ST. TERESA'S COLLEGE
(AUTONOMOUS)
ERNAKULAM

CURRICULUM AND SYLLABUS FOR BACHELOR'S PROGRAMME IN PHYSICS

Under Choice Based Credit & Semester System

(2015 Admissions Onwards)

GRADUATE ATTRIBUTES

On completion of the B.Sc. programme in Physics, Students should be able to demonstrate the graduate attributes listed below.

- Systematic functional knowledge and understanding of core physical concepts, principles and theories and their applications.
- Proficiency in the appropriate use of contemporary technology in Physics.
- Ability to apply effective, creative and innovative solutions both independently and cooperatively to current and future problems in Physics.
- Adequate knowledge in Statistical methods to understand and analyse problems in science.
- Skills in the use of computers for control, data acquisition and data analysis in experimental investigations.
- Efficiency in the analysis of complex physical problems and the use of mathematical and other appropriate techniques including computer technology to solve them.
- Commitment to the highest standards of professional endeavour.
- Ability to work both autonomously and collaboratively.
- Proficiency to demonstrate effective communication in oral and written English language.
- Confidence in using a second language Hindi, Malayalam or French for effective communication.
- Ability to be a self-directed learner, fostering a healthy intellectual curiosity in Physics as well as in other disciplines and the ability to determine one's own learning needs and to organise one's own learning.
- Independent to plan, execute, analyse and report upon the results of an experiment or investigation.
- Professional skills of team work, independent learning, information

retrieval, critical analysis and communication of scientific concepts in writing and orally.

- Enthusiasm and curiosity in Physics and its applications and confidence in the work using principles of Physics.
- Encouraged to become informed, responsible and respected members of society.

Also the course enables graduates to be ethically informed and able to

- Demonstrate respect for the dignity of each individual and for human diversity.
- Recognize responsibility for common good, environment and society.
- Demonstrate values, knowledge, skills and attitudes appropriate to the discipline and profession.
- Solve problems taking local and international perspectives into account.
- Utilise information and communication and other technologies effectively for the betterment of society and mankind.

Objectives:

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

1) The students should have attained a common level understanding in basic mechanics and properties of matter,
2) A secure foundation in mathematics and other relevant subjects to complement the core for their future courses,
3) Developed their experimental and data analysis skills through a wide range of lab experiments.

By the end of the second year (4th semester),

1) The students should have been introduced to a broad spectrum of topics in Electricity, Electronics and Electrodynamics.
2) Familiarised with additional relevant mathematical techniques and other relevant subjects to complement the core.
3) Developed their experimental skills through a series of experiments supplementing major themes of the lecture courses.

4) Obtained effective communication skills.

By the end of the third year (6^{th} semester),

1) The students should have covered a range of topics in almost all areas of physics including quantum physics, solid state physics, computational physics, optics and spectroscopy, nuclear physics, thermal and statistical physics and electronics,
2) Undergone through the experience of independent work such as projects; seminars and assignments,
3) Specialised in one of the frontier area of Physics via Choice Based learning.

SYLLABI OF COURSES

CORE COURSES

Semester I

PH1B01TB Methodology in Physics and Simple Harmonic Motion

Credits – 2

Total lecture hours – 36

Aim

This course will be an introduction to the pursuit of Physics, its history and basic footsteps. The course also aims at emphasizing the importance of error analysis which is central to physics and will provide a theoretical basis for doing experiments in related areas.

Course Overview and context

Physics is, the oldest and most basic pure science; its discoveries find applications throughout the natural sciences. The course starts with a view on the discoveries starting from ancient to modern times. As we know, no measurement of a physical quantity can be entirely accurate and it is important to have knowledge about the deviations of measured quantity from true value. Brief

discussions about how errors are reported, the kinds of errors that can occur, how to estimate random errors, and how to carry error estimates into calculated results are included as a part of this course. Understanding simple harmonic motion is essential for later study of waves, sound, light, alternating currents.etc. A detailed study on harmonic motion is also included in this course.

Module I

Historical perspective on Physics and its method (7 hrs for guidance only)

Ancient perspectives on the universe - Geocentric model of Ptolemy – Copernican revolution - Galileo and his emphasis on experiments and observations- Kepler's laws -Newton and the deterministic universe - Maxwell and the unification of electricity, magnetism and optics - Planck's hypothesis of quantum- Einstein and his theories of relativity - Contributions by S. N. Bose, M. N. Saha, C. V. Raman and S. Chandrasekhar- Emergence of modern physics and technology - Semiconductor revolution – nanotechnology - Contemporary worldview - the expanding universe – fundamental particles and the unification of all forces of nature.

(The above topics are meant for self study by the students under the guidance of teachers. Not included for external evaluation and meant for internal evaluation only. All from a historical and qualitative perspective .Derivations not required but related equations may be applied at its fundamental level.)

Learning resources:

www.britannica.com.

This online Encyclopedia is a good resource for module I (See articles on Ptolemaic System, Copernican System, Galileo, Johannes Kepler, James Clerk Maxwell, Electromagnetism, Max Planck, Quantum Mechanics and Relativity.)

Vignettes in Physics – G. Venkataraman, Universities Press

This series of books gives authentic accounts of contributions of Indian physicists (See 'Bose and his Statistics', 'Saha and his formula', 'Raman and his effect' and 'Chandrasekhar and his limit')

Module II

Simple harmonic motion (7 hrs)

Periodic and harmonic motion-Harmonic oscillator - SHM- differential equation of SHM, phase relationship between displacement, velocity, acceleration of simple harmonic oscillator- energy of a simple harmonic oscillator- average values of kinetic and potential energies of a harmonic oscillator-some examples of S.H.M.-the simple pendulum, the compound pendulum-determination of value of g-by means of a bar pendulum , by means of a Kater's pendulum

Text book:Mechanics – Prof. D.S Mathur Revised by: Dr. P.S Hemne. , S Chand & Company Pvt. Ltd, Chapter 7

Damped and Driven Harmonic Oscillators (10 hrs)

Damping- theory of damped harmonic oscillator- differential equation -over, under, critically damped cases, logarithmic decrement - power dissipation- quality factor-driven harmonic oscillator- differential equation- amplitude resonance-sharpness of resonance – phase of the driven harmonic oscillator - velocity amplitude –half width of resonance curve

Text book:Mechanics – Prof. D.S Mathur Revised by: Dr. P.S Hemne. , S Chand & Company Pvt. Ltd, Chapter 8

Module III

Error Analysis (12 hours)

Basic ideas – uncertainties of measurement – importance of estimating errors – dominant errors – random errors – systematic errors - rejection of spurious measurements-Estimating and reporting errors – errors with reading scales, errors of digital instruments – number of significant digits –absolute and relative errors - standard deviation – error bars and graphical representation-propagation of errors – sum and differences – products and quotients – multiplying by constants – powers - calibration – need for calibration – methods of calibration.

Learning resources:

1. ***An Introduction to Error Analysis: The Study of Uncertainties in Physical Measurements, John R. Taylor - Univ. Science Books***
2. ***http://www.upscale.utoronto.ca/PVB/Harrison/ErrorAnalysis/***
3. ***http://phys.columbia.edu/~tutorial/index.html***

References:

1. Cultural Boundaries of Science -Gieryn, T.F., Univ. Chicago Press, 1999.

2. The Golem: What Everyone Should Know About Science - Collins H. and T. Pinch. Cambridge Univ Press, 1993.
3. Conceptual Integrated Science - Hewitt, Paul G, Suzanne Lyons, John A. Suchocki & Jennifer Yeh, Addison-Wesley, 2007
4. The Truth of Science , Newton RG.: New Delhi, 2nd edition
5. Mechanics- H.S.Hans and S.P.Puri. ,Tata McGraw-Hill
6. Properties of Matter- Brijlal and N. Subrahmanyam ,S. Chand & Co.
7. Mechanics- J.C. Upadhyaya ,Ram Prasad and sons
8. Fundamentals of Physics – Halliday and Resnik ,John Wiley & sons
9. Properties of Matter - -D.S.Mathur ,S.Chand
10. Concepts of Modern physics-Arthur Beiser,TMH.

Competencies:

C1. Recognize Ancient perspectives on the universe
C2. State Kepler's laws
C3. Identify Newton and the deterministic universe, Maxwell and the unification of electricity, magnetism and optics
C4. State Planck's hypothesis of quantum
C5. Identify Einstein and his theories of relativity
C6. Mention Contributions by S. N. Bose, M. N. Saha, etc
C7. Aware of Emergence of modern physics and technology
C8. Summarize Contemporary worldview
C9. Differentiate Periodic and harmonic motion
C10. Explain Harmonic oscillator
C11. Express energy of a harmonic oscillator
C12. Instantiate S.H.M
C13. Recognize Damping
C14. Explain theory of damped & driven harmonic oscillator-
C15. Generalize Differential equation -over, under, critically damped cases
C16. State terms associated with damped & driven harmonic oscillations
C17. Identify Basic ideas regarding uncertainties of measurement
C18. Mention importance of estimating errors
C19. Classify errors
C20. Investigate Estimating and reporting of errors

C21. Clarify errors with reading scales, errors of digital instruments
C22. Write down the number of significant digits
C23. Calculate absolute, relative errors, standard deviation
C23. Represent error bars
C24. Compute propagation of errors in sum, differences, products, quotients, multiplication by constants, power of a measured quantity
C25. Identify the need for calibration

Semester II

PH2B02TB Mechanics and Properties of Matter

Credits – 2

Total contact hours – 36

Aim

This course will try to provide conceptual understanding of basic physics to students and will provide a theoretical basis for doing experiments in related areas.

Course Overview

This course exposes students to basic physics. Module I is divided into rigid body dynamics and viscosity. Module II handles wave motion and acoustics. The last module covers elasticity and surface tension.

Module I

Dynamics of Rigid Bodies (9 hrs)

Rigid body – translational and rotational motion-torque -angular momentum-angular impulse -Moment of inertia- radius of gyration, General theorems on moment of inertia- parallel and perpendicular theorems for a plane lamina and 3D body (proof) , calculation of moment of inertia of uniform rod, rectangular lamina, thin circular ring, circular disc, annular ring, solid cylinder, hollow cylinder, solid sphere, hollow sphere-kinetic energy of rotation- moment of inertia of flywheel(experimental determination), applications of flywheel.

Text book:*Mechanics – Prof. D.S Mathur Revised by: Dr. P.S Hemne. , S Chand & Company Pvt. Ltd, Chapter11*

Viscosity (4 hrs)

Laminar or viscous flow- Newton's law of viscous flow-coefficient of viscosity- steady or stream line and turbulent flow – lines and tubes of flow- -Critical velocity,-significance of Reynold's Number- Poiseuille's equation for a liquid flow through a narrow tube (method not included)- Motion of body in a viscous medium- Stoke's method for the coefficient of viscosity of a viscous liquid (the falling sphere viscometer)-effect of temperature and pressure on the viscosity of liquids

Text book:*Mechanics – Prof. D.S Mathur Revised by: Dr. P.S Hemne. , S Chand & Company Pvt. Ltd, chapter 15*

Module II

Wave Motion (6 hrs)

Wave motion- types of waves – wavelength, frequency, wave number – displacement, velocity and pressure curves- Expression for a plane progressive harmonic wave - particle velocity and wave velocity -differential equation of wave motion - energy density of a plane progressive wave – distribution of energy in a plane progressive wave, energy current –intensity of wave- superposition of waves- interference –beats- Doppler effect, Doppler effect in light

Text book:

1. ***Mechanics – Prof. D.S Mathur Revised by: Dr. P.S Hemne. , S Chand & Company Pvt. Ltd, Chapter10***
2. ***For topics Doppler effect and Doppler effect in light -- A textbook of sound- N. Subrahmaniam, Brijlal, Vikas Publishing House Pvt.Ltd,Revised edition , ,Chapter 8***

Acoustics (4 hrs)

Acoustics - reverberation- Sabines reverberation formula(Derivation not needed) -determination of absorption coefficient- acoustic intensity- acoustic measurements -factors affecting acoustics of buildings- sound distribution in an auditorium-requisites for good acoustics-ultrasonics-acoustic grating

Text book:*A textbook of sound- N. Subrahmaniam, Brijlal, Vikas Publishing House Pvt.Ltd, Revised edition ,Chapter 10*

Module III

Elasticity (9 hrs)

Hookes law- elastic limit, elastic behavior of solids in general-different types of elasticity-work done per unit volume- Poisson's ratio, limiting values of Poisson's ratio- relation between volume strain and linear strain. Twisting couple on a cylinder, angle of twist and angle of shear -torsional rigidity -ratio of adiabatic and isothermal elasticities of a gas. Bending of beams-bending moment, expression for bending moment- the cantilever depression at its loaded end (weight of the cantilever ineffective-theory only)- Depressions of supported beam(Centrally loaded and the weight of the beam is ineffective- theory only)

Text book:*Mechanics – Prof. D.S Mathur Revised by: Dr. P.S Hemne. , S Chand & Company Pvt. Ltd, Chapter 13*

Surface tension (4 hrs)

Molecular theory of surface tension- surface energy- excess pressure in a liquid drop or an air bubble in a liquid –velocity of a wave on the surface of a liquid- effect of gravity- effect of surface tension- factors affecting surface tension- applications.

Text book:*Properties of Matter- Brijlal and N. Subrahmaniam, S. Chand &Company Pvt. Ltd,1989, Chapter 8*

References

1. Fundamentals of Physics – Halliday and Resnik,John Wiley & sons
2. Mechanics - D.S.Mathur , S.Chand
3. Vibration, Waves and Acoustics - D.Chattopadhyay ,Books and Allied Pvt Ltd
4. Properties of Matter - -D.S.Mathur ,S.Chand
5. Mechanics- H.S.Hans and S.P.Puri. ,Tata McGraw-Hill
6. Mechanics- J.C. Upadhyaya ,Ram Prasad and Sons
7. Properties of Matter and Acoustics - R.Murugeshan & Kiruthiga Sivaprasath
8. Refresher course in Physics. Vol. 1 – C.L.Arora

Competencies:

C1. Define rigid body

C2. Distinguish translational and rotational motion

C3. Mention torque, angular momentum, angular impulse

C4. Define moment of inertia and radius of gyration

C5. State and prove parallel and perpendicular theorems

C6. Determine the moment of inertia of different shapes specifically uniform rod,rectangular lamina, thin circular ring, circular disc, annular ring, solid cylinder, hollow cylinder, solid sphere and hollow sphere

C7. Compute total energy of a rolling body

C8. Determine experimentally moment of inertia of a flywheel

C9. State Newton's law of viscous flow

C10. Distinguish stream line and turbulent flow

C11. Define Critical velocity,

C12. State the significance of Reynold's Number

C13. Derive Poiseuille's equation for a liquid flowing through a narrow tube

C14. Illustrate the calculation of coefficient of viscosity of a viscous liquid

C15. Classify types of waves

C16. Recognize wavelength, frequency and wave number

C17. Obtain the equation for a plane progressive harmonic wave

C18. Explain distribution of energy in a plane progressive wave

C19. Extend the theory beats to concerned problems

C20. Explain reverberation

C21. Write down Sabines reverberation formula

C22. Define acoustic intensity

C23. Examine the factors affecting acoustics of buildings

C24. State the requisites for good acoustics

C25. Introduce ultrasonics and acoustic grating

C26. Solve velocity of sound using Newton's formula

C27. State Doppler effect

C28. State Hooke's law

C29. Categorize different types of elasticity

C30. Define Poisson's ratio

C31. Establish the relation between volume strain and linear strain

C32. Define twisting couple on a cylinder, angle of twist and angle of shear

C33. Identify bending moment,

C34. Discuss the cases of bending of beams in cantilever, centrally loaded supported beam

C35. Introduce Molecular theory of surface tension and surface energy-

C36. Calculate excess pressure in a liquid drop or an air bubble in a liquid

C37. Determine the velocity of transverse waves on liquid surface

C38. Mention factors affecting surface tension

Semester III

PH3B03TB Electronics

Credits- 3

Total lecture hours- 54

Aim

It is impossible to live in the present world without using electronic devices. Even in daily life, there are instances where we should have at least a basic understanding of the working of various electronic devices and the properties of electrical circuits. The electronics course is intended to give the students this basic knowledge

Course overview and context

The students already have the required basic knowledge of semiconductors and pn junction diodes. The course starts with a revision of these fundamentals and extends it to the applications of diodes in constructing DC voltage sources, voltage multipliers, regulators and wave shaping circuits. The course proceeds to the characteristics of transistors and their applications in constructing various

amplifiers. Operational amplifiers, modulators and demodulators are also included.

Module I

Basics of semiconductor diodes and their applications. (15 hrs)

P-N junction Diode: Diode Characteristics, Equation for Diode current (No derivation), Static and Dynamic resistances, Junction capacitance, Equivalent circuits of forward and reverse biased diode, Avalanche and Zener breakdown.Rectifiers: Half wave, Centre tapped full wave and Bridge rectifiers, Derivation ofefficiency and ripple factor of half wave and full wave rectifiers. Working of Filter circuits: Shunt capacitor filter, Series inductor filter, LC filter, π section filter.Voltage regulation: Line regulation and load regulation, Zener diode shunt regulator, Circuit design for zener regulator and calculation of optimum value of current limiting resistor.Wave shaping circuits: Clipper - Positive, negative and biased clipping circuits, Clampers-positive, negative and Biased clampers, Voltage multipliers - Doubler-Tripler & Quadrupler.

Text Books

1. ***A Text Book of Applied Electronics - R.S.Sedha: S.Chand Co. Multi Colour Edn. Chapters-12, 19, 20 &33***
2. ***Basic Electronics-B.L.Theraja: S.Chand Co. Chapters13&14***

Module II

Transistors (18 hrs)

Bipolar junction transistors, Mechanism of transistor action, transistor currents, transistor circuit configurations –CB,CE and CC configurations , their characteristics and the experiment to draw them, current gains in CE,CB and CC, relation between them, leakage currents in CB and CE , thermal runaway.

Load line, Q- point, Maximum Undistorted output, Need for biasing, factors affecting Bias variations , Stability factor, Beta sensitivity, Stability factor for CB and CE circuits, Methods for transistor biasing, Base Bias, Base bias with emitter feedback, Base bias with collector feedback, Voltage divider bias, stability factor for each biasing methods .h parameters-determination and meaning, hybrid equivalent circuit of common base and common emitter, amplifier expressions in terms of h parameters.

Classification of amplifiers, CB, CE and CC amplifiers, comparison of performance, Classification of power amplifiers based on biasing condition , Class A, B,C, and Class AB amplifiers.

Text Books:

1. ***A text book of Applied Electronics- R S Sedha - S Chand , Chapter :14 Sections 7 to 17, Chapter:15 Section 1 to 8 and 19, Chapter :22 Sections 2 to 19, Chapter : 25 Sections 1 to 11***
2. ***Basic Electronics: B L Theraja-S Chand, , Chapter: 22 Sections 1 to 14***

Module III

Amplifiers with Negative Feedback and Oscillators (11 hrs)

Feedback - Principles of in negative voltage feedback amplifiers, Gain of negative voltage feedback amplifier, Advantages of negative voltage feedback, Feedback circuit, Principles of negative current feedback , current gain with negative current feedback ,Effects of negative current feedback , Emitter follower (Qualitative idea) , Applications of Emitter follower.

Oscillators - Sinusoidal oscillator, Oscillatory circuit, Positive feedback amplifier – Oscillators, Essentials of transistor oscillator, Different types of transistor oscillator, Tuned collector oscillator, Colpitt's oscillator, Hartley oscillator, Phase Shift oscillator, Non- Sinusoidal oscillator - Multivibrators, Types of multivibrators, Transistor astable multivibrator, Transistor monostable multivibrator, Transistor bistable multivibrator.

Text Book: Principles of Electronics – V.K Mehta, Rohit Mehta. Eleventh edition 2008. Publication, S Chand & Company PVT.LTD, Ram Nagar, New Delhi – 110055, Chapter 13,14, Chapter 18 – Sections, 18.10 to 18.14

Operational Amplifiers (4 hrs)

Operational amplifiers - Ideal opamp, Virtual ground and summing point, Applications - Inverting amplifier, Non inverting amplifier, Unity follower & Summing amplifier.

Text Book: A Text Book of Applied Electronics-R.S.Sedha, Multi colour Edn. Publication, S Chand & Company PVT.LTD, Ram Nagar, New Delhi – 110055, Chapter-29

Modulation & Demodulation (6 hrs)

Radio broadcasting, Transmission and Reception, modulation, Types of modulation, Amplitude modulation - Modulation factor, Analysis of amplitude modulated wave, Sideband frequencies in AM wave, Transistor AM modulator, Power in AM wave, Limitations of Amplitude Modulation, Frequency modulation, Theory of frequency modulation, Demodulation, Essentials in demodulation, AM diode detector.

Text Book: Principles of Electronics – V.K Mehta, Rohit Mehta. Eleventh edition 2008 Publication, S Chand & Company PVT.LTD, Ram Nagar, New Delhi – 110055, Chapter16.

Competencies

C1. Set up circuits to study forward and reverse characteristics of a diode.
C2. Identify zener and ordinary diodes by performing experiments or from available data sheets.
C3. Find out various diode parameters from elementary equations.
C4. Construct circuits for HWR and FWR and explain their working.
C5. Compare various features of HWR and FWR and calculate various parameters from basic equations.
C6. Explain the working of various filter circuits.
C7. Design zener diode voltage regulator.
C8. Understand the concept of voltage regulation.
C9. For a given input wave, plot the outputs obtained from various types of clippers and clampers.
C10. Design biased clippers and clampers according to a given requirement.
C11. Explain the working of wave shaping circuits.
C12. Explain the working of voltage doublers.
C13. Explain Mechanism of transistor action
C14. Illustrate the working of transistor as an amplifier
C15. Identify the transistor currents and state relation between transistor currents
C16. Explain transistor circuit configurations–CB, CE and CC configurations
C17. Compare CB, CE and CC configurations and draw their characteristics
C18. Describe the experiments to draw transistor characteristics
C19. Define current gains in CE, CB and CC and determine relation between current gains in them
C20. Define leakage currents in CB and CE
C21. Explain thermal runaway.

C22. Draw Load line in transistor characteristics
C23. Define Q- point
C24. Describe the relevance of Q point in transistor biasing to get maximum undistorted output
C25. Describe the need for biasing transistors
C26. Discuss the factors affecting Bias variations
C27. Define Stability factor and Beta sensitivity
C28. Determine Stability factor for CB and CE circuits
C29. Describe Methods for transistor biasing- Base Bias, Base bias with emitter feedback, Base bias with collector feedback and voltage divider bias
C30. Find stability factor for each biasing methods.
C31. Define h parameters
C32. Describe the hybrid equivalent circuit of common base and common emitter configurations
C33. Compute amplifier expressions in terms of h parameters
C34. Classify and compare amplifiers, CB, CE and CC amplifiers
C35. Classify and compare power amplifiers based on biasing condition - Class A, B,C and Class AB amplifiers
C36. Explain the working of AM diode detector with circuit diagram.
C37. Describe feedback concept.
C38. Draw the circuit diagram of negative voltage feedback amplifier, discuss its working and determine the voltage gain.
C39. Mention the advantages of negative voltage feedback amplifiers.
C40. Draw the circuit of negative current feedback amplifier, discuss its working and determine the current gain.
C41. Mention the effects of negative current feedback amplifiers.
C42. Apply negative current feedback in transistor circuit (emitter follower), draw its circuit diagram and describe its working only.
C43. Mention the applications of emitter follower.
C44. Classify different types of oscillators.
C45. Discuss Barkhausen criterion.
C46. Explain the working of LC tank circuit.
C47. List Different types of transistor oscillators.
C48. Draw the circuit diagram of Tuned collector oscillator and explain its working.
C49. Draw the circuit diagram of Colpitt's oscillator and explain its working.

C50. Draw the circuit diagram of Hartley oscillator and explain its working
C51. Draw the circuit diagram of Phase Shift oscillator and explain its working
C52. Classify different types of multivibrators.
C53. Explain the working of Transistor astable multivibrator with circuit diagram.
C54. Explain the working of Transistor monostable multivibrator with circuit diagram.
C55. Explain the working of Transistor bistable multivibrator with circuit diagram.
C56. Compare the properties of ideal and real operational amplifier.
C57. Explain the concept of virtual ground and summing point in operational amplifier.
C58. Explain the working of inverting amplifier with circuit diagram, determine its voltage gain, input impedence, output resistance and common mode rejection ratio.
C59. Explain the working of inverting amplifier with circuit diagram, determine its voltage gain, input impedence, output resistance and common mode rejection ratio.
C60. Explain the working of Transistor astable multivibrator with circuit diagram.
C61. Explain the working of unity follower with circuit diagram.
C62. Explain the working of summing amplifier with circuit diagram.
C63. Explain the necessity of modulation in wireless communication system
C64. Classify different types of modulation.
C65. Explain the principle of amplitude modulation, define modulation index, analyse the amplitude modulated wave and describe the occurrence of sidebands.
C66. Calculate power of amplitude modulated wave.
C67. Explain the working of Transistor AM modulator with circuit diagram.
C68. Mention the limitations of amplitude modulation.
C69. Explain the principle of frequency modulation.
C70. Describe demodulation.

Semester IV

PH4B04TB Electricity & Electrodynamics

Credits- 3

Total lecture hours- 54

Aim

In the development of modern technology- electricity and electrodynamics plays an important role. Needless to say without electric power and communication facilities, life will become difficult. It's for this reason that a course in electricity and electrodynamics is essential part of physics education at graduate level. This course is designed to provide a strong foundation in electricity and electrodynamics.

Course overview and context

This course envisages to cover behavior of dc currents in series combination active and passive elements, theory of Ballistic galvanometer and experiments, LCR series and parallel circuits, network theorems, electrostatics, magnetostatics and electrodynamics.

Module I

Transient Current (9 hrs)

Growth of current in a circuit containing a resistance and inductance - Decay of current in a circuit containing a resistance and inductance - Charge and discharge of a capacitor through a resistor - Measurement of high resistance by leakage - Growth of charge in a circuit with inductance, capacitance and resistance- Discharge of a capacitor through an inductor and a resistor in series - Moving coil ballistic galvanometer - Current and voltage sensitivities of a moving-coil galvanometer - Measurement of charge sensitiveness - Absolute capacitance of a capacitor.

Text book- Electricity & Magnetism – R.Murugeshan- Ninth revised edition- reprint 2013 Publications- S Chand & Company PVT-LTD, Ram Nagar, New Delhi – 110055. Chapter12 & Chapter 10 – Sections 10.11 to 10.15

Alternating Current (7 hrs)

EMF induced in a coil rotating in magnetic field- AC circuit containing resistance- inductance and capacitance in series (Series resonance circuit)-

Parallel resonant circuit- Power in ac circuit containing resistance-inductance and capacitance- Wattless current- Choke coil- Skin effect- Three phase ac generator- Distribution of three phase alternating current- The ac watt meter

Text book-– Electricity & Magnetism – R.Murugeshan- Ninth revised edition- reprint 2013- Publications- S Chand & Company PVT-LTD, Ram Nagar, New Delhi –* 110055.*Chapter13- Sections 13.1 to 13.6 & 13.8- Chapter14 - Sections 14.1 & 14.2 & Chapter30- Section 30.12

Network Theorem (3 hrs)

Ideal current source- Ideal voltage source- Superposition theorem- Reciprocity theorem- Thevenin's theorem- Norton's theorem- Maximum power transfer theorem

Text book- Electricity& Magnetism – R. Murugeshan- Ninth revised edition- reprint 2013 Publications- S Chand & Company PVT-LTD, Ram Nagar, New Delhi – 110055- Chapter18

Module II

Electrostatics & Magnetostatics (17 hrs)

Electric field - Continuous charge distribution - Divergence and curl of electrostatic fields - Gauss' Law and its application to obtain fields due to Spherically symmetric charge distribution, Uniformly charged spherical conductor, Line charge, Infinite plane sheet of charge & Electric field at a point between two oppositely charged parallel plates. Electric potential- Poisson's equation and Laplace's equation- The potential of a localized charge distribution- Work and Energy in electrostatics- The work done to move a charge- Energy of a point charge distribution and continuous charge distribution. Conductors: Basic properties- induced charges- Surface charge and force on a conductor- Capacitors.

Magnetic field of Steady currents: - Biot Savart's law - magnetic induction at a point due to a straight conductor, axis of a circular coil & at the axis of a solenoid - Force on a current carrying conductor in magnetic field - force between two parallel conductors carrying current- electron moving in a

magnetic field and Lorentz force- Ampere's circuital law - differential form - applications - to find the magnetic fields due to long solenoid & toroid- Comparison of magnetostatics and electrostatics

Text book - Electricity& Magnetism – R. Murugeshan- Ninth revised edition- reprint 2013 Publications- S Chand & Company PVT-LTD, Ram Nagar, New Delhi – 110055.

Module III

Maxwell's equations and Electromagnetic waves (18 hrs)

Maxwell's equations- Electrodynamics before Maxwell- Modification of Ampere circuital law- Magnetic Charge- 'theorem The wave equation in one dimension- Boundary condition -Reflection and Transmission- Polarization- Electromagnetic waves in vacuum- Monochromatic plane waves- Energy and momentum in Electromagnetic waves- Electromagnetic waves in matter- Propagation in linear media- Electromagnetic waves in conductors

Text book- Chapter7,8 & 9 - Sections 7.3, 8.1, 9.1 to 9.3.1 and 9.4.1 Introduction to Electrodynamics - David J Griffiths Publications- Prentice Hall -Inc(Pearson Education-Inc)

Reference:

1. Electricity and Magnetism – J-H-Fewkes &John Yarwood, University tutorial
2. Fundaments of Magnetism and Electricity D N Vasudeva - S chand
3. Electricity and Magnetism A S Mahajan and AA Rangwala -TMH
4. Introduction to electrodynamics- David J Griffiths- PHI
5. Electromagnetics Matthew N Sadiku- Oxford 4th Edn
6. Electromagnetics with applications Kraus/Fleish 5th Edn – TMH
7. Electromagnetics J A Edminister 2nd Edn - TMH
8. Electromagnetic Fields TVS Arunmurthi – S- Chand

Competencies:

C1.Set up circuits to study forward and reverse characteristics of a diode.

C2.Identify zener and ordinary diodes by performing experiments or from available data sheets.

C3. Find out various diode parameters from elementary equations.

C4. Construct circuits for HWR and FWR and explain their working.

C5. Compare various features of HWR and FWR and calculate various parameters from basic equations.

C6. Explain the working of various filter circuits.

C7. Design zener diode voltage regulator.

C8. Understand the concept of voltage regulation.

C9. For a given input wave, plot the outputs obtained from various types of clippers and clampers.

C10. Design biased clippers and clampers according to a given requirement.

C11. Explain the working of wave shaping circuits.

C12. Explain the working of voltage doublers.

C13. Discuss varying current.

C14. State Kirchhoff's law for varying current.

C15. Explain the growth and decay of current in LR circuit.

C16. Explain the charging and discharging of a capacitor through resistor.

C17. Discuss the method to determine high resistance by leakage.

C18. Explain the charging and discharging of a capacitor through resistor and inductor in series.

C19. Discuss the theory of moving coil ballistic galvanometer.

C20. Mention logarithmic decrement and Define voltage and current sensitivities

C21. Design experiments to measure the capacitance of a given capacitor using ballistic galvanometer and charge sensitivity of ballistic galvanometer using a standard capacitor

C22. Discuss variation of alternating current with time and define basic parameters and Determine mean value and rms values of ac.

C23. Explain the phase relationship between alternating voltage and current in LCR series circuit and Calculate power in an LCR series circuit.

C24. Explain the phase relationship between alternating voltage and current in LCR parallel circuit

C25. Explain skin effect.

C26. Discuss three phase distribution

C27. Explain the working of ac watt meter.

C28. State and prove Superposition, Reciprocity , Thevenin's, Norton's & Maximum power transfer theorems.

C29. Discuss the Propagation of electromagnetic waves in linear Media.

C30. Describe the propagation of electromagnetic waves in conductors

C31. State and arrive at Maxwell's equations.

C32. Describe Electrodynamics before Maxwell

C33. Explain how Ampere circuital law is modified by Maxwell.

C34. Determine Maxwell's equations in matter.

C35. Find the Boundary conditions for electric and magnetic Fields.

C36. State and prove Poynting's theorem.

C37. Apply Poynting's theorem to find energy propagated, electric field or magnetic field in the given electromagnetic field.

C38. Derive the general wave equation in one dimension.

C39. Find the Boundary condition under Reflection and Transmission.

C40. Discuss the Polarization of Electromagnetic waves.

C41. Derive the wave equation for electromagnetic waves in vacuum.

C42. Describe Monochromatic plane waves.

C43. Get the expressions for Energy and Momentum in Electromagnetic waves.

Semester V
PH5B05TB Classical and Quantum Mechanics

Credits -3

Total lecture hours - 54

Aim

The course gives an introduction to techniques in classical mechanics as an alternative to Newtonian mechanics. Since the branches of science in the micro level are governed by principles of quantum mechanics, this course provides a platform for better understanding of various phenomena observed in the nuclear, atomic and molecular world.

Course overview and context

Classical and quantum mechanics remains indispensable part of physics education. They have a two-fold role in preparing the student for the study of modern physics. The first module gives formulations of Lagrangian and Hamiltonian. The second module deals with wave mechanical formulations and the theories that demanded quantum mechanical concepts. Third module introduces the general formalism of quantum mechanics and energy eigen value problems

Module 1

Lagrangian and Hamiltonian Dynamics (18 hours)

Degrees of freedom, Constraints- holonomic, nonholonomic, rheonomous, scleronmous constraints, Generalized coordinates, Principle of virtual work, D' Alembert's principle, Lagrange's equation from D' Alembert's principle, Applications -Simple pendulum, Atwood's machine, Motion under central force. Hamilton's principle and Lagrange's equations, Merits of Lagrange's equation over Newtonian approach

Generalized momentum and cyclic coordinates, Hamilton's equations, Examples in Hamiltonian Dynamics- Applications-one dimensional and two dimensional Harmonic oscillators, Simple pendulum. Calculus of variations and Euler Lagrange's equations- Applications- Shortest distance between two points, Brachistochrone problem, the equation of the curve between two fixed points which revolve about a given axis to give the surface of revolution for which surface area is minimum and one dimensional harmonic

oscillator.

Text Book :Classical mechanics, J C Upadhyaya, Himalaya Publishing house, Chapters 2 & 3

Module – II

Quantum mechanics

Origin of Quantum theory (8 hrs)

Limitations of classical physics, black body radiation, Planck's quantum hypothesis, particle nature of radiation, photoelectric effect, Compton effect, the Bohr atom, Rutherford planetary model, Bohr postulates, Stern and Gerlach experiment, the correspondence principle

Text Books

1. ***Quantum Physics – Stephen Gasirowicz Wiley –India Edition,Chapter 1***
2. ***Quantum Mechanics- G.Aruldhas,PHI Learning Private Limited,Chapter 1***

Wave Mechanical Concepts (6hrs)

Wave nature of matter, deBroglie hypothesis, electron diffraction experiment, uncertainty principle – single slit experiment, uncertainty relations for other variables, applications of uncertainty relations, principle of superposition, wave packet, particle velocity and group velocity

Text Book: Quantum Mechanics, G.Aruldhas,PHI Learning Private Limited,Chapter2

Module – III

General formalism of Quantum Mechanics (10 hrs)

Time dependant Schrodinger equation for free particle and for particle in a field, Interpretation of wave function, probability interpretation, probability current density, expectation value, time independent Schrodinger equation, stationary states, admissibility conditions on the wave function, Operators, linear operators, the commutator, general Eigen value equation, Hermitian operator, postulates of quantum mechanics, simultaneous measurability of observables

Text Book: Quantum Mechanics,G.Aruldhas,PHI Learning Private Limited,Chapter2 &3

One dimensional Energy Eigen value Problems (6 hrs)

Particle in a box (square well potential with rigid walls), square potential barrier, alpha emission, linear harmonic oscillator Schrodinger method (basic ideas only), zero point energy

Text Book: Quantum Mechanics- G.Aruldhas,PHI Learning Private Limited,Chapter 4

Three dimensional Energy Eigen value Problems (6hrs)

Particle moving in a spherically symmetric potential- separation of the equation-solution of Φ equation, solution of θ equation (Qualitative idea only) and radial equation

Text Book: Quantum Mechanics- G.Aruldhas,PHI Learning Private Limited,Chapter 5

References:

1. Classical Mechanics, Herbert Goldstein, Charles Poole and John Safk, Pearson Education, Indian Edition.
2. Mechanics, H S Hans, S P Puri, Tata Mc Graw Hill Education Pvt. Ltd.
3. Classical Mechanics, Rana and Joag, TMH.
4. Classical Mechanics, K. Sankara Rao, Prentice Hall of India.
5. Classical Mechanics, Greiner, Springer.
6. Concepts of Modern Physics - Arthur Beiser, Tata Mc Graw Hill.
7. A Text book of Quantum Mechanics, P.M.Mathews and S.Venkatesan, TMH.
8. A text book of Quantum Mechanics, Ghatak and Lokanathan.
9. Feynman lecture series –volume 3.
10. Modern Physics -G. Aruldhas, P. Rajagopal, PHI Learning Pvt. Ltd.

Competencies:

C1. Define degrees of freedom.

C2. Elaborate the role of constraints in equations of motion.

C3. Classify Constraints.

C4. Describe generalized coordinates.

C5. State principle of virtual work.

C6. Explain D' Alembert's principle.

C7. Derive Lagrange's equation from D' Alembert's principle

C8.Find the Lagrange's equation of motion for Simple pendulum

C9. Describe Atwood's machine in terms of its Lagrange's equations

C10. Extend the Lagrange's equation of motion to represent motion under central force.

C11. Outline Hamilton's principle to derive Lagrange's equations

C12.Recognize the merits of Lagrange's equation over Newtonian approach

C13. Define generalized momentum and cyclic coordinates

C14. Illustrate Hamilton's equations

C15. Extend Hamiltonian Dynamics to explain one dimensional and two dimensional Harmonic oscillators

C16. Apply Hamilton's principle to describe Simple pendulum.

C17. Illustrate Calculus of variations to find out Euler Lagrange's equations

C18. Extend the method of calculus of variations to find shortest distance between two points

C19. Explain Brachistochrone problem using the method of calculus of variations.

C20. Outline the method of calculus of variations to find the equation of the curve between two fixed points which revolve about a given axis to give the surface of revolution for which surface area is minimum

C21. Examine one dimensional harmonic oscillator by the method of calculus of variations.

C22. Summarize the limitations of classical mechanics through photoelectric effect and Compton Effect.

C23. State the Bohr postulates

C24. Describe Stern & Gerlach Experiment

C25. State the correspondence principle

C26. Illustrate the dual nature of matter through diffraction experiment

C27. Explain uncertainty principle

C28. Express the concept of wave packet

C29. Clarify particle velocity and group velocity

C30. Set up the time dependant Schrodinger equation for wave function give its Interpretation

C31. Obtain the time independent Schrodinger equation

C32. Identify the operators associated with coordinate, energy, momentum

C33. State the postulates of quantum mechanics

C34. Solve time dependent Schrodinger equation for specific cases like particle in a box,Square potential barrier

C35. Express the concept of zero point energy of a harmonic oscillator.

C36. Derive the radial &Polar - θ equation for a particle in spherically symmetric potential

C37. List the solutions of polar & Azimuthal equations

SEMESTER V

PH5B06TB Physical Optics and Photonics

Credits – 3

Total Lecture hours – 54

Aim

This course aims to provide necessary foundation in optics and photonics. Further this course will provide a platform for an extensive study of advanced topics at a later stage.

Course Overview

This course covers delivers basic idea of wave optics and deals different optical phenomena such as interference, diffraction and polarization in detail. A good knowledge of optics is essential for the understanding of developments of Photonics further, this course incorporate topics such as lasers, Fibre Optics and Optical Communication.

Module I

Wave optics (Basic ideas) (1hr)

Nature of light- theories of light- EM nature of light.Wavefront- propagation of wavefront.Characteristics of a wave- mathematical representation of a travelling wave.

Text Book: ***Optics - Subramanayam, Brijlal, M. N Avadhanalu, S.Chand, Revised 24th EditionChapter 1 (Sec. 1.2-1.3) &Chapter 12 (Sec. 12.1-12.6)***

Interference (10hrs)

Review of basic ideas of interference – optical path – phase difference - coherence- superposition of waves- condition for bright and dark fringes. Interference (Analytical method) - intensity distribution. Techniques of obtaining interference- wavefront splitting- Fresnel's biprism-theory- fringe width- lateral displacement of fringes. Amplitude splitting- Interference in

thin films-planeparallel film (reflected system)-conditions for brightness anddarkness-Fizeau and Haidinger fringes- Air wedge- theory-determination of wedge angle and thickness of spacer- colours in thin films.Newton's rings(reflected system)-determination of wavelength of light-refractive index of liquid.Michelson interferometer-principle-construction-working (formation of fringes- qualitative ideas)- applications-determination of wavelength- thickness of thin transparent sheet-refractive index of gases.

Text Book: ***Optics - Subramanayam, Brijlal, M. N Avadhanalu, S.Chand, Revised 24th EditionChapter 14 (Sec.14.1 – 14.4.2, 14.8, 14.9 – 14.9.4) and Chapter 15 (Sec. 15.1 – 15.2.5, 15.4- 16.6.9, 15.7, 15.8)***

Diffraction (11 hrs)

Fresnel Diffraction

Huygens- Fresnel theory –Fresnel assumptions- Fresnel half period zones-theory of rectilinear propagation- zone plate – action of zone platefor an incident spherical wavefront-comparison between zone plate and convex lens.Diffraction pattern due to a straight edge – intensity at a point in the geometrical shadow.

Fraunhoffer diffraction (calculus method not required)

Fraunhoffer diffraction at a single slit, double slit- missing orders in double slit, theory of plane diffraction grating-(normal incidence, N slits)- width of principal maxima-absent spectra-overlapping of spectral lines-determination of wavelength of a spectral line-dispersive power of grating-comparison of prism & grating spectra. Comparison between interference and dfiffraction.

Text Book :*Optics - Subramanayam, Brijlal, M. N Avadhanalu, S.Chand, Revised 24th EditionChapter 17 (Sec. 17.1 – 17.7, 17.10 -17.10.2) and Chapter 18 (18.1 – 18.2.1, 18.4,18.4.2, 18.4.3, 18.7 – 18.7.2, 18. 7.4 – 18.7.8)*

Module II

Polarization (10hrs)

Polarization- introduction to polarization- polarization by reflection-Brewster's law-Malus' Law-polarization by double refraction-calcite crystal-

optic axis- principal section-Huygen's explanation of double refraction-phase difference between e ray and o ray- superposition of waves linearly polarized at right angles-types of polarized light – retarders-quarter wave plates- half wave plates – production and detection of elliptically and circularly polarized light- optical activity- Fresnels explanation of optical rotation (analytical treatment not needed)- specific rotation-application-Laurent's half shade polarimeter.

Text Book :*Optics - Subramanayam, Brijlal, M. N Avadhanalu, S.Chand, Revised 24th Edition, Chapter 20*

Module-III

Lasers (12hrs)

Absorption and emission of light-Absorption-spontaneous emission and stimulated emission-light amplification by stimulated emission.Einstein's relations-condition forlight amplification –population inversion-pumping – pumping methods –optical pumping – electrical pumping –injection pumping. Active medium-metastable states- pumping schemes (two level, three level and four level)- Characteristics of laser beam- Optical resonator (theory not required) -Threshold condition. Types of lasers-ruby laser, He-Ne laser, semiconductorlaser. Applications of lasers-Holography (principle, recording and reconstruction)-medical applications- materials processing-cutting, drilling and welding.

Text Book

1. ***An introduction to lasers theory and applications- MN Avadhanulu.S.Chand, Chapters 1,2,3& 5.***
2. ***Optics - Subramanayam, Brijlal, M. N Avadhanalu, S.Chand, Revised 24th Editio, Chapter 22& 23*.**

Fibre Optics and Optical Communication (10hrs)

Optical fibre- Critical angle of propagation-modes of propagation (Ray theory only)- Acceptance angle-Fractional refractive index change-Numerical Aperture- Types of Optical fibers-Normalized Frequency- pulse dispersion Attenuation- Applications- Fibre opticcommunication system-Advantages of Optical fibers.

Text Book :*Optics - Subramanayam, Brijlal, M. N Avadhanalu, S.Chand, Revised 24th Edition, Chapter 24*.

References

1. Optics 3rd edition- AjoyGhatak, TMH

2. Optical Electronics – AjoyGhatak and K Thyagarajan, Cambridge

3. Optics and Atomic Physics D P Khandelwal, Himalaya Pub. House

4. Optics S K Srivastava, CBS Pub. N Delhi

5. A Text book of Optics S L Kakani, K L Bhandari, S Chand.

6. Optical Fiber Communications – Principles and Practice - John M Senior, Pearson, 3rdEdn.

Competencies:

C1. Recognise the different theories proposed in the field of light.
C2. Examine the electromagnetic nature of light.
C3. Define wavefront.
C4. Recognise the attributes which characterizes a wave.
C5. Give the mathematical representation of a travelling wave.
C6. Define the optical path and phase difference.
C7. Understand coherence.
C8. Discuss the principle behind interference.
C9. Recall the conditions for brightness and darkness for interference patteren.
C10. Estimate the intensity distribution of interference analytically.
C11. Classify Interference based on the different ways of obtaining of coherent sources.
C12. Discuss interference in Biprism.
C13. Estimate the lateral displacement of fringes due to introduction of a plate in the path of one of the interfering beam.
C14. Explain the interference in plane parallel thin film formed in reflected system.
C15. Distinguish between the different types of interference fringes in thin film.

C16. Contrast the interference in reflected and transmitted system.
C17. Describe the interference in air wedge.
C18. Determine the thickness of spacer in air wedge.
C19. Recognize the theory behind colours seen in thin film.
C20. Explain Newton's rings Formation.
C21. Determine wavelength of light and refractive index of liquid.
C22. Illustrate principle, construction and working of Michelson interferometer.
C23. Generalize the applications of Michelson interferometer.
C24. Classify diffraction.
C25. State Fresnel assumptions of diffraction.
C26. DescibeFresnel half period zones.
C27. Recognize the theory of rectilinear propagation
C28. Identify action of zone plate.
C29. Compare zone plate and convex lens.
C30. Explain Diffraction pattern due to a straight edge.
C31. Extend Fraunhoffer diffraction to single slit, double slit and N slits.
C32. Explain missing orders in double slit
C33. Determine wavelength of a spectral line
C34. Compare prism & grating spectra.
C35. Differentiate interference and diffraction.
C36. Define polarization.
C37. State and prove Brewster's law. Apply it in calculation of polarizing angle and refractive index.
C38. Understand polarization by double refraction.
C39. Discuss the Huygen's explanation for double refraction.
C40. Differentiate between o-ray and e-ray.
C41. Explain the superposition of waves linearly polarized at right angle.
C42. List the different types of polarized light.
C43. Classify retardation plates.
C44. Discuss the production and detection of elliptically and circulary polarised light.
C45. Understand the theory behind optical rotation and apply the principle in Laurent's half shade polarimeter.
C46. Use the concepts of A and B coefficients to predict the possibilities of laser emission.
C47. Understand the significance of Einstein's coefficients.

C48. Classify various pumping methods and pumping schemes.
C49. Describe the working of various lasers mentioned in the syllabus and compare their output wavelengths.
C50. Understand the basics of holography and use basic theory to explain the formation of real and virtual images.
C51. Use elementary equations to calculate population, equilibrium temperature, output frequency, and optimum cavity length of various lasers.
C52. Learn any two applications each of lasers in the field of medicine and material processing.
C53. Explain the basic principles and fundamental concepts of optical fibers using ray theory.
C54. Calculate numerical aperture, critical angle, acceptance angle, and normalized frequency using basic equations.
C55. Classify optical fibers using refractive index profile.
C56. Outline the schematic used to convey the meaning of optical fiber communication systems.
C57. Explain how light as a carrier wave will increase the communication band width.
C58. List the advantages of OFC compared to electrical communication systems.
C59. Explain the formation of modes using ray theory.

Semester V

PH5B07TB Thermal and Statistical Physics

Credits – 3

Total lecture hours – 54 hrs

Aim

The topics on thermodynamics are intended to develop a basic knowledge required to design any device involving the interchange between heat and work or the conversion of material to produce heat. The topic on statistical mechanics, on the other hand is expected to provide an understanding of the behavior of these systems in a microscopic level.

Course overview and context

Thermodynamics describes the bulk behavior of the body, not the microscopic behavior of the very large numbers of its microscopic constituents, such as molecules. The first module deals with the laws of thermodynamics and the working of heat engines. The concept of entropy, thermodynamic potentials and the various laws of thermal radiation are discussed in the second module. The third module deals with the fundamental topics of statistical mechanics and a description of the different types of statistics.

Module I

Thermal Physics (18 hrs)

Thermodynamic system- Zeroth law(Statement and explanation)- Thermodynamic equilibrium- First law of thermodynamics- Applications of first law-Specific heats of a gas, isochoric process, isobaric process, adiabatic process, adiabatic equation of a perfect gas, cyclic process, isothermal process-Indicator diagram- Work done during isothermal and adiabatic process- slopes of adiabatics and isothermals- relation between adiabatic and isothermal elasticities..

Reversible and irreversible process- Heat Engines-Carnot's ideal heat engine-Carnot's cycle-Effective way to increase efficiency-Carnot's engine and refrigerator-coefficient of performance -Second law of thermodynamics-Kelvin's and Clausius's statement-Carnot's theorem-Steam engine-Internal combustion engine-Otto engine, Petrol engine, Diesel engine-its efficiencies.

Text Book: Thermodynamics and Statistical physics Brij Lal, N.Subrahmanyam and P S Hemne, S. Chand &Co, Multi colour edition 2007, Chapters 4

Module II

Thermodynamic relations and Thermal radiation (18 hrs)

Entropy- change in entropy- entropy change in adiabatic process and reversible cycles- Principle of increase of entropy- The T-S diagram-Physical significance of entropy- Entropy of steam- Third law of thermodynamics: Nernst's Heat theorem-Zero point energy.

Thermodynamic potentials- Significance of thermodynamic potentials-relation of thermodynamic potentials with their variables- The TdS equations- Clapeyron's Latent heat equation using Maxwell's Thermodynamical relations.

Thermal radiation- Prevost's theory of heat exchanges- Black body- Fery's black body- Black body radiation and its temperature dependence- Emissive power and absorptive power- Stefan –Boltzmann law- Distribution of energy in blackbody spectrum- Wein's displacement law- Rayleigh-Jeans law- The ultraviolet catastrophe- Planck's law (no derivation).

Text Book: Thermodynamics and Statistical physics Brij Lal, N.Subrahmanyam and P S Hemne, (S. Chand &Co, Multi colour edition 2007, Chapters 5,6and8.

Module III

Statistical Mechanics (18hrs)

Probability – Principle of equal a priori probability – Micro and macro state – Thermodynamic probability

Position space, Momentum space, phase space, mu – space and gamma space (qualitative ideas only) Minimum size in classical and quantum mechanics – entropy and thermodynamic probability - Boltzmann's entropy relation – Ensembles – Kinds of ensembles – Gibbs paradox

Three kinds of particles – Classical statistics – Maxwell – Boltzmann Distribution law – Need of quantum statistics – indistinguishability of particles – Bose – Einstein Distribution law and its application to black body radiation – Fermi – Dirac statistics and its application to electron gas

Text Book: Thermodynamics and Statistical Physics – Brijlal& Subramanyam, S. Chand &Co, Multi colour edition 2007, Chapters 9,10,11,12

Reference:

1. Heat and Thermodynamics, Mark W Zemaskay and Richard H Dittman, TataMcGraw-Hill Publishing Co. (Special Indian Edition)

2. Thermodynamics and Statistical Mechanics, Greiner, Springer

3. Berkeley Physics Course Volume 5; Statistical Physics; Frederick Reif. McGraw Hill.

4. A Treatise on Heat; Saha and Srivastava, The Indian Press, Allahabad.

5. Statistical Mechanics, R.K. Pathria, Pergamon press, Oxford

Competencies

C1. Understand the concept of Thermodynamic system.
C2. Explain Zeroth law of thermodynamics.
C3. Illustrate Thermodynamic equilibrium.
C4. Explain first law of thermodynamics.
C5. Apply first law to isochoric process, isobaric process, adiabatic process.
C6. Derive the equation for adiabatic process of a perfect gas.
C7. Explain cyclic process.
C8.Exemplify Indicator diagram.
C9. Derive the work done during isothermal and adiabatic process.
C10.Determine slopes of adiabatics and isothermals.
C11. Relate adiabatic and isothermal elasticities.

C12. Differentiate between reversible and irreversible process.
C13. Describe the parts of heat engines.
C14.Explain Carnot's ideal heat engine using Carnot's cycle and derive it's efficiency.
C15. Describe effective ways to increase efficiency of Carnot's engine.
C16.Compare the working of a heat engine and refrigerator
C17. Define coefficient of performance a refrigerator.
C19. Explain second law of thermodynamics.
C20.State and verify Carnot's theorem.
C21. Distinguish between internal and external combustion engines.
C22.Describe the working of Steam engine, Otto engine, Petrol engine and Diesel engine and derive their efficiencies.
C23. Understand the concept of entropy and change in entropy.
C23. Derive entropy change in adiabatic process and reversible cycles.
C24. Explain the Principle of increase of entropy.
C25. Explain T-S diagram.
C26. Understand the physical significance of entropy.
C27. Determine entropy of steam.
C28.State Third law of thermodynamics: Nernst's Heat theorem.
C29. Understand the concept of zero point energy.
C30. Recognize the significance of thermodynamic potentials.
C31. Establish the relation of thermodynamic potentials with their variables.
C32. Discuss TdS equations.
C33.Derive Clapeyron's Latent heat equation using Maxwell's Thermodynamical relations.
C34. Define thermal radiation.
C35. Describe Prevost's theory of heat exchanges.
C36. Illustrate black body.
C37. Understand the temperature dependence of black body radiation.
C38. Define emissive power and absorptive power.
C39. State the principle of Equal a priori probability.
C40. Define and distinguish between micro and macrostates.
C41. Classify the different coordinate and spaces.
C42. Derive the Boltzmann's thermodynamic relation.
C43. Define an ensemble and classify them.
C44. State and explain Gibb's paradox.
C45. Explain the three kinds of particles.

C46. Derive the Maxwell – Boltzmann Distribution Law.
C47. Discuss the need for quantum statistics and derive Bose – Einstein and Fermi – Dirac distribution laws.
C48. Discuss one application of B- E and F- D statistics.

SEMESTER V

PH5B08TB Digital Electronics

Credits – 3

Total contact hours – 54

Aim

This course is expected to nurture basic understanding of principles of digital electronics and to provide necessary back ground to the major aspects of combinational and sequential logics.

Course Overview

The course on digital electronics starts from different number system- specifically, the binary number system and the various operations associated with it. Boolean algebra is introduced and discussed in detail. Finally, the course includes topics such as combinational and sequential logics.

Module I

Number systems (8 hrs)

Digital and analog systems- Comparison-.Different number systems- decimal, binary, octal and hexadecimal-conversion between different number systems. Binary arithmetic addition, subtraction and multiplication. Subtraction with 2's complement and 1's complement method- BCD code, ASCII code.

Text Book: ***Digital principles and applications 5thEdn. Malvino, Leach, TMH. Chapters 5and 6 (Sec. 6.1-6.6)***

Module II

Boolean algebra (20 hrs)

Binary logic- AND,OR, NOT,NAND, NOR, XOR, XNOR gates – operators- Logic symbol - truth table-Laws of Boolean algebra- Demorgan's theorem- Duality theorem- Boolean functions- Complement of a function. Reducing Boolean expressions- Sum of product method, product of sum method- Conversion between truth table, Boolean expressions and Logic diagrams- Simplification of Boolean functions using Karnauh map (Two,

three and four variables).

Text Book:*Digital principles and applications 5th Edn. Malvino, Leach, TMH. Chapter 2 and 3.*

Module III

Combinational Logic (9 hrs)

Adders- Half and Full adders- Subtractor- Four bit adder- Subtractor. Encoders, Decoders, Multiplexers and Demultiplexers

Sequential logic (17 hrs)

Flip-flops, RS, Clocked RS, D flip flop, JK flip flop, Master Slave flip flop, T flip flop- Shift register- serial in- serial out- Counters- Binary ripple counter- Decade counter. D/A converters (Ladder type), A/D Converter (Counter type).

Text Book:

1. ***Digital principles and applications 5th Edn. Malvino, Leach, TMH. Chapter 6 (Sec. 6.7&6.8) and Chapter 4 (Sec. 4.1 - 4.6), Chapter 8(Sec. 8.1-8.7), Chapter 9 (Sec.9.1& 9.2).***
2. ***Digital Computer Electronics- Malvino, Appendix 1 The analog interface.***

References:

1. Digital design- M Morris Mano PHI
2. Digital logic and computer design - M Morris Mano PHI
3. Digital Electronics- William H Gothmann PHI
4. Digital principles and applications 6th Edn. Malvino, Leach and Saha TMH
5. Digital circuits and design- S Salivahanan and S Arivazhakan PHI
6. Digital Electronics- Sedha S Chand
7. Pulse, Digital and switching wave forms –Millam and Taub.
8. Digital computer electronics- Malvino, Brown TMH

9. Digital electronics- Tokheim(TMH)

Competencies:

C1.Compare Digital and analog systems.

C2.Classify different number systems.

C3.Instantiate conversion between different number systems.

C4.Explain binary arithmetic addition, subtraction and multiplication.

C5. Illustrate subtraction with 2's complement and 1's complement method.

C6. Mention BCD code and ASCII code.

C7. Differentiate logic gates

C8. Compare operators, logic symbols and truth tables of different logic gates.

C9. State laws of Boolean algebra.

C10. Describe Demorgan'sand duality theorem.

C11. Use Sum of product method, product of sum method for reducing Boolean expressions.

C12. Simplify Boolean functions using Karnauh map.

C13. Categorize Adder circuits.

C14. Mention encoders, decoders, multiplexers and demultiplexers.

C15. Illustrate and classify Flip-flops, Registers and Counters.

C16. Describe D/A and A/D converters.

Semester VI
PH6B09TB Computational Physics

Credits – 3

Total lecture hours– 54 hrs

Aim

This course is intended to give an insight to computer hardware and computer applications. It also aims at teaching students the basic elements and functions of microprocessors. This course provides a comprehensive study of the C++programming language and an introduction to the field of numerical analysis.

Course Overview and context

The first module includes a basic idea of microprocessors, microprocessor initiated, internal and external operations, internal architecture, pinout and signals, instruction format and addressing modes of 8085 microprocessor. Module II deals with C++ programming basics, the basic ideas of structures, arrays, functions, objects and classes. In module III different numerical methods for finding the solution of algebraic equation, numerical integration and the numerical solution of differential equations are explained.

Module 1

Microprocessors (20 hrs)

Introduction to microprocessors- microprocessor operations (with relevance to 8085microprocessor): 8085 bus organization-address bus- data bus- control bus, internal data operations- 8085 registers- accumulator- flags- program counter- stack pointer, externally initiated operations.

The 8085 microprocessor architecture- pinout and signals- internal architecture of 8085 microprocessor .Machine language- assembly language- high level language. Instruction cycle, machine cycle and T state- instruction format- addressing modes. The 8085 instruction set- simple programmes for data transfer, addition and subtraction.

Text Book*: Microprocessor architecture, programming and applications, Ramesh S. Gaonkar, Chapter 1-6.*

Computer hardware (Internal assessment only; self study)

Characteristics of a computer- I/O devices- memory and storage devices- RAM,

ROM,Primary and secondary memory

Text book:*Fundamentals of Microprocessors and microcomputers- B. Ram (Dhanpat Rai Pub.)*

Module II

Programming in C++ (22 hrs)

Introduction- C++ programming basics- C++ program structure-data types in C++ variables-input/output with cout and cin-arithmetic operators-library functions.

Loops and decisions: Relational operators-Loops-for, while and do while-Decisions-if, if-else, switch-The conditional operator-logical operators-exit ()-Loop control statements-break , continue and the goto.

Structures: Structure specifiers and definitions-accessing structure members-structures within structures.

Functions: Simple functions-function definitions and declarations-Passing arguments to functions by value-Simple functions with return value, variables and storage classes.

Objects and classes: Simple class-C++ objects as physical objects and C++ objects as data types.

Arrays: Basic idea of one and two dimensional arrays-array definitions-accessing array elements- Addition and multiplication of matrices.

Text book: *Object oriented programming in Turbo C++- Robert Lafore, Galgotia Pub, Chapter ……*

Module III

Numerical methods (12 hrs)

Iteration principle- solution of algebraic and transcendental equations- bisection, false position and Newton-Raphson methods- algorithms - numerical integration –trapezoidal rule and Simpson's 1/3 rule - algorithm- Numerical solution of differential equation- Euler's method and second order Runge-Kutta method -

algorithm.

Text Book: Computer oriented numerical methods. V Rajaraman 3rd Edn PHI, Ch. 3,8and 9

References:

1. Microprocessor architecture, programming and applications- Ramesh S. Gaonkar (Penram Int. Pub.)

2. Fundamentals of Microprocessors and microcomputers- B. Ram (Dhanpat Rai Pub.)

3. Microcomputers and Microprocessors- John Uffenbeck (PHI Pub.)

4. Object oriented programming in Turbo C++ - Robert Lafore (Galgotia Pub.)

5. Programming with C++ - John R. Hubbard (Mc Graw Hill Pub.)

6. Numerical method- V. Rajaram (PHI Pub.)

7. Introductory methods of Numerical methods -S.S .Sastry (PHI Pub.)

8. Numerical method with computer programming in C++ - Ghosh (PHI Pub.) B Sc Programme in Physics, Mahatma Gandhi University

Competencies:

C1. Define microprocessor.

C2. Explain microprocessor operations

C3. Represent the bus structure of microprocessor

C4. Explain and represent programmable registers of microprocessor

C5. Illustrate and Explain pinout diagram and architecture of microprocessor

C6. Differentiate machine language, assembly language and high level language

C7. Explain instruction cycle and machine cycle

C8. Define addressing modes of microprocessor

C9. Understand the 8085 instruction set

C10. Develop simple programmes for data transfer, addition and subtraction

C11.Understand C++ program structure

C12.Illustrate data types in C++.

C13. Recognize variables.

C14.Explain input/output with **cout** and **cin.**

C15. Explain arithmetic operators and library functions.

C16. Illustrate relational operators.

C17.Explain for, while and do while loops.

C18. Explain if, if-else and switch decision statements.

C19. Explain the conditional operator and recognize its significance.

C20. Explain logical operators and **exit** ().

C21.Explain loop control statements-break, continue and the **goto.**

C22. Illustrate structures.

C23. Explain simple functions.

C24. Categorize variables and storage classes.

C25. Explain a simple class.

C26.Explain C++ objects as physical objects and C++ objects as data types.

C27. Explain one and two dimensional arrays.

C28. Illustrate addition and multiplication of matrices.

C29.Explain bisection, false position and Newton-Raphson methods to find solution of algebraic and transcendental equations also state algorithm.

C30. Explain trapezoidal rule and Simpson's 1/3 rule for numerical integration also state algorithm.

C31. Explain Euler's method and second order Runge-Kutta method to find the numerical solution of differential equation also state algorithm.

Semester VI

PH6B10TB Nuclear and Particle Physics

Credits – 3

Total lecture hours – 54 hrs

Aim

This course is intended to explore the interior of nucleus and to understand the paramount importance of nucleus in the grant scheme of things. It is also aimed to provide an exposure to Particle Physics, a branch of physics that studies the elementary constituents of matter and the interactions between them.

Course Overview and context

Nuclear physics is a science dealing with structures, elements and forces of the nuclei. And its applications in modern world are enormous ranging from production of nuclear energy, weapons to diagnosis and treatment in medicine. The course starts with the basic topics such as classification and static properties of nuclei, nuclear forces. Then it gives an introductory note on models and detectors of nuclear radiations. The principal aspects of radioactivity, nuclear reactions, particle physics are further included in this course.

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Module I

Nuclear structure & General properties of nuclei (15 hrs)

Classification of nuclei – isotopes, isobars, isomers, mirror nuclei. General properties of nucleus – size, nuclear mass, density, charge - angular momentum- nuclear magnetic dipole moments- electric quadrupole moment- Mass defect- binding energy- B.E. curve- packing fraction- nuclear stability. Theories of nuclear composition – proton-electron hypothesis, proton-neutron hypothesis. Properties of Nuclear forces – Meson theory of nuclear forces. Models of Nuclear structure- Liquid drop model -semi empirical mass formula- shell model- collective model (Quantitative ideas only). Detectors of nuclear radiations – ionisation chamber, Proportional counter, G.M Counter.

Text Book:

Modern Physics R. Murugeshan Kiruthiga Sivaprasad, S. Chand. Thirteenth Revised Multicolour Edition 2007, Chapter 27 Section 27.1- 27.12 , & Chapter 29 Sections 29.3,29.5,29.6

Module II

Radioactivity (18 hrs)

Natural radioactivity – Radioactive disintegration law – half life, Mean life- Radioactive series. Radioactive dating – Uranium dating, Carbon dating. Range of α particles – range – energy relationship. Geiger – Nuttal law - Alpha particle disintegration energy- Theory of α decay – Gamow's theory. β decay - β ray energy spectrum- Neutrino hypothesis- Positron emission, orbital electron capture (Basic ideas only). γ decay – Internal conversion - Electron positron pair production by γ rays-Electron positron annihilation. Artificial radioactivity- Transuranic elements. (Basic ideas only). Nuclear waste disposal - radiation hazards from nuclear explosion.

Text Book:

Modern Physics- R. Murugeshan Kiruthiga Sivaprasad S.Chand. Thirteenth Revised Multicolour Edition 2007, Chapter 31

For topics Nuclear waste disposal and radiation hazards from nuclear explosion, Chapter 32

For topics Artificial radioactivity Chapter 34 Section 34.9

For topics Transuranic elements Chapter 35, Section 35.10

Module III

Nuclear fission & Fusion (11 hrs)

Discovery of nuclear fission – Energy released in fission - Bohr and Wheeler Theory- chain reaction- Atom Bomb-Nuclear reactors –Power reactors, Breeder reactor. Nuclear fusion – Sources of stellar energy – Proton-Proton cycle, Carbon - Nitrogen cycle- Thermonuclear reactions - Hydrogen bomb- Controlled thermonuclear reactions.

Text Book:*Modern Physics- R. Murugeshan Kiruthiga Sivaprasad S.Chand. Thirteenth Revised Multicolour Edition 2007, Chapter 35Section 35.1- 35.9*

Elementary particles (10 hrs)

Particles and antiparticles –Antimatter- Fundamental interactions in nature. Classification of elementary particles (based on nuclear interactions)-Resonance particles

Elementary particle quantum numbers- conservation laws- symmetry, the quark model –

Compositions of hadron (based on quark model). Cosmic rays – Discovery - lattitude effect- altitude effect- east west effect- Primary and secondary ray – Cosmic Ray showers-Origin of cosmic rays.

Text Book:*Modern Physics- R. Murugeshan Kiruthiga Sivaprasad,S.Chand. Thirteenth Revised Multicolour Edition 2007, Chapter 38, Sections 38.1- 38.7 and Chapter 37, Sections 37.1- 37.7&37.10-37.11*

References:

1. Modern Physics- Aruldhas & P.Rajagopal, PHI
2. Concepts of Modern Physics -Arthur Beisser
3. Atomic and Nuclear Physics (Ch. 15) R. Murugeshan S.Chand
4. Nuclear Physics D. C. Tayal
5. Nuclear and Particle Physics S L Kakani and Subhra Kakani -Viva Books 2008

Competencies:

C1. Identify Isotopes, Isobars, Isomers, Mirror nuclei.

C2. Illustrate General properties of nucleus

C3. Describe angular momentum, nuclear magnetic dipole moments and electric quadrupole moment.

C4. State Mass defect, binding energy

C5. Draw and explain B.E. curve.

C6. Explain the theories of nuclear composition

C7. Recognize properties of Nuclear forces

C8. Classify Models of Nuclear structure

C9. Distinguish and differentiate detectors of nuclear radiations.

C10.State Radioactive disintegration law

C11. Illustrate half life, Mean life

C12. Retrieve Radioactive series, radioactive dating.

C13. Explain Range of α particles, range – energy relationship.

C14. State Gamow's theory of α decay.

C15. Understand β & γ decay and associated processes

C16. Mention artificial radioactivity, transuranic elements

C17. Recognize nuclear waste disposal & radiation hazards from nuclear explosion

C18. Illustrate Energy released in fission

C19. State Bohr and Wheeler Theory

C20. Classify Nuclear reactors

C21. Associate & discuss Sources of stellar energy

C22. Categorize Fundamental interactions in nature

C23. Classify elementary particles

C14. Instantiate the quark model.

C15. Distinguish primary & secondary cosmic rays

C16. Discuss lattitude effect, altitude effect, east west effect.

Semester VI

PH6B11TB Condensed Matter Physics

Credits – 3

Total lecture hours – 54

Aim

This course aims to provide a comprehensive introduction to the subject of Condensed Matter. It intends to provide with a basic foundation in the subject and also to familiarize the student with new and advanced topics in the field.

Course Overview and Context

Condensed matter physics deals with the physical properties of condensed phases of matter which try to understand their behavior by using physical laws. In particular, these include the laws of quantum mechanics, electromagnetism and statistical mechanics. This course provides basic knowledge about the structure of crystals, theories that discuss the distribution and motion of electrons in materials and the properties thereof. It also explores new materials like superconductors, Polymers, liquid crystals which have high prospects of application.

Module I

Crystal Structure (14 hrs)

Crystal lattice – Unit cell – Basis – Symmetry Operations – Point groups and Space groups – Types of Bravais lattices – Lattice directions and Planes – Miller Indices - Interplanar spacing – Crystal structures – simple cubic, fcc, bcc and hcp – structure of diamond, Zinc Blende and Sodium Chloride

X Ray Diffraction (4 hrs)

Bragg's Law – Experimental methods of X ray Diffraction – Powder Method – Reciprocal Lattice – Reciprocal lattice vectors (Elementary ideas only)

Text Book: ***Solid State Physics – R. K. Puri and V. K. Babbar, Chapter 1 and 2***

Module II

Free Electron Theory and Band theory of Solids (13 hrs)

Drude – Lorentz's classical theory – Sommerfeld's quantum theory – Free electron gas in one dimension – Fermi energy – Total energy- Density of states – Filling of energy levels – Application of free electron gas model

Band theory – Bloch theorem (statement only) – Kronig – Penney model (Qualitative ideas only) – Velocity and effective mass of electron – Distinction between metals, insulators and semiconductors.

Semiconductors – Intrinsic and Extrinsic – Carrier concentration, Fermi level and conductivity for intrinsic and extrinsic semiconductors (Expression only)

Text Book ***: Solid State Physics – R. K. Puri and V. K. Babbar - Chapter 5, 6 and 7***

Materials Science and Technology (5 hrs)

Amorphous Semiconductors - Liquid Crystals – Polymers - Thin films - (Qualitative ideas only)

Text Books*:*

1. ***Elementary Solid State Physics - Ali Omar (Pearson) -Chapter 12***
2. ***Thin film fundamentals - A.Goswami, New Age International,2008 - Chapter1***

Module III

Magnetic and Dielectric properties of Solids (11 hrs)

Types of Magnetism – Dia and Paramagenetism – Langevin's classical theory – Ferromagnetism – Domains and hysteresis – Antiferromagnetism and feriimagnetism (Qualitative ideas only)

Dielectric properties – Local field – Clausius Mossotti relation – Sources of polarisability – Frequency dependence – Ferro and Piezo electricity

Text Book: ***Solid State Physics – R. K. Puri and V. K. Babbar Chapter 8 and 9***

Superconductivity (7 hrs)

Superconducting phenomenon – Meissner effect –Critical field - Type I and Type II superconductors – Entropy, specific heat, energy gap – Isotope Effect – Josephson Effect – SQUIDs – BCS theory (qualitative ideas only) – Applications

Text Book: ***Solid State Physics – R. K. Puri and V. K. Babbar - Chapter 10***

References

1. Introduction to Solid State Physics- Kittel, C. Wiley -8th edition
2. Elementary Solid State Physics - Ali Omar - Pearson
3. Solid State Physics, P.K. Palanisamy, Scitech publications
4. Solid State Physics -Ashcroft, N.W. & Mermin, N.D., TMH
5. Solid State Physics - Blakemore, J.S., Cambridge, 2nd edition
6. Solid State Physics - C.L. Arora,. S Chand.
7. Solid State Physics - S.O. Pillai,. New Age International
8. Superconductivity, Superfluids and Condensate - James F Annett - Oxford.

Competencies

C1. Define the fundamental terms needed to study the structure of a crystal.

C2. Describe the symmetry operations in a crystal.

C3. Define point groups and space groups.

C4. Discuss the different types of lattices.

C5. Use the idea of Miller indices to represent lattice directions

C6. Distinguish the different crystal structures with examples.

C7. State and prove Bragg's law.

C8. Discuss the experimental methods of X- ray diffraction with one example in detail.

C9. Explain the concepts of reciprocal lattice and reciprocal lattice vectors.

C10. Discuss the classical and quantum theories of free electron model.

C11. Derive expressions for Fermi energy, total energy and density of states for a free electron gas in one dimension.

C12. Describe the filling of energy levels in a metal.

C13. Discuss one application of free electron gas model.

C14. State Bloch's theorem.

C15. Discuss band theory qualitatively using Kronig – Penney model.

C16. Derive expressions for velocity and effective mass of an electron using the ideas of band theory.

C17. Classify materials on the basis of their band structure.

C18. Define semiconductors and classify them.

C19. Discuss the ideas of carrier concentration, Fermi level and conductivity for semiconductors study the expressions.

C20. Describe amorphous materials, liquid crystals and polymers qualitatively.

C21. Discuss fundamental ideas and properties of thin films.

C22. Classify magnetic materials and discuss their properties.

C23. Discuss Langevin's classical theory for dia and paramagnetic materials.

C24. Explain domains and hysteresis for ferromagnetic materials.

C25. Define antiferromagnetic and ferromagnetic materials.

C26. Explain the dielectric properties of materials.

C27. Define local electric field and derive Clausius – Mosotti relation.

C28. Distinguish between different types of polarisabilities and discuss their frequency dependence.

C29. Explain ferro and piezo electricity.

C30. Explain the phenomenon of superconductivity.

C31. Discuss the fundamental properties of superconductors.

C32. Classify superconductors into Type I and Type II and discuss about them.

C33. Define Josephson effect and discuss how it is used in SQUIDs.

C34. Explain BCS theory of superconductivity qualitatively.

C35. Discuss the applications of superconductors.

Semester VI
PH6B12TB Relativity and Spectroscopy

Credits -3

Total Lecture hours- 54

Aim

To introduce the principles and features of Special theory of Relativity and Spectroscopy. The course is meant to enable the student to understand the laws of physics in the context of relativistic speed and to know how the spectral lines from various atoms and molecules are originated.

Course overview and Context

The first module discusses the changes in mass, energy and time due to relativistic motion. Second module deals with the of origin of atomic spectra and advances to describe Nuclear Magnetic Resonance and Electron Spin Resonance. Third module gives description of electronic, vibrational and rotational spectroscopy. It also describes Raman scattering, fluorescence and phosphorescence.

Module I

Special Theory of Relativity (18 hrs)

Inertial and non inertial frames of reference, Galilean transformation, Michelson – Morley experiment, Postulates of Special Theory of Relativity, Lorentz transformation, Velocity transformations, Length contraction, time dilation, Relativistic Mass, Equivalence of mass and energy.

Text Book: ***Modern Physics, G. Aruldhas, P. Rajagopal, PHI Learning Pvt. Ltd. Chapter 1***

Module II

Atomic Spectroscopy (18 hours)

Vector Atom model, Quantum numbers associated with vector atom model, Coupling Schemes- L-S coupling, j-j coupling, Pauli Exclusion principle, Magnetic dipole moment due to orbital and spin motion of electron, Stern and Gerlach Experiment, Spin-Orbit coupling.

Optical spectra, spectral terms and notations, selection rules, intensity rule and

interval rule, fine structure of sodium D line, Zeeman Effect, Larmors theorem, quantum mechanical explanation of the normal Zeeman Effect, Anomalous Zeeman effect, Paschen Back Effect and Stark Effect

Nuclear magnetic Resonance (NMR) Principle, Electron spin resonance (ESR) Principle

Text Books:

1. ***Modern Physics, R Murugeshan&KiruthigaSivaprasath , S Chand, Chapter 6 (Relevant sections)***
2. ***Modern Physics, G Aruldhas& P Rajagopal, PHI Learning Pvt. Ltd. Sections 9.13.1 and 9.14.1***

Module III

Molecular spectroscopy (18 hours)

Electromagnetic spectrum, Molecular energies, Classification of molecules, Rotational Spectra of diatomic molecules, Diatomic vibrational spectra, Explanation with simple harmonic oscillator.

Electronic Spectra of molecules, Phosphorescence and Fluorescence, Raman Scattering, Quantum theory of Raman Scattering, Classical description of Raman scattering, Raman Spectrometer

Text books:

1. ***Fundamentals of molecular spectroscopy, Colin N. Banwell and Elanine M McCash,Tata McGraw- Hill -Sections 2.1to 2.3.1&3.1to 3.1.2***

2. ***Modern Physics,G Aruldhas& P Rajagopal - PHI Learning Pvt. Ltd, Sectins 9.1, 9.2 &9.12***
3. ***Concepts of Modern Physics, Arthur Beiser, Mc Graw Hill Education (India) Pvt. Ltd. Section 8.8***

References:

1. Concepts of modern Physics, Arthur Beiser, Tata McGraw Hill Publication
2. Mechanics, H S Hans, S P Puri, Tata Mc Graw Hill Education Pvt. Ltd.
3. Classical Mechanics – K. Sankara Rao, Prentice Hall of India

4. Fundamentals of molecular spectroscopy, Colin N. Banwell and Elanine M McCash, Tata McGraw- Hill
5. Modern Physics ,GAruldhas& P Rajagopal Sections - PHI Learning
6. Modern Physics, R Murugeshan & KiruthigaSivaprasath , S Chand
7. Molecular structure and Spectroscopy, G Aruldhas, Prentice Hall of India

Competencies:

C1. Recognize the relative nature of motion.

C2.Categorize frames of reference.

C3. Illustrate Galilean transformation.

C4.Describe Michelson Morley experiment.

C5.Recognize the significance of Michelson Morley experiment

C6. State the postulates of Special Theory of Relativity.

C7. Explain Lorentz transformation and velocity transformations.

C8. Extend the Lorentz transformation to concepts of Length contraction, time dilation and relativistic Mass.

C9. Summarize the equivalence of mass and energy.

C10. Outline the introductory concepts of general theory of relativity.

C11. Describe Vector Atom model

C12.Illustrate the quantum numbers associated with Vector atom model

C13.Compare the Coupling Schemes- L-S coupling, j-j coupling

C14. State Pauli Exclusion principle

C15. Find the Magnetic dipole moment due to orbital and spin motion of electron

C16. Discuss the Stern and Gerlach Experiment to establish electron spin

C17. Outline the effect of Spin-Orbit coupling.

C18. Describe the spectral terms and notations

C19.State selection rules for emission of spectral lines.

C20. Give the intensity rule and interval rule for spectral lines

C21. Illustrate the fine structure of sodium D line

C22. Discuss Zeeman Effect

C23. StateLarmors theorem

C24. Give the quantum mechanical explanation of the normal Zeeman Effect,

C25. Explain with theory the Anomalous Zeeman effect

C26. Distinguish between Paschen Back Effect and Stark Effect

C27. Write down the principle of Nuclear magnetic Resonance (NMR)

C28. Write down the Principle of Electron spin resonance (ESR)

C29. Examine the components of electromagnetic spectrum

C30.Describe the Molecular energies -electronic, vibrational and rotational

C31. State the classification of molecules

C32. Examine the Rotational Spectra of diatomic molecules

C33. Illustrate the Diatomic vibrational spectra of molecules

C34. Explain the vibration spectra of molecule in comparison with simple harmonic oscillator.

C35. Differentiate between Phosphorescence and Fluorescence

C36.Examine Raman Scattering

C37. Illustrate Quantum theory of Raman Scattering

C38. Justify Raman scattering with the classical description.

C39. Describe Raman Spectrometer

Semester VI

Choice Based Course

PH6B13aTB Nanoscience and Nanotechnology

Credits - 4

Total lecture hours - 72

Aim

Nanoscience is the best example of a truly interdisciplinary research field where contributions from physics, chemistry, engineering, mathematics, biotechnology etc design the developmental pattern of this relatively new branch of science. This in turn nurture many other high tech ventures like optics, photonics, medicine, computers, automobiles, besides providing luxuries like self cleaning windows, smart surfaces, cosmetics and so on. In fact there is nearly nothing that nanoscience has not influenced. To enable them understand the science of small things, synthesis and analysis techniques and then to probe much more, Nanoscience and Nanotechnology is the right beginning.

Course Overview

The course summarises the fundamentals and technical approaches in synthesis, fabrication and processing of nanostructures and nanomaterials so as to provide a systematic and coherent picture of the field. Also some important nanostructures and nanodevices are introduced.

Module I

Introduction to nanoscience (5 hrs)

Introduction to nanoscience- Bulk to nano transition- magic numbers- mass spectroscopy, Size Dependence of Properties- melting point, mechanical, optical, electrical and magnetic properties at the nanoscale.

Text Books:

1. ***Nanostructures and Nanomaterials- Synthesis, Properties & Applications, Guozhong Cao, Imperial College Press, Chapter 8.***
2. ***Introduction to Nanotechnology, C P Poole, Wiley Interscience, Chapter 4***

Quantum Confined Structures (11 hrs)

Quantum confined structures-Quantum Wells, Wires, and Dots - Fermi gas

model - Comparison of density of states and energy dispersion curve in bulk, Quantum well, Quantum wire and Quantum dots. Equation representing energy of electrons and holes in the quantum confined structures and the concept of Blue shift in band gap - properties dependent on density of states - absorption, emission. Applications – quantum confined structures as lasing media.

Text Books:

1. ***Nanophotonics, Paras N Prasad, Wiley Interscience, Chapter 4***
2. ***Introduction to nanotechnology, C P Poole, Wiley Interscience, Chapter 9***

Module II

Synthesis techniques (10 hrs)

Top - down methods : a) Lithography - electron beam lithography, two photon lithography, nanoimprint lithography b) ball milling. Bottom - up methods: a) Chemical method, b) self organization, c) sol gel method for fabrication of photonic nanomaterials, d) reverse micelle route. Other important methods: a) Chemical vapour deposition, b) pulsed laser deposition and c) pulsed laser ablation, d) RF plasma.

Text Books:

1. ***Introduction to nanotechnology, C P Poole, Wiley Interscience, Chapter 4, 9***
2. ***Nanophotonics, Paras N Prasad, Wiley Interscience, Chapter 7,9,11***
3. ***Ball milling basic ideas from Preparation of Lithium Niobate Nanoparticles by High Energy Ball Milling and their Characterization, Sujan Kar et al., Universal Journal of Materials Science 1(2): 18-24, 2013***
4. ***Introduction to Nanoscience and Nanotechnology, K.K. Chattopadhyay and A. N Banerjee, PHI Learning and Pvt. Ltd Chapter 6***

Methods of Characterization (11 hrs)

XRD- Determination of crystallographic structure- Particle Size Determination, RHEED, LEED- Surface Structures, Microscopy for structure and size determination-Transmission Electron Microscopy- Field Ion Microscopy- Scanning Electron Microscopy, AFM, STM - STM and FIM as synthesis tools for nanoparticles, electron microscope for chemical analysis.

Text Books:

1. ***Introduction to nanotechnology, C P Poole, Wiley Interscience, Chapter 3***
2. ***Nanophotonics, Paras N Prasad, Wiley Interscience, Chapter 7***

Module III

Carbon nanostructures (10 hrs)

Carbon nanostructures: Carbon molecules, Buckminister fullerene, Carbon nanotube- structure, Properties-Vibrational Properties-Mechanical Properties - Applications of Carbon Nanotubes -Computers -Fuel Cells -Chemical Sensors- Catalysis –Mechanical Reinforcement -Field Emission and Shielding. (elementary ideas).

Text books*:*

1. ***Introduction to Nanotechnology, Charles. P. Poole , Jr. and Frank J Owens, Wiley, 2003 Chapter 5.***
2. ***Nanostructures and Nanomaterials- Synthesis, Properties & Applications, Guozhong Cao, Imperial College Press, Chapter 6.***

Nanocomposites(4 hrs)

Nanocomposites - Introduction, designing, advantages and disadvantages, Polymer nanocomposites, Metal nanocluster Composite glasses.

Text Book:

1. ***Nanotechnology-fundamentals and Applications- Manasi Karkare, IK International- Chapter 8***

Photonic crystals (11 hrs)

Photonic crystals:1D, 2D, 3D photonic crystals, comparison of photonic and electronic crystals(elementary ideas), features- presence of band gap- reflection and transmission of electromagnetic waves, defect and defect modes- point defect , line defect and surface defect , Photonic Crystal fiber: (Introduction only)- PCF: band gap guidance and dielectric guidance – Applications : Photonic crystal optical circuitry, superprism, point defect, line defect, Types of PCF.

Text Book:

1. ***Nanophotonics, Paras N Prasad, Wiley Interscience, Chapter 9***

2. ***Reference - Photonic crystals , Moulding the flow of light – john D Joannopoulos, Princeton University Press.***

Nanomachines and Nanodevices (8 hrs)

Micro electromechanical Systems (MEMS) - Nanoelectromechanical Systems (NEMS)-Nanoelectronics: single electron transistor. Spintronics- GMR, CMR materials, Multilayer thin films and spin valve transistors.

Text Book:

1. ***Introduction to Nanotechnology, Charles. P. Poole , Jr. and Frank J Owens, Wiley, 2003 Chapter 5.***

Role of Nanotechnology in improving standard of life (2 hrs)

Nanomedicines, smart surfaces-smart window, self cleaning surfaces, smart paint, applications in automobile.

Text Book:

1. ***Nanophotonics, Paras N Prasad, Wiley Interscience, Chapter 14***

References :

1. Nanoscience- The Science of the Small in Physics, Engineering, Chemistry, Biology and Medicine, Hans Eckhardt Schaefer, Springer.
2. Introduction to Nanoscience and Nanotechnology , Chris Binns, Wiley.
3. Introduction to Nanoscience and Nanotechnology, K. K. Chattopadhyay and A. N Banerjee, PHI Learning and Pvt. Ltd

Competencies:

C1. Mention the transition from bulk to nano meter dimension.

C2. Understand magic numbers involved in the formation of clusters.

C3. Introduce the mass spectroscopy as tool to analyse the cluster.

C4. Discuss the effect of nano dimension in physical, chemical, optical, electrical and magnetic properties of the material.

C5. Classify and distinguish the different quantum confined structures with

the bulk counterparts.

C6. Illustrate dimension and confinement effect on some applications such as Infrared Detectors and Quantum Dot lasers.

C7. Distinguish Top Down and Bottom Up approach in the synthesis of nanomaterials.

C8. Recognise and understand the synthesis method required for different nanomaterials.

C9. Introduce different tools used in characterising nanomaterials.

C10. Examine the different types of carbon nanostructures.

C11. Describe the structure and properties of Carbon Nanotube.

C12. Analyse the different applications of Carbon Nano tube.

C13. Distinguish the properties of Photonic and Electronic Crystals.

C14. Introduce the Photonic Crystal Fibre.

C15. Recognise the importance of Nanocomposite.

C16. Introduce Polymer nanocomposite and metal nanocluster composite glass.

C17. Discuss the viability of MEMS

C18. Explain the role of NEMS in revolutionising the industry.

C19. Analyse the characteristics of a Single Electron Transistor.

C20. Classify different types of Magnetoresistive materials.

C21. Introduce Spin Valve Transistor.

C22. Express current applications of nanotechnology.

C23. Explain and illustrate every concept mentioned in the syllabus.

Semester VI
Choice Based Course
PH6B13bTB Alternate Energy Sources

Credits -4
Total lecture hours- 72
Aim

To provide the perspectives of energy sources, their availability and demand. The topics give the basic principles of energy conversions, conservation.

Module 1

Energy Sources (6 hours)

World Energy Reserves —Various forms of energy - Conventional energy Sources – Fossil fuels -Coal, Oil and Natural Gas - impact of conventional energy sources on environment - global warming – climate change – non-conventional energy sources .

Solar Energy (12 hours)

Physical Principles of the Solar Energy Conversion—- Solar pond – Applications: Solar Water Heating, Space Cooling, Distillation, Green Houses – Solar Photovoltaics – Solar Cells – Principles, types and power generation– Merits and Demerits

Module II

Wind Energy and Biomass Energy (18 hours)

Wind Data and Energy Estimation – Basic Components of a Wind Energy Conversion System(WECS) – Classification of WECS – Applications - Merits and Demerits. Biomass Conversion Technologies – Photosynthesis – Photosynthetic Efficiency - Biogas Generation – Applications - Advantages and Disadvantages

Module III

Other Sources of Renewable Energy (18 hours)

Geothermal energy – Ocean Thermal Energy Conversion (OTEC) – Tidal Energy – Micro Hydel Systems – Chemical Energy Sources – Fuel Cells, Hydrogen Energy - Magneto Hydro Dynamic Power Generation – Basic Principles, Applications, Advantages and Disadvantages

Module IV

Energy Consumption and Conservation (18 hours)

Patterns of energy consumption in domestic, industrial, transportation and agricultural sectors - Principles of Energy Conservation and Energy Audit – energy crisis and possible solutions - energy options for the developing countries

Text Book

1. ***G.D. Rai, Non Conventional Energy Sources, 4th Ed. Khanna Publishers, 2007.***
2. ***D.S. Chauhan and S. K. Srivastava, Non-conventional Energy Resources, New Age Int. Pvt. Ltd., 2004***

References

1. B.H. Khan, Non-conventional Energy Resources, 2nd Ed., Tata McGraw Hill, 2009
2. G.D. Rai, Solar Energy Utilization, Khanna Publishers, Ed. V, 1995.
3. S.P. Sukhatme, Solar energy, Tata McGraw-Hill Publishing Company, 2ndEd., 1997.
4. S. Rao and Dr. B.B. Parulekar, Energy Technology, 2nd Edition, 1997.
5. Godfrey Boyle, Renewable Energy: Power for a sustainable Future, Oxford Univ. Press, 2nd Ed.,2004.
6. Jyoti K. Parikh, Energy models for 2000 and Beyond, Tata McGraw Hill, 1997.
7. A.K. Wahil, Power Plant technology, Tata McGraw Hill, 1st Ed., 2nd Reprint, 2010
8. Renewable energy resources - C S Solanki - PHI - 2008

Competencies

C1 Explore World Energy Reserves for Future
C2 List various forms of energy
C3 Examine Conventional energy Sources
C4 Distinguish between the Fossil fuels -Coal, Oil and Natural Gas
C5 Compare the impact of conventional energy sources on environment -

global warming – climate change – non-conventional energy sources

C6 Enumerate Prospects in the energy sector.

C7 Examine the amount of Solar Radiation at the Earth's surface

C8 State the Physical Principles of the Solar Energy Conversion

C9 Define Solar pond

C10 Discuss the applications of solar energy: Solar Water Heating, Space Cooling, Distillation, Green Houses Solar Photovoltaics and Solar Cells in the context of Principles types and power generation

C11. Examine the Merits and Demerits of the above mentioned applications

C12. Discuss the Wind data and Energy estimated with wind

C13 Discuss the Basic Components of a Wind Energy Conversion System (WECS)

C14 Classify WECS

C15 Discuss the applications of Wind Energy

C16 Compare the Applications with respect to Merits and Demerits.

C17 Illustrate Biomass Conversion Technologies

C18 Describe Photosynthesis

C19 Define Photosynthetic Efficiency

C20 Discuss the technique of - Biogas Generation

C21 List the Applications of biogas generation

C22 Illustrate Advantages and Disadvantages of biogases

C23 Explain Geothermal energy

C24 Outline the technique of Ocean Thermal Energy Conversion (OTEC)

C25 Describe Tidal Energy

C26 Define Micro Hydel Systems

C27 Illustrate Chemical Energy Sources Fuel Cells and Hydrogen Energy

C28 Describe the Magneto Hydro Dynamic Power Generation with respect to Basic Principles, Applications Advantages and Disadvantages

C29 Compare the Patterns of energy consumption in domestic, industrial, transportation and agricultural sectors

C30 Give the Principles of Energy Conservation and Energy Audit

C31 Examine the energy crisis and possible solutions

C32 List the energy options for the developing countries

Semester VI

Choice Based Course

PH6B13cTB Information Technology

Credits – 4

Total Lecture hours –72

Aim

The aim of the course is to learn about the fascinating world of information technology and to use the tools available in Internet and the World Wide Web for a deep study of the subjects related to physics in better way by the students themselves.

Course overview and Context

The electronic storage of information, retrieval and transmission has become an important feature of this century and all of the students must be introduced to the techniques of the same. Web page designing with HTML, Networking, Network security alogorithms and Basics of DBMS are discussed

Module I (26 hrs)

Information And Its Use : Information Technology – Quality of information – Message transmission – Electronic Office – E mail – Document storage – Computers in Industry – Different types – Graphical user interface

Text Books: ***Information Technology – The Breaking Wave", D. Curtin, K. Sen and K .Morin, Tata McGraw Hill, 1999. Chapter – 1, 2***

Computer Networks: Importance of Networks. Components of Networks. Classification ofNetworks: Broad cast networks-Switched networks. Switching Techniques. Types of Networks – LAN – MAN – WAN. Networking Models – OSI reference model – TCP/IP reference model-Comparison between the OSI and TCP/IP models. Network Topology – Bus-Star-Ring-Tree-Mesh-Cellular. Network Architecture – Client/Server, Peer-to-Peer

Text Books:

1. ***Computer Networks – A.S. Tanenbaum - Prentice Hall of India,***

Chapter – 1

2. ***Computer Fundamentals – P.K. Sinha 3rd Edn. BPB Publications, Chapter – 17***

THE INTERNET: Internet Protocols – Internet Protocol (IP)-Transmission Control Protocol(TCP) -Internet Address – Structure of Internet Servers Address-Address Space-Internet Infrastructure -Services on Internet – Domain Name System-SMTP and Electronic mail – Http and World Wide Web-Usenet and News groups-FTP-Telnet-Network Security – Ideas of secret key Algorithms and Public key Algorithms-Digital Signature-E-mail Privacy-Internet Tools – Search Engines-Web browsers- Internet explorer, Netscape Navigator, Mozilla Firefox(Working Knowledge)

Text Books:

1. ***Computer Networks – A.S. Tanenbaum – PHI, Chapter – 5,6,7***
2. **Computer Fundamentals – P.K. Sinha 3rd Edn. BPB Publications, Chapter – 18**

Module – II (26 hrs)

THE HTML: What is HTML? Basic Tags of HTML – HTML-TITLE-BODY - Starting an HTML document – The <!DOCTYPE>declaration-setting boundaries with <HTML>-the HEAD element-the BODY element-the STYLE element and the SCRIPT element. -Formatting of text– Headers-Formatting Tags-PRE tag-FONT tag-Special Characters. Working with Images-META tag -Links – Anchor Tag -Lists – Unordered Lists-Ordered Lists-Definition Lists - Tables – TABLE, TR and TD Tags-Cell Spacing and Cell Padding-Colspan and Rowspan -Frames – Frameset-FRAME Tag-NOFRAMES Tag - Forms – FORM and INPUT Tag-Text Box-Radio Button-Checkbox-SELECT Tag and Pull Down Lists-Hidden-Submit and Reset -Some Special Tags–COLGROUP-THREAD,TBODY-TFOOT-_blank-_self,_parent-_top-IRFRAME-LABEL-Attribute for <SELECT>- TEXTAREA

Text Books: ***HTML4 – 2nd Edn. Rick Darnell, Techmedia, Chapter – 1, 2,3,4,5***

Module III (20 hrs)

Basic Idea of DBMS: Need for Data Base – Database Systems versus File systems - View of Data - Data Abstraction-Instances and Schemas - Data Models – ER Model-Relational Model-Network Model-Hierarchical Model (general ideas) -Basic ideas about Structured Query Language

Text Books: ***Fundaments of Database System – Elmasri, Ramez and Navathe Shamkant B. 4th Edn.*** **Person Education, India, 2004. Chapter – 1**

MS – OFFICE/OPEN OFFICE (Working Knowledge): Word processors – PowerPoint -Spreadsheets – Databases

(No specific text book is preferred. MS office (97, 98, 2000, /Open Office which is installed in the lab can be used. Working practice must be given)

Reference

1. "Information Technology – The Breaking Wave", D.Curtin, K.Sen and K.Morin, Tata McGraw Hill, 1999.
2. Computer Networks – A.S. Tanenbaum - Prentice Hall of India
3. Computer Fundamentals – P.K. Sinha 3rd Edn. BPB Publications
4. Internet and World Wide Web – Deitel
5. HTML4 – 2nd Edn. Rick Darnell, Techmedia
6. Database System Concepts – Silberschatz –Korth -Sudarshan 4th Edn – Tata Mac Graw Hill
7. "Information Technology and systems", Green, B.C., Longman Scientific & Technical Publishers, England, 1994.
8. Networks – Tirothy S. Ramteke – 2nd Edn. Pearson Edn – New Delhi, 2004
9. Data and Computer Communucation, William Stalling, PHI, New Delhi.
10. Mastering HTML4 – Ray D.S. and Ray E.J. – BPB
11. HTML – The Complete Reference – Tata Mc Graw Hill
12. Fundaments of Database System – Elmasri, Ramez and Navathe Shamkant B. 4th Edn.v Pearson Education, India, 2004.

Competencies

C1 Describe the message transmission techniques in the context of email.

C2 Enumerate and compare different types of computers.

C3 Find the features of Graphical User Interface

C4 Distinguish between different types of networks LAN, MAN and WAN

C5 Compare of performance of OSI model and TCP/IP models.

C6 Analyze different types of network topology – Bus, Star, Ring, Tree, Mesh, and Cellular

C7 Examine Different Network Architectures Client/Server and Peer-to-Peer

C8 Elaborate on the Internet Protocols the Internet Protocol (IP) and Transmission Control Protocol (TCP)

C9 Find the Structure of Internet Servers

C10 Illustrate Domain Name System.

C11 Describe SMTP and Electronic mail

C12 Relate Http and World Wide Web

C13 Examine Usenet and News groups and the file transfer protocol, FTP

C14 Discuss the ideas of secret key Algorithms and Public key Algorithms-Digital Signature-E-mail Privacy

C15 Elaborate the working of Search Engines, and Web browsers incase of Internet explorer, Netscape Navigator, Mozilla Firefox

C16 Find the Basic Tags of HTML for HTML TITLE and BODY , HEAD, STYLE, SCRIPT

C17 Discuss the formatting tags of HTML tags PRE tag, FONT tag and Special Characters.

C18 Discus working with Images, -META tag ,Links , Anchor Tag ,Lists , Unordered Lists-Ordered Lists

C19 Examine HTML tags for Tables TR and TD Tags, Cell Spacing and Cell Padding, Colspan and Rowspan

C20 Illustrate HTML tags for Frames – Frameset, FRAME Tag, NOFRAMES Tag

C21 Describe the tags for forms in HTML ,FORM and INPUT Tag, Text Box, Radio Button, Checkbox, SELECT Tag and Pull Down List, Hidden, Submit and Reset, COLGROUP-THREAD,TBODY,TFOOT, blank, self, parent, top, IRFRAME LABEL and Attribute for SELECT and TEXTAREA

C22 Give the Basic Idea of DBMS with respect to Need for Data Base

C23 Compare Database Systems versus File systems

C24 Describe View of Data , Data Abstraction-Instances and Schemas

C25 Examine and compare the general ideas of Data Models, ER Model, Relational Model and Network Model and Hierarchical Model

C26 Outline basic ideas of Structured Query Language

C27 Describe of MS offices with respect to word, power point, spread sheet and data bases.

Semester VI

Choice Based Course

PH6B13dTB Astronomy and Astrophysics

Credits –4

No. of contact hours – 72

Aim

A good introduction to the basics of astronomy and astrophysics will be given in the course. It is expected that some of the students will opt for this specialization for their post graduation.

Course Overview and Context

The course introduces the students to how to observe and identify celestial objects by giving an idea about the celestial co-ordinate system and tools employed in observational astronomy. The stellar structure and its evolution is discussed in the following module. The course also provides light into different types of galaxies and cosmology.

Module I

Introduction to observational astronomy (24 hours)

Celestial sphere. Constellations and nomenclature of stars. The cardinal points and circles on the celestial sphere. Equatorial. ecliptic and galactic system of co-ordinates. Aspects of sky from different places on the earth. Sidereal, Apparent and Mean solar time and their relations. Equation of time. Ephemeris and Atomic Times. Calendar. Julian date and heliocentric correction. Introduction to telescopes. Amateur Refracting telescopes and their design. Newtonian reflectors, Cassegrain telescopes. Telescope mounts - equatorial and alt-azimuth, telescope drives. Distances of stars from parallaxes. Stellar motions. Magnitude scale and magnitude systems. Black-body approximation to the continuous radiation and temperatures of stars. Variable stars as distance indicators

Text Books:

1. ***World Book Encyclopedia of Science, Volume. 1***

2. ***Textbook of Astronomy and Astrophysics with Elements of Cosmology, V. B. Bhatia, Narosa Publishing House.***
3. ***Exploring the Night Sky with Binoculars, Patrick Moore, Cambridge University Press.***

Module II

Stars (24 hours)

Sun –internal structure and atmosphere- photosphere- sunspots - chromospheres – corona –solar flares –prominences. Stellar structure - hydrostatic equilibrium- structure equations - energy sources - energy transport. Types of stars – classification and HR diagram.

Formation - Interstellar dust and gas – Jeans' mass - formation of protostars – evolution of planetary systems with special reference to Sun -Pre-main sequence evolution; nuclear fusion. P-P chain and CNO cycle. Energy production in massive stars. Evolution on the main sequence - Late stages of evolution. Fate of massive stars, supernovae - White dwarfs - Chandrasekhar limit - Neutron stars – Pulsars – Black holes

Text Books:

1. ***Astrophysics: Stars and galaxies, K. D. Abhyankar, Tata McGraw Hill***
2. ***The Physics of Stars, A.C. Philips, Wiley***

Module III

Galaxies and the expanding Universe (24 hours)

Galaxies-their morphology and classification. Cepheid variables and distance measurements. Origin and evolution of Galaxies. Large scale structure of the universe – isotropy and homogeneity. Expanding universe – Doppler effect – red shift – distance scale –Hubble law. Standard Big bang theory , cosmic microwave background and its discovery ; early universe – nucleo synthesis in early universe – inflationary model of the universe – age of the universe and its determination.

Text Books:

1. ***Introduction to Cosmology, J. V. Narlikar, Cambridge University Press. Particle Astrophysics, Donald Perkins, Oxford***
2. ***Astrophysics: Stars and galaxies, K. D. Abhyankar, Tata McGraw Hill***

References: 1. Baidyanath basu, An Introduction to Astrophysics. PHI

Reference

1. *James B. Seaborn, Understanding the Universe, Springer.*
2. *The Physical Universe – An Introduction to Astronomy – Frank H. Shu- University Science Books.*
3. *The First Three Minutes. Steven Weinberg*

Competencies

C1. Describe the co ordinate system used in astronomy.
C2. Define the different terms denoting time and their relations.
C3. Distinguish between refracting and reflecting telescopes with examples.
C4. Understand the different types of telescope mounts.
C5. Explain magnitude systems.
C6. Describe the stellar structure of sun.
C7. Understand the energy generation and stability in stars
C8. Describe HR diagram and its various components
C9. Classify different types of galaxies.
C10. Understand the concept of expanding universe.
C11. Describe the importance of cosmic microwave background.
C12. Discuss the determination of age of the universe.

Semester VI

PH6B13eTB Choice Based Course - Optoelectronics

Credits – 4

Total Lecture hours – 72

Aim: This century is going to be the century of Optoelectronics or Photonics – the light wave technology. Today we have optical technologies replacing electronic memories, amplifiers etc. These enable high speed computing. Hence no Physics student can avoid this latest field of science and technology.

Course overview and Context:

Optical communication techniques are very relevant in the context of higher band width and less distortion. The course describes different types of sources employed for optical communication and the bounded media the optical fibre.

Module I

Optoelectronic Fundamentals

Introduction to Photonics (10 hrs)

Optical radiation and light- Luminescence and Radiation-Radiation source parameters– Receiver parameters (1.1.1, 1.1.2,1.1.4 &1.1.5 of Ref.1)- Photometric and Radiometric terms and units- Inverse square law – verification by photometer-comparison of efficiency of light sources available in the market and recommended values of illumination for various activities (General awareness) (Ch.6 of Ref.2).

Introduction to Photonics – electrons Vs photons – Electronics Vs Optics Photonics (1.1 to 1.3 of Ref.3)- Photonics and light technology and applications-introduction (1.2 to 1.5 of Ref.4)

Properties of Photons (2.1 of Ref.4)- Gausian beams – beam characteristics and

parameters (2.4 of Ref.4) - Light Characteristics – Power, energy, peak power, beam radius, intensity, divergence, beam quality, brightness, brilliance, radiation pressure, optical levitation (2.7 of Ref.4)

Optical process in semiconductors (12 hrs)

Electron hole pair formation and recombination. Radiative and non radiative recombination. Absorption in semiconductors – indirect transitions, exciton absorption, donor- acceptor band impurity band absorption. Long wavelength absorption. Franz Keldysh and Stark effect. Radiation in semiconductors. Stokes shift in optical transitions. Deep level transitions, Auger recombination. (Ch.3 of Ref.5)

Module II

Optical Devices

Radiation sources (9hrs)

LED –Principle –characteristics (V-I & light – current)–materials- efficiencies- LED structures- hetero junction and edge emitting LED-. Applications &advantages.

Semiconductor lasers – Homo junction and hetero junction and Quantum well lasers – Principle -Optical and carrier confinement

Photodetectors (9hrs)

Introduction- Classification of detectors- Qualitative idea of each type- Photo detector parameters – Noise mechanisms (Ch.4 of Ref.1, Ch.5.3 of Ref.3)– Principle and operation of Photodiode, APD, Phototransistor, PIN photodiode- opto isolators

Solar cells (6 hrs)

Principle-. V-I characteristics- Fill factor – conversion efficiency (Qualitative study)-Hetero junction solar cells. (Ch.10 of Ref.5, Ch.6 of Ref.1)

Module III

Optical Communication

Introduction (5hrs)

Introduction to Optical communication- Historical perspective- Advantages and disadvantages of optical communication links in comparison with radio and microwave system and with guided systems- measurement of information and the capacity of telecommunication channel- Communication system architecture- basic optical communication system – Definition of attenuation, pulse duration and band width. Ch. 1 of Ref.9)

Optical Modulation. (12hrs)

Direct modulation of LED and diode laser. Digital and analog modulation of LED and diode laser. External modulation. Birefringence, Pockel effect , phase modulation. Wave guide modulators . Electro-optic , Magneto- optic and acousto- optic modulators. Bipolar controller modulator. (Ref.1,7,10)

Fibre optic communication (9hrs)

Introduction to Optical fibres and fibre optic communication (Ch.1 of Ref.11 and Ch.1.1 to1.3 of Ref.13)- Types of optical fibres- Numerical aperture- Fibre bundles, cables- strength-fibre optical properties- Fibre materials – Classification of fibres – Step index and graded index- mono mode and multi mode fibres –plastic fibres-latest developed fibres (Ch.2,3 of Ref.11)- Fibre loses.

References:

1. Optoelectronic Engineering S.N. Biswass, Dhanpat Rai Publications
2. A Text book of Optics- Brijlal, Subramoniam, S Chand & Co
3. Photonics Elements and Devices, V. V. Rampal , Wheeler Publishing Co
4. Photonics, Ralf Menzel, Springer
5. Semiconductor optoelectronic devices – Pallab Bhattacharya PHI
6. Optoelectronics, Wilson and Hawkes
7. Optoelectronics, Jasprit Singh
8. Semiconductor Physics and Devices – Donald A Neamen, Tata McGraw-

Hill
9. Optical communication system- John Gowar , Prentice Hall of India
10. Optical Electronics – Ajoy Ghatak and K Thyagarajan Cambridge
11. Optical fibres and fibre optic communication systems, Subir Kumar Sarkar, S.Chand & Co
12. Semiconductor Physics and Optoelectronis, V. Rajendran et al, Vikas Publishing House
13. Fibre Optic Communication, D.C.Agarwal, Wheeler Publishing
14. Physics of Semiconductor devices, Dilip K Roy, University Press.
15. Physics of Semiconductor devices, S M Sze, Wiley Eastern Limited

Competencies:

C1 Define optical radiation and Luminescence

C2 Illustrate Radiation source parameters, Receiver parameters

C3 Examine Photometric and Radiometric terms and units

C4 Give Inverse square law and demonstrate verification by photometer

C5 Compare efficiency of light sources available in the market

C6 Enumerate recommended values of illumination for various activities.

C7 Illustrate applications of photonics in light technology.

C8 Describe Gausian beams with respect to beam characteristics and parameters

C9 Examine Light Characteristics – Power, energy, peak power, beam radius, intensity, divergence, beam quality, brightness, brilliance, radiation pressure, and optical levitation.

C10. Outline the technique of Electron hole pair formation and recombination. Also discuss radiative and non radiative recombination.

C11 Discuss absorption in semiconductors.

C12 Illustrate indirect transitions, exciton absorption, donor- acceptor band impurity band absorption and Long wavelength absorption.

C13 Describe Franz Keldysh and Stark effect.

C14 Examine Radiation in semiconductors and Stokes shift in optical transitions. Also Characterise Deep level transitions and Auger recombination.

C15 Enumerate and characterize radiation sources.

C16 Describe LED with respect to principle and characteristics, Structure, hetero junction and edge emitting, Applications &advantages.

C17 Discuss semiconductor lasers in the context of Homo junction and hetero Junction.

C18 Illustrate Quantum well lasers and Optical and carrier confinement.

C19 Outline the principle of photo detectors

C20 Classify photodetectors and give Qualitative idea of each type and examine Photo detector parameters and Noise mechanisms.

C21 Give the Principle and operation of Photodiode, APD, Phototransistor, PIN photodiodes and opto isolators

C22 Give the principle of Solar cells , illustrate the corresponding V-I characteristics, Fill factor, conversion efficiency and examine Hetero junction solar cells.

C23 Outline Advantages and disadvantages of optical communication links in comparison with radio and microwave system and with guided systems

C24 Describe the method of measurement of information and the capacity of telecommunication channel

C25 Give the Communication system architecture and basic optical communication system

C26 Define attenuation, pulse duration and band width.

C27 illustrate Direct modulation of LED and diode laser.

C28 Examine Digital and analog modulation of LED and diode laser.

C29 Outline the principles of External modulation and Birefringence, Pockel

effect, phase modulation.

C30 Elaborate on Wave guide modulators . Electro-optic , Magneto- optic and acousto- optic modulators and describe Bipolar controller modulator.

C31 Outline the techniques of Fibre optic communication with respect to types of optical fibres- Numerical aperture- Fibre bundles, cables- strength

C32 Classify fibres as Step index and graded index, mono mode and multi mode Fibres.

C33 Examine plastic fibres and examine latest developed fibres.

SYLLABUS FOR PRACTICAL

CORE COURSE

PH2B01PB Practical (1st Year)

Credit - 2
No. of hours: 72

1. Vernier Calipers - Volume of a cylinder, sphere an d a hollow cylinder
2. Screw gauge - Volume of a sphere and a glass plate
3. Spherometer - Thickness of a glass plate, radius of curvature of a convex surface and a concave surface
4. Beam balance - Mass of a solid (sensibility method)
5. Travelling microscope - Radius of a capillary tube
6. Multimeter -Measurement of resistance , potential difference, current
7. Multimeter -Checking of capacitor, diode ,inductance and transistor
8. Identification of electronic components- Coil, capacitor, resistor, transistor, triac, diac, I C's 741, 555 etc.
9. Viscosity of a liquid -Variable pressure head
10. Spectrometer - Angle of prism
11. Cantilever- pin & microscope –Determination of Young's modulus
12. Carey Foster's Bridge-Measurement of resistivity
13. Symmetric Compound Pendulum-Determination of radius of gyration(K) and Acceleration due to gravity (g)
14. Surface tension - Capillary rise method
15. Half wave rectifier with and without filter-ripple factor and load regulation
16. Conversion of Galvanometer into voltmeter
17. Viscosity-constant pressure head- coefficient of viscosity (η) of the liquid
18. Spectrometer- Refractive Index of material of Prism
19. Field along the axis of a coil-Variation of magnetic field along the axis of a circular coil
20. Electro chemical equivalent of copper.

PH4B02PB Practical (2nd Year)

Credit: 2

No. of hours : 72

1. Cantilever – Young's modulus of material of bar.
2. Non Uniform Bending - Young's modulus of material of bar.
3. The Torsion Pendulum – Rigidity modulus of material of wire.
4. Asymmetric Compound Pendulum – Acceleration due to gravity, radius of gyration & moment of inertia.
5. Spectrometer – Refractive index of liquid.
6. Spectrometer – i-d curve
7. Lee's Disc – Thermal Conductivity.
8. Potentiometer – Resistivity of the given wire.
9. Potentiometer – Calibration of low range voltmeter.
10. Carey Foster's Bridge – Temperature coefficient of Resistance.
11. Searle's Vibration Magnetometer – Moment of magnet.
12. Diode Characteristics – Knee voltage, dynamic & static resistances.
13. Diode Full Wave Rectifier.- Ripple factor & load regulation.
14. Bridge Rectifier – Ripple factor & load regulation.
15. Diode Clamper.
16. Gates – AND, OR & NOT – Truth table verification.
17. Transistor Characteristics – Common base configuration.
18. Transistor Characteristics – Common emitter configuration.
19. Uni Junction Transistor - Characteristics.
20. Sweep Generators – ON & OFF state.

PH6B03PB Practical I (3rd Year)

Credit - 2

No. of hours -72

1. Fly Wheel – Moment of Inertia
2. Uniform bending – Young's Modulus-Optic lever method.
3. Static torsion- Rigidity modulus
4. Viscosity- Stoke's method
5. Viscosity- Searle's rotation viscometer method
6. Thermal conductivity of rubber
7. Melde's String – Measurement frequency
8. Sonometer – Verification of laws, Measurement of density of solid.
9. A.C Sonometer- Frequency of a.c.
10. Liquid Lens- Refractive index of Liquid
11. Young's Modulus –Koenig's method
12. Torsion pendulum- n and I - using two identical masses
13. Spectrometer- Small angled prism-Refractive index of material of prism (Supplementary angle method)
14. Field along the axis of circular coil-Moment of magnet (null method)
15. Kater's pendulum-g
16. Kundt's tube- Velocity of sound
17. Specific heat of liquid –Newton's law of cooling
18. Computer programming – Simple Pendulum –Calculation of 'g' from experimental data.
19. Computer programming – Solving differential equation – Rungekutta method – II order.
20. Computer programming – Multiplication of any two matrices- (m x n) and (n x q)

PH6B04PB Practical II (3rd Year)

Credit - 2

No. of hours -72

1. Spectrometer–Grating-wavelength
2. Spectrometer-prism-Dispersive power
3. Liquid lens-Optical constants of a convex lens
4. Air wedge-Diameter of wire
5. Potentiometer-Calibration of low range ammeter
6. Potentiometer-Calibration of high range voltmeter.
7. Conversion of Galvanometer in to ammeter
8. LCR circuit analysis-Series, parallel and Q-factor
9. Mirror Galvanometer-Figure of merit
10. B.G-charge sensitivity–Standard capacitor method
11. Universal gates IC–NAND,NOR-Realize basic gates from universal gates.
12. B.G.–Measurement of high resistance by leakage method
13. BCDto7segmentdecoder(IC)
14. Astable multivibrator –using transistor
15. Monostable multivibrator- using transistor
16. Monostablemultivibrator–IC555
17. 8085Microprocessor–sortinginascendinganddescendingorder.
18. Computer programming–Conversion of temperature scale
19. Computer programming–sorting the numbers in ascending and Descending order C++
20. Computer programming–Solving a quadratic equation

PH6B05PB Practical III (3rd Year)

Credit - 2

No. of hours -72

1. Characteristics of Zener diode
2. Voltage regulation using Zener diode
3. Voltage multiplier-Doubler and Tripler.
4. Characteristics of FET
5. RegulatedpowersupplyusingIC741
6. Wave shaping RC circuits-Integrator and differentiator
7. Diode clipper-Positive, Negative and Biased
8. Hartley Oscillator–frequency
9. Colpitt's oscillator–frequency
10. Phase shift oscillator-frequency
11. Thermistor– Temperature coefficient of resistance
12. Regulated power supply–Transistor and Zener diode
13. Regulatedpowersupply-UsingIC's-LM7805,7905,7809,7909,7812,7912
14. Construction and measurement of a dual Regulated power supply with filter.
15. Op-Amp-Adder and Subtractor
16. R.C. Coupled amplifier-Gain
17. Amplitude modulation
18. Pulse width modulation
19. Ringcounterusing74194and74151
20. Astablemultivibrator–IC555

PH6B06PB Practical IV (3rd Year)

Credit - 2

No. of hours -72

1. Spectrometer- Grating – Dispersive power
2. Spectrometer–Cauchy's constants
3. Newton's rings-Determination of wavelength.
4. Laser-Determination of wavelength
5. Ultrasonic-Determination of velocity of ultrasonic waves
6. Single slit– Diffraction using Laser
7. Verification of Thevenin's and Norton's theorem
8. Deflection and Vibration Magnetometer-m &B_h
9. e/m–Thomson's apparatus-Bar magnet/magnetic focusing
10. B.G-Measurement of capacitance
11. D/A Converter using IC
12. 4bitShiftregister
13. Flip-Flop–R.S
14. J.K Flip-Flop
15. Schmitttriggerusing7414
16. Op-Amp–Inverter, noninverter and buffer.
17. 8085Microprocessor-BCDadditionandsubtraction
18. 8085Microprocessor–multiplicationoftwoeightbitnumberswithresult16 bit.
19. Computer programming–Solving a linear equation-Bisection method.
20. Computer programming–Solving an equation by Newton–Raphson method
21. Computer programming-Generation of Fibonacci series

References:

1. Properties of Matter-D.S. Mathur
2. Optics-Subramanyan & Brijlal
3. Electricity &Magnetism-Sreevastava
4. Electronics Lab Manual(Vol.1)-K.A. Navas
5. Laboratory manual for electronic devices and circuits-David A Bell
6. Electronic Laboratory Primer-A design approach-S Poorna Chandra and B Sasikala.
7. A text book of practical Physics_ Indu Prakash and Ramakrishnan.

SYLLABUS FOR COMPLEMENTARY PHYSICS FOR MATHEMATICS

Semester I

PH1CM01TB Properties of Matter, Mechanics and Fourier Analysis

Credits: 2

Total lecture hours: 36hrs

Aim

The syllabus will cater to the basic requirements for his/her higher studies. It helps to understand the physical phenomena of elasticity, moment of inertia and wave motion. It inculcates an appreciation of the physical world.

Module I

Elasticity (12 hrs)

Hooke's law - elastic limit - elastic behavior of solids in general - different types of elasticity - work done per unit volume - Poisson's ratio - limiting values of Poisson's ratio - Relation between volume strain and linear strain.
Twisting couple on a cylinder - angle of twist and angle of shear - torsional rigidity –variation of stress in a twisted cylinder-strain energy in a twisted cylinder.

Bending of beams - bending moment - expression for bending moment - cantilever and its depression at its loaded end (weight of the cantilever ineffective ,theory only) - depression of supported beam (Centrally loaded and the weight of the beam is ineffective, theory only) – I section girders.

Text Book :*Mechanics - D. S. Mathur- Revised by P. S. Hemne, S. Chand & Co., Chapters 13 & 14.*

Module II

Dynamics of rigid bodies (10 hrs)

Rigid body - translational and rotational motion - torque - angular momentum - angular impulse - moment of inertia – radius of gyration - general theorems on moment of inertia - parallel and perpendicular axes theorems for a plane laminar body - particular cases of moment of inertia - uniform rod, rectangular lamina, thin circular ring, circular disc, annular ring, solid cylinder, hollow cylinder,

spherical shell, sphere and hollow sphere - moment of inertia of a fly wheel – experimental determination.

Text Book ***: Mechanics - D. S. Mathur- Revised by P. S. Hemne- S. Chand & Co., Chapter 11.***

Module III

Simple Harmonic Motion (9 hrs)

Periodic and harmonic motion - simple harmonic motion - differential equation of S.H.M - phase relationship between displacement - velocity and acceleration of simple harmonic oscillator - energy of a harmonic oscillator - average values of kinetic and potential energies of a harmonic oscillator - damping (frictional effects) - damped harmonic oscillator (over damped, under damped and critically damped cases) - logarithmic decrement - power dissipation- quality factor - driven harmonic oscillator - sharpness of resonance - phase of the driven harmonic oscillator - velocity amplitude.

Text Book***: Mechanics - D. S. Mathur- Revised by P. S. Hemne- S. Chand & Co., Chapters 7 & 8.***

Fourier analysis (5 hrs)

Fourier's theorem- Dirichlet's conditions- Fourier analysis – evaluation of Fourier coefficients for periodic functions with periodicity in space, time and phase ,- odd and even functions –- application as analysis of waves – square wave, saw tooth wave and triangular wave only.

Text Book: ***A text book on Waves and Acoustics, Pradip Kumar Chakrabarti, Satyabrata Chowdhury ,New Central Book Agency (P)Ltd, Chapter 6***

Reference:

1. Mechanics- H.S. Hans and S. P.Puri, Tata McGraw-Hill
2. Properties of Matter Brijlal and Subrahmanyam S. Chand & Co.,
3. Mechanics- J.C. Upadhyaya, Ram Prasad and sons
4. Mathematical methods for Physicists-– G. B. Arfken and H.J. Weber, Academic press

Competencies:

C1. Define Hooke's law
C2. Describe elastic behavior of a solid

C3. Understand different types of elasticity
C4. Compute the work done per unit volume under stress
C5. Define Poisson's ratio
C6. Describe bending of beams
C7. Define torsional rigidity
C8. Understand torsional couple
C9. Relate adiabatic and isothermal elasticities
C10. Calculate the depression for a cantilever loaded at the free end
C11. Estimate the depression for a beam centrally loaded
C12. Define Simple Harmonic Motion with examples
C13. Set up differential equation of Simple Harmonic Motion
C14. Describe velocity and acceleration of harmonic oscillator
C15. Recognize the phase relationship between displacement, velocity and acceleration of harmonic oscillator
C16. Explain the Potential, Kinetic and total energies of harmonic oscillator
C17. Draw the variations of Potential, Kinetic and total energies with amplitude.
C18. Classify different types of harmonic oscillator.
C19. Set up and solve the differential equation of damped harmonic oscillator
C20. Illustrate overdamped, underdamped and critically damped cases
C21. Set up and solve the differential equation of forced harmonic oscillator.
C22. Describe amplitude and velocity resonance.
C23. Describe sharpness of resonance.
C24. Define rigid body
C25. Focus and distinguish between translational and rotational motions.
C26. Describe torque.
C27. Describe angular momentum.
C28. Describe angular impulse.
C29. Describe moment of inertia.
C30. Describe radius of gyration.
C31. Determine the relationship between torque and angular momentum.
C32. Determine the relationship between torque and moment of inertia.
C33. Determine the relationship between torque and angular acceleration.
C34. State and prove parallel and perpendicular axes theorems
C35. Determine the moment of inertia of following shapes, (i)Uniform Rod (ii)

Rectangular lamina (iii) thin circular ring (iv) circular disc (v) annular ring (vi) solid cylinder (vii) hollow cylinder (viii)Spherical shell, sphere and hollow sphere.

C36. Describe flywheel.
C37. Design an experiment to determine moment of inertia of flywheel.
C38. State Fourier's theorem & Dirichlet's conditions
C39. Discuss evaluation of Fourier coefficients for periodic functions with periodicity in space, time and phase
C40. Differentiate odd and even functions
C41. Implement the Fourier theorem to the analysis of square wave, saw tooth wave and triangular wave

Semester II

PH2CM2TB Magnetic Phenomena, Thermodynamics and Special Theory of Relativity

Credits: 2

Total lecture hours: 36hrs

Aim

The syllabus will cater to the basic requirements for his/her higher studies. It helps to understand the physical phenomena of thermodynamics, magnetism and electricity. It inculcates an appreciation of the physical world.

Module I

Magnetic Properties of Materials (8 hrs)

Magnetic induction - magnetisation - relation between the three magnetic vectors B, H and M - magnetic permeability - properties of diamagnetic materials - properties of paramagnetic materials - properties of ferromagnetic materials - antiferromagnetism and ferrimagnetism - the electron theory of magnetism - experiment to draw M-H curve (horizontal model) - energy loss due to hysteresis - the importance of hysteresis curve.

Text Book :*Electricity and Magnetism, R. Murugeshan, S. Chand & Co., Chapters 15.*

Module II

Thermodynamics (18 hrs)

Thermodynamic system - Zeroth law of thermodynamics (statement and

explanation) - thermodynamic equilibrium – work - internal energy - first law of thermodynamics - the indicator diagram - isothermal and adiabatic processes, their equations and work done – cyclic process - slopes of adiabatics and isothermals - relation between adiabatic and isotheral elasticity.

Reversible and irreversible process - heat engines - definition of efficiency - Carnot's ideal heat engine - Carnot cycle - effective way to increase efficiency - Carnot engine and refrigerator - coefficient of performance - second law of thermodynamics (Kelvin and Clausius's statement).

Entropy and change in entropy - changes of entropy in reversible and irreversible cycles -principle of increase of entropy - T-S diagram for Carnot cycle - calculation of entropy when ice is converted into steam - thermodynamic potentials - significance of thermodynamic potentials - relation of thermodynamic potential with their variables - Clapeyron's latent heat equation - effect of pressure on melting point of solid and boiling point of liquid.

Text Book ***: Heat and Thermodynamics, Brijlal and Subrahmanyam and P. S. Hemne, S. Chand & Co., Chapter 5 & 6***

Module III

Special theory of relativity (10 hrs)

Galilean transformations- Electromagnetism and Galilean transformations - postulates of special theory of relativity- Lorentz transformations - velocity transformation - length contraction- time dilation -simultaneity- - relativistic mass -equivalence of mass and energy

Text Book:

Modern Physics - G.Aruldhas, PHI Learning Private Limited, Chapter 1

Reference:

1. Concepts of Modern Physics - A. Beiser ,Tata McGraw-Hill, 5th Edn.
2. Modern Physics - R. Murugeshan, Kiruthiga Sivaprasth (S. Chand and Co.)
3. Modern Physics- G.Aruldhas and P.Rajagopal , PHI Publications
4. Thermodynamics- Zemansky and Dittmann, ,Tata McGraw-Hill

Competencies:

C1. Define magnetic induction.
C2. Describe magnetization.
C3. Determine the relation between the three magnetic vectors magnetic flux density(B), magnetising field (H) and intensity of magnetisaion (M).

C4. Compare the properties of diamagnetic, paramagnetic and ferromagnetic materials.
C5. Define antiferromagnetism and ferrimagnetism
C6. Illustrate diamagnetism, paramagnetism and ferromagnetism on the basis of electron theory.
C7. Describe hysteresis
C8. Design an experiment to draw hysteresis curve.
C9. Calculate the energy loss/ cycle of magnetisaion due to hysteresis loss.
C10. Mention the importance of hysteresis curve
C11. Understand thermodynamic systems
C12. Explain zeroth law of thermodynamics
C13. Define first law of thermodynamics
C14. Draw indicator diagram
C15. Differentiate between adiabatic and isothermal processes
C16. Understand thermodynamic potentials
C17. Distinguish between reversible and irreversible processes
C18. Describe the working of Carnot's engine
C19. Define entropy
C20. Calculate entropy in reversible and irreversible processes
C21. Discuss Clapeyron's latent heat equation
C22. Illustrate Galilean transformation
C23. State the postulates of Special Theory of Relativity
C24. Explain Lorentz transformation and velocity transformations
C25. Extend the Lorentz transformation to concepts of Length contraction, time dilation and Relativistic Mass.
C26. Summarize the equivalence of mass and energy

Semester III

PH3CM3TB Quantum Mechanics, Spectroscopy, Nuclear Physics, Basic Electronics and Digital Electronics

Credits - 3

Total lecture hours - 54 hrs

Aim

The syllabus will cater to the basic requirements for his/her higher studies. It is expected to provide the learner the knowledge about quantum mechanics, spectroscopy, basic electronics and digital electronics. It inculcates an

appreciation of the physical world and the discipline of physics.

Module I

Elementary Quantum theory (12 hrs)

Introduction – breakdown of classical physics – black body radiation and Planck's quantum hypothesis (qualitative) – photoelectric effect – Einstein's explanation of photoelectric effect – de Broglie hypothesis – matter wave – Davisson Germer experiment – uncertainty principle (derivation and application not required) – wave packet – wave function – properties of wave function – probabilistic interpretation of wave function – normalisation condition – time independent Schrödinger equation – particle in a box problem.

Text Books :

1. ***Modern Physics, G. Aruldhas and P. Rajagopal, Tata McGraw-Hill, 5th edn.***
2. ***Quantum Mechanics, Aruldhas, PHI Pub.***
3. ***Modern Physics , Arthur Beiser, Tata McGraw-Hill***

Spectroscopy (12 hrs)

Thomson's model – Rutherford's nuclear atom model (qualitative) – Bohr atom model – Bohr radius – total energy of the electron – Bohr's interpretation of Hydrogen atom – Sommerfeld's relativistic atom model – elliptical orbits of Hydrogen (qualitative) – Sommerfeld's relativistic theory – fine structure of Hα line – Vector atom model – quantum numbers associated with vector atom model – coupling scheme (qualitative) – optical spectra – spectral terms – spectral notation – selection rules.

Text Book : ***Modern Physics, R. Murugeshan, S. Chand and Co., Chapter 6***

Molecular spectra – theory of origin of pure rotational spectra of rigid diatomic molecule – Raman effect – experimental study of Raman effect – quantum theory of Raman effect.

Text Book ***:Modern Physics, R. Murugeshan, S. Chand and Co., Chapter 19***

Module II

Introduction to the Nucleus & Radioactivity (10 hrs)

Classification of nuclei - general properties of nucleus – binding energy - nuclear stability – theories of nuclear composition – nuclear forces – magic numbers – natural radioactivity – alpha– beta & gamma rays – properties of alpha rays – properties of beta rays – properties of gamma rays– fundamental laws of radioactivity – Soddy Fajan's displacement law – law of radioactive disintegration – half life – mean life – units of radioactivity – law of successive disintegration – radioactive dating – energy balance in nuclear reaction and the Q value – threshold energy of an endoergic reaction.

Text book : ***Modern Physics , R Murugeshan, Kiruthiga Sivaprasath, S. Chand and Co., Chapter 27- sections:27.1 to 27.7 & 27.10, Chapter 31- sections:31.1 to 31.5, 31.29 to 31.31 & 31.33 to 31.35. Chapter 34- sections: 34.2, 34.3, 34.6***

Module III

Basic Electronics (13 hrs)

Energy bands in solids – conduction in solids – semiconductors – majority and minority charge carriers – intrinsic conduction. PN junction diodes – biasing – diode equation (derivation not required), diode parameters, diode ratings – diode characteristics – junction break down. Rectifiers – half wave, full wave and bridge rectifiers. Zener diode characteristics – voltage regulation. Bipolar junction transistors – biasing – transistor currents – transistor circuit configurations - common base, common emitter and common collector – relations between α and β, γ and β – leakage current – thermal runaway – transistor characteristics for common base, common emitter and common collector configurations.

Text Book ***: Basic Electronics , B. L. Theraja - Chapter12 (12.17, 12.20, 12.22, 12.23-26, 12.30), Chapter 13, Chapter14, Chapter15(15.1-2), Chapter 18 & 19(19.1,3).***

Digital electronics (7 hrs)

Different number systems – decimal - binary – octal - hexa decimal number systems – conversion between different number systems – binary mathematics – addition and subtraction – basic theorems of Boolean algebra – de Morgan's theorems – AND, OR, NOT, NAND, NOR, XOR gates – truth tables – half adder and full adder (qualitative).

Text Book ***:Digital principles and applications, A. P. Malvino and P.Leach***

References :

1. Concepts of Modern Physics- A. Beiser , Tata McGraw-Hill, 5th Edn.
2. Modern Physics, G. Aruldas and P.Rajagopal , PHI Pub.
3. Quantum Physics- S. Gasiorowicz (John Wiley & Sons)
4. Modern Physics, G. Aruldas and P.Rajagopal, PHI Pub.

Competencies:

C1. Understand the inefficiency of classical mechanics
C2. Explain black body radiation
C3. State Planck's quantum hypothesis of black body radiation
C4. Define photoelectric effect
C5. Discuss Einstein's explanation of black body radiation
C6. Define de Broglie hypothesis
C7. Define uncertainty principle
C8. Discuss Davisson Germer experiment
C9. Define wavefunction
C10. List the properties of wavefunction
C11. Explain time independent Schrodinger equation
C12. Discuss particle in a box problem
C13. Discuss Thomson's and Rutherford's atom models
C14. Discuss the Bohr's atom model
C15. Calculate the Bohr radius and total energy of an electron
C16. Explain Bohr's interpretation of Hydrogen atom
C17. Discuss Sommerfeld's atom model
C18. Discuss vector atom model
C19. Explain quantum numbers in vector atom model
C20. Understand the coupling schemes and selection rules
C21. Mention different types of nuclei.
C22. Describe the properties of nucleus.
C23. Explain Binding energy.
C24. Calculate binding energy of nucleus.
C25. Describe Nuclear stability.
C26. State electron- proton hypothesis.
C27. State proton- neutron hypothesis.
C28. Describe nuclear force.
C29. Mention the features of nuclear force.
C30. List magic numbers.

C31. Explain natural radioactivity.
C32. Describe the experimental set up.
C33. Focus and distinguish between Properties of Alpha, Beta & Gamma rays.
C34. State Soddy Fajan's displacement law.
C35. State law of radioactive disintegration.
C36. Determine the mean life of radioactive material.
C37. Define Units of radioactivity- Curie & Rutherford.
C38. Determine the age of earth.
C39. Determine the age of biological specimen – carbon dating.
C40. Define Q value.
C41. Calculate threshold energy of an endoergic reaction.
C42. Understand the conduction in solids
C43. Discuss p-n junction diode
C44. Explain diode characteristics
C45. Discuss rectification process
C46. Understand the working of Zener as a voltage regulator
C47. Define thermal run away
C48. Relate α, β and γ
C49. Explain different types of transistor configurations
C50. List different number systems
C51. Discuss the binary addition and subtraction
C52. Explain the conversional between decimal, binary, octal and hexadecimal number systems
C53. Describe the working of different types of logic gates
C54. Draw half adder and full adder circuits

Semester IV

PH4CM4TB Physical Optics,- Laser Physics and Astrophysics

Credits - 3

Total lecture hours - 54 hrs

Aim

The syllabus will cater to the basic requirements for his/her higher studies. It is expected to provide the learner the knowledge about interference, diffraction, polarization of light, lasers, and astrophysics. It inculcates an appreciation of the physical world and the discipline of physics.

Module I

Interference (12 hrs)

Interference of light – Principle of superposition – conditions for maximum and minimum intensities – coherent sources – Interference by division of wave front and division of amplitude – Young's double slit experiment (division of wave front) – Expression for fringe width – Newton's rings by reflected light (division of amplitude) – measurement of wavelength of sodium light by Newton's rings – interference in thin films.

Diffraction (8 hrs)

Introduction – Difference between Interference and diffraction – Fresnel and Fraunhofer diffraction – Fresnel Diffraction at a straight edge – Theory of plane transmission grating – Determination of wavelength (normal incidence) – resolving power – dispersive power.

Text Book ***:A Text book of Optics- N. Subrahmanyam, Brijlal and M.N. Avadhanulu (S. Chand and Co.)***

Module II

Polarization (15 hrs)

Polarization – preferential direction in a wave – polarized light – natural light – production of linearly polarized light – polarization by reflection – Brewster's law – polarization by double refraction – calcite crystal – optic axis – principal section – positive and negative crystals – Huygen's explanation of double refraction – phase difference between O and E rays – types of polarization – retardation plates – Nicol prism – Malus's law.

Text book : A ***Text book of Optics- N. Subrahmanyam, Brijlal and M.N. Avadhanulu (S. Chand and Co.)***

Module III

Lasers (10 hours)

Interaction of light and matter - quantum behavior of light - energy levels – population - thermal equilibrium - absorption and emission of light - the three processes - Einstein relation - condition for large stimulated emissions - condition for light amplification - population inversion – pumping - active medium - metastable state - pumping schemes - solid state lasers – ruby laser &YAG laser - gas laser – helium-neon laser - applications (basic ideas).

Text book : ***An Introduction to LASER – theory and applications, M.N. Avadhanulu., S Chand & Company, First edition, Chapter 1- sections: 1.3 to 1.13-1.15 to 1.16 & 1.18 to1.20- Chapter 2- sections:2.2- 2.2.1 & 2.2.2 - 2.3 & 2.3.1. & Chapter 5.***

Astrophysics (9 hrs)

Basic Physics required for understanding the relation between temperature and color of stars - Planck's law of black body radiation - Wiedmann Franz law- Stefan's law - continuous absorption and emission spectra.

Text book :*An introduction to Astrophysics- Baidyanath Basu, Chapter 2*

Brightness and distances of stars - Stellar magnitude sequence - absolute magnitude and distance modulus - stellar parallax (trigonometric) and units of stellar distances.

Text book :*An introduction to Astrophysics- Baidyanath Basu, Chapter 3*

Spectral classification of stars: HR diagram and main sequence stars.

Text book :*An introduction to Astrophysics- Baidyanath Basu, Chapter 4*

Formation and evolution of stars (Qualitative ideas only) - How a stable star is formed - death of a star and formation of red giants, white dwarfs - neutron stars and black holes. Chandrasekhar limit - super novae explosion.

Text book :*Astronomy : A Self-Teaching Guide – Dinah L. Moche, Wiley, 6th edn., Chapters 7 and 12*

Competencies:

C1. Define interference of light

C2. State the principle of superposition

C3. Derive the conditions for maximum and minimum intensities

C4. Define coherent sources

C5. Discuss interference by division of wavefront and division of amplitude

C6. Explain Young's double slit experiment

C7. Calculate the expression for fringe width

C8. Calculate the wavelength of sodium light by Newton's rings experiment

C9. Discuss the interference in thin films

C10. Differentiate between Fresnel and Fraunhofer diffraction
C11. Discuss Fresnel's diffraction at a straight edge
C12. Determine the wavelength of light using transmission grating
C13. Define resolving and dispersive powers
C14. Identify transverse and longitudinal waves
C15. Define polarization of light
C16. Discuss polarization by reflection
C17. State Brewster's law
C18. Define optic axis, principal section, positive crystals and negative crystals
C19. State double refraction
C20. Describe Huygen's explanation of double refraction
C21. Discuss retardation plates
C22. Understand Nicol prism
C23. State Malus's law
C24. Explain the terms - Interaction of light and matter, Quantum behavior of light, Energy levels, Population and Thermal equilibrium.
C25. Explain Absorption and emission of light.
C26. Categorize absorption and emission process.
C27. Describe Einstein coefficients.
C28. Determine the relation between Einstein coefficients.
C29. Determine the condition for light amplification.
C30. Discuss population inversion.
C31. Define pumping and metastable state
C32. Describe the basic components of laser device.
C33. Explain different methods of pumping.
C34. Explain the construction and working of Ruby laser.
C35. Describe the working of YAG laser.
C36. Explain the construction and working of Helium – Neon laser.

SYLLABUS FOR COMPLEMENTARY PHYSICS FOR CHEMISTRY

Semester I

PH1CC1TB Properties of Matter, Mechanics and Particle Physics

Credits - 2

Total lecture hours - 36

Aim

The syllabus will cater to the basic requirements for his/her higher studies. It helps to understand the physical phenomena of elasticity, moment of inertia and elementary particles. It inculcates an appreciation of the physical world.

Module I

Elasticity (12 hrs)

Hooke's law – elastic limit – elastic behavior of solids in general – different types of elasticity – work done per unit volume – Poisson's ratio – limiting values of Poisson's ratio – Relation between volume strain and linear strain.
Twisting couple on a cylinder – angle of twist and angle of shear – torsional rigidity – variation of stress in twisted cylinder – strain energy in a twisted cylinder.

Bending of beams – bending moment – expression for bending moment – cantilever and its depression at its loaded end (weight of the cantilever ineffective, theory only.) – depression of supported beam (Centrally loaded and the weight of the beam is ineffective, theory only) – I section girders.

Text Book: ***Mechanics - D. S. Mathur- Revised by P. S. Hemne, S. Chand & Co., Chapters13 & 14.***

Module II

Dynamics of rigid bodies (10 hrs)

Rigid body – translational and rotational motion – torque – angular momentum – angular impulse – moment of inertia – radius of gyration – general theorems on moment of inertia – parallel and perpendicular axes theorems for a plane laminar body – particular cases of moment of inertia – uniform rod, rectangular lamina, thin circular ring, circular disc, annular ring, solid cylinder, hollow cylinder, spherical shell, sphere and hollow sphere – moment of inertia of a fly wheel –

experimental determination.

Text Book: ***Mechanics - D. S. Mathur- Revised by P. S. Hemne- S. Chand & Co., Chapter 11.***

Module III

Simple Harmonic Motion (9 hrs)

Periodic and harmonic motion – simple harmonic motion – differential equation of S.H.M – phase relationship between displacement – velocity and acceleration of simple harmonic oscillator – energy of a harmonic oscillator – average values of kinetic and potential energies of a harmonic oscillator – damping (frictional effects) – damped harmonic oscillator (over damped, under damped and critically damped cases) – logarithmic decrement – power dissipation – quality factor – driven harmonic oscillator – sharpness of resonance – phase of the driven harmonic oscillator – velocity amplitude.

Text Book:***Mechanics - D. S. Mathur- Revised by P. S. Hemne- S. Chand & Co., Chapters 7,8.***

Particle Physics (5 hrs)

Fundamental interactions in nature – gauge particles – classification of particles – antiparticles – elementary particle quantum numbers – conservation laws – quark model (qualitative)

Text Book: ***Modern Physics - R. Murugeshan, Kiruthiga Sivaprasath, S. Chand and Co.***

References:

1. Mechanics- H.S.Hans and S.P.Puri. (Tata McGraw-Hill)
2. Properties of Matter- Brijlal and N. Subrahmanyam (S. Chand and Co.)
3. Mechanics- J.C. Upadhyaya (Ram Prasad and sons)
4. Concepts of Modern Physics - A. Beiser (Tata McGraw-Hill, 5th Edn.)
5. Modern Physics - G.Aruldhas, PHI Learning Private Limited.

Competencies:

C1. Define Hooke's law
C2. Describe elastic behavior of a solid
C3. Understand different types of elasticity
C4. Compute the work done per unit volume under stress
C5. Define Poisson's ratio
C6. Describe bending of beams

C7. Define torsional rigidity
C8. Understand torsional couple
C9. Relate adiabatic and isothermal elasticities
C10. Calculate the depression for a cantilever loaded at the free end
C11. Estimate the depression for a beam centrally loaded
C12. Define Simple Harmonic Motion with examples
C13. Set up differential equation of Simple Harmonic Motion
C14. Describe velocity and acceleration of harmonic oscillator
C15. Recognize the phase relationship between displacement, velocity and acceleration of harmonic oscillator
C16. Explain the Potential, Kinetic and total energies of harmonic oscillator
C17. Draw the variations of Potential, Kinetic and total energies with amplitude.
C18. Classify different types of harmonic oscillator.
C19. Set up and solve the differential equation of damped harmonic oscillator
C20. Illustrate overdamped, underdamped and critically damped cases
C21. Set up and solve the differential equation of forced harmonicoscillator.
C22. Describe amplitude and velocity resonance.
C23. Describe sharpness of resonance.
C24. Define rigid body
C25. Focus and distinguish between translational and rotational motions.
C26. Describe torque.
C27. Describe angular momentum.
C28. Describe angular impulse, moment of inertia.
C29. Describe radius of gyration.
C30. Determine the relationship between torque and angular momentum.
C31. Determine the relationship between torque and moment of inertia.
C32. Determine the relationship between torque and angular acceleration.
C33. State and prove parallel and perpendicular axes theorems
C34. Determine the moment of inertia of following shapes, (i) Uniform Rod (ii) Rectangular lamina (iii) thin circular ring (iv) circular disc (v) annular ring (vi) solid cylinder (vii) hollow cylinder (viii)Spherical shell, sphere and hollow sphere.
C35. Describe flywheel.
C36. Design an experiment to determine moment of inertia of flywheel.
C37. Discuss elementary particles
C38. Name examples of elementary particles

C39. List the features of elementary particles
C40. Classify elementary particles
C41. Discuss the quantum numbers associated with elementary particles
C42. Discuss quark model qualitatively

Semester II

PH2CC2TB Magnetic phenomena, Thermodynamics and Solid State Physics

Credits - 2

Total lecture hours - 36hrs

Aim

The syllabus will cater to the basic requirements for his/her higher studies. It helps to understand the physical phenomena of thermodynamics, magnetism and about crystalline solids. It inculcates an appreciation of the physical world and the discipline of Physics.

Module I

Magnetic Properties of Materials (8 hrs)

Magnetic induction – magnetisation – relation between the three magnetic vectors B, H and M – magnetic permeability – properties of diamagnetic materials – properties of paramagnetic materials – properties of ferromagnetic materials – antiferromagnetism and ferrimagnetism – the electron theory of magnetism – experiment to draw M-H curve (horizontal model) – energy loss due to hysteresis – the importance of hysteresis curve.

Text Book: ***Electricity and Magnetism, R. Murugeshan, S. Chand & Co., Chapters 15.***

Module II

Thermodynamics (18 hrs)

Thermodynamic system – Zeroth law of thermodynamics (statement and explanation) – thermodynamic equilibrium – work – internal energy – first law of thermodynamics – the indicator diagram – isothermal and adiabatic processes, their equations and work done – cyclic process – slopes of adiabatics and isothermals – relation between adiabatic and isotheral elasticity.

Reversible and irreversible process – heat engines – definition of efficiency – Carnot's ideal heat engine – Carnot cycle – effective way to increase efficiency – Carnot engine and refrigerator – coefficient of performance – second law of

thermodynamics (Kelvin and Clausius's statement).

Entropy and change in entropy – changes of entropy in reversible and irreversible cycles –principle of increase of entropy – T–S diagram for Carnot cycle – calculation of entropy when ice is converted into steam – thermodynamic potentials – significance of thermodynamic potentials – relation of thermodynamic potential with their variables – Clapeyron's latent heat equation – effect of pressure on melting point of solid and boiling point of liquid.

Text Book: ***Heat and Thermodynamics, Brijlal and Subrahmanyam and P. S. Hemne, S. Chand & Co., Chapter 5.***

Module III

Crystalline Solids (10 hrs)

Crystalline and amorphous solids – crystal lattice and translation vectors – basis – unit cell – lattice parameters – crystal systems – crystal planes and directions – Miller indices – inter planar spacing – hcp, fcc, bcc, sc crystal structures – Bragg's law of X ray diffraction.

Text Book: ***Solid State Physics, R. K. Puri and V. K. Babbar, S. Chand & Co.***

References:

1. Thermodynamics- Zemansky and Dittmann (Tata McGraw-Hill)
2. Heat and Thermodynamics- Brijlal and Subrahmanyam (S. Chand &Co)

Competencies:

C1. Define magnetic induction.

C2. Describe magnetization.

C3. Determine the relation between the three magnetic vectors magnetic flux density(B), magnetizing field (H) and intensity of magnetization (M).

C4. Compare the properties of diamagnetic, paramagnetic and ferromagnetic materials.

C5. Define antiferromagnetism and ferrimagnetism

C6. Illustrate diamagnetism, paramagnetism and ferromagnetism on the basis of electron theory.

C7. Describe hysteresis

C8. Design an experiment to draw hysteresis curve.

C9. Calculate the energy loss/ cycle of magnetization due to hysteresis loss.

C10. Mention the importance of hysteresis curve

C11. Understand thermodynamic systems

C12. Explain zeroth law of thermodynamics

C13. Define first law of thermodynamics

C14. Draw indicator diagram

C15. Differentiate between adiabatic and isothermal processes

C16. Understand thermodynamic potentials

C17. Distinguish between reversible and irreversible processes

C18. Describe the working of Carnot's engine

C19. Define entropy

C20. Calculate entropy in reversible and irreversible processes

C21. Discuss Clapeyron's latent heat equation

C22. Differentiate between crystals and amorphous solids

C23. Identify lattice and basis

C24. Explain lattice translation vectors

C25. Define unit cell

C26. List crystal systems

C27. Calculate Miller indices

C28. Relate between inter planar spacing and Miller indices

C29. Discuss hcp, fcc, bcc and sc crystal structures

C30. Explain X-ray diffraction by powder method

C31. Define Bragg's law

C32. Illustrate Galilean transformation

C33. State the postulates of Special Theory of Relativity

C34. Explain Lorentz transformation and velocity transformations

C35. Extend the Lorentz transformation to concepts of Length contraction, time

dilation and Relativistic Mass

C36. Summarize the equivalence of mass and energy

Semester III

PH3CC3TB Quantum mechanics, Spectroscopy, Nuclear Physics and Electronics

Credits - 3

Total lecture hours - 54 hrs

Aim

The syllabus will cater to the basic requirements for his/her higher studies. It is expected to provide the learner the knowledge about quantum mechanics, spectroscopy, nuclear physics, and electronics. It inculcates an appreciation of the physical world and the discipline of physics.

Module I

Elementary Quantum theory (12 hrs)

Introduction – breakdown of classical physics – black body radiation and Planck's quantum hypothesis (qualitative) – photoelectric effect – Einstein's explanation of photoelectric effect – de Broglie hypothesis – matter wave – Davisson Germer experiment – uncertainty principle (derivation and application not required) - wave packet – wave function – properties of wave function – probabilistic interpretation of wave function – normalisation condition – time independent Schrödinger equation – particle in a box problem.

Text Books:

1. ***Modern Physics, G. Aruldhas and P. Rajagopal, Tata McGraw-Hill, 5th edn.***
2. ***Quantum Mechanics, Aruldhas, PHI Pub.***
3. ***Modern Physics , Arthur Beiser, Tata McGraw-Hill***

Spectroscopy (12 hrs)

Thomson's model - Rutherford's nuclear atom model (qualitative) - Bohr atom model – Bohr radius – total energy of the electron – Bohr's interpretation of Hydrogen atom- Sommerfeld's relativistic atom model – elliptical orbits of Hydrogen (qualitative) – Sommerfeld's relativistic theory – fine structure of Hα line - Vector atom model – quantum numbers associated with vector atom model – coupling scheme (qualitative) - optical spectra – spectral terms – spectral notation – selection rules.

Text Book: ***Modern Physics, R. Murugeshan, S. Chand and Co., Chapter 6***

Molecular spectra – theory of origin of pure rotational spectra of rigid diatomic molecule -Raman effect – experimental study of Raman effect – quantum theory of Raman effect.

Text Book: ***Modern Physics, R. Murugeshan, S. Chand and Co., Chapter 19***

References:

1. Concepts of Modern Physics- A. Beiser , Tata McGraw-Hill, 5th Edn.
2. Modern Physics, G. Aruldas and P.Rajagopal , PHI Pub.
3. Quantum Physics- S. Gasiorowicz (John Wiley & Sons)

Module II

Introduction to the Nucleus & Radioactivity (10 hrs)

Classification of nuclei - general properties of nucleus - binding energy - nuclear stability - theories of nuclear composition - nuclear forces - magic numbers - natural radioactivity - alpha- beta & gamma rays - properties of alpha rays - properties of beta rays - properties of gamma rays- fundamental laws of radioactivity – Soddy Fajan's displacement law - law of radioactive disintegration – half life - mean life - units of radioactivity - law of successive disintegration - radioactive dating - energy balance in nuclear reaction and the Q value - threshold energy of an endoergic reaction.

Text Book: ***Modern Physics , R Murugeshan, Kiruthiga Sivaprasath, S. Chand and Co., Chapter 27- sections:27.1 to 27.7 & 27.10, Chapter 31- sections:31.1 to 31.5, 31.29 to 31.31 & 31.33 to 31.35. Chapter 34- sections: 34.2, 34.3, 34.6***

.**Reference:**

1.Modern Physics, G. Aruldas and P.Rajagopal, PHI Pub.

Nuclear Fission & Fusion (7 hrs)

Nuclear fission- Energy released in fission- Chain reaction- Atom bomb- Nuclear reactors - Nuclear Fusion- Source of stellar energy- Thermonuclear reactions- Transuranic elements.

Text book: ***Modern Physics, R Murugeshan- Kiruthiga Sivaprasath, S Chand & Co. , Chapter 35***

Module III

Basic Electronics (13 hrs)

Energy bands in solids - conduction in solids – semiconductors - majority and minority charge carriers - intrinsic conduction. PN junction diodes – biasing -

diode equation (derivation not required), diode parameters, diode ratings - diode characteristics - junction break down. Rectifiers - half wave, full wave and bridge rectifiers. Zener diode characteristics – voltage regulation. Bipolar junction transistors – biasing - transistor currents - transistor circuit configurations - common base, common emitter and common collector- relations between α and β, γ and β-leakage current - thermal runaway - transistor characteristics for common base, common emitter and common collector configurations.

Text Book: ***Basic Electronics , B. L. Theraja - Chapter12 (12.17, 12.20, 12.22, 12.23-26, 12.30), Chapter 13, Chapter14, Chapter15(15.1-2), Chapter 18 & 19(19.1,3).***

References:

1 Introduction to Modern Physics- H.S. Mani and G.K. Mehta

2 Concepts of Modern Physics- A. Beiser (Tata McGraw-Hill, 5th Edn.)

3 Modern Physics- G.Aruldas and P.Rajagopal (PHI Pub)

Competencies:

C1. Understand the inefficiency of classical mechanics

C2. Explain black body radiation

C3. State Planck's quantum hypothesis of black body radiation

C4. Define photoelectric effect

C5. Discuss Einstein's explanation of black body radiation

C6. Define de Broglie hypothesis

C7. Define uncertainty principle

C8. Discuss Davisson Germer experiment

C9. Define wavefunction

C10. List the properties of wavefunction

C11. Explain time independent Schrodinger equation

C12. Discuss particle in a box problem

C13. Discuss Thomson's and Rutherford's atom models

C14. Discuss the Bohr's atom model

C15. Calculate the Bohr radius and total energy of an electron

C16. Explain Bohr's interpretation of Hydrogen atom

C17. Discuss Sommerfield's atom model

C18. Discuss vector atom model

C19. Explain quantum numbers in vector atom model

C20. Understand the coupling schemes and selection rules

C21. Mention different types of nuclei.

C22. Describe the properties of nucleus.

C23. Explain Binding energy.

C24. Calculate binding energy of nucleus.

C25. Describe Nuclear stability.

C26. State electron- proton hypothesis.

C27. State proton- neutron hypothesis.

C28. Describe nuclear force.

C29. Mention the features of nuclear force.

C30. List magic numbers.

C31. Explain natural radioactivity.

C32. Describe the experimental set up.

C33. Focus and distinguish between Properties of Alpha, Beta & Gamma rays.

C34. State Soddy Fajan's displacement law.

C35. State law of radioactive disintegration.

C36. Determine the mean life of radioactive material.

C37. Define Units of radioactivity- Curie & Rutherford.

C38. Determine the age of earth.

C39. Determine the age of biological specimen – carbon dating.

C40. Define Q value.

C41. Calculate threshold energy of an endoergic reaction.

C42. Understand the conduction in solids

C43. Discuss p-n junction diode

C44. Explain diode characteristics

C45. Discuss rectification process

C46. Understand the working of Zener as a voltage regulator

C47. Define thermal run away

C48. Relate α, β and γ

C49. Explain different types of transistor configurations

C50. Describe Nuclear fission with examples.

C51. Calculate the energy released in a fission.

C52. Determine the energy released by 1Kg of uranium in fission. and express the answer in Kilowatt- hour.

C53. Discuss Bohr and Wheeler's theory of nuclear fission.

C54. Describe chain reaction with example.

C55. Define multiplication factor and categorize chain reaction.

C56. Discuss critical size for maintenance of chain reaction.

C57. Describe the working of atom bomb.

C58. Explain the components and working of nuclear reactor.

C59. Mention the uses of nuclear reactor.

C60. Describe Nuclear fusion with examples.

C61. Calculate the energy released in a fission.

C62. Discuss the source of stellar energy.

C63. Describe carbon – nitrogen and proton- proton Cycles.

C64. Discuss thermonuclear reaction.

C65. Describe hydrogen bomb and controlled thermonuclear reactions.

C66. List transuranic elements.

Semester IV

PH4CC4TB Physical Optics, Laser Physics and Superconductivity

Credits - 3

Total lecture hours - 54 hrs

Aim

The syllabus will cater to the basic requirements for his/her higher studies. It is expected to provide the learner the knowledge about interference, diffraction, polarization of light, lasers, and superconductivity. It inculcates an appreciation of the physical world and the discipline of physics.

Module I

Interference (12 hrs)

Interference of light - Principle of superposition - conditions for maximum and minimum intensities - coherent sources - Interference by division of wave front and division of amplitude - Young's double slit experiment (division of wave front) – Expression for fringe width - Newton's rings by reflected light (division of amplitude) - measurement of wavelength of sodium light by Newton's rings - interference in thin films.

Diffraction (8 hrs)

Introduction – Difference between Interference and diffraction - Fresnel and Fraunhofer diffraction - Fresnel Diffraction at a straight edge - Theory of plane transmission grating - Determination of wavelength (normal incidence) – resolving power - dispersive power.

Text Book: A*Text book of Optics- N. Subrahmanyam, Brijlal and M.N.Avadhanulu (S. Chand and Co.)*

Module II

Polarization (15 hrs)

Polarization - preferential direction in a wave - polarized light - natural light - production of linearly polarized light – polarization by reflection – Brewster's law - polarization by double refraction – calcite crystal – optic axis – principal section – positive and negative crystals – Huygen's explanation of double refraction - phase difference between O and E rays – types of polarization – retardation plates – Nicol prism – Malus's law.

Text Book: *Modern Physics, R Murugeshan, Kiruthiga Sivaprasath, S. Chand*

and Co.

Module III

Lasers (10 hours)

Interaction of light and matter - quantum behavior of light - energy levels – population - thermal equilibrium - absorption and emission of light - the three processes - Einstein relation - condition for large stimulated emissions - condition for light amplification - population inversion – pumping - active medium - metastable state - pumping schemes - solid state lasers – ruby laser & yag laser - gas laser – helium-neon laser - applications (basic ideas).

Text book : ***An Introduction to LASER – theory and applications, M.N. Avadhanulu., S Chand & Company, First edition, Chapter 1- sections: 1.3 to 1.13-1.15 to 1.16 & 1.18 to1.20- Chapter 2- sections:2.2- 2.2.1 & 2.2.2 - 2.3 & 2.3.1. & Chapter 5.***

Superconductivity (9 hrs)

Superconductivity - The Meissner effect - The BCS Theory - Classification of Superconductors - Principle of magnetic levitation - The Josephson effect - High Tc superconductivity - Applications.

Text book:*Modern Physics – R Murugeshan- Kiruthiga Sivaprasath, S Chand & Company, Chapter 41- Sections: 41.13-41-14 & 41.15- Chapter 42- Sections: 42.1 & 42.2 & Chapter 44 - Sections: 44.1- 44.5 &44.6*

Refererence:

1. Introduction to Modern Physics- H.S. Mani and G.K. Mehta (Affiliated East West press Pvt. Ltd)
2. Concepts of Modern Physics- A. Beiser (Tata McGraw-Hill, 5th Edn.)
3. A text book of optics- N. Subrahmanyam, Brijlal and M.N.Avadhanulu (S. Chand and Co.)
4. Optics- Satyaprakash (Ratan prakash Mandir)
5. Modern Physics- G.Aruldas and P.Rajagopal (PHI Pub)
6. Optics- A. Ghatak (Tata McGraw-Hill)

Competencies:

C1. Define interference of light

C2. State the principle of superposition

C3. Derive the conditions for maximum and minimum intensities

C4. Define coherent sources

C5. Discuss interference by division of wavefront and division of amplitude

C6. Explain Young's double slit experiment

C7. Calculate the expression for fringe width

C8. Calculate the wavelength of sodium light by Newton's rings experiment

C9. Discuss the interference in thin films

C10. Differentiate between Fresnel and Fraunhofer diffraction

C11. Discuss Fresnel's diffraction at a straight edge

C12. Determine the wavelength of light using transmission grating

C13. Define resolving and dispersive powers

C14. Identify transverse and longitudinal waves

C15. Define polarization of light

C16. Discuss polarization by reflection

C17. State Brewster's law

C18. Define optic axis, principal section, positive crystals and negative crystals

C19. State double refraction

C20. Describe Huygen's explanation of double refraction

C21. Discuss retardation plates

C22. Understand Nicol prism

C23. State Malus's law

C24. Explain the terms - Interaction of light and matter, Quantum behavior of light, Energy levels, Population and Thermal equilibrium.

C25. Explain Absorption and emission of light.

C26. Categorize absorption and emission process.

C27. Describe Einstein coefficients.

C28. Determine the relation between Einstein coefficients.

C29. Determine the condition for light amplification.

C30. Discuss population inversion.

C31. Define pumping.

C32. Define metastable state

C33. Describe the basic components of laser device.

C34. Explain different methods of pumping.

C35. Explain the construction and working of Ruby laser.

C36. Describe the working of YAG laser.

C37. Explain the construction and working of Helium – Neon laser.

C38. Describe Superconductivity.

C39. Define persistent current.

C40. Explain critical magnetic field.

C41. Write down the formula relating the temperature and critical magnetic field

C42. Explain Meissner effect

C43. Recognize that superconductors are diamagnetic materials.

C44. Explain BCS theory.

C45. Classify superconductors.

C46. Discuss magnetic levitation.

C47. Explain ac and dc Josephson effect.

C48. Mention high Tc superconductivity.

C49. List applications of superconductivity.

SYLLABUS FOR PRACTICAL

COMPLEMENTARY PHYSICS FOR MATHEMATICS AND CHEMISTRY

PH2CM(C)1PB Practical (1st Year)

Credit: 2

No. of hours: 72

1. Vernier Calipers - Volume of a cylinder- sphere and a beaker
2. Screw gauge - Volume of a sphere and a glass plate
3. Beam balance - Mass of a solid (sensibility method)
4. Radius of a capillary tube- Using (1) travelling microscope
5. Density of a liquid - U-Tube and Hare's apparatus
6. Viscosity of a liquid - Variable pressure head
7. Surface Tension – Capillary rise method.
8. Cantilever - Pin & Microscope – Determination of Young's Modulus
9. Symmetric Compound Pendulum-Determination of radius of gyration(K) and Acceleration due to gravity (g)
10. Spectrometer – Angle of the Prism.
11. Cantilever – Scale and Telescope-Determination of Young's modulus
12. Asymmetric Compound Pendulum-Determination of K and g
13. Coefficient of Viscosity – Constant pressure head
14. Spectrometer - Refractive Index of material of prism.
15. Liquid lens - Refractive Index of glass using liquid of known refractive index
16. Potentiometer-Calibration of low range voltmeter
17. Characteristics of Zener diode
18. Construction of half wave rectifier with and without filter – Ripple factor and Load regulation
19. Characteristics of p-n junction diode

20. Torsion pendulum - Rigidity modulus

PH4CM(C) 2PB Practical (2nd Year)

Credit: 2

No. of hours: 72

1. Non-uniform bending-Young's modulus-Pin and Microscope method
2. Field along the axis of circular coil- Variation of magnetic field and determination of B_H
3. Carey Foster's Bridge - Measurement of resistivity
4. Liquid lens - Refractive index of liquid
5. Searle's vibration Magnetometer-magnetic moment
6. Tangent Galvanometer – Ammeter calibration
7. Spectrometer – Prism – Dispersive power
8. Potentiometer-Calibration of low range ammeter
9. Construction of full wave rectifier with and without filter – Ripple factor and Load regulation
10. Construction of regulated power supply using Zener diode
11. Uniform bending – Young's modulus-Optic lever method
12. Torsion pendulum (Equal mass method) - Rigidity modulus and Moment of Inertia
13. Fly wheel - Moment of Inertia
14. Static Torsion - Rigidity modulus
15. Spectrometer - Grating Dispersive power
16. Newton's rings - Wave length
17. Deflection and Vibration Magnetometer- m & Bh
18. Conversion of Galvanometer into voltmeter

19. Transistor characteristics- CE configuration
20. Gates – AND - OR- NOT- verification of truth table
21. Construction of CE amplifier – gain

References

1. Properties of matter - D.S. Mathur
2. Optics - Subrahmanyan & Brijlal
3. Electricity &Magnetism - Sreevastava
4. Electronics Lab Manual (Vol.1) - K.A.Navas
5. Laboratory manual for electronic devices and circuits- David A Bell
6. Electronic Laboratory Primer- A design approach- S Poorna Chandra and B Sasikala.
7. A text book of Practical Physics _ Indu Prakash and Ramakrishnan.

Semester V

PH5D01aTB Open course: Amateur Astronomy

Credits- 3

Total lecture hours: 72 hrs

Aim

This course is intended for students of other disciplines. The main objective is to introduce the student to the fascinating world of Astronomy. The course is expected to provide basic ideas and resources to a student who is interested in getting started with astronomy and give answers to many intriguing astronomical puzzles.

Course Overview and Context

Astronomy is the study of the stars, planets, and other celestial objects that populate the sky. It is an endlessly fascinating field, the oldest of the natural sciences, and one of the few areas of science that amateurs can directly assist the professionals. It is open and accessible for any level of interest and involvement from common man to astrophysicists.

This course covers fundamental topics like stars, constellations, galaxies, solar system and the universe. It also gives information about the tools of astronomy.

Module 1

Observation of sky- 18 hrs

Constellations -Celestial coordinates – Location on the celestial sphere – Apparent daily and annual motion of the stars – The ecliptic - Earth's seasons – Equinoxes and solstices – The solar and sidereal day

Text Book :Architecture of the Universe -Necia H. Apfel & Allen Hynek- The Benjamin Cummings publishing company, Inc.,

The tools of Astronomy- Optical Telescope - refracting telescope, reflecting telescope – Resolving power – Magnification – Telescope aberration – Hubble Space telescope – Radio Telescope – GMRT

Text Book : Astronomy: A Self-Teaching Guide – Dinah L. Moche, Wiley, 6th edn., Chapters 1 and 2

Module II

Stars and Galaxies – 18 hrs

Distance to stars, Parallax method – Spectra of stars – Spectral classes – temperature – Luminosity – apparent and absolute magnitudes – H – R Diagram

Galaxy – Milky Way- classification of galaxies - Cluster of galaxies.

Stellar Evolution – Life cycle of stars – birth, lifetimes, Shining stars, Old age – Red giants – synthesis of heavier elements – Variable stars – Death – Mass Loss – White dwarfs – Exploding stars – Supernova – Neutron stars – Black holes

Text Book : Astronomy : A Self-Teaching Guide – Dinah L. Moche, Wiley, 6th edn., Chapters 3, 5 and 6

Module III

The Solar system – 18 hrs

The sun- distance and size – structure – Rotation - surface – sunspots – Activity cycles – Magnetism – Flares and coronal mass ejections – Solar wind

Planets – Brief history and Origin – Laws of planetary motion – Comparison of Planets - Mercury – Venus – Earth – Mars – Jupiter – Saturn – Uranus – Neptune (Structure, atmosphere, Surface features – Moons of all planets)

Moon- rotation, size, density – Surface features – Craters, Mountains – Structure - Lunar and solar eclipse

Minor members of the solar system- Asteroids, comets and meteors

Text Book : Astronomy : A Self-Teaching Guide – Dinah L. Moche, Wiley, 6th edn., Chapters 4, 8, 9, 10 and 11

Module IV

Our universe – 18 hrs

Early models of universe- Earth at the centre- Aristotle- Ptolemy- a spinning earth- unanswered questions- Sun at the centre- Copernican model. Planetary paths- Beyond the eye- Galileo and his observations - Starry messenger- force of gravity.

Text Book :Architecture of the Universe -Necia H. Apfel & Allen Hynek- The Benjamin Cummings publishing company, Inc., (ch- 3, 4, 8& 9)

The expanding universe- Hubble's law - Big bang theory – Steady state theory - age and size of universe. Extraterrestrial Life, SETI (Search for extra terrestrial intelligence) – Space Travel

Text Book :Astronomy : A Self-Teaching Guide – Dinah L. Moche, Wiley, 6^{th} edn., Chapters 7 and 12

References

1. Concepts of Contemporary Astronomy – Paul W. Hodge, Mc Graw _ Hill
2. Astronomy: A Beginners Guide To The Universe - Steve Mcmillan and Eric Chaisson, Pearson Education
3. Understanding the Universe, James B. Seaborn, Springer
4. Elements of Cosmology, Jayant V. Narlikar, Universities Press
5. Introduction to Astrophysics. Baidyanath Basu:,Prentice-Hall of India Pvt. Ltd
6. Astrophysics of the Solar System, K. D. Abhyankar ,Universities Press
7. Chandrasekhar and his limit – G Venkataraman, University Press

Competencies

C1. Define constellations.
C2. Understand the location of stars with the help of celestial coordinates.
C3. Compare the apparent daily and annual motion of the stars.
C4. Explain the seasons on Earth.
C5. Define a sidereal day and solar day and explain why they differ.
C6. Compare the working of optical telescopes.

C7. Define resolving power and magnification with respect to a telescope.
C8. Discuss the defects in a telescope.
C9. Describe Hubble space telescope.
C10. Explain how radio telescopes work with the example of GMRT.
C11. Describe the parallax method for determining the distance to stars.
C12. Give a general description of the stellar spectra and how they are divided into spectral classes.
C13. List the different kinds of information that are obtained from stellar spectra.
C14. Distinguish between apparent and absolute magnitude.
C15. Describe the H – R diagram.
C16. Define a galaxy and discuss about milkyway.
C17. Classify the different galaxies and discuss about them.
C18. Define a cluster of galaxies.
C19. Describe the different stages in the life cycle of a star.
C20. Compare and contrast the final stages of the life cycle of stars of different masses.
C21. List the basic physical dimensions of the sun.
C22. Sketch the structure of the sun and identify and describe the different regions.
C23. Describe the Sun's rotation and magnetic field.
C24. Describe the origin, properties and cyclic nature of sunspots and explain how they are related to solar activity.
C25. Describe the surface of the sun and compare and contrast the nature of different features that originate from the surface
C26. State Kepler's laws of planetary motion.
C27.Compare and contrast the general properties, surface conditions, atmospheres and moons of the 8 planets.
C28. List the physical parameters of the moon.
C29. Describe the general surface features of the moon.
C30. Explain the current model of moon's internal structure.
C31. Differentiate and describe lunar and solar eclipses.
C32. Discuss about the minor members of the solar system.
C33. Discuss about the early models of the universe and differentiate them.
C34. Explain what is meant by starry messenger.
C35. Specify the reasons for the idea that the universe is expanding.
C36. State the Hubble's law.

C37. Discuss the theories about the evolution of the universe.
C38. Discuss how one can estimate the age and size of the universe.

Semester V

PH5D01bTB Open course: Energy and Environmental Studies

Credits – 3

No. of contact hours – 72

Aim

The course creates concern among the students on energy conservation and environmental protection.

Course Overview and context

Energy and Environmental Studies focuses on the large-scale issues and contributes to possible solutions to the energy and environmental challenges. It seeks solutions to the environmental issues on a global scale, like climate change, sustainable development, greenhouse effect etc. and explores the alternative sources of energy. This course covers the various energy sources, utilisation of solar energy. It also points our attention to topics such as environmental pollution, environment impact assessment and control, waste management etc.

Module I

Energy sources (14 hrs)

World's reserve of energy sources - various forms of energy - non-renewableenergy sources:- coal, oil, natural gas; merits and demerits - renewable energysources:- solar energy, biomass energy, biogas energy, wind energy, wave energy,tidal energy, hydro energy, geothermal, fusion energy, hydrogen; merits anddemerits - storage of intermittently generated renewable energy (qualitative).

Text Books

1. ***Renewable Energy sources; Their impact on Global Warming and Pollution, Tasneem Abbasi and S.A. Abbasi (PHI Pvt. Ltd)***

2. Non- conventional energy resources D.S Chauhan and S.K Srivastava (New Age International)

Solar energy utilization (16 hrs)

Sun as a source of energy - solar radiation - spectral distribution - flat plate collector- solar water heating – different types of solar water heaters - solar pond -convective and salt gradient types - optical concentrator - solar desalination – solardryer – direct and indirect type - solar cooker - direct and indirect type - solar heatingof buildings - solar green houses- solar photovoltaics - working principle.

Text Book: ***Non-conventional Energy Sources- G.D. Rai (Khanna Publishers)***

Module II

Environmental pollution (20 hrs)

Basic concepts of ecology and environment - environmental pollution:-primary and secondary pollutants, classification - environmental degradation(causes, effects and control/treatment methods):- air pollution:- green house gases,global warming, climatic effects, water pollution, soil pollution, groundwaterpollution, marine pollution, noise pollution, nuclear hazards – environmentalpollution due to environmental disasters.

Text Books

1. ***Essential Environmental Studies S.P Misra, S.N Pandey (Ane Books Pvt Ltd)***
2. ***Environmental Science: Principles and Practice- R.C. Das and D.K. Behera (PHI Pvt. Ltd)***
3. ***Environmental chemistry and pollution control S.S Dara (S. Chand)***

Module III

Environment impact assessment and control (8 hrs)

Basic ideas of environment impact assessment - environment ethics - environmental laws and constitutional provisions to control pollutions in India:- thegeneral acts , water and air acts , environment protection acts.

Text Books

1. ***Environmental Science: Principles and Practice- R.C. Das and D.K. Behera (PHI Pvt.Ltd)***
2. ***Environmental Pollution - R K Khitoliya (S Chand)***
3. ***Essential Environmental Studies S.P Misra, S.N Pandey (Ane Books Pvt Ltd)***

Waste management (14 hrs)

Waste minimization and resource conservation:- source reduction,recycling , conservation and waste minimization - management of solid wastes(management and handling):- hazardous solid waste, municipal solid wastes,biomedical solid wastes - waste treatment and disposal methods:- physical,biological and chemical process- biogas plant-moving dome type.

Text Books

1. ***Environmental Science: Principles and Practice- R.C. Das and D.K. Behera (PHI Pvt. Ltd)***
2. ***Environmental chemistry and pollution control S.S Dara (S. Chand)***

3. Biotechnology for waste and wastewater treatment- N.P. Cheremisinoff (PHI Pvt.Ltd)

4. Environmental management- B. Krishnamoorthy (PHI Pvt. Ltd)

References

1. Essential Environmental Studies S.P Misra, S.N Pandey (Ane Books Pvt Ltd)
2. Environmental Science G Tyler Miller (Cengage Learning)
3. Introduction to Environmental Science Y Anjaneyulu (B S Publications)
4. Introduction to Environmental engineering and science- G.M. Masters and W.P.Ela(PHI Pvt. Ltd)
5. Environmental management- B. Krishnamoorthy (PHI Pvt. Ltd)
6. Solar energy- fundamentals and applications- H.P. Garg and J. Prakash (Tata Mc GrawHill).
7. Solar energy-fundamentals, design, modeling and applications- G.N. Tiwari (Narosa Pub. House)

Competencies

C1. Discuss about world's reserve of energy sources.
C2. Differentiate between non – renewable and renewable energy sources with examples.
C3. Discuss the merits and demerits of renewable and non – renewable energy sources.
C4. Explain how storage, transportation and distribution of energy can be done.
C5. Define solar radiation, spectral distribution and sunshine hours.
C6. Discuss the various practical applications of solar energy.
C7. Define solar thermo – mechanical power and discuss an application.
C8. Discuss the economic aspects of solar energy usage.
C9. Acquire skills in optimizing the energy usage.
C10. Identify and classify various environmental pollutants.
C11. Explain Green house effect and global warming.
C12. Discuss the relation between environmental pollution and climatic changes.
C13. Assess the impacts of pollution on water, soil and ground water.
C14. Identify the reasons for marine and noise pollution.
C15. Discuss the environmental disasters caused by pollution.
C16. Discuss the basic ideas of assessment of environmental impacts.

C17. Explain the term environmental ethics.
C18. Discuss the environmental laws and constitutional provisions to control pollutions in India
C19. Discuss different methods for waste minimization and resource conservation.
C20. Discuss the management and handling of different types of solid waste.
C21. Classify waste treatment and disposal methods into different categories.
C22. What is a bio gas plant? Discuss the moving dome type.