सत्यमेव जयते

GOVERNMENT OF PUDUCHERRY
DEPARTMENT OF PHYSICS
KANCHI MAMUNIVAR CENTRE FOR PG STUDIES
(AUTONOMOUS)
COLLEGE WITH POTENTIAL FOR EXCELLENCE
(REACCREDITED AT B++ GRADE BY NAAC)
(AFFILIATED TO PONDICHERRY UNIVERSITY)
PUDUCHERRY – 605 008.

KMCPGS

STRUCTURE OF THE COURSE
M.Sc. PHYSICS – CHOICE BASED CREDIT SYSTEM (CBCS)
SCHEME OF EXAMINATION
SYLLABUS FOR SEMESTER I TO IV
&
M. Phil - PHYSICS - SCHEME OF EXAMINATION
SYLLABUS FOR SEMESTER I & II

(EFFECTIVE FROM THE ACADEMIC YEAR **2019-2020** AND THEREAFTER)

NOTE : REVISED BY 9th BOS

M.Sc DEGREE UNIVERSITY EXAMINATION
SCHEME OF EXAMINATIONS
(FOR STUDENTS ADMITTED IN 2019-20 ONWARDS)

1. Theory papers - (Theory paper, Practical);

(A) EXTERNAL (University Exam.) - 60 Marks
(B) INTERNAL ASSESSMENT - 40 Marks

i)The best THREE and Average of best two out of 15Marks -15 Marks
ii) End semester test out of 60 marks -15 Marks
iii) Seminar and assignment /Record -10 Marks

Total - 40 Marks

TOTAL - 100 Marks

2. Project (Softcore):

(A) EXTERNAL (University Exam.) - 60 Marks
i) Preparation and Presentation of the project: 40 Marks
ii) Viva-Voce : 20 Marks

Total : 60 Marks

(B) INTERNAL ASSESSMENT - 40 Marks

i) Literature survey : 15 Marks
ii) Sample Preparation/Programming : 15 Marks
iii) Viva-oral / written test : 10 Marks

Total : 40 Marks

TOTAL - 100 Marks

STRUCTURE OF THE COURSE M.Sc. PHYSICS – CHOICE BASED CREDIT SYSTEM (CBCS)

SCHEME OF EXAMINATION

SEMESTERS - I & II

SEMESTER	PAPER NUMBERS	COURSE	CODE	TITLE OF THE PAPER	HOURS/ WEEK(30)	CREDITS	TOTAL CREDITS
S – I	PAPER-I	Hard Core Course - 1	PHHT -101	Classical Mechanics	4	4	18
	PAPER-II	Hard Core Course - 2	PHHT -102	Mathematical Physics	4	4	
	PAPER-III	Hard Core Course - 3	PHHT -103	Electronics and communication	4	3	
	PAPER-IV	Practical - I	PHHP -104	Practical – I	8	4	
	PAPER-V	Soft Core -I	PHSC -105X (X=A/B/C/D)	From list-I in Annexure-I	4	3	
		Seminar / Tutorial/ Test			6		
S -II	PAPER-VI	Hard Core Course - 4	PHHT- 206	Quantum Mechanics - I	4	4	18
	PAPER-VII	Hard core Course - 5	PHHT -207	Statistical Mechanics	4	4	
	PAPER-VIII	Hard core Course - 6	PHHT- 208	Condensed Matter Physics	4	3	
	PAPER-IX	Practical - II	PHHP -209	Practical – II	8	4	
	PAPER-X	Soft Core - II	PHSC -210X (X=A/B/C/D)	From list-II in Annexure-I	4	3	
		Seminar / Tutorial/ Test			6		

STRUCTURE OF THE COURSE
M.Sc. PHYSICS – CHOICE BASED CREDIT SYSTEM(CBCS)
SCHEME OF EXAMINATION SEMESTERS-III&IV

SEMESTER	PAPER NUMBER	COURSE	CODE	TITLE OF THE PAPER	HOURS/ WEEK (30)	CRE-DITS	TOTAL CRE-DITS
S-III	PAPER-XI	Hard Core Course - 7	PHHT-311	Quantum Mechanics - II	4	4	20
	PAPER-XII	Hard Core Course - 8	PHHT-312	Electrodynamics and Plasma Physics	4	4	
	PAPER-XIII	Hard Core Course - 9	PHHT-313	Microprocessor and Microcontroller	4	3	
	PAPER-XIV	Practical - III	PHHP-314	Practical - III	8	4	
	PAPER-XV	Soft Core -III	PHSC-315X (X=A/B/C/D)	From list-III in Annexure-I	4	3	
	PAPER-XVI	INTERNSHIP PROGRAMME	PHIP-316		4	2	
		Seminar / Tutorial/ Test			2		
S-IV	PAPER-XVII	Hard Core Course-10	PHHT -417	Principles of Spectroscopy	4	4	18
	PAPER-XVIII	Hard core Course-11	PHHT-418	Nuclear and Particle Physics	4	4	
	PAPER-XIX	Hard core Course-12	PHHT-419	Nanoscience	4	3	
	PAPER-XX	Practical - IV	PHHP-420	Practical –IV	8	4	
	PAPER-XXI	Soft Core-IV	PHSC -421X (X=A/B/C/D)	From list-IV in Annexure-I	4	3	
		Seminar / Tutorial/ Test			6		

ANEXTURE-II

SYLABUS FOR SOFT CORE PAPERS

PAPER-1: LIQUID CRYSTALS (PHSC- 105 A)

UNIT- I: Introduction

States of matter, Liquid crystals, Symmetry, structure and order, Mesogenic molecules, Liquid crystals of achiral and chiral molecules, calamitic, disc shape and polymer liquid crystals.

UNIT –II: Physical Properties

Order parameters, measurement by magnetic resonance spectroscopy, Optical anisotropy, refractive index, Dielectric anisotropy, dielectric permittivity, Diamagnetic anisotropy, magnetic susceptibility;, Transport properties, Elastic constants, continuum description. Statistical Theories of Nematic Order: Landau-de-Gennes theory, hard particle, Maier saupe- and van der Walls type theories.

UNIT- III: Types of liquid crystal

Nematic-Smectic A transition- Phenomenological description, McMillan theory, ymorphism in smectic A Phase.

UNIT- IV: Chiral liquid crystals

Chirality in liquid crystals: chiral nematic phase, optical properties, field induced nematic-cholesteric phase change, distortion of structure by magnetic field; Blue phase. Chiral smectic phases, origin of ferroelectricity: Structure, symmetry and ferroelectric ordering in chiral smectic C phase; Antiferroelectric and ferroelectric chiral smectic C phase.

Reference Books:

1. Liquid Crystals: S. Chandrasekhar.
2. The Physics of Liquid Crystals: P.G. de Gennes and J Prost.
3. Liquid Crystals, Fundamentals: S Singh.

PAPER -2: NONLINEAR DYNAMICS (PHSC – 105 B)

UNIT -1: Introduction Oscillator system

Harmonic oscillator, phase space motion in phase space, oscillator as integrable system, pendulum conservation and non-conservation of areas in phase space, damped harmonic oscillators, dissipation, forced oscillator, stability of solutions sensitivity to initial conditions.

UNIT -2: Ordinary differential equation

Linear ODE, S+N decomposition. Linearization of nonlinear equations, stable and unstable manifolds HortmonGrobman theorem, stable manifold theorem. Flows &maps ,Periodic system, Floquet multipliers, Poincore section. Attractors: Types of attractors, strange attractors, stretching and folding, Lorenz and Rossler attractors.

UNIT – 3: Maps

Logistic map, analysis of the logistic map, period doubling, intermittency Feigenbaum universality circle map, standard map, Henonmap.Elements of bifurcation theory, routes to chaos.

Characterization of chaotic solutions and attractors, power spectrum, ergo-dicity, invariant measure, Lyapunov exponent, dimensions and their evaluation, K-entropy and symbolic dynamics.

UNIT -4: Hamiltonian systems Introduction

Hamiltonian phase flow and integral invariants, canonical formalism, Hamilton-Jacobi methods, Generating functions, integrable systems, Liouville Arnold integrability Central force problem, Harmonic oscillators, Toda chain, action variables. Perturbation Theory : Adiabatic invariance, Averaging KAM theorem Resonances, variational calculation of Tori, Stochastic motion. Diffusion other area preserving systems: Maps Baker's transformation, Cat map, and Stmbolicsynamics.

Recommended Books:

1. Ordinary Diff. Equations, V. J. Arnold.
2. Differential Equations, Dynamical Systems and an Introduction to Chaos, Hirsch, Smale and Devaney, Academic Press, (Elsevier Imprint), 2004.
3. Int. to applied nonlinear dynamical ststems& Chaos, Wiggins (Springer Verlag).
4. Nonlinear Oscillations, Dynamical Systems and bifurcations of vector fields, Springer Verlag,
5. Guckenheimer and Holmes, (Springer Verlag).
6. Chaotic Evolution and Cambridge, D. Ruelle. (Uni. Press),
7. Nonlinear Ordinary diff. Eq., Jordan & Smith, (Oxford Univ. Press).
8. Nonlinear dynamics & Chaos, Strogatz, (Addison Wesley).
9. Chaos and integrability in Nonlinear Dynamics, An introduction, M. Tabor, (J. Wiley), 1989.
10. Introduction to Dynamics, I. Percival, D. Richards, (Cambridge Univ. Press).
11. Berge Pomeo Vidal, Order within chaos, J.Wiley, 1984.
12. Chaos in Dynamical System, E. Ott, (Cambridge University Press).
13. Chaotic Dynamics, G. L. Baker, J. P. Gollub, (Cambridge University Press).
14. Chaotic Dynamics of Non-linear Systems, S. Neil Rasband, (John Wiley).

PAPER -3: ENERGY PHYSICS (PHSC – 105 C)

UNIT I : Introduction to Energy Sources and solar cells

Energy sources – Types of energy sources – World energy futures- Energy sources and their availability – Prospects of renewable energy sources.Solar Cells: Solar cells for direct conversion of solar energy to electric powers – Solar cell parameter – Solar cell electrical characteristics – Efficiency – Single crystal silicon solar cells – Polycrystalline silicon solar cells – Cadmium sulphide solar cells.

UNIT II : Applications of Solar Energy

Solar water heating – space heating and space cooling – solar photo voltaics – agricultural and industrial process heat – solar distillation – solar pumping– solar furnace – solar cooking – solar green house.

UNIT III : Wind Energy

Base principles of wind energy conversion wind data and energy estimation – Base components of wind energy conversion systems (WECS) types of wind machines – Generating systems – scheme for electric generation – generator control – load control – applications of wind energy.

UNIT IV : Energy from Biomass

Biomass conversion Technologies – wet and Dry process – Photosynthesis-Biogas Generation: Introduction – basic process and energetic – Advantages of anaerobic digestion – factors affecting bio digestion and generation of gas – Classification of Biogas plants: Continuous and batch type – the done and drum types of Bio gas plants – biogas from wastes fuel – properties of biogas – utilization of biogas.

BOOKS FOR STUDY AND REFERENCE:

1. F. Kreith and J.F. Kreider, Principles of Solar Engineering, Tata McGraw Hill (1978).
2. A.B. Meinel and A.P.Meinel, Applied Solar Energy, Addison Wesley Publishing Co. (1976).
3. M.P.Agarwal, Solar Energy, S. Chand and Co., New Delhi (1983).
4. S.P.Sukhatme, Solar Energy, Tata McGraw Hill (1997).
5. G.D. Rai, Non-conventional Energy sources, Khanna Publications,Delhi (2009).

PAPER 4 : ASTROPHYSICS (PHSC – 105 D)

Unit-I: Observational Astronomy

The electromagnetic spectrum; geometrical optics (ray diagrams, focal length, magnification etc); diffraction (resolving power, Airy disc, diffraction limit etc); telescopes (reflecting, refracting, multi-wavelength).

Unit-II: Properties of stars

Brightnesses (luminosities, fluxes and magnitudes); colours (blackbody radiation, the Planck, Stefan-Boltzmann and Wien laws, effective temperature, interstellar reddening); spectral types; spectral lines (Bohr model, Lyman &Balmer series etc, Doppler effect); Hertzprung -Russell diagram; the main sequence (stellar masses, binary systems, Kepler's laws, mass-luminosity relations); distances to stars (parallax, standard candles, P-L relationships, m-s fitting etc); positions of stars (celestial sphere, coordinate systems, proper motions, sidereal and universal time).

Unit-III: The life and death of stars

Quantaization of gravitational field –gravitation-Energy source (nuclear fusion, p-p chain, triple-alpha, CNO cycle, lifetime of the Sun); solar neutrinos; basic stellar structure (hydrostatic equilibrium, equation of state); evolution beyond the main sequence; formation of the heavy elements; supernovae; stellar remnants (white dwarfs, neutron stars, black holes, degeneracy pressure, Swarszchild radius, escape velocities).

Unit-IV: Galaxies

Constituents of galaxies; stellar populations; the interstellar medium; HII regions; 21cm line; spirals and ellipticals; galactic dynamics; galaxy rotation curves and dark matter; active galaxies and quasars.

Recommended texts:

1. Zeilik& Gregory, Introductory Astronomy & Astrophysics,4thed (Saunders College Publishing)
2. Morison, I., Introduction to Astronomy and Cosmology (Wiley)
3. Kutner, M.L., Astronomy: A Physical Perspective (Cambridge University Press)
4. Green, S.F. & Jones, M.H., An Introduction to the Sun and Stars(Cambridge University Press)
5.Jones,M.H.&Lambourne,R.J.A.,AnIntroductionto Galaxies &Cosmology(Cambridge University Press)
6. Carroll, B.W. &Ostlie, D.A., An Introduction to Modern Astrophysics(Pearson)
7. Shu, F.H.,The Physical Universe, An Introduction to Astronomy (University Science Books)
8. Motz, L. &Duveen, A.,The Essentials of Astronomy , (Colombia University Press)

PAPER-5: COMPUTATIONAL PHYSICS (PHSC – 210 A)

Unit -I: Fortran Programming fundamentals

Fortran constants and variables, Type declarations,Arithmetic operators, Hierarchy, Arithmetic expressions, Logical operators and expressions, Arithmetical and assignment statements, Special functions, Input/output statements, Relational operators, Control statements(go to, arithmetic and logical if), Do loop, repeat hile,Dimensioned variables, Formats, Subprograms, Functions and subroutines, Common declaration, File operations (creating, reading, writing, updating and merging of sequential files), Complex Arithmetic, Enough exercises.

Unit -II: Essentials of Numerical Techniques

Roots of transcendental equations: Bisection,Iteration, Newton- Raphson methods (SS). Linear interpolation: Newton's forward, backward& general formula, Lagrange formula. Least squares curve fitting: (Linear and Nonlinear), Numerical integration: General formula, Simpson's formula's, Gauss quadrature formula, Solution of ordinary differential equations: Runge-Kutta method (first and higher orders), Enough exercises.

Unit -III: Random numbers, Random walk

Concepts of randomness, Random number generators,Pseudo random numbers, Tests for randomness, Random walk – basic concepts, Brownian motion and diffusion, Enough exercises.

Unit -IV: Fourier analysis Spectral analysis

Finding root of a polynomial by Newton-Raphson method, Application of Fortran programming to physical problems; Programmes for interpolation and extrapolation, computing eigenvalues and eigen functions of a matrix, Integration and Differentiation, Solution to differential equations, Diffusion and Brownian motion problems(Simple).

Text Books

1. Computer Programming in Fortran 90, V. Rajaraman, PHI
2. Programming with Fortran 77 – Schaum's Outline Series, McGraw Hill
3. Introductory Methods of Numerical Analysis – S. S. Sastry (SS), PHI
4. Numerical Mathematical Analysis – J. B. Scarborough, Oxford & IBH
5. An Introduction to Computational Physics, 2nd ed. – Tao Pang - Cambridge University Press,Cambridge (2006)

References

1. Computational Physics – An Introduction – R.C. Verma, P.K. Ahluwalia and K.C. Sharma, New Age International Publishers, New Delhi (1999)
2. A first Course in Computational Physics – Paul L De Vries, John Wiley & Sons, Inc, New York (1994)

3. Numerical Recipes in Fortran, The art of Scientific Computing, W. H. Press et al Cambridge.
4. Computer Simulation of Liquids, M. P. Allen, D. J. Tyldesley, Clarendon Press, Oxford.

PAPER-6: RADIATION PHYSICS (PHSC – 210 B)

UNIT- 1: Radiation sources

Different types of sources, alpha, beta, gamma, neutron and heavy ion sources, radioactive sources – naturally occurring, production of artificial isotopes, accelerators – cyclotrons, nuclear reactors.

UNIT – 2: Interaction of radiations with matter

Electrons – classical theory of inelastic collisions with atomic electrons, energy loss per ion pair by primary and secondary ionization, specific energy loss, bremsstrahlung, range energy relation, energy and range straggling Heavy charged particles – stopping power, energy loss, range and range – energy relations, Bragg curve, specific ionization, Gamma rays – Interaction mechanism – Photoelectric absorption, Compton scattering, Pair production,gamma ray attenuation, attenuation coefficients, Elastic and inelasticscattering, Neutrons – General properties, fast neutron interactions, slowing down and moderation .

UNIT -3: Radiation quantities, Units and Dosimeters

Particle flux and fluence, energy flux andfluence, cross sections, linear and mass absorption coefficients, stopping power, LET,exposure and its measurements, absorbed dose and its relation to exposure,Kerma, Biological effectiveness, Equivalent dose, Effective loss, Dosimeters,Primary and secondary dosimeters, Pocket dosimeter, Films and solid dosimeter (TLD and RPL), Clincal and calorimetric devices.

UNIT- 4: Radiation transport and shielding

Basic concept, Transport equation, Fick's law and diffusion equation, Boundary conditions, Analytical solution, Slowing down theory,Resonance absorption, Criticality calculations, Fermi age theory, Four factor formula, Shielding factor for radiations, Choice of material, Primary and secondary radiations, Source geometry, Beta shielding, Gamma shielding, neutron shielding, Shielding requirements for medical, industrial and research facilities.

Reference books :

1."Atomic Nucleus" , R.D. Evans
2."Source book on Atomic Energy" – Samuel Glasstone
3."The Physics of Radiology", H.E. Jones and Cunningham, (Charles C Thomas – 1989)
4."Fundamentals of radiology", W.J. Meredith and J.B. Massey (John Right and sons – 1989)
5."Principles of radiation shielding", A.B. Chilton (Prentice Hall of India)

PAPER- 7: NANOTECHNOLOGY AND ITS APPLICATIONS (PHSC – 210 C)

UNIT-I: INTRODUCTION

Introduction to Nano –Technology - Nano particles as building Blocks. Nano – particle - Processing (Mechanical, wet Chemical) Importance of Nano particle – Nano rods – Nano wires.

UNIT –II: APPLICATION – I (Environment, Energy and Chemistry)

Filtration - Reduction of energy consumption - Increasing the efficiency of energy production - Chemical sensor - Interaction of sensor with its environment. Synthesis of quantum dots - Quantum dots in chemistry - Advantages of inorganic quantum dots over organic Fluoropheres.

UNIT – III: APPLICATION – II (Information, Communication, and Application to Computers)

Memory Storage - Novel semiconductor devices - Novel optoelectronic devices. Displays - Quantum computers - Nano manipulations - Nano robots - Benefits of Nano computers.

UNIT – IV: APPLICATION – III (Bio –Medical Application)

Nano electromechanical devices to drug delivery systems-MEMS &NEMS Regulatory dimension - Implantable devices - Photo dynamic therapy in targeted drug administration - Bio sensor types - Bio sensor and marketing of sensor device - Quantum dot technology in cancer treatment - Quantum dots in early diagnosis of cancer.

TEXT BOOKS

1. Nano Bio Technology SubbiahBalaji Mjppublishers.com
2. Introduction to Nanotechnology Charles P Poole JR and frank J.Owens Wiley International.
3 .Hand Book of Nano technology Akhlesh and Lakhtakia Prentice Hall of India

BOOKS FOR REFERENCE

1 .Nano scale Materials of Chemistry Kennath J. KlabundeA John Wiley and Sons
2. Nanotechnology Richard Bukker and Earl Boison Wiley Publishing Company
3 Nano bio technologyChristoberM.NiemeyerChadd A. MirkinSchlapbach

PAPER –8: LASER AND ITS APPLICATIONS (PHSC – 210 D)

UNIT – I: LASER FUNDAMENTALS

Unique properties of Laser : coherence , monochromaticity , directionality and Intensity - Absorption , spontaneous emission and stimulated emission. Metastable level - Population inversion - A brief general outline of working of Laser. Light amplification - Threshold Condition - Steady state population inversion - Three level and four level systems.

Laser resonators : Plane mirror and curved mirror cavities- Cavity losses and condition for lasing - Quality factor - Q – Switching and Short laser pulses. Longitudinal laser cavity modes Transverse cavity modes - Mode locking and ultrashort pulses .

UNIT – II: LASER SYSTEMS

LASER structure - Excitation mechanism - Working with energy level diagram of Low density gain media : Helium – Neon laser , Argon ion laser, Carbon dioxide LASER , Nitrogen LASER and excimer LASERS. High density gain media : Ruby LASER , Nd – YAG and Nd –Glass LASERS , semiconductor LASERS, colour centre LASERS and Dye LASERS.

UNIT – III: LASER SPECTROSCOPY

Laser Raman Spectroscopy : Hyper Raman effect - stimulated Raman effect -coherent anti – stokes Raman effect , Photo – acoustic Raman scattering. Hormonic generation - Phase matching optical mixing - Photo dependent refractive index - Self focusing. Multiphoton processes : multiquantum photoelectric effect - Theory of two photon processes - Doppler free two photon spectroscopy - Laser fluorescence.

UNIT-IV: APPLICATIONS OF LASERS

Optical Fibre communication: optical fibres numerical aperture. Pulse dispersion in step index fibers - Modal analysis for a step index fiber. Vector modes optical fibre communications laser ranging. A brief description of LASER applications in industry, medicine, astronomy and biology. Application of LASER in Isotope separation.

TEXTBOOK

1.Lasers and Non Linear Optics: B.B.Laud- Wiley Eastern Ltd.
2.Laser Theory and Application: A.K.Ghatak and K.Thyagarajan- Macmillan India Ltd.
3.Laser Principles,Types and Application: K.R.Nambiar- New Age International.

BOOKS FOR REFERENCE

1.Principles of laser: Grazio Svelto- Plemum Press
2.Laser Fundamental: William T. Silfvast- Cambridge University
3.Lasers: Lengyel- Wiley Inter Science

PAPER –9: ENVIRONMENTAL SCIENCE (PHSC – 315 A)

UNIT-I: NATURAL RESOURCES

Renewable and non-renewable resources: Natural resources and associated problems - Forest resources, Water resources, Mineral resources, Food resources, Energy resources, Land resources. Role of an individual in conservation of natural resources, Equitable use of resources for sustainable life styles.

UNIT-II: ECOSYSTEMS

Concept of an ecosystems – Structure and function of an ecosystem – producers, consumers and decomposers. Energy flow in the ecosystem – Ecological succession – Food chains – Introduction, types, characteristic features, structure and function of the following ecosystem – Forest ecosystem – desert ecosystem – aquatic ecosystem.

UNIT-III: BIO-DIVERSITY AND ITS CONSERVATION

Introduction – definition: genetic species and ecosystem diversity; Bio - geographical classification of India, value of biodiversity - productive use, social, ethical and option values, Biodiversity at global, national and local levels, India as a mega-diversity nation, Hot – spots of biodiversity, Threats to biodiversity – Habitat loss, poaching of wildlife, man – wildlife conflicts, Conservation of biodiversity – In-situ and ex-situ conservation of biodiversity.

UNIT-IV: ENVIRONMENTAL POLLUTION

Definition: Cause, effect and control measures of Air pollution, Water pollution, Marine pollution, Thermal pollution, Nuclear hazards, solid waste management – causes effects and control measures of urban and industrial waste – Role of an individual in prevention of pollution, pollution case studies, Disaster management – Floods. Earthquake, cyclone.

TEXT BOOKS

1.Environmental Science & Engineering: Dr.A. Ravikrishnan- Sri Krishna Hitech Publishing Company Pvt.Ltd.
2. Environmental Science & Engineering: P.Anandan & R. Kumaravelan- Scitech Publications(India) Pvt. Ltd.

BOOKS FOR REFERENCE

1.Environmental Science and Engineeri: Anubhakaushik and C.P. Kaushik- New Age International Pub
2.Environmental Pollution Control Engineering: C.S.Rao- New Age International Pub.
3.Environmental Chemistry: A.K. De- New Age International Pub.
4.Environmental Studies: Erach Bharucha- University Press.
5.Introduction to Environmental Engineering: P.Anandan & R. Kumaravelan- Prentice-Hall of India.

PAPER 10: CRYSTAL GROWTH (PHSC – 315 B)

Unit- 1: NUCLEATION AND KINETICS OF CRYSTAL GROWTH

Theories of nucleation - classical theory of nucleation - heterogeneous nucleation - singular and rough faces - modes on surface roughness - Kossel, Stranski, Volmer (KSV) theory -Burton, Cabrera, Frank (BCF) theory - periodic bond chain theory - Muller-Krumbhaar model.

Unit -2: CRYSTAL GROWTH FROM THE MELT

Growth from the melt - Bridgeman and related techniques - crystal pulling - convection in melts - simulation of bulk crystal - melt growth of oxide crystals - Czochralski technique - Zone melting technique - Skull melting process - verneuil process - heat exchanger method.

Unit- 3: SOLUTION GROWTH

Low temperature solution growth - crystal growth system - non-linear phenomena in KDP family crystals - solubility of KDP and ADP - Seed preparation - high temperature solution growth - growth of potassium titanyl phosphate - practical aspects.

Unit- 4: MODERN CRYSTAL GROWTH TECHNIQUES

Vapour growth (physical and chemical) - Hydrothermal growth - Electro crystallization - Gel growth - Liquid crystals - Technology of Epitaxy - Practical aspects.

BOOKS FOR STUDY

1. Crystal growth process and methods Dr.P.Santhanaraghavan and Dr.P.Ramasamy: KRU Pub, Kumbakonam, 2000.
2. Physics of crystals, Macmillan S.Bhagavantam and S.Radhakrishna , New Delhi, 1965
3 .Crystal growth processes J.C.Brice , John wiley and sons, New York, 1986

BOOKS FOR REFERENCE

1. Crystal Growth H.E.Buckley, John wiley and sons, New York, 1986
2The Artand Science of growing crystals J.Gilman:Johnwiley and sons, New York 1965
3. Fundamentals of crystal physics I.Sirotin and P.Shaskolskaya: Mir Publications, New Delhi, 1982.

PAPER- 11: MEDICAL PHYSICS (PHSC – 315 C)

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Unit- I: MECHANICS OF HUMAN BODY

Static, dynamic and frictional forces in the body-composition, properties and function of bone-heart-temperature-temperature scales-clinical thermometer- thermography- heat theraphycroyogenics in medicine- heat losses from body-pressure in the body pressure in skull, eye and urinary bladder.

Unit- II: PHYSICS OF RESPIRATORY AND CARDIOVASCULAR SYSTEM

Body as a machine-airways system-blood & lungs interaction measurements of lung volume-structure and physics of alveoli breathing mechanism- ventilators-types of ventilators- airway resistance- components & functions of cardiovascular systems-work done by heart-components & flow of blood-laminar and turbulent flow-blood pressure-direct and indirect method of measuring-heart sounds.

Unit- III: ELECTRICITY IN THE BODY

Nervous system & neuron-electrical potentials of nerves electric signals from muscles, eye, heart-block diagram & working to record EMG- normal ECG wave form- electrodes for ECGamplifier and recording device-block diagram and working to record ECG-patient monitoring-pace maker.

Unit- IV: DIAGNOSTIC X-RAYS AND NUCLEAR MEDICINE

Production and properties of X rays-basic diagnostic X-ray machine - X-ray image - live X-Ray image - X-ray computed tomography-characteristics of radio activity-radio isotopes and radio nuclides - radioactivity sources for nuclear medicine – basic instrumentation and clinical applications- priniciples of radiation therapy - nuclear medicine imaging devices-radiation sources – Basic principles of photodynamic therapy.

Books for study

1. Study Material prepared by the Department
2. Hand of biomedical instrumentation (section 33.3 & 33.4)
3. R.S.Khandhur, 2010, Tata McGraw Hill education privatelimited.

PAPER – 12: PHILOSOPHY OF PHYSICS (PHSC -315 D)

Unit-I: Basics tools of logic

Propositions, Observations, concept, theory, Meaning of knowledge and process of knowledge generation, Inductive and detective logic, evolution of symbolic logic. Truth and proofs. Otology and epistemology in knowledge.

Unit-II: Space time and motion

Definition of time, prediction, and simultaneity. Equation of motion and realism. Generalized formulations and reality. Principle of correspondence. Absolute and Relative space time. Newton's Determinism.

Unit-III: Philosophy in quantum mechanics

Measurement, identity, observer observable paradox, Non Locality, space time Quantum mechanics and entanglement, correlation. Vector space and reality. Concept of free will. Probability, sets and Godales theorem.

Unit-IV: Contemporary issues in physics and philosophy

Relation of statistics and mechanics. Duality and questions in non-deterministic approach of reality. Bohr, Bohm, Einstein logic in physics. Inclusiveness in metaphysics.

Textbooks

1. J. T. Cushing (1998) Philosophical Concepts in Physics (Cambridge: Cambridge University Press)

PAPER-13 : CHARACTERIZATION OF MATERIALS (PHSC – 421A)

UNIT – I: Structural characterizations

Construction, Principle and working of XRD, SEM, TEM, AFM, XPS, TGA-DTA characterization techniques- Data analysis using above characterization techniques.

UNIT – II: Compositional Analysis

Atomic Absorption Spectrometry: EDAX, Augurelectron spectroscopy- Working, actual determination, limitations, procedure, and experimental analysis.

UNIT – III: Optical Properties

UV–Vis, IR, 2D-NMR and Raman spectroscopy and photoluminescence: principle and working, reflection, absorption, transmission analysis, band gap determination, Identification of molecular groups for radicals in solids, zero phonon mode of vibration, electron-phonon and phonon-phonon interactions and scattering geometry in Raman spectroscopy.

UNIT - IV: Thermal characterization

Theories of TGA,DTA,DSC-Experimental procedure- Data analysis.

Reference books

1. Elements of X- ray diffraction By B. D. Cullity, (1956), Addison-Wesley Publishing company Inc., USA
2. X ray theory and experiments by Compton and Alison
3. Instrumental methods of analysis (Vthedition) by Willard, Merritt, DeanSettle
4. Photoelectrochemical solar cells by Suresh Chandra
5. Solar cells by Martin a Green
6. Thin film preparation by Joy George
7. Characterization techniques by ChatwalAnand
8. Modern Raman Spectroscopy: Practical Approach by Deon and Smith
9. Microscopy of materials - D.K. Bowen & C.R. Hall (the MacMillan press Ltd. (London) 1975
10. Characterization of Materials, John B. Wachtman&Zwi. H. Kalman, Pub. Butterworth-Heinemann (1992)

PAPER-14 : BIO-ELECTRONICS (PHSC – 421 B)

UNIT - 1 Signals & classification

Biosignals& origin, volume conduction, Time & frequency domain, characteristics of biosignals such as ECG, EEG, EP, EMG, MEG Signal acquisition & processing basics.

UNIT - 2 Electrode + electrode interface

Polarization, Electrode behavior & circuit model, Electrode skin interface, Body surface electrodes, internal electrodes, Microelectrodes, electrode arrays, Displacements, resistive, capacitive, piezoelectric sensors, temperature measurement, fiber-optic sensors, radiation sensors for biomedical uses

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UNIT - 3 Bioelectric amplifiers

Basic requirements, Differential amplifier, Instrumentation amplifier, Integrators, differentiators, active filters, ECG amplifier, right leg driven system, EEG multichannel amplifiers &filters, noise filtering & transient protection, Amplifiers for use with glass electrodes & intracellular electrodes.

UNIT - 4 Stimulators, Recording

Constant current & constant voltage stimulator, internal external stimulators Pacemaker types & circuits, Photo-stimulator for vision, Acoustic stimulators for hearing, Wave shaping circuits &waveform generator, Complete recording system for ECG, EMG, EEG, EP & specifications, Cardiac monitors, defibrillator, ventilator systems, hemodiatctar system, micro shock, macro shock hazards, Basic approach for shock protection.

Text Books:

1. Principles of Neural Science – Kandel & Schwartz (Elsevier, North Holland), 1981.
2. Op-Amps & linear Integrated Circuits - Gaikwad, (EEE Prentice Hall).
3. Biomedical Instrumentation, (EEE Prentice Hall).
4. Introduction to Biomedical Equipment Technology-Carr& Brown (John Wiley)
5. Design of Microcomputer based medical Inst, Webster & Tompkins
6. Encyclopedia of Biomed, Inst. Ed. Webster
7. Digital Electronics, Malvino& Leach

PAPER-15: PHYSICS IN EVERYDAY LIFE (PHSC– 421 C)

(For other Department also)

Unit – 1:Physics and Life

Physics in Earth's Atmosphere: Sun, Earth's atmosphere as an ideal gas; Pressure, temperature and density, Pascal's Law and Archimedes' Principle, Coriolis acceleration and weather systems, Rayleigh scattering, Red sunset, Reflection, refraction and dispersion of light, Total internal reflection, Rainbow.

Unit – 2:Physics in Human Body:

The eyes as an optical instrument, Vision defects, Rayleigh criterion and resolving power, Sound waves and hearing, Sound intensity, Decibel scale, and temperature control.

Unit – 3:Physics in Sports:

The sweet spot, Dynamics of rotating objects, Running, Jumping and pole vaulting, Motion of a spinning ball, Continuity and Bernoulli equations, Banana shot: Magnus force, Turbulence and drag.

Unit – 4:Physics in Technology:

Microwave ovens, Lorentz force, Global Positioning System, CCDs, Lasers, Displays, Optical recording, CD, DVD Player, Tape records, Electric motors, Hybrid car, Telescope, Microscope, Projector etc.

Text Book

1. University Physics by F. W. Sears, M. Zemansky, R. A. Freedman, and H. D. Young, Pearson Education
2. Fundamentals of Physics by D. Halliday, R. Resnick, J. Walker, John Wiley & Sons