ST. XAVIER'S COLLEGE (AUTONOMOUS)

PALAYAMKOTTAI - 627 002

(Recognized as "College with Potential for Excellence" by UGC)
(Accredited by NAAC at "A^{++}" Grade with a CGPA of 3.66 in IV Cycle)
(Star College Programme by DBT, Govt. of India.)

Affiliated to Manonmaniam Sundaranar University
Tirunelveli

SYLLABUS

Preserve this copy of the syllabus until you complete the course, as it is an important document of your present course of study.

Name _____

B.SC. PHYSICS

(w.e.f. June 2021)

Programme : B.Sc. Physics
Programme Code : UPH

Programme Specific Outcomes:

At the completion of the B.Sc. programme in Physics the Students will be able to

1. understand and experiment the basic concepts of Properties of Matter and Acoustics, Solar Energy, Space Science and Cosmology, Nuclear Energy, Heat and Thermodynamics, Electricity and Magnetism, Optics and Lasers, Mechanics, Non-conventional Energy Sources, Digital Principles, Electronics, Nuclear Physics, Fiber Optics, Quantum Mechanics and Relativity, Geophysics, Solid State Physics, Instrumentation, Reactor Physics, Nanophysics and Spectroscopy.

2. develop the skills on scientific programming through Programming with C and C++ and Microprocessor 8085 which will make them choose their career in wide spectrum of areas.

3. realise their dream on designing electronic appliances by themselves

4. harness the scientific ideas to reduce pollution by promoting non-conventional or renewable energy resources

5. gain confidence and move to higher studies

B.Sc. Physics Programme Structure

Sem	Part	Status	Course Code	Title of the Course	Hrs	Cdts
I	I	Lang.	21 UGT 11	General Tamil – I		
	I	Lang.	21 UGH 11	Hindi – I		
	I	Lang.	21 UGF 11	French – I	6	3
	II	Lang.	21 UGE 11	General English – I	6	3
	III	Core	21 UPH11	Properties of Matter and Acoustics	4	4
	III	Core P	21 UPH 12	Practical - Properties of Matter and Acoustics	2	1
	III	Allied	21 UMT A11	Maths - Allied Physics – I	4	4
	III	Allied P	21 UMT A12	Practical - Maths - Allied Physics – I	2	1
	IV	NME	21 UNM 11	Introduction to Solar Energy	2	2
	IV	SBE1	21 USB 11	Integrated Personality Development	2	2
	IV	VE	21 UVE 11	Religion / Ethics	2	2
				Course Total	30	22
II	I	Lang.	21 UGT 21	General Tamil – II		
	I	Lang.	21 UGH 21	Hindi – II		
	I	Lang.	21 UGF 21	French – II	6	3
	II	Lang.	21 UGE 21	General English – II	6	3
	III	Core	21 UPH 21	Heat and Thermodynamics	4	4
	III	Core P	21 UPH 22	Practical - Heat and Thermodynamics	2	1
	III	Allied	21 UMT A21	Maths - Allied Physics – II	4	4
	III	Allied P	21 UMT A22	Practical - Maths - Allied Physics – II	2	1
	IV	NME	21 UNM 21	Nuclear Energy and its Applications	2	2
	IV	SBE2	21 USB 21	Life Issues And Coping Skill Development	2	2
	IV	SBE3	21 USB 23	English for Physics	2	2
				SubTotal	30	22
III	I	Lang.	21 UGT 31	General Tamil – III		
	I	Lang.	21 UGH 31	Hindi – III		
	I	Lang.	21 UGF 31	French – III	6	3
	II	Lang.	21 UGE 31	General English – III	6	3
	III	Core	21 UPH 31	Electricity and Magnetism	4	4
	III	Core P	21 UPH 32	Practical - Electricity and Magnetism	2	1
	III	Allied	21 UCH A31	Chemistry- Allied Physics – I	4	4
	III	Allied P	21 UCH A32	Practical - Chemistry- Allied Physics – I	2	1
	IV	ES	21 UES 31	Environmental Studies	2	2
	IV	SBE4	21 USB 31	Human Rights and Social Analysis	2	2
	IV	SBE5	21 USB 36	Physics for Competitive Examinations	2	2
				Course Total	30	22
IV	I	Lang.	21UGT 41	General Tamil- IV		
	I	Lang.	21UGH 41	Hindi- IV		
	I	Lang.	21UGF 41	French	6	3
	II	Lang.	21UGE 41	General English-IV	6	3
	III	Core	21 UPH 41	Optics and Lasers	4	4
	III	Core P	21 UPH 42	Practical - Optics and Lasers	2	1
	III	Allied	21UCHA 41	Chemistry- Allied Physics – II	4	4
	III	Allied P	21UCHA 42	Practical - Chemistry- Allied Physics – II	2	1

	III	Elect.	21UPHE41	Mechanics/ Non-conventional Energy Sources	4	3
	IV	SBE6	21USB 42	Electronics in Daily life	2	2
				Course Total	30	21
V	III	Core	21UPH 51	Programming with C and C++	4	4
	III	Core P	21 UPH 56	Practical - Programming with C and C++	2	1
	III	Core	21 UPH 52	Digital Principles	4	4
	III	Core P	21 UPH 57	Practical - Digital Principles	2	1
	III	Core	21 UPH 53	Electronics - I	4	4
	III	Core P	21 UPH 58	Practical - Electronics – I	2	1
	III	Core	21 UPH 54	Nuclear Physics	4	4
	III	Core	21 UPH 55	Fiber Optics	4	4
	III	Elect.	21UPHE 51	Quantum Mechanics and Relativity/ Geophysics	4	3
				Course Total	30	26
VI	III	Core	21 UPH 61	Electronics- II	4	4
	III	Core P	21 UPH 66	Practical - Electronics- II	2	1
	III	Core	21 UPH 62	Microprocessor 8085	4	4
	III	Core P	21 UPH 67	Practical - Microprocessor 8085	2	1
	III	Core	21 UPH 63	Solid State Physics	4	4
	III	Core	21 UPH 64	Instrumentation	4	4
	III	Core P	21 UPH 68	Practical - Instrumentation	2	1
	III	Core	21 UPH 65	Nanophysics	4	4
	III	Elect	21UPHE 61	Reactor Physics/Spectroscopy	4	3
				Course Total	30	26
				STAND		1
				Total	**180**	**140**

PROPERTIES OF MATTER AND SOUND
(Course Code: 21 UPH 11)

SEMESTER: I	HOURS – 4	CREDITS – 4

Course Outcomes : At the end of the course the students will be able to

1. understand the properties of matter such as elasticity, surface tension, viscosity etc.
2. understand the fundamentals and applications of sound
3. understand the differences between surface tension and viscosity.

Unit I: Elasticity

Introduction - Hooke's Law, stress-strain diagram and Factors affecting elasticity. Poisson's ratio - expression for poissons ratio in terms of elastic constants (for problems only) - twisting couple of a wire - work done in twisting - torsional pendulum - determination of rigidity modulus of a rod by static torsion method.

Unit II: Bending of beams

Definitions -- Expression for bending moment - cantilever expression for depression - experiment to find youngs modulus - cantilever oscillation - expression for period - uniform bending - expression for elevation – searles methods for determining E,G and V-Konig's method -experiment to find Youngs modulus using telescope - I form girders.

Unit III: Surface Tension and Low pressure

Introduction- work done in increasing the area of the surface - excess of pressure over curved surfaces- determination of surface tension by ripples method - variation of surface tension with temperature Jaegars experiment. Production and measurement of low pressure – Gaede's molecular pump - detection of leakage.

Unit IV: Viscosity

Streamlined motion -turbulent motion - coefficient of viscosity - rate of flow of liquid in a capillary tube - Poiseuilles formula - analogy between liquid flow and current flow - equation of continuity of flow of liquid - energy possessed by a flowing liquid - Bernoullis theorem - applications - venturimeter.

Unit V: Sound

Orgin of sound , velocity of longitudinal waves in gases , Newton's formula for velocity of sound, Laplace correction, effect of pressure, effect of density of medium, effect of humidity – effect of wind , velocity of sound in water, velocity of sound in isotropic solids, wave velocity and molecular velocity.

TEXT BOOKS:

1. Brijlal and Subramanian - Properties of Matter, S. Chand & Company Ltd, 3rd edition 2000.
2. Brijlal and Subramanian - Waves & Oscillations, S. Chand & Company Ltd., Edition 1984.
3. M. Arumugam - Solid state physics, Anuradha Publications, 2nd Ed, 2009. (Unit V).

REFERENCE BOOKS:

1. D. S. Mathur - Properties of Matter, S. Chand & Company Reprint 2010.
2. L. P. Sharma & H.C. Sexana - Oscillations, Waves and Sound, S. Chand & Companies PVt Ltd., 2000.

PROPERTIES OF MATTER AND SOUND (PRACTICALS)
(Course Code18 UPH 12)

SEMESTER: I	HOURS – 2	CREDITS – 1

1. Youngs modulus - Uniform bending - telescope
2. Youngs modulus - uniform bending - Pin & microscope
3. Young modulus - Non Uniform Bending
4. Coefficient of viscosity – Poiseuilles method
5. Coefficient of viscosity - Constant pressure head method
6. Surface Tension - drop weight method
7. Melde's string
8. Helmholtz Resonator
9. Acceleration due to gravity - Compound pendulum
10. Biflar pendulum
11. Rigidity modulus - static torsion
12. Rigidity modulus - Torsion pendulum

ALLIED MATHEMATICS – I
(PHYSICS AND CHEMISTRY)
(Course Code: 21 UMTA 11)

Semester - I	**Allied - 1**	**Hours - 6**	**Credits - 5**

Course outcomes: By the end of the course the student will be able to

CO 1. define the rank of matrix (K1)
CO 2. discuss hyperbolic functions and inverse hyperbolic functions (K2)
CO 3. explain the relation between the coefficients and the roots of algebraic equation (K2)
CO 4. solve the system of linear equations (K3)
CO 5. analyze binomial series, exponential series and logarithmic series (K4)
CO 6. compare two sets of data using correlation (K5)

UNIT - I:

Binomial Series – Exponential Series – The Logarithmic series

(Text book 1: Chapter 1: Sections 1.2-1.4)

UNIT - II:

Nature of roots - Relation between the coefficients and the roots of an algebraic equation -Transformation of equations

(Text book 1: Chapter 2: Sections 2.1-2.3)

UNIT- III:

Rank of a matrix - Simultaneous linear equations - Eigen values and Eigen vectors

(Text book 1: Chapter 3: Sections 3.2 – 3.4)

UNIT - IV:

Expansion of sin θ and cos θ in a series of ascending powers of θ - Hyperbolic function - Logarithm of complex numbers.

(Text book 1: Chapter 5: Sections 5.3 – 5.5)

UNIT - V:

Correlation – Rank Correlation – Regression

(Text book 2: Chapter 1)

Text books:

1. S. Narayanan, R. Hanumantha Rao, T.K. Maicavachagom Pillai and P. Kandaswamy, Ancillary Mathematics Volume I, S. Viswanthan (Printers and Publishers) Pvt. Ltd., 2009.
2. S. Arumugam and Issac, Allied Mathematics paper V, New Gamma Publishing House, 2004

NON MAJOR ELECTIVE
INTRODUCTION TO SOLAR ENERGY
(Course Code: 21UNM 11)

SEMESTER - II	**HOURS - 2**	**CREDITS – 2**

Course Outcomes : At the end of the course the students will be able to

1. understand the solar energy including and its practical applications.
2. know about applications as they apply to commercial, residential and industrial markets.
3. understand the physics of sun nuclear fission and fusion
4. understand the black body radiation and solar spectrum
5. gain knowledge in physics of semiconductors

Unit I: Solar Energy

Physics of the sun – solar energy – nuclear fission and nuclear fusion – advantages and disadvantages of solar energy. Black body radiation – solar spectrum – electromagnetic spectrum – conduction – convection – radiation – basic laws of radiation– solar constant – green house effect

Unit II: Solar Radiation Measurement

Solar radiation on the earth's surface – terrestrial radiation – beam , diffuse and global radiation --Measurement of solar radiation – pyranometer – pyrheliometer – sunshine recorder.

Unit III: Solar cell and applications

Semiconductors – n-type and p – type semiconductors – photon interactions with semiconductors – photovoltaic effect -- Applications of solar energy – solar cells – solar cooker – solar dryer – solar water heating systems.

TEXT BOOK:

1. G.D.Rai - Solar Energy Utilisation, Khanna Publishers, 5th Edition, 2014.

REFERENCE BOOKS:

1. Sukhatme, S.P. – Solar Energy, Tata McGraw Hill Publishing House, 1997.
2. Garg, H.P. and Prakash, J. – Solar Energy – Fundamentals and Applications, Tata McGraw Hill Publishing House, First Revised Edition, 2008.
3. Tiwari, G.N. – Solar Energy, Narosa Publishing House, 3rd Reprint 2006.

HEAT AND 18THERMODYNAMICS
(Course Code: 21 UPH 21)

SEMESTER II	HOURS - 4	CREDITS - 4

Course Outcomes: At the end of the course the students will be able to

1. understand the basic concepts and methods used to study the behavior of gases, transmission of heat and liquefaction of gases
2. know the statistical behaviour of an ideal gas an electron gas and a photon gas have been discussed.
3. know the basic concepts and the methods to study the properties of radiations.
4. correlate the parameters on transport phenomena and viscosity of gases.
5. understand the concepts in first and second law of thermodynamics.

Unit I: Nature and Transmission of Heat

Concept of ideal or perfect gas – kinetic theory of gases – expression for the pressure of gas- Searles apparatus - heat flow through a compound wall - Weidmann Frantz law- central heating system – change of pressure with height – convective equilibrium of the atmosphere. Properties of radiations – applications – black body – stefan's law – determination of Stefan's constant (Lab method) – distribution of energy in the spectrum of a black body.

Unit II: Transport Phenomena

Mean free path – transport phenomena – viscosity of gases – Brown- ian motion – critical constants – corresponding states – coefficient of Vander Walls constants – properties of matter near critical point - intermolecular attraction – porous plug experiment – theory of porous plug experiment

Unit III: Laws of thermodynamics

Zeroth law of thermodynamics- First law of thermodynamics- second law of thermodynamics – gas equation during an adiabatic process Carnot reversible engine - carnot's theorem. - third law of thermodynamics - Temperature – Entropy diagram – entropy of a perfect gas – zero point energy negative temperature - Maxwell's thermodynamic relations - First order and second order phase transitions – Tds equations.

Unit IV: Liquefaction of gases

Introduction – cascade process - liquefaction of oxygen – liquefaction of Hydrogen and Helium (Knee's method) - properties of Helium I & II – production of low temperatures – Adiabatic demagnetization on super conductivity- Helium vapour pressure thermometer.

Unit V: Statistical Thermodynamics

Wien's displacement law–Rayleigh Jean's law–Solar constant Statistical mechanics - statistical equilibrium – probability theorems in statistical thermodynamics – Quantum statistics – phase space - Fermi Dirac distribution law - Bose Einstein distribution law - comparison of the three statistics

TEXT BOOKS:

1. Brijlal & Subramaniam - Heat and Thermodynamics, S. Chand & Com., Ltd., Revised Edition 2010.
2. Jose Robin and Ubald raj - Applied Physics, Indra Publications Edition 2000.
3. Nelkon Parker, Advanced level Physics, Cbs Publishers & Distributors- Edition 2006

REFERENCE BOOKS:

1. Y. Madavan and others - Thermal physics and Statistical Mechanics,
2. D. S. Mathur - Fundamental of Heat, S.Chand & Sons 2000.
3. S.S. Singhal & Others - Heat, Thermodynamics and Statistical Physics, Pregath Prakasan 14th Edn 2000.

HEAT AND THERMODYNAMICS (PRACTICALS)

(Course Code: 21 UPH 22)

SEMESTER II	HOURS - 2	CREDITS - 1

1. Stefan's constant
2. Planck's constant
3. Boltzmann constant
4. Conductivity of bad conductor- Lee's Disc Method
5. Conductivity of air- Lee's Disc Method
6. Conductivity of good conductor- Searle's Method
7. Newton's law of cooling – vertification
8. Emissivity of a surface
9. Specific heat capacity of a liquid - Newton's law of cooling
10. Specific heat capacity by the method of mixtures

ALLIED MATHEMATICS – II
(FOR PHYSICS)
(Course Code: 21 UMTA 21)

Semester - II	**Allied - 2**	**Hours - 6**	**Credits - 5**

Course Outcomes: By the end of the course the student will be able to

CO 1. discuss the concept of vector differentiation and vector Integration (K2)
CO 2. discuss Fourier series (K2)
CO 3. calculate Line, surface and volume integrals using Green, Gauss and Stoke's theorem (K3)
CO 4. determine partial differential equations and solve the first order partial differential equations (K3)
CO 5. illustrate solenoidal and irrotational functions (K4)
CO 6. solve the differential equations with constant coefficients and homogeneous linear equations (K5)

Unit - I:

Vector algebra - Differentiation of vectors - Gradient - Divergence and Curl

(Text book 1: Chapter 5)

Unit - II:

Line integrals - Surface integrals - Theorems of Green - Gauss and Stokes

(Text book 1: Chapter 7)

Unit - III:

Fourier series - Definition - The Cosine and Sine series

(Text book 2: Chapter 3)

Unit - IV:

Linear equation with constant coefficients - Methods of finding complementary functions - Methods of finding particular integrals - Homogeneous linear equations

(Text book 2: Chapter 5: Sections 1- 4)

Unit - V:

Formation of partial differential equations - First order partial differential equations - Methods of solving first order partial differential equations - Some standard forms

(Text book 2: Chapter 6)

Text books:

1. S. Arumugam and Issac, Allied Mathematics paper II, New Gamma Publishing House, 2003.
2. S. Arumugam and Issac, Allied Mathematics paper III, New Gamma Publishing House, 2004.

NON MAJOR ELECTIVE
NUCLEAR ENERGY AND ITS APPLICATIONS
(Course Code: 21 UNM 21)
(For students of other Major)

SEMESTER II	HOURS – 2	CREDITS - 2

Course Outcomes: At the end of the course the students will be able to

1. know about the large scale demand of energy for meeting day to day domestic, and industrial requirements.
2. understand the differences between nuclear fission and nuclear fusion.
3. understand the functioning of various nuclear reactors in india.

Unit I: Nuclear Energy

Introduction – Atomic structure – Chain reaction – Nuclear fusion - Atom bomb – Nuclear fission - Hydrogen bomb – Nuclear reactors – Stellar energy – Nuclear energy – Nuclear fuel – Applications of nuclear physics in Archeology.

Unit II: Reactors

Types of reactors in Tamil Nadu – Koodangulam nuclear reactor – Reactors in India – Breader reactor – Uranium ore – sources in India – Advantages and disadvantages – Advantages and disadvantages of nuclear energy - Chernobyl disaster – Nuclear hazards.

Unit III: Nuclear Treaty

Nuclear treaty – Hyde Act – Indo-American agreement of nuclear treaty.

TEXT BOOKS:

1. R.Murugesan - Modern Physics, S. Chand and Company, Edition, 2010.
2. Irwing Kaplan - Nuclear Physics, Narosa Publishing House, Edition 2002.

ENGLISH FOR PHYSICS
SBE-3
(Course Code: 21 USP 23)

Semester II	**Hours - 2**	**Credits - 2**

SCIENCESOBJECTIVES:

- To develop the language skills of students by offering adequate practice in professional contexts.
- To enhance the lexical, grammatical and socio-linguistic and communicative competence of first year physical sciences students
- To focus on developing students' knowledge of domain specific registersand the required language skills.
- To develop strategic competence that will help in efficientcommunication
- To sharpen students' critical thinking skills and make students culturally aware of the target situation.

LEARNING OUTCOMES:

- Recognise their own ability to improve their own competence in using thelanguage
- Use language for speaking with confidence in an intelligible andacceptable manner
- Understand the importance of reading for life
- Read independently unfamiliar texts with comprehension
- Understand the importance of writing in academic life
- Write simple sentences without committing error of spelling or grammar(Outcomes based on guidelines in UGC LOCF – Generic Elective)

NB: All four skills are taught based on texts/passages.

UNIT 1: COMMUNICATION

Listening: Listening to audio text and answering questions-Listening o Instructions
Speaking: Pair work and small group work.
Reading: Comprehension passages –Differentiate between facts and opinion
Writing: Developing a story with pictures**.**
Vocabulary: Register specific - Incorporated into the LSRW tasks

UNIT 2: DESCRIPTION

Listening: Listening to process description.-Drawing a flow chart.
Speaking: Role play (formal context)
Reading: Skimming/Scanning- Reading passages on products, equipment and gadgets.
Writing: Process Description –Compare and Contrast Paragraph-Sentence Definition and Extended definition-Free Writing.
Vocabulary: Register specific -Incorporated into the LSRW tasks.

UNIT 3: NEGOTIATION STRATEGIES

Listening: Listening to interviews of specialists / Inventors in fields(Subject specific)
Speaking: Brainstorming. (Mind mapping). Small group discussions (Subject- Specific)
Reading: Longer Reading text.
Writing: Essay Writing (250 words)
Vocabulary: Register specific - Incorporated into the LSRW tasks

UNIT 4: PRESENTATION SKILLS

Listening: Listening to lectures.
Speaking: Short talks.
Reading: Reading Comprehension passages
Writing: Writing Recommendations Interpreting Visuals inputs
Vocabulary: Register specific - Incorporated into the LSRW tasks

UNIT 5: CRITICAL THINKING SKILLS

Listening: Listening comprehension- Listening for information.
Speaking: Making presentations (with PPT- practice).
Reading: Comprehension passages –Note making. Comprehension: Motivational article on Professional Competence,Professional Ethics and Life Skills)
Writing: Problem and Solution essay– Creative writing –Summary writing
Vocabulary: Register specific - Incorporated into the LSRW tasks

ELECTRICITY AND MAGNETISM
(Course Code: 21 UPH 31)

SEMESTER – III	HOURS – 4	CREDITS – 4

Course Outcomes: At the end of the course the students will be able to

1. Remember the physical aspects on electricity and magnetism and to apply the principles in day today life.
2. Learn the concept of charges and how they interact with each other
3. Apply knowledge of electricity and magnetism to explain natural physical processes and related technology advances
4. Identify and apply appropriate theoretical techniques to solve a range of different problems in electricity and magnetism
5. Have a basic exposure and grasp on how experimental equipments related to electricity and magnetism can be used (through lab exercises)
6. Analyses the basic concept and the properties of elements in AC circuits and their applications.

UNIT I Electric Field

Electric field due to a point charge - electric dipole - electric field due to an electric dipole at an axial point, a point on the equatorial line - Gauss law - applications - field due to (i) uniformly charged non conducting sphere and (ii) uniformly charged conducting sphere

UNIT II (A) Electric potential

Electric potential – Potential difference, relation between electric field and electric potential equipotential surface- potential at a point due to (i) point charge (ii) uniformly charged non-conducting sphere - electrical potential energy.

(B) Capacitors

Principle of capacitor - spherical capacitor - capacitance of parallel plate capacitor - capacitors in series and parallel – energy stored in a charged capacitor - loss of energy on sharing of charges between two capacitor.

UNIT III AC circuits

Alternating current: emf induced in a coil rotating in a magnetic field - peak value - mean value - effective value - impedance - AC circuits: circuit containing resistance only - inductance only - capacitance only. Transient current: growth and decay of current in LR circuit - growth and decay of charge in LCR circuit - Measurement of high resistance by leakage.

UNIT IV (A) Magnetic effect of electric current

Torque on a current loop in a uniform magnetic field - moving coil ballistic galvanometer - current and voltage sensitivities of a moving coil galvanometer - determination of emf and capacity of a capacitor

(B) Electromagnetic induction

Self inductance - self inductance of a long solenoid - Owen's bridge - mutual inductance - determination of mutual inductance - coefficient of coupling.

UNIT V Magnetic properties of materials

Classification of magnetic materials Magnetic induction - magnetization - relation between B, H & M – magnetic susceptibility and permeability the electron theory of magnetism - Langevin's theory of diamagnetism and para magnetism.

TEXT BOOK:

1. Murugesan R. - Electricity and Magnetism, S. Chand and Company Ltd. Edition 10^{th}revised edition, 2017.
2. Brijilal and Subramaniyan - Electricity and magnetism, S. Chand and Company Ltd., Reprint 2009.

REFERENCE BOOKS:

1. S.G. Starling - Electricity and Magnetism, Longmann Green 8th Edition 2000.
2. Chakraborty - Electricity & Magnetism, New Age International, 2008.
3. N.K. Sehgal & Chopra - Electricity & magnetism, Sultan Chand & Sons, 2nd Edition, 2000.

PRACTICALS (ELECTRICITY AND MAGNETISM)
(Course Code: 21 UPH 32)

SEMESTER – III	**HOURS – 2**	**CREDITS – 1**

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1. Figure of merit – Spot galvanometer.
2. Thermo emf Determination – Spot galvanometer.
3. Self inductance – Maxwell's bridge.
4. Self inductance – Owen's bridge.
5. Comparison of Capacitance – De Sauty's bridge
6. Calibration of low range Voltmeter – Potentiometer.
7. LCR series resonance circuit
8. LCR parallel resonance circuit.
9. Absolute capacity of a capacitor.
10. High resistance by leakage.

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ALLIED CHEMISTRY 1 (FOR PHYSICS)
SUBJECT CODE:21UCHA31

Semester: III	Core : 1	Credits : 4	Hours / W : 4

OUTCOMES:

- Understanding atomic structure and periodicity
- Appreciating the mystery of existence of atoms together in molecular form
- Enjoying the regularity in solids
- Understanding acids and bases and redox process
- Application of learnt knowledge in practicals.

UNIT 1 ATOMIC STRUCTURE AND PERIODIC TABLE 12 hrs

ATOMIC STRUCTURE

Bohr model of atom- Atomic spectrum of hydrogen and Bohr theory - Refinement of the Bohr theory- Duel nature of electrons particles or waves- Quantum numbers and its significance- Uncertainty principle- Paul's exclusion principle, Hund's rule- Periodic table- Modern periodic table- Long form of periodic table- Division of elements into s,p,d and f blocks-Bohr's aufbau principle electronic configuration of ground state of atoms up to K(Z=19)-Trends in atomic properties Ionization energy, successive ionization energy , electron affinity, electro negativity Pauling, Mulliken and Allred Rochow's scale

UNIT II STRUCTURAL AND CHEMICAL BONDING 12 hrs

Types of chemical bond - Electrovalent bond (conditions for formation and associated properties)- Covalent bond (conditions for formation and associated properties)- Coordinate covalent bond- Orbital overlap ss, sp, pp overlap- Sigma and pi bond formation of N_2 and O_2 properties- Polar and non-polar molecules- Dipole moment and its applications- VSPER theory application to CH_4 , NH_3 and H_2O - Molecular orbital theory, bonding, antibonding and non-bonding orbitals- MO diagrams for H_2 , He_2 and O_2 bond order

UNIT III SOLID STATE AND ENERGETICS 12 hrs

Macroscopic properties of solids- Types of characteristics of crystals- Covalent solids structure and properties of diamond and graphite- Ionic crystals solid NaCl- Metallic crystals- Molecular crystals intermolecular forces- Metals free electron theory and bond theory of metallic bond- Superconductors- Lattice energy- BornHaber cycle- Law of conversation of energy- Enthalpy of reactions- Entropy and Gibbs energy- Relationship between Gibbs energy and equilibrium-

UNIT IV ACID, BASES AND REDOX PROCESSES 12 hrs

Concept of acids and bases- Arrhenius concept- Bronsted Lowry concept conjugate acids and bases- Lewis concept- Effect of solvents and substituents on relative strengths of acids and bases- Hydrolysis- Ionization of water- pH scale definition of pOH , pK_a, pK_b simple numerical problem- Buffer solution - Redox processes- Electronic concept of oxidation and reduction- Oxidation number rules- Calculation of oxidation number of elements in neutral molecules and in ions- Balancing ionic equation by oxidation number method-

UNIT V PRACTICAL CHEMISTRY1 12 hrs

Introduction acquaintance with chemical laboratory laboratory equipments solid reagents, liquid reagents and test papers laboratory instructions and some don'ts Bunsen burner (self study) -Chemistry involved in the analysis of anion and cations - Dry tests

(action of heat, flame test, filter ash test) -Wet test (with acids , with Na_2CO_3 extract)- Elimination of interfering anions and preparation of original solutions-Classification of cations into analytical groups- Condition for precipitation, application of solubility product and common ion effect in qualitative analysis- Cleaning- Soap reaction with acids and hard water effect of high temperature- Chemistry of cleaning soap micelle cleaning action of soap- Dry cleaning general rules for stain removal chemicals used for spots and stains from fabrics- Synthetic detergent and their advantages over soap- Safety in laboratory- General safety measures (safety equipment, safety notices, personal protection, dangers to avoid)- Chemical hazards (corrosive, irritant substances, toxic compounds, flammable explosives)- Physical hazards (fire, pressure) fire extinguisher- Spillage and waste disposal- First aid (immediate assistance, burns, eye injuries, bleeding, toxic materials) first aid kit

Note: Course materials will be supplied to the students

ALLIED CHEMISTRY PRACTICAL – I (FOR PHYSICS)
Inorganic qualitative analysis
(Subject Code: 21UCHAP31)

Semester:III	Allied: AP3	Credit: 1	Hours/W : 2

Qualitative analysis of a simple salt containing one anion and one cation
ANIONS: Carbonate, Borate, Fluoride, Oxalate and Phosphate
CATIONS: Lead, Bismuth, Copper, Cadmium, Cobalt, Nickel, Manganese, Zinc, Barium, Strontium and Ammonium

Note: Laboratory manual is supplied

SKILLS BASED ELECTIVE
PHYSICS FOR COMPETITIVE EXAMS
(Course Code: 21 USB 36)
(For Physics Major Only)

SEMESTER III	HOURS – 2	CREDITS – 2

Course Outcomes: At the end of the course the students will be able to

1. refresh their knowledge of fundamentals of physics and thus prepare them for entrance examinations
2. revise the subjects quickly at the time of examinations.
3. understand the subject from the elementary level to the required standard level in a simple language.
4. understand the various laws of motion
5. understand the reflection and refraction of light

UNIT – I : Mechanics

Laws of motion– force – momentum– work– energy– circular motion– simple harmonic motion– rigid body rotation– gravitation– Equation of continuity– Bernoulli's principle and applications–velocity of sound.

UNIT – II: Elasticity and Thermodynamics

Hooke's law– stress, strain– elastic modulus - viscosity.-- Surface tension– capillary rise of liquids. -- Osmosis– Diffusion– Carnot cycle- Specific heat of liquids and gases– liquefaction of gases.-- Conduction,-- Convection and radiation– Black body radiation.

UNIT – III: Optics

Reflection of plane surface – Refraction at plane surface and through a prism. defects in images - Interference- Newton's rings, critical angle, optical fibres, Lasers, polarization.

UNIT – IV: Electricity

Electric potential– Ohm's law– resistor– capacitor– galvanometer. Magnetic elements– electromagnetic induction.

UNIT – V : Atomic physics and Electronics

Classification of nuclei, properties of nuclei – nuclear radiations– photoelectric effect– chain reaction- nuclear fission and fusion– atom bomb and hydrogen bomb– nuclear reactor- elementary particles.-- Diode– transistor – logic gates.

BOOKS FOR REFERENCE:

1. N. K. Nayyar – Unique Quintessence of Physics (Ed) for M.Sc.Entrance Examinations, Unique Publishers, New Delhi, 2009.
2. N. K. Nayyar – Unique Quintessence of Physics (Ed) for UPSC /State Civil Services and other Competitive Examinations, Unique Publishers, New Delhi, 2009.
3. M.T. Dharmadhikari, A.Y. Waghale, Vidyadhar Kande-Patil, Himalaya Publishing House, Mumbai, 2006.

4. R. Adamson (ed) - Phsyics Quiz, Anmol Publications, New Delhi, 1994.
5. Course in Physics for IIT-JEE, Tata McGraw-Hill, New Delhi, 1993 (7^{th} Reprint).
6. D.C. Pandey - IIT-JEE Physics, Arihant Prakashan, Meerut, 2007.
7. Narinder Kumar – Objective Physics, Kalyani Publishers, 1999.
8. Satya Prakash – Objective Physics, A.S. Prakashan, Agra.
9. S. Malhotra – Objective Physics, New Light Publishers, New Delhi
10. 10.M.P. Sinha - Civil Services Preliminary Examination Physics, Upkar Prakashan, Agra.
11. David Halliday, Robert Resnick, Jearl Walker – Fundamentals of Physics, Wiley-India, 2001.
12. 34 Years' Solved Papers IIT-JEE Physics, Cengage Learning, Delhi, 2011.

OPTICS AND LASERS
(Course Code: 21 UPH 41)

SEMESTER – IV	HOURS – 4	CREDITS - 4

Course Outcomes: At the end of the course the students will be able to

1. gain good knowledge of optics and understand the developments in photonics .
2. understand the various optical instruments
3. understand the differences between interference, diffraction and polarization
4. understand the basic concepts in lasers
5. understand the camera, size and resolution power

UNIT I: Optical instruments

Eye - Camera – Size of an object – The simple magnifier – Com pound Microscope – Refracting astronomical telescope – Compound microscope – Resolving Power - Rayleigh's criterion of resolution - Resolving power of a telescope and prism.

UNIT II : Interference of light

Young's Double – slit Experiment – Optical Path Difference between the waves – Bright Fringes – Dark Fringes – Separation between neighbouring bright fringes – Conditions for sustained interference – Fresnel biprism - Experimental arrangement – Determination of wavelength of light – Interference Fringes with white light – Lateral displacement of fringes – Haidinger's fringes – Variable thickness (wedge-shaped) film - Colours of thin films – Newton's Rings – Determination of wavelength of light – Refractive index of a liquid - Michelson's interferometer – Applications of Michelson's Interferometer.

UNIT III: Diffraction

Introduction - Zone plate - Fresnel's diffraction pattern due to a straight edge – Diffraction due to a narrow slit - Fraunhoffer diffraction at double slit - Theory of plane transmission grating - Oblique incidence - Absent spectra with a diffraction grating - overlapping of spectral lines – Determination of wavelength of a spectral line using the trans mission grating - Dispersive power of grating.

UNIT IV: Polarization

Introduction - Polarization by double refraction – Fabrication of linear polarizer - Nicol Prism – Polaroid sheets - Huygen's explanation of double refraction – Types of polarized light - Quarter wave plate - Half wave plate - Production and detection of plane, elliptically and circularly polarized light - Babinet compensator – Double image polarizing prisms - Optical activity - Fresnel's explanation of optical rotation - Laurent's half shade polarimeter.

UNIT V: Lasers

Introduction - Attenuation of light in an optical medium - Thermal Equilibrium - Interaction of light with matter - Einstein relations (no derivations) - Light Amplification - Population inversion – Components of Laser: Active medium – Pumping - optical resonant cavity – Principal pumping schemes - Ruby laser – Helium-neon laser – Carbon dioxide laser - Laser beam characteristics – Applications.

TEXT BOOK:

N. Subrahmanyam, Brijlal & M.N. Avadhanulu - ATextbook of Optics, S. Chand & Company Ltd, New Delhi, Twenty Fourth Revised Edition, 2010.

REFERENCE BOOKS:

1. Anchal Srivastava, R.K. Shukla - Optics, S. Chand & Com. 2000.
2. R. Murugesan - Optics and Spectroscopy, S. Chand & Com. 2010.
3. A.B. Gupta - Modern Optics, Books and Allied (P) 2010.
4. K. John Robertson - Introduction to Optics, D van Nostrand Company IV, 2000.
5. Khanna & Gulati - Fundamental of Optics, R. Chand & Com V, 2000.
6. Francis Jenkins and Harvey E. White - Fundamentals of Optics, Tata McGraw-Hill , Edition, Fourth Edition, 2011.
7. S.P.Singh, J.P. Agarwal, Optics, Pragathi Prakashan, 2003.

PRACTICALS (OPTICS and LASERS)
(Course Code: 21 UPH 42)

SEMESTER – IV	HOURS – 2	CREDITS - 1

1. Dispersive power of a prism using spectrometer.
2. Grating - Normal incidence using spectrometer.
3. Grating - Oblique incidence using spectrometer.
4. Air wedge - Thickness of insulation.
5. Newton's Rings
6. Effective focal length of lenses in contact.
7. Effective focal length of lenses (two thin convex lenses) out of contact.
8. Effective focal length of lenses (one convex and other concave) out of contact.
9. Polarimeter
10. Optic bench

MECHANICS
(Course Code: 21 UPHE 41)

SEMESTER IV	HOURS – 4	CREDITS - 4

Course Outcomes: At the end of the course the students will be able to

1. understand the various conservation laws in mechanics.
2. understand the basic concepts in moment f inertia
3. learn the various theories on hydrostatics and hydrodynamics
4. solve problems in hydrodynamics and hydrostatics
5. learn the classical mechanics in detail.

UNIT 1: Conservation laws

Concept of work, power and energy - work energy theorem - conservative force - potential energy - law of conservartion of energy - applications of law of conservation of energy - ballistic pendulum - mechanics of systems of particles- c frame and L - frame of reference - kinetic energy of system of particles - two body problem and reduced mas - impulse of a force - impact between two smooth bodies - direct and oblique impacts - direct impact - impact between two smooth spheres - loss of kinetic energy due to direct impact between two smooth spheres.

UNIT 2: Moment of inertia

Moment of inertia of a rigid body - radiation of gyration - theorem of parallel axes - theorem of perpendicular axes - moment of inertia of a solid cylinder - moment of inertia of a solid sphere about a diameter - hollow sphere about a diameter - precessional motion - expression for precessional velocity of spinning top in terms of the torque acting on it - gyroscope- gyrocompass on ships.

UNIT 3: Hydrodynamics

Introduction – gradient, divergence and cur - fundamentals of hydrodynamics - some important types of fluid flow - expressions for velocity and acceleration of a fluid particle – equation of continuity for fluid flow - Euler's hydro-dynamical equations of motion - applications

UNIT 4: Hydrostatics

Introduction - thrust on a plane surface immersed in a liquid at rest - centre of pressure - centre of pressure of a vertical rectangular lamina - centre of pressure of a triangular lamina – Low of floatation – meta - centre and stability of floating bodies - determination of meta - centric height of ship - principle of working of submarine.

UNIT 5: Classical mechanics

Mechanics for a system of particles – constraints - generalised coordinates - transformation equation - configuration of space - principle of virtual work- D'Alemberts principle – Lagrange's equation for a system containing dissipative forces - applications.

TEXT BOOKS:

1. Ubaldraj- Mechanics and acoustics, Indira publications, Marthandam, Revised
2. edition, 2003
3. Ubaldraj- Mechanics, Indira publications, Marthandam, 1998
4. Ubaldraj-Mechanics and Thermal physics, Indira publications, Marthandam, Revised
5. edition, 2003

REFERENCE BOOKS

1. John Robert Taylor- Classical mechanics, university science books, 2005
2. T.W.B Kibble, Frank H. Berkshire- Classical mechanics, Imperial college press,
3. 2004
4. Herbert Goldstein- Classical mechanics, Addison Wesley pub.co, 1980
5. Goldstein- Classical mechanics- Third edition, Pearson education India, 2002

ALLIED CHEMISTRY- II (FOR PHYSICS)

SUBJECT CODE: 21UCHA41

Semester : IV	Core : 1	Credits : 4	Hours / W : 4

COURSE OUTCOMES:

- Students will be able to write nomenclature of organic compounds.(K2)
- Develop the knowledge in the area of electromotive force(K1)
- Use various processes involved in metallurgy for industrial applications(K5)
- Know the application of chemistry in industries(K3)
- Develop the practical knowledge in volumetric analysis.(K2)

UNIT I Nomenclature and Isomerism of Organic Compounds 12 hrs

Nomenclature of organic compounds - Alkane, alkene, alkyne, cycloalkane and alkyl groups- IUPAC names of alcohols, acids, aldehyde and ketones- Hybridization- Need for the concept of hybridization- sp, sp^2 and sp^3 hybridization with suitable examples- Isomerism in organic compounds- Structural isomerism types with example- Stereoisomerism conformational, geometrical and optical isomerism- Geometrical isomerism cis and trans nomenclature- Optical isomerism elemental of symmetry chirality optical activityenantiomers, diastereomers,mesomer and racemic mixture optical activity exhibited by lactic acid and tartaric acid.

Self study: Fundamentals of isomerism and hydridization.

UNIT II Electromotive Force 12 hrs

Introduction- Requirements of an electrochemical change- Electrochemical cells difference between electrolytic and galvanic cells- Salt bridge- Electrode potential and standard electrode potential- Electrochemical series and applications- Conventions used in electrode representation and in cell representation- Types of electrodes description of hydrogen, calomel and glass electrodes Nernst equation- Weston cadmium cell- Experimental determination of a cell emf and determination of electrode potential simple calculation- Potentiometric titrations and their advantages principle and method of acid base, redox and precipitation titrations- Determination of pH using hydrogen, glass and quinhydrone electrodes

Self study: Electrolysis and galvanic cells

UNIT III Metallurgical Principles and Polymers 12 hrs

Minerals and ores- Native,sulphide, oxide, carbonate, halide and sulphate ores- Metallurgy extraction metals- Concentration of ores hand picking, gravity separation,magnetic separation, froth flotation processes and leaching- Calcination and roasting- Purification of

metals electrolysis and zone refining method- Polymers - Properties of polymers ;Mechanical, physical, thermal, optical, electrical and chemical properties- Preparation and uses of thermoplastics polyethylene and PVC- Preparation and uses of thermosetting plastics nylon, epoxy resins, Bakelite- Rubber and uses of rubber- Vulcanization. - Biopolmers.
Self study: Simple extraction procedure

UNIT IV Industrial Chemistry and Magneto Chemistry 12 hrs

Silicones preparation, properties and uses- Manufacture and types of glass- Cement composition, manufacture and setting of cement- Fuel gases manufacture, composition and uses of producer gas, water gas, LPG and bio Gas- Softening of water: Ion exchange, electro dialysis and reverses osmosis methods - Volume, mass and molar susceptibility- Diamagnetism and temperature independent paramagnetism- Temperature dependent paramagetism- Ferro and antiferromagnetism- Measurements of magnetic susceptibility- Applications of magnetic susceptibility studies.
Self study: Fundamentals of magnetism

UNIT V Practical Chemistryii and Solvent Extraction 12 hrs

Introduction definition of various terms (titrations, volumetric analysis, titrant indicator, end point requirements of the reaction selected for the titration commom types of titration. Law of equivalence equivalent weight of acids, bases, oxidizing agents, reducing agents and salts calculation of molecular weights and equivalentweights. Requirements of a primary standard - Secondary standards- Numerical problems in the preparation of solutions- Law of normalities preparation of HCl, H_2SO_4, HNO_3(approximately 0.1N) from standard acids- Principles behind - Acid base titration - pH verses volume curves, choice of indicates form different acid base titrations- Permanganimetry- Dichrometrydiphenylamine and potassium ferricyanide as indicators- Iodimetry Preparation of iodine and starch solutions - starch as indicators- Iodometry role of $KMnO_4$ and $K_2Cr_2O_7$- Solution Nernst distribution law and solvent extraction numerical problems

Self study: Preparation of solution

Note: Course materials will be supplied to the students

ALLIED CHEMISTRY PRACTICAL – II (FOR PHYSICS)

Inorganic Qualitative Analysis

(Subject Code: 21UCHAP41)

Semester: IV	**Allied: AP4**	**Credit: 1**	**Hours/W: 2**

S. No	**Estimation**	**Link**	**Standard**
1	Strong Acid	Weak Base/Strong Base	Strong Base
2	Strong Acid	Strong Base	Weak Acid
3	Strong Base	Strong Acid	Weak Base
4	Oxalic acid	Potassium Permanganate	Oxalic acid
5	Ferrous Sulphate	Potassium Permanganate	Ferrous Ammonium Sulphate
6	Potassium dichromate	Ferrous Sulphate	Potassium dichromate
7	Ferrous Ammonium Sulphate	Potassium dichromate	Ferrous Sulphate
8	Potassium Permanganate	Sodium thiosulphate	Potassium dichromate
9	Magnesium Sulphate	EDTA	Zinc Sulphate
10	Zinc Sulphate	EDTA	Magnesium Sulphate

Note: Laboratory manual will be supplied

NON-CONVENTIONAL ENERGY SOURCES
(Course Code: 21 UPHE 41)

SEMESTER IV	HOURS – 4	CREDITS -4

Course Outcomes: At the end of the course the students will be able to

1. get knowledge about the Sun as a source of energy
2. learn about solar thermal and photovoltaic devices
3. understand the basic concepts of Wind, Bio-mass and Geothermal energy sources
4. learn Various forms of energy utilization concepts

Unit I Energy sources

Energy sources and their availability – commercial or conventional energy sources – fossil fuels, water power, nuclear energy - non-conventional and renewable energy sources – solar energy, wind energy, bio-mass, geothermal and tidal energy – advantages of renewable energy.

Unit II Solar energy

Introduction – solar constant – solar radiation at the earth's surface – beam and diffuse solar radiation – physical principles of the conversion of solar radiation into heat – flat plate collectors – concentrating collectors (focusing type) – solar pond - solar photo voltaic – solar cell principles – applications of solar energy.

Unit III Wind energy

Introduction - basic principles of wind energy conversion: nature of the wind – power in the wind – wind energy conversion – basic components of wind energy conversion – classification of wind energy conversion systems (WECS) – advantages and disadvantages of WECS - applications of wind energy.

Unit IV Geothermal energy

Introduction – estimation of geothermal power – nature of geothermal fields – geothermal sources – hydrothermal (convective resources) – geopressured resources – advantages and disadvantages of geothermal energy over other energy forms – applications of geothermal energy.

Unit V Biomass and tidal energy

Introduction – biomass conversion technologies – photosynthesis – biogas generation – factors affecting biodigestion on generation of gas - biogas plants –floating drum plant - fixed dome plant. Tidal energy – Basic principle of tidal power - advantages and limitations of tidal power generation – Wave - energy conversion devices – Advantages and disadvantages of wave energy.

TEXT BOOK:

Non-Conventional energy sources – G.D. Rai, Khanna Publishers – Fourth edition (2008).

BOOKS FOR REFERENCE:

1. Non conventional energy resources- D.S Chauhan and S.K Srivastava, New age international (p) Ltd, Second edition 2011.
2. Solar energy utilization - G.D.Rai, Khanna Publishers, Fifth edition (2009).
3. Solar energy principles of thermal collection and storage - S.P.Sukhatme , Tata McGraw Hill Publishing company Ltd., Second edition (1997).

SKILLED BASED ELECTIVE
ELECTRONICS IN DAILY LIFE
(COURSE CODE: 21 USB 42)

SEMESTER IV	HOURS - 2	CREDITS - 2

Course Outcomes : At the end of the course the students will be able to

1. get the hobby constructing electronics circuits.
2. construct the Logic gates diode rectifiers and simple circuits
3. know the components like resistances, transistors, capacitors etc.
4. construct the circuits in printed board circuits.
5. After completing the course the students are allowed to carry their circuits to their houses. Fabrication of printed circuit boards for different electronics circuits is also possible.

PROGRAMMING WITH C and C++
(Course Code: 21 UPH 51)

SEMESTER V	HOURS – 4	CREDITS - 4

Course Outcomes: At the end of the course the students will be able to

1. know the programming principles of C and C++
2. know the operators, expressions, and functions in C and C++
3. understand the OOP concepts
4. write programs to perform matrix addition sorting

Unit I: Introduction to C

Introduction to C – character set – constants – variables – data types – declaration of variables – arithmetic operators – relational operators – logical operators – assignment operators – increment and decrement operators – conditional operators – bitwise operators – special operators – arithmetic expressions – evaluation of expressions – procedure of arithmetic operators.

Unit II : Looping and Arrays

Reading and writing a character – formatted input and output – simple of statement – if-else statement – nesting of if-else statements – the else-if lad- der – switch statement – go to statement – while statement – do statement – for statement – jumps in loops – one dimensional array – two dimensional array – initializing arrays – multidimensional arrays.

Unit III: User defined functions

Need for user defined functions – return values and their types – no arguments and no return values – arguments but no return values – arguments with return values – structure definition – structure initialization – arrays of structures – arrays within structures – structures within structures.

Unit IV: Object Oriented Programming with C++

Introduction to C++ - basic concept of object oriented programming – object oriented languages – what is C++? – Applications of C++ - basic data types – user defined data types – derived data types – operators – manipulators – operator overloading – operator precedence.

Unit V: Functions in C++

Functions in C++ - main function – function prototyping – call by reference – return by reference – inline functions – default arguments – constant arguments – function overloading – classes and objects.-- C++ streams – C++ Stream classes- Unformatted I/O Operations- Formatted console I/O operations – Managing output with manipulators.

TEXT BOOKS:

1. E. Balagurusamy- Programming in ANSI C, Tata McGraw Hill, 4th Edition, 2007.
2. E. Balagurusamy - Object oriented program with C++, Tata McGraw Hill, 2nd Edition, 2007.

REFERENCE BOOKS:

1. Graham Neill - Learning C++, Tata McGraw-Hill, 2000.
2. D. Ravichandran - Programming with C++, Tata McGraw-Hill, 2000.
3. R. Rajaram - Object Oriented Programming and C++, New Age, 1997.

PRACTICALS (PROGRAMMING WITH C AND C++)
(Course Code: 21 UPH 56)

SEMESTER V	HOURS – 2	CREDITS - 1

1. To find the variance and standard deviation.
2. Evaluate sin x with .0001 accuracy.
3. Matrix addition.
4. Arrange the numbers in ascending order
5. Simple interest and compound interest
6. A program with arrays within a class.
7. To find the largest of N numbers
8. A program to manage console I/O operation.
9. Matrix multiplication.
10. Complex numbers manipulation

DIGITAL PRINCIPLES
(Course Code: 21 UPH 52)

SEMESTER V	HOURS - 4	CREDITS - 4

Course Outcomes: At the end of the course the students will be able to

1. understand the basic tool for the design of digital circuits and the hardware side of\ computers.
2. understand the basic concepts in arithmetic circuits
3. understand the difference between half subtractor and full subtractor
4. understand the various functions of flip flops and registers
5. understand the functions of registers and counters.

UNIT – I Arithmetic circuits

Binary, octal and hexadecimal number system - Boolean algebra – verification of Boolean relations – Sum of product circuits - Product of sum circuits - Karnaugh map simplification – binary addition – binary subtraction – $1's$ & $2's$ complement representation - arithmetic – operations half adder – full adder – half subtractor – full subtractor, Logic gates.

UNIT – II Data processing circuits

16 to 1 Multiplexer – 1 to 16 Demultiplexer – 1 of 16 decoder – BCD to decimal decoder – seven segment display – encoder – decimal to BCD encoder – Parity checker – Parity generation – ROM using diodes - PAL.

UNIT – III Flip flops

555 Timer – astable and monostable multivibrators – flip flop – RS flip flop – clocked RS flip flop – JK flip flop – JK Master Slave flip flop.

UNIT – IV Registers and counters

Registers – Universal gates – Types of registers – serial in serial out shift register – Parallel in parallel out shift register – Counters – Asynchronous counter (4 bit up - down) - Synchronous counter (4 bit up - down) – BCD ripple counter.

UNIT – V Digital to Analog conversion

Introduction – Resistor Divider D/A Counter – Binary Ladder Network D/A Converter – D/A Converter Specifications – Analog to Digital Conversion – A/D Counter – Simultaneous Conversion – Counter Method.

TEXT BOOK:

Donald P.Leach, Albert Paul Malvino, Goutam Saha – Digital Principles and Applications, Tata McGraw – Hill, 6 th Edition.

BOOKS FOR REFERENCE:

1. Mono Morris – Digital Logic and Computer Design, Prentice Hall, 2000.
2. Virendrakumar – Digital Electronics, New Age International, 2002.
3. Thomas C.Bartee – Digital Computer Fundamentals, Tata McGraw – Hill, 2002.

DIGITAL PRINCIPLES (PRACTICALS)
(Course Code: 21 UPH 57)

SEMESTER V	HOURS - 2	CREDITS - 1

1. Boolean Relations.
2. Flip-flops.
3. Gates (IC) - Verification of truth tables.
4. De Morgan's theorem - Verification.
5. Half adder and half subtractor.
6. Full adder and Full subtractor.
7. 16 to 1 Multiplexer.
8. 1 to 16 De Multiplexer.
9. BCD to Decimal decoder.
10. Decimal to BCD encoder.

ELECTRONICS - I
(Course Code: 21UPH 53)

SEMESTER V	HOURS - 4	CREDITS – 4

Course Outcomes: At the end of the course the students will be able to

1. understand the working of electronic devices.
2. apply these techniques in practical circuits
3. develop the skill in handling instruments
4. understand the various characteristics pertaining to diodes and its applications
5. understand the various biasing techniques.

UNIT I: Diode characteristics

Constant voltage source- constant current source- Maximum power transfer theorem- Thevenine's theorem- procedure for finding Thevenin Equivalent circuit- V-I characteristics of a PN junction diode- half wave rectifier-full wave rectifier- bridge rectifier-calculations of dc current, r.m.s value of current, rectifier efficiency, ripple factor in each case

UNIT II: Diode applications

Zener diode-Equivalent circuit-Zener diode as voltage stabilizer- LED- V-I characteristics-advantages- applications - photo diode - characteristics - applications – Schottky diode - clipping and clamping circuits - differentiator and integrator using passive elements

UNIT III: Transistor characteristics and biasing techniques

Junction transistor-working of a transistor– transistor action- transistor characteristics- CB, CE, CC- comparison between the three configurations - Alpha and beta of a transistor-operating point – transistor biasing - requirements of a biasing circuit - voltage divider biasing circuit

UNIT IV: Single stage, multistage and power amplifiers

Single stage transistor amplifier- classification of amplifiers- analyzing an amplifier - graphical method - equivalent circuit method - gain of a multistage amplifier - RC and transformer coupling- frequency response curve of an RC coupled amplifier- classification of power amplifiers

UNIT V: FET and UJT characteristics

FET- the junction field-effect transistor-The MOS field effect transistor-circuit characteristics of the FET- types of MOSFET- UJT-Construction-operation-equivalent circuit-characteristics-UJT as relaxation oscillator-over voltage detector.

TEXT BOOKS:

1. V.K.Mehta- Principles of electronics, S. Chand &Co Reprints 2010
2. Bhargava N.N, Kulshreshtha D.C and S.C Gupta - Basic electronics and linear circuits, Tata McGraw Hill Publishing Company Limited, 2007.
3. Milmann and Halkias – integrated electronics, Tata McGraw Hill-43rd reprint 2007

REFERENCE BOOKS:

1. John D. Ryder- Electronics fundamentals and applications, PHI V edition 1999
2. Albert Paul Malvino- Electronic principles, Tata McGraw Hill- 6th edition
3. N.N.Bhargava, D. Kulshrashtha & G. Gupta- Basic electronics and linear circuits, Tata McGraw Hill.

ELECTRONICS - I (PRACTICALS)
(Course Code: 21 UPH 58)

SEMESTER V	HOURS - 2	CREDITS – 1

1. Transistor characteristics - CE configuration.
2. Transistor characteristics - CB configuration.
3. Clipping circuits.
4. Differentiator and integrator.
5. Construction of Bridge rectifier.
6. FET characteristics.
7. UJT characteristics.
8. Construction of full wave rectifier.
9. SCR - Characteristics.
10. UJT relaxation oscillator.

NUCLEAR PHYSICS
(Course Code: 21 UPH 54)

SEMESTER V	HOURS - 4	CREDITS - 4

Course Outcomes: At the end of the course the students will be able to

1. Learn the basic concepts of physics of the nucleus, nuclear models and nuclear force.
2. Phrase a chronology of some of the major events in nuclear physics.
3. Distinguish between principles and working of different types of particles detectors, counters and accelerators.
4. Analyses the various nuclear reaction and application of nuclear fission and fusion.
5. Keep up with latest developments and new applications in nuclear physics.
6. Recognize the connection between nuclear physics and other branches of physics.

UNIT I Introduction to the nucleus

Introduction– classification of nuclei– general properties of nucleus– nuclear density– nuclear charge– spin angular momentum– resultant angular momentum– nuclear magnetic dipole moment– binding energy– packing fraction– nuclear stability– theories of nuclear composition– non-existence of electron within the nucleus– nuclear forces– meson theory of nuclear forces – liquid drop model– Weizacker's semi-empirical mass formula - shell model.

UNIT II Radiation detectors and particle accelerators

Interaction between energetic particles and matter– ionization chamber– proportional counter– bubble chamber– nuclear emulsion technique– Wilson cloud chamber– linear accelerator– cyclotron– synchrocyclotron – betatron – synchrotron.

UNIT III Radioactivity

Determination of e/m of alpha particles – alpha particle disintegration energy – alpha particle spectra – Gamow's theory of alpha decay – e/m of beta particle (Bucherer's experiment) – beta ray spectra – magnetic spectrograph – neutrino theory of beta decay – origin of gamma rays – nuclear isomerism – internal conversion – Mossbauer effect – Soddy Fajan's law – half life period – mean life - law of successive disintegration – radioactive dating: age of the earth – biological effects of nuclear radiations.

UNIT IV Nuclear reactions

Discovery of artifficial transmutation – Bohr's theory of nuclear disintegration – nuclear reaction – types – Q-value equation – nuclear transmutation by alpha particles, protons, deuterons, neutrons – artificial radioactivity – application of radioisotopes – discovery, basic properties and classification of neutrons – neutron sources – neutron detection – nuclear fission – Bohr and Wheeler's theory – chain reaction – atom bomb – nuclear reactors – nuclear fusion – source of stellar energy - thermonuclear reactions: hydrogen bomb.

UNIT V Elementary particles

Classification of elementary particles – fundamental interactions – strong interaction – electromagnetic interaction – weak interaction – gravitational interaction – elementary particle quantum numbers – baryon number – lepton number – strangeness number – hyper charge – isospin quantum number – conservation laws and symmetry – quark model – compositions of hadrons - coloured quarks and gluons – charm, bottom and top quarks - three generations of quarks and leptons.

TEXT BOOK:

1. R. Murugesan and Kiruthiga Sivaprasath – Modern Physics, S.Chand & Company Pvt. Ltd., Seventeenth Revised Edition 2014.
2. Mani H.S. and Mehta (G.K), Introduction to Modern Physics, Affiliated East West Press PVT Ltd

REFERENCE BOOKS:

1. Goshal, S.N. – Nuclear Physics, S.Chand & Company Pvt. Ltd., Revised Enlarged Edition, 2014.
2. Tayal, D.C. – Nuclear Physics, Himalaya Publishing House, 4th Edition, 2000.
3. Irwing Kaplan – Nuclear Physics, Narosa Publishing House, Edition 2002.
4. Elankovan, K. – Nuclear Physics, MJP Publishers, 2012.

FIBER OPTICS

(Course Code: 21 UPH 55)

SEMESTER V	HOURS – 4	CREDITS – 4

Course Outcomes: At the end of the course the students will be able to

1. Understand the overview of signals transmitted over optical fibers and optical fiber communication devices.
2. Understand the importance of fiber optic material like GA As laser, LED, modulation formats modulation and demodulation.
3. Know and differentiate types of losses, couplers and connectors its function
4. Understand the basic concepts of modulation and demodulation.
5. learn the various fiber optic materials.

UNIT – 1: Fiber optics – introduction

Introduction - different types of fibers - step index and graded index fibers - mode theory of fibers - single mode and multimode fiber – light propagation through step index fibers –- numerical aperture of graded index fiber - numerical aperture for skew rays in graded index fibers

UNIT – 2: Fiber couplers and connectors

Losses in fibers – absorption losses – scattering losses – bending losses – core and cladding losses – Fiber splices- fiber connectors and fiber couplers

UNIT – 3: Communication in fibers

Analog optical fiber communication system – digital optical fiber communication system – different generation in optical fiber – advantages of optical fiber communication – requirements for communication – laser fundamentals – laser action – threshold condition for laser action – optical fiber laser amplifier – soliton – soliton based optical fiber communication.

UNIT – 4: Optical sources

Semiconductor laser materials – PN junction laser diodes – Ga As laser diode – hetero junction laser diode – LED – Transient response of LED – heterojunction LED structures – surface emitting LED – edge emitting LED.

UNIT – 5: Modulation and Demodulation

Modulation – Demodulation -- modulation formats based on pockels and kerr effect- External modulators – Electro optic modulators — magneto optic modulators– acoustic optic modulators – demodulation schemes – photodetectors – PIN photo diodes – Avalanche photo diodes – photodetector noises

TEXT BOOKS:

1. Optical Fiber communication – Gend Keiser, 4th Ed. MGH, 2004
2. M.Arumugam – Semiconductor physics and optoelectronics, Anuradha Agencies 1st Edition 2005.
3. K.Thyagarajan and Ajoy Chatok – Introduction to Fiber Optics, Crystal Achagam Ed 1999-2000.
4. John M. Senior, Pearson Education, 3rd Impression, 2007
5. subir kumar sarkar. Optical fibers and fiber optic communication systems, 4th. Gol. S.Chand.2007

REFERENCE BOOKS:

1. Ajoy Chatak – Optics, TMH publishing Company 1st Edition 2000.
2. J.Wilson and J.F.W. Halkes – Optpelectronics – An introduction, Prentice Hall of India Edition 2001.
3. C.K.Sekar and D.C.Sarkar – Optoelectronics and Fiber Optics Communication, New Age International Edition 2004.
4. Pallab Battacharya – Semiconductor and optoelectronic devices, New Age International 2nd Edition.

QUANTUM MECHANICS AND RELATIVITY
(Course Code: 21 UPH E51)

SEMESTER V	HOURS – 4	CREDIT – 4

Course Outcomes: At the end of the course the students will be able to

1. understand the postulates of quantum mechanics and capable of solving one dimensional transmission and reflection problems.
2. understand Debroglie wavelength and the matter waves.
3. solve schrodinger time dependent and time independent equations
4. solve the various problems pertaining to hydrogen atom and rigid rotor
5. understand the differences between general and special theory of relativity.

UNIT I Matter waves

The de Broglie wavelength – G.P. Thompson's experiment – expression for group velocity – relation between group velocity and wave velocity – Experimental study of matter waves – Davisson and Germer's experiment – Compton effect.

UNIT II Uncertainty principle

Heisenberg's uncertainty principle – Determination of position with ã-ray microscope – Diffraction of a beam of electrons by a slit – Complementarity principle of Bohr – wave mechanical atom model – the particle in a box – Mathematical proof of uncertainty principle for one dimensional wave-packet – basic postulates of quantum mechanics.

UNIT III Schrodinger equations and their applications

Schrodinger time-dependent equation – Schrodinger time-independent (steady state) equation – Properties of the wave function – particle in a one- dimensional box – Potential step – the barrier penetration problem – Linear harmonic oscillator – the hydrogen atom – the rigid rotator.

UNIT IV Relativity

Relativity – frame of reference – Galilean transformation equations – the Michelson-Morley experiment – postulates of special theory of relativity – the Lorentz transformation equations – length contraction – time-dilation – the twin paradox – Relativity of simultaneity.

UNIT V Mass, energy and general theory of relativity

Addition of velocities – variation of mass with velocity – mass energy equivalence – Minkowski's four dimensional space-time continuum – the general theory of relativity.

TEXT BOOK:

1. R. Murugeshan and Kirthuthiga Sivaprakash - Modern Physics, Chand & company, 12th Revised Edition
2. 2005.
3. Mathews and Venkatesan, 1976, A Text book of Quantum Mechanics McGraw-Hill Higher Education

REFERENCE BOOKS:

1. S. P. Singh and M. K. Bagde - Quantum Mechanics, S. Chand & Co., Edition 1998-1999.
2. Kumar and Sharma -Quantum Mechanics, JaiPrakash Nath & Co., 5th Ed 2000.
3. Seighal and Chopra - Quantum Mechanics, Seeman Pathipagam, Ed 2000.
4. Arthur Beiser- Quantum Mechanics, Tata McGraw Hill, Ed 2010.
5. A. K. Saxena - Quantum Mechanics, Narosa Publishing House, 2002.
6. D. S. Mathur - Mechanics, S. Chand & Co., Ed 2009.

GEOPHYSICS
(Course Code: 21 UPH E51)

SEMESTER V	HOURS – 4	CREDIT – 4

Course Outcomes: At the end of the course the students will be able to

1. understand seismology
2. understand different waves and seismometry
3. know about earthquakes and gravity
4. understand the internal structure of the earth
5. learn radioactivity and sources of head within the earth

Unit 1. Seismology

Introduction and Seismology: Introduction - Seismology: P waves, S waves, their velocities - Time distance curves and the location of epicenters - Effect of boundaries - Major discontinuities and resulting phase of seismic waves - Derivation of properties from the velocities

Unit 2. scismometry

Surface Waves and Seismometry: Surface waves: Rayleigh waves and Love waves - Study of earth by surface waves. Seismometry: Horizontal seismograph and seismography equation - Strain seismograph.

Unit 3. Earth quake and Prediction

Earthquakes and Gravity: Earthquakes: Focus, magnitude, frequency - Detection and prediction - Gravity: The potential (Laplace's equation and Poisson's equation) - Absolute and relative measurements of gravity - Hammond Faller method - Worden gravimeter

Unit 4. Geo magnetism

Geomagnetism and Internal structure of the Earth: Geomagnetism: Fundamental equations - Measurements: method of Gauss, saturation induction magnetometers, proton precession magnetometers, alkali vapour magnetometers - Theories of earth's magnetism - Causes of the main field -Dynamo theories - Internal structure of the earth: The core variation of mechanical properties with depth - Materials and equation of state of the interior of the earth.

Unit 5. Geochronology

Geochronology and Geothermal Physics: Geochronology: Radioactivity of the earth - Radioactive dating of rocks and minerals Geological time scale - The age of the earth - Geothermal physics: Flow of heat to the surface of the earth - Sources of heat within the earth - Process of heat transport Internal temperature of the earth.

TEXT BOOKS:-

1. Garland, G.D., Introduction to Geophysics 11 Ed., WB Saunder Company, London, 1979.
2. Cook, A. H., Physics of the Earth and Planets I Ed, McMillan Press, London, 1973.

ELECTRONICS - II
(Course Code: 21 UPH 61)

SEMESTER - VI	HOURS - 4	CREDIT - 4

Course Outcomes: At the end of the course the students will be able to

1. attain a sound understanding of the principles of electronics. It enhances the designing capability of the learner.
2. learn the different electric parameters and units used and also the different types of power amplifiers
3. understand the feedbacks in amplifiers
4. understand the functions of operational amplifiers
5. learn the construction and working of oscillators.

UNIT I Feedback amplifiers

Feed back in amplifiers- gain with negative feedback-gain stability by negative feedback-reduction of non linear distortion-effect of feedback on output resistance-effect of feedback on input resistance-voltage series feedback(emitter follower)-current series feedback-differential amplifier-differential mode gain-common mode gain-CMRR.

Unit II Operational amplifiers

Op.amp- ideal characteristics-op.amp as inverting amplifier-virtual ground-non inverting amplifiers-input offset voltage-input offset current-slew rate- op.amps sign changer-scale changer-averaging amplifier-subtractor-differentiator-integrator-comparator-logarithmic amplifier-solving differential equations

Unit III Oscillators

Oscillators- barkhausen criterion for oscillation- positive feedback amplifier as an oscillator - Tuned collector oscillator-Hartley oscillator- Colpitt's oscillator- RC phase shift oscillator-piezo electric effect- piezo electric crystals-crystal oscillator.

Unit IV SCR characteristics and applications

SCR- working of SCR-equivalent circuit of SCR- important terms-V-I characteristics of SCR- SCR in normal operation- SCR as a switch- SCR turn on methods- SCR as half wave rectifier- SCR as full wave rectifier- SCR as over light detector

Unit V Modulation

Types of modulation- need for modulation-expression for power in AM wave-transistor AM modulator-balanced modulator-limitations of AM modulation-frequency modulation-expression for frequency modulated wave-advantages-FM transmitter-demodulation-diode detector.

TEXT BOOKS:

1. Principles of electronics-V.K.Mehta- Revised edition 2013.
2. Electronic fundamentals and applications- John D Ryder- V edition 1999.

REFERENCE BOOKS:

1. Integrated electronics- Millman and Halkias- Tata mc Graw Hill- 43rd reprint, 2007.
2. Electronics – Ubald Raj and Jose Robin- 2003 edition.
3. Electronic Principles – Albert Paul Malvino- Tata Mc Graw Hill- 6th edition.
4. Basic electronics and linear circuits- N. N. Bhargava, D. C. Kulshrashtha and S. C. Gupta-Tata McGraw Hill.

ELECTRONICS - II (PRACTICALS)
(Course Code: 21 UPH 66)

SEMESTER – VI	HOURS - 2	CREDIT - 1

1. Single stage amplifier without feedback.
2. Two stage amplifier.
3. Emitter follower.
4. Single stage amplifier with feedback.
5. Colpit's oscillator.
6. Hartley oscillator.
7. Op-amp - characteristics
8. Solving simultaneous equation.
9. A/D converter using Op-amp.
10. Op-amp - adder, subtractor, unit gain buffer.

MICROPROCESSOR (8085)
(Course Code: 21 UPH 62)

SEMESTER – VI	HOURS – 4	CREDITS – 4

Course Outcomes: At the end of the course the students will be able to

1. understand the microprocessor hardware and software
2. write programs using Assembly language and describe the purpose of microprocessor internal registers
3. demonstrate a thorough understanding of programming, implementing programs that search and sort arrays
4 know the terms applicable to microprocessor, program using Assembly Level Language.
5 understand the different types of interrupts

Unit I: 8085 Microprocessor Architecture

Microprocessors - Microprocessor Instructions Set and Computer Languages - Microprocessor architecture and its operations - Memory - I/O devices- Examples.

Unit II: Programming the 8085

Programming the 8085 - Data Transfer operations - Arithmetic operations Logic operations - Branch operations - Writing assembly language pro- grams - Programming techniques; Looping counting and indexing - Additional data transfer and 16 bit arithmetic instructions - arithmetic operations related to memory - Rotate - Compare.

Unit III: Stack and subroutines

Counters and Time delays - Stack - PUSH and POP instructions - Subroutine - CALL and RETURN instructions - Restart, Conditional CALL and RETURN instructions.

Unit IV: Code conversion

BCD to binary conversion – binary to BCD conversion – BCD addition – BCD subtraction – multiplication - Subtraction with carry - Sorting - Transfer a block of data - Transfer a block of data in reverse order.

Unit V: Interrupts

Interrupts - The 8085 interrupt - IN & RST instruction - Illustration of 8085 interrupt - Issues in implementing interrupts - multiple interrupts and priorities - 8085 vector interrupts - TRAP - RST 7.5, 6.5 and 5.5 - OUT instruction - Display a name - Digital clock design- Interfacing

TEXT BOOK:

1. Ramesh S. Gaonkar - Microprocessor Architecture, Programming and applications with the 8085., Penram International Publishing (India) Private Ltd, 5th Edition.

REFERENCE BOOKS:

1. Leventhal, Lance A, 8080A/8085-Assembly Language Programming, Osbrne McGraw-Hill, 2000.
2. Sunil MAthur, Microprocessor 8085 and its interfacing, PHI, 2010.
3. Udaya Kumar.k, Umasankar. B.S., The 8085 Microprocessor Architecture, Pearson Education, 2008.

MICROPROCESSOR (8085) (PRACTICALS)
(Course Code: 21 UPH 67)

SEMESTER – VI	HOURS – 2	CREDITS – 1

1. 8-bit addition and 8-bit subtraction
2. Unpacking of packed 8 bit number
3. Multiplication of two 8 bit numbers
4. Division of 8 bit number
5. Addition of N numbers
6. Multibyte addition
7. Multibyte subtraction
8. Multibyte decimal addition
9. Multibyte decimal subtraction
10. Largest of given N numbers
11. Smallest of given N numbers
12. Arranging numbers in a Ascending order
13. Arranging numbers in Descending order
14. Binary to BCD conversion
15. BCD to Binary conversion
16. Generating square wave / Triangular wave
17. Traffic signal display
18. Name display

SOLID STATE PHYSICS
(Course Code: 21 UPH 63)

SEMESTER VI	HOURS – 4	CREDITS - 4

Course Outcomes: At the end of the course the students will be able to

1. Remember the different bonding and structures of solid materials.
2. Understand the types of crystal systems based on lattice parameters identified using diffraction.
3. Distinguish materials based on electrical conductivity, arrangement of atoms/molecules- etc.,
4. Do quantitative calculations based on established theoretical models to describe the properties of materials.
5. Distinguish between different types of magnetic materials and different kind of magnetism manifested in materials.
6. Account for the links between solid state physics and other fundamental branches of physics.

UNIT I Bonding in solids

Interatomic forces–bonding-primary bonds - ionic bond- cohesive energy of ionic crystals - covalent bond- metallic bond–secondary bonds - molecular bond - Vanderwaals bond– hydrogen bond- dipole bond.

UNIT II Crystallography

Lattice points, space lattice, basis and crystal structure – unit cell and primitive cell -lattice parameters – Bravice lattices and crystal systems – lattice planes and Miller indices – inter planar spacing – packing fraction – simple cubic structure, body centered cubic structure, face centered cubic structure, hexagonal close packed structure, diamond structure, Zinc Blende structure, Sodium chloride structure, Caesium chloride structure.

UNIT III Semiconductors

Types of semiconductors– intrinsic and extrinsic semiconductors– Fermi level in intrinsic and extrinsic semiconductors– variation of Fermi level with temperature– carrier concentration in intrinsic semiconductors- carrier concentration in n-type and p-type semiconductors– band gap– direct and indirect band gap semiconductors – Hall effect.—semiconducting materials.

UNIT IV Dielectrics

Fundamental definitions– dielectric constant- polarizability– polarization – electronic polarisation– ionic polarisation– orientational polarisation– space-charge polarisation– frequency and temperature effects on polarisation– local field or internal field– Clausius-Mossotti relation– applications of dielectric/insulating materials- solid dielectric materials– liquid dielectric materials.

UNIT V Super conductors

Superconductivity– properties of superconductors– Meissner effect– effect of magnetic field - heat capacity– critical current - isotope effect– London penetration depth – type I and type II superconductors– BCS theory– applications --- magnetic levitation– SQUID – AC and DC

Josephson effect (qualitative explanation). – superconducting materials.

TEXT BOOKS:

1. M. Arumugam – Solid State Physics, Anuradha publications, 2nd Edition 2009, (Units I-IV).
2. S.O.Pillai - Solid State Physics, New Age International publishers, 60th Edition 2008 (Unit V).

REFERENCE BOOKS:

1. K. Elangovan - Solid State Physics, MJP Publishers, 2013.
2. Arun Kumar - Solid State Physics, PHI Learning Pvt. Ltd., 2010.
3. M.A.Wahab - Solid State Physics, Narosa Publishing House, 2nd Edition, 2010.
4. R.K.Puri and V.K.Babbar – Solid State Physics, S.Chand & Company Ltd., 2004.

INSTRUMENTATION
(Course Code: 21 UPH 64)

SEMESTER - VI	HOURS - 4	CREDITS - 4

Course Outcomes: At the end of the course the students will be able to

1. understand the construction and working principle of various type of measuring instruments and transducers
2. learn the difference between accuracy and precision
3. understand DC & AC indicating instruments
4. know the uses of Oscilloscopes
5. get the knowledge about display devices

Unit – I: Measurement and error

Measurement and error - definition - accuracy and precision - significant figures - types of error - statistical analysis - probability of errors - limiting errors - suspension galvanometer - torque and deflection of galvanometer - permanent magnet moving coil mechanism - Taut band suspension.

Unit – II: AC, DC Instruments and display devices

A) DC & AC indicating instruments:

DC ammeter - DC voltmeter - voltmeter sensitivity - loading effect - voltmeter - ammeter method of measuring resistance - series type ohmmeter - shunt type ohmmeter - multimeter - calibration of dc instruments - AC and DC indicating instruments - electrodynamometer - thermocouple instrument.

B) Digital display system and indicators:

Classification of displays - display devices - light emitting diodes - liquid crystal display -gas discharge plasma displays - electro luminent displays - incandescent display - liquid vapour display (LVD)

Unit – III: Electronic instruments for measuring basic parameters

Electronic instruments for measuring basic parameters - amplified DC meter - Chopper stabilized amplifier - AC voltmeter using rectifiers - true r.m.s - responding voltmeter - electronic multimeter - digital voltmeter - ramp type DVM.

Unit – IV: Oscilloscopes

Oscilloscopes - block diagram- electrostatic deflection - post deflection acceleration - delay line - function of the delay line - lumped parameter delay line - distributed parameter delay line - frequency determination (Lissajoues method).

Unit – V: Transducers

Transducers - classification of transducers - active & passive - applications –Active photoelectric transducer - photo emissive - photo conductive (passive) - strain gauge - LVDT.

TEXT BOOKS:

1. Helfrick and Cooper – Electronic Instrumentation and measurement Techniques, Prentice -Hall of India, 3rd Edition, 2000.
2. H.S. Kalsi - Electronic Instrumentation, Tata McGraw Publication, 2000.

REFERENCE BOOKS:

1. A.K. Sawhney - Course in Electrical and Electronic Instrumentation, Dhanpat Rai & Sons, 4th Edition, 2000.
2. U.A. Bakshi and A.V. Bakshi - Measurements and Instrumentation, Technical Publications, 3rd Edition 2009.
3. S. Namasivayam and S.V. Singaravelun -Measurements and Instrument, Technical Publications, 1st Edition 2000.
4. D.V.S. Murthy - Transducers and Instrumentation, Prentice Hill of India, 1st Edition, 2006.

INSTRUMENTATION (PRACTICALS)
(Course Code: 21 UPH 68)

SEMESTER - VI	HOURS - 2	CREDITS - 1

1. Calculation of standard deviation and variance and probable error.
2. Plotting of histogram of a physical quantity.
3. Construction of a multi range dc voltmeter.
4. Construction of series - type ohm meter
5. Construction of shunt - type ohm meter
6. Calibration of dc ammeter/ dc voltmeter
7. Full wave rectifier as ac voltmeter
8. Photo electric Transducer
9. Measurement of voltage & frequency by CRO /4 bit D/A converter using op-amp 741.

REACTOR PHYSICS
(Course Code: 21 UPHE 61)

SEMESTER VI	HOURS- 4	CREDITS - 4

Course Outcomes: At the end of the course the students will be able to

1. understand the nuclear reactions
2. understand about reactor theory
3. understand the differences between fission and fusion reaction
4. know the various sources of reactor fuel
5. understand the radioactive effects

Unit I Neutron Interactions

Slow Neutron reactions - Nuclear reaction cross sections - Compound nucleus formation - Energy dependence of neutron cross section - Fission cross section

Unit II Thermal Neutrons and Diffusion

Energy distribution of thermal neutrons - Effective cross section for thermal neutrons - Slowing down of reactor neutrons - Thermal neutron diffusion - Diffusion equation - Diffusion length - fast neutron diffusion and Fermi age equation

Unit III Reactor Theory

Multiplication factor; - Neutron leakage and critical size - Nuclear reactors and their classification - Pressurised water reactors∝ - Boiling water reactor - Gas cooled reactor - Homogeneous reactor - Nuclear fission reactor - Nuclear fussion reactor - Reactor control - Reactor shielding - Research Reactors - calculation of k_∞ for a homogeneous reactors - critical equation and reactor buckling.

Unit IV Control of Nuclear Reactors

Basic Principles of control - Methods of control - source control - Specification of the control system - Types of control rods - Range of control system - Temperature effect - Fuel Depletion - Fission product poisoning - burnable poisons

Unit V Reactor Fuels

Fuel introduction - Source of uranium - Treatments of uranium ores - production of reactor fuels - Separation of uranium isotopes by gas diffusion - Reactor fuel cycle - Radioactive waste disposal

TEXT BOOKS:

1. Salomon E. Liverhant - Elementary Introduction to Nuclear Reactor Physics - John Wiley & Sons Ltd (1966)
2. Samuel Glasstone - Principles of nuclear reactor engineering – D. Van Nostrand Company Inc. (1955)

BOOKS FOR REFERENCE:

1. John R. Lamarsh - Introduction to Nuclear Reactor Theory – Addison-Wesley Publishing Company (1966)
2. John R. Lamarsh & Anthony J. Baratta - Introduction to nuclear engineering 3rd edition - Prentice Hall Inc (2001)
3. Raymond L. Murray - Nuclear Energy - An-Introduction to the Concepts Systems and Applications of Nuclear Processes 6th edition – Butterworth Heinemann - Elsevier (2009)
4. Samuel Glasstone & Alexander Sesonske - Nuclear Reactor Engineering - Reactor Systems Engineering 4th edition Volume 2 – Springer Science Business Media (1994)

NANO PHYSICS
(Course Code: 21 UPH 65)

SEMESTER VI	HOURS - 4	CREDITS – 4

Course Outcomes: At the end of the course the students will be able to

1. understand the basic concepts in nano particles and crystal
2. understand the properties of measuring the properties.
3. understand the various functions of transmission and scanning electron microscope
4. understand the various carbon nanostructures
5. understand the effects of nanotechnology and its environment.

Unit I : Introduction to the physics of the solid state

Introduction – Atomic structure – crystallography – insulators ,semiconductors and conductors—donors , acceotors and deep traps—mobility—excitons—reciprocal space—Fermi surfaces.

Unit II : Properties of individual Nanoparticles and measuring techniques

Introduction – Metal Nanoclusters – Magic numbers – theoretical modeling of Nanoparticles – geometric structure – electronic structure – bulk to Nanotransition.- – particle size determination – Transmission Electron Microscopy – Field Ion Microscopy – Scanning Electron Microscope—Dynamic light scattering—Infrared surface spectroscopy—Raman spectroscopy-- Photoluminescence

Unit III Semiconducting Nanoparticles

Semiconducting Nanoparticles – optical properties – methods of synthesis – RF plasma – chemical methods – thermolysis – pulsed laser methods.

Unit IV Carbon Nanostructures

Introduction – carbon clusters – small carbon clusters – discovery of C_{60} – superconductivity in C_{60} – larger and smaller fullerences – carbon nanotubes– fabrication – structure – electrical properties – vibrational properties – mechanical properties – applications of carbon nanotubes – field emission an shielding – computers – fuel cells – chemical sensors.

Unit V Organic compounds and polymers

Introduction- forming and characterizing polymers – polymerization –sizes of polymers – nano crystals- condensed ring types – polydiacetylene types – polymers. –conductive polymers- block copolymers

TEXT BOOKS:

1. Charles P. Poole and Frank J. Owens - Introduction to Nanotechnology (Unit I – IV),John Wiley & sons (Asia) Pvt. Ltd. Reprint 2007.
2. Dr. Shalini Suri - Nanotechnology – Basic science to emerging technology, (Unit V) , APH Publishing Corporation, New Delhi, 2006.
3. Nano: The Essentials book by T. Pradeep McGraw-Hill Education

REFERENCE BOOKS:

1. Michael J. O'Connell - Carbon nanotubes: properties and applica- tions, CRC/Taylor & Francis, 2006.
2. Poorvi Dutta & Sushmita Gupta - Understanding of Nano Science and Technology, Global Vision Publishing Ho, 2006.
3. Martin V. Berg - Frontal nanotechnology research, Nova Science Publishers, 2007.

SPECTROSCOPY
(Course Code: 21 UPH E61)

SEMESTER - VI	HOURS - 4	CREDITS – 4

Course Outcomes: At the end of the course the students will be able to

1. understand the properties of electromagnetic spectrum
2. know the classification and interaction of molecules
3. understand the concepts of infrared spectroscopy
4. understand the Raman spectra and Raman effects
5. differentiate ESR and NMR

Unit I: Electromagnetic Spectrum

Electromagnetic spectrum-properties-Atomic spectra-molecular spectra-fluorescence-phosphorescence-different spectroscopic methods-spectral line width-absorption and emission of radiation-Einstein's coefficient-laser as a spectroscopic source-sources, detection and investigations of ultra violet spectroscopy and infrared spectroscopy.

Unit II: Classification of molecules

Classification of molecules-interaction of radiation with rotating molecule-Rotational spectra of rigid diatomic molecule-isotope effect in rotational spectra-intensity of rotational lines-non –rigid rotator-linear polyatomic molecules-symmetric top molecules-asymmetric top molecules-microwave spectrometer-information derived from rotational spectra.

Unit III: Infrared spectroscopy

Infrared spectroscopy-vibration energy of a diatomic molecule-infrared spectra-preliminaries-infrared selection rules-vibrating diatomic molecules-diatomic vibrating rotator-asymmetry of rotation-vibration band-vibrations of polyatomic molecules-normal vibrations of CO2 and H2O molecules-rotation vibration spectra of poly atomic molecules-interpretation of vibration spectra-group frequencies.

Unit IV: scattering of Light

Discovery-explanation of light scattering by molecules-nature of Raman spectra-apparatus used for studying Raman effect-sample preparation-mechanism of Raman effect-Raman effect in liquids-Raman effect in gases-Raman effect in solids-applications of Raman effect to chemistry-molecular structure-qualitative analysis-advantages and limitations of Raman spectroscopy.

Unit V: Instrumentation

Introduction-Nuclear spin and magnetic moment-nuclear magnetic resonance-theory of NMR spectroscopy-precession of particles in a field-resonance-flipping-the origin of signal-instrumentation-technique and principle-experimental methods of NMR spectroscopy-interpretation of spectra ESR spectroscopy-introduction-limitations of ESR-difference between ESR and NMR-instrumentation to study ESR.

TEXT BOOKS:

1. Ubaldraj and Jose robin – Spectroscopy, Indira publication, first edition 2010.

REFERENCE BOOKS:

1. Kiruthiga Sivaprasath & R Murugeshan - Optics and Spectroscopy, S. Chand and Co Ltd, 2008.
2. Kiruthiga Sivaprasath & R Murugeshan - Modern Physics, S. Chand & Co Ltd, 18th edition, 2016.

SELF STUDY PAPERS
CRYSTAL GROWTH AND CHARACTERIZATION

Course Outcomes: At the end of the course the students will be able to

1. understand the basics of crystal growth
2. understand the various crystal growth techniques
3. understand the basic concepts in solution growth techniques
4. understand the various characterization methods in the formation of crystals
5. understand the various methods in vapour growth and epitaxy.

UNIT- I Basics of Crystal Growth

The crystalline state – concept of crystal growth – Historical review – Importance of crystal growth – Crystal Growth theory: Classical theory – Gibbs-Thomson equation – Kinetic Theory of nucleation – Energy of formation of a nucleus.

UNIT- II Solution Growth

Solution - Choice of solvents - Preparation of solution – Solubility and super solubility - Saturation and Super Saturation – Measurement and expression of super saturation - Constant temperature bath and crystallizer – Seed preparation and mounting Low temperature solution growth - solvent evaporation methods – Temperature gradient method

UNIT- III Growth from Melt and flux

Fundamentals of melt growth – Phase diagram and phase rules – Bridgman method – various crucial design – Vertical Bridgman technique – Experimental arrangement - Czochralski technique – Experimental arrangement – Verneuil method – Kyropolous Method – Zone melting method.

UNIT- IV Vapour Growth and Epitaxy

Basic principle – Methods – Physical vapour deposition – Evaporation and sublimation process – sputtering – Chemical vapour deposition– Physical vapour transport – Chemical vapour transport – Epitaxy – Vapour phase epitaxy (VPE) – Liquid phase epitaxy (LPE) – Molecular beam epitaxy (MPE

UNIT- V Characterization Methods

X-ray powder diffraction method-Single crystal method-Debye scherrer method – Electron microscopy techniques-SEM, EDAX and TEM – Optical methods-UV-Vis spectroscopy studies-Band gap calculation-Fluorescence and Photoluminescence studies.

BOOKS FOR STUDY AND REFERENCES:

1. K.Sangawal, Elementary Crystal Growth – Sahan Publisher, UK, 1994.
2. M.M.Flaktor, I.Garret, Growth of Crystals from Vapor, Chapmann and Hall (1988)
3. P.Santhana Ragavan, P.Ramasamy, Crystal Growth And Processes, KRU Publications, Kumbakonam (2000)
4. P.Ramasamy, ISTE Summer school Lecture Notes, Crysatl Growth Centre, Anna University, Chennai (1991)
5. J.C.Brice, Crysatl Growth Process, John Wiley Publications, New York (1996)

6. A.A.Chernov, Modern crystallography:III,-Crysatal Growth in Solid State, Springer Series, NewYork (1984)
7. B.R.Pamplin, Progress in Crystal Growth Characterization, Pergamon Press Ltd. (UK)
8. X.F.Zong, Y.Y.Wang, J.Chen, Material and Process characterization for VLSI, World Scientific, New Jersey (1998).
9. M. William and D. Steve, Instrumental Methods of Analysis (CBS Publishers, New Delhi, (1986).
10. H. H. Williard, L. L. Merritt, J. Dean, and F. A. Settle, Instrumental Methods of Analysis – Sixth Edition, CBS Publishers & Distributors, Delhi (1986).

SELF STUDY PAPERS
THIN FILM GROWTH AND TECHNOLOGY

Course Outcomes: At the end of the course the students will be able to

1. understand the basic concepts in basic of thin films
2. understand the various characterization techniques
3. understand the various applications in mems and solar cell applications.
4. understand the properties of thin films and their applications.
5. know the various methods of preparation in thin films and crystals

UNIT I Basics of Thin Films

Steps in thin film growth process- sticking coefficients, surface bombardment rate; Thin film growth models- adsorption, thermal accommodation, Van der Waals forces, lifetime of adsorbed species, surface diffusion, chemisorptions.

UNIT II Properties of Thin Films

Mechanical properties of thin films: Elastic and plastic behavior of thin films. Theories of size effect, Optical properties of thin film: optical constants, reflectance, transmittance and absorbance.

UNIT III Preparation of Thin Films

Physical methods: Vacuum evaporation - Study of thin film vacuum coating unit - Construction and uses of vapour sources-wire, sublimation, crucible and electron bombardment heated sources. Resistance heating method – Electron beam method.

UNIT IV Thickness measurement

Electrical methods – optical interference methods – multiple beam interferometry – Fizeau – FECO methods – Quartz crystal thickness monitor.

UNIT V Characterization Techniques

X-ray diffraction, electron microscopy, high and low energy electron diffraction, Auger emission spectroscopy. Photoluminescence(PL) – Raman Spectroscopy, UV-Vis-IR Spectrophotometer – AFM – Hall effect – SIMS – X-ray Photoemission Spectroscopy (XPS) - Dynamic light scattering – ellipsometry method

BOOKS FOR STUDY AND REFERENCES:

1. L I Maissel and R Clang, Hand book of Thin films Technology, McGraw-Hill (1970).
2. George Hass, Physics of thin films, vol. 12 , Academic Press (1963). K. L. Chopra, Thin Film Phenomena, McGraw - Hill, 1969.
3. J. L. Vossen and W. Kern, Thin Film processes, Academic Press, 1978
4. T. J. Coutts, Active and Passive Thin Film Devices, Academic Press, 1978.
5. M. Grasserbauer and H. W. Werner, Analysis of Microelectronic Materials and devices, John Wiley and Sons, 1991.
6. M. Ohring, The Materials Science of Thin Films, Academic Press, 1992.
7. A Wagendristel and Y. Wang, An introduction to Physics and Technology of Thin Films,(World Scientific, 1994.
8. K.L. Chopra, Thin Film Phenomena, McGraw-Hill (1983).
9. K.L. Chopra and and I.J. Kaur, Thin Film Solar Cells, Plenum Press (1983).
10. J.C. Anderson, The Use of Thin Films in Physical Investigation, Academic Press (1966).
11. R.W. Berry, P.M. Hall and M.T. Harris, Thin Film Technology, Vn Nostrand (1968).
12. Ludminla Eckertova, Physics of Thin Films, Plenum press, New York (1977).
13. A. Goswami, Thin Film Fundamentals, New Age international (P) Ltd. Publishers, New Delhi (1996).