tables and figures, preface, acknowledgement), main text (abstract, introduction, experimental section, results and discussion), conclusion, references, scope of future study. Paper writing:- general format for a science journal (title of the work- author/authors name- address of the author- abstract- key words- introduction-theory/experimental section- analysis/discussion of results- summary/conclusion- references- list of tables- list of figures).

Unit 5 - Hamiltonian dynamics (7 hrs)

Generalized momentum and cyclic coordinates-Hamiltonian function H – conservation of energy – Hamilton's equations –examples of Hamiltonian dynamics – one dimensional harmonic oscillator-two dimensional harmonic oscillator using Cartesian coordinates (comparison of Newtonian, Lagrangian and Hamiltonian approach

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Unit 6 – Frames of reference and Galilean transformation (5 hrs)

Inertial frames of reference-Galilean transformation-non-inertial frames- reference frame with translational acceleration-uniformly rotating frame- fictitious forces-centrifugal forces and coriolis forces.

Unit 7 - Special theory of relativity (20 hrs):

Origin and significance of special theory of relativity – search for universal frame of reference – Michelson-Morley experiment – postulates of special theory of relativity – consequences – Lorentz transformation equations – kinematical consequences of Lorentz Transformation – length contraction – time dilation – twin paradox - transformation of velocity – causality and maximum signal velocity – relativistic optical shifts – space like and time like intervals – variation of mass with velocity – mass energy equivalence – transformation of relativistic momentum and energy – tachyons –four vector and their transformation – experimental evidence for special theory of relativity.

Books for reference

1. C.R.Kothari; Research methodology-methods and techniques, New age international publishers
2. Bass, Joel, E and et.al. Methods for Teaching Science as Inquiry, Allyn & Bacon, 2009
3. Hewitt, Paul G, Suzanne Lyons, John A. Suchocki & Jennifer Yeh, Conceptual Integrated Science, Addison-Wesley, 2007
4. Newton RG. The Truth of Science: New Delhi, 2nd edition
5. John R. Taylor. An Introduction to Error Analysis: The Study of Uncertainties in Physical Measurements, Univ. Science Books
6. Yarwood and Wittle; Experimental Physics for Students, Chapman & Hall Publishers.
7. Chopra S.C and Cande R.D, Introduction to computers for Engineers, TMH

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8. Sanjay Saxena, A first course in computers, Vikas Publishing House Pvt Ptd.
9. <http://www.upscale.utoronto.ca/PVB/Harrison/ErrorAnalysis/>
10. Mechanics – H.S.Hans and S.P.Puri (Tata-McGraw Hill).
11. Classical Mechanics – J C Upadhyaya (Himalaya Publishing House)
12. Introduction to classical mechanics – R.G.Thakwale and P.S.Puranik (Tata- McGraw Hill).

Topics for assignments (sample)

1. Make a sample data and prepare a model of thesis (report) for an exercise (content can be blank paragraphs or with dashed lines).
2. Collect data based on a topic. eg. “mobile use among the students in your college” and write a thesis model (strictly following the format of thesis writing).
3. Make a sample data and prepare a model paper for publication as an exercise (content can be blank paragraphs or with dashed lines).
4. Prepare a model article based on a topic, eg “internet use among the students in your college” for publication (strictly following the format of journal publication).

PY1542- QUANTUM MECHANICS

(72 HRS-42 CREDITS)

Unit 1–The Emergence of Quantum Mechanics (14 hrs) Book 1; Chapter 1

Black body radiation- photoelectric effect- The Compton effect-wave properties of matter and electron diffraction-The Bohr atom -The Rutherford planetary model-The Bohr postulates-The correspondence principle.

Unit 2–The Wave Function (8 hrs) Book 2; Chapter 1 & Book 3

The Schrödinger equation- The statistical interpretation-probability-normalization-momentum-The uncertainty principle- postulates of quantum mechanics

Unit 3– The Time -Independent Schrödinger Equation (30 hrs) Book 2; Chapter 2 & Book 3

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Stationary states-infinite square well- The harmonic oscillator-free particle-The Delta-Function potential-The finite square well

Unit 4 – Formalism (20 hrs) Book 2; Chapter 3 & Book 3

Linear algebra-Function spaces-The generalized statistical interpretation-The generalized uncertainty principle.

Books for Study

1. Quantum Physics (3/e) - Stephen Gasiorowicz, John Wiley and Sons (2003).
2. Introduction to Quantum Mechanics – D.J.Griffiths, PHI (1995).
3. Quantum Mechanics – G. Aruldas, PHI.

Books for Reference

1. Quantum Mechanics: An Introduction (4/e), W. Greiner, Springer (2001)
2. Schaum's Outline of Theory and Problems of Quantum Mechanics, Y. Peleg, R.Pnini, E.Zaarur, Schaum's outline series, MGH (ISBN 0070540187)
3. A Text book of Quantum Mechanics, P.M.Mathews and S.Venkatesan, TMH.
4. A text book of Quantum Mechanics, Ghatak and Lokanathan.
5. Principles of Quantum Mechanics (2/e), R. Shankar, ISBN 0-306-44790-8, Plenum Press.

**PY1543-ELECTRONICS
(72 HOURS-4 CREDITS)**

Unit 1. Diode Circuits: (14 hours); [Ref. 1: Chapter. 2, Ref. 2: Chapter 17, Ref. 3: Chapter 9]

Extrinsic semi conductor – n-type and p-type semi conductors - PN junction –PN junction under forward and reverse biased conditions – rms value and peak inverse voltage – diode characteristics - ac and dc resistances - half wave and full wave rectifiers (average dc value of current, ripple factor and efficiency) - different types of filters (shunt capacitor, LC and CLC) - breakdown mechanism in diodes - Zener diode-voltage regulator- LED (theory and application)-solar cell-photodiode-Tunnel diode-theory, characteristics and working

Unit 2. Transistor: (18 hours); [Ref. 1: Chapter 4, Ref. 2: Chapter18]

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Theory of BJT operation - CB, CE and CC characteristics - alpha and beta and gamma - relation between transistor currents - biasing circuits (CE configuration) - stability factors - selection of operating point - ac and dc load lines -Q point- collector feed back; base

resistor and potential divider methods - small signal BJT amplifiers - input and output resistances - graphical analysis of the small signal CE amplifier (frequency response, band width and gain in dB) - small signal CC amplifier (emitter follower) - h parameter - h parameter model equivalent circuit - effect of Q point on AC operation.

Unit 3. Large signal (power) amplifiers: (6 hours);[Ref. 2: Chapter. 22]

Amplifier classes and efficiency - class A operation - transformer coupled class A amplifier - class B amplifier - push pull amplifier - basic ideas of class AB and class C operation - multi stage amplifiers - frequency responses - distortion in amplifiers.

Unit 4. Feedback & Oscillator circuits: (8 hours); [Ref. 1: Chapter. 6, Ref. 2: Chapter. 25]

Feedback principles - negative feedback - emitter follower - advantages of negative feedback - positive feedback - principle of sinusoidal feedback oscillation - Barkhausen criterion for oscillations - RC phase shift, Wien bridge, Hartley, Colpitt's, and Crystal oscillators (derivations not required)

Unit 5. Modulation: (6 hours); [Ref. 1: Chapter. 14]

Fundamentals of modulation - AM, FM and PM -Analysis of AM- frequency spectrum of AM - power in AM - modulated class C amplifier - linear demodulation of AM signal - frequency spectrum for FM - super heterodyne AM receivers.

Unit 6. Field Effect Transistor: (8 hours); [Ref. 2: Chapters. 15 & 16, Ref. 3, Ref. 4: Chapter. 4]

JFET- Basic construction - Theory of operation - Static characteristics - Drain characteristics- Advantages - MOSFET - Depletion enhancement MOSFET - Construction - Static characteristics.

Uni-junction Transistor - Construction- operation Silicon Controlled rectifier - Construction- biasing - operation-applications.

Unit 7. Operational amplifiers (IC741): (12 hours); [Ref. 1: Chapter. 7, Ref. 4: Chapter. 16]

Introduction - Schematic symbol and pin configuration - circuit configuration and block diagram representation - ideal OP amp. - equivalent circuit - CMRR - dual input, balanced output differential amplifier - voltage gain, input and output resistances - differential mode and common mode - virtual ground principle - parameters of OP amp. - inverting amplifier - non inverting amplifier - differential amplifier - summing

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and subtractor amplifiers.

Books for study:

1. Basic electronics- Santiram Kal
2. Basic electronics- B. L. Theraja
3. Principles of electronics- V. K. Mehta
4. A first course in Electronics- Anwar A. Khan, Kanchan K. Dey

Books for references:

5. Electronic Devices and Circuits- Theodore F. Bogart, Jr. – Universal book stall
6. Electronic devices and Circuit theory- Robert Boylestad & Louis Nashelski- Vth edition PHI
7. Electronic fundamentals & applications- John D Ryder-Prentice Hall of India Pvt. Ltd.
8. Electronic Communications - Dennis Roddy, John Coolen, Fourth edition.

Topics for assignments/discussion in the tutorial session (sample)

1. Electronic projects using flip flops
2. Electronic projects using logic gates
3. Electronic projects using IC 741 OP amp.
4. Electronic projects using timer 555
5. Electronic projects using IC 311
6. Constant voltage power supplies
7. Constant current sources
8. Oscillators of different frequencies
9. Low range frequency generators
10. High range frequency generators
11. Voltage regulated dc power supplies with variable output
12. Voltage regulated dual power supplies with variable output
13. Instrument for the measurement of capacitance
14. Instrument for the measurement of dielectric constant of a liquid/ solid
15. Effect of temperature on electronic components

**PY1544- ATOMIC AND MOLECULAR PHYSICS
(72 HRS-4 CREDITS)**

Unit 1- Vector Atom Model: (10hrs)(Ref: 2, art. 6.1 to 6.21, pages 98-112)

Bohr's theory, correspondence principle. Sommerfeld's atom model and explanation of fine structure of H line in Balmer series of hydrogen atom. Limitation of Sommerfeld atom model. Vector atom model- Various quantum numbers associated with vector atom model-, L.S and j couplings –application of spatial quantization- Pauli's exclusion principle – periodic classification of elements –some examples of electronic configuration with modern symbolic representations- magnetic dipole moment of electron due to orbital and spin motion - Stern and Gerlach experiment- Spin-Orbit coupling.

Unit 2- Atomic Spectra (14hrs) (Ref: 2, art.6.22 to 6.28)

Optical spectra-Spectral terms and notations - selection rules - intensity rule and interval rule - fine structure of sodium D lines – hyperfine structure-alkali spectra - Zeeman effect - Larmor's theorem – quantum mechanical explanation of normal Zeeman effect. Anomalous Zeeman Effect –Paschen-Back effect-Stark effect.

Unit 3- X-ray Spectra (8 hrs) (Ref: 3, art.6.1 to 6.7, pages 147-158 & Ref: 2, art 26.6, pages 386-387)

Introduction-production of X-ray-properties of X-rays-continuous and characteristic X-ray spectrum-Origin of X-rays-Moseley's law-absorption of X-rays-hydrogen like character of X-ray spectrum-X-ray absorption spectrum.

Unit 4- Molecular spectra (28 hrs) (Ref: 1 appendix C& art. 9.1 to 9.12.5, pages 166-188, 417-419)

Molecular orbital-hydrogen molecule ion-hydrogen molecule-hybridization electromagnetic spectra-molecular energies-classification of molecules-rotational spectra of diatomic molecules-rotational energy levels-selection rules-rotational spectrum-isotope effect- bond length and atomic mass. Diatomic vibrational spectra-vibrational energy levels-selection rule-vibrational transitions-Rotation-Vibration transitions-I.R spectrometer-electronic spectra sequences and progressions-Frank-Condon principle - Raman scattering-quantum theory of Raman scattering-classical description of Raman scattering-vibrational Raman spectra-diatomic molecules-polyatomic molecules- rotational Raman spectra- Raman spectrometer.

Unit 5- Resonance Spectroscopy (12 hrs)(Ref: 1 art. 9.13.1 to 9.15.2, pages 189-200)

NMR principle-Resonance condition-NMR spectrometer-chemical shift-indirect spin-spin interaction applications of NMR spectroscopy.ESR principle- Resonance condition - ESR spectrometer-hyperfine interaction-applications of ESR spectroscopy. Moss Bauer spectroscopy principle -isomer shift.

Books for Reference:

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1. Modern Physics- G.Aruldas and P.Rajagopal, PHI, New Delhi, 2005.
2. Modern Physics by R.Murugesan, S.Chand& Co., Reprint, 2008.
3. Atomic and Nuclear Physics- N.Subramaniam&Brijlal, S.Chand& Co.
4. Atomic Physics - J.B.Rajam, S.Chand&Co.edition.
5. Concepts of Modern Physics by A. Beiser, Tata McGraw-Hill, New Delhi, 6th edition
6. Fundamentals of Molecular Spectroscopy - Banwell (TMH)
7. Spectroscopy- Walker & Straw, Chapman & Hill.
8. Molecular Spectroscopy- G.Aruldas.

Topics for assignments/discussion in the tutorial session (sample)

1. History of atom model
2. Rutherford experiment leading to atom model
3. Bohr model of atom and correspondence principle.
4. Molecular bond and electron sharing.
5. Width of spectral lines.
6. Spectroscopic techniques.
7. X-ray diffraction for identification of samples

**PY1551-OPEN COURSES
(54 HOURS-2CREDITS) FOR EACH COURSES**

**PY1551.1. BIO PHYSICS
(54 HOURS)**

Unit 1 (18 hrs)

Bio mechanics- biophysics and fluid flow—Gas transport—physics of audition Physics of vision (chapter 1 to 5 of Reference 3)

Unit 2 Cellular – Molecular biophysics (18 hrs)

Cell -components-proteins-nucleic acids—physics of bio-membranes -Thermodynamics of bio systems (Chapter 6 to 9 of reference 3)

Unit 3 (18 hrs)

Radiation biophysics (chapter 18 of reference 1)

Bio –electronics and Bio Instrumentation (chapter 17 of reference 1) Bio –informatics - (chapter 6 of reference 1) Demonstration of biophysics experiments (reference 3)

Reference books

1. Essentials of Biophysics, P.Narayanan, 2nd edn. New Age publishers
2. A text book of biophysics, R.N.Roy, New central book agency Kolkata.
3. Elementary bio physics,P.K.Srivastava,Narosa publishing house ,New Delhi

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4. Introduction to Biophysics ,Pranab kumar banerjee,S.Chand& co ,New Delhi
5. Biological science ,Green,Stout,&Taylor, Cambridge university press

**PY1551.2. ASTRONOMY AND ASTROPHYSICS
(54 HOURS)**

Unit 1-Introduction 4 hrs (Book 2, Chapter 1, P 1 – 6)

Astronomy and Astrophysics, Importance of Astronomy, Methods of Astronomy and Astrophysics, The Scientific Methods, Scope of Astronomy

Unit 2 - Astronomy 15 hrs (Book 1, Chapter 4, 5, P 65-70, 78-101)

Birth of the Universe, Ancient astronomy, Medieval Astronomy, Renaissance Astronomy, Modern Astronomy

Unit 3-The Objects in the Sky 15 hrs ((Book 1, Chapter 6, P 102 -127)

The Microwave background radiation, The Sun, The Stars, Neutron Stars and Black holes, Supernovae, Galaxies

Unit 4 -The Solar System15 hrs (Book 1, Chapter 7, P 128-154)

Sun and Planets, Formation of the Planets, Comets, Planets and Satellites, Asteroids,Meteorites

Unit 5 -Earth in Space 5hrs (Book 1, Chapter 8 , P 155 -162)

Motion of the Earth, The Calendar, The Seasons

Books for Study

1. Planet Earth, Cesare Emiliani , (Cambridge University Press, 1995)
2. Astrophysics - K. D. Abhayankar (University Press,2001)

Books for reference

1. Fundamentals of Geophysics William Lowrie(Cambridge University Press,1997)
2. Modern Physics- R. Murugesan, Kiruthika Sivaprasath (2007), S.Chand &Company Ltd.
3. Introduction to Astrophysics – Baidyanadh Basu
4. Modern Trends in Physics Vol I , C. J. Babu
5. Space Science –Louise K. Harra& Keith O.Mason(Imperial College Press,London, 2004)

**PY1551.3. APPLIED PHYSICS
(54 HOURS)**

Unit-1. Electric and Electronic Equipments (12 hrs)

Electric motor – principles of working, Microwave oven – principle – technical specifications- applications – advantages, Public address system – Block diagram representation – function of each unit - CD player and drives – DVD player and drives – Telephonic communication (Cable and

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cellular) – Principles (qualitative using block diagrams) – Cell phone – SIM card - technical specifications – Radio –History of radio revolution – different types of radios – Television – working (qualitative) – Touch screens & ATM (Automatic Telling machine)

Unit 2. Scientific Instruments (12 hrs)

Tunneling Electron Microscope (TEM) – What is it – working principle- schematic representation – applications - technical specifications, Scanning Electron Microscope (SEM) - What is it – working principle - schematic representation –applications - technical specifications, Atomic Force Microscope (AFM) - What is it –working principle- schematic representation – applications - technical specifications XRD – Principle and applications – Spectrophotometer working and applications – Scanning Tunneling Microscope.

Unit 3. Medical Instruments (10 hrs)

CT Scan – basic principle – applications & advantages, MRI Scan – principle and applications & advantages – X ray - applications & advantages, Echo Cardio Gram (ECG), Ultra sound scan.

Unit 4. Optical Instruments (10 hrs)

Microscope, Electron microscope, Camera – History of evolution of camera – Digital camera, Holography, Optical communication net work- building blocks – Over head Projector (OHP), LCD Projector, OMR reader, radar

Unit 5. Common Mechanical devices (10 hrs)

Pumps – what is it – working – different types of pumps – Refrigerator – working principle - technical specifications – Heat engines- Automobile engines working (Qualitative description only) – Different types – Brakes – Different types of brakes

References

1. Audio and video Systems. R.G.Gupta, Technical Education Series.
2. Mobile Satellite Communication Network (Ch 1 & 2), Ray E Sherrif & Y.Funttu,Wiley India Edn.
3. Television Engineering & Video System, R.G.Gupta, TMH.
4. Electrical Technology (Vol I & II), B.L.Theraja.
5. A Text book of elements of Mech. Engg (page 105-114), S.Trynbaka Moorthy,I.K International Publishing house.
6. Physical principles of electron microscopy- An introduction to TEM, SEM, AFM, Springer, 2005.

PY1551.4. ENVIRONMENTAL PHYSICS

(54 HOURS)

Unit 1 Essentials of Environmental physics (18 hrs)

Structure and thermodynamics of the atmosphere; composition of air; Green house effect; Transport of matter; energy and momentum in nature; Stratification and stability of the atmosphere; Laws of motion; Hydrostatic equilibrium; General circulation of the tropics; Elements of weather and climate in India.

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Unit 2 Environmental pollution and Degradation :(18 hrs)

Factors governing air, water and noise pollution; Air and water quality standards; Waste disposal; Heat island effect; Land and sea breeze; Puffs and Plumes; Gaseous and particulate matter; Wet and dry deposition; Dispersal mechanism of air and water pollutants; Mixing height and turbulence; Gaussian plume models; Dispersion models; Environmental degradation; Thermal and radioactive pollution; Nuclear radiation; Health hazards and safety.

Unit 3 Environmental Changes and remote sensing (18 hrs)

Energy sources and combustion processes; Renewable sources of energy; Solar energy, Wind energy, Bio energy, hydro power; fuel cells; and nuclear energy; Forestry and bio-energy; Deforestation; Degradation of soils; Agriculture and land use changes; Changing composition of local and global environment; Remote sensing techniques.

Books for Study

- 1 The Physics of Monsoon: R.N. Kesavamoorthy and N Sankar Rao (Allied Pbl)
- 2 The Physics of Atmosphere : J.T. Houghton (Cambridge Uty)
- 3 Renewal Energy Resources: J. Twidell and J Weir (ELBS 1988)
- 4 Numerical Weather Prediction: G.J. Haltiner and R.T. Williams (John Wiley)

**PY1551.5. ENERGY PHYSICS
(54 HOURS)**

Unit I (7 hrs)

Various forms of energy – renewable and conventional energy systems – comparison – coal, oil and natural gas – availability – applications – merits and demerits.

Unit 2 (10 hrs)

Solar energy - Solar radiation measurements, solar energy collector, principle of the conversion of solar radiation in to heat, Solar energy storage, solar heaters, space cooling, solar ponds, solar cookers, solar distillation, solar furnaces, solar green houses, photovoltaic generation basics, merits and demerits of solar energy.

Unit 3 (9 hrs)

Wind energy: Basic principle of wind energy conversion, basic components of wind energy conversion system, wind energy collectors. Energy storage, application of wind energy.

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Unit 4 (9 hrs)

Biomass energy, classification, photosynthesis, biomass conversion process, gobar gas plants, wood gasification, ethanol from wood, merits and demerits of biomass as energy source

Unit 5 (9 hrs)

Energy from Oceans and Chemical energy resources: Ocean thermal energy conversion, energy from waves and tides – basic ideas, nature, applications, merits and demerits.

Unit 6 (10 hrs)

Patterns of energy consumption in domestic, industrial, transportation and agricultural sectors – energy crisis and possible solutions – energy options for the developing countries – energy storage and hydrogen as a fuel (basics) – impact due to non-conventional energy sources – global warming.

Text books.

1. Non – Conventional Energy Resources by G. D. Rai, Khanna Publishers,2008.
2. Solar energy by G.D. Rai, 5th edition, 1995.
3. Solar Energy Fundamentals and application by H.P. Garg and J. Prakash, Tata McGraw - Hill Publishing company ltd, 1997.
4. Solar energy by S. P. Sukhatme, Tata McGraw- Hill Publishing company ltd,1997.

References

1. Energy Technology by S. Rao and Dr. B.B. Parulekar, 1997, 2nd edition
2. Power Plant Technology by A. K. Wahil. 1993.

**PY1641- SOLID STATE PHYSICS
(72 HRS-4 CREDITS)**

Unit I- Crystal Structures and interatomic forces (18 hrs) (Book 1: Chapter 1)

Introduction-crystalline state-basic definitions-Fourteen Bravais lattices and seven crystal systems-elements of symmetry-nomenclature of crystal directions and crystal planes-Miller indices-examples of simple crystal structures-amorphous solids and liquids-interatomic forces-types of bonding.

Unit 2 – X-ray, Neutron and Electron diffraction (12 hrs) (Book 1: Chapter 3)

Introduction-generation and absorption of X-rays-Bragg's law-reciprocal lattice and X-ray diffraction-diffraction condition and Bragg's law-experimental techniques-neutron diffraction-electron diffraction.

Unit 3 – Conduction in metals – Free electron model (12 hrs) (Book 1: Chapter 5)

Introduction-conduction electrons-free electron gas-electrical conductivity-electrical

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resistivity versus temperature-heat capacity of conduction electrons -Fermi surface-electrical conductivity-effects of the Fermi surface-thermal conductivity in metals-Hall effect and magneto resistance (Book 2, ch.10 & Book 3, ch.9)-A.C conductivity and optical properties-failure of free electron model.

Unit 4- Band Theory (5 hrs)(Book 2: Chapter 11, art.11.1, 11.2, 11.3, 11.11)

Bloch theorem-The Kronig -Penney model-construction of Brillouin zones- conductors, semiconductors and insulators.

Unit 5- Magnetic Properties of materials (8 hrs) (Book 1: Chapter 9, art.9.1 to 9.11)

Introduction-review and basic formulae-magnetic susceptibility-classification of materials-Langevin diamagnetism-Para magnetism-magnetism in metals- ferromagnetism in insulators-antiferromagnetism and ferromagnetism-ferromagnetism in metals-ferromagnetic domains.

Unit 6- Dielectric and Optical properties of materials (9hrs) (Book 1: Chapter 8, Book 2: Chapter 15, art. 15.1 to 15.6)

Introduction-dielectric constant and polarisability-local field-sources of polarisability-dipolar polarisability- dipolar dispersion-dipolar polarization in solids-ionic polarisability-piezoelectricity-ferroelectricity. Absorption processes-photoconductivity-photoelectric effect-photovoltaic effect- photoluminescence-colour centres.

Unit 7-Superconductivity (8 hrs) (Book 1: Chapter 10)

Introduction- Zero resistance-perfect diamagnetism or The Meissner effect-The critical field-electrodynamics of superconductors-Theory of superconductivity- tunneling and the Josephson effect-miscellaneous topics (intermediate state, Type I & II superconductors).

Books for Study:

- 1 Elementary Solid State Physics – Principles and Applications, M.A.Omar.
- 2 Solid State Physics – Structure and Properties of Materials, M.A.Wahab, 2nd edition, Narossa Publishing House.

Books for Reference :

1. Introduction to Solid State Physics, Kittel, Wiley & Sons, 7th edition.
2. Concepts of Modern Physics by Beiser, Tata McGraw Hill, 5th Edition, 1997.
3. Fundamentals of Solid State Physics, Saxena-Gupta-Saxena, 9th edition (2004-05), Pragathi Prakasan, Meerut.
4. Fundamentals of Physics, 6th Edition, by D.Halliday, R.Resnick and J.Walker, Wiley. NY, 2001.

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5. Physics, 4th Edition, Vols I, II & II Extended by D.Halliday, R.Resnick and K.S.Krane, Wiley, NY. 1994.
6. The Feynman Lectures on Physics, Vols. I, II, and III, by R. P. Feynman, RB Leighton and M Sands, Narosa, New Delhi, 1998.
7. Introductory Solid State Physics by H.P.Myers, Viva books, New Delhi, 1998

PY1642 – NUCLEAR AND PARTICLE PHYSICS
(72 HOURS-4 CREDITS)

Unit 1 - Introduction to the nucleus (14 hrs)

(Book 2, art. 17.1-17.13, pages 322-343 & Book 1, art. 27.1-27.12, pages 391-405)

Constituents of nuclei- nuclear charge -binding energy-angular momentum of the nucleus-magnetic moment-nuclear quadrupole moment-nuclear stability-models of nuclear structure-The liquid drop model-shell model-collective model.

Unit 2 - Radioactivity (10 hrs)

(Book 2, art. 18.1-18.10.1, p. 344-364 & Book 1, art. 31.1-31.36, p. 442-476)

Alpha, beta and gamma rays - rate of decay-half life and mean life-units of radioactivity-conservation laws in radioactive series-decay series-radioactive equilibrium-secular and transient equilibrium -radioactive dating-range of alpha particles-Geiger-Nuttal law- alpha decay-Gamow's theory-alpha particle disintegration energy-beta ray spectra-magnetic spectrograph-origin of line and continuous spectrum -neutrino energy of beta decay-gamma decay-radio isotopes-applications.

Unit 3 - Nuclear forces (8 hrs)

(Book 2 art. 17.11.1-17.13, pages 337-343)

Two-nucleon system, deuteron problem-nucleon-nucleon potential-spin and magnetic moment-results of proton-proton and proton-neutron scattering experiments-meson theory of nuclear forces.

Unit 4 - Nuclear radiation detectors and particle accelerators (8 hrs)

(Book 1 art. 30.1-30.8, pages 428-441 & Book 2 art. 20.1-20.2, pages 382-385)

G.M Counter-scintillation counter-Van de Graf generator-cyclotron-synchrocyclotron-betatron.

Unit 5 – Nuclear reactions (10 hrs)

(Book 1: art. 34.1-34.8, pages 483-491 & Book 2 art. 19.3-19.3.1, pages 368-369)

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The Q value equation for a nuclear reaction-threshold energy-nuclear reactions -conservation laws-energy balance in nuclear reaction and Q value-threshold energy of an endoergic reaction-scattering cross section-determination of cross section-reaction mechanism-compound nucleus.

Unit 6 – Nuclear fission and fusion (12 hrs)

(Book 1 art. 35.1-35.9, pages 503-516 & Book 3, pages 566-577)

Nuclear fission-energy released in fission-Bohr and Wheeler's theory-chain reaction-multiplication factor-critical size-atom bomb-nuclear reactors-breeder reactors-uses of nuclear reactors. Nuclear fusion-sources of stellar energy-thermonuclear reactions-hydrogen bomb-controlled thermo-nuclear reactions-magnetic bottle-Tokamak inertial confinement-nuclear power in India.

Unit 7 - Cosmic rays and elementary Particles (10 hrs)

(Book 1, pages 523-529 & Book 2, pages 394-412 & Book 3, pages 159-161)

Discovery of cosmic rays -latitude effect-altitude effect- primary cosmic rays - secondary cosmic rays-cosmic showers-origin of cosmic rays. Fundamental interactions in nature-classification of elementary particles-conservation law s-lepton conservation-baryon conservation-strangeness-iso-spin-hyper charge-resonance particles-The quark model Bremsstrahlung effect-Cerenkov radiations.

Books for Study

1. Modern Physics by R. Murugesan, S. Chand & Co., Reprint,2008.
2. Modern Physics- G. Aruldas and P. Rajagopal, PHI, New Delhi, 2005.
3. Nuclear Physics – D. C. Tayal, Himalaya Publishing House, 4th edition.

References

1. Concepts of Modern Physics by A. Beiser, Tata McGraw-Hill, New Delhi, 6th edition.
2. Atomic and Nuclear Physics – N.Subramaniam and Brijlal, S.Chand & Co.
3. Nuclear Physics – S.N.Ghoshal, S.Chand & Co.
4. “Nuclear Physics”- Kaplan (Narosa)
5. Atomic Physics – J.B.Rajam, S.Chand & Co.

Topics for assignments/discussion in the tutorial session (sample)

1. Fusion reactors.
2. History of the Universe (elementary particle).
3. Linear accelerator.
4. Ionization chamber and Wilson cloud chamber.

5. Solid state detectors and proportional counter.

PY1643- CLASSICAL AND MODERN OPTICS

(72 HRS-4 CREDITS)

Unit 1. Interference of light (12 hrs)

(Book 1: Chapter 14 & 15 and Book 3: chapter 12 & 13)

The principle of superposition - coherent sources – Double slit interference (theory of interference fringes and band width) - Interference by division of wavefront and amplitude – Fresnel’s biprism - interference in thin films – fringes of equal inclination- fringes of equal thickness - wedge shaped films- testing of optical flatness - Newton’s rings (reflected system)- refractive index of a liquid - Michelson interferometer – determination of wavelength

Unit 2. Diffraction (12 hrs)

(Book 1: Chapter 17, 18 & 19 and Book 3: Chapter 16 & 17)

Fresnel diffraction: - Half-period zones - explanation of rectilinear propagation of light– diffraction at a straight edge-zone plate. Fraunhofer diffraction: - Diffraction at a single slit, double slits – plane transmission grating - Rayleigh’s criterion for resolution - resolving power of diffraction grating.

Unit 3. Polarisation (12 hrs) (Book 1: Chapter 20 and Book 3: chapter 19)

Plane polarized light - polarization by reflection – Brewster’s law - pile of plates - Malus law - Double refraction - Huygens explanation for double refraction in uniaxial crystals - Nicol prism - Nicol prism as a polarizer and analyzer – Theory of production and analysis of plane, circularly and elliptically polarized light - quarter and half wave plates.

Unit 4. Dispersion (6 hrs) (Book 2: Chapter 11)

Normal dispersion - Elementary theory of dispersion - Cauchy’s and Hartmann dispersion formula - anomalous dispersion

Unit 5. Fiber Optics (8 hrs) (Book 1: Chapter 24 and Book 3: chapter 24)

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Introduction, optical fiber, the numerical aperture, coherent bundle, pulse dispersion in step index fiber, graded index fiber, single mode fiber, multimode fiber, Fibre optic sensors (qualitative), fiber optic communication (qualitative), Advantages of fiber optic communication system.

Unit 6. Holography: (8 hrs) (Book 1: Chapter 23)

Principle of holography, recording of holograms, reconstruction of images (Theory not needed), application of holography, different types of holograms, transmission and reflection types.

Unit 7. Laser: (14 hrs)

(Book 2: Ch. 12, Book 1: Ch. 22, Book 3: chapter 23 and Book 4: Ch. 6)

Basic principle of laser operation Einstein coefficient, light propagation through medium and condition for light amplification population inversion by pumping and cavity threshold condition, line shape function- optical resonators (qualitative) Q factor various laser systems –Ruby laser - He-Ne laser, Dye laser, semiconductor laser, (working principle only) Application of lasers- characteristics of laser beams -spatial coherence - Temporal coherence and spectral energy density Nonlinear optics : Nonlinear Polarization –second harmonic generation – phase matching.

Books of Study

1. Text Book of Optics. Subramaniam & Brijlal, M.N.Avadhanulu, 23rd edition (2006)
2. Optics and spectroscopy -R.Murugesan.
3. Optics - Ajoy Ghatak
4. Lasers: Principles, Types and applications – K.R.Nambiar

References

1. Optics P.Vivekanandan
2. Fundamentals of Optics - Jenkins and White
3. Modern Classical Optics – Geoffrey Brooker.
4. Principles of Optics - B. K. Mathur
5. Fundamentals of Optics - Khanna and Gulati
6. Lasers & Non-Linear Optics - B. B. Laud
7. Electronic Communications- Dennis Roddy & John Coolen

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Topics for assignments/discussion in the tutorial session (sample)

1. Michelson's interferometer-Standardization of metre.
2. Diffraction at a rectangular aperture and circular aperture
3. Optical activity-Fresnel's theory of optical rotation.
4. Resolving power of prism and telescope
5. Constant deviation spectrometer.
6. Laurent's half shade polarimeter.
8. Harmonic generation.
9. Laser applications.
10. Study of Fraunhofer lines using spectrometer.
11. Study of absorption spectra of KMnO₄.
12. Determination of refractive index of liquid by Newton's rings method.
13. Comparison of radii of curvature by Newton's rings method.

**PY1644-DIGITAL ELECTRONICS AND COMPUTER SCIENCE
(72HRS-4 CREDITS)**

Unit-1 (20 hours)

1. Number systems :-Decimal number system-binary number system-conversion of binary number to decimal and decimal number to binary-binary addition and subtraction-1's complement-2's complement-binary subtraction using 2's complement- signed arithmetic operation-conversion of real numbers-conversion of decimal fraction to binary fraction-binary coded decimal- hexa decimal number system- conversion of hexa- decimal number to decimal, decimal to hexadecimal, binary to hexa- decimal and hexa-decimal to binary-ASCII code.(**Textbook1**)

2. Boolean algebra and logic gates :- Logic gates AND, OR, NOT, NAND,NOR And Ex-OR gate-realization of other logic functions using NAND / NOR gates-tri state logic gate-Boolean laws- Demorgan's theorem-Simplification of Boolean equations using Boolean laws. Karnaugh map (**Textbook1**)

3. Arithmetic circuits:-Half adder-full adder-controlled inverter-binary adder- subtractor. (**Textbook2**)

4. Sequential circuits:- Flip-Flop, S-R Flip Flop, J-K Flip-flop, Master slave JK Flip- Flop (**Textbook1**)

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Unit-2 (10hours)

5. Basics of computers:-Hardware- input and output units- memory unit-ALU-control unit–basic operational concepts-Software – operating systems (**Textbook3 and 4**)

6. The memory systems- Basic concepts-semiconductor RAM- internal organization memory chips-static memories-asynchronous and synchronous DRAMs-structure of large memories–ROM,PROM,EPRM, EEPROM–flash memory-speed size and cost-Basic concepts of cache memory and virtual memories. Secondary storage-magnetic hard disks-optical disks-magnetic tape systems.(**Textbook3**)

Unit-3 (24hours)

7. Programming in C:-Importance of C-basic structure of C program-C constants and variables-data types-declaration of variables-assigning values to variables-defining symbolic constants-operators and expressions-input and output functions-reading and writing a character-formatted input-formatted output-control statements-simple IF statement-IFELSE statement-nested IFELSE-SWITCH statement-GOTO statement-loop control structures-WHILE loop-DO loop-FOR loop-jumps in loops- arrays and subscripted variables-functions in C-user defined functions-the form of C function-calling a function-category of functions-recursion-standard library functions-basics of structures and pointers (introduction only)-sequential file management-defining and opening a sequential file-input and output operations on files-closing a file. Simple C programs for solving problems in physics. (**Textbook5**)

Unit-4(18hours)

8. Computer oriented numerical methods) (Including algorithms):- Iterative methods-method of successive bisection to find the roots of an equation-Newton– Raphson iterative method-polynomial equation–interpolation-Lagrange interpolation-least square approximation of functions-linear regression-regression coefficients-algorithm for linear regression-polynomial regression-fitting exponential functions-numerical differentiation and integration-Simpson’s rule-Trapezoidal rule-algorithms for integrating tabulated function and known function–numerical solution of differential equations-Euler’s method-Runge-Kutta method(second order method only) (**Text book6**)

Text books:-

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1. Fundamentals of microprocessors and micro-computers by B. Ram, Dhanpat Rai Publications (p) Ltd, NewDelhi (sixth edition)
2. Digital principles and applications by Albert.P. Malvinoand P.Leach, TMH, New Delhi (Fourth edition)
3. Computer organization by Carl Hamcher, Zvonko Vranesic and Safwat Zaky (Fifth International edition Indian print) McGraw-Hill
4. Fundamentals of computers by V. Rajaraman, PHI, New Delhi (Fourth edition)
5. Programming in ANSIC by E. Balagurusamy, TMH Publishing company Ltd, New Delhi (Fourth edition).
6. Computer oriented numerical methods by V. Rajaraman, PHI, New Delhi (Third edition)

Books for reference:-

1. Introduction to digital electronics-NIIT-PHI.
2. A first course in Computers- Sanjay Saxena-Vikas publishing house Pvt Ltd
3. Theory and problems of programming with C-Schaum series-Byron S Gottfried.
4. Graphics under C-Yashavant Kanetkar- BPB Publications-New Delhi
5. Beginning Linux programming-Neil Mathew and Richard Stones-Wiley India Pvt Ltd.
6. Computational Physics-V K Mittal, RC Verma and SC Gupta-Ane Books India
7. Numerical methods with Computer programs in C++-Pallab Ghosh-PHI

PRACTICALS

**PY1442- MECHANICS, PROPERTIES OF MATTER, HEAT AND ACOUSTICS
(Minimum 16 experiments to be done)**

1. Simple pendulum-Study of variation of period with length, mass and amplitude.
2. Spring mass system-spring constant
3. Fly Wheel - Moment of Inertia
4. Compound Bar Pendulum – Symmetric
5. Compound Bar Pendulum – Asymmetric
6. Uniform Bending---Y---Pin and Microscope
7. Uniform bending—Y- optic lever method
8. Non-uniform bending-Y-Optic lever & telescope
9. Rigidity modulus –Static torsion
10. Torsion pendulum-Rigidity modulus

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11. Kater's pendulum-Acceleration due to gravity
12. Melde's string-----Frequency of fork
13. Phase transition-determination of M.P of wax.
14. Determination of thermal conductivity of rubber
15. Lee's disc-determination of thermal conductivity of a bad conductor
16. Viscosity of a liquid-----Stoke's method
17. Viscosity-Continuous flow method using constant pressure head.
18. Viscosity-Variable pressure head arrangement
19. Surface tension-Capillary rise
20. Sonometer-frequency of A.C
21. Kundt's tube-determination of velocity of sound.
22. Comparison of least counts of measuring instruments.
23. Evaluation of errors in simple experiments.

References

1. Yarwood and Wittle; Experimental Physics for Students, Chapman & Hall Publishers.
2. An advanced course in practical physics, Chathopadhyaya, Rakshit and Saha, New central agency, Kolkata.
3. A text book of practical physics, S.Viswanathan & Co., Chennai.
4. Advanced Practical Physics, B.L.Worsnop and H.T.Flint, Khosla Publishers, Delhi.

PY1645-OPTICS, ELECTRICITY AND MAGNETISM

(Minimum 20 experiments to be done)

1. Spectrometer-A, D and n of a solid prism.
2. Spectrometer –Dispersive power and Cauchy's constants
3. Spectrometer Grating—Normal incidence- N & wavelength
4. Spectrometer-i-d curve
5. Spectrometer- Hollow prism
6. Liquid lens-refractive index of liquid and lens
7. Newton's Rings—Reflected system
8. Air wedge-diameter of a wire
9. Potentiometer-Resistivity.
10. Potentiometer-Calibration of ammeter
11. Potentiometer –Reduction factor of T.G

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12. Potentiometer –Calibration of low range voltmeter
13. Potentiometer – Calibration of high range voltmeter
14. Thermoemf-measurement of emf using digital multimeter.
15. Carey Foster’s bridge-Resistivity
16. Carey Foster’s bridge-Temperature coefficient of resistance.
17. Mirror galvanometer-figure of merit.
18. BG- Absolute capacity of a condenser
19. Conversion of galvanometer into ammeter and calibration using digital Multimeter
20. Conversion of galvanometer into voltmeter and calibration using digital Voltmeter.
21. Circular coil-Calibration of ammeter.
22. Study of network theorems-Thevenin’s & Norton’s theorems and maximum power transfer theorem.
23. Circular coil-Study of earth’s magnetic field using compass box.
24. Absolute determination of m and Bh using box type and Searle’s type vibration magnetometers.
25. Searle’s vibration magnetometer-comparison of magnetic moments.

References

1. Yarwood and Wittle; Experimental Physics for Students, Chapman & Hall Publishers.
2. An advanced course in practical physics, Chathopadhyaya, Rakshit and Saha, New central agency, Kolkata.
3. A text book of practical physics, S.Viswanathan & Co., Chennai.
4. Advanced Practical Physics, B.L.Worsnop and H.T.Flint, Khosla Publishers, Delhi.

**PY1646—ELECTRNICS AND COMPUTER SCIENCE
(Minimum 20 experiments to be done – 5 from Computer Science)**

ELECTRONICS

1. PN junction Diode (Ge & Si) characteristics-To draw the characteristic curves of a PN junction diode and to determine its ac and dc forward resistances.
2. Full wave (centre tapped) rectifier-To construct a full wave rectifier using junction diode and to calculate the ripple factor with and without shunt filter (10 readings for R_L 100 Ω to 5000 Ω).
3. Full wave (centre tapped) rectifier-To construct a full wave rectifier using junction diode and to study effect of L,C, and LC filters on the ripple factor (for different R_L).

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4. Bridge rectifier-To construct a bridge rectifier using junction diodes and to calculate the ripple factor with and without shunt filter (10 readings for R_L 100 Ω to 5000 Ω).
5. Bridge rectifier- Dual power supply-To construct a dual power supply using bridge rectifier and measure the output voltages for different pair of identical load resistors.
6. Zener diode characteristics-To draw the I-V characteristic of a Zener diode and to find the break down voltage and the dynamic resistance of the diode.
7. Zener diode as a voltage regulator-To construct a voltage regulator using Zener diode and to study the output voltage variation (i) for different R_L and (ii) for different input voltage with same R_L .
8. Transistor characteristics-CE-To draw the characteristic curves of a transistor in the CE configuration and determine the current gain, input impedance and output impedance.
9. Transistor characteristics-CB-To draw the characteristic curves of a transistor in the CB configuration and determine the current gain, input impedance and output impedance.
10. Single stage CE amplifier-To construct a single stage CE transistor amplifier and study its frequency response.
11. OP amp. IC741- Inverting amplifier-To construct an inverting amplifier using IC741 and determine its voltage gain.
12. OP amp. IC741- Non inverting amplifier
To construct a non inverting amplifier using IC741 and determine its voltage gain.
13. OP amp. IC741- Differentiator-To construct an OP amp. Differentiator, determine its voltage gain and study the output response to pulse and square wave.
14. OP amp. IC741- Integrator-To construct an OP amp. Integrator, determine its voltage gain and study the output response to pulse and square wave.
15. Phase shift oscillator-To construct a phase shift oscillator using transistor and measure the frequency of the output waveform.
16. Logic gates- OR and AND-To verify the truth tables of OR and AND gates using diodes.
17. Logic gate- NOT-To verify the truth tables of NOT gate using a transistor.
18. Network theorems (Superposition, Thevenin's & Norton's theorems)
To verify the (i) Superposition, (ii) Thevenin's & (iii) Norton's theorems
19. RC-Filter circuits (Low pass)
To construct an RC –low pass filter circuit and to find the upper cut off frequency.
20. RC-Filter circuits (High pass)-To construct an RC –high pass filter circuit and to find the lower cut off frequency.

COMPUTER SCIENCE (C- Programs)

1. Program to find the roots of a quadratic equation (both real and imaginary root)

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2. Program to sort a given list containing the name of students and their total marks and print the rank list.
3. Programs to plot the functions $\sin x$, $\tan x$ and e^{-x} .
4. Program to find the product of two $n \times n$ matrices.
5. Program to find the dot product and cross product of vectors
6. Program to simulate the trajectory of the projectile thrown (a) horizontally and (b) at an angle.
7. Program to study the motion of a spherical body in a viscous fluid.
8. Program to study the motion of a body under a central force field.
9. Program to fit a straight line through the given set of data points using least square fitting algorithm.
10. Program to integrate a given function using Simpson's rule.
11. Program to integrate a given function using Trapezoidal rule.
12. Program to find the solution of differential equation by RK2 method.

References:

1. Basic electronics and linear circuits; N.N. Bhargava, D.C. Kulshreshtha, S.C. Gupta
2. OP- Amps and linear integrated circuits; Ramakant A. Gayakwad
3. Basic electronics; Santiram Kal
4. Basic electronics; B. L. Theraja
5. Principles of electronics; V. K. Mehta
6. A first course in Electronic s; Anwar A. Khan, Kanchan K. Dey

**PY1661. ELECTIVE COURSES
(54 HOURS-2CREDITS) FOR EACH COURSES**

PY1661.1 ELECTRONIC INSTRUMENTATION

Unit 1 (10 hrs) (Ref: 1, Ch.1 & 3; Ref 2, Ch. 1; Ref 3, Ch. 13.1 to 13.4)

Basic Concept of Measurement- measurement errors- standards of measurement functional elements of an instrument- standard in quality management.

Unit 2 (10 hrs) (Ref: 4, Ch.3, 4, & 5)

Instruments for measuring basic parameters-ammeter-voltmeters-multimeter digital voltmeter-accuracy and resolution of DVM.

Unit 3 – Oscilloscopes (10 hrs) (Ref: 1, Ch.7; Ref 4, Ch. 7)

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Cathode ray tubes- CRT circuits- vertical deflection system- delay line- horizontal deflection system- multiple trace- oscilloscope probes and transducer- storage oscilloscopes.

Unit 4 – Transducers (10 hrs) (Ref: 4, Ch.13; Ref 5)

Basic principles- classification of transducers- strain gauges- temperature measurements- thermistors- photosensitive devices- radiation detectors- basic idea of instrumentation amplifier.

Unit 5 – Signal Generation and Analysis (14 hrs)

(Ref: 1, Ch.8 & 9.1 to 9.4.1; Ref 3, Ch.8.1 to 8.4.2)

Sine wave generator- frequency synthesizer- sweep generator- astable multivibrator- laboratory pulse generator- function generator- wave analysers harmonic distortion analyzer- wave meter- spectrum analyzer (qualitative idea only).

References

1. Modern Electronic Instrumentation and Measurement Techniques, Albert D.Helfrick & William D.Cooper, PHI Ltd.
2. Instrumentation-Devices and Systems, C.S.Rangan, G.R.Sarma, V.S.V.Mani, TMH Publishers.
3. Electronic Instruments and Instrumentation Technology, M.M.S.Anand, PHI Ltd.
4. Electronic Instrumentation, 2nd edition, Kalsi H.S, TMH Publishers.
5. Sensors and Transducers, D.Patranabis, Wheeler Publishing Co. Ltd.
6. Industrial Electronics and Control, S.K.Bhattacharya & S.Chatterjee, TMH Publishers.
7. Electronic measurement and Instrumentation, K.B.Klaassen, Cambridge University Press.
8. Measurement Systems-Applications and Design, 5th edition, Ernest O.Doebelin & Dhanesh N.Manik, TMH Publishers.
9. Principles of Measurement systems, John P.Bentley, 3rd edition,(Longman), Pearson Education Publishers.

PY1661.2. SPACE SCIENCE

(54 HRS)

Universe (12 hrs)

Large Scale Structure of the Universe: Astronomy and Cosmology, Our Galaxy, Galaxy types, Radio sources, Quasars, Structures on the largest scale, Coordinates and catalogues of astronomical objects, Expansion of the Universe

Ref; Introduction to Cosmology- J. V. Narlikar (1993), Cambridge University Press, Art. 1.1 to 1.8 (Pages 1 to 26)

The evolution of Stars (9hrs)

Introduction, Classification of Stars: The Harvard classification, Hertzsprung –Russel diagram, Stellar evolution, White dwarfs, Electrons in a white dwarf star, Chandrasekhar limit, Neutron stars, Black holes, Supernova explosion, Photon diffusion time, Gravitational potential energy of a star, Internal temperature of a star, Internal pressure of a star.

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Ref; Modern Physics- R. Murugesan, Kiruthika Sivaprasath, S.Chand & Company Ltd. (2007), Art. 78.1 to 78.15(Pages 963 to 976)

The active Sun (10 hrs)

Introduction, Sunspots and Solar storms, Sunspots and Solar activity, Cosmic rays of Solar origin, The Solar wind, Solar corona and the origin of the solar wind, Disturbed Solar wind.

Ref; Earth's Proximal Space- Chanchal Uberoi (2000), Universities Press (India) Limited, Art. 3.1 to 3.6 (Pages 36 to 55)

The earth's Atmosphere (15 hrs)

Introduction, Nomenclature and temperature profile, Temperature distribution in the troposphere, Temperature of stratosphere, temperature of mesosphere and thermosphere, Temperature variability, The pressure profile, Scale height, Density variation. The Ionosphere: Effect on scale height, Ionospheric electric fields, Ionization profile, Layer of charge, Ionospheric hydrogen and Helium.

Ref; Introduction to Space Science- Robert C. Haymes (1971) John Wiley & Sons Art. 3.1 to 3.9 and 3.12 to 3.17 (Pages 54 to 65 and 69 to 78)

Magnetosphere (8 hrs)

Introduction, The magnetic field of Earth, Earth's variable magnetic field, Solar activity and Earth's magnetic weather, solar wind interaction, The Chapman-Ferraro closed magnetosphere, Dungey's open magnetosphere, Structure of the magnetosphere: Magneto tail and Plasma sheet, Plasma sphere, Earth's radiation belts.

Ref; Earth's Proximal Space- Chanchal Uberoi (2000), Universities Press (India) Limited, Art. 4.1 to 4.6 and 4.8 to 4.8.3 (Pages 56 to 67 and 71 to 74)

Books for Study

1. Introduction to Space Science – Robert C Hymes (1971), John Wiley & Sons Inc.
2. Earth's Proximal Space- Chanchal Uberoi (2000), Universities Press (India)
3. Introduction to Cosmology- J. V. Narlikar (1993), Cambridge University Press
4. Modern Physics- R. Murugesan, Kiruthika Sivaprasath (2007), S.Chand & Company Ltd.

Books for reference

1. Space Physics and Space Astronomy – Michael D Pappagiannis (1972), Gordon and Breach Science Publishers Ltd.
2. Introductory Course on Space Science and Earth's environment-Degaonkar (Gujarat University, 1978)
3. Introduction to Ionosphere and magnetosphere- Ratcliffe (CUP, 1972)
4. The Physics of Atmospheres-Houghton (Cambridge University Press)
5. Introduction to Ionospheric Physics-Henry Rishbeth & Owen K. Garriot (Academic Press, 1969)
6. Space Science – Louise K. Harra & Keith O. Mason (Imperial College Press, London, 2004)
7. Introduction to Space Physics- Kivelson and Russel

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8. Introduction to Astrophysics – Baidyanadh Basu
9. Astrophysics - K. D. Abhayankar (University Press)

PY1661.3. PHOTONICS
(54 HOURS)

Unit 1: (7 hrs)

Photons in semiconductors-semiconductors-energy band and charge carriers-semi conducting materials-electron and hole concentrations -generation, recombination and injection-junctions-hetero junctions-quantum wells and super lattices

Unit 2: (6 hrs)

Semiconductor photon sources -light emitting diodes-injection-electroluminescence- LED characteristics- internal photon flux-output photon flux and efficiency-responsivity spectral distribution-materials-response time-device structures.

Unit 3: (8 hrs)

Semiconductor laser amplifiers-gain-amplifier band width-optical pumping-electrical current pumping-hetero structures -semiconductor injection lasers-amplification-feedback and oscillators-resonator losses -gain condition-internal photon flux-output photon flux and efficiency-spectral distribution-spatial distribution-single frequency operation quantum well lasers (qualitative).

Unit 4: (8 hrs)

Semiconductor photon detectors-The external photo effect-photo electron emission-The internal photo effect-semiconductor photo detection-quantum efficiency-responsivity devices with gain-response time-photoconductors- photo diodes-PIN photo diodes-hetero structure photo diode- Schotky barrier photodiodes - array detectors-avalanche photodiodes-gain and responsivity- response time.

Unit 5: (8 hrs)

Electro optic, Pockels and Kerr effects- electro optic modulators and switches –scanners directional couplers-spatial light modulators-electro optics of liquid crystals-wave retarders and modulators-spatial light modulators.

Unit 6: (7 hrs)

Non linear optics-second order and third order optical non linearity-intensity dependent refractive index-optical Kerr effect-self focusing.

Unit 7: (10 hrs)

Photonic switching and computing-opto mechanical, electro optic, acousto-optic and magneto optic switches-all optical switches- bistable systems-principle of optical bistability- bistable optical devices - optical inter connectors-optical computing-digital optical computing-analog optical processing.

Book of Study

1. Fundamentals of Photonics: BFA Saleh and M.C.Teich, John Wiley & Sons, Inc.

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Reference books

1. Semiconductor optoelectronic devices: Pallab Bhattacharya, Printice Hall of India.
2. Optics and Photonics- An introduction: F. Graham Smith and Terry A.King, John Wiley & Sons, Inc.
3. Lasers and Non linear Optics: B.B.Laud, New Age International Pvt Ltd.

PY 1661.4 NANOSCIENCE AND TECHNOLOGY

(54 HOURS)

Unit 1 Introduction to Nanoscience and Nanotechnology (10 Hours)

Nanoscience and nanotechnology- Definition-Historical development, scope and applications

[Book 1, Chapter 1].

Comparison of bulk and nanomaterials-, classification of nanostructured materials: one, two and three dimensional confinement, size and dimensionality effects - size effects, conduction electrons and dimensionality, Fermi gas and density of states, Potential wells, Partial confinement, Properties dependent on density of states,excitons.

[Book 2 Chapter 9.1, 9.3, 9.4]

Unit 2 Properties of nanomaterials and scaling laws (6 Hours)

Introduction, size dependent properties, Properties of nanomaterials-chemical reactivity, solubility, melting points, electronic energy levels, electrical conductivity, Super-paramagnetism, Electron confinement, Integrated optics, Optical properties, Mechanical properties, Thermodynamic properties, scaling laws.

[Book 1 Chapter 3.1 to 3.4]

Unit 3 Synthesis and characterisation (16 Hours)

Synthesis of nanoscale materials and structures, Zero Dimensional materials-Inert gas condensation, Inert gas expansion, Sonochemical processing, Sol-gel deposition, Molecular self assembly, 1D and 2D- Foil beating, Electro-deposition, PVD, CVD, 3D- Rapid solidification, Equiangle extrusion, Milling and Mechanical alloying, Micromachining, Consolidation of nanoclusters and milled powders, Methods for nanoprofiling.

[Book 3 chapter 8.1]

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Electron microscopy, Scanning probe microscopy, Optical microscopy, XRD [Book 4, Chapter 2.1 to 2.4, 2.6]

IR and Raman Spectroscopy, Photoemission and X-ray spectroscopy

[Book 2 Chapter 3.4]

Unit 4 Carbon nanostructures (10 Hours)

Carbon nanostructures-carbon molecules, carbon clusters, Fullerene-structure of C-60 and its crystal-larger and smaller fullerenes-other bucky balls. Carbon nanotubes-fabrication-structure-electrical properties-vibrational properties-mechanical properties. Applications of carbon nanotubes-Field Emission and shielding- computers-fuel cells-chemical sensors-catalysis-mechanical reinforcement.

[Book 2, Chapter 5]

Unit 5 Nanomachines and nanodevices (12 Hours)

Resonant Tunneling diode, quantum cascade lasers, single electron transistors- operating principles and applications.

[Book 5, Chapter 9.1 to 9.4]

Books for study

- 1 Nanotechnology, An Introduction to synthesis, Properties and Applications of Nanomaterials, Thomas Varghese and KM Balakrishna, Atlantic Publishers and Distributors (P) Ltd, New Delhi
- 2 Introduction to Nanotechnology, Charles P. Poole Jr and Frank J Ovens, Wiley Interscience, USA
- 3 Nanomaterials, Nanotechnologies and design, Michael F Ashby, Paulo J Ferreira and Daniel L Schodek, Elsevier Publishers, UK
- 4 Nano, The Essentials, T. Pradeep, Tata Mc Graw Hill, New Delhi
- 5 Nanotechnology and Nanoelectronics, W.R. Fahrner, Springer, Newyork.

References

Revised Syllabus for CBCSS -FDP in Physics -2014

- 1 Encyclopedia of Nanoscience and Nanotechnology, H.S.Nalwa (Ed), American Scientific Publishers, Los Angeles
- 2 Nanotubes and Nanowires, C.N.R. Rao and Govindraj, RSC Publishing
- 3 Nanotechnology, An Introduction, Jeremy J Ramsden, Elsevier Publishers, UK
- 4 Nanotechnology, Mick Wilson, Kamali Kannagara, Geoff Smith, Michelle Simmons and Burkhard Raguse, Overseas Press, New Delhi

**PY1661.5. COMPUTER HARDWARE & NETWORKING
(54 HRS)**

Unit 1 - 3 hrs

P.C. Architecture Functional block diagram of a computer.ProcessorsIntroduction to Microprocessor.CISC, RISC processors Type of Processors and their specification.(Intel: Celeron, Pentium family-PII, PIII, PIV, dual core, core 2duo - AMD-K5,K6 series

Unit 2 -10 hrs

Motherboards:Motherboard components Types, Form factor, Different components of Motherboard (BIOS, CMOS,BICMOS, RAM, CMOS Battery, I/O slots, I/O connectors), Riser architecture, Main Memory (SIMM, DIMM, RIMM), extended/expanded/cache memories. Chipsets (Intel & AMD)-ROM, DRAM, SDRAM, CDRAM, RDRAM, WRAM. Bus standards: Types of Buses (PC, ISA, MCA, AGP, PCI, USB, IEEE FireWire).Add on Cards Different latest Add on Cards (TV Tuner Card, DVR card, Video Capture,Internal Modem, Sound Card)

Unit 3 -9 hrs

Drivers:

1. Floppy Disk Drive- Floppy Drive Components(overview only)
2. Hard Disk Drive (HDD)

Types, Capacity, Hard Disk Components (Media, Read/Write Head, Spindle Motor Head Actuator), Connector, Jumper setting, trouble shooting in HDD.Hard Disk Controller (HDC) – Block diagram, Working, Interfacing (IDE,SCSI, ATA and SATA series) Configuration of HDD- Installation, Formatting, File Format (FAT, NTFS).Pen drive, i-pods

2. Optical Disk Drive

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Types (ROM, R/W, DVD ROM, DVD R/W), Capacity, Difference between CD & DVD (capacity, format)-trouble shooting.

Unit 4 -5 hrs

Peripherals . Keyboard and Mouse- operation

Types of VDU (CRT, LCD, and TFT), Resolution, and Dot pitch -Printers – Types (dot matrix, inkjet, laser) Scanner- operation.Power conditioning Device:SMPS- Block diagram, operation-UPS- Types (online, off line, Hybrid)-trouble shooting in all these devices.

Unit 5- 4 hrs

Viruses & Vaccines-Virus- Introduction, infection methods,Types of viruses, Different symptoms of virus attack, precautions.Vaccine- Method of vaccine, Different types of Antivirus used in PC,Firewalls

Unit 6- 7 hrs

NETWORKING ESSENTIALS

Introduction-Need for networking-Network Topology-OSI Model-Types of networks (LAN, WAN, MAN)

Protocols-LAN Protocols- Classification, Examples, Ethernet networking-WAN Protocols- PPP, X .25, PPTP, L2TP, ISDN

Unit 7-- 8 hrs

LAN Connectivity Devices- NIC, Repeater, Hub, Switch, Bridge.Internet Connectivity Device- Routers, Gateways, CSU/DSU-TCP/IP Protocol Suite-What is TCP/IP, Importance, OSI vs TCP/IP

Unit 8- 6 hrs

IP Addressing-Overview, Address classes, Network ID, Host ID and Subnet Mask,Addressing guidelines, Reserved IP Address, Subnetting and Supernetting(overview)

Unit 9 -2 hrs

Emerging Technologies-Wireless Technology - Bluetooth, WAP-Mobile Technology- GSM, CDMA, GPRS

Books for Study:

Revised Syllabus for CBCSS -FDP in Physics -2014

1. D. Balasubramanian, “Computer Installation & Servicing”, Tata McGraw Hill.
2. Rom Gilster, Black book, “PC Upgrading and Repairing”, Dream tech, New Delhi.
3. Street Smart, James Pylar, “PC Upgrading and Repairing”, Wiley Publishing, Inc.
4. Stephen.J.Bigelow,”Bigelow’s Troubleshooting, Maintenance & Repairing PCs”,Tata McGraw Hill
5. Craig Zacker, “The Complete Reference- Networking”, Tata McGraw Hill
6. Douglowe, “Networking All in One Desk Reference”-3Edn, Wiley India Pvt Ltd

References:

1. Mark Minasi, “The Complete PC Upgrade & Maintenance Guide” BPB Publication
2. C.A. Schmidt, “The Complete Computer Upgrade & Repair Book”, Dreamtech
3. Craig Zacker, John Rourke, “The Complete Reference- PC Hardware”Tata McGraw Hill
4. Scott Mueller, “Upgrading & Repairing PC’s”, Pearson Education
5. Vishnu Priya Sing & Meenakshi Singh, “Computer Hardware Course”, Computech
6. Manahar Lotia, Pradeep Nair, Payal Lotia, “Modern Computer Hardware Course”,BPB Publication.
7. Richard Mc Mohan, “Introduction to Networking”, Tata McGraw Hill.

Internet Resources:

www.edugrid.ac.in/webfolder/courses/cn/cn_resources.htm

www.howstuffwork.com

www.e-tutes.com

www.learnthat.com

www.intel.com

www.amd.com

<http://en.wikipedia.org>

SEMESTER 1 (MATHEMATICS MAIN)

PY1131.1 – MECHANICS AND PROPERTIES OF MATTER (36 HOURS)

Unit I (28 hours)

Dynamics of rigid bodies (6 hours)

Theorems of M.I with proof-Calculation of M.I of bodies of regular shapes rectangular lamina, uniform bar of rectangular cross section, annular disc, circular disc, solid sphere-K.E of a rotating body. Determination of M.I of a fly wheel (theory and experiment).

Oscillations and waves (15 hours)

Examples of S.H oscillator-compound pendulum-determination of g -torsion pendulum-oscillations of two particles connected by a spring-vibration state of a diatomic molecule. Wave motion-general equation of wave motion-plane progressive harmonic wave energy density of a plane progressive wave-intensity of wave and spherical waves transverse waves in stretched string-modes of transverse vibrations of strings longitudinal waves in rods and in gases.

Mechanics of solids (7 hours)

Bending of beams-bending moment-cantilever-beam supported at its ends and loaded in the middle-uniform bending-experimental determination of Y using the above principles with pin and microscope-twisting couple on a cylinder-angle of twist and angle of shear-torsional rigidity.

Unit II (8 hours);

Surface Tension (5 hours)

Excess of pressure on a curved surface-force between two plates separated by a thin layer of liquid-experiment with theory to find surface tension and its temperature dependence by Jaeger's method-equilibrium of a liquid drop over solid and liquid surfaces.

Viscosity (3 hours)

Flow of liquid through a capillary tube-derivation of Poiseuille's formula-limitations-Ostwald's viscometer-variation of viscosity with temperature.

References

1. Mechanics: J.C.Upadhyaya, Ram Prasad & Sons
2. Oscillations & Waves: K.RamaReddy, S.Bbadami & V.Balasubramaniam (University Press)

SEMESTER 2 (MATHEMATICS MAIN)

PY1231.1 – HEAT AND THERMODYNAMICS (36 HOURS)

Unit I – Transmission of Heat (13 hours)

Thermal conductivity and thermometric conductivity-Lee's disc experiment-Weidmann and Franz law (statement only)-energy distribution in the spectrum of black body and results-

Revised syllabus CBCSS-FDP Physics-2014

Wien's displacement law-Rayleigh-Jeans law-their failure and Planck's hypothesis-Planck's law-comparison-solar constant-its determination temperature of sun.

Unit II – Thermodynamics (13 hours)

Isothermal and adiabatic processes-work done-isothermal and adiabatic elasticity.Heat engines-Carnot's cycle-derivation of efficiency-petrol and diesel engine cycles efficiency in these two cases-second law of thermodynamics-Kelvin and Clausius statements.

Unit III – Entropy (10 hours)

Concept of entropy-change of entropy in reversible and irreversible cycles-principle of increase of entropy-entropy and disorder-entropy and available energy-T-S diagram for Carnot's cycle-second law in terms of entropy-calculation of entropy when ice is converted into steam.

References

1. Heat & Thermodynamics: N.Subramaniam & Brijlal, S.Chand & Co
2. Heat & Thermodynamics: W.Zemansky, McGraw Hill
3. Heat & Thermodynamics: C.L.Arora.

SEMESTER 3 (MATHEMATICS MAIN)

PY1331.1 – OPTICS, MAGNETISM AND ELECTRICITY (54 HOURS)

Unit I (34 hours)

Interference (12 hours)

Analytical treatment of interference-theory of interference fringes and bandwidth.Interference in thin films-reflected system-colour of thin films-fringes of equal inclination and equal thickness. Newton's rings-reflected system-measurement of wavelength and refractive index of liquid.

Diffraction (14 hours)

Phenomenon of diffraction-classification-Fresnel and Fraunhofer. Fresnel's theory of approximate rectilinear propagation of light-Fresnel diffraction at a straight edge and circular aperture. Fraunhofer diffraction at a single slit, two slits and N slits. Plane transmission grating-determination of wavelength-Resolving power of grating.

Laser and Fibre Optics (8 hours)

Revised syllabus CBCSS-FDP Physics-2014

Principle of operation of laser-population inversion-optical pumping-ruby laser applications of lasers. Light propagation in optical fibres-step index fibre-graded index fibre-applications.

Unit II (20 hours)

Magnetism (10 hours)

Magnetic properties of matter-definition and relation between magnetic vectors B, H and M. Magnetic susceptibility and permeability. Magnetic properties-diamagnetism paramagnetism-ferromagnetism-antiferromagnetism. Electron theory of magnetism explanation of ferromagnetism.

Electricity (10 hours)

EMF induced in a coil rotating in a magnetic field-peak, mean, *rms* and effective values of A.C. AC circuits-AC through RC, LC, LR and LCR series circuits resonance-sharpness of resonance-power factor and choke coil-transformers.

References

5. A text book of optics – Brijlal & Subramaniam
6. Electricity and Magnetism – R.Murugesan, S.Chand & Co Ltd.
7. A text book of B.Sc subsidiary Physics – P.Vivekanandan.

SEMESTER 4 (MATHEMATICS MAIN)

PY1431.1 – MODERN PHYSICS AND ELECTRONICS (54 HOURS)

Unit I

Modern Physics (20 hours)

Basic features of Bohr atom model-Bohr's correspondence principle-vector atom model-various quantum numbers-magnetic moment of orbital electrons-electron spin- Spin-Orbit coupling-Pauli's exclusion principle-periodic table.Atomic nucleus-basic properties of nucleus-charge, mass, spin, magnetic moment binding energy and packing fraction-nuclear forces-salient features-radioactivity radioactive decay-decay laws-decay constant-half life and mean life-radioactive equilibrium-secular and transient equilibrium-measurement of radioactivity-Nuclear detectors (basic ideas).

Quantum mechanics (16 hours)

Revised syllabus CBCSS-FDP Physics-2014

Inadequacies of classical physics-experimental evidences-evidences for quantum theory-Planck's hypothesis-foundation of quantum mechanics-wave function and probability density-Schrödinger equation-time dependent and time independent particle in a potential box.

Unit II (18 hours)

Electronics (10 hours)

Current-voltage characteristics of a diode-forward and reverse bias-breakdown mechanism of p-n junction diode-Zener diode and its characteristics-half wave and full wave rectifiers-bridge rectifier-ripple factor, efficiency. Construction and operation of a bipolar junction transistor-transistor configurations current components-transistor characteristics-DC load line-Q point-AC load line transistor biasing-need for biasing-bias stabilization-biasing circuits-fixed bias,emitter feed back bias, voltage divider bias (qualitative study only).Transistor amplifier-basic features of an amplifier-gain, input and output resistances frequency response and band width-small signal CE amplifier-circuit and its operation

Digital Electronics (8 hours)

Number systems and codes-decimal numbers-binary arithmetic-1's and 2's compliment-decimal to binary conversion-octal numbers-hexadecimal numbers binary coded decimal-digital codes-logic gates-NOT, OR, AND, NOR and NAND gates.Boole algebra-Boole operations-logic expressions-laws of Boole algebra-DeMorgan's theorem-Boole expression for gate network-simplification of Boole expression.

References

1. Modern Physics – R.Murugesan, S.Chand & Co. Ltd.
2. A text book of B.Sc subsidiary Physics – P.Vivekanandan.
3. Principles of Electronics – V.K.Mehta.

SEMESTER 1 (CHEMISTRY MAIN)

PY1131.2 – ROTATIONAL DYNAMICS AND PROPERTIES OF MATTER (36 HOURS)

Unit I (26 hours)

Revised syllabus CBCSS-FDP Physics-2014

Dynamics of rigid bodies (7 hours)

Theorems of M.I with proof-Calculation of M.I of bodies of regular shapes rectangular lamina, uniform bar of rectangular cross section, annular disc, circular disc, solid cylinder, solid sphere-K.E of a rotating body-spinning top.

Oscillations and waves (13 hours)

Examples of S.H oscillator-compound pendulum-determination of g-torsion pendulum-oscillations of two particles connected by a spring-vibration state of a diatomic molecule Wave motion-general equation of wave motion-plane progressive harmonic wave energy density of a plane progressive wave-intensity of wave and spherical waves-

Mechanics of solids (6 hours)

Bending of beams-bending moment-cantilever-beam supported at its ends-and loaded in the middle-uniform bending-experimental determination of Y using the above principles with pin and microscope-twisting couple on a cylinder-angle of twist and angle of shear-torsional rigidity.

Unit II (10 hours)

Surface Tension (5 hours)

Excess of pressure on a curved surface-force between two plates separated by a thin layer of liquid-experiment with theory to find surface tension and its temperature dependence by Jaeger' method-equilibrium of a liquid drop over solid and liquid surfaces.

Viscosity (5 hours)

Flow of liquid through a capillary tube-derivation of Poiseuille's formula-limitations-Ostwald's viscometer-variation of viscosity with temperature-Stokes formula determination of viscosity of a highly viscous liquid by Stokes method.

References

1. Mechanics: J.C.Upadhyaya, Ram Prasad & Sons
2. Oscillations & Waves: K.RamaReddy, S.Bbadami & V.Balasubramaniam (University Press)

SEMESTER 2 (CHEMISTRY MAIN)

PY1231.2 – THERMAL PHYSICS (36 HOURS)

Unit I – Diffusion (4 hours)

Revised syllabus CBCSS-FDP Physics-2014

Graham's law of diffusion in liquids-Fick's law-analogy between liquid diffusion and heat conduction-methods of estimating concentrations-determination of coefficient of diffusivity.

Unit II – Transmission of Heat (16hours)

Thermal conductivity and thermometric conductivity-Lee's disc experiment-Radial flow of heat-cylindrical flow of heat-thermal conductivity of rubber-Weidmann and Franz law (statement only)-Radiation of heat-black body radiation-Kirchoff's laws of heat radiation-absorptive power-emissive power-Stefan's law (no derivation) –energy distribution in the spectrum of black body and results-Wien's displacement law-Rayleigh-Jeans law-their failure and Planck's hypothesis-Planck's law-comparison solar constant-temperature of sun.

Unit III – Thermodynamics (8 hours)

Isothermal and adiabatic processes-work done-isothermal and adiabatic elasticity.Heat engines-carnot's cycle-derivation of efficiency-petrol and diesel engine cycles efficiency in these two cases-second law of thermodynamics-Kelvin and Clausius statements.Phase transition- first order and second order-liquid helium-super fluidity.

Unit IV – Entropy (8 hours)

Concept of entropy-change of entropy in reversible and irreversible cycles-principle of increase of entropy-entropy and disorder-entropy and available energy-T-S diagram for Carnot's cycle-second law in terms of entropy-calculation of entropy when ice is converted into steam.

References

1. The general Properties of matter: F.H.Newman & V.H.L.Searle
2. Heat & Thermodynamics: N.Subramaniam & Brijlal, S.Chand & Co
3. Heat & Thermodynamics: W.Zemansky, McGraw Hill
4. Heat & Thermodynamics: C.L.Arora.

SEMESTER 3 (CHEMISTRY MAIN)

PY1331.2 – OPTICS, MAGNETISM AND ELECTRICITY (54 HOURS)

Unit I (34 hours)

Interference (10 hours)

Revised syllabus CBCSS-FDP Physics-2014

Analytical treatment of interference-theory of interference fringes and bandwidth. Interference in thin films-reflected system-colour of thin films-fringes of equal inclination and equal thickness. Newton's rings-reflected system-measurement of wavelength.

Diffraction (10 hours)

Phenomenon of diffraction-classification-Fresnel and Fraunhofer. Fresnel's theory of approximate rectilinear propagation of light-Fresnel diffraction at a straight edge Fraunhofer diffraction at a single slit, two slits and N slits. Plane transmission grating determination of wavelength-Resolving power of grating.

Polarisation (8 hours)

Experiments showing the transverse nature of light-plane polarized light-polarization by reflection-Brewster's law-double refraction-Nicol prism-propagation of light in uni-axial crystals-positive and negative crystals-principal refractive indices-half wave plate and quarter wave plate-elliptically and circularly polarized light-optical activity-Fresnel's theory and applications-polarimeters-determination of specific rotation.

Laser and Fibre Optics (6 hours)

Principle of operation of laser-population inversion-optical pumping-ruby laser applications of lasers. Light propagation in optical fibres-step index fibre-graded index fibre-applications.

Unit II (20 hours)

Magnetism (10 hours)

Magnetic properties of matter-definition and relation between magnetic vectors B, H and M. Magnetic susceptibility and permeability. Magnetic properties-diamagnetism paramagnetism-ferromagnetism-antiferromagnetism. Electron theory of magnetism explanation of ferromagnetism.

Electricity (10 hours)

EMF induced in a coil rotating in a magnetic field-peak, mean, *rms* and effective values of A.C. Ac circuits-AC through RC, LC, LR and LCR series circuits resonance-sharpness of resonance-power factor and choke coil-transformers.

References

1. A text book of optics – Brijlal & Subramaniam
2. Electricity and Magnetism – R.Murugesan, S.Chand & Co Ltd.

3. A text book of B.Sc subsidiary Physics – P.Vivekanandan.

SEMESTER 4 (CHEMISTRY MAIN)

PY1431.2– ATOMIC PHYSICS, QUANTUM MECHANICS AND ELECTRONICS (54 HOURS)

Unit I Atomic physics (12 hours)

Basic features of Bohr atom model-Bohr's correspondence principle-vector atom model-various quantum numbers-magnetic moment of orbital electrons-electron spin-Spin-Orbit coupling-Pauli's exclusion principle-periodic table.

Unit II Superconductivity (8 hours)

Properties of superconductors-zero electrical resistance-Meissner effect-critical magnetic field-Type I and Type II superconductors-isotope effect-high temperature ceramic superconductors-applications of superconductors.

Unit III Quantum mechanics (12 hours)

Inadequacies of classical physics-experimental evidences-evidences for quantum theory-Planck's hypothesis-foundation of quantum mechanics-wave function and probability density-Schrodinger equation-time dependent and time independent particle in a potential box.

Unit IV Spectroscopic Techniques (7 hours)

EM spectrum-UV, Visible, IR, Radio and microwave regions-principle of various spectrometers used in specific regions of EM spectrum-absorption spectroscopy emission spectroscopy-mass spectroscopy-qualitative ideas of ESR & NMR spectrometer.

Unit V Electronics (15 hours)

Current-voltage characteristics of a diode-forward and reverse bias-breakdown mechanism of p-n junction diode-zener diode and its characteristics-half wave and full wave rectifiers-bridge rectifier-ripple factor, efficiency. Construction and operation of a bipolar junction transistor-transistor configurations current components-transistor characteristics-DC load line-Q point-AC load line transistor biasing-need for biasing-bias stabilization-biasing circuits-fixed bias, emitter feedback bias, voltage divider bias (qualitative study

Revised syllabus CBCSS-FDP Physics-2014

only). Transistor amplifier-basic features of an amplifier-gain, input and output resistances frequency response and band width-small signal CE amplifier-circuit and its operation.

References

1. Modern Physics – R.Murugesan, S.Chand & Co. Ltd.
2. A text book of B.Sc subsidiary Physics – P.Vivekanandan.
3. Principles of Electronics – V.K.Mehta.

SEMESTER 1 (STATISTICS MAIN)

PY1131.3 – MECHANICS AND PROPERTIES OF MATTER (36 HOURS)

Unit I (28 hours)

Dynamics of rigid bodies (8 hours)

Theorems of M.I with proof-Calculation of M.I of bodies of regular shapes rectangular lamina, uniform bar of rectangular cross section, annular disc, circular disc, solid sphere-K.E of a rotating body. Determination of M.I of a fly wheel (theory and experiment).

Oscillations and waves (12 hours)

Examples of S.H oscillator-compound pendulum-determination of g -torsion pendulum-oscillations of two particles connected by a spring.Wave motion-general equation of wave motion-plane progressive harmonic wave energy density of a plane progressive wave-intensity of wave and spherical waves transverse waves in stretched string-modes of transverse vibrations of strings longitudinal waves in rods and in gases.

Mechanics of solids (8 hours)

Bending of beams-bending moment-cantilever-beam supported at its ends-and loaded in the middle-uniform bending-experimental determination of Y using the above principles with pin and microscope-twisting couple on a cylinder-angle of twist and angle of shear-torsional rigidity.

Unit II (8 hours)

Surface Tension (5 hours)

Revised syllabus CBCSS-FDP Physics-2014

Excess of pressure on a curved surface-force between two plates separated by a thin layer of liquid-experiment with theory to find surface tension and its temperature dependence by Jaeger' method-equilibrium of a liquid drop over solid and liquid surfaces.

Viscosity (3 hours)

Flow of liquid through a capillary tube-derivation of Poiseuille's formula-limitations-Ostwald's viscometer-variation of viscosity with temperature.

References

1. Mechanics: J.C.Upadhyaya, Ram Prasad & Sons
2. Oscillations & Waves: K.RamaReddy, S.Bbadami & V.Balasubramaniam (University Press)

SEMESTER 2 (STATISTICS MAIN)

PY1231.3 – THERMAL PHYSICS AND STATISTICAL MECHANICS (36 HOURS)

Unit I – Transmission of Heat (8 hours)

Thermal conductivity and thermometric conductivity-Lee's disc experiment-Weidmann and Franz law (statement only)-energy distribution in the spectrum of black body and results-Wien's displacement law.

Unit II – Thermodynamics (8 hours)

Isothermal and adiabatic processes-work done-isothermal and adiabatic elasticity.Heat engines-carnot's cycle-derivation of efficiency- second law of thermodynamics-Kelvin and Clausius statements.

Unit III – Entropy (8 hours)

Concept of entropy-change of entropy in reversible and irreversible cycles-principle of increase of entropy-entropy and disorder-entropy and available energy-T-S diagram for Carnot's cycle-second law in terms of entropy-calculation of entropy when ice is converted into steam.

Unit IV – Statistical Mechanics (12 hours)

Concepts of phase-space-ensemble and statistical equilibrium-probability theorems in statistical thermodynamics-distribution laws-Maxwell-Boltzman, Fermi-Dirac and Bose-

Revised syllabus CBCSS-FDP Physics-2014

Einstein distribution laws (no derivation)-comparison of three statistics-Molecular energies in an ideal gas-Quantum statistics-Rayleigh-Jeans formula-Planck's radiation law-specific heat of solids-free electrons in metals-electron energy distribution.

References

1. Heat & Thermodynamics: N.Subramaniam & Brijlal, S.Chand & Co
2. Heat & Thermodynamics: W.Zemansky, McGraw Hill
3. Heat & Thermodynamics: C.L.Arora.
4. Concepts of modern physics: Arthur Beiser (TMH).
5. Statistical Mechanics: Sinha (TMH).
6. Theoretical Chemistry: Samuel Gladstone, New York, D Van Nostrand Co.,Inc.
7. Heat: Saha and Srivasthava.

SEMESTER 3 (STATISTICS MAIN)

PY1331.3 – PHYSICAL AND MODERN OPTICS AND ELECTRICITY (54 HOURS)

Unit I (34 hours)

Interference (12 hours)

Analytical treatment of interference-theory of interference fringes and bandwidth.Interference in thin films-reflected system-colour of thin films-fringes of equal inclination and equal thickness. Newton's rings-reflected system-measurement of wavelength and refractive index of liquid.

Diffraction (14 hours)

Phenomenon of diffraction-classification-Fresnel and Fraunhofer. Fresnel's theory of approximate rectilinear propagation of light-Fresnel diffraction at a straight edge and circular aperture. Fraunhofer diffraction at a single slit, two slits and N slits. Plane transmission grating-determination of wavelength-Resolving power of grating.

Laser and Fibre Optics (8 hours)

Principle of operation of laser-population inversion-optical pumping-ruby laser applications of lasers. Light propagation in optical fibres-step index fibre-graded index fibre-applications.

Unit II (20 hours)

Magnetism (10 hours)

Revised syllabus CBCSS-FDP Physics-2014

Magnetic properties of matter-definition and relation between magnetic vectors B, H and M. Magnetic susceptibility and permeability. Magnetic properties-diamagnetism paramagnetism-ferromagnetism-antiferromagnetism. Electron theory of magnetism explanation of ferromagnetism.

Electricity (10 hours)

EMF induced in a coil rotating in a magnetic field-peak, mean, *rms* and effective values of A.C. Ac circuits-AC through RC, LC, LR and LCR series circuits resonance-sharpness of resonance-power factor and choke coil-transformers.

References

4. A text book of optics – Brijlal & Subramaniam
5. Electricity and Magnetism – R.Murugesan, S.Chand & Co Ltd.
6. A text book of B.Sc subsidiary Physics – P.Vivekanandan.

SEMESTER 4 (STATISTICS MAIN)

PY1431.3– MODERN PHYSICS AND ELECTRONICS (54 HOURS)

Unit I

Modern Physics (20 hours)

Basic features of Bohr atom model-Bohr's correspondence principle-vector atom model-various quantum numbers-magnetic moment of orbital electrons-electron spin-Spin-Orbit coupling-Pauli's exclusion principle-periodic table. Atomic nucleus-basic properties of nucleus-charge, mass, spin, magnetic moment-binding energy and packing fraction-nuclear forces-salient features radioactivity-radioactive decay-decay laws-decay constant-half life and mean life radioactive equilibrium-secular and transient equilibrium-measurement of radioactivity-Nuclear detectors (basic ideas).

Quantum mechanics (16 hours)

Inadequacies of classical physics-experimental evidences-evidences for quantum theory-Planck's hypothesis-foundation of quantum mechanics-wave function and probability density-Schrodinger equation-time dependent and time independent particle in a potential box.

Revised syllabus CBCSS-FDP Physics-2014

Unit II (18 hours)

Electronics (10 hours)

Current-voltage characteristics of a diode-forward and reverse bias-breakdown mechanism of p-n junction diode-zener diode and its characteristics-half wave and full wave rectifiers-bridge rectifier-ripple factor, efficiency. Construction and operation of a bipolar junction transistor-transistor configurations current components-transistor characteristics-DC load line-Q point-AC load line transistor biasing-need for biasing-bias stabilization-biasing circuits-fixed bias,emitter feed back bias, voltage divider bias (qualitative study only).Transistor amplifier-basic features of an amplifier-gain, input and output resistances frequency response and band width-small signal CE amplifier-circuit and its operation.

Digital Electronics (8 hours)

Number systems and codes-decimal numbers-binary arithmetic-1's and 2's compliment-decimal to binary conversion-octal numbers-hexadecimal numbers binary coded decimal-digital codes-logic gates-NOT, OR, AND, NOR and NAND gates.Booleen algebra-Booleen operations-logic expressions-laws of Booleen algebra-DeMorgan's theorem-Booleen expression for gate network-simplification of Booleen expression.

References

1. Modern Physics – R.Murugesan, S.Chand & Co. Ltd.
2. A text book of B.Sc subsidiary Physics – P.Vivekanandan.
3. Principles of Electronics – V.K.Mehta.

SEMESTER 1 (GEOLOGY MAIN)

PY1131.4 – MECHANICS AND PROPERTIES OF MATTER (36 HOURS)

Unit I (29 hours)

Dynamics of rigid bodies (7 hours)

Theorems of M.I with proof-Calculation of M.I of bodies of regular shapes rectangular lamina, uniform bar of rectangular cross section, annular disc, circular disc, solid cylinder, solid sphere-K.E of a rotating body-gyroscope-spinning top.

Oscillations and waves (15 hours)

Examples of S.H oscillator-compound pendulum-determination of g-torsion pendulum-oscillations of two particles connected by a spring-vibration state of a diatomic molecule-Wave motion-general equation of wave motion-plane progressive harmonic wave energy density of a plane progressive wave-intensity of wave and spherical waves- waves in solids-

Revised syllabus CBCSS-FDP Physics-2014

longitudinal waves-transverse waves-torsional waves-common characteristics-reflection and transmission of waves-reflection and transmission of energy-flexural vibrations-applications in geophysics.

Mechanics of solids (7 hours)

Bending of beams-bending moment-cantilever-beam supported at its ends-and loaded in the middle-uniform bending-experimental determination of Y using the above principles with pin and microscope-twisting couple on a cylinder-angle of twist and angle of shear-torsional rigidity.

Unit II (7 hours)

Surface Tension (4 hours)

Excess of pressure on a curved surface-force between two plates separated by a thin layer of liquid-experiment with theory to find surface tension and its temperature dependence by Jaeger' method-equilibrium of a liquid drop over solid and liquid surfaces.

Viscosity (3 hours)

Flow of liquid through a capillary tube-derivation of Poiseuille's formula-limitations-Ostwald's viscometer-variation of viscosity with temperature.

References

1. Mechanics: J. C. Upadhyaya, Ram Prasad & Sons
2. Oscillations & Waves: K. Rama Reddy, S.Bbadami & V.Balasubramaniam (University Press)

SEMESTER 2 (GEOLOGY MAIN)

PY1231.4 – THERMAL PHYSICS AND PHYSICS OF THE EARTH (36 HOURS)

Unit I – Transmission of Heat (9 hours)

Thermal conductivity and thermometric conductivity-Lee's disc experiment-Weidmann and Franz law (statement only)-energy distribution in the spectrum of black body and results-Wien's displacement law-Rayleigh-Jeans law-their failure and Planck's hypothesis-Planck's law-comparison-solar constant-temperature of sun

Unit II – Thermodynamics (9 hours)

Isothermal and adiabatic processes-work done-isothermal and adiabatic elasticity. Heat engines-carnot's cycle-derivation of efficiency-petrol and diesel engine cycles efficiency in these two cases-second law of thermodynamics-Kelvin and Clausius statements-Carnot's theorem with proof.

Unit III – Physics of the Earth (18 hours)

Revised syllabus CBCSS-FDP Physics-2014

The solar system-origin of solar system-the dynamic earth-continental drift-earth's structure-earth's size and shape-gravitation-gravitational field and potential equi-potential surfaces-gravitational field and potential due to a thin spherical shell and solid sphere-gravitational self energy-gravity measurements-free fall method-rise and fall method-gravity anomalies. The tide-tidal effect of sun-earth quakes-causes seismic wave propagation-seismographs. Atmospheric physics-atmospheric structure and composition-atmospheric pressure, density and temperature-measurement of air temperature-daily cycle of air temperature-atmospheric radiation-ionosphere-magnetosphere.

References

1. Heat & Thermodynamics: N.Subramaniam & Brijlal, S.Chand & Co
2. Heat & Thermodynamics: W.Zemansky, McGraw Hill
3. Heat & Thermodynamics: C.L.Arora.
4. Fundamentals of Geophysics: William Lowrie, Cambridge University Press.
5. Applied Physics: G.Aruldas et al, Rajam publishers, Tvpam.

SEMESTER 3 (GEOLOGY MAIN)

PY1331.4 – OPTICS AND ELECTRODYNAMICS (54 HOURS)

Unit I (34 hours)

Interference (12 hours)

Analytical treatment of interference-theory of interference fringes and bandwidth. Interference in thin films-reflected system-colour of thin films-fringes of equal inclination and equal thickness. Newton's rings-reflected system-measurement of wavelength and refractive index of liquid.

Diffraction (14 hours)

Phenomenon of diffraction-classification-Fresnel and Fraunhofer. Fresnel's theory of approximate rectilinear propagation of light-Fresnel diffraction at a straight edge and circular aperture. Fraunhofer diffraction at a single slit, two slits and N slits. Plane transmission grating-determination of wavelength-Resolving power of grating.

Polarisation (8 hours)

Revised syllabus CBCSS-FDP Physics-2014

Experiments showing the transverse nature of light-plane polarized light-polarization by reflection-Brewster's law-double refraction-Nicol prism-propagation of light in uni-axial crystals-positive and negative crystals-principal refractive indices-half wave plate and quarter wave plate-elliptically and circularly polarized light-optical activity-Fresnel's theory and applications.

Unit II (20 hours)

Magnetism (12 hours)

Magnetic properties of matter-definition and relation between magnetic vectors B, H and M. Magnetic susceptibility and permeability. Magnetic properties-diamagnetism paramagnetism-ferromagnetism-antiferromagnetism. Electron theory of magnetism explanation of ferromagnetism.Earth's magnetism-elements of earth' magnetism-dip, declination, horizontal and vertical components-magnetic maps-magnetographs-cause of earth's magnetism geomagnetic prospecting.

Electricity (8 hours)

EMF induced in a coil rotating in a magnetic field-peak, mean, *rms* and effective values of A.C. Ac circuits-AC through RC, LC, LR and LCR series circuits resonance-sharpness of resonance-power factor and choke coil-transformers.

References

1. A text book of optics – Brijlal & Subramaniam
2. Electricity and Magnetism – R.Murugesan, S.Chand & Co Ltd.
3. A text book of B.Sc subsidiary Physics – P.Vivekanandan.

SEMESTER 4 (GEOLOGY MAIN)

PY1431.4 – MODERN PHYSICS, ELECTRONICS AND CRYSTALLOGRAPHY

(54 HOURS)

Unit I

Modern Physics (20 hours)

Revised syllabus CBCSS-FDP Physics-2014

Basic features of Bohr atom model-Bohr's correspondence principle-vector atom model-various quantum numbers-magnetic moment of orbital electrons-electron spin-Spin-Orbit coupling-Pauli's exclusion principle-periodic table.Atomic nucleus-basic properties of nucleus-charge, mass, spin, magnetic moment-binding energy and packing fraction-nuclear forces-salient features radioactivity-radioactive decay-decay laws-decay constant-half life and mean life radioactive equilibrium-secular and transient equilibrium-measurement of radioactivity-radio carbon dating-age of the earth-biological effects of radiation.

Crystallography (16 hours)

Crystal structure-crystal lattice and translation vectors-unit cell-symmetry operations point groups and space groups-types of lattices-lattice directions and planes interplaner spacing-simple crystal structures-close packed structures-structure of diamond-zinc blend structure-sodium chloride structure.X-ray crystallography-diffraction of x-rays-Bragg's law-x-ray diffraction methods rotating crystal method-powder diffraction method.

Unit II (18 hours)

Electronics (10 hours)

Current-voltage characteristics of a diode-forward and reverse bias-breakdown mechanism of p-n junction diode-zener diode and its characteristics-half wave and full wave rectifiers-bridge rectifier-ripple factor, efficiency.Construction and operation of a bipolar junction transistor-transistor configurations current components-transistor characteristics-DC load line-Q point-AC load line transistor biasing-need for biasing-bias stabilization-biasing circuits-fixed bias,emitter feedback bias, voltage divider bias (qualitative study only).Transistor amplifier-basic features of an amplifier-gain, input and output resistances frequency response and band width-small signal CE amplifier-circuit and its operation

Digital Electronics (8 hours)

Number systems and codes-decimal numbers-binary arithmetic-1's and 2's compliment-decimal to binary conversion-octal numbers-hexadecimal numbers binary coded decimal-digital codes-logic gates-NOT, OR, AND, NOR and NAND gates.Booleen algebra-Booleen operations-logic expressions-laws of Booleen algebra-DeMorgan's theorem-Booleen expression for gate network-simplification of Booleen expression.

References

Revised syllabus CBCSS-FDP Physics-2014

1. Modern Physics – R.Murugesan, S.Chand & Co. Ltd.
2. A text book of B.Sc subsidiary Physics – P.Vivekanandan.
3. Principles of Electronics – V.K.Mehta.

SEMESTER 1 (HOME SCIENCE MAIN)

PY1131.5 – MECHANICS AND PROPERTIES OF MATTER (36 HOURS)

Unit I (26 hours)

Dynamics of rigid bodies (8 hours)

Theorems of M.I with proof-Calculation of M.I of bodies of regular shapes rectangular lamina, uniform bar of rectangular cross section, annular disc, circular disc, solid cylinder, solid sphere-K.E of a rotating body-spinning top

Oscillations and waves (12 hours)

Examples of S.H oscillator- oscillations of two particles connected by a spring vibration state of a diatomic molecule.Wave motion-general equation of wave motion-plane progressive harmonic wave energy density of a plane progressive wave-intensity of wave and spherical waves-

Mechanics of solids (6 hours)

Bending of beams-bending moment-cantilever-beam supported at its ends-and loaded in the middle-uniform bending-experimental determination of Y using the above principles with pin and microscope-twisting couple on a cylinder-angle of twist and angle of shear

Unit II (10 hours)

Surface Tension (5 hours)

Excess of pressure on a curved surface-force between two plates separated by a thin layer of liquid-experiment with theory to find surface tension and its temperature dependence by Jaeger' method-equilibrium of a liquid drop over solid and liquid surfaces.

Viscosity (5 hours)

Flow of liquid through a capillary tube-derivation of Poiseuille's formula-limitations - variation of viscosity with temperature-Stokes formula-determination of viscosity of a highly viscous liquid by Stokes method.

References

Revised syllabus CBCSS-FDP Physics-2014

1. Mechanics: J.C.Upadhyaya, Ram Prasad & Sons
2. Oscillations & Waves: K.RamaReddy, S.Bbadami & V.Balasubramaniam (University Press)

SEMESTER 2 (HOME SCIENCE MAIN)

PY1231.5 – THERMAL PHYSICS (36 HOURS)

Unit I – Diffusion (4 hours)

Graham's law of diffusion in liquids-Fick's law-analogy between liquid diffusion and heat conduction-methods of estimating concentrations-determination of coefficient of diffusivity.

Unit II – Transmission of Heat (14hours)

Thermal conductivity and thermometric conductivity-Lee's disc experiment -Weidmann and Franz law (statement only)-Radiation of heat-black body radiation -absorptive power-emissive power-Stefan's law (no derivation) -energy distribution in the spectrum of black body and results-Wien's displacement law-Rayleigh-Jeans law their failure and Planck's hypothesis-Planck's law-comparison-solar constant temperature of sun.

Unit III – Thermodynamics (10 hours)

Isothermal and adiabatic processes-work done-isothermal and adiabatic elasticity. Heat engines-carnot's cycle-derivation of efficiency-petrol and diesel engine cycles efficiency in these two cases-second law of thermodynamics-Kelvin and Clausius statements. Phase transition- first order and second order-liquid helium-super fluidity.

Unit. IV – Entropy (8 hours)

Concept of entropy-change of entropy in reversible and irreversible cycles-principle of increase of entropy-entropy and disorder-entropy and available energy-T-S diagram for Carnot's cycle-second law in terms of entropy-calculation of entropy when ice is converted into steam.

References

1. The general Properties of matter: F.H.Newman & V.H.L.Searle
2. Heat & Thermodynamics: N.Subramaniam & Brijlal, S.Chand & Co
3. Heat & Thermodynamics: W.Zemansky, McGraw Hill
4. Heat & Thermodynamics: C.L.Arora.

SEMESTER 3 (HOME SCIENCE MAIN)

PY1331.5 – OPTICS AND ELECTRICITY (54 HOURS)

Unit I (34 hours)

Interference (12 hours)

Analytical treatment of interference-theory of interference fringes and bandwidth. Interference in thin films-reflected system-colour of thin films-fringes of equal inclination and equal thickness. Newton's rings-reflected system-measurement of wavelength and refractive index of liquid.

Diffraction (14 hours)

Phenomenon of diffraction-classification-Fresnel and Fraunhofer. Fresnel's theory of approximate rectilinear propagation of light-Fresnel diffraction at a straight edge and circular aperture. Fraunhofer diffraction at a single slit, two slits and N slits. Plane transmission grating-determination of wavelength-Resolving power of grating.

Laser and Fibre Optics (8 hours)

Principle of operation of laser-population inversion-optical pumping-ruby laser applications of lasers. Light propagation in optical fibers-step index fibre-graded index fibre-applications.

Unit II (20 hours)

Electricity

EMF induced in a coil rotating in a magnetic field-peak, mean, *rms* and effective values of A.C. AC circuits-AC through RC, LC, LR and LCR series circuits resonance-sharpness of resonance-power factor and choke coil-transformers. Electric motors- principles of working- Devices working with electric motors-Electric fan- wet grinder, Mixer grinder, Microwave oven – principle – technical specifications- applications – advantages,

References

1. A text book of optics – Brijlal & Subramaniam
2. Electricity and Magnetism – R.Murugesan, S.Chand & Co Ltd.
3. A text book of B.Sc subsidiary Physics – P.Vivekanandan.
4. Electrical Technology (Vol I & II), B.L.Theraja.

SEMESTER 4 (HOME SCIENCE MAIN)

PY1431.5 – ATOMIC PHYSICS AND ELECTRONICS (54 HOURS)

Unit I

Modern Physics (20 hours)

Basic features of Bohr atom model-Bohr's correspondence principle-vector atom model-various quantum numbers-magnetic moment of orbital electrons-electron spin-Spin-Orbit coupling-Pauli's exclusion principle-periodic table.Atomic nucleus-basic properties of nucleus-charge, mass, spin magnetic moment binding energy and packing fraction-nuclear forces-salient features-radioactivity radioactive decay-decay laws-decay constant-half life and mean life-radioactive equilibrium-secular and transient equilibrium-measurement of radioactivity-

Unit II Superconductivity (8 hours)

Properties of superconductors-zero electrical resistance-Meissner effect-critical magnetic field-Type I and Type II superconductors-isotope effect-high temperature ceramic superconductors-applications of superconductors.

Unit III Spectroscopic Techniques (8 hours)

EM spectrum-UV, Visible, IR, Radio and microwave regions-principle of various spectrometers used in specific regions of EM spectrum-absorption spectroscopy emission spectroscopy-mass spectroscopy-qualitative ideas of ESR & NMR spectrometer.

Unit IV (18 hours)

Electronics (10 hours)

Current-voltage characteristics of a diode-forward and reverse bias-breakdown mechanism of p-n junction diode-Zener diode and its characteristics-half wave and full wave rectifiers-bridge rectifier-ripple factor, efficiency.Construction and operation of a bipolar junction transistor-transistor configurations-current components-transistor characteristics-DC load line-Q point-AC load line-transistor biasing-need for biasing-bias stabilization-biasing circuits-fixed bias, emitter feedback bias, voltage divider bias (qualitative study only).Transistor amplifier-basic features of an amplifier-gain, input and output resistances frequency response and band width-small signal CE amplifier-circuit and its operation

Digital Electronics (8 hours)

Revised syllabus CBCSS-FDP Physics-2014

Number systems and codes-decimal numbers-binary arithmetic-1's and 2's complement-decimal to binary conversion-octal numbers-hexadecimal numbers binary coded decimal-digital codes-logic gates-NOT, OR, AND, NOR and NAND gates. Boolean algebra-Boolean operations-logic expressions-laws of Boolean algebra-DeMorgan's theorem-Boolean expression for gate network-simplification of Boolean expression.

References

1. Modern Physics – R.Murugesan, S.Chand & Co. Ltd.
2. A text book of B.Sc subsidiary Physics – P.Vivekanandan.
3. Principles of Electronics – V.K.Mehta.

**COMPLEMENTARY ELECTRONICS FOR PHYSICS MAIN
SEMESTER 1**

EL1131- ELECTRONICS I (36 HOURS)

Unit I (Chapters 1, 2, 3, 4, 5, 6 of Book 1) – 16 hrs

Circuit fundamentals (5 hrs), Kirchoff's laws and network theorems (6 hrs), Passive circuit elements (5 hrs).

Unit II (Chapters 7, 8, 9, 12, 13, 14 of Book 1) – 20 hrs

Magnetism and transformers (3 hrs), A.C fundamentals-series AC circuits (4 hrs), Time constant (3 hrs), Solid state Physics (4 hrs), p-n junction diode (6 hrs).

Books of Study

1. Basic Electronics Solid State – B.L.Theraja, S.Chand & Co. Ltd.
2. Principles of Electronics – V.K.Mehta.

SEMESTER 2

EL1231- ELECTRONICS II (36 HOURS)

Unit I (Chapters 11, 15, 16, 17, 18, 19 of Book 1) – 21 hrs

Tuning circuits and filters (4 hrs), Opto-electronic devices (4 hrs), DC power supplies (5 hrs), The basic transistor (4 hrs), Transistor characteristics and approximations (4hrs).

Unit II (Chapters 20, 21 of Book 1) – 15 hrs

Revised syllabus CBCSS-FDP Physics-2014

Load line and DC bias circuits (5 hrs), Transistor equivalent circuits and models (10 hrs).

Books of Study

1. Basic Electronics Solid State – B.L.Theraja, S.Chand & Co. Ltd.
2. Principles of Electronics – V.K.Mehta.

SEMESTER 3

EL1331- ELECTRONICS III (54 HOURS)

Unit I (Chapters 22, 23, 24 of Book 1) – 22 hrs

Single stage amplifiers (10 hrs), Multi stage amplifiers (8 hrs), Decibels and frequency response (4 hrs).

Unit II (Chapters 25 to 30 of Book 1) – 32 hrs

Feedback amplifiers (4 hrs), sinusoidal and non-sinusoidal oscillators (10 hrs), Field effect transistors (6 hrs), Breakdown devices (4 hrs), Modulation and demodulation (8hrs).

Books of Study

1. Basic Electronics Solid State – B.L.Theraja, S.Chand & Co. Ltd.
2. Principles of Electronics – V.K.Mehta.

SEMESTER 4

EL1431- ELECTRONICS IV (54 HOURS)

Unit I (Chapters 31 to 35 of Book 1) – 32 hrs

Integrated circuits (8 hrs), Number systems (6 hrs), Logic gates (8 hrs), Boolean algebra (6 hrs), Logic families (4 hrs).

Unit II (Chapters 36, 37, 38 of Book 1) – 22 hrs

Transducers (8 hrs), Electronic instruments (6 hrs), Fibre optics (8 hrs).

Books of Study

1. Basic Electronics Solid State – B.L.Theraja, S.Chand & Co. Ltd.
2. Principles of Electronics – V.K.Mehta.

COMPLEMENTARY PRACTICALS (PHYSICS)
(COMMON FOR ALL COMPLEMENTARY SUBJECTS)

PY1432-PRACTICAL

List of Experiments (Minimum 20 experiments to be done)

1. Torsion Pendulum- n by torsional oscillations
2. Torsion Pendulum- n and I using equal masses
3. Fly Wheel
4. Cantilever- Y by pin and microscope method
5. Uniform bending- Y by pin and microscope
6. Symmetric bar pendulum- g and radius of gyration
7. Surface tension- capillary rise method
8. Coefficient of viscosity- capillary flow method
9. Specific heat-method of mixtures applying Barton's correction
10. Lee's disc- Thermal conductivity of cardboard
11. Melde's string- frequency of tuning fork
12. Method of parallax- optical constants of convex lens using i) mirror and mercury ii) mirror and water
13. Method of parallax- refractive index of liquid.
14. Spectrometer- A , D and n
15. Spectrometer- dispersive power of a prism
16. Spectrometer- Grating-normal incidence
17. Deflection and vibration magnetometer- M and Bh
18. Circular coil- magnetization of a magnet
19. Carey Foster's bridge- Resistivity
20. Potentiometer- Resistivity
21. Potentiometer- Calibration of ammeter
22. Mirror galvanometer- Current and Voltage sensitivity
23. Diode Characteristics (for Ge and Si diodes)
24. Half wave rectifier-Measurement of ripple factor with and without filter capacitor
25. Full wave rectifier- Measurement of ripple factor with and without filter capacitor

COMPLEMENTARY ELECTRONICS PRACTICALS

EL1432-PRACTICAL

LIST OF EXPERIMENTS (MINIMUM 20 EXPERIMENTS TO BE DONE)

1. Semiconductor diode (IN 4001/ IN 4007) Characteristics; To (i) trace and construct the circuit,
(ii) to draw the forward V-I characteristic curve and
(iii) to determine the static and dynamic resistances of the diode at a particular operating point.
2. Zener diode characteristics; To (i) trace and construct the circuit,
(ii) to plot the V-I characteristic under reverse biased condition and
(iii) to calculate the dynamic resistance of the diode under reverse bias when conducting.
2. LED and photo diode characteristics:
To (i) study the variations in resistance with varying current and
(ii) to study the output characteristics of a photo diode.
4. Thevenin and Norton equivalent circuits:
To (i) determine Thevenin's and Norton's equivalent circuits of Wheatstone's bridge and (ii) to verify the power transfer theorem.
5. R-C resonant circuits:
To (i) study the input-output characteristics of an R-C circuit as a function of frequency and
(ii) to study the square wave response of R-C circuits.
6. Transistor characteristics; CE configuration:
(i) Construct the circuit,
(ii) To plot the input characteristics (IB-VBE graph for constant VCE) and to calculate the dynamic resistance at an operating point,
(iii) To study the output characteristics (IC-VCE graph for constant IB) and to calculate the output ac resistance, dc gain and ac current gain at a given operating point.
7. Transistor characteristics; CB configuration:
(i) Construct the circuit,
(ii) Plot the input characteristics (IE-VEB graph for constant VCB) and to calculate the dynamic resistance at an operating point,

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(iii) To study the output characteristics (IC-VCB graph for constant IC) and to calculate the output dynamic resistance, dc current gain and ac current gain at a given operating point.

8. FET characteristics:

(i) Trace the circuit

(ii) To plot the static drain characteristics of FET

(iii) To calculate the FET parameters (drain dynamic resistance, mutual conductance and amplification factor at a given operating point).

9. Fixed-bias circuit with and without emitter resistor:

(i) Trace the circuit

(ii) To measure the Q -Point (IC and VCE) with and without emitter resistor RE.

(iii) To note the variation of Q-point by increasing the temperature of the transistor in fixed bias circuit with and without emitter resistor

(iv) To note the variation of Q-point by changing the base resistor in bias circuit with and without emitter resistor

10. Collector-to-base feedback bias circuit:

(i) Trace the circuit

(ii) To measure the Q-Point (IC and VCE)

(iii) To note the variation of Q-point by increasing the temperature of the transistor

11. Potential-divider biasing circuit:

(i) Trace the circuit

(ii) To measure the Q-Point (IC and VCE)

(iii) To note the variation of Q-point by increasing the temperature of the transistor

(iv) To measure the operating point when one of the bias resistor changes

12. Half-wave rectifier:

(i) To draw the input and output wave shapes

(ii) To verify $V_{dc} = V_m/p$ and ripple factor = 1.21 (Observe for different load resistances)

13. Full-wave rectifier – Centre tapped:

(i) To draw the input and output wave shapes

(ii) To verify $V_{dc} = 2V_m/p$ and ripple factor = 0.482 (Observe for different load resistances)

14. Bridge rectifier:

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- (i) To draw the input and output wave shapes
 - (ii) To verify $V_{dc} = 2V_m/p$ and ripple factor = 0.482 (Observe for different load resistances)
15. Filter circuits (shunt capacitor, LC and CLC filters):
- (i) To plot the output wave shapes with and without shunt capacitor
 - (ii) To find the ripple factor with and without different filters
16. Single stage RC coupled amplifier:
- (i) To measure the Q-point (I_C and V_{CE})
 - (ii) To measure the maximum signal that can be amplified by the amplifier without clipping
 - (iii) To measure the voltage gain at 1 KHz
 - (iv) To plot the frequency response
 - (v) To find the voltage gain for different values of load resistance
17. FET amplifier:
- (i) To measure the frequency response
 - (ii) To measure voltage gain, BW and gain-BW product
18. Hartley oscillator:
- (i) Trace the circuit
 - (ii) To measure the Q-point of the transistor
 - (iii) To observe the output wave form and to measure the frequency of oscillations
19. Phase shift oscillator:
- (i) Trace the circuit
 - (ii) To measure the frequency from the output wave form
 - (iii) To observe the phase shift at different points
20. Clipping circuits:
- (i) To observe the output wave form corresponding to different clipping circuits
21. Clamping circuits:
- (i) To observe the output wave form corresponding to different clamping circuits
22. OP amp. - Inverting amplifier using IC 741
- (i) Trace the circuit
 - (ii) To construct an inverting amplifier using IC 741 and determine its voltage gain for different input voltage

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23. OP amp. - Non inverting amplifier using IC 741

(i) Trace the circuit

(ii) To construct a Non inverting amplifier using IC 741 and determine its voltage gain for different input voltage

24. OP amp. - Unity gain buffer using IC 741

(i) Trace the circuit and

(ii) To construct a unity gain buffer using IC 741 and to find the voltage gain



University of Kerala
Thiruvananthapuram, Kerala, India 695 034
(Established as University of Travancore by the Travancore University Act in 1937 and reconstituted as
University of Kerala by the Kerala University Act of 1957 and presently governed by the
Kerala University Act of 1974 passed by the Kerala State Legislative Assembly)
(Re-accredited by NAAC with 'A' Grade)

No.Ac/AV/1/2018

Thiruvananthapuram

Dated:26-06-2018

From:

The Registrar

To:

The Principals of all Colleges offering First Degree Programmes under CBCS system

Sub:- First Degree Programmes under CBCS system -Approved syllabus w.e.f 2018
admissions for intimation- reg.

Sir,

I am to inform you that the syllabus of the following **First Degree Programmes under CBCS system have been revised from the Academic year 2018-19.**

1. Computer Science
2. Computer Application
3. Physics & Computer Application (portions of Computer Application alone has been revised)
4. **Physics**
5. Mathematics
6. Geography
7. Statistics
8. Polymer Chemistry
9. Home Science
10. Commerce
11. Commerce with Computer Application
12. Commerce & Hotel Management and Catering
13. Commerce & Tax Procedure and Practice
14. Commerce & Tourism and Travel Management
15. Sanskrit (General)
16. Sanskrit
17. Education
18. Journalism and Mass Communication
19. B.A. English
20. B.A. History

The revised syllabus and the relevant U O's are uploaded in the University website for your information and further action.

Kindly take note of the same.

Yours faithfully,

Sd/-
Deputy Registrar(Acad-II)

UNIVERSITY OF KERALA

**REVISED SYLLABI FOR
FIRST DEGREE PROGRAMME IN
PHYSICS**

**UNDER CHOICE BASED
CREDIT AND SEMESTER SYSTEM
(CBCSS)**


(2018 ADMISSION ONWARDS)

..

UNIVERSITY OF KERALA

REVISED SYLLABI FOR

FIRST DEGREE PROGRAMME IN

PHYSICS

UNDER

CHOICE BASED-CREDIT & SEMESTER-

SYSTEM (CBCSS)

(2018 admission onwards)

AIM AND OBJECTIVES OF THE PROGRAMME

In this programme, we aim to provide a solid foundation in all aspects of Physics and to show a broad spectrum of modern trends in physics and to develop experimental, computational and mathematical skills of students. The syllabi are framed in such a way that it bridges the gap between the plus two and post graduate levels of physics by providing more or less complete and logical framework in almost all areas of basic Physics.

The programme also aims to

- (i) Provide education in physics of the highest quality at the undergraduate level and generate graduates of the calibre sought by industries and public service as well as academic teachers and researchers of the future.
- (ii) Attract outstanding students from all backgrounds.
- (iii) Provide an intellectually stimulating environment in which the students have the opportunity to develop their skills and enthusiasms to the best of their potential.
- (iv) Maintain the highest academic standards in undergraduate teaching.
- (v) Impart the skills required to gather information from resources and use them.
- (vi) Equip the students in methodology related to Physics.

Objectives

By the end of the first year (2nd semester), the students should have,

- (i) Attained a common level in basic mechanics and properties of matter and laid a secure foundation in mathematics for their future courses.
- (ii) Developed their experimental and data analysis skills through a wide range of experiments in the practical laboratories.

By the end of the fourth semester, the students should have

- i. Been introduced to powerful tools for tackling a wide range of topics in Thermodynamics, Electrodynamics, Classical Mechanics and Relativistic Mechanics.
- ii. Become familiar with additional relevant mathematical techniques.
- iii. Further developed their experimental skills through a series of experiments which also illustrate major themes of the lecture courses.

By the end of the sixth semester, the students should have

- i. Covered a range of topics in almost all areas of physics including Quantum Physics, Solid State Physics, Computational Physics, Electronics etc.
- ii. Had experience of independent work such as projects, seminars etc.
- iii. Developed their understanding of corePhysics.

I. General Structure for the First-Degree Programme in Physics

Sem.

No.

Course title
Instructional
hours/week
Credit
University. Exam
duration
Evaluation
Total
credit

L
P

Internal
Uty.

Exam

I
EN1111 English Lang I
5
4
3 hours

1111 Addl Lang I

4

3

”

EN1121 Foun Course I

4

2

”

20%

80%

16

PY1141 Core Course I

2

2

”

Core pract. I

-

2

-

-

MM1131.1 Compl. Course I

2

3

3 hours

2

Compl. Course II

2

2

2

”

(CH1131.1/ST1131.2/PCH1131.7/EL1131)

II

EN1211 Eng Lang. II

5

4

3 hours

EN1212 Eng Lang. III

4

3

”

1211 Addl Lang. II

4

3

”

20%

80%

17

PY1241 Core Course II

2

2

”

Core pract. I

2

MM1231.1 Compl. Course III

2

3

”

2-

Compl. Course IV

2

2

2

”

(CH1231.1/ST1231.2/ PCH1231.7/EL1231)

III
EN1311 Eng Lang. IV
5
4
3 hours

1311 Addl Lang. III
5
4
”

PY1341 Core Course II
3
-
3
”

20%

80%

18

Core Pract I

-

2

-

-

MM1331.1 Compl. Course V

3

2

4

3 hours

Compl. Course VI

3

2

3

”

(CH1331.1/ST1331.2/PCH1331.7/EL1331)

20%

80%

IV
EN1411 Eng Lang. V
5

4
3 hours

1411Addl Lang. IV
5

4
”

PY1441Core Course III
3

3
”

80%

80%

25

PY 1442 Core (Pract I) IV

-

2

3

”

MM1431.1 Compl. Course VII

5

-

4

3 hours

Compl. Course VIII

3

-

3

”

(CH1431.1/ST1431.2/ PCH1431.7/EL1431)

Compl. (Practical) IX

-

4

”

(CH1432.1/ST1432.2/ PCH1432.7/EL1432)

V

PY1541 Core Course V

4

4

3 hours

-

PY1542 Core Course VI

4

4

”

-

PY1543 Core Course VII

80%

4

80%

4

”

18

PY1544 Core Course VIII

4

4

”

Core (PracticalII)

-

4

-

-

Open Course

3

2

3 hours

(PY1551.1/PY1551.2/

PY1551.3/PY1551.4/

PY1551.5)

Project

-

2

-

-

VI

PY1641 Core Course IX

4

80%

80%

4
3 hours

PY1642 Core Course X

4

4

”

PY1643 Core Course XI

4

4

”

26

PY1644 Core Course XII

4

3

”

PY1645 Core (Pract II) XIII

-

2

2

”

PY1646 Core (Pract III) XIV

-

2

3

”

Elective Course

3

-

2

”

(PY1661.1/PY1661.2/

PY1661.3/PY1661.4/

PY1661.5)

PY1647 Project and Research

-

2

4

-

Institute/Science Museum visit

II. Course structure:(1a). Core Courses (theory)

Sem.	Title of paper	Number of hours per week	Number of credits	Total hours/ semester	UE Duration
1	PY1141 – Basic mechanics & Properties of matter	2	2	36	3 hrs
2	PY1241 - Heat	2	2	36	3

	& Thermo dynamic s				
3	PY1341 – Electrod ynamics	3	3	54	3
4	PY1441 - Classica l & Relativi stic Mechani cs	3	3	54	3
	PY1541– Quantum Mechanic s	4	4	72	3
	PY1542 – Statistic al Mechani cs Researc h Method ology and Disaster Manage	4	4	72	3

5	ment				
	PY1543	4	4	72	3
	– Electronics				
	PY1544	4	4	72	3
	–Atomic & M o l e c u l a r P h y s i c s				
	PY1551	3	2	54	3
	– Open course				
	PY1641	4	4	72	3
	-Solid State Physics				

	PY1642	4	4	72	3
	- Nuclear & Particle Physics				
6	PY1643	4	4	72	3
	- Classica l & Modern O pt ic s				
	PY1644	4	3	72	3
	-Digital Electron ics & Comput er Science				
	PY1661	3	2	54	3
	- Elective Course				

(1b). COURSE STRUCTURE FOR PRACTICAL AND PROJECT WORK

FOR THE CORE COURSE:

Sem	Title of Paper	Duration of Exam	Number Of Credits	Weightage		Allotted hours	
				IA	UE	Per week	Per year
4	PY144 2- Basic Physics Lab 1	3	3	1	3	S1--- 2 S2--- 2 S3--- 2 S4--- 2	144
6	PY164 5- Advanced Physics Lab 2	3	2	1	3	S5--- 2 S6--- 2	72
	PY164 6- Advanced	3	3	1	3	S5--- 2	72

6	Physics Lab 3					S6— 2	
6	PY-1647-Project	-	4	-	4	S5-2 S6-2	72

2(a). Complementary Courses (General structure)

Semester	Theory		Practical		
	Number of hours/week	Number of credits		number of hours/week	Number of credits
1	2	2	36	2	-
2	2	2	36	2	-
3	3	3	54	2	-

4	3	3	54	2	4

(2b). COMPLEMENTARY COURSES (Theory and Practical)

1. Physics for Mathematics B.Sc Programme

Se me ster	Title of the cour se		No. of hour s/ wee k	No. of cred its	Tota l cred its	Tota l hou rs per sem .	UE
1	PY1 131. 1- Mec hani cs & prop erties of matte r	2	2	2	36	3	dura tion
	Prac tical		2			36	
2	PY1 231. 1- Ther mal		2	2	2	36	3

	Phy sics and stati stica l mec hani cs						
	Prac tical		2			36	
3	PY1 331. 1- Opti cs,m agne tism & elect ricit y	3	3	3	54	3	
	Prac tical		2			36	
4	PY1 431- Mod ern Phy sics &	3	3	7		3	
	Elec troni cs						

	PY1 432- Prac tical	2	4		36	
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2. Physics for Chemistry B.Sc Programmes

Se me Ste r	Titl e of the cou rse	No. of	No. of hou rs/ wee k	Tot al cre dits	Tot al cre dits	UE hou rs	sem per .	dur atio n
1	PY1 131. 2- Rot atio nal & dyn ami cs Mat ter of prop ertie s	2	2	2	36	3		
	Prac tic al		2			36		
2	PY 123	2	2	2	36	3		

	1.2- Thermal Physics							
	Practical			2			36	
3	PY 133 1.2- Magnetics & Electricity	Optics,		3	3	3	54	3
	Practical			2			36	
4	PY 143 1.2- Atomic Quantum Electronics	physics, mechanics &	3	3	7	54	3	
	PY 143			2	4		36	3

2- Pra ctic al								
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3. Physics for Statistics B.Sc Programme

Se me ster	Title of the cour se	No. of	No. of hour s/ wee k	Tota l cred its	Tota l Cre dits	UE hour s per sem.	dura tion
1	PY1 131. 3- Mec hani cs & prop ertie s of matt er	2	2	2	36	3	
	Prac tical		2			36	
2	PY1 231. 3- & stati stica l mec hani cs	The rma l Phys ics	2	2	2	36	3

	Pra ctic al		2			36	
3	PY1 331. Opti cs, 3- Mag neti sm & elec trici ty Pra ctic al	3	3	3	54	3	
			2			36	
4	PY1 431. Mo der n & Elec tron ics PY1 432- Pra ctic al	phys ics	3	3	7	54	3
			2	4	36	3	

4. Physics for Geology B.Sc Programme

Semester	Title of the course	No. of	No. of hours/ week	Total credits	Total credits	UE hours per sem.	duration
1	PY1 131. 4- properties of matter	Mechanics &	2	2	2	36	3
	Practical		2			36	
2	PY1 231. 4- Physics & Physics of the Earth	Thermal	2	2	2	36	3
	Practical		2			36	

3	PY1 331. 4- elect rody nami cs Pract ical	O pti cs and	3	3	3	54	3	
			2			36		
4	PY1 431. 4- Phys ics, cryst allog raph y	Mode rn Elect ronic s &	3	3	7	54	3	
	PY1 432- Pract ical		2	4		36	3	

5. Physics for Home Science B.Sc Programme

Semester	Title of the course	No. of hours/week	No. of credits	Total credits	Total hours per sem.	UE	duration
1	PY11 31.5- Mechanics & properties of matter	2	2	2	36	3	
	Practical	2			36		
2	PY12 31.5- Thermal Physics	2	2	2	36	3	
	Practical	2			36		
3	PY13 31.5- Optics and	3	3	3	54	3	

	electricity Practical	2			36	
4	PY14 31.5- Atomic physics & Electronics	3	3	7	54	3
	PY14 32- Practical	2	4		36	3

6. Electronics for Physics B.Sc Programme

Semester	Title of the course	No. of hours/week	No. of credits	Total credits	Total hours per sem.	UE ion durat
1	EL11 31- Electronics I	2	2	2	36	3
	Practical	2			36	
2	EL12 31- Electronics II	2	2	2	36	3
	Practical	2			36	
3	EL13 31- Electronics III	3	3	3	54	3

	Practical	2			36	
4	EL14 31- Electronics IV	3	3	7	54	3
	EL14 32- Practical	2	4		36	3

7. Physics for Polymer Chemistry B.Sc Programme

Semester	Title of the course	No. of	No. of hours/ week	Total credits	Total credits	UE hours per sem.	duration
1	PY1 131. 7- Mechanics and Fluid	2	2	2	36	3	

	dynamics							
	of							
	Practical		2				36	
2	PY 123 1.7- Thermal Physics	2	2	2	2	36	3	
	Practical		2				36	
3	PY 133 1.7- Modern Optics & Electricity		3	3	3	3	54	3
	Practical		2				36	
4	PY 143 Physics	3	3	7	54	3		

	1.7- Ato mic and Ele ctro nics	&					
	PY 143 2- Pra ctic al	2	4		36	3	

III. QUESTION PAPER PATTERN

For all semesters

1. The examination has duration of 3 hours
2. Each question paper has four parts A, B, C & D.
3. Part A contains 10 questions and the candidate has to answer all questions. Each question carries 1mark. The answer may be in the forms-one word/one sentence
4. Part B contains 12 short answer questions. Out of these 12 questions, the candidate has to answer 8 questions. Each question carries 2marks.
5. Part C contains 9 questions of which the candidate has to answer 6 of them. Each question carries 4 marks.
6. Part D contains 4 long answer questions (essays) of which the candidate has to answer 2 questions. Each question carries 15 marks.
7. The total weightage for the entire questions to be answered is 80 marks.

QUESTION PAPER PATTERN FOR TEST

Question No	Type of Question	Marks
Part A : 1-10	10 One word/One sentence	10
Part B : 11-22	8 out of 12; Short answer	16
Part C : 23-31	6 out of 9; Short essay/problem	24
Part D : 32-35	2 out of 4; Essay	30

Total=
80
marks

V. OPEN/ELECTIVE COURSES

During the programme the students have to undergo two open/elective courses. The students attached to the Physics department can opt one course from the Physics department (Elective course) and the other from any one of the other departments (Open course). The student has to do the open course during the fifth semester and the elective course during the sixth semester. As a beginning, the department will choose one open course for the fifth semester and one elective course for the sixth semester depending on the faculty and infrastructure available.

(a). Open Courses.

i) Bio-Physics ii) Astronomy & Astrophysics iii) Applied Physics
iv) Environmental Physics v) Energy Physics

(b). Elective Courses.

i) Photonics ii) Nano science iii) Computer hardware and networking iv)
Instrumentation v) Space Science

VI. IMPLEMENTATION OF PROJECT WORK AND STUDY TOUR(RESEARCH INSTITUTE/SCIENCE MUSEUM VISIT)

As part of study the candidate has to do a project work. The aim of the project work is to bring out the talents of students and to introduce research methodology. The work may be chosen from any branch of Physics, which may be experimental, theoretical or computational. Emphasis should be given for originality of approach. The project shall be done individually or as a group of maximum 5 students. The projects are to be identified during the 4th semester with the help of the supervising teacher. The report of the project (of about 30-40 pages) in duplicate shall be submitted to the department by the end of the 6th semester well before the commencement of the examination. The reports are to be produced before the external examiners appointed by the University for valuation.

STUDY TOUR

Students are directed to visit one research institute /science museum preferably within the state of Kerala. Scientifically prepared hand-written study tour report must be submitted by each student for ESE on the day of the examination of project evaluation.

VII. CONTINUOUS EVALUATION

There will be continuous evaluation (CE) based on continuous assessment and end semester examination (ESE) for each course. CE carries 20 marks based on specific components such as attendance, tests, assignments, seminars etc. and ESE 80 marks. Out of the 20marks in internal assessment, 5marks shall be given to attendance, 10 marks to test papers, 5marks to seminar / assignments (minimum one test & one assignment). The components of the internal evaluation for theory and practical and their marks are given below.

(a). Theory

No	Component	marks
1	Attendance	5
2	Assignment	5
3	Test paper	10
	Total	20

The continuous evaluation (CE) shall be based on periodic written tests, assignments, viva/ seminar and attendance in respect of theory courses. **Written Tests:** Each test paper may have duration of minimum 3 hours. For each course there shall be a minimum of one written test during a semester. **Assignments:** Each student is required to submit one assignment for a theory course. Seminar / Viva: For each theory course, performance of a student shall also be assessed by conducting a viva – voce examination or seminar presentation based on topics in that course.

(b). Continuous Evaluation CE (Practical)

No	Component	Marks
1	Attendance	5
2	Skill & Punctuality	5
3	Laboratory record	5
4	Test (internal exam)	5
	Total	20

Lab skill is to be assessed based on the performance of the student in practical classes. Minimum one practical test paper and an internal viva – voce examination based on the experiments done in the lab are to be conducted in each practical course. The laboratory record should contain an index and a certificate page. Separate records are to be used for each practical course. **A candidate shall be permitted to attend an end semester practical examination only if he / she submit a certified record with a minimum of 10 experiments.** This is to be

endorsed by the examiners.

The **evaluation of certified record** shall be according to the scheme given below.

No of experiments recorded	Marks
18	10
16	9
14	8
12	7
10	6

(c) The allotment of marks for attendance shall be as follows.

	% of attendance	Marks
	Attendance less than 50%	0
	51%-60%	1
Attendance	61%-70%	2
	71%-80%	3
	81%-90%	4
	91%-100%	5

(d) Tests, Assignments and Seminars

For each course there shall be at least two class tests during a semester. Marks for the test in continuous evaluation shall be awarded on the basis of the marks secured for the better of the two tests. Valued answer scripts shall be made available to the students for perusal within 10 working days from the date of the test.

Each student shall be required to do one assignment and one seminar for each course. Valued assignments shall be returned to the students. The seminars shall be organized by the teacher in charge and the same shall be assessed by a group of teachers including the teacher in charge of that course.

VIII. END SEMESTER EXAMINATION (ESE)

The external theory examinations of all semesters shall be conducted by the University. There will be no supplementary examinations. For reappearance/improvement, as per university rules, the students can appear along with the next batch.

IX. EVALUATION OF PROJECT AND TOUR REPORT

The evaluation of the project shall be done by two external examiners according to the scheme given above. Each candidate shall be evaluated separately. There shall be a maximum of 12 candidates per session with two sessions per day. However, there shall be no continuous evaluation for the project.

The **evaluation of project** shall be according to the scheme given below.

Component	Marks
Originality of approach	15
Relevance of the topic	10
Involvement	10
Viva-voce	15
Presentation of report	20
Research Institute/Science museum visit and Report	30

Evaluation of Tour report

The evaluation of tour report shall be according to the scheme given below

Component	Marks
Presentation of the report	10
Certified report	20

X. EVALUATION OF PRACTICAL EXAMINATION

The practical examinations for the core subject shall be conducted by the University at the end of semesters 4 and 6 with a common time table and questions set by the University. Similarly, the practical examination for the complementary course shall be conducted by the University at the end of the 4th semester. The examiners shall be selected from a panel of experts prepared by the University.

For each examination centre there shall be two external examiners and one internal examiner who is not in charge of the practical at that centre. The mark sheet duly certified by the head of the institution should be sent to the University

before the commencement of the end semester examinations.

The evaluation scheme for the end semester practical examinations shall be as follows.

Component	Marks
Formula, circuit,graph, brief procedure	20
Setting and experimental skill	15
Observations and tabulations	15
Substitution, calculation, result with correct unit	20
Certified record with 18 experiments	10
Total	80

For electronics experiments, the scheme shall be as follows.

Component	Marks
Formula, circuit,graph, brief procedure	20
Observations, skill and	25

tabulations	
Substitution, calculation, result with correct unit	25
Certified record with 18 experiments	10
Total	80

For computer experiments, the following scheme shall be followed.

Component	Marks
Writing the programme	30
Execution of the programme	20
Output/Result	20
Certified record with 18 experiments	10
Total	80

PY1141: BASIC MECHANICS & PROPERTIES OF MATTER

(36 HOURS-2 CREDITS)

MECHANICS (22 hrs)

Unit 1- Dynamics of Rigid Bodies (7 hrs)

Equations of motion for rotating rigid bodies- angular momentum and M.I- Theorems on MI.- calculation of MI. of bodies of regular shapes- uniform rod, ring, disc, annular ring, solid cylinder, hollow cylinder and solid sphere- KE of rotating and rolling bodies- torque- Determination of MI. of a fly wheel (theory, experiment and applications).

Unit 2- Conservation of energy (3 hrs)

Energy Conservation law- Work – power- Kinetic Energy – Work Energy theorem- Conservative Forces - potential energy- Conservation of energy for a particle– energy function- .

Unit 3-Oscillations (12 hrs)

Simple harmonic motion – Energy of harmonic oscillators-simple pendulum-mass on a spring-oscillation of two particles connected by a spring- compound bar pendulum - interchange ability of suspension and oscillation-four points collinear with C.G about which the time period is the same-conditions for maximum and minimum periods - Determination of g using symmetric bar pendulum.Mechanical and electromagnetic wave motion- General equation of a wave motion-expression for a plane progressive harmonic wave- energy density for a plane progressive wave.

PROPERTIES OF MATTER (14hrs)

Unit 4- Elasticity (8 hrs)

Modulus of elasticity (revision)Relations connecting the three elastic moduli- Poisson's ratio- bending of beams- bending moment-cantilever-centrally loaded beams and uniformly bent beams-I section girders-torsion of a cylinder-expression for torsional couple -work done in twisting a wire-torsion pendulum-.

Unit 5– Surface Tension (3 hrs)

Surface tension-molecular explanation of ST.-angle of contact(revision)shapes of drops -expression for excess of pressure on a curved liquid surface -variation of ST. with temperature.

Unit 6 – Fluid Dynamics (3 hrs)

Streamline and turbulent flow-equation of continuity-Bernoulli's theorem-venturimeter-viscosity-Newton's law- Stoke's formula.

Books for Study:

1. Mechanics: Hans H. S. and Puri S. P, TMH, 2nd Edn.
2. Mechanics: J.C. Upadhyaya and, Ram Prasad S. Chand Publications, 2017
3. Elements of Properties of Matter: D.S. Mathur, S. Chand Publications, 2008
4. Fundamentals of Physics: Halliday and Resnick, Wiley India Pvt. Ltd., 2006

Books for Reference:

1. Properties of matter: Brijlal and Subramaniam, S.Chand & Co.,2004
2. Principles of Physics: P.V.Naik, PHI,2010

Topics for assignments /discussion in the tutorial session (sample)

1. Physics-The fundamental science-historical development of mechanics-some implications of the principle of mechanics-The scope of mechanics.
2. Life of eminent physicists- Newton, Einstein, C.V.Raman, Edison.
3. Study of Young's modulus for different types of wood.
4. Study of variation of surface tension for different detergents.
5. Study of viscosity of different types of ink and to arrive at knowledge of its fluidity.
6. Wide applications of Bernoulli's equation.
7. Variation of surface tension with temperature by Jaeger's method

PY1241 –HEAT AND THERMODYNAMICS

(36 HRS-2 CREDITS)

Unit 1- Transference of heat (8 hrs)

Thermal conductivity - determination by Lee's Disc method for bad conductor radial flow of heat, cylindrical flow,thermal conductivity of rubber, Weidman-Franz law. Radiation of heat, Stefan's law, determination of Stefan's constant, solar constant, determination of solar temperature

Unit 2- Thermodynamics (18 hrs)

Zeroth Law & First law of Thermodynamics, differential form-Thermodynamic Processes-Expression for work done in isothermal and adiabatic processes. Application of first law to specific heat and latent heat.Reversible and irreversible processes.Second law of thermodynamics- Clausius and Kelvin statements-Carnot engine- Principle of refrigerator- working and efficiency, Otto engine and Diesel engine – working and efficiency.

Unit 3- Entropy (10 hrs.)

Definition of entropy, change of entropy in reversible and irreversible cycle, Clausius inequality and second law of thermodynamics, entropy and available energy, Entropy, probability and disorder. Nernst theorem and third law of thermodynamics. phase transition, phase diagram, first order and second order phase transition (qualitative idea) Clausius-Clepeyron Equation

Books for Study:

1. Thermal and Statistical Mechanics: S.K. Roy, NewAge International
2. Heat and Thermodynamics: D. S. Mathur, S. Chand & Co
3. Heat and Thermodynamics: Brijlal & Subramaniam, S. Chand & Co
4. Thermal Physics, Statistical Physics and Solid State Physics: C. J. Babu, Calicut University Press
5. Engineering Thermodynamics: P. K. Nag, McGraw-Hill, 5th Edn.

Books for Reference:

1. Heat and Thermodynamics: Zemansky, McGraw-Hill
2. Heat and Thermodynamics: Rose C McCarthy, The Rosen Publishing Group, Inc. NY, 2005
3. Thermodynamics, Kinetic Theory and Statistical Thermodynamics: F. W. Sears and G. L. Salinger, Addison-Wesley Publishing Company, 3rd Edn.

PY 1341 ELECTRODYNAMICS

(54 Hours-3Credits).

Unit 1-Electrostatic Field (10hrs)

Electric field: introduction, Coulomb's law, Electric field, continuous distribution (Revision), Divergence and curl of electrostatic fields; Field lines, flux applications of Gauss's law, Curl of E, Electric potential: Introduction to potential, Comments on potential, Poisson's and Laplace's equations, potential of a localized charge distribution, Electrostatic boundary, Work and Energy in Electrostatics: The work done to move a charge, the energy of a point charge distribution, The energy of a continuous charge distribution.

Unit 2-Electrostatic fields in matter (10 hrs)

Polarization: Dielectrics, induced dipoles, Polarization, The field of a polarized object: Bound charges, physical interpretation of bound charges and the field inside a dielectric Electric displacement: Gauss's law in the presence dielectrics,

Boundary conditions.

Unit 3-Magnetostatics (7hrs)

Introduction The Biot- Savart law, Ampere's force law (revision), Magnetic torque, Magnetic flux and Gauss's law for magnetic fields, magnetic vector potential, Magnetic intensity and Ampere's circuital law, magnetic materials.

Unit 4-Electromagnetic Induction (7hrs)

Electromotive force: Ohm's law Electromagnetic Induction Faraday's law, the induced electric field, Maxwell's equations, Magnetic charge,

Unit 5-Electromagnetic waves (6hrs)

Waves in one dimension: The wave equation Electromagnetic waves in vacuum: The wave equation for E and B, Monochromatic plane waves, Energy and momentum in electromagnetic waves.

Unit 6-Transient currents(7hrs)

Growth and decay of current in LR and CR Circuits-Measurement of high resistance by leakage-Charging and discharging of a capacitor through LCR circuit.

Unit 7-Alternating current (7 hrs)

AC through series LCR (acceptor circuit) and parallel LCR circuit (rejecter circuit)- Q- factor, Power in AC-power factor.

Books for Study:

1. Electrodynamics: David J Griffith, PHI, 3rdEdn.
2. Electricity and Magnetism: Murugesan, S.Chand & Co.
3. Electricity and Magnetism: K.K.Tiwari, S.Chand & Co.
4. Principles of electromagnetics: Matthew N.O. Sadiku and S. V. Kulkarni, Oxford University Press, 6thEdn.

Books for Reference:

1. Electricity and Magnetism: Muneer H. Nayfeh & Norton K. Bressel, John Wiley & Sons
2. Electricity and Magnetism: E.M. Purcell, Berkley Physics course, Vol.2, MGH
3. Electricity and Magnetism: J.H. Fewkes & John Yarwood, University Tutorial Press
4. Classical Electrodynamics: Walter Greiner, Springer International Edn.
5. Electromagnetic waves and radiating systems: Jordan & Balmain, PHI
6. Electromagnetics: B.B.Laud, Wiley Eastern Ltd., 2ndEdn.
7. Introduction to electrodynamics: Reitz & Milford Addison Wesley

8. Electromagnetic theory fundamentals: Bhag Guru and Huseyin Hizirogulu, Cambridge University Press, 2ndEdn.
9. Electricity and Magnetism: D.C.Tayal, Himalaya Publishing Co.

Topics for discussion in Tutorial session/Assignments (sample)

1. Comment on how electrostatic energy is stored in a field
2. Discuss the electrostatic properties of conductors
3. What is meant by electrostatic shielding? In what way it helps us?
4. Discuss the peculiarities of electric displacement D and electric field E . How they are incorporated in Maxwell's Equations
5. Discuss the properties of linear dielectrics. What differentiates adielectric to be linear or not?
6. Discuss applications of Ampere's circuital law
7. Compare electrostatics and magnetostatics
8. Why magnetic forces cannot do work
9. Discuss about cyclotron motion & cycloid motion
10. Discuss whether there exists any stand-off between ohm's law and Newton'ssecond law
11. A battery has an *emf*. Can this *emf*. be a 'force'? How will you interpret electromotive force?
12. Discuss the role of motional *emf* in power generation
13. Discuss the orthogonality of E , B and propagation vector k
14. A wave function can have a sinusoidal representation. Solve the wave equation for this function and discuss the various terms related to a wave such as amplitude, frequency, phase, wave number.
15. Complex representation of wave function has good advantage. Why? Discuss the linearity of wave function. (use complex notation)

16. Discuss AC through LC, LR and CR circuits
17. Show that sharpness of resonance is equal to Q- factor
18. What is a choke coil? Discuss the advantage of using a choke coil instead of a resistor

**PY1441 CLASSICAL AND RELATIVISTIC MECHANICS
(54 Hours-3Credits).**

Unit 1 - Particle Dynamics (5 hrs)

Mechanics of a particle – equation of motion of a particle – Motion of a charged particle in electromagnetic field – mechanics of a system of particles.

Unit 2-Conservation laws (6 hrs)

linear uniformities of space and conservation of linear momentum – rotational invariance of space and law of conservation of angular momentum – homogeneity of flow of time and conservation of energy.

Unit 3- Motion in central force field (10 hrs)

Equivalent one body problem – motion in central force field – general features of motion – motion in an inverse square law force field – equation of the orbit – Kepler’s laws of planetary motion and their deduction.

Unit 4 - Collisions (6 hrs)

Conservation laws- Conservation of momentum- laboratory and centre of mass systems- kinetic energies in the lab and CM systems-Cross-section of elastic scattering

Unit 5. Lagrangian Dynamics(9hrs)

Constraints-generalized coordinates- principle of virtual work-D’Alembert’s principle, Lagrange’s equation from D’Alembert’s principle-applications of Lagrange’s equation in simple pendulum, Atwood’s machine and compound pendulum, Comparison of Lagrangian approach with Newtonian approach.

Unit 6. Hamiltonian Dynamics(5hrs)

Generalized momentum and cyclic coordinates- Hamiltonian function H- conservation of energy- Hamilton’s equation - examples of Hamiltonian dynamics- one dimensional harmonic oscillator

Unit 7. Frames of Reference, Galilean transformation and Special theory of relativity(13hrs)

Inertial frames of reference- Galilean transformation- non- inertial frames
Origin and significance of special theory of relativity-search for universal frame of reference-Michelson-Morley experiment- postulates of special theory of relativity- consequences-Lorentz transformation equations- kinematical consequences of Lorentz transformations-length contraction-time dilation-twin paradox-transformation of velocity- variation of mass with velocity- mass energy equivalence

Books for Study:

1. Classical Mechanics: J. C. Upadhyaya, Himalaya Publishing
2. Mechanics: H.S.Hans and S.P.Puri, Tata-McGraw Hill
3. Classical Mechanics: G. Aruldas, PHI Learning Pvt Ltd., 2008
4. Introduction to classical mechanics: R.G.Thakwale and P.S.Puranik, Tata-McGraw Hill.
5. Classical Mechanics: Vimal Kumar Jain, Ane Books Pvt. Ltd., 2009

Books for Reference:

1. Classical Mechanics: Goldstein.
2. Modern Physics: Ronald Gautreau, Shaum's outlines series, 1999
3. Classical Mechanics-Systems of Particles & Hamiltonian Dynamics: Walter Greiner, Springer, 2nd Edn.
4. Classical Mechanics: N.C Rana and P.S. Joag, TMH Education Pvt. Ltd., 2015

PY1541- QUANTUM MECHANICS

(72 HRS-4 CREDITS)

Unit 1 – The Emergence of Quantum Mechanics (18 hrs)

Limitations of classical physics, Black body radiation curve-Optical spectra — photoelectric effect -specific heat of solids -Planck's quantum hypothesis, Einstein's theory of photoelectric effect -Compton effect- Quantum theory of specific heat of solids, -Bohr model- hydrogen atom- Bohr postulates-The correspondence principle.

Unit 2-Wave Mechanics (22 hrs)

Wave nature of particles-electron diffraction- standing wave of electron in the orbit uncertainty principle -uncertainty relation among canonically conjugate pairs-application- non-existence of electrons in the nucleus-ground state energy of hydrogen atom- width of spectral lines-Properties of wave function-Conditions for Physical Acceptability of Wave Function, Normalization and orthogonality condition. Superposition Principle-wave packets, relation between - Particle velocity- group velocity and phase velocity- Probability Interpretation of Wave Function -Statistical Interpretation of Wave function -probability current density in one dimension-Expectation value- Time dependent Schrodinger equation,-Time independent Schrodinger equation - stationary states.

Unit 3-One Dimensional Energy Eigen Value Problems (14hrs)

Free particle Schrodinger equation—square-well potential with infinite walls-Square well potential with finite walls, square potential barrier– The Harmonic oscillator- (Schrodinger method)-

Unit 4- General Formalism of Quantum Mechanics (18hrs)

Linear vector space, Linear operator, Eigen values and Eigen functions-, Hermitian operator, Postulates of Quantum Mechanics-Equation of motion-Schrodinger representation- Momentum representation

Books for Study:

1. Quantum Mechanics: G. Aruldhas, PHI, 2ndEdn., 2002
2. A Text book of Quantum Mechanics: P.M. Mathews & K. Venkatesan- McGraw Hill, 2ndEdn., 2010
3. Quantum Mechanics: Robert Eisberg and Robert Resnick, Wiley, 2nd Edn. 2002
4. Quantum Mechanics: Leonard I. Schiff, TMH, 3rd Edn., 2010
5. Concepts of Modern Physics: Arthur Beiser, TMH, 6th Edn.

Books for Reference:

1. Quantum Mechanics:Eugen Merzbacher, John Wiley and Sons Inc.,2004
2. Introduction to Quantum Mechanics: David J. Griffith, Pearson Education, 2nd Ed. 2005
3. Quantum Mechanics: Walter Greiner, Springer,4thEdn., 2001
4. Quantum Mechanics: Bruce Cameron Reed, Jones and Bartlett, 2008.
5. Quantum Mechanics for Scientists & Engineers: D.A. B. Miller, Cambridge University Press, 2008
6. Shaum's outline series

**PY1542: STATISTICAL PHYSICS, RESEARCH METHODOLOGY AND
DISASTER MANAGEMENT
(72 HRS- 4 CREDITS)**

Unit 1- Statistical Physics (18 hrs)

Statistical probability, Macro and Micro states, Phase space, Statistical ensemble, Postulate of equal probability, Maxwell Boltzmann distribution, Velocity distribution. Indistinguishability of identical particles, Bose Einstein and Fermi Dirac distribution function, comparison of three statistics

Unit 2 Research Methodology (18 hrs)

Research - Objectives and motivation in research – different types of research- research approaches- Significance of research- Research methods and

methodology – Research and scientific method- Various steps in a research process- importance of literature survey- criteria of good research.

Thesis/ Report writing - preliminary section (Title page, declaration of author, certificate of supervisor, table of contents, list of tables and figures, preface acknowledgement), Main Text (abstract, introduction, experimental section, results and discussion), Conclusions, references, scope for future study.

Unit 3 Error Analysis (12 hrs)

Significant figures- Basic ideas of error measurement, uncertainties of measurement, importance of estimating errors, dominant errors, random errors, systematic errors, rejection of spurious measurements.

Estimating and reporting of errors, errors with reading scales, absolute and relative errors, and standard deviation, Variance in measurements, error bars and graphical representation.

Unit 4 – Disaster Management (24hrs)

Global natural disasters: Natural hazards and natural disasters, Recent major disasters and their relief efforts, Impact of global climate change and major natural disasters, Human adaptability of natural disasters, Fragile natural eco-environment, Disaster reduction activity, achievements, challenges and future development

Earth quake disaster and their and their effects, Advancement in research of earthquake disaster, earthquake and tsunami warnings, earthquake disaster prevention, earthquake disaster mitigation

Health emergencies and diseases: environmental health and diseases, disasters and emergencies, steps in disaster management, pre-disaster activity, role of water supply, need for protecting large scale water supply schemes, assessment of damaged and available and water resources, water quality testing- Personal hygiene, control of communicable diseases and prevention of epidemics, measures for controlling communicable diseases and epidemics.

Radiation emergencies, health consequence of radiation, measures to prevent sudden health emergencies due to radiation

Books for Study:

1. Thermal and Statistical Mechanics: S.K. Roy –New Age International-2001
2. Elements of Statistical Mechanics: Kamal Singh and S. P. Singh- S. Chand & Co,1999
3. Thermal Physics, Statistical Physics and Solid State Physics: C. J. Babu, Calicut University Press
4. Introduction to Statistical Mechanics: S. K. Sinha, Alpha Science International Ltd. 2005
5. Statistical Mechanics: B. K. Agarwal- New Age International 2007
6. Research Methodology: C. R. Kothari, New Age International

Publishers.

7. Natural disaster mitigation – a scientific and practical approach: Science Press, Beijing, 2009
8. Environmental health in emergencies and disasters: A practical guide, B.Wisner & J.Adams (Eds.), WHO, Geneva, 2002 ISBN 92-4 154541-0.
9. Introduction to Disaster Management: SatishModh, Macmillan, 2010

Books for Reference:

1. Statistical Mechanics: S. Rajagopal
2. Introduction to Statistical Physics: Kerson Huang -CRC Press, 2001
3. Statistical Mechanics: Norman Davison, Courier Corporation, 2013
4. Disaster Management: Harsh K Gupta, Universities Press, 2003

**PY1543-ELECTRONICS
(72 HOURS-4 CREDITS)**

Unit 1. Circuit Theory (4 hours)

Kirchhoff's law- Ideal voltage and current sources- Thevenin's and Norton's theorem, Maximum power transfer theorem

Unit 2. Diode Circuits(14 hours)

Extrinsic semiconductors-n- type and – p-type semiconductors-PN junction-PN junction under forward and reverse biased conditions- r_m s value and peak inverse voltage- diode characteristics-ac and dc resistances- half wave and full wave rectifiers- (average dc value of current, ripple factor and efficiency)- different types of filters(shunt capacitor, LC and RC)- break down mechanism in diodes- Zener diode- voltage regulator-

Unit 3. Transistors(16 hours)

Theory of BJT operation- CB,CE and CC characteristics-alpha , beta and gamma – relation between transistor currents- biasing circuits(CE configuration)- stability factors-selection of operating point-ac and dc load lines-Q point-collector feedback; base resistor and potential divider methods- BJT amplifiers- input and output impedances-graphical analysis of CE amplifier(frequency response,band width and gain in dB)- emitter follower.

Unit 4. Power amplifiers: (5 hours)

Amplifier classes and efficiency - class A operation - transformer coupled class A amplifier - class B amplifier - push pull amplifier - basic ideas of class C operation - distortion in amplifiers.

Unit 5. Feedback & Oscillator circuits (8 hours)

Feedback principles – negative feedback - advantages of negative feedback - positive feedback - principle of sinusoidal feedback- oscillation - Barkhausen criterion for oscillations - RC phase shift, Hartley Oscillator, Colpitt's, Oscillator (derivations not required).

Unit 6. Modulation (5 hours)

Fundamentals of modulation - AM, FM - frequency spectrum of AM - power in AM - demodulation of AM signal - frequency spectrum for FM

Unit 7. Special devices: (8 hours)

JFET- Basic construction - Theory of operation - Static characteristics - Drain characteristics- Advantages - MOSFET – Depletion enhancement MOSFET – Construction – Static characteristics. Uni-junction Transistor - Construction-operation.

Unit 8. Operational amplifiers (IC741)(12 hours)

Introduction – Schematic symbol and pin configuration - circuit configuration and block diagram representation – differential amplifier-ideal OP amp. - CMRR – differential mode and common mode – virtual ground principle – parameters of OP amp. - inverting amplifier – non-inverting amplifier –summing- differentiator-integrator amplifiers.

Books for Study:

1. Basic electronics: Devices, circuits and IT fundamentals: Santiram Kal, PHI, 2009
2. Basic Electronics-Solid State: B. L. Theraja, S. Chand Ltd., 2005
3. Principles of Electronics: V. K. Mehta, S. Chand Ltd.,2005
4. A first course in Electronics: Anwar A. Khan, Kanchan K. Dey,PHI, 2006
5. Communication Electronics:Jose Robin and Ubald Raj, Indira Publications, 2002

Books for Reference:

5. Electronic Devices and Circuits: Theodore F. Bogart Jr., Universal book stall
6. Electronic devices and Circuit theory: Robert Boylestad & Louis Nashelski,PHI,5th Edn.
7. Electronic fundamentals & applications: John D Ryder, PHI, 4thEdn.
8. Electronic Communications: Dennis Roddy, John Coolen,Pearson, 4thEdn.

Topics for assignments/discussion in the tutorial session (sample)

1. Electronic projects using flip flops.
2. Electronic projects using logic gates.
3. Electronic projects using IC 741 OP amp.
4. Electronic projects using timer 555.

5. Electronic projects using IC 311.
6. Constant voltage power supplies.
7. Constant current sources.
8. Oscillators of different frequencies.
9. Low range frequency generators.
10. High range frequency generators.
11. Voltage regulated dc power supplies with variable output.
12. Voltage regulated dual power supplies with variable output.
13. Instrument for the measurement of capacitance.
14. Instrument for the measurement of dielectric constant of a liquid/ solid.
15. Effect of temperature on electronic components.

PY1544-ATOMIC & MOLECULAR PHYSICS

(72 HOURS-4 CREDITS)

Unit 1- Vector Atom Model (10hrs)

Bohr's theory, correspondence principle Sommerfeld's atom model and explanation of fine structure of H line in Balmer series of hydrogen atom. Limitation of Sommerfeld atom model. Vector atom model - Various quantum numbers associated with vector atom model - L.S and j.j couplings - application of spatial quantization - Pauli's exclusion principle - magnetic dipole moment of electron due to orbital and spin motion - Spin-Orbit coupling.

Unit 2- Atomic Spectra (14hrs)

Optical spectra - Spectral terms and notations - selection rules - intensity rule and interval rule - fine structure of sodium D lines - hyperfine structure - alkali spectra - Zeeman effect - Larmor's theorem - quantum mechanical explanation of normal Zeeman effect. Anomalous Zeeman effect - Paschen-Back effect - Stark effect.

Unit 3- X-ray Diffraction (8 hrs)

X-rays - Discovery - properties - scattering - Measurement of X-ray wavelengths by ruled gratings - X-ray Spectra - continuous and characteristic X-ray spectrum - Origin of continuous Spectrum - Origin of characteristic X-rays - X-ray energy level diagram. - Absorption of X-rays - Applications of X-rays

Unit 4- Molecular spectra (28 hrs)

Electromagnetic spectra - molecular energies - classification of molecules - rotational spectra of diatomic molecules - rotational energy levels - selection rules - rotational spectrum - isotope effect - bond length and atomic mass.

Diatomic vibrational spectra-vibrational energy levels-selection rule-vibrational transitions-Rotation-Vibration transitions-IR spectrometer

Raman scattering- classical description of Raman scattering, quantum theory of Raman scattering- -vibrational Raman spectra-diatomic molecules-polyatomic molecules-rotational Raman spectra Raman spectrometer.

Electronic spectra sequences and progressions-Frank-Condon principle-

Unit 5- Resonance Spectroscopy (12 hrs)

NMR principle-Resonance condition-NMR spectrometer-chemical shift-indirect spin-spinInteraction- applications of NMR spectroscopy-

ESR principle- Resonance condition –ESR spectrometer-hyperfineinteraction – applicationsofESR spectroscopy.

Mossbauerspectroscopy- principle -isomer shift.

Books for Study:

1. Modern Physics: G.Aruldas and P.Rajagopal, PHI, New Delhi, 2005
2. Modern Physics: R.Murugesan, S.Chand& Co., Reprint, 2008
3. Atomic and Nuclear Physics: N.Subramaniam&Brijlal, S.Chand& Co.
4. Atomic Physics: J.B.Rajam, S.Chand&Co.
5. Concepts of Modern Physics: A. Beiser, TMH, New Delhi, 6thEdn.

Books for Reference:

1. Fundamentals of Molecular Spectroscopy: Banwell, TMH
2. Spectroscopy: Walker & Straw, Chapman & Hill.
3. Molecular Spectroscopy: G.Aruldas, PHI, 2004
4. Atomic and Nuclear Physics: Dr.V.W.Kulkarni-Himalaya Publishing House

PY 1551-OPEN COURSES (54 HOURS-2CREDITS) FOR EACH COURSE

PY1551.1. BIO PHYSICS (54 HOURS)

Unit 1 (18 hrs)

Bio mechanics- biophysics and fluid flow—Gas transport—physics of audition
Physics of vision (chapter 1 to 5 of Reference 3)

Unit 2 Cellular – Molecular biophysics (18 hrs)

Cell -components-proteins-nucleic acids—physics of bio-membranes
-Thermodynamics of bio systems (Chapter 6 to 9 of reference 3)

Unit 3 (18 hrs)

Radiation biophysics

Bio –electronics and Bio Instrumentation (chapter 17 of reference 1) Bio –informatics - (chapter 6 of reference 1) Demonstration of biophysics experiments (reference 3)

Booksfor Study

1. Essentials of Biophysics: P. Narayanan, 2nd Edn. New Age publishers
2. A text book of biophysics: R.N.Roy, New central book agency Kolkata.
3. Elementary bio physics,P.K.Srivastava,Narosa publishing house ,New Delhi
4. Introduction to Biophysics ,Pranab kumar banerjee,S.Chand& co ,New Delhi
5. Biological science ,Green,Stout,&Taylor, Cambridge university press

Reference

PY 1551.2 ASTRONOMY AND ASTROPHYSICS

(54 Hours)

Unit 1: Introduction to Astronomy (10 hours)

What is Astronomy – Branches of Astronomy - The celestial sphere and stellar magnitudes: constellations, stellar magnitudes, apparent magnitudes – The celestial coordinate system – Precession of Earth's axis.

Unit 2: History of Modern Astronomy (14 hours)

Ptolemy's model of Universe – Copernican and Galilean contributions – Laws of planetary motion: Tycho Brahe's observations, Kepler's laws – Newton and his law of Universal law of Gravity – Einstein's special and general theories of relativity (*topics in this unit are intended as brief qualitative introductions only*)

Unit 3: The Solar system (15 hours)

Formation of solar system: Nebular hypothesis – The Sun: Physical properties – Internal structure – Solar atmosphere - Sun spots – Solar wind, prominences and flares – Physical characteristics of planets in solar system – Earth's motion and Seasons - Lunar and Solar eclipses – Brief familiarisation of solar system objects: Satellites, Asteroid belt, Kuiper belt, Comets and Meteorites.

Unit 5: Outer Universe (15 hours)

Properties of stars: luminosity, colour and surface temperature – Spectral types of stars – Hertzsprung-Russell diagram – Evolution of a Sun-like star – Fate of high-mass stars: Supernova, Neutron stars and Black holes (*qualitative description only*) – Brief familiarization of Milky Way galaxy, Types of galaxies according to shape.

Sources for Study:

1. <https://www.space.com/16014-astronomy.html>
2. Introduction to Astronomy and Cosmology – Ian Morison (Wiley)
3. <https://theplanets.org/solar-system/>

Additional Reference:

1. Planet Earth, Cesare Emiliani, (Cambridge University Press)
2. Astrophysics - K. D. Abhayankar (University Press)
3. Introduction to Astrophysics – Baidyanadh Basu

PY 1551.3- APPLIED PHYSICS(54HOURS)

UNIT-1.ELECTRIC AND ELECTRONIC EQUIPMENTS (14 hrs)

Electric motor-principles of working, Microwave oven-principle-technical specifications-applications-advantages, public address system-Block diagram representation- function of each unit-CD player and drives-DVD player and drives-Telephonic communication(Cable and cellular)-principles (qualitative study using block diagram) -Cell phone-SIM card-technical specifications-Radio –History of radio revolution-different types of radios-Television-working(qualitative)-Touch screens & ATM (Automatic Telling machine)

UNIT-2- X-RAY AND ITS APPLICATIONS (11 hrs)

Discovery of X-rays, Gas filled tube, Coolidge X-ray tube, Properties of X-ray, X-ray spectra-continuous and characteristic spectra, C T Scan-basic principle-applications and advantages –MRI Scan-Principle, applications and advantages.

UNIT-3- LASERS (13 hrs)

Introduction-Interaction of light with matter, Absorption, spontaneous emission, stimulated emission, Light amplification, population inversion, metastable states-Components of Laser-Principal pumping Schemes-Role of resonant cavity- Ruby laser, He-Ne Laser-Applications.

UNIT-4- HOLOGRAPHY(6 hrs)

Introduction, principle of holography, Recording of the hologram, Reconstruction of the image-applications.

UNIT-5-FIBRE OPTIC COMMUNICATION (10 hrs)

Introduction, optical fibre, Necessity of cladding, optical fibre system, Total internal reflection, propagation of light through an optical fibre, critical angle of propagation , Modes of propagation- Types of rays-classification of optical fibres- Applications

References

1. Audio and Video Systems. R.G.Gupta, Technical Education Series.
2. Mobile Satellite Communication Network (ch 1 &2),Ray E Sherrif &Y. Funttu,Wiley India Edu.
3. Television Engineering & Video System, R.g.Gupta,TMH.
4. Electrical Technology (Vol 1& 2),B.L.Theraja
5. A Text book of Optics by DR. N. Subrahmanyam Brijlal,Dr MN Avadhanulu-S.Chand & Company Pvt Ltd
6. Modern Physics by R.Murugesan & Kiruthiga Siva Prasath
S.Chand & Company Pvt Ltd
7. Atomic and Nuclear Physics By Dr.V.W.Kulkarni-Himalaya Publishing House

PY1551.4. ENVIRONMENTAL PHYSICS

(54 HOURS)

Unit 1 Essentials of Environmental physics (18 hrs)

Structure and thermodynamics of the atmosphere; composition of air; Greenhouse effect; Transport of matter; energy and momentum in nature; Stratification and stability of the atmosphere; Laws of motion; Hydrostatic equilibrium; General circulation of the tropics; Elements of weather and climate in India.

Unit 2 Environmental pollution and Degradation(18 hrs)

Factors governing air, water and noise pollution; Air and water quality standards;Waste disposal; Heat island effect; Land and sea breeze; Puffs and Plumes; Gaseous and particulate matter; Wet and dry deposition; Dispersal mechanism of air and water pollutants; Mixing height and turbulence; Gaussian plume models; Dispersion models; Environmental degradation; Thermal and radioactive pollution; Nuclear radiation; Health hazards and safety.

Unit 3 Environmental Changes and remote sensing (18 hrs)

Energy sources and combustion processes; Renewable sources of energy; Solar energy, Wind energy, Bio energy, hydro power; fuel cells; and nuclear energy; Forestry and bio-energy; Deforestation; Degradation of soils; Agriculture and land use changes; Changing composition of local and global environment; Remote sensing techniques.

Books for Study:

1. The Physics of Monsoon: R.N. Kesavamoorthy and N. Sankar Rao, Allied Publications
2. The Physics of Atmosphere: J.T. Houghton, Cambridge University
3. Renewal Energy Resources: J.T. Widell and J. Weir, ELBS 1988
4. Numerical Weather Prediction: G.J. Haltiner and R.T. Williams, John Wiley

PY1551.5. ENERGY PHYSICS

(54 HOURS)

Unit I (7 hrs)

Various forms of energy – renewable and conventional energy systems – comparison – coal, oil and natural gas – availability – applications – merits and demerits.

Unit 2 (10 hrs)

Solar energy - Solar radiation measurements, solar energy collector, principle of the conversion of solar radiation into heat, Solar energy storage, solar heaters, space cooling, solar ponds, solar cookers, solar distillation, solar furnaces, solar green houses, merits and demerits of solar energy.

Unit 3 (9 hrs)

Wind energy: Basic principle of wind energy conversion, basic components of wind energy conversion system (WECS), wind energy collectors. application of wind energy.

Unit 4 (9 hrs)

Biomass energy, classification, photosynthesis, biomass conversion process, Gobar gas plants, wood gasification, ethanol from wood, merits and demerits of biomass as energy source

Unit 5 (9 hrs)

Energy from Oceans and Chemical energy resources: Ocean thermal energy Conversion, energy from waves and tides – basic ideas, nature, applications, merits and demerits.

Unit 6 (10 hrs)

Patterns of energy consumption in domestic, industrial, transportation and agricultural sectors –energy crisis and possible solutions – energy options for the developing countries – energy storage-primary and secondary cells – fuel cells (basics) – impact due to non-conventional energy sources – global warming.

Books for Study:

1. Non – Conventional Energy Resources: G. D. Rai, Khanna Publishers,2008.
2. Solar energy: G.D. Rai, 5th edition, 1995.
3. Solar Energy Fundamentals and application: H.P. Garg and J. Prakash, Tata McGraw - Hill Publishing company Ltd., 1997.

Books for Reference:

1. Energy Technology: S. Rao and Dr. B.B. Parulekar, 1997, 2ndEdn.
2. Power Plant Technology: A. K. Wahil. 1993.
3. Solar energy: S. P. Sukhatme, Tata McGraw- Hill Publishing company Ltd.,1997.

PY 1641SOLID STATE PHYSICS (72 HOURS -4 CREDITS)

Unit 1Crystal Structure(18hrs)

Solids: Amorphous and Crystalline Materials. Lattice Translation Vectors.Lattice with a Basis – Unit Cell-Elements of symmetry-Types of Lattices -two and three dimensional- Miller Indices-Reciprocal Lattice.-.Brillouin Zones.Diffraction of X-rays by Crystals.Bragg's Law.X- ray diffraction techniques-Inter atomic forces. Types of bonding

Unit 2 Conduction in Metals- Free electron model (12 hrs) Introduction-conduction electrons-free electron gas-electrical conductivity-electrical resistivity versus temperature-heat capacity of conduction electrons -Fermi surface -electrical conductivity-effects of the Fermi surface-thermal conductivity in metals-Hall effect and magneto resistance -A.C conductivity and optical properties-failure of free electron model. -The Kronig -Penney model- conductors, semiconductors and insulators.

Unit 3 Band theory(10 hrs)

Bloch theorem- Kronig Penny model-Band Gaps- Conductors-Semiconductors and insulators- P and N type Semiconductors- Conductivity of Semiconductors- mobility- Hall Effect- Hall coefficient.

Unit 4 Dielectric Properties of Materials (12 hrs)

Polarization- Local Electric Field at an Atom- Depolarization Field- Electric Susceptibility- Polarizability- Clausius Mosotti Equation- Classical Theory of Electric Polarizability- Normal and Anomalous Dispersion- Cauchy and Sellmeier relations- Langevin-Debye equation- Complex Dielectric Constant- Optical Phenomena- Application: Plasma Oscillations- Plasma Frequency- Plasmons

Unit 5 Magnetic Properties of Matter(12hrs) Dia, Para, Ferri and Ferromagnetic Materials. Classical Langevin Theory of Dia and Paramagnetic Domains. Quantum Mechanical Treatment of Para magnetism. Curie's law, Weiss's Theory of Ferromagnetism and Ferromagnetic Domains. Discussion of B-H Curve. Hysteresis and Energy Loss

Unit 6 Superconductivity(8 hrs)

Critical Temperature-Critical magnetic field-Meissner effect- Type I and type II Superconductors- London's Equation and Penetration Depth- Isotope effect-.BCS theory- Tunnelling and Josephson effect(Qualitative study)

Books for Study:

1. Elements of Solid State Physics: J.P. Srivastava, 2nd Ed., 2006, Prentice-Hall of India
2. Elementary Solid State Physics: 1/e M. Ali Omar, Pearson India, 1999
3. Solid State Physics: M.A. Wahab, Narosa Publication, 2011
4. Elements of Solid State Physics: J.P. Srivastava, 2nd Edn., Prentice-Hall of India, 2006

Books for Reference:

1. Introduction to Solid State Physics: Charles Kittel, 8th Edn., Wiley India Pvt. Ltd., 2004
2. Introduction to Solids: Leonid V. Azaroff, Tata Mc-Graw Hill, 2004
3. Solid State Physics: Neil W. Ashcroft and N. David Mermin, Cengage Learning, 1976
4. Solid State Physics: Rita John, McGraw Hill, 2014
5. Solid-state Physics: H. Ibach and H Luth, Springer, 2009

PY 1642 NUCLEAR AND PARTICLE PHYSICS (72 HOURS-4 CREDITS)

Unit 1. General Properties of Nuclei(14hrs)

Constituents of nucleus and their Intrinsic properties-quantitative facts about size-mass- charge density (matter energy), binding energy- average binding energy and its variation with mass number- main features of binding energy versus mass number curve- nuclear stability- angular momentum- parity- magnetic moment- electric quadrupole moments- Nuclear forces-meson theory.

Unit 2. Nuclear Models(11 hrs)

Liquid drop model -semi empirical mass formula and significance of various terms, condition of nuclear stability. Shell model-evidence for nuclear shell structure, nuclear magic numbers, basic assumptions of shell model, Collective model.

Unit 3. Radioactivity:(12 hrs)

Alpha decay-basics of α -decay processes, theory of α -emission, Gamow's theory, Geiger Nuttall law, β -decay- energy kinematics for β -decay, positron emission, electron capture, neutrino hypothesis, Gamma decay: Gamma ray emission & kinematics, internal conversion.

Unit 4.Nuclear Reactions (9 hrs)

Types of Reactions, Conservation Laws, kinematics of reactions, Q-value- reaction rate- reaction cross section- reaction mechanism-Concept of compound nucleus.

Unit 5. Particle Detectors & Accelerators (6 hrs)

GM counter-scintillation counter- Linear accelerator- Cyclotron- Synchrotron- betatron.

Unit 6 – Nuclear fission and fusion (12 hrs)

Nuclear fission-energy released in fission-Bohr and Wheeler's theory-chain reaction -multiplication factor-critical size-atom bomb-nuclear reactors-breeder reactors-uses of nuclear reactors. Nuclear fusion-sources of stellar energy-thermonuclear reactions-hydrogen bomb-controlled thermo-nuclear reactions-magnetic bottle-Tokamak- inertial confinement-nuclear power in India.

Unit 7.Particle physics: (8 hrs)Particle interactions- basic features- types of particles and its families-Symmetries and Conservation Laws-baryon number- Lepton number- Isospin- Strangeness and charm- concept of quark model- Cerenkov radiation.

Books for Study

1. Modern Physics: R. Murugesan, S. Chand & Co., Reprint,2008
2. Modern Physics: G. Aruldas and P. Rajagopal, PHI, New Delhi, 2005.
3. Nuclear Physics: D. C. Tayal, Himalaya Publishing House, 4thEdn.
4. Concepts of Modern Physics: A. Beiser, Tata McGraw-Hill, New Delhi, 6thEdn.
5. Atomic and Nuclear Physics:N. Subramaniam and Brijlal, S.Chand & Co.
6. Atomic Physics: J.B.Rajam, S.Chand & Co.

7. Introduction to Elementary Particles: D. Griffith, John Wiley & Sons
8. Nuclear Physics: S.N.Ghoshal, S.Chand & Co.

Books for Reference:

1. Concepts of nuclear physics: Bernard L. Cohen, Tata Mcgraw Hill, 1998
2. Nuclear Physics: Kaplan, Narosa publications
3. Introductory nuclear Physics: Kenneth S. Krane, Wiley India Pvt. Ltd., 2008
4. Introduction to the physics of nuclei & particles: R.A. Dunlap, Thomson Asia, 2004
5. Quarks and Leptons: F. Halzen and A.D. Martin, Wiley India, New Delhi
6. Basic ideas and concepts in Nuclear Physics An Introductory Approach: K. Heyde, Institute of Physics Publishing, 2004
7. Radiation detection and measurement: G.F. Knoll, John Wiley & Sons, 2000
9. Theoretical Nuclear Physics: J.M. Blatt & V.F. Weisskopf, Dover Pub.Inc., 1991

**PY1643- CLASSICAL AND MODERN OPTICS
(72 HRS-4 CREDITS)**

Unit 1. Interference of light (12 hrs)

The principle of superposition - coherent sources – Double slit interference (theory of interference fringes and band width) - Interference by division of wave front and amplitude –Fresnel’s biprism-interference in thin films-classification of fringes-wedge shaped films-testing of optical flatness-Newton’s rings(reflected system)-refractive index of a liquid-Michelson interferometer – determination of wavelength

Unit 2. Diffraction (14 hrs)

Fresnel diffraction: - Half-period zones - explanation of rectilinear propagation of light– diffraction at a straight edge-zone plate. Fraunhofer diffraction: - Diffraction at a single slit, double slits – plane transmission grating - Rayleigh’s criterion for resolution -

resolving power of diffraction grating.

Unit 3. Dispersion (5 hrs)

Unit 4. Polarisation (12 hrs)

Plane polarized light -polarization by reflection – Brewster’s law - pile of plates -
Malus law - Double refraction - Huygens explanation for double refraction in uniaxial
crystals - Nicol prism - Nicol prism as a polarizer and analyzer – Theory-
production and
analysis of plane, circularly and elliptically polarized light - quarter and half
wave plates.

Unit 4. Laser (14 hrs)

Basic principle of laser operation Einstein coefficient, light propagation through medium and condition for light amplification population inversion by pumping and cavity threshold condition, line shape function- optical resonators (qualitative) Q factor various laser systems –Ruby laser - He-NE laser, Dye laser, semiconductor laser, (working principle only) Application of lasers- characteristics of laser beams -spatial coherence - Temporal coherence and spectral energy density Nonlinear optics : Nonlinear Polarization –second harmonic generation – phase matching

Unit 5. Fibre Optics (8 hrs)

Introduction, optical fibre, the numerical aperture, coherent bundle, pulse dispersion in step
index fibre, graded index fibre, single mode fibre, multimode fibre, Fibre optic sensors
(qualitative), fibre optic communication (qualitative), Advantages of fibre optic communication system.

Unit 6. Holography: (7 hrs)

Principle of holography, recording of holograms, reconstruction of images (Theory not needed), application of holography, different types of holograms, transmission and reflection types.

Books for Study:

- 1 Text Book of Optics: Subramaniam & Brijlal, .Avadhanulu, 23rd edition,2006
- 2 Optics: Ajoy Ghatak, TMH, 2005
- 3 Optics and spectroscopy: R.Murugesan and K Sivaprasad, S. Chand & Co., 2010
- 4 Lasers Principles, Types and applications: K.R.Nambiar, New Age International Pvt. Ltd. 2006
- 5 Optics: Eugene Hecht, Addison-Wesley 2002

Books for Reference:

1. Fundamentals of Optics: Jenkins and White, MCH
2. Modern Classical Optics: Geoffrey Brooker, Oxford University Press, 2003
3. Fundamentals of Optics-Geometrical Physical and Quantum: D. R. Khanna and H. R. Gulati, R. Chand, 1984
4. Lasers & Non-Linear Optics: B. B. Laud, New Age International Pvt. Ltd., 2011
5. Electronic Communications: Dennis Roddy & John Coolen, Pearson, 1995

Topics for assignments/discussion in the tutorial session (sample)

1. Michelson's interferometer-Standardization of metre.
2. Diffraction at a rectangular aperture and circular aperture
3. Optical activity-Fresnel's theory of optical rotation.
4. Resolving power of prism and telescope
5. Constant deviation spectrometer.
6. Laurent's half shade polarimeter.
8. Laser applications.
9. Study of Fraunhofer lines using spectrometer. .
10. Determination of refractive index of liquid by Newton's rings method.
11. Comparison of radii of curvature by Newton's rings method.

**PY1644-DIGITAL ELECTRONICS AND COMPUTER
SCIENCE**

(72HRS-4 CREDITS)

Unit-1 (22hrs)

Number systems :-Decimal number system-binary number system-conversion of binary number to decimal and decimal number to binary-binary addition and subtraction-2's complement-1's complement-binary subtraction using 2's complement-signed arithmetic operation-conversion of real numbers-conversion of decimal fraction to binary fraction-binary coded decimal -hexadecimal number system-conversion of hexadecimal number to decimal, decimal to hexadecimal, binary to hexadecimal and hexadecimal to binary-real or floating point representation of numbers-ASCII code.

Boolean algebra and logic gates: - Logic gates AND, OR, NOT, NAND,NOR
And Ex-OR gate-realization of other logic functions using NAND / NOR gates-tri state logic gate-Boolean laws- Demorgan's theorem-Simplification of Boolean equations using Boolean laws. Karnaugh map

Arithmetic circuits:-Half adder-full adder-controlled inverter-binary adder-subtractor.

Sequential circuits:- Flip-Flop, S-R Flip Flop, J-K Flip-flop, Master slave JK Flip-Flop

Unit2 (11hrs)

Basics of computers:-Hardware- input and output units- memory unit-ALU-control unit-basicoperational concepts-Software – operating systems

The memory systems:- Basic concepts-semiconductor RAM- internal organization memorychips-static memories-asynchronous and synchronous DRAM-structure of large memories– ROM,PROM,EPROM, EEPROM–flash memory-speed size and cost-Basic concepts of cache memory and virtual memories. Secondary storage-magnetic hard disks-optical disks-magnetic tape systems.

Unit-3: Programming in C++ (25 hrs)

Features of c++ - basic structure of c++ program – library files-header files – preprocessor directives- inbuilt functions- output using cout- input with cin - constants and variables – data types – declaration of variables – integer variables, character variables, floating point types, type bool - assigning values to variables–manipulators-operators and expressions–arithmetic operators, relational operators, logical operators, short hand operators-control statements-for loops , while loop, do...while loop- if statement, if.....else, else....if constructions, switch statement- break, continue, goto statements-user defined functions-function definition,

function declaration, function header and body, function call and execution, passing arguments to functions, returning values from functions, overloaded functions, inline functions, default arguments, scope rule for functions- storage classes-Arrays-array elements, array initialization, multidimensional arrays, passing arrays to functions-strings-basics of structures and pointers in c++, classes and objects (introduction only)-basic file operations-serial and sequential files, reading and writing -simple examples of c++ programs for solving problems in physics-compilation and execution of data.

Unit 4: Introduction to microprocessors (14 hrs)

Microprocessors and microcontrollers (definition only)-intel 8085- 8 bit microprocessor-pin disruption - 8085 instructions - addressing modes(definition only)- interrupts (definition only) -assembly language - simple programs- addition, subtraction.

Books for study:

1. Fundamentals of Microprocessors and Microcomputers: B. Ram,Dhanpat Rai Publications
2. Digital principles and Applications: Malvino and Leach.TMH, New Delhi, 4th Edn.
3. Fundamentals of Computers: V.Rajaram, PHI, New Delhi, 4th Edn.
4. A first course in Computers: S. Saxena, Vikas Publishing House Pvt. Ltd.,
5. Programming in C++: D. Ravichandran, Tata Mc Graw Hill, 2011
6. Object oriented programming in C++:Robert Lfore,Galgotia publications Pvt Ltd., 3Edn., 2004
7. The C++ programming language:Bjome Stroustrup, 4th Edn. Addison Wesley
8. Object oriented programming with C++: E. Balaguruswami, 5Edn., Tata Mc Graw Hill
9. Programming in C++: M.T. Somasekharan, PHI Pvt. Publishing,2005
- 10.Numerical Methods with computer programs in C++:P. Ghosh, PHI Learning Pvt. Ltd.

11. The 8085 microprocessors: K. Udayakumar and B. S. Umasankar, Dorling Kindersley (India) Pvt. Ltd., 2008
12. Microprocessor 8085, 8086: Abhishek Yadav, University Science Press, New Delhi 2008
13. Microprocessor-Architecture, Programming and applications with 8085: R.S. Gaonkar,

Books for Reference: -

1. Introduction to digital electronics: NIIT, PHI.
2. A first course in Computers: Sanjay Saxena, Vikas publishing house Pvt. Ltd.

PRACTICAL

**PY1442- Basic Physics Lab 1
(minimum 18 experiments to be done)**

1. Fly Wheel - Moment of Inertia
2. Compound Bar Pendulum – Symmetric
3. Compound Bar Pendulum – Asymmetric
4. Uniform Bending---Y---Pin and Microscope
5. Uniform bending—Y- optic lever method
6. Non-uniform bending-Y-Optic lever & telescope
7. Rigidity modulus –Static torsion
8. Torsion pendulum I- By Torsional oscillations
9. Torsion pendulum I- By Equal masses
11. Kater's pendulum-Acceleration due to gravity
12. Melde's string-----Frequency of fork
13. Phase transition-determination of M.P of wax.
14. Determination of thermal conductivity of rubber
15. Lee's disc-determination of thermal conductivity of a bad conductor
16. Viscosity-Continuous flow method using constant pressure head.
17. Viscosity-Variable pressure head arrangement
18. Surface tension-Capillary rise
19. Sonometer-frequency of A.C
20. Kundt's tube-determination of velocity of sound.

21. Determination of m and B_h using deflection and vibration magnetometers.
22. Potentiometer-Resistivity.
23. Comparison of least counts of measuring instruments.
24. Evaluation of errors in simple experiments.

References

1. Yarwood and Wittle; Experimental Physics for Students, Chapman & Hall Publishers.
2. An advanced course in practical physics, Chathopadhyaya, Rakshit and Saha, New central agency, Kolkata.
3. A text book of practical physics, S. Viswanathan & Co., Chennai.
4. Advanced Practical Physics, B.L. Worsnop and H.T. Flint, Khosla Publishers, Delhi.

PY1645-Advanced Physics Lab 2 (Minimum 18 experiments to be done)

1. Spectrometer-A, D and n of a solid prism.
2. Spectrometer –Dispersive power and Cauchy's constants
3. Spectrometer Grating—Normal incidence- N & wavelength
4. Spectrometer- i - d curve
5. Spectrometer- Hollow prism
6. Liquid lens-refractive index of liquid and lens
7. Newton's Rings—Reflected system
8. Air wedge-diameter of a wire
9. Potentiometer-Resistivity.
10. Potentiometer-Calibration of ammeter
11. Potentiometer –Reduction factor of T.G
12. Potentiometer –Calibration of low range voltmeter

13. Potentiometer – Calibration of high range voltmeter
14. Thermoemf-measurement of emf using digital multimeter.
15. Carey Foster's bridge-Resistivity
16. Carey Foster's bridge-Temperature coefficient of resistance.
17. Mirror galvanometer-figure of merit.
18. BG- Absolute capacity of a condenser
19. Conversion of galvanometer into ammeter and calibration using digital Multimeter
20. Conversion of galvanometer into voltmeter and calibration using digital Voltmeter.
21. Circular coil-Calibration of ammeter.
22. Study of network theorems-Thevenin's & Norton's theorems and maximum power transfer theorem.
23. Circular coil-Study of earth's magnetic field using compass box.
24. Absolute determination of m and B_h using box type and Searle's type vibration magnetometers.
25. Searle's vibration magnetometer-comparison of magnetic moments.

References

1. Yarwood and Wittle; Experimental Physics for Students, Chapman & Hall Publishers.
2. An advanced course in practical physics, Chathopadhyaya, Rakshit and Saha, New central agency, Kolkata.
3. A text book of practical physics, S.Viswanathan & Co., Chennai.
4. Advanced Practical Physics, B.L.Worsnop and H.T.Flint, Khosla Publishers, Delhi.

PY1646—Advanced Physics Lab 3
(Minimum 18 experiments to be done – 4
from Computer Science)

ELECTRONICS

1. PN junction Diode (Ge & Si) characteristics-To draw the characteristic curves of a PN junction diode and to determine its ac and dc forward resistances.
2. Full wave (centre tapped) rectifier-To construct a full wave rectifier using junction diode and to calculate the ripple factor with and without shunt filter (10 readings for R_L 100 to 5000).
3. Full wave (centre tapped) rectifier-To construct a full wave rectifier using junction diode and to study effect of L,C, and LC filters on the ripple factor (for different R_L).
4. Bridge rectifier-To construct a bridge rectifier using junction diodes and to calculate the ripple factor with and without shunt filter (10 readings for R_L 100 to 5000).
5. Bridge rectifier- Dual power supply-To construct a dual power supply using bridge rectifier and measure the output voltages for different pair of identical load resistors.
6. Zener diode characteristics-To draw the I-V characteristic of a Zener diode and to find the break down voltage and the dynamic resistance of the diode.
7. Zener diode as a voltage regulator-To construct a voltage regulator using Zener diode and to study the output voltage variation (i) for different R_L and (ii) for different input voltage with same R_L .
8. Transistor characteristics-CE-To draw the characteristic curves of a transistor in the CE configuration and determine the current gain, input impedance and output impedance.
9. Transistor characteristics-CB-To draw the characteristic curves of a transistor in the CB configuration and determine the current gain, input impedance and output impedance.
10. Single stage CE amplifier-To construct a single stage CE transistor amplifier and study its frequency response.
11. OP amp. IC741- Inverting amplifier-To construct an inverting amplifier using IC741 and determine its voltage gain.

12. OP amp. IC741- Non inverting amplifier

To construct a non inverting amplifier using IC741 and determine its voltage gain.

13. OP amp. IC741- Differentiator-To construct an OP amp. Differentiator, determine its voltage gain and study the output response to pulse and square wave.

14. OP amp. IC741- Integrator-To construct an OP amp. Integrator, determine its voltage gain and study the output response to pulse and square wave.

15. Phase shift oscillator-To construct a phase shift oscillator using transistor and measure the frequency of the output waveform.

16. Logic gates- OR and AND-To verify the truth tables of OR and AND gates using diodes.

17. Logic gate- NOT-To verify the truth tables of NOT gate using a transistor.

18. Network theorems (Superposition, Thevenin's & Norton's theorems)

To verify the (i) Superposition, (ii) Thevenin's & (iii) Norton's theorems

19. RC-Filter circuits (Low pass)

To construct an RC –low pass filter circuit and to find the upper cut off frequency.

20. RC-Filter circuits (High pass)-To construct an RC –high pass filter circuit and to find the lower cut off frequency.

Computer Science (C++ Programs)

1. Program to find the roots of a quadratic equation (both real and imaginary root)
2. Program to find the dot product and cross product of vectors
3. Program to plot the functions Sin x, Tan x and e^x
4. Program to find the matrix addition, multiplication, trace, transpose and inverse.

5. Program to convert hexadecimal to decimal number, decimal to hexadecimal number, binary to hexadecimal numbers and hexadecimal to binary numbers
6. Program to find the result of binary addition and subtraction.
7. Program to find the moment of inertia of regular bodies about various axes of rotation.
8. Program to find the velocity of a rolling body (without sliding) at any point in an inclined plane
9. Program to study the motion of a spherical body in a viscous fluid
10. Program to study the motion of projectile in central force field
11. Program to study the planetary motion and Kepler's law
12. Monte carlo simulation

References:

1. Basic electronics and linear circuits; N.N. Bhargava, D.C. Kulshreshtha, S.C.Gupta
2. OP- Amps and linear integrated circuits; Ramakant A. Gayakwad
3. Basic electronics; Santiram Kal
4. Basic electronics; B. L. Theraja
5. Principles of electronics; V. K. Mehta
6. A first course in Electronic s; Anwar A. Khan, Kanchan K. Dey

PY1661. ELECTIVE COURSES

(54 HOURS-2CREDITS) FOR EACH COURSE

PY1661.1 ELECTRONIC INSTRUMENTATION

Unit 1 (14 hrs)

Basic concepts of measurements- Instruments for measuring basic parameters-

ammeter-voltmeters-multimeter- digital voltmeter-accuracy and resolution of DVM.

Unit 2 – Oscilloscopes (14 hrs)

Cathode ray tubes- CRT circuits- vertical deflection system- delay line- horizontal deflection system-multiple trace- oscilloscope probes and transducer- storage oscilloscopes.

Unit 3 – Transducers (10 hrs)

Basic principles- classification of transducers- Passive and Active transducers- strain gauges- temperature measurements- thermistors-photosensitive devices.

Unit 5 – Signal Generation and Analysis (16 hrs)

Sine wave generator- frequency synthesizer- sweep generator- astable multivibrator- laboratory pulse generator- function generator- wave analysers harmonic distortion analyzer- wave meter- spectrum analyzer (qualitative idea only).

Books for Study:

1. Modern Electronic Instrumentation and Measurement Techniques: Albert D.Helfrick & William D.Cooper, PHI, Ltd.
2. Electronic Instrumentation:Kalsi H. S, 2nd Edn, TMH Publishers.
3. Instrumentation-Devices and Systems: C.S. Rangan, G.R.Sarma, V.S.V.Mani, TMH Publishers.
4. Electronic Instruments and Instrumentation Technology: M.M.S.Anand, PHI Ltd.

Books for Reference:

1. Sensors and Transducers: D.Patranabis, Wheeler Publishing Co. Ltd.
2. Industrial Electronics and Control: S.K.Bhattacharya & S.Chatterjee, TMH Publishers.
3. Electronic measurement and Instrumentation: K.B.Klaassen, Cambridge University Press.
4. Measurement Systems-Applications and Design: Ernest O.Doebelin & Dhanesh N.Manik, 5th Edn. TMH Publishers.

5. Principles of Measurement systems: John P. Bentley, Longman, Pearson Education Publishers. 3rd Edn.

**PY1661.2. SPACE SCIENCE
54 HOURS-2CREDITS)**

Unit 1. Universe (12 hrs) [Book3]

Large Scale Structure of the Universe: Astronomy and Cosmology, Our Galaxy, Galaxy types, Radio sources, Quasars, Structures on the largest scale, Coordinates and catalogues of astronomical objects, Expansion of the Universe

Unit 2. The evolution of Stars (9hrs) [Book4]

Introduction, Classification of Stars: The Harvard classification, Hertzsprung – Russel diagram, Stellar evolution, White dwarfs, Electrons in a white dwarf star, Chandrasekhar limit, Neutron stars, Black holes, Supernova explosion, Photon diffusion time, Gravitational potential energy of a star, Internal temperature of a star, Internal pressure of a star.

Unit 3. The active Sun (10 hrs) [Book2]

Introduction, Sunspots and Solar storms, Sunspots and Solar activity, Cosmic rays of Solar origin, The Solar wind, Solar corona and the origin of the solar wind, Disturbed Solar wind.

The earth's Atmosphere (15 hrs) [Book 1]

Introduction, Nomenclature and temperature profile, Temperature distribution in the troposphere, Temperature of stratosphere, temperature of mesosphere and thermosphere, Temperature variability, The pressure profile, Scale height, Density variation. The Ionosphere: Effect on scale height, Ionospheric electric fields, Ionization profile, Layer of charge, Ionospheric hydrogen and Helium.

Magnetosphere (8 hrs) [Book 2]

Introduction, The magnetic field of Earth, Earth's variable magnetic field, Solar activity and Earth's magnetic weather, solar wind interaction, The Chapman-Ferraro closed magnetosphere, Dungey's open magnetosphere, Structure of the

magnetosphere: Magneto tail and Plasma sheet, Plasma sphere, Earth's radiation belts.

Books for Study

1. Introduction to Space Science – Robert C Hymes (1971), John Wiley & Sons Inc.
2. Earth's Proximal Space- Chanchal Uberoi (2000), Universities Press (India)
3. Introduction to Cosmology- J. V. Narlikar (1993), Cambridge University Press
4. Modern Physics- R. Murugesan, Kiruthika Sivaprasath (2007), S.Chand & Company Ltd.

Books for reference

1. Space Physics and Space Astronomy – Michael D Pappagiannis (1972), Gordon and Breach Science Publishers Ltd.
2. Introductory Course on Space Science and Earth's environment-Degaonkar (Gujarat University, 1978)
3. Introduction to Ionosphere and magnetosphere- Ratcliffe (CUP, 1972)
4. The Physics of Atmospheres-Houghton (Cambridge University Press)
5. Introduction to Ionospheric Physics-Henry Rishbeth & Owen K. Garriot (Academic Press, 1969)
6. Space Science – Louise K. Harra & Keith O. Mason (Imperial College Press, London, 2004)
7. Introduction to Space Physics- Kivelson and Russel
8. Introduction to Astrophysics – Baidyanadh Basu
9. Astrophysics - K. D. Abhayankar (University Press)

PY1661.3. PHOTONICS

(54 HOURS)

Unit 1: (5 hrs)

Photons in semiconductors-semiconductors-energy band and charge carriers-direct and indirect gap semiconductors –Different type of semi conducting materials–-generation, recombination and injection-electron hole injection homo andhetero junctions-quantum wells ,quantum dots and quantum wires.

Unit 2: (6 hrs)

Semiconductor photon sources -light emitting diodes-injection electroluminescence-in thermal equilibrium –in the presence of carrier injection-LED characteristics- internal photon flux-output photon flux and efficiency-responsivity- spectral distribution- materials- response time-device structures (Basics).

Unit 3: (10 hrs)

Semiconductor laser amplifiers-gain-amplifier band width-optical pumping-electrical current pumping-hetero structures -semiconductor injection lasers-amplification-feedback and oscillators-laser amplification-resonator losses -gain condition-Laser threshold-Power-internal photon flux-output photon flux.

Unit 4: (10 hrs)

Semiconductor photon detectors-The external photo effect-photo electron emission-The internal photo effect-properties of semiconductor photo detectors--quantum efficiency-responsivity devices with gain-response time-photoconductors-gain-spectral response- p-n photo diodes-PIN photo diodes-hetero structure photo diode- Schotky barrier photodiodes - array detectors-avalanche photodiodes (basics)-

Unit 5: (8 hrs)

Electro optics, Pockels and Kerr effects- electro optic modulators and switches phase modulators–dynamic wave retarders- intensity Modulators- scanners-directional couplers-spatial light modulators-

Unit 6: (7 hrs)

Non linear optics-second order non-linear optics - electro-optic effect-three wave mixing- third order non-linear optics- self phase modulation-optical kerr effect-self focusing. .

Unit 7: (8 hrs)

Photonic switching and computing-photonic switches-switches-opto mechanical, electro optic, acousto-optic and magneto optic switches-all optical switches-optical computing-digital optical computing-analog optical processing.

Book for Study:

1. Fundamentals of Photonics: BFA Saleh and M.C.Teich, John Wiley & Sons, Inc.

Books for Reference:

1. Semiconductor optoelectronic devices: Pallab Bhattacharya, Printice Hall of India.
2. Optics and Photonics- An introduction: F. Graham Smith and Terry A.King, John Wiley & Sons, Inc.
3. Lasers and Non linear Optics: B.B.Laud, New Age International Pvt Ltd.

Core Course – XII (ELECTIVE) 54 hrs (Credit – 2)

PY 1661.4: NANO SCIENCE AND TECHNOLOGY

Module 1: Introduction : (6 Hrs)

Length scales in Physics- nanometre- Nanostructures: Zero, One Two and Three dimensional nanostructures (Chapter 3, Text 2)

Band Structure and Density of State at nanoscale: Energy Bands, Density of States at low dimensional structures. (Chapter 3, Text 1)

Module 2: Electrical Transport in Nanostructure: (15 hours)

Electrical conduction in metals, The free electron model. Conduction in insulators/ionic crystals - Electron transport in semiconductors - Various conduction mechanisms in 3D (bulk), 2D(thin film) and low dimensional systems: Thermionic emission, field enhanced thermionic emission (Schottky effect). (Chapter 4, Text 1)

Module 3: Introductory Quantum Mechanics for Nanoscience: (8 hrs)

Size effects in small systems, Quantum behaviour of nanometric world: Applications of Schrödinger equation – infinite potential well, potential step, potential box; trapped particle in 3D (nanodot), electron trapped in 2D plane (nanosheet), electrons moving in 1D (nanowire, nanorod, nanobelt), Excitons, Quantum confinement effect in nanomaterials (Chapter 5, Text 1)

Module 4: Growth Techniques of Nanomaterials (Elementary ideas only): (9 hrs)

Top down vs bottom up techniques, Lithographic process, Non Lithographic techniques: Plasma arc discharge, sputtering. Evaporation: Thermal evaporation, Electron beam evaporation. Chemical Vapour Deposition (CVD). Pulsed Laser Deposition, Molecular Beam Epitaxy, Sol-Gel Technique, Electro-deposition., Ball-milling. (Chapter 6, Text 1)

Module 5: Characterization tools of nanomaterials: (Qualitative ideas only) (10 hrs)

Atomic Structures -Grain size determination – XRD (Debye Scherrer equation), Microscopy – Scanning Electron Microscope (SEM), Tunneling Electron Microscope (TEM), Scanning Probe Microscope (SPM), Scanning Tunneling Microscope (STM), Atomic Force Microscope (AFM). (Text -1).

Module 6: Applications of nanotechnology: (Elementary ideas only) (6 hrs)

Buckminster fullerene, Carbon nanotube, nano diamond, BN Nanotube, Nanoelectronics - single electron transistor (no derivation), Molecular machine, Nanobiomaterials (Chapter 8, Text 1).

Applications of nanotechnology: (Elementary ideas only) Potential applications, Expected benefits from nanotechnologies, Can nanotechnology help in addressing various challenges?, Energy and Energy Efficiency, new energy producers, Medicine, security, Other Applications. (Text book-2, Chapter 5, 6, 7 &8, Nanotechnology: Technology Revolution of 21st Century, Rakesh Rathi, S Chand & Company, New Delhi.).

Text books:

1. Introduction to Nanoscience & Nanotechnology by K. K. Chattopadhyay and A. N. Banerjee, Publisher: PHI Learning and Private Limited
2. Nanotechnology, Rakesh Rathi, S Chand & Company, New Delhi
3. NANO: The Essentials, T. Pradeep, McGraw Hill Education (India) Private Limited

References:

1. Nanoparticle Technology Handbook – M. Hosokawa, K. Nogi, M. Naita, T. Yokoyama (Eds.), Elsevier 2007
2. Encyclopaedia of Materials Characterization, Surfaces, Interfaces, Thin Films, Eds. Brundle, Evans and Wilson, Butterworth – Heinmann, 1992
3. Springer Handbook of nanotechnology, Bharat Bhushan (Ed.), Springer-Verlag, Berlin, 2004
4. Nano Science and Technology, V. S. Muraleedharan and A Subramaniam, Ane Books Pvt. Ltd, New Delhi

5. A Handbook on Nanophysics, John D, Miller, Dominant Publishers and Distributors, Delhi-51
6. Introduction to Nanotechnology, Charles P Poole Jr. and Frank J Owens, Wiley Students Edition
7. Nano-and micro materials, K Ohno et. al, Springer International Edition 2009, New Delhi

PY1661.5. COMPUTER HARDWARE & NETWORKING(54 HRS)

Unit 1 - 3 hrs

P.C. Architecture Functional block diagram of a computer. Processors Introduction to Microprocessor.CISC, RISC processors Type of Processors and their specification.(Intel: Celeron, Pentium family-PII, PIII, PIV, dual core, core 2duo - AMD-K5,K6 series

Unit 2 -10 hrs

Motherboards:Motherboard components Types, Form factor, Different components of Motherboard (BIOS, CMOS,BICMOS, RAM, CMOS Battery, I/O slots, I/O connectors), Riser architecture, Main Memory (SIMM, DIMM, RIMM), extended/expanded/cache memories. Chipsets (Intel & AMD)-ROM, DRAM, SDRAM, CDRAM, RDRAM, WRAM. Bus standards: Types of Buses (PC, ISA, MCA, AGP, PCI, USB, IEEE FireWire).Add on Cards Different latest Add on Cards (TV Tuner Card, DVR card, Video Capture,Internal Modem, Sound Card)

Unit 3 -9 hrs

Drivers:

1. Floppy Disk Drive- Floppy Drive Components(overview only)

2. Hard Disk Drive (HDD)

Types, Capacity, Hard Disk Components (Media, Read/Write Head, Spindle Motor Head Actuator), Connector, Jumper setting, trouble shooting in HDD.Hard Disk Controller (HDC) – Block diagram,

Working, Interfacing (IDE,SCSI, ATA and SATA series) Configuration of HDD-Installation, Formatting, File Format (FAT, NTFS).Pen drive, i-pods

3.Optical Disk Drive

Types (ROM, R/W, DVD ROM, DVD R/W), Capacity, Difference between CD &DVD (capacity, format)-trouble shooting.

Unit 4 -5 hrs

Peripherals . Keyboard and Mouse- operation

Types of VDU (CRT, LCD, and TFT), Resolution, and Dot pitch -Printers – Types (dot matrix, inkjet, laser) Scanner- operation.Power conditioning Device:SMPS- Block diagram, operation-UPS- Types (online, off line, Hybrid)-trouble shooting in all these devices.

Unit 5- 4 hrs

Viruses & Vaccines-Virus- Introduction, infection methods,Types of viruses, Different symptoms of virus attack, precautions.Vaccine- Method of vaccine, Different types of Antivirus used in PC,Firewalls

Unit 6- 7 hrs**NETWORKING ESSENTIALS**

Introduction-Need for networking-Network Topology-OSI Model-Types of networks (LAN, WAN, MAN)

Protocols-LAN Protocols- Classification, Examples, Ethernet networking-WAN Protocols- PPP, X

.25, PPTP, L2TP, ISDN

Unit 7-- 8 hrs

LAN Connectivity Devices- NIC, Repeater, Hub, Switch, Bridge.Internet Connectivity Device-Routers, Gateways, CSU/DSU-TCP/IP Protocol Suite-What is TCP/IP, Importance, OSI vs TCP/IP

Unit 8- 6 hrs

IP Addressing-Overview, Address classes, Network ID, Host ID and Subnet Mask,Addressing guidelines, Reserved IP Address, Subnetting and Supernetting(overview)

Unit 9 -2 hrs

Emerging Technologies-Wireless Technology - Bluetooth, WAP-Mobile Technology- GSM, CDMA, GPRS

Books for Study:

1. D. Balasubramanian, “Computer Installation & Servicing”, Tata McGraw Hill.
2. Rom Gilster, Black book, “PC Upgrading and Repairing”, Dream tech, New Delhi.

3. Street Smart, James Pylar, “PC Upgrading and Repairing”, Wiley Publishing, Inc.
4. Stephen.J.Bigelow,”Bigelow’s Troubleshooting, Maintenance & Repairing PCs”,Tata McGraw Hill
5. Craig Zacker, “The Complete Reference- Networking”, Tata McGraw Hill
6. Douglowe, “Networking All in One Desk Reference”-3Edn, Wiley India Pvt Ltd

Books for Reference:

1. Mark Minasi, “The Complete PC Upgrade & Maintenance Guide” BPB Publication
2. C.A. Schmidt, “The Complete Computer Upgrade & Repair Book”, Dreamtech
3. Craig Zacker, John Rourke, “The Complete Reference- PC Hardware”Tata McGraw Hill
4. Scott Mueller, “Upgrading & Repairing PC’s”, Pearson Education
5. Vishnu Priya Sing & Meenakshi Singh, “Computer Hardware Course”, Computech
6. Manahar Lotia, Pradeep Nair, Payal Lotia, “Modern Computer Hardware Course”,BPB Publication.
7. Richard Mc Mohan, “Introduction to Networking”, Tata McGraw Hill.

Internet Resources:

www.edugrid.ac.in/webfolder/courses/cn/cn_resources.htm

www.howstuffwork.com

www.e-tutes.com

www.learnthat.com

www.intel.com

www.amd.com

<http://en.wikipedia.org>

II Complementary Courses

Semester 1 (Mathematics Main)

PY1131.1 – Mechanics and Properties of matter (36 hours)

Unit I (28 hours)

Dynamics of rigid bodies (7 hours)

Theorems of M.I with proof-Calculation of M.I of bodies of regular shapes rectangular lamina, uniform bar of rectangular cross section, annular disc, circular disc, solid sphere-K.E of a rotating body. Determination of M.I of a fly wheel (theory and experiment).

Oscillations and waves (13 hours)

Examples of S.H oscillator-compound pendulum-determination of g -torsion pendulum-oscillations of two particles connected by a spring-vibration state of a diatomic molecule.

Wave motion-general equation of wave motion-plane progressive harmonic wave - energy density of a plane progressive wave -intensity of wave and spherical waves-

Mechanics of solids (8 hours)

Bending of beams-bending moment-cantilever-beam supported at its ends and loaded in the middle-uniform bending-experimental determination of Y using the above principles with pin and microscope-twisting couple on a cylinder-angle of twist and angle of shear-torsional rigidity, .

Unit II (8 hours)

Surface Tension (5 hours)

Excess of pressure on a curved surface-force between two plates separated by a thin layer of liquid-experiment with theory to find surface tension and its temperature dependence by Jaeger' method-equilibrium of a liquid drop over solid and liquid surfaces.

Viscosity (3 hours)

Flow of liquid through a capillary tube-derivation of Poiseuille's formula -limitations-Ostwald's viscometer-variation of viscosity with temperature.

Books for Study

1. Mechanics: J.C.Upadhyaya, Ram Prasad & Sons

2. Oscillations & Waves: K.RamaReddy, S.Bbadami & V.Balasubramaniam
(University Press)

Semester 2 (Mathematics Main)

PY1231.1 – Thermal Physics and statistical mechanics (36 hours)

Unit I – Transmission of Heat (14 hours)

Thermal conductivity and thermometric conductivity-Lee's disc experiment-Weidmann and Franz law (statement only)-energy distribution in the spectrum of black body and results-Wien's displacement law-Rayleigh-Jeans law-their failure and Planck's hypothesis-Planck's law-comparison-solar constant-its determination-temperature of sun.

Unit II – Thermodynamics (9 hours).

Isothermal and adiabatic processes-work done-isothermal and adiabatic elasticity-Heat engines-Carnot's cycle -derivation of efficiency-petrol and diesel engine cycles-efficiency in these two cases-second law of thermodynamics-Kelvin and Clausius statements.

Unit III – Entropy (9 hours)

Concept of entropy-change of entropy in reversible and irreversible cycles-principle of increase of entropy-entropy and disorder-entropy and available energy-T-S diagram for Carnot's cycle-second law in terms of entropy-calculation of entropy when ice is converted into steam.

Unit 4- Statistical Mechanics(4hours)

Statistical probability-Macro and Microstates- Phase space-statistical ensemble-postulates of equal probability-Maxwell Boltzmann Distribution- velocity distribution.

Books for Study

1. Heat & Thermodynamics: N.Subramaniam & Brijlal, S.Chand & Co
2. Heat & Thermodynamics: W.Zemansky, McGraw Hill
3. Heat & Thermodynamics: C.L.Arora.

Semester 3 (Mathematics Main)

PY1331.1 – Optics, Magnetism and Electricity (54 hours)

Unit I (34 hours)

Interference (12 hours)

Analytical treatment of interference-theory of interference fringes and

bandwidth. Interference in thin films-reflected system-colour of thin films-fringes of equal inclination and equal thickness -Newton's rings-reflected system-measurement of wavelength and refractive index of liquid.

Diffraction (14 hours)

Phenomenon of diffraction-classification-Fresnel and Fraunhofer. Fresnel's theory of approximate rectilinear propagation of light-Fresnel diffraction at a straight edge and circular aperture. Fraunhofer diffraction at a single slit, two slits and N slits. Plane transmission grating-determination of wavelength.

Laser and Fibre Optics (8 hours)

Principle of operation of laser-population inversion-optical pumping-ruby laser-applications of lasers. Light propagation in optical fibres-step index fibre-graded index fibre-applications.

Unit II (20 hours)

Magnetism (10 hours)

Magnetic properties of matter-definition and relation between magnetic vectors B, H and M. Magnetic susceptibility and permeability. Magnetic properties-diamagnetism-paramagnetism-ferromagnetism-antiferromagnetism. Electron theory of magnetism-explanation of ferromagnetism.

Electricity (10 hours)

EMF induced in a coil rotating in a magnetic field-peak, mean, rms and effective values of A.C. AC circuits-AC through RC, LC, LR and LCR series circuits-resonance-sharpness of resonance-power factor and choke coil-transformers.

Books for Study

1. A text book of optics – Brijlal & Subramaniam
2. Electricity and Magnetism – R. Murugesan, S. Chand & Co Ltd.
3. A text book of B.Sc subsidiary Physics – P. Vivekanandan.

Semester 4 (Mathematics Main)

PY1431.1 Modern Physics and Electronics (54 hours)

Unit 1.. Modern Physics (20 hours)

Basic features of Bohr atom model-Bohr's correspondence principle -vector atom model-various quantum numbers-magnetic moment of orbital electrons -electron spin-Spin-Orbit coupling-Pauli's exclusion principle-

Atomic nucleus-basic properties of nucleus-charge, mass, spin, magnetic moment-binding energy and packing fraction-nuclear forces-salient features-radioactivity-radioactive decay-decay laws-decay constant-half life and mean life-radioactive equilibrium-secular and transient equilibrium-measurement of radioactivity.

Quantum Mechanics (10 hours)

Inadequacies of classical physics-experimental evidences- quantum theory-Planck's hypothesis-foundation of quantum mechanics-wave function and probability density-Schrödinger equation-time dependent and time independent-particle in a potential box.

Unit2.

(20hours)Electronics(16hour)

Current-voltage characteristics of a diode-forward and reverse bias-breakdown mechanism of p-n junction diode-Zener diode and its characteristics-half wave and full wave rectifiers-bridge rectifier-ripple factor, efficiency.

Construction and operation of a bipolar junction transistor-transistor configurations-current components-transistor characteristics-DC load line-Q point-AC load line-transistor biasing-need for biasing-bias stabilization-biasing circuits-voltage divider bias. amplifier-basic features of an amplifier-gain, -frequency response and band width

Digital Electronics (8 hours)

Number systems and codes-decimal numbers-binary arithmetic -1's and 2's compliment-decimal to binary conversion-octal numbers-hexadecimal numbers-binary coded decimal-digital codes-logic gates-NOT, OR, AND, NOR and NAND gates. Boolean algebra-Boolean operations -logic expressions-laws of Boolean algebra-DeMorgan's theorem-Boolean expression for gate network-simplification of Boolean expression.

Books for Study:

1. Modern Physics – R.Murugesan, S.Chand & Co. Ltd.
2. Principles of Electronics – V.K.Mehta.

Semester 1 (Chemistry Main)

PY1131.2 – Rotational dynamics and Properties of matter (36 hours)

Unit I (28 hours)

Dynamics of rigid bodies (7 hours)

Theorems of M.I with proof -Calculation of M.I of bodies of regular shapes-
rectangular lamina, uniform bar of rectangular cross section, annular disc,
circular

disc, solid cylinder, solid sphere-K.E of a rotating body-Determination of MI of a
flywheel(Theory and Experiment).

Oscillations and waves (13 hours)

Examples of S.H oscillator-compound pendulum-determination of g-torsion
pendulum-oscillations of two particles connected by a spring-vibration state of a
diatomic molecule-

Wave motion-general equation of wave motion-plane progressive harmonic wave -
energy density of a plane progressive wave -intensity of wave and spherical waves-

Mechanics of solids (8 hours)

Bending of beams-bending moment-cantilever-beam supported at its ends-and
loaded in the middle-uniform bending-experimental determination of Y using the
above principles with pin and microscope-twisting couple on a cylinder-angle of
twist and angle of shear-torsional rigidity.

Unit II (8hours)

Surface Tension (5 hours)

Excess of pressure on a curved surface-force between two plates separated by a
thin layer of liquid-experiment with theory to find surface tension and its
temperature dependence by Jaeger' method-equilibrium of a liquid drop over solid
and liquid surfaces.

Viscosity (3 hours)

Flow of liquid through a capillary tube-derivation of Poiseuille's formula
-limitations-Ostwald's viscometer-variation of viscosity with temperature.

References

1. Mechanics: J.C.Upadhyaya, Ram Prasad & Sons
2. Oscillations&Waves: K.RamaReddy, S.B.badami & V.Balasubramaniam (University Press)

Semester 2 (Chemistry Main)
PY1231.2 – Thermal Physics (36 hours)

Unit I – Diffusion (4 hours)

Graham's law of diffusion in liquids-Fick's law-analogy between liquid diffusion and heat conduction-methods of estimating concentrations-determination of coefficient of diffusivity.

Unit II.Transmission of Heat (14hours)

Thermal conductivity and thermometric conductivity – Lee's Disc experiment-Weidmann and Franz law (statement only) -Radiation of heat-black body radiation-Kirchoff's laws of heat radiation-absorptive power-emissive power-Stefan's law (no derivation) -energy distribution in the spectrum of black body and results-Wien's displacement law - Rayleigh-Jeans law-their failure and Planck's hypothesis -Planck's law-comparison-solar constant-temperature of sun.

Unit III – Thermodynamics (9 hours)

Isothermal and adiabatic processes-work done-isothermal and adiabatic elasticity. Heat engines-carnot's cycle -derivation of efficiency-petrol and diesel engine cycles-efficiency in these two cases-second law of thermodynamics-Kelvin and Clausius statements.

Unit IV – Entropy (9 hours)

Concept of entropy-change of entropy in reversible and irreversible cycles-principle of increase of entropy-entropy and disorder-entropy and available energy-T-S diagram for Carnot's cycle-second law in terms of entropy-calculation of entropy when ice is converted into steam.

References

1. The general Properties of matter: F.H.Newman & V.H.L.Searle
2. Heat & Thermodynamics: N.Subramaniam & Brijlal, S.Chand & Co
3. Heat & Thermodynamics: W.Zemansky, McGraw Hill
4. Heat & Thermodynamics: C.L.Arora.

Semester 3 (Chemistry Main)

PY1331.2 – Optics, Magnetism and Electricity (54 hours)

Unit I (34 hours)

Interference (11 hours)

Analytical treatment of interference-theory of interference fringes and bandwidth. Interference in thin films-reflected system-colour of thin films-fringes of equal inclination and equal thickness. Newton's rings-reflected system-measurement of wavelength and refractive index of a liquid.

Diffraction (11 hours)

Phenomenon of diffraction-classification-Fresnel and Fraunhofer. Fresnel's theory of approximate rectilinear propagation of light-Fresnel diffraction at a straight edge.

Fraunhofer diffraction at a single slit, two slits and N slits. Plane transmission grating-determination of wavelength.

Polarisation (6 hours)

Experiments showing the transverse nature of light-plane polarized light-polarization by reflection-Brewster's law-double refraction-Nicol prism-propagation of light in uni-axial crystals-positive and negative crystals-principal refractive indices-half wave plate and quarter wave plate-elliptically and circularly polarized light-optical activity.

Laser and Fibre Optics (6 hours)

Principle of operation of laser-population inversion-optical pumping-ruby laser-applications of lasers. Light propagation in optical fibres-step index fibre-graded index fibre-applications.

Unit II (20 hours)

Magnetism (10 hours)

Magnetic properties of matter-definition and relation between magnetic vectors B, H and M. Magnetic susceptibility and permeability. Magnetic properties-diamagnetism-paramagnetism-ferromagnetism-antiferromagnetism. Electron theory of magnetism-explanation of ferromagnetism.

Electricity (10 hours)

EMF induced in a coil rotating in a magnetic field-peak, mean, rms and effective values of A.C. AC circuits-AC through RC, LC, LR and LCR series circuits-resonance-sharpness of resonance-power factor and choke coil-transformers.

References

1. A text book of optics – Brijlal & Subramaniam
2. Electricity and Magnetism – R.Murugesan, S.Chand & Co Ltd.
3. A text book of B.Sc subsidiary Physics – P.Vivekanandan .

Semester 4 (Chemistry Main)

PY1431.2 – Atomic Physics, Quantum Mechanics and Electronics (54 hours)

Unit I Atomic physics (12 hours)

Basic features of Bohr atom model-Bohr's correspondence principle -vector atom model-various quantum numbers-magnetic moment of orbital electrons -electron spin-Spin-Orbit coupling-Pauli's exclusion principle-periodic table.

Unit II Superconductivity (8 hours)

Properties of superconductors-zero electrical resistance- Meissner effect- electrical magnetic field-Type I and Type II superconductors-isotope effect-high temperature ceramic superconductors-applications of superconductors.

Unit III Quantum mechanics (14 hours)

Inadequacies of classical physics-experimental evidences-evidences for quantum theory-Planck's hypothesis-foundation of quantum mechanics-wave function and probability density-Schrodinger equation-time dependent and time independent-particle in a potential box.

Unit IV. Spectroscopic Techniques(4hours)

EM Spectrum- UV, Visible, IR,, Radio and microwave regions-principle of various spectrometers used in specific regions of EM spectrum-absorption spectroscopy, emission spectroscopy.

Unit V. Electronics (12 hours)

Current-voltage characteristics of a diode -forward and reverse bias-breakdown

mechanism of p -n junction diode-zener diode and its characteristics-half wave and full wave rectifiers-bridge rectifier-ripple factor, efficiency.

Construction and operation of a bipolar junction transistor-transistor configurations-current components-transistor characteristics-DC load line-Q point-

AC load line transistor biasing-need for biasing-bias stabilization-biasing circuits-fixed bias, emitter feed back bias, voltage divider bias (qualitative study only). Transistor amplifier-basic features of an amplifier-gain, input and output resistances-frequency response and band width

Unit V. Digital Electronics(4hours)

Number systems and codes-decimal numbers-binary arithmetic -1's and 2's compliment-decimal to binary conversion-octal numbers-hexadecimal numbers-binary coded decimal-digital codes-logic gates-NOT, OR, AND, NOR and NAND gates..

References

1. Modern Physics – R.Murugesan, S.Chand & Co. Ltd.
2. A text book of B.Sc subsidiary Physics – P.Vivekanandan.
3. Principles of Electronics – V.K.Mehta.

Semester 1 (Statistics Main)

PY1131.3 – Mechanics and Properties of matter (36 hours)

Unit I (28 hours)

Dynamics of rigid bodies (8 hours)

Theorems of M.I with proof -Calculation of M.I of bodies of regular shapes-rectangular lamina, uniform bar of rectangular cross section, annular disc, circular disc, solid sphere-K.E of a rotating body. Determination of M.I of a fly wheel (theory and experiment).

Oscillations and waves (12 hours)

Examples of S.H oscillator-compound pendulum-determination of g-torsion pendulum-oscillations of two particles connected by a spring. Wave motion-general equation of wave motion-plane progressive harmonic wave energy density of a plane progressive wave-intensity of wave and spherical waves transverse waves in stretched string-modes of transverse vibrations of string longitudinal waves in rods and in gases.

Mechanics of solids (8 hours)

Bending of beams-bending moment-cantilever-beam supported at its ends-and loaded in the middle-uniform bending-experimental determination of Y using the

above principles with pin and microscope-twisting couple on a cylinder-angle of twist and angle of shear-torsional rigidity.

Unit II (8 hours)

Surface Tension (5 hours)

Excess of pressure on a curved surface-force between two plates separated by a thin layer of liquid-experiment with theory to find surface tension and its temperature dependence by Jaeger' method-equilibrium of a liquid drop over solid and liquid surfaces.

Viscosity (3 hours)

Flow of liquid through a capillary tube-derivation of Poiseuille's formula -limitations-Ostwald's viscometer-variation of viscosity with temperature.

References

1. Mechanics: J.C.Upadhyaya, Ram Prasad & Sons
2. Oscillations & Waves: K.RamaReddy, S.Bbadami & V.Balasubramaniam (University Press)

Semester 2 (Statistics Main)

PY1231.3 – Thermal Physics and statistical mechanics (36 hours)

Unit I – Transmission of Heat (8 hours)

Thermal conductivity and thermometric conductivity-Lee's disc experiment Weidmann and Franz law (statement only)-energy distribution in the spectrum of black body and results-Wien's displacement law.

Unit II – Thermodynamics (8 hours)

Isothermal and adiabatic processes-work done-isothermal and adiabatic elasticity.Heat engines-carnot's cycle-derivation of efficiency- second law of thermodynamics Kelvin and Clausius statements.

Unit III – Entropy (8 hours)

Concept of entropy-change of entropy in reversible and irreversible cycles-principle of increase of entropy-entropy and disorder-entropy and available energy-T-S diagram for Carnot's cycle-second law in terms of entropy-calculation of entropy when ice is converted into steam.

Unit IV – Statistical Mechanics (12 hours)

Concepts of phase-space-ensemble and statistical equilibrium-probability

theorems in

statistical thermodynamics-distribution laws-Maxwell-Boltzmann, Fermi-Dirac and Bose-Einstein distribution laws (no derivation)-comparison of three statistics-Molecular energies in an ideal gas-Quantum statistics-Rayleigh-Jeans formula-Planck's radiation law-specific heat of solids-free electrons in metals-electron energy distribution.

References

1. Heat & Thermodynamics: N.Subramaniam & Brijlal, S.Chand & Co
2. Heat & Thermodynamics: W.Zemansky, McGraw Hill
3. Heat & Thermodynamics: C.L.Arora.
4. Concepts of modern physics: Arthur Beiser (TMH).
5. Statistical Mechanics: Sinha (TMH).
6. Theoretical Chemistry: Samuel Gladstone, New York, D Van Nostrand Co., Inc.
7. Heat: Saha and Srivastava.

Semester 3 (Statistics Main)

PY1331.3 –Optics , Magnetism and Electricity (54 hours)

Unit I (34 hours)

Interference (12 hours)

Analytical treatment of interference-theory of interference fringes and bandwidth.Interference in thin films-reflected system-colour of thin films-fringes of equal inclination and equal thickness.Newton's rings-reflected system-measurement of wavelength and refractive index of liquid.

Diffraction (14 hours)

Phenomenon of diffraction-classification-Fresnel and Fraunhofer.Fresnel's theory of approximate rectilinear propagation of light-Fresnel diffraction at a straight edge and circular aperture. Fraunhofer diffraction at a single slit, two slits and N slits. Plane transmission grating-determination of wavelength-Resolving power of grating.

Laser and Fibre Optics (8 hours)

Principle of operation of laser-population inversion-optical pumping-ruby laser-applications of lasers. Light propagation in optical fibres-step index fibre-graded index fibre-applications.

Unit II (20 hours)

Magnetism (10 hours)

Magnetic properties of matter-definition and relation between magnetic vectors B, H and M. Magnetic susceptibility and permeability. Magnetic properties-diamagnetism-paramagnetism-ferromagnetism-antiferromagnetism. Electron theory of magnetism-explanation of ferromagnetism.

Electricity (10 hours)

EMF induced in a coil rotating in a magnetic field-peak, mean, rms and effective values of A.C. AC circuits-AC through RC, LC, LR and LCR series circuits-resonance-sharpness of resonance-power factor and choke coil-transformers.

References

1. A text book of optics – Brijlal & Subramaniam
2. Electricity and Magnetism – R. Murugesan, S. Chand & Co Ltd
1.
3. A text book of B.Sc subsidiary Physics – P. Vivekanandan.

Semester 4 (Statistics Main)

PY1431.3 – Modern Physics and Electronics (54 hours)

Unit I

Modern Physics (20 hours)

Basic features of Bohr atom model-Bohr's correspondence principle -vector atom model-various quantum numbers-magnetic moment of orbital electrons -electron spin-Spin-Orbit coupling-Pauli's exclusion principle-periodic table.

Atomic nucleus-basic properties of nucleus-charge, mass, spin, magnetic moment-binding energy and packing fraction-nuclear forces-salient features-radioactivity-radioactive decay-decay laws-decay constant-half life and mean life-Radioactive equilibrium-secular and transient equilibrium-measurement of radioactivity.

Quantum mechanics (14 hours)

Inadequacies of classical physics-experimental evidences-evidences for quantum theory-Planck's hypothesis-foundation of quantum mechanics-wave function and probability density-Schrodinger equation-time dependent and time independent-particle in a potential box.

Unit II (20 hours)

Electronics (12 hours)

Current-voltage characteristics of a diode -forward and reverse bias-breakdown

mechanism of p -n junction diode-zener diode and its characteristics-half wave and full wave rectifiers-bridge rectifier-ripple factor, efficiency.

Construction and operation of a bipolar junction transistor-transistor configurations-current components-transistor characteristics-DC load line-Q point-AC load line-transistor biasing-need for biasing-bias stabilization-biasing circuits-fixed bias, emitter feed back bias, voltage divider bias (qualitative study only).

Transistor amplifier-basic features of an amplifier-gain, input and output resistances-frequency response and band width.

Digital Electronics (8 hours)

Number systems and codes-decimal numbers-binary arithmetic -1's and 2's compliment-decimal to binary conversion-octal numbers-hexadecimal numbers-binary coded decimal-digital codes-logic gates-NOT, OR, AND, NOR and NAND gates. Boolean algebra-Boolean operations -logic expressions-laws of Boolean algebra-DeMorgan's theorem-Boolean expression for gate network-simplification of Boolean expression.

References

1. Modern Physics – R.Murugesan, S.Chand & Co. Ltd.
2. A text book of B.Sc subsidiary Physics – P.Vivekanandan.
3. Principles of Electronics – V.K.Mehta.

Semester 1 (Geology Main)

PY1131.4 – Mechanics and Properties of matter (36 hours)

Unit I (29 hours)

Dynamics of rigid bodies (7 hours)

Theorems of M.I with proof -Calculation of M.I of bodies of regular shapes-

rectangular lamina, uniform bar of rectangular cross section, annular disc, circular

disc, solid cylinder, solid sphere-K.E of a rotating body- Determination of MI of a flywheel(Theory and Experiment).

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Oscillations and waves (15 hours)

Examples of S H oscillator- compound pendulum- determination of g-torsion pendulum-oscillations of two particles connected by a spring- vibrational state of diatomic molecule -damped and forced harmonic oscillators-damping force-damped harmonic oscillator -examples-power dissipation-Q factor. Wave motion-general equation of wave motion-plane progressive harmonic wave intensity of wave and spherical waves-waves in solids-longitudinal waves –transverse waves-torsional waves-common characteristics-reflection and transmission of waves-reflection and transmission of energy- flexural vibrations-applications of geophysicscharacteristics-reflection and transmission of waves-reflection and transmission of energy-flexural vibrations-applications in geophysics.

Mechanics of solids (7 hours)

Bending of beams-bending moment-cantilever-beam supported at its ends-and loaded in the middle-uniform bending-experimental determination of Y using the above principles with pin and microscope-twisting couple on a cylinder-angle of twist and angle of shear-torsional rigidity.

Unit II (7 hours)

Surface Tension (4 hours)

Excess of pressure on a curved surface-force between two plates separated by a thin layer of liquid-experiment with theory to find surface tension and its temperature dependence by Jaeger' method-equilibrium of a liquid drop over solid and liquid surfaces.

Viscosity (3 hours)

Flow of liquid through a capillary tube-derivation of Poiseuille's formula -limitations-Ostwald's viscometer-variation of viscosity with temperature.

References

1. Mechanics: J.C.Upadhyaya, Ram Prasad & Sons
2. Oscillations & Waves: K.RamaReddy, S.B.badami & V.Balasubramaniam (University Press)

Semester 2 (Geology Main)

PY1231.4 – Thermal Physics and Physics of the Earth (36 hours)

Unit I – Transmission of Heat (9 hours)

Thermal conductivity and thermometric conductivity-Lee's disc experiment-Weidmann and Franz law (statement only)-energy distribution in the spectrum of black body and results-Wien's displacement law-Rayleigh-Jeans law-their failure and Planck's hypothesis-Planck's law -comparison-solar constant-temperature of sun.

Unit II – Thermodynamics (9 hours)

Isothermal and adiabatic process- work done -isothermal and adiabatic elasticity Heat engines-carnot's cycle -derivation of efficiency-petrol and diesel engine cycles-efficiency in these two cases-second law of thermodynamics-Kelvin and Clausius statements-Carnot's theorem with proof.

Unit III – Physics of the Earth (18 hours)

The solar system-origin of solar system-the dynamic earth-continental drift-earth's

structure-earth's size and shape-gravitation-gravitational field and potential-equipotential surfaces-gravitational field and potential due to a thin spherical shell and solid sphere-gravitational self energy-gravity measurements-free fall method-rise and fall method-gravity anomalies. The tide-tidal effect of sun-earth quakes-causes seismic wave propagation-seismographs. Atmospheric physics-atmospheric structure and composition-atmospheric pressure, density and temperature-measurement of air temperature-daily cycle of air temperature-atmospheric radiation-ionosphere-magnetosphere.

References

1. Heat & Thermodynamics: N.Subramaniam & Brijlal, S.Chand & Co
2. Heat & Thermodynamics: W.Zemansky, McGraw Hill
3. Heat & Thermodynamics: C.L.Arora.
4. Fundamentals of Geophysics: William Lowrie, Cambridge University Press.
5. Applied Physics: G.Aruldas et al, Rajam publishers, Tvpm.

Semester 3 (Geology Main)

PY1331.4 – Optics and Electrodynamics (54 hours)

Unit I (34 hours)

Interference (12 hours)

Analytical treatment of interference-theory of interference fringes and bandwidth. Interference in thin films-reflected system-colour of thin films-fringes of equal inclination and equal thickness. Newton's rings-reflected system-measurement of wavelength and refractive index of liquid.

Diffraction (14 hours)

Phenomenon of diffraction-classification-Fresnel and Fraunhofer. Fresnel's theory of approximate rectilinear propagation of light-Fresnel diffraction at a straight edge and circular aperture. Fraunhofer diffraction at a single slit, two slits and N slits. Plane transmission grating-determination of wavelength-Resolving power of grating.

Polarisation (8 hours)

Experiments showing the transverse nature of light-plane polarized light-polarization by reflection-Brewster's law-double refraction-Nicol prism-propagation of light in uni-axial crystals-positive and negative crystals-principal refractive indices-half wave plate and quarter wave plate-elliptically and circularly polarized light-optical activity-Fresnel's theory and applications.

Unit II (20 hours)

Magnetism (12 hours)

Magnetic properties of matter-definition and relation between magnetic vectors B, H and M. Magnetic susceptibility and permeability. Magnetic properties-diamagnetism- paramagnetism-ferromagnetism-anti-ferro magnetism. Electron theory of magnetism-Explanation of ferromagnetism
Earth's magnetism-dip- inclination -vertical components-magnetic maps -magnetographs -cause of earth's magnetism geomagnetic prospecting.

Electricity (8 hours)

EMF induced in a coil rotating in a magnetic field-peak, mean, rms and effective values of A.C. Ac circuits-AC through RC, LC, LR and LCR series circuits-resonance-sharpness of resonance-power factor and choke coil-transformers.

Books for study:

1. A text book of optics – Brijlal & Subramaniam
2. Electricity and Magnetism – R.Murugesan, S.Chand & Co Ltd.
3. A text book of B.Sc. subsidiary Physics – P.Vivekanandan.

Semester 4 (Geology Main)

PY1431.4 – Modern Physics, Electronics and Crystallography(54hours)

Unit I

Modern Physics (20 hours)

Basic features of Bohr atom model-Bohr's correspondence principle -vector atom model-various quantum numbers-magnetic moment of orbital electrons -electron spin-Spin-Orbit coupling-Pauli's exclusion principle-periodic table.

Atomic nucleus-basic properties of nucleus-charge, mass, spin, magnetic moment-binding energy and packing fraction-nuclear forces-salient features-radioactivity-radioactive decay-decay laws-decay constant-half life and mean life-radioactive equilibrium-secular and transient equilibrium-measurement of radioactivity-radio carbon dating-age of the earth-biological effects of radiation. Crystallography (16 hours)

Crystal structure-crystal lattice and translation vectors-unit cell-symmetry operations point groups and space groups-types of lattices-lattice directions and planes interplaner spacing-simple crystal structures-close packed structures-structure of diamond-zinc blend structure-sodium chloride structure. X-ray crystallography-diffraction of x -rays-Bragg's law-x-ray diffraction methodsrotating crystal method-powder diffraction method.

Unit II (18 hours)

Electronics (10 hours)

Current-voltage characteristics of a diode -forward and reverse bias-breakdown mechanism of p-n junction diode-Zener diode and its characteristics-half wave and full wave rectifiers-bridge rectifier-ripple factor, efficiency.

Construction and operation of a bipolar junction transistor-transistor configurationscurrent components-transistor characteristics-DC load line-Q point-AC load linetransistor biasing-need for biasing-bias stabilization-biasing circuits-fixed biasemitter feedback bias, voltage divider bias (qualitative study only).

Transistor amplifier-basic features of an amplifier-gain, input and output resistances-frequency response and band width-small signal CE amplifier-circuit and its operation

Digital Electronics (8 hours)

Number systems and codes-decimal numbers-binary arithmetic -1's and 2's compliment-decimal to binary conversion-octal numbers-hexadecimal numbers-binary coded decimal-digital codes-logic gates-NOT, OR, AND, NOR and NAND gates. Boolean algebra-Boolean operations -logic expressions-laws of Boolean algebra-DeMorgan's theorem-Boolean expression for gate network-simplification of Boolean expression.

References

1. Modern Physics – R.Murugesan, S.Chand & Co. Ltd.
2. A text book of B.Sc subsidiary Physics – P.Vivekanandan.
3. Principles of Electronics – V.K.Mehta.

Semester 1 (Home Science Main)

PY1131.5–Mechanics and Properties of matter (36 hours)

Unit I (26 hours)

Dynamics of rigid bodies (8 hours)

Theorems of M.I with proof -Calculation of M.I of bodies of regular shapes-rectangular lamina, uniform bar of rectangular cross section, annular disc, circular

circular disc, solid cylinder, solid sphere-K.E of a rotating body-Determination of MI of fl heel(Theory and experiment)

Oscillations and waves (12 hours)

Examples of S.H oscillator- oscillations of two particles connected by a spring-vibration state of a diatomic molecule..Wave motion-general equation of wave motion-plane progressive harmonic wave - energy density of a plane progressive wave-intensity of wave and spherical waves-

Mechanics of solids (6 hours)

Bending of beams-bending moment-cantilever-beam supported at its ends-and loaded in the middle-uniform bending-experimental determination of Y using the above principles with pin and microscope-twisting couple on a cylinder-angle of twist and angle of shear-

Unit II (10 hours) Surface

Tension (5hours)

Excess of pressure on a curved surface-force between two plates separated by a thin layer of liquid-experiment with theory to find surface tension and its temperature dependence by Jaeger' method-equilibrium of a liquid drop over solid and liquid surfaces.

Viscosity (5 hours)

Flow of liquid through a capillary tube -derivation of Poiseuille's formula-limitations - variation of viscosity with temperature-Stokes formula-determination of viscosity of a highly viscous liquid by Stokes method.

References

1. Mechanics: J.C.Upadhyaya, Ram Prasad & Sons
2. Oscillations & Waves: K.RamaReddy, S.Bbadami & V.Balasubramaniam
(University Press)

Semester 2 (Home Science Main)

PY1231.5 – Thermal Physics (36 hours)

Unit I – Diffusion (4 hours)

Graham's law of diffusion in liquids-Fick's law-analogy between liquid diffusion and heat conduction-methods of estimating concentrations-determination of coefficient of diffusivity.

Unit II – Transmission of Heat (14hours)

Thermal conductivity and thermometric conductivity- disc experiment
Lee's
Weidmann and Franz law (statement only) -Radiation of heat-black body radiation
- absorptive power-emissive power-Stefan's law (no derivation) -energy
distribution in the spectrum of black body and results-Wien's displacement law
-Rayleigh-Jeans law -
their failure and Planck's hypothesis-Planck's law-comparison-solar
constanttemperature of sun.

Unit III – Thermodynamics (10 hours)

Isothermal and adiabatic processes-work done-isothermal and adiabatic
elasticity.Heat engines-carnot's cycle -derivation of efficiency-petrol and diesel
engine cycles-efficiency in these two cases-second law of thermodynamics-Kelvin
and Clausius statements.

Phase transition- first order and second order-liquid helium-super fluidity.

Unit IV – Entropy (8 hours)

Concept of entropy-change of entropy in reversible and irreversible cycles-principle of increase of entropy-entropy and disorder-entropy and available energy-T-S diagram for Carnot's cycle-second law in terms of entropy-calculation of entropy when ice is converted into steam.

References

1. The general Properties of matter: F.H.Newman & V.H.L.Searle
2. Heat & Thermodynamics: N.Subramaniam & Brijlal, S.Chand & Co
3. Heat & Thermodynamics: W.Zemansky, McGraw Hill
4. Heat & Thermodynamics: C.L.Arora.

Semester 3 (Home Science Main)

PY1331.5 – Optics and Electricity (54 hours)

Unit I (34 hours)

Interference (12 hours)

Analytical treatment of interference-theory of interference fringes and bandwidth.Interference in thin films-reflected system-colour of thin films-fringes of equal inclination and equal thickness.Newton's rings-reflected system-measurement of wavelength and refractive index of liquid.

Diffraction (14 hours)

Phenomenon of diffraction-classification-Fresnel and Fraunhofer.Fresnel's theory of approximate rectilinear propagation of light-Fresnel diffraction at a straight edge and circular aperture. Fraunhofer diffraction at a single slit, two slits and N slits. Plane transmission grating-determination of wavelength.

Laser and Fibre Optics (8 hours)

Principle of operation of laser-population inversion-optical pumping-ruby laser-applications of lasers.

Light propagation in optical fibers-step index fibre-graded index fibre-applications.

Unit II (20 hours)

Electricity

EMF induced in a coil rotating in a magnetic field-peak, mean, rms and effective values of A.C. AC circuits-AC through RC, LC, LR and LCR series circuits-resonance-sharpness of resonance-power factor and choke coil-transformers.

Electric motors- principles of working- Devices working with electric motors-Electric fan- wet grinder, Mixer grinder, Microwave oven – principle – technical specifications - applications – advantages,

References

1. A text book of optics – Brijlal & Subramaniam
2. . Electricity and Magnetism – R.Murugesan, S.Chand & Co Ltd.
3. A text book of B.Sc subsidiary Physics – P.Vivekanandan.
4. Electrical Technology (Vol I & II), B.L.Theraja.

Semester 4 (Home Science Main)

PY1431.5 – Atomic Physics and Electronics (54 hours)

Unit I

Modern Physics (20 hours)

Basic features of Bohr atom model-Bohr's correspondence principle -vector atom model-various quantum numbers-magnetic moment of orbital electrons -electron spin-Spin-Orbit coupling-Pauli's exclusion principle-periodic table.

Atomic nucleus-basic properties of nucleus -charge, mass, spin magnetic moment-binding energy and fraction-nuclear forces-salient features-packing radioactivity-

radioactive decay-decay laws-decay constant-half life and mean life-radioactive equilibrium-secular and transient equilibrium-measurement of radioactivity-

Unit II Superconductivity (8 hours)

Properties of superconductors-zero electrical resistance-Meissner effect-critical magnetic field-Type I and Type II superconductors-isotope effect-high temperature ceramic superconductors-applications of superconductors.

Unit III Spectroscopic Techniques (8 hours)

EM spectrum-UV, Visible, IR, Radio and microwave regions-principle of various spectrometers used in specific regions of EM spectrum-absorption spectroscopy-emission spectroscopy-mass spectroscopy-qualitative ideas of ESR & NMR spectrometer.

Unit IV (18 hours)

Electronics (10 hours)

Current-voltage characteristics of a diode-forward and reverse bias-breakdown

mechanism of p-n junction diode-Zener diode and its characteristics-half wave and full wave rectifiers-bridge rectifier-ripple factor, efficiency. Construction and operation of a bipolar junction transistor-transistor configurations-current components-transistor characteristics-DC load line-Q point-AC load line-transistor biasing-need for biasing-bias stabilization-biasing circuits-fixed bias, emitter feedback bias, voltage divider bias (qualitative study only).

Transistor amplifier-basic features of an amplifier-gain, input and output resistances-frequency response and band width-small signal CE amplifier-circuit and its operation

Digital Electronics (8 hours)

Number systems and codes-decimal numbers-binary arithmetic -1's and 2's compliment-decimal to binary conversion-octal numbers-hexadecimal numbers-binary coded decimal-digital codes-logic gates-NOT, OR, AND, NOR and NAND gates. Boolean algebra-Boolean operations -logic expressions-laws of Boolean algebra-DeMorgan's theorem-Boolean expression for gate network-simplification of Boolean expression.

References

1. Modern Physics – R.Murugesan, S.Chand & Co. Ltd.
2. A text book of B.Sc subsidiary Physics – P.Vivekanandan.
3. Principles of Electronics – V.K.Mehta.

Complementary Electronics for Physics Main Semester 1

EL 1131-ELECTRONICS I

(36 HOURS)

Unit 1 Circuit Elements and Fundamentals (10 hour)

Ohm's Law, Linear and non-linear Resistors, Resistor types-Wire wound Resistors, Carbon composition Resistors, Carbon film Resistors, Metal film Resistors, Resistor Colour code, Resistive circuits, Series and Parallel Resistor

circuits, Series aiding and Series opposing Voltages, Proportional Voltage formula, Proportional Current formula, Series Voltage Dividers, 'Open' and 'Short' in Series, Parallel and Series –Parallel Circuits.

Inductor, Inductor Types- Air core inductor, Iron-core Inductor, Ferrite-core Inductor, Self Inductance, Mutual Inductance, Coefficient of Coupling, Inductors in Series or Parallel without M, series combination with M, Stray Inductance, Reactance offered by a Coil.

Capacitors, Type of Capacitors- Fixed Capacitors, Variable Capacitors, Capacitance, Capacitors in Series and Parallel, Reactance offered by the Capacitor, Cells in Series and Parallel

Unit 2 Network Theorems (6 hour)

Kirchhoff's Law, Super position theorem, Ideal constant Voltage Source, Ideal constant Current Source, Thevenin's and Norton's Theorem, Maximum Power Transfer Theorem(Proof).

Unit 3 Magnetism and A.C (8 hour)

Magnetic Field, Type of Magnets, Magnetic Shielding, Magnetic Terms and Units, Ohm's Law in Magnetism, Transformer, Transformer working, Transformer Types, Transformer Impedance.

Type of alternating waveforms, Different values of sinusoidal voltage and current, Phase and Phase difference of A.C, Non-sinusoidal waveform, Harmonics, A.C through Resistor, Inductor, Capacitor, L-R, R-C and LCR circuits, Sharpness of resonance, Q-factor, Bandwidth, Tuning of radio, Parallel LCR.

Unit 4 Transient Current (6 hour)

Rise and fall of Current in pure Resistance, Time constant of an L-R Circuit, Inductive Kick, Time constant of an R-C Circuit, Charging and Discharging of capacitor, Decreasing Time Constant, Flasher, Pulse Response of an R-C Circuit, Effect of Long and Short Time Constants.

Unit 5 Introduction to semiconductors(6 hour)

Energy Band, Valance band, Conduction Band, Classification of materials based on energy bands, Type of semiconductors-Intrinsic and Extrinsic, hole formation and its movements, Type of Extrinsic semiconductors-P-type and N-type, Drift current in Intrinsic semiconductors.

Books of Study

- a. Basic Electronics Solid State – B.L.Theraja, S.Chand & Co. Ltd.

b. Principles of Electronics – V.K.Mehta.

Semester 2

EL1231 - Electronics II (36 hours)

Unit I (Chapters 11, 15, 16, 17, 18, 19 of Book 1) – 21 hrs

Tuning circuits and filters (4 hrs), Opto-electronic devices (4 hrs), DC power supplies (5 hrs), The basic transistor (4 hrs), Transistor characteristics and approximations (4 hrs).

Unit II (Chapters 20, 21 of Book 1) – 15 hrs

Load line and DC bias circuits (5 hrs), Transistor equivalent circuits and models (10 hrs).

Books of Study

1Basic Electronics Solid State – B.L.Theraja, S.Chand & Co. Ltd. 2Principles of Electronics – V.K.Mehta.

EL 1331 - ELECTRONICS III

(Total 54 Hours)

1. Single Stage Transistor Amplifiers (10 Hrs)

Amplifier Classifications - Common Base (CB), Common Emitter (CE) and Common Collector (CC) Amplifier : Gains and Characteristics - Comparison of Amplifier Configurations - Classification of Amplifiers Based on Biasing Conditions - Class A Amplifier - Transformer Coupled Class A Amplifier - Class B Amplifier - Class B Push Pull Amplifier - Cross Over Distortion - Complimentary Symmetry Push Pull Class B Amplifier - Class C Amplifier - Distortion in Amplifiers - Noise

2. Multi Stage Amplifiers (9 Hrs)

Amplifier Coupling - RC Coupled Two Stage Amplifier - Impedance Coupled Two Stage Amplifier - Transformer Coupled Two Stage Amplifier - Direct Coupled Two Stage Amplifier Using Similar Transistors - Direct Coupled Two Stage Amplifier Using Complimentary Symmetry of Two Transistors - Darlington Pair - Differential Amplifier.

3. Decibels and Frequency Response (3 Hrs)

Decibel System - Frequency Response - Cut off Frequencies - Alpha and Beta Cut off Frequencies - Gain Bandwidth Product.

4. Feedback Amplifiers (4 Hrs)

Feedback Principle - Types of Feedback - Negative Feedback and its Properties - Forms of Negative Feedback.

5. Field Effect Transistors (7 Hrs)

FET - JFET : Structure, Theory of Operation and Characteristics - JFET Parameters - MOSFET - DE MOSFET and E only MOSFET : Working and Characteristics - FET Applications.

6. Breakdown Devices (6 Hrs)

Unijunction Transistor (UJT) - UJT Relaxation Oscillator - Silicon Controlled Rectifier (SCR) - Triac - Diac - Silicon Controlled Switch.

7. Sinusoidal Oscillators (8 Hrs)

Difference between Amplifier and Oscillator - Classification of Oscillators - Types of Sinusoidal Oscillations - Oscillatory Circuit and its Frequency - Essentials of Transistor LC Oscillator - Barkhausen Criterion for Oscillator - Tuned Base Oscillator - Tuned Collector Oscillator - Hartley Oscillator - Colpitt's Oscillator - Clapp Oscillator - Phase Shift Oscillator - Wien Bridge Oscillator - Crystal Controlled Oscillators.

8. Nonsinusoidal Oscillators (7 Hrs)

Nonsinusoidal Waveforms - Classification of Nonsinusoidal Oscillators - UJT Sawtooth Generator - Multivibrators - Astable Multivibrator - Monostable Multivibrator - Bistable Multivibrator - Schmitt Trigger - Transistor Blocking Oscillator.

Books of Study

1Basic Electronics Solid State – B.L.Theraja, S.Chand & Co.
Ltd. 2Principles of Electronics – V.K.Mehta.

Semester 4

EL1431 - Electronics IV (54 hours)

Unit I (Chapters 31 to 35 of Book 1) – 32 hrs

Integrated circuits (8 hrs), Number systems (6 hrs), Logic gates (8 hrs), Boolean algebra (6 hrs), Logic families (4 hrs).

Unit II (Chapters 36, 37, 38 of Book 1) – 22 hrs

Transducers (8 hrs), Electronic instruments (6 hrs), Fibre optics (8 hrs).

Books of Study

1. Basic Electronics Solid State – B.L. Theraja, S.Chand & Co. Ltd.
2. Principles of Electronics – V.K.Mehta.

Semester 1 (Polymer chemistry Main) **PY1131.7–Mechanics and fluid dynamics (36 hours)**

Unit I (18 hours)

Dynamics of rigid bodies (8 hours)

Theorems of M.I with proof -Calculation of M.I of bodies of regular shapes-

rectangular lamina, uniform bar of rectangular cross section, circular disc, annular ring

solid cylinder, solid sphere- spherical shell, K. E of a rotating body-

Oscillations and waves (10 hours)

Examples of S.H oscillator- oscillations of two particles connected by a spring, vibration state of a diatomic molecule- wave motion-general equation of wave motion-plane progressive harmonic wave - energy density of a plane progressive wave-intensity of wave and spherical waves, superposition principle-

Unit II (18 hours)

Mechanics of solids (8 hours)

Bending of beams-bending moment-cantilever-beam supported at its ends-and loaded in the middle-uniform bending-experimental determination of Y using the above principles with pin and microscope-twisting couple on a cylinder-angle of twist and angle of shear- Torsional rigidity (Qualitative study)

Surface Tension (5hours)

Excess of pressure on a curved surface- force between two plates separated by a thin layer of liquid-experiment with theory to find surface tension of a liquid by

Jaeger' method- temperature dependence of surface tension.

Viscosity (5 hours)

Equation of continuity, Bernoulli's theorems- venturimeter, - Flow of liquid through a pipe -derivation of Poiseuille's formula-limitations – variation of viscosity with temperature-Stokes formula-

Books for study:

1. Mechanics: J. C. Upadhyaya, Ram Prasad & Sons
2. Oscillations & Waves: K. RamaReddy, S. Badami & V.Balasubramaniam (University Press)

Semester 2 (Polymer chemistry Main) **PY1231.7 – Thermal Physics (36 hours)**

Unit I – Behaviour of real gases (4 hours)

Joule Thomson effect- Theory and experiment, Phase transition- first order and second order-liquid helium-super fluidity.

Unit II – Transmission of Heat (14hours)

Thermal conductivity and thermometric conductivity-Lee's disc experiment

Weidmann and Franz law (statement only) -Radiation of heat-black body radiation - absorptive power-emissive power-Stefan's law (no derivation) -energy distribution in the spectrum of black body and results-Wien's displacement law -Rayleigh-Jeans law - their failure and Planck's hypothesis-Planck's law-comparison-solar constant, temperature of sun.

Unit III – Thermodynamics (10 hours)

Isothermal and adiabatic processes-work done-isothermal and adiabatic elasticity Heat engines-Carnot's cycle -derivation of efficiency-petrol and diesel engine cycles-efficiency in these two cases-second law of thermodynamics-Kelvin and Clausius statements.

Unit IV – Entropy (8 hours)

Concept of entropy-change of entropy in reversible and irreversible cycles-principle of increase of entropy-entropy and disorder-T-S diagram for Carnot's cycle-second law in terms of entropy-calculation of entropy when ice is converted into steam.

Books for Study:

- 1.The general Properties of matter: F.H.Newman & V.H.L.Searle
- 2.Heat & Thermodynamics: N.Subramaniam & Brijlal, S.Chand & Co
- 3.Heat & Thermodynamics: W.Zemansky, McGraw Hill
- 4.Heat & Thermodynamics: C.L.Arora.

Semester 3 (Polymer chemistry Main)**PY1331.7 – Modern Optics and Electricity (54 hours)****Unit I (18 hours)****Interference (8 hours)**

Analytical treatment of interference-theory of interference fringes and bandwidth. Interference in thin films-reflected system-colour of thin films- Newton's rings-reflected system-measurement of wavelength and refractive index of liquid.

Diffraction (10 hours)

Phenomenon of diffraction- classification-Fresnel and Fraunhofer diffraction Fresnel's theory of approximate rectilinear propagation of light-Fresnel diffraction at a straight edge. Fraunhofer diffraction at a single slit, double slits. Plane transmission grating-determination of wavelength.

Unit II (18 hours)**Polarization (10hrs)**

Experiments showing the transverse nature of light-plane polarized light-polarization by reflection-Brewster's law-double refraction-Nicol prism-propagation of light in uni-axial crystals-positive and negative crystals-principal refractive indices-half wave plate and quarter wave plate-elliptically and circularly polarized light-optical activity-Fresnel's theory and applications.

Laser and Fibre Optics (8 hours)

Principle of operation of laser-population inversion-optical pumping-ruby laser-applications of lasers -Light propagation in optical fibres-step index fibre-graded index fibre-single mode and multi-mode fibres (qualitative ideas only).

Unit III

Electricity (18 hrs)

EMF induced in a coil rotating in a magnetic field-peak, mean, rms and effective values of A.C. Ac circuits-AC through RC, LC, LR and LCR series circuits-resonance-sharpness of resonance-power factor and choke coil-transformers,

Electric motors principle of working Devices working with electric motors – electric fan wet grinder.

Books for Study:

1. A text book of optics – Brijlal & Subramaniam
2. Electricity and Magnetism – R.Murugesan, S.Chand & Co Ltd.
3. A text book of B.Sc subsidiary Physics – P.Vivekanandan.
4. Electrical Technology (Vol I & II), B.L.Theraja.

Semester 4 (Polymer Science Main)

PY1431.7 – Atomic Physics and Electronics (54 hours)

Unit I

Modern Physics (18 hours)

Basic features of Bohr atom model-Bohr's correspondence principle -vector atom model-various quantum numbers-magnetic moment of orbital electrons -electron spin-Spin-Orbit coupling-Pauli's exclusion principle-periodic table. Atomic nucleus-basic of nucleus -charge, mass, spin magnetic properties moment-binding energy and packing fraction-nuclear forces-salient features-Radioactivity radioactive decay-decay laws-decay constant-half life and mean life-radioactive equilibrium-secular and transient equilibrium-measurement of radioactivity-

Unit II Superconductivity (8 hours)

Properties of superconductors-zero electrical resistance-Meissner effect-critical magnetic field-Type I and Type II superconductors-isotope effect-high temperature ceramic superconductors-applications of superconductors.

Unit III Quantum Mechanics (10 hours)

Inadequacies of classical physics-experimental evidences-evidences for quantum

theory-Planck's hypothesis-foundation of quantum mechanics-wave function and probability density-Schrödinger equation-time dependent and time independent-particle in a potential box.

Unit III (18 hours)

Electronics (18hours)

Current-voltage characteristics of a diode-forward and reverse bias-breakdown

mechanism of p -n junction diode-Zener diode and its characteristics-half wave and full wave rectifiers-bridge rectifier-ripple factor, efficiency. Construction and operation of a bipolar junction transistor-transistor configurations-current components-transistor characteristics-DC load line-Q point-AC load line-transistor biasing-need for biasing-bias stabilization-biasing circuits-fixed bias, emitter feedback bias, voltage divider bias (qualitative study only).

Transistor amplifier-basic features of an amplifier-gain, input and output resistances-frequency response and band width-small signal CE amplifier-circuit and its operation

Books for Study:

1. Modern Physics – R.Murugesan, S.Chand & Co. Ltd.
2. A text book of B.Sc subsidiary Physics – P.Vivekanandan.
3. Principles of Electronics – V.K.Mehta.

COMPLEMENTARY PRACTICAL (PHYSICS)

(Common for all complementary subjects)

PY1432-Practical

List of Experiments (Minimum 18 experiments to be done)

1. Torsion Pendulum- n by torsional oscillations
2. Torsion Pendulum- n and I using equal masses
3. Fly Wheel
4. Cantilever- Y by pin and microscope method
5. Uniform bending- Y by pin and microscope
6. Symmetric bar pendulum - g and radius of gyration
7. Surface tension- capillary rise method
8. Coefficient of viscosity- capillary flow method
9. Specific heat-method of mixtures applying Barton's correction

10. Lee's disc- Thermal conductivity of cardboard
 11. Melde's string- frequency of tuning fork
 12. Method of parallax- optical constants of convex lens using
 - i) mirror and mercury
 - ii) mirror and water
13. Method of parallax- refractive index of liquid.
14. Spectrometer- A, D and n
 15. Spectrometer- dispersive power of a prism
 16. Spectrometer- Grating-normal incidence
 17. Deflection and vibration magnetometer- M and Bh
 18. Circular coil- magnetization of a magnet
 19. Carey Foster's bridge - Resistivity
 20. Potentiometer- Resistivity
 21. Potentiometer- Calibration of ammeter
 22. Mirror galvanometer- Current and Voltage sensitivity
 23. Diode Characteristics (for Ge and Si diodes)
 24. Half wave rectifier- Measurement of ripple factor with and without filter capacitor
 25. Full wave rectifier- Measurement of ripple factor with and without filter capacitor

COMPLEMENTARY ELECTRONICS PRACTICAL

EL1432-Practical

List of Experiments (Minimum 18 experiments to be done)

1. Semiconductor diode (IN 4001/ IN 4007) characteristics; To (i) trace and construct the circuit, (ii) to draw the forward V-I characteristic curve and (iii) to determine the static and dynamic resistances of the diode at a particular operating point.
2. Zener diode characteristics: To (i) trace and construct the circuit, (ii) to plot the V-I characteristic under reverse biased condition and (iii) to calculate the dynamic resistance of the diode under reverse bias when conducting.
3. LED and photo diode characteristics: To (i) study the variations in resistance with varying current and (ii) to study the output characteristics of a photo diode.
4. Thevenin and Norton equivalent circuits: To (i) determine Thevenin's and Norton's equivalent circuits of Wheatstone's bridge and (ii) to verify the power transfer theorem.
5. R-C resonant circuits: To (i) study the input-output characteristics of an R -C circuit as a function of frequency and (ii) to study the square wave response of R-C circuits.
6. Transistor characteristics; CE configuration: (i) Construct the circuit, (ii) To plot the input characteristics (IB-VBE graph for constant V CE) and to calculate the dynamic resistance at an operating point, (iii) To study the output characteristics (IC-VCE graph for constant I B) and to calculate the output ac resistance, dc gain and ac current gain at a given operating point.
7. Transistor characteristics; CB configuration: (i) Construct the circuit, (ii) Plot the input characteristics (IE-VEB graph for constant VCB) and to calculate the dynamic resistance at an operating point, (iii) To study the output characteristics (IC-VCB graph for constant I C) and to calculate the output dynamic resistance, dc current gain and ac current gain at a given operating point.
8. FET characteristics: (i) Trace the circuit (ii) To plot the static drain characteristics of FET (iii) To calculate the FET parameters (drain dynamic resistance, mutual conductance and amplification factor at a given operating point).
9. Fixed-bias circuit with and without emitter resistor: (i) Trace the circuit (ii) To measure the Q-Point (IC and VCE) with and without emitter resistor RE. (iii) To note the variation of Q -point by increasing the temperature of the transistor in fixed bias circuit with and without emitter resistor (iv) To note the variation of Q-point by changing the base resistor in bias circuit with and without emitter resistor

10. Collector-to-base feedback bias circuit: (i) Trace the circuit (ii) To measure the Q-Point (I_C and V_{CE}) (iii) To note the variation of Q-point by increasing the temperature of the transistor
11. Potential -divider biasing circuit: (i) Trace the circuit (ii) To measure the Q-Point (I_C and V_{CE}) (iii) To note the variation of Q-point by increasing the temperature of the transistor (iv) To measure the operating point when one of the bias resistor changes
12. Half-wave rectifier: (i) To draw the input and output wave shapes (ii) To verify $V_{dc} = V_m/p$ and ripple factor = 1.21 (Observe for different load resistances)
13. Full-wave rectifier – Centre tapped: (i) To draw the input and output wave shapes (ii) To verify $V_{dc} = 2V_m/p$ and ripple factor = 0.482 (Observe for different load resistances)
14. Bridge rectifier: (i) To draw the input and output wave shapes (ii) To verify $V_{dc} = 2V_m/p$ and ripple factor = 0.482 (Observe for different load resistances)
15. Filter circuits (shunt capacitor, LC and CLC filters): (i) To plot the output wave shapes with and without shunt capacitor (ii) To find the ripple factor with and without different filters
16. Single stage RC coupled amplifier: (i) To measure the Q-point (I_C and V_{CE}) (ii) To measure the maximum signal that can be amplified by the amplifier without clipping (iii) To measure the voltage gain at 1 KHz (iv) To plot the frequency response (v) To find the voltage gain for different values of load resistance
17. FET amplifier: (i) To measure the frequency response (ii) To measure voltage gain, BW and gain-BW product
18. Hartley oscillator: (i) Trace the circuit (ii) To measure the Q-point of the transistor (iii) To observe the output wave form and to measure the frequency of oscillations
19. Phase shift oscillator: (i) Trace the circuit (ii) To measure the frequency from the output wave form (iii) To observe the phase shift at different points
20. Clipping circuits: (i) To observe the output wave form corresponding to different clipping circuits
21. Clamping circuits: (i) To observe the output wave form corresponding to different clamping circuits

22. OP amp. - Inverting amplifier using IC 741 (i) Trace the circuit (ii) To construct an inverting amplifier using IC 741 and determine its voltage gain for different input voltage
23. OP amp. - Non inverting amplifier using IC 741 (i) Trace the circuit (ii) To construct a Non inverting amplifier using IC 741 and determine its voltage gain for different input voltage
24. OP amp. - Unity gain buffer using IC 741 (i) Trace the circuit and (ii) To construct a unity gain buffer using IC 741 and to find the voltage gain.