JSS College of Arts, Commerce & Science (Autonomous),
Ooty Road, Mysore-25

DEPARTMENT OF PHYSICS

SEMESTER I

Course code: DMA29001/ DMA29002/ DMA29003/ DMA29004
Credits: Theory – 04, Practical – 02 **Theories:60 Lectures**

COURSE OUTCOME:

After successful completion of the course, the student is able to

CO1.Learn the details of Elasticity

CO2.Understand the classification and characteristics of motion of a point particle

CO3.Understand in details with examples Frames of reference and relative motion

CO4.Deliberate the classification and characteristics of Dynamics of particle in conservative field

CO5.Specify the classification and characteristics of Special theory of relativity and gravitation

CO6.Write down the characteristics of Surface tension and viscosity

MECHANICS: DSC1

Unit-1

Vectors: Vector algebra (with special reference to the rules of addition and multiplication), Scalar and vector products with specific examples.

Motion of a point particle: The position vector *r(t)* of a moving point particle and its Cartesian components. Velocity and acceleration as the vector derivatives. Derivatives of a vector with respect to a parameter; Derivation of planar vector of a constant magnitude. Radial and transverse components of velocity and acceleration for arbitrary planar motion, deduction of results for uniform circular motion-centripetal force. **(05 Lectures)**

Frames of references and relative motion:

Newton's laws of motion and inertial mass. Galilean transformation; Galilean principle of relativity, Plumb line accelerometer and a freely falling elevator, Non-inertial frames and fictitious force, uniformly

rotating frame of reference and coriolis force. Effect of rotation of earth on acceleration due to gravity. **(07Lectures)**

Dynamics of a particle in conservative fields:

Work done by force acting on a particle, work-energy theorem. Conservative and non conservative force field. Conservation of energy. Conservative force as a negative gradient of potential, central force as an example of conservative force field. **(05 Lectures)**

Conservation of momentum: Conservation of linear momentum, centre of mass, rocket equation. Angular momentum and torque, law of conservation of angular momentum, angular momentum of a system taking centre of mass of the system. **(06 Lectures)**

Dynamics of rigid bodies: Moment of inertia, radius of gyration, calculation of momentum of inertia of rectangular plate, circular plate and solid sphere, kinetic energy of rotation. **(04 Lectures)**

Oscillations: Simple harmonic motion. Differential equation of SHM and its solutions. Kinetic and Potential Energy, Total Energy and their time averages. Damped oscillations. (**03 Lectures)**

Unit-2

Gravitation: Newton's Law of gravitation. Motion of a particle in a central force field (motion is in a plane, angular momentum is conserved, areal velocity is constant). Kepler's Laws, derivations of Kepler's law, satellite in circular orbit and applications, geosynchronous orbits, weightlessness, basic idea of global positioning system (GPS). **(08 Lectures)**

Special Theory of Relativity: Postulates of Special Theory of Relativity. Lorentz transformation equations, Length contraction, time dilation, relativistic addition of velocities. Mass-Energy relation, energy-momentum relation**.** **(06 Lectures)**

Elasticity:

Review of concepts of modulii of elasticity, Hooke's Law and Poisson's ratio(σ). Relation between the elastic constants ***q, k, n*** and ***σ***, limiting values for **σ.**Work done in stretching. Elastic potential energy. Bending moment. Theory of light single cantilever. I-section girders. Torsion; calculation of couple per unit twist. The Torsional pendulum, Static torsion, Searle's double bar experiment.

Surface Tension: Review of basic concepts. Pressure inside curved liquid surface. Surface tension and

interfacial tension by drop-weight method. Surface tension and angle of contact of mercury by Quincke's method.

Viscosity: Review of basic concepts; Variation of Viscosity of liquids with temperature and pressure.

(16 Lectures)

Reference Books:

- Halliday, Resnick, Jearl Walker, "Principles of Physics" 9th edition, Wiley, 2013.
- Berkeley Physics Course, Vol-1 "Mechanics", 2nd edition, Charles Kittle, Walter D Knight, Malvin A
- D S Mathur, "Elements of properties of matter", S Chand and company, New Delhi, Reprint-2007.
- D S Mathur, "Mechanics", S Chand and company, New Delhi, Reprint-2001.
- BrijLal and N Subrahmanyam, "Properties of matter", 6th edition, Eurasia publishing house Ltd. New Delhi, Reprint-1993.
- Mechanics by Shankara Narayana &Chopra.
- Mechanics by Bhargava and Sharma.

PHYSICS LAB: DSC 1A LAB: MECHANICS

Course code: DMA29101/ DMA29102/ DMA29103/ DMA29104

(Minimum of eight is to be conducted)

1. Bar pendulum: Determination of the acceleration due to gravity and radius of gyration (Both graphical and calculation methods).
2. To determine the Moment of Inertia of a Flywheel.
3. Determination of the Young's modulus by Dynamic method (graphical and calculation method).
4. Torsional pendulum; Determination of the rigidity modulus.
5. Oscillations of a spiral Spring and calculate a) Spring Constant b) Value of g
6. Young's modulus by the single cantilever method.
7. Determination of rigidity modulus by the static torsion method.
8. To determine g by Kater's Pendulum.
9. Determination of young's modulus by the method of uniform bending.
10. Drop weight method; Determination of surface tension of liquid and the interfacial tension between two liquids.
11. To determine the Elastic Constants of a Wire by Searle's method.
12. To determine the Modulus of Rigidity of a Wire by Maxwell's needle

13. To determine **g** and velocity for a freely falling body using Digital Timing Technique
14. To determine the Height of a Building using a Sextant.

Reference Books:

- Advanced Practical Physics for students, B.L.Flint and H.T.Worsnop, 1971, Asia Publishing House.
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
- Engineering Practical Physics, S.Panigrahi& B.Mallick,2015, Cengage Learning India Pvt. Ltd.
- A Text Book of Practical Physics, InduPrakash and Ramakrishna, 11th Edition, 2011, KitabMahal, New Delhi.

SEMESTER II

Course code: DMB29001/ DMB29002/ DMB29003/ DMB29004
Credits: Theory – 04, Practical – 02 **Theories:60Lectures**

COURSE OUTCOME:

After successful completion of the course, the student is able to

CO1.Deliberate in detail with examples vector analysis

CO2.Write down in detail with application, electrostatics and magneto static

CO3.Write down the classification and characteristics of AC Circuits

CO4.Specify in details with application, if applicable, properties of magnet material

CO5.Understand the characteristics of electromagnetic theory

CO6.Write down the characteristic of galvanometer

ELECTRICITY AND MAGNETISM: DSC 2

Unit-1

Vector Analysis: Review of vector algebra (Scalar and Vector product), Scalar and vector fields, gradient, divergence, Curl and their significance, Vector Integration, Line, surface and volume integrals

of Vector fields, Gauss-divergence theorem and Stoke's theorem of vectors (statement only). **(07 Lectures)**

Electrostatics: Electrostatic Field, electric flux, Gauss's theorem of electrostatics and applications; 1) infinite line of charge and 2)plane charged sheet. Electric potential as line integral of electric field, potential due to a point charge, electric dipole, uniformly charged spherical shell and solid sphere. Calculation of electric field from potential.

Capacitance of an isolated spherical conductor. Parallel plate, spherical and cylindrical condenser. Energy per unit volume in electrostatic field.

Dielectric medium, Polarization, Displacement vector. Gauss's theorem in dielectrics. Parallel plate capacitor completely filled with dielectric.

Galvanometers: Construction, theory and working of Helmholtz galvanometer. **(15Lectures)**

Alternating current: R M S values, Response of LR, CR and LCR circuits to sinusoidal voltages (discussion using the j symbol), Series and parallel resonance, Half-power frequencies, bandwidth and Q-factor, Power in electrical circuits, power factor and Maximum power transfer theorem.

(08 Lectures)

Unit-2

Applications of ac circuits - ac bridges**;** Anderson's bridge and De-Sauty's bridge

(02 Lectures)

Magneto statics: Biot-Savart's law & its applications; long straight conductor, circular coil and solenoid carrying current. Divergence and curl of magnetic field. Magnetic vector potential. Ampere's circuital law.

Magnetic properties of materials: Magnetic intensity, magnetic induction, permeability, magnetic susceptibility. Brief introduction of Dia-magnetic, Para-magnetic and Ferro-magnetic materials.

(10Lectures)

Electromagnetic Induction: Faraday's laws of electromagnetic induction, Lenz's law, self Inductance (L) and mutual inductance (M), L of single coil, M of two coils. Energy stored in magnetic field. **(06 Lectures)**

Electromagnetic Theory: Equation of continuity, Displacement current, setting up of Maxwell's equations, wave equation in free space, Poynting vector, energy density in electromagnetic field, electromagnetic wave propagation through free space and isotropic dielectric medium, Transverse nature of electromagnetic waves, polarization. **(12 Lectures)**

Reference Books:

- D. C. Tayal, Electricity and Magnetism, 1988, Himalaya Publishing House.
- K. K. Tewari: Electricity and magnetism, S. Chand Co. Ltd., New Delhi, Reprint 2007.
- B. B. Laud: Electrodynamics, Wiley Eastern Limited, New Delhi.
- David. J. Griffiths: Introduction to Electrodynamics, 3rd edition, Prentice-Hall of India Private limited, New Delhi.
- BrijLal and N. Subramanian:Electricity and Magnetism, 19th edition-RatanPrakashanMandir, Educational and University Publishers, Agra.
- D.N. Vasudeva: Fundamentals of Magnetism and Electricity, 12th edition-S.Chand and Co. Ltd., New Delhi

PHYSICS LAB- DSC 2A LAB: ELECTRICITY AND MAGNETISM

Course code: DMB29101 / DMB29102 / DMB29103 / DMB29104

(Minimum of eight is to be conducted)

1. LCR series circuits – Determination of L & Q factor
2. LCR parallel circuits – Determination of L & Q factor
3. Anderson's Bridge – Determination of the self-inductance of the coil.
4. De-Sauty's bridge – Verification of laws of combination of capacitances, unknown capacitance.
5. To verify the Thevinin's theorem.
6. Maximum Power Transfer Theorem.
7. Maxwell's bridge-determination of mutual inductance.
8. Low resistance-determination of the resistivity of the material.
9. Determination of capacitance by measuring impedance of RC circuit.
10. Determination of inductance by measuring impedance of RL circuit.
11. Low pass and High pass filters.
12. Black box – Identification of L,C & R .
13. Measurement of Magnetic field strength B and its gradient in a Solenoid (Determine dB/dx).
14. To determine a Low Resistance by Carey Foster's Bridge.
15. B_H using Helmholtz double coil galvanometer.

Reference Books

- Advanced Practical Physics for students, B.L.Flint&H.T.Worsnop, 1971, Asia Publishing House.

- A Text Book of Practical Physics, InduPrakash and Ramakrishna, 11th Edition, 2011, KitabMahal, New Delhi.
- Edition, reprinted 1985, Heinemann Educational Publishers

II YEAR B.Sc
SEMESTER - III Paper 3
ELECTROMAGNETISM

(Course duration: 14 weeks with three hours of instructions per week)

UNIT I

Scalar and Vector fields- Gradient of scalar field , divergence and curl of vector field- their physical significance, line, surface and volume integrals, flux of a vector field with examples, Gauss divergence theorem and Stokes theorem, spherical polar co-ordinates- expression for line element $\vec{dl}$ and surface element $\vec{da}$ in terms of $\hat{r},\hat{\theta},\hat{\phi}$. **5 hrs**

Electrostatics- Gauss law in integral and differential form $(\nabla.\vec{E} = \frac{\rho}{\varepsilon_0})$ **,** work done on a charge in an electrostatic field expressed as line integral, conservative nature of electrostatic field electrostatic potential V, $\vec{E} = -\nabla V$, potential inside and outside a charged spherical shell. **2 hrs**

Isotropic dielectrics- Polarization of isotropic dielectric in an electric field, polarization vector $\vec{p}$, surface charge density ρ_s and bound charge density ρ_b in a polarized dielectric, Gauss law in a dielectric-electric displacement vector $\vec{D}$, electric susceptibility and dielectric constant, molecular field – Clausius- Mossotti equation. **4 hrs**

Magnetostatics- Relation between current I and current density $\vec{J}$, continuity equation, Ampere's law $(\nabla \times \vec{B} = \mu_0 \vec{J})$, magnetization of dielectric medium in a magnetic field, magnetization vector $\vec{M}$ volume current density $\vec{J}_v$ and surface current density J_s, Ampere's law in magnetized material, magnetic intensity $\vec{H}$, magnetic permeability, interpretation of bar magnet as a surface distribution of solenoid current **3 hrs**

Electromagnetic theory- Maxwell's field equations in free space, wave equation for field vectors, plane electromagnetic wave and its transverse nature, propagation of EM waves through free space, characteristic impedance of free space, setting up of Maxwell's field equations in material medium, wave equation in material medium, Poynting vector, derivation of Poynting's theorem, linearly accelerated charge and oscillating dipole (qualitative) **7 hrs**

UNIT II

Thermoelectricity-Thermocouple, Seeback, Peltier and Thomson effects, thermodynamic theory of thermoelectric effect, law of intermediate metals and intermediate temperature applications of

thermoelectric devices-thermoelectric generator –design considerations, figure of merit and efficiency. **4 hrs**

Alternating current circuits- growth and decay of current in LR and CR circuits, significance of j operator, rms value, response of LR, CR, LCR(series and parallel) circuits to sinusoidal voltage, resonance , band width, Q-factor, power factor, maximum power transfer theorem for ac circuits **7 hrs**

Filters- high pass and low pass filters with LR and CR combination, expression for cutoff frequency, band pass filter **3 hrs**

AC bridges: Anderson Bridge, Maxwell's bridge, Owen's Bridge, Wein bridge **4 hrs**
CRO- Construction and working of CRO, measurement of voltage, frequency and phase using CRO **3 hrs**

REFERENCE BOOKS:

1. D.G. Griffiths "Introduction to electrodynamics", IIIrd edition, 1989, Prentice Hall –India
2. M.H. Nayfeh and M.K. Brussel "Electricity & Magnetism" (Wiley Publications)
3. Optics- Eugene Hecht- 4th edition
4. E.M. Purcell, Berkeley Physics Course "Electricity & Magnetism", Vol II, 1981, McGraw Hill
5. Halliday & Resnick, 'Physics Vol II', 1984, Seventeenth edition, Wiley Eastern Ltd.,
6. Panofsky and Phillips "Classical Electricity and Magnetism" (India Book House)
7. Reitz and Millford "Electricity and Magnetism", Indian Book Co. 1967.
8. A.S. Mahajan and A.A. Rangawala "Electricity and Magnetism", 1992, Tata McGraw Hill.
9. A.F. Kipp "Fundamentals of Electricity and Magnetism" (McGraw Hill)
10. A.M. Portis "Electromagnetic Fields"
11. Duggal and Chabra "Electricity and Magnetism", 1991, Shobanlal Nagin Chand and Co
12. William H Hayt, Jr. "Engineering Electromagnetism" 7th edition, McGraw Hill Edu Private Ltd.

Practical 3

(Course duration: 14 weeks with three hours of lab work per week)

Any Eight of the following experiments

1. Anderson's bridge – Determination of self-inductance of a coil
2. Desauty's bridge- verification of laws of combination of capacitance
3. Determination of capacitance by measuring impedance of RC circuit
4. LCR series circuit – Determination of L and Q-factor
5. Low resistance – Determination of the resistivity of the material
6. Low pass and High pass filters – Determination of cut off frequencies
7. Determination of inductance by measuring impedance of LR circuit

8. LCR parallel circuit – Determination of L and Q-factor
9. Phase measurement using CRO
10. Maxwell's bridge-Determination of self inductance of the coil

II YEAR B.Sc
SEMESTER - IV Paper 4
WAVES, ACOUSTICS AND OPTICS

(Course duration: 14 weeks with three hours of instructions per week)

UNIT I

Wave motion- differential equation for a wave, wave equation in complex form, superposition principle, addition of waves of different frequency- expression for group velocity, expression for speed of transverse waves on a stretched string- modes of vibrations**,** speed of longitudinal wave in a rod, Kundt's tube experiment **5 hrs**

Acoustics- Acoustic impedance of the medium, percentage of reflection and transmission of sound waves at a boundary between two media, impedance matching

Acoustics of buildings- reverberation time, derivation of Sabine's formula **4 hrs**

Transducers-types of transducers, microphones and loud speaker, their characteristics, impedance matching for transducers **2 hrs**

Fourier's theorem- Expression for Fourier co-efficient, analysis of square wave and saw tooth wave **2 hrs**

Propagation of Electromagnetic (EM) waves through matter- Propagation of EM waves through conductor, attenuation constant, skin depth, intrinsic impendence , Propagation of EM waves through isotropic non- conducting medium, refractive index of a medium (in terms of permittivity and permeability), velocity of light by Kerr cell method, dispersion formula-variation of refractive index with frequency , non- dispersive medium, qualitative discussion of scattering and absorption with examples **8 hrs**

UNIT II

Interference- Coherent sources, interference by division of wave front and division of amplitude, Fresnel`s biprism, Lloyd's mirror, thin film of uniform thickness, colour of thin films, interference at an air wedge, Newton's rings, Michelson`s interferometer- determination of λ & $d\lambda$ **6 hrs**

Diffraction- Fresnel and Fraunhoffer diffraction, explanation of rectilinear propagation of light, theory of zone plate-comparison with convex lens, Fraunhoffer diffraction at a single slit, diffraction at N parallel slits- intensity distribution, plane diffraction transmission grating- theory of normal incidence, resolution of images-Rayleigh criterion, resolving power of telescope and microscope, resolving power of grating **7 hrs**

Polarization- Double refraction in a uniaxial crystal, positive and negative crystals**,** principal refractive indices, Huygens's construction of O & E –wave fronts in uniaxial crystals, retarding plates, production and analysis of linearly, circularly and elliptically polarized light, optical activity- Fresnel's theory of optical rotation, interference of polarized light **8 hrs**

REFERENCE BOOKS:

1. Optics- Eugene Hecht- 4th edition Pearson education
2. 'Waves and oscillations', Berkley Physics course: Vol. III, McGraw Hill.
3. Vibrations and waves: I.G. Main, III edition, 1995, Cambridge University Press
4. The physics of vibrations and waves: H. J. Pain McMillan 1975
5. Optics: Ajay Ghatak , 1980, Tata McGraw Hill
6. Principle of Optics: B.K. Mathur (III edn)
7. Text book of Optics: Brijlal and Subramanyam, S.Chand and co.
8. Optics: F.A. Jenkins and H.E. White, third edition, 1957, McGraw Hill
8. Universities Optics : Vol I & II , Whittkar and Yarwood
9. Waves and Sound: Harnam Singh, 1963, S. Chand and Co.
10. Oscillations, Waves and Acoustics: P.K. Mittal

Practical 4

(Course duration: 14 weeks with three hours of lab work per week)

Any Eight of the following experiments

1. Interference at air wedge – Determination of the thickness of paper
2. Newton's rings –Determination of radius of curvature
3. Biprism – Determination of wavelength of a monochromatic light source
4. Diffraction grating – Determination of wavelengths of mercury spectral lines
5. Diffraction at a straight wire – Determination of diameter of the wire
6. Cauchy's constants using spectrometer.
7. Polarimeter – Determination of concentration of sugar solution
8. Calcite crystal-Determination of refractive indices of O and E rays
9. Helmholtz resonator- Determination of the frequency of a tuning fork
10. Characteristics of a microphone and loud speaker

III YEAR B.Sc
SEMESTER - V Compulsory Paper: Paper 5

MODERN PHYSICS-I

(Course duration: 14 weeks with three hours of instructions per week)

UNIT I

Properties of the electron-Determination of e/m of electron by Thomson method, determination of charge of electron by Millikan's oil drop method, ionization and excitation potentials, Franck -Hertz experiment. **3 hrs**

Wave Mechanics - Development of quantum mechanics, de-Broglie's hypothesis of matter waves, Davisson and Germer experiment, wave group- equality of group velocity and particle velocity, Heisenberg's uncertainty principle, gamma ray microscope, wave function and its interpretation, Setting up of time dependent and independent Schrödinger wave equation, dynamical variables as operators and their average values, eigenfunctions and eigenvalues, eigen functions and eigenvalues in case of one dimensional infinite potential well , finite potential barrier(tunneling), one dimensional harmonic oscillator - energy eigenvalues, Schrodinger wave equation for hydrogen atom in spherical co-ordinates and separation of variables r, θ, Φ, quantum numbers n, l, m, and quantization of related physical quantities, comparison with Bohr's theory **11 hrs**

Atomic Spectroscopy- magnetic moment of electron due to orbital motion- gyro magnetic ratio, vector model-space quantization, spin magnetic moment- Stern-Gerlach experiment, spin-orbit coupling-fine structure, Pauli's exclusion principle, normal Zeeman effect and its explanation- expression for Zeeman shift, - anomalous Zeeman effect, Paschen Back effect, Stark effect **7 hrs**

UNIT II

Molecular Spectroscopy - Types of energy in a molecule, salient features of molecular spectra, pure rotational and rotational-vibration spectra of diatomic molecule, quantization of rotational and vibration energies, transition rules

Raman effect- Experimental setup, explanation of Raman effect, intensity and polarization of Raman lines, comparison of Raman spectra with IR spectra, expression for Raman shift, determination of molecular structure (illustration) **5 hrs**

Lasers- Spontaneous and stimulated emission, condition for laser action, population inversion construction and working of He-Ne laser, applications of laser in medicine, industry, communication, basic aspects of holography-principle, method and uses of hologram **4 hrs**

Nucleus- Properties of nucleus, Dempster's mass spectrograph, nuclear forces and their characteristics, Yukawa's theory (qualitative).

Nuclear decay- Alpha decay-range and energy relation, Geiger-Nuttall law, experimental determination of range of α-particle. α-particle disintegration energy, Gamow's explanation of α-decay , Beta decay-beta ray spectrum, Pauli's neutrino hypothesis, qualitative aspects of Fermi's theory of beta decay, parity

violation, positron emission and electron capture, Gamma decay: nuclear isomerism, internal conversion. **8 hrs**

Accelerators: - Cockcroft-Walton voltage multiplier, LINAC **2 hrs**

Nuclear detectors- GM counter, Scintillation detector, Semiconductor detector **2 hrs**

REFERENCE BOOKS:

1. Modern physics – Kenneth S Krane. – John wiley and sons
2. Introduction to Quantum Mechanics, David J Griffiths, 2nd edition
3. Quantum Physics of Atoms, Molecules, Solids. Nuclei and Particles –Robert Eisberg and Robert Resnick, 2nd edition
4. Quantum mechanics - S.N. Biswas, Books and Allied, Calcutta (P) limited
5. Lasers: P. Milony and J.H Eberly; John Wiley and sons.
6. Concepts of Modern physics - A. Beiser, 5th edition, 1997, Tata McGraw Hill.
7. Modern physics- John. R Taylor, Chris D. Zafiratos, Michael Dubson- Printice Hall of India limited.
8. Introduction to Modern physics. - H S Mani & G .K. Mehta, 1988, EW press.
9. Physics of the Atom – M. E. Wehr, J.A. Richards, T.W. Adair, 1985, Narosa Publishing House.
10. Lasers- KR Nambiar- New age international
11. Atomic and nuclear physics – A.B Gupta, New central book agency Pvt. Ltd.
12. Introduction to Modern physics - F. K. Richtmeyer, E.H. Kennand, J N Cooper, VI edition, 1998, Tata McGraw Hill.
13. Lasers and Non-linear optics: B.B. Laud, 1995, Wiley Eastern.
14. Modern Physics - Murugeshan R, II edition, 1990, Shobanlal and Co.
15. Nuclear Physics- S N Ghoshal, S Chand and Co.
16. Atomic Physics – J B Rajam, S Chand and Co.

III YEAR B.Sc
SEMESTER - V ELECTIVE Paper- 6.1
CONDENSED MATTER PHYSICS AND NUCLEAR PHYSICS
(Course duration : 14 weeks with three hours of instructions per week)

UNIT I

Superconductivity- Experimental facts, Meissner effect, superconducting transition, critical magnetic field. types of superconductors, applications. BCS theory (qualitative), high temperature superconductors **4 hrs**

X rays- Continuous X-ray spectra, Duane and Hunt limit, characteristic X-ray spectra, Moseley's law and its importance, Bragg's law and Bragg's spectrometer. Compton effect- expression for Compton shift

Types of crystals-space lattice, Bravais lattice, basis vector, translation vector, unit cell, lattice parameter, crystal planes, crystal system, Miller indices, expression for interplanar spacing, NaCl and KCL structure **7 hrs**

Bonding in solids-Potential between pair of atoms- Lennard-Jone potential, ionic bonding- binding energy and cohesive energy, covalent bond, metallic bond **3 hrs**

Specific heat of solids- Specific heat, Dulong and Pettit's law and its limitations, Einstein's theory and Debye's theory of specific heat of solid **3 hrs**

Liquid crystals- Types of crystals, classification, optical, electro optical, magneto optical and thermal properties **4 hrs**

UNIT II

Mass Spectrographs- Theory of Bainbridge and Aston mass spectrographs **2 hrs**

Nuclear models- Liquid drop model, semi-empirical mass formula, Shell model & magic numbers (qualitative). **3 hrs**

Accelerators-Microtron, Betatron, Synchrotron **2 hrs**

Nuclear reactions- Types of nuclear reactions and classification, exoergic and endoergic reactions. Q-values, threshold energy of an endoergic reaction. Reactions induced by protons, deuterons & alpha particles, photodisintegration. **3 hrs**

Nuclear fission and fusion- Estimation of the fission energy on the basis of liquid drop model, controlled & uncontrolled chain reaction, Four factor formula, types of reactors, confinement of plasma-Tokomak **3 hrs**

Elementary particles- Classification - Leptons and Hadrons, particle quantum numbers, four fundamental interactions in nature and conservation laws. Quarks – color, quark confinement, mention of Standard model, Large Hadron Collider **3 hrs**

Astrophysics-Basic source of energy in stars, thermonuclear reactions, P-P chain, CNO cycle, evolution of star, nucleosynthesis- s process and r process, white dwarf, Chandrashekar limit, supernova explosion, neutron star, pulsars, black holes, Schwartzschild radius, singularity event horizon.

Cosmology- expansion of universe- Hubble's law, Big bang and evolution of universe, evidence for Big bang- cosmic microwave background radiation, dark matter, matter density in the universe, deceleration parameter, future of universe. **5 hrs**

REFERENCE BOOKS

1. Modern physics – Kenneth S Krane. – John wiley and sons
2. Introduction to Solid State Physics – C. Kittel, John Wiley and Sons, 1966, III edition.
3. Solid state Physics – A.J. Dekkar, 1993, IX edition, McMillan India Ltd.
4. Introduction to Solids – L.V. Azaroff, 2000, Tata- McGraw Hill.
5. Crystallography applied to Solid State Physics – A.R.Verma ,etal
6. Crystal structure- R.W.G.Wykoff Krieger
7. 'Solid State Physics' – P.K. Paliniswamy, SCITEC Publications (India) Pvt Ltd. Chennai
8. 'Solid State Physics' – M.A. Wahab, Narosa Publishing House, New Delhi 1999.
9. Solid State Physics- S O Pillai- New age international limited.
10. Nuclear physics: Kaplan, 1971, II edition, Addison Wesley.
11. Atomic & Nuclear Physics: S.N.Ghoshal, 1994, Vol II, S. Chand and Co.
12. Perspectives of Modern Physics: Arthur Beiser, 1996, McGraw Hill Book Co.
13. Concepts of Nuclear Physics: B.H. Cohen, 1988, Tata McGraw Hill.
14. Introduction to Nuclear Physics: Harold Enge
15. Modern physics- John. R Taylor, Chris D. Zafiratos, Michael Dubson- Printice Hall of India limited.
16. Astrophysics- B Basu, PHI limited.
17. Introduction to Elementary Particles - D.G. Griffiths
18. Nuclear Physics- S N Ghoshal, S Chand and Co.

III YEAR B.Sc
SEMESTER - VI Compulsory Paper: Paper 7
MODERN PHYSICS-II
(Course duration: 14 weeks with three hours of instructions per week)

UNIT I

Special theory of relativity- basic aspects of Newtonian mechanics - absolute space and absolute time, concept of ether, Michelson & Morley experiment, Basic postulates of special theory of relativity, Lorentz transformation, the Lorentz –Fitzgerald contraction, concept of simultaneity, Einstein's time dilation, velocity addition theorem, expression for relativistic mass, mass less particle(photon), energy equation $E=mc^2$, energy-momentum relation, Minkowski space-time , concept of four vectors

General theory of relativity- accelerated frames, principle of equivalence, predictions of general theory of relativity - bending of light, perihelion motion of mercury, gravitational red shift
7 hrs

Quantum Statistics- Probability of distribution of distinguishable and indistinguishable particles, Bose-Einstein and Fermi-Dirac distributions -comparison with Maxwell-Boltzmann distribution, Bose condensation **2 hrs**

Electrical properties of metals- free electron theory of metals, expression for electrical conductivity-Ohm's law, drawbacks of the theory, statement of number of available energy states between E and E+ dE, expression for Fermi energy and average energy at absolute zero. Quantum theory of free electrons. Hall effect- expression for Hall coefficient in metals and semiconductors, magneto resistance
5 hrs

Band theory of solids- formation of energy bands, intrinsic semiconductor, derivation of the expression for carrier concentration and electrical conductivity for intrinsic semiconductor, expression for energy gap, extrinsic semiconductor, effect of temperature and impurity concentration on Fermi energy
4 hrs

Semiconductor Devices- Bridge rectifier-expression for ripple factor and efficiency, filters, DC regulated power supply-shunt regulator using zener diode clippers and clampers

3 hrs

UNIT II

Network Theorems: Superposition theorem, Thevenin's theorem, Norton's Theorem, application to the analysis of DC circuits **4 hrs**

Transistors- DC biasing of transistors- self biasing (potential divider type) operating point, DC load line and AC load line, stability of Q point-thermal runaway **4 hrs**

Amplifiers- Comparison of CE, CB and CC amplifiers, h-parameters. A.C. equivalent circuit of a transistor in terms of the h-parameters, derivation of the expressions for voltage gain. current gain, power gain, input resistance and output resistance for CE mode. RC coupled amplifier –mathematical analysis frequency response, input and output impedances and band width

7 hrs

Oscillators- Positive and negative feedback, mention of the Barkhausen criteria. Phase shift and Hartley oscillators, expressions for frequency and gain **3 hrs**

Digital Electronics- Binary number system, Laws of Boolean algebra, De-Morgan's theorem-simplification of Boolean expressions, construction of AND, OR and NOT logic gate using a transistor **3 hrs**

REFERENCE BOOKS:

1. Special relativity - A.P. French, 1975, ELPS.
2. Bose and his statistics –G.Venkataraman
3. Concepts of Modern physics - A. Beiser, 5 edn, 1997, Tata McGraw Hill.
4. Special theory of relativity – Resnick, 1979, Wiley Eastern Limited.
5. Electronic principle: Malvino, 1999, Tata McGraw Hill.
6. Digital principles & applications: Malvino & Leach, 1991, Tata McGraw Hill.
7. Basic electronics: B.Grob, 1984, McGraw Hill.
8. Electronics: V.K.Mehta, 1996, V edition, S.Chand and Co.
9. Network analysis: Boylstead, 1982, Abel and Howell Co.
10. Electronic Devices and circuit theory: R.Boylstead etal, 1993, Prentice Hall India.
11. Digital fundamentals: Floyd, 2000, III edition, UBS
12. Solid state electronic devices: B G Streetman

III YEAR B.Sc
SEMESTER - VI ELECTIVE Paper 8.2
PHOTONICS
(Course duration: 14 weeks with three hours of instructions per week)

UNIT I

Lasers

Basic Principles, Properties of laser light, coherence-spatial & temporal, divergence, line shape broadening, cavity laser modes, mode selection, single mode operation, selection of laser emission line **2 hrs**

Laser Oscillator: Pumping Schemes, gain-threshold conditions, optical feedback, optical resonator. **4 hrs**

Types of Lasers: Nd – YAG. CO_2 and Dye lasers – construction and principles of working **3 hrs**

Laser Diodes: Lasing conditions and gain in a semiconductor, selective amplification and coherence, materials for laser diodes, quantum well lasers, surface emitting lasers, characterization and modulation of lasers. **5 hrs**

Optoelectronics-Introduction: Optoelectronics in the information technology, optoelectronic devices, optoelectronic materials - liquid crystals, semiconductors, ceramics, polymers and optical fibers, fabrication of Optoelectronic devices. **2 hrs**

Light emitting diodes: The electroluminescence process, materials for light emitting diodes, LED structures and efficiency, light output from LED, performance characteristics, manufacturing process. **5 hrs**

UNIT II

Photo Detectors: Specifications, Types – junction photodiodes, avalanche photodiodes, CCD Photo detectors, comparison of different detectors, performance characteristics and fabrication **6 hrs**

Photovoltaics – solar cell I -V characteristics, materials and device fabrication. **1 hr**

Fiber Optics and Dielectric wave guides

Wave Guide-Slab wave guide, modes, V number, Modal, material and waveguide dispersions **3 hrs**

Optical Fiber- Types, optical fiber functions. Light propagation, Optical power, velocity of Propagation, critical angle, acceptance angle, numerical aperture, mode of propagation, Index profile. Single mode step-index optical fiber, multimode step- index fiber, graded index fibers advantages and disadvantages, energy losses in optical fiber, Bit rate, dispersion and optical bandwidth, absorption and scattering, Block diagram of optical fiber communication. construction of optical cables. Optocoupler. **11 hrs**

REFERENCE BOOKS:

1. John Wilson and John Hawkes, "Optoelectronics- An Introduction" - 3rd Edition, Prentice Hall, 1998

2. J Singh, "Optoelectronics: an introduction to materials and devices", McGraw Hill, New York

3. P Bhattacharya "Semiconductors, Optoelectronic devices", Prentice Hall International, 1997

4. KR Nambiar, Lasers –Principles, Types and Applications, New Age International, New Delhi.

5. Wayne Tomaal, Electronic Communication Systems-Fundamentals through advanced- 5th editions, Pearson Education, New Delhi

6. Dennis Roddy and John Coolen, Electronic Communication, 4th edition, Pearson Education, New Delhi

JSS College of Arts, Commerce & Science (Autonomous),
Ooty Road, Mysore-25

DEPARTMENT OF PHYSICS

SEMESTER I

Course code: DMA29001/ DMA29002/ DMA29003/ DMA29004
Credits: Theory – 04, Practical – 02 **Theories: 60 Lectures**

COURSE OUTCOME:

After successful completion of the course, the student is able to

CO1.Learn the details of Elasticity

CO2.Understand the classification and characteristics of motion of a point particle

CO3.Understand in details with examples Frames of reference and relative motion

CO4.Deliberate the classification and characteristics of Dynamics of particle in conservative field

CO5.Specify the classification and characteristics of Special theory of relativity and gravitation

CO6.Write down the characteristics of Surface tension and viscosity

MECHANICS: DSC1

Unit-1

Vectors: Vector algebra (with special reference to the rules of addition and multiplication), Scalar and vector products with specific examples.

Motion of a point particle: The position vector *r(t)* of a moving point particle and its Cartesian components. Velocity and acceleration as the vector derivatives. Derivatives of a vector with respect to a parameter; Derivation of planar vector of a constant magnitude. Radial and transverse components of velocity and acceleration for arbitrary planar motion, deduction of results for uniform circular motion-centripetal force. **(05 Lectures)**

Frames of references and relative motion:
Newton's laws of motion and inertial mass. Galilean transformation; Galilean principle of relativity, Plumb line accelerometer and a freely falling elevator, Non-inertial frames and fictitious force,

uniformly rotating frame of reference and coriolis force. Effect of rotation of earth on acceleration due to gravity.

(07Lectures)

Dynamics of a particle in conservative fields:

Work done by force acting on a particle, work-energy theorem. Conservative and non conservative force field. Conservation of energy. Conservative force as a negative gradient of potential, central force as an example of conservative force field. **(05 Lectures)**

Conservation of momentum: Conservation of linear momentum, centre of mass, rocket equation. Angular momentum and torque, law of conservation of angular momentum, angular momentum of a system taking centre of mass of the system. **(06 Lectures)**

Dynamics of rigid bodies: Moment of inertia, radius of gyration, calculation of momentum of inertia of rectangular plate, circular plate and solid sphere, kinetic energy of rotation. **(04 Lectures)**

Oscillations: Simple harmonic motion. Differential equation of SHM and its solutions. Kinetic and Potential Energy, Total Energy and their time averages. Damped oscillations. (**03 Lectures)**

Unit-2

Gravitation: Newton's Law of gravitation. Motion of a particle in a central force field (motion is in a plane, angular momentum is conserved, areal velocity is constant). Kepler's Laws, derivations of Kepler's law, satellite in circular orbit and applications, geosynchronous orbits, weightlessness, basic idea of global positioning system (GPS). **(08 Lectures)**

Special Theory of Relativity: Postulates of Special Theory of Relativity. Lorentz transformation equations, Length contraction, time dilation, relativistic addition of velocities. Mass-Energy relation, energy-momentum relation**.** **(06 Lectures)**

Elasticity:

Review of concepts of modulii of elasticity, Hooke's Law and Poisson's ratio(σ). Relation between

the elastic constants ***q, k, n*** and ***σ***, limiting values for **σ.**Work done in stretching. Elastic potential energy. Bending moment. Theory of light single cantilever. I-section girders. Torsion; calculation of couple per unit twist. The Torsional pendulum, Static torsion, Searle's double bar experiment.

Surface Tension: Review of basic concepts. Pressure inside curved liquid surface. Surface tension and interfacial tension by drop-weight method. Surface tension and angle of contact of mercury by Quincke's method.

Viscosity: Review of basic concepts; Variation of Viscosity of liquids with temperature and pressure. **(16 Lectures)**

Reference Books:

- Halliday, Resnick, Jearl Walker, "Principles of Physics" 9th edition, Wiley, 2013.
- Berkeley Physics Course, Vol-1 "Mechanics", 2nd edition, Charles Kittle, Walter D Knight, Malvin A
- D S Mathur, "Elements of properties of matter", S Chand and company, New Delhi, Reprint-2007.
- D S Mathur, "Mechanics", S Chand and company, New Delhi, Reprint-2001.
- BrijLal and N Subrahmanyam, "Properties of matter", 6th edition, Eurasia publishing house Ltd. New Delhi, Reprint-1993.
- Mechanics by Shankara Narayana &Chopra.
- Mechanics by Bhargava and Sharma.

PHYSICS LAB: DSC 1A LAB: MECHANICS

Course code: DMA29101/ DMA29102/ DMA29103/ DMA29104

(Minimum of eight is to be conducted)

1. Bar pendulum: Determination of the acceleration due to gravity and radius of gyration (Both graphical and calculation methods).
2. To determine the Moment of Inertia of a Flywheel.
3. Determination of the Young's modulus by Dynamic method (graphical and calculation method).
4. Torsional pendulum; Determination of the rigidity modulus.
5. Oscillations of a spiral Spring and calculate a) Spring Constant b) Value of g
6. Young's modulus by the single cantilever method.
7. Determination of rigidity modulus by the static torsion method.

8. To determine g by Kater's Pendulum.
9. Determination of young's modulus by the method of uniform bending.
10. Drop weight method; Determination of surface tension of liquid and the interfacial tension between two liquids.
11. To determine the Elastic Constants of a Wire by Searle's method.
12. To determine the Modulus of Rigidity of a Wire by Maxwell's needle
13. To determine **g** and velocity for a freely falling body using Digital Timing Technique
14. To determine the Height of a Building using a Sextant.

Reference Books:

- Advanced Practical Physics for students, B.L.Flint and H.T.Worsnop, 1971, Asia Publishing House.
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
- Engineering Practical Physics, S.Panigrahi& B.Mallick,2015, Cengage Learning India Pvt. Ltd.
- A Text Book of Practical Physics, InduPrakash and Ramakrishna, 11th Edition, 2011, KitabMahal, New Delhi.

SEMESTER II

Course code: DMB29001/ DMB29002/ DMB29003/ DMB29004
Credits: Theory – 04, Practical – 02 **Theories: 60 Lectures**

COURSE OUTCOME:

After successful completion of the course, the student is able to

CO1.Deliberate in detail with examples vector analysis

CO2.Write down in detail with application, electrostatics and magneto static

CO3.Write down the classification and characteristics of AC Circuits

CO4.Specify in details with application, if applicable, properties of magnet material

CO5.Understand the characteristics of electromagnetic theory

CO6.Write down the characteristic of galvanometer

ELECTRICITY AND MAGNETISM: DSC 2

Unit-1

Vector Analysis: Review of vector algebra (Scalar and Vector product), Scalar and vector fields, gradient, divergence, Curl and their significance, Vector Integration, Line, surface and volume integrals of Vector fields, Gauss-divergence theorem and Stoke's theorem of vectors (statement only). **(07 Lectures)**

Electrostatics: Electrostatic Field, electric flux, Gauss's theorem of electrostatics and applications; 1) infinite line of charge and 2)plane charged sheet. Electric potential as line integral of electric field, potential due to a point charge, electric dipole, uniformly charged spherical shell and solid sphere. Calculation of electric field from potential.

Capacitance of an isolated spherical conductor. Parallel plate, spherical and cylindrical condenser. Energy per unit volume in electrostatic field.

Dielectric medium, Polarization, Displacement vector. Gauss's theorem in dielectrics. Parallel plate capacitor completely filled with dielectric.

Galvanometers: Construction, theory and working of Helmholtz galvanometer. **(15Lectures)**

Alternating current: R M S values, Response of LR, CR and LCR circuits to sinusoidal voltages (discussion using the j symbol), Series and parallel resonance, Half-power frequencies, bandwidth and Q-factor, Power in electrical circuits, power factor and Maximum power transfer theorem.

(08 Lectures)

Unit-2

Applications of ac circuits - ac bridges**;** Anderson's bridge and De-Sauty's bridge

(02 Lectures)

Magneto statics: Biot-Savart's law & its applications; long straight conductor, circular coil and solenoid carrying current. Divergence and curl of magnetic field. Magnetic vector potential. Ampere's circuital law.

Magnetic properties of materials: Magnetic intensity, magnetic induction, permeability, magnetic susceptibility. Brief introduction of Dia-magnetic, Para-magnetic and Ferro-magnetic materials.

(10Lectures)

Electromagnetic Induction: Faraday's laws of electromagnetic induction, Lenz's law, self Inductance (L) and mutual inductance (M), L of single coil, M of two coils. Energy stored in

magnetic field. **(06 Lectures)**

Electromagnetic Theory: Equation of continuity, Displacement current, setting up of Maxwell's equations, wave equation in free space, Poynting vector, energy density in electromagnetic field, electromagnetic wave propagation through free space and isotropic dielectric medium, Transverse nature of electromagnetic waves, polarization. **(12 Lectures)**

Reference Books:

- D. C. Tayal, Electricity and Magnetism, 1988, Himalaya Publishing House.
- K. K. Tewari: Electricity and magnetism, S. Chand Co. Ltd., New Delhi, Reprint 2007.
- B. B. Laud: Electrodynamics, Wiley Eastern Limited, New Delhi.
- David. J. Griffiths: Introduction to Electrodynamics, 3rd edition, Prentice-Hall of India Private limited, New Delhi.
- BrijLal and N. Subramanian:Electricity and Magnetism, 19th edition-RatanPrakashanMandir, Educational and University Publishers, Agra.
- D.N. Vasudeva: Fundamentals of Magnetism and Electricity, 12th edition-S.Chand and Co. Ltd., New Delhi

PHYSICS LAB- DSC 2A LAB: ELECTRICITY AND MAGNETISM

Course code: DMB29101 / DMB29102 / DMB29103 / DMB29104

(Minimum of eight is to be conducted)

1. LCR series circuits – Determination of L & Q factor
2. LCR parallel circuits – Determination of L & Q factor
3. Anderson's Bridge – Determination of the self-inductance of the coil.
4. De-Sauty's bridge – Verification of laws of combination of capacitances, unknown capacitance.
5. To verify the Thevinin's theorem.
6. Maximum Power Transfer Theorem.
7. Maxwell's bridge-determination of mutual inductance.
8. Low resistance-determination of the resistivity of the material.
9. Determination of capacitance by measuring impedance of RC circuit.
10. Determination of inductance by measuring impedance of RL circuit.
11. Low pass and High pass filters.
12. Black box – Identification of L,C & R .
13. Measurement of Magnetic field strength B and its gradient in a Solenoid (Determine dB/dx).
14. To determine a Low Resistance by Carey Foster's Bridge.

15. B_H using Helmholtz double coil galvanometer.

Reference Books

- Advanced Practical Physics for students, B.L.Flint&H.T.Worsnop, 1971, Asia Publishing House.
- A Text Book of Practical Physics, InduPrakash and Ramakrishna, 11th Edition, 2011, KitabMahal, New Delhi.
- Edition, reprinted 1985, Heinemann Educational Publishers

SEMESTER III

Course code: DMC29001/ DMC29002/ DMC29003/ DMC29004

Credits: Theory – 04, Practical – 02 **Theories: 60 Lectures**

COURSE OUTCOME:

After successful completion of the course, the student is able to

CO1.Specify in details with examples kinetic theory of gases

CO2.Specify in depth low temperature physics

CO3.Identify in detail with application thermal conductivity and theory of radiation

CO4.write down the classification and characteristics of laws of thermodynamics

CO5.Have a clear understanding about reversible and irreversible process

CO6.Understand the classification and characteristics of entropy and thermodynamic potential

THERMAL PHYSICS AND STATISTICALMECHANICS: DSC 3

Unit-1

Laws of Thermodynamics: Thermodynamic description of system, Zeroth Law of thermodynamics and temperature. Applications of First Law; General Relation between C_P& C_V.

Work Done during Isothermal and Adiabatic Processes. Compressibility & Expansion Coefficient. Reversible & irreversible processes; Carnot's theorem. Thermodynamic scale of temperature and its identity with perfect gas scale.

Entropy: The concept of entropy. Change of entropy in reversible and irreversible cycles. Entropy and non-available energy. Principle of increase of entropy; Clausius inequality. Second law of thermodynamics in terms of Entropy. Entropy of ideal gas, T-S diagram. Probability and entropy, Boltzmann relation. Concept of absolute zero and the third law of thermodynamics.

(15 Lectures)

Thermodynamic Potentials: Internal energy, Enthalpy, Helmholtz and Gibbs functions, Maxwell's thermodynamic relations & applications; Joule-Thompson Effect. Clausius-Clapeyron first Latent heat equation, effect of pressure on melting point of a solid, effect of pressure on boiling point of a liquid, Expression for $(C_P - C_V)$, C_P/C_V, T dS equations. **(08 Lectures)**

Kinetic Theory of Gases: Derivation of Maxwell's law of distribution of velocities and its experimental verification, Mean free path (Zeroth Order).Transport Phenomena; Viscosity, Conduction and Diffusion (for vertical case), Law of equipartition of energy (no derivation) and its applications to specific heat of gases; mono-atomic and diatomic gases. **(07 Lectures)**

Unit-2

Thermal conductivity: Equation of flow of heat through solid bar, determination of thermal conductivity of a bad conductor by Lee and Charlton method. **(03 Lectures)**

Theory of Radiation: Induced and spontaneous emission of radiation. Derivation of Planck's law of radiation using Einstein's A and B coefficients. Deduction of Rayleigh-Jeans law, Stefan's law and Wien's displacement law from Planck's law, Wien's formula. **(08 Lectures)**

Low temperature Physics: Ideal gas and real gas.Van-der Waals equation of state. Porous-plug experiment and its theory. Joule-Thomson expansion - expression for the temperature of inversion, inversion curve. Relation between Boyle temperature, temperature of inversion and critical temperature of a gas. Principle of regenerative cooling. Liquefaction of air by Linde's methods.

Adiabatic demagnetization**.** **(07 Lectures)**

Statistical Mechanics: Probability concept, Phase space, Microstate and Microstate, Entropy and Thermodynamic probability, Maxwell-Boltzmann law- distribution of velocity. Quantum statistics: Bose-Einstein, Maxwell-Boltzmann and Fermi-Dirac distribution law – electron gas-Bose-Einstein distribution law - photon gas - comparison of three statistics. **(12 Lectures)**

Reference Books:

- BrijLal, N. Subramanyam P.S. Hemne: Heat Thermodynamics and Statistical Physics, 1st edition. S Chand Publishing, 2007.
- S C Gupta: Thermodynamics, 1st edition, Pearson, 2005.
- C. L. Arora: Refresher Course in Physics Vol I, S Chand publishing, 2011.
- S. R. Shankara Narayana: Heat and Thermodynamics, 2nd edition, Sulthan Chand and Sons, 1990.
- A Treatise on Heat, MeghnadSaha, and B.N. Srivastava, 1969, Indian Press.
- Heat and Thermodynamics, M.W.Zemasky and R. Dittman, 1981, McGraw Hill

PHYSICS LAB-DSC 3A LAB: THERMAL PHYSICS AND STATISTICAL MECHANICS

Course code: DMC29101/ DMC29102/ DMC29103/ DMC29104

(Minimum of eight is to be conducted)

1. Verification of distribution law using Monte-Carlo Method.
2. Verification of Stefan's-Boltzmann law.
3. Specific heat of a liquid by cooling – graphical method.
4. To determine Stefan's Constant.
5. To determine the coefficient of thermal conductivity of a bad conductor by Lee and Charlton's disc method.
6. To determine the coefficient of thermal conductivity of copper by Searle's Apparatus.
7. To determine the Coefficient of Thermal Conductivity of Cu by Angstrom's Method.
8. Determination of moment of inertia of Irregular body by Torsional pendulum method.
9. Determine young's modulus of a material by Koenig's method.

10. To study the variation of thermo emf across two junctions of a thermocouple with temperature.
11. Measurement of Planck's constant using black body radiation.
12. Determine boiling point of a liquid using Platinum resistance thermometer.
13. To determine the temperature co-efficient of resistance by Platinum resistance thermometer.
14. To determine Mechanical Equivalent of Heat, J, by Callender and Berne's constant flow method.
15. To record and analyze the cooling temperature of a hot object as a function of time using a thermocouple and suitable data acquisition system.
16. To calibrate Resistance Temperature Device (RTD) using Null Method/Off-Balance Bridge.

Reference Books:

- Advanced Practical Physics for students, B.L.Flint&H.T.Worsnop, 1971, Asia Publishing House.
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
- A Text Book of Practical Physics, InduPrakash and Ramakrishna, 11th Edition, 2011, KitabMahal, New Delhi.
- A Laboratory Manual of Physics for Undergraduate Classes, D.P. Khandelwal, 1985, Vani Publication

SEMESTER IV

Course code: DMD29001/ DMD29002/ DMD29003/ DMD29004

Credits: Theory – 04, Practical – 02 **Theories: 60 Lectures**

COURSE OUTCOME:

After the completion of the course, Students will be able to

CO1.Specify the classification and characteristics of Fourier theorem

CO2.Learn in detail with application, superposition of simple harmonic motion

CO3.Understand in detail with application of wave motion

CO4.Deliberate in detail with examples Sound, wave optics and transducers

CO5.Learn the details of Interference, diffraction and polarization

CO6.Learn in detail with application of acoustics

WAVES AND OPTICS: DSC 4

Unit-1

Analysis of Complex Waves: Fourier's Theorem- Application to saw tooth wave and square wave.

(03 Lectures)

Superposition of simple harmonic motion:

Superposition of two simple harmonic motion; Lissajous' figures. Damped vibration; Equation for damped vibrations. Forced vibration; solution in exponential form, Resonance, Expression for amplitude and phase at resonance.

Superposition of two collinear harmonic oscillations: Linearity and Superposition Principle. (1) Oscillations having equal frequencies and (2) Oscillations having different frequencies (Beats).

(11 Lectures)

Wave Motion:

Progressive waves; Differential equation of wave motion; Relation between amplitude and intensity. Expression for velocity of progressive waves in a medium; Newton's formula, Laplace's correction.

Transverse waves on a string. Travelling and standing waves on a string. Normal Modes of a string. Expression for frequency of vibration of a stretched string, harmonics. Group velocity, Phase velocity. Longitudinal vibrations in a rod; Kundt's tube experiment. **(10 Lectures)**

Sound: Intensity and loudness of sound - Decibels - Intensity levels - musical notes - musical scale. Acoustics of buildings: Reverberation and time of reverberation, Absorption coefficient, Sabine's formula, measurement of reverberation time. Acoustic aspects of halls and auditoria.

(06 Lectures)

Unit-2

Transducers: Types of transducers, dynamic microphone and loudspeaker-construction, working and their characteristics, Piezo electrical transducer. **(03 Lectures)**

Wave Optics: Electromagnetic nature of light. Definition and Properties of wave front. Huygens

Principle. **(03 Lectures)**

Interference: Interference: Review of basic concepts, Coherent sources, and conditions for constructive and destructive interference.

Coherent source by division of amplitude: Interference in Thin Films: – reflected and transmitted light, color of thin films, theory of air wedge, theory of Newton's rings; measurement of wavelength and refractive index.

Coherent source by division of division of wave front: Lloyd's Mirror and Fresnel's Biprism. Michelson's interferometer; Measurement of λ and $d\lambda$. **(11 Lectures)**

Diffraction: Fresnel and Fraunhoffer diffraction. Explanation of rectilinear propagation of light. Theory of the zone plate and comparison with convex lens. Fresnel diffraction at a straight edge. Fraunhoffer diffraction at a single slit. Transmission grating: theory for the case of normal incidence**.** **(06 Lectures)**

Polarization: Double refraction in uniaxial crystals. Huygens's theory. Positive and negative crystal. Principle refractive indices. Huygens's constructions of ordinary and extraordinary wave fronts in a uniaxial crystal, retarding plates. Production and analysis of linearly, circularly and elliptically polarized light. Optical activity, Fresnel's theory, Lorentz half shade polarimeter.

(07 Lectures)

Reference Books:

- Fundamentals of Optics, F A Jenkins and H E White, 1976, McGraw-Hill. Principles of Optics, B.K. Mathur, 1995, Gopal Printing
- Fundamentals of Optics, H.R. Gulati and D.R. Khanna, 1991, R. Chand Publication
- Brijlal and N Subramanyam: Waves and Oscillations, 2nd edition, Vikas publishing house Pvt. Ltd., New Delhi.
- S K Gupta, O P Varma: Waves and Oscillations, 3rd edition, R.Chand& Co., New Delhi.
- R.L. Saihgal, A Text Book of Sound, S.Chand& Company Ltd. New Delhi, Reprint 1990.

PHYSICS LAB-DSC 4A LAB: WAVES AND OPTICS

Course code: DMD29101/ DMD29102/ DMD29103/ DMD29104

(Minimum of eight is to be conducted)

1. To determine wavelength of sodium light using Newton's Rings.
2. To determine wavelength of sodium light using Fresnel Biprism.
3. To determine wavelength of Sodium light using plane diffraction Grating.
4. Air wedge – Determination of thickness of a thin paper/diameter of a thin wire
5. Cauchy's constants using spectrometer.
6. Polarization – Determination of unknown concentration of sugar solution by graphical method using a polarimeter.
7. Diffraction at a Straight wire -To determine the diameter of the Straight wire
8. Helmholtz resonator-determination of frequency of tuning fork
9. To determine the Refractive Index of the Material of a given Prism using Sodium Light.
10. To study Lissajous Figures
11. Kundt's tube experiment – Velocity of sound in air at room temperature
12. To investigate the motion of coupled oscillators
13. To determine the Frequency of an Electrically Maintained Tuning Fork by Melde's Experiment and to verify λ^2 – T Law
14. Familiarization with Schuster`s focusing; determination of angle of prism
15. To measure the intensity using photo sensor and laser in diffraction patterns of single and double slits.

Reference Books:

- Advanced Practical Physics for students, B.L. Flint & H.T. Worsnop, 1971, Asia Publishing House.
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
- A Text Book of Practical Physics, InduPrakash and Ramakrishna, 11th Edition, 2011, KitabMahal, New Delhi.

III YEAR B.Sc
SEMESTER - V Compulsory Paper: Paper 5

MODERN PHYSICS-I

(Course duration: 14 weeks with three hours of instructions per week)

UNIT I

Properties of the electron-Determination of e/m of electron by Thomson method, determination of charge of electron by Millikan's oil drop method, ionization and excitation potentials, Franck - Hertz experiment. **3 hrs**

Wave Mechanics - Development of quantum mechanics, de-Broglie's hypothesis of matter waves, Davisson and Germer experiment, wave group- equality of group velocity and particle velocity, Heisenberg's uncertainty principle, gamma ray microscope, wave function and its interpretation, Setting up of time dependent and independent Schrödinger wave equation, dynamical variables as operators and their average values, eigenfunctions and eigenvalues, eigen functions and eigenvalues in case of one dimensional infinite potential well , finite potential barrier(tunneling), one dimensional harmonic oscillator - energy eigenvalues, Schrodinger wave equation for hydrogen atom in spherical co-ordinates and separation of variables r, θ, Φ, quantum numbers n, l, m, and quantization of related physical quantities, comparison with Bohr's theory **11 hrs**

Atomic Spectroscopy- magnetic moment of electron due to orbital motion- gyro magnetic ratio, vector model-space quantization, spin magnetic moment- Stern-Gerlach experiment, spin-orbit coupling-fine structure, Pauli's exclusion principle, normal Zeeman effect and its explanation-expression for Zeeman shift, - anomalous Zeeman effect, Paschen Back effect, Stark effect **7 hrs**

UNIT II

Molecular Spectroscopy - Types of energy in a molecule, salient features of molecular spectra, pure rotational and rotational-vibration spectra of diatomic molecule, quantization of rotational and vibration energies, transition rules

Raman effect- Experimental setup, explanation of Raman effect, intensity and polarization of Raman lines, comparison of Raman spectra with IR spectra, expression for Raman shift, determination of molecular structure (illustration) **5 hrs**

Lasers- Spontaneous and stimulated emission, condition for laser action, population inversion construction and working of He-Ne laser, applications of laser in medicine, industry, communication, basic aspects of holography-principle, method and uses of hologram **4 hrs**

Nucleus- Properties of nucleus, Dempster's mass spectrograph, nuclear forces and their characteristics, Yukawa's theory (qualitative).

Nuclear decay- Alpha decay-range and energy relation, Geiger-Nuttall law, experimental determination of range of α-particle. α-particle disintegration energy, Gamow's explanation of α-decay , Beta decay- beta ray spectrum, Pauli's neutrino hypothesis, qualitative aspects of Fermi's theory of beta decay, parity violation, positron emission and electron capture, Gamma decay: nuclear isomerism, internal conversion. **8 hrs**

Accelerators: - Cockcroft-Walton voltage multiplier, LINAC **2 hrs**

Nuclear detectors- GM counter, Scintillation detector, Semiconductor detector **2 hrs**

REFERENCE BOOKS:

1. Modern physics – Kenneth S Krane. – John wiley and sons
2. Introduction to Quantum Mechanics, David J Griffiths, 2nd edition
3. Quantum Physics of Atoms, Molecules, Solids. Nuclei and Particles –Robert Eisberg and Robert Resnick, 2nd edition
4. Quantum mechanics - S.N. Biswas, Books and Allied, Calcutta (P) limited
5. Lasers: P. Milony and J.H Eberly; John Wiley and sons.
6. Concepts of Modern physics - A. Beiser, 5th edition, 1997, Tata McGraw Hill.
7. Modern physics- John. R Taylor, Chris D. Zafiratos, Michael Dubson- Printice Hall of India limited.
8. Introduction to Modern physics. - H S Mani & G .K. Mehta, 1988, EW press.
9. Physics of the Atom – M. E. Wehr, J.A. Richards, T.W. Adair, 1985, Narosa Publishing House.
10. Lasers- KR Nambiar- New age international
11. Atomic and nuclear physics – A.B Gupta, New central book agency Pvt. Ltd.
12. Introduction to Modern physics - F. K. Richtmeyer, E.H. Kennand, J N Cooper, VI edition, 1998, Tata McGraw Hill.
13. Lasers and Non-linear optics: B.B. Laud, 1995, Wiley Eastern.
14. Modern Physics - Murugeshan R, II edition, 1990, Shobanlal and Co.
15. Nuclear Physics- S N Ghoshal, S Chand and Co.
16. Atomic Physics – J B Rajam, S Chand and Co.

III YEAR B.Sc
SEMESTER - V ELECTIVE Paper- 6.1
CONDENSED MATTER PHYSICS AND NUCLEAR PHYSICS
(Course duration : 14 weeks with three hours of instructions per week)

UNIT I

Superconductivity- Experimental facts, Meissner effect, superconducting transition, critical magnetic field. types of superconductors, applications. BCS theory (qualitative), high temperature superconductors **4 hrs**

X rays- Continuous X-ray spectra, Duane and Hunt limit, characteristic X-ray spectra, Moseley's law and its importance, Bragg's law and Bragg's spectrometer. Compton effect- expression for Compton shift

Types of crystals-space lattice, Bravais lattice, basis vector, translation vector, unit cell, lattice parameter, crystal planes, crystal system, Miller indices, expression for interplanar spacing, NaCl and KCL structure **7 hrs**

Bonding in solids-Potential between pair of atoms- Lennard-Jone potential, ionic bonding- binding energy and cohesive energy, covalent bond, metallic bond **3 hrs**

Specific heat of solids- Specific heat, Dulong and Pettit's law and its limitations, Einstein's theory and Debye's theory of specific heat of solid **3 hrs**

Liquid crystals- Types of crystals, classification, optical, electro optical, magneto optical and thermal properties **4 hrs**

UNIT II

Mass Spectrographs- Theory of Bainbridge and Aston mass spectrographs **2 hrs**

Nuclear models- Liquid drop model, semi-empirical mass formula, Shell model & magic numbers (qualitative). **3 hrs**

Accelerators-Microtron, Betatron, Synchrotron **2 hrs**

Nuclear reactions- Types of nuclear reactions and classification, exoergic and endoergic reactions. Q-values, threshold energy of an endoergic reaction. Reactions induced by protons, deuterons & alpha particles, photodisintegration. **3 hrs**

Nuclear fission and fusion- Estimation of the fission energy on the basis of liquid drop model, controlled & uncontrolled chain reaction, Four factor formula, types of reactors, confinement of plasma- Tokomak **3 hrs**

Elementary particles- Classification - Leptons and Hadrons, particle quantum numbers, four fundamental interactions in nature and conservation laws. Quarks – color, quark confinement, mention of Standard model, Large Hadron Collider **3 hrs**

Astrophysics-Basic source of energy in stars, thermonuclear reactions, P-P chain, CNO cycle, evolution of star, nucleosynthesis- s process and r process, white dwarf, Chandrashekar limit, supernova explosion, neutron star, pulsars, black holes, Schwartzschild radius, singularity event horizon.

Cosmology- expansion of universe- Hubble's law, Big bang and evolution of universe, evidence for Big bang- cosmic microwave background radiation, dark matter, matter density in the universe, deceleration parameter, future of universe. **5 hrs**

REFERENCE BOOKS

1. Modern physics – Kenneth S Krane. – John wiley and sons
2. Introduction to Solid State Physics – C. Kittel, John Wiley and Sons, 1966, III edition.
3. Solid state Physics – A.J. Dekkar, 1993, IX edition, McMillan India Ltd.
4. Introduction to Solids – L.V. Azaroff, 2000, Tata- McGraw Hill.
5. Crystallography applied to Solid State Physics – A.R.Verma ,etal
6. Crystal structure- R.W.G.Wykoff Krieger
7. 'Solid State Physics' – P.K. Paliniswamy, SCITEC Publications (India) Pvt Ltd. Chennai
8. 'Solid State Physics' – M.A. Wahab, Narosa Publishing House, New Delhi 1999.
9. Solid State Physics- S O Pillai- New age international limited.
10. Nuclear physics: Kaplan, 1971, II edition, Addison Wesley.
11. Atomic & Nuclear Physics: S.N.Ghoshal, 1994, Vol II, S. Chand and Co.
12. Perspectives of Modern Physics: Arthur Beiser, 1996, McGraw Hill Book Co.
13. Concepts of Nuclear Physics: B.H. Cohen, 1988, Tata McGraw Hill.
14. Introduction to Nuclear Physics: Harold Enge
15. Modern physics- John. R Taylor, Chris D. Zafiratos, Michael Dubson- Printice Hall of India limited.
16. Astrophysics- B Basu, PHI limited.
17. Introduction to Elementary Particles - D.G. Griffiths
18. Nuclear Physics- S N Ghoshal, S Chand and Co.

III YEAR B.Sc
SEMESTER - VI Compulsory Paper: Paper 7
MODERN PHYSICS-II
(Course duration: 14 weeks with three hours of instructions per week)

UNIT I

Special theory of relativity- basic aspects of Newtonian mechanics - absolute space and absolute time, concept of ether, Michelson & Morley experiment, Basic postulates of special theory of relativity, Lorentz transformation, the Lorentz –Fitzgerald contraction, concept of simultaneity, Einstein's time dilation, velocity addition theorem, expression for relativistic mass, mass less particle(photon), energy equation $E=mc^2$, energy-momentum relation, Minkowski space-time , concept of four vectors

General theory of relativity- accelerated frames, principle of equivalence, predictions of general theory of relativity - bending of light, perihelion motion of mercury, gravitational red shift
7 hrs

Quantum Statistics- Probability of distribution of distinguishable and indistinguishable particles, Bose-Einstein and Fermi-Dirac distributions -comparison with Maxwell-Boltzmann distribution, Bose condensation **2 hrs**

Electrical properties of metals- free electron theory of metals, expression for electrical conductivity- Ohm's law, drawbacks of the theory, statement of number of available energy states between E and E+ dE, expression for Fermi energy and average energy at absolute zero. Quantum theory of free electrons. Hall effect- expression for Hall coefficient in metals and semiconductors, magneto resistance **5 hrs**

Band theory of solids- formation of energy bands, intrinsic semiconductor, derivation of the expression for carrier concentration and electrical conductivity for intrinsic semiconductor, expression for energy gap, extrinsic semiconductor, effect of temperature and impurity concentration on Fermi energy **4 hrs**

Semiconductor Devices- Bridge rectifier-expression for ripple factor and efficiency, filters, DC regulated power supply-shunt regulator using zener diode clippers and clampers

3 hrs

UNIT II

Network Theorems: Superposition theorem, Thevenin's theorem, Norton's Theorem, application to the analysis of DC circuits **4 hrs**

Transistors- DC biasing of transistors- self biasing (potential divider type) operating point, DC load line and AC load line, stability of Q point-thermal runaway **4 hrs**

Amplifiers- Comparison of CE, CB and CC amplifiers, h-parameters. A.C. equivalent circuit of a transistor in terms of the h-parameters, derivation of the expressions for voltage gain. current gain, power gain, input resistance and output resistance for CE mode. RC coupled amplifier – mathematical analysis frequency response, input and output impedances and band width

7 hrs

Oscillators- Positive and negative feedback, mention of the Barkhausen criteria. Phase shift and Hartley oscillators, expressions for frequency and gain **3 hrs**

Digital Electronics- Binary number system, Laws of Boolean algebra, De-Morgan's theorem-simplification of Boolean expressions, construction of AND, OR and NOT logic gate using a transistor **3 hrs**

REFERENCE BOOKS:

1. Special relativity - A.P. French, 1975, ELPS.
2. Bose and his statistics –G.Venkataraman
3. Concepts of Modern physics - A. Beiser, 5 edn, 1997, Tata McGraw Hill.
4. Special theory of relativity – Resnick, 1979, Wiley Eastern Limited.
5. Electronic principle: Malvino, 1999, Tata McGraw Hill.
6. Digital principles & applications: Malvino & Leach, 1991, Tata McGraw Hill.
7. Basic electronics: B.Grob, 1984, McGraw Hill.
8. Electronics: V.K.Mehta, 1996, V edition, S.Chand and Co.
9. Network analysis: Boylstead, 1982, Abel and Howell Co.
10. Electronic Devices and circuit theory: R.Boylstead etal, 1993, Prentice Hall India.
11. Digital fundamentals: Floyd, 2000, III edition, UBS
12. Solid state electronic devices: B G Streetman

III YEAR B.Sc
SEMESTER - VI ELECTIVE Paper 8.2
PHOTONICS
(Course duration: 14 weeks with three hours of instructions per week)

UNIT I

Lasers

Basic Principles, Properties of laser light, coherence-spatial & temporal, divergence, line shape broadening, cavity laser modes, mode selection, single mode operation, selection of laser emission line **2 hrs**

Laser Oscillator: Pumping Schemes, gain-threshold conditions, optical feedback, optical resonator. **4 hrs**

Types of Lasers: Nd – YAG. CO_2 and Dye lasers – construction and principles of working **3 hrs**

Laser Diodes: Lasing conditions and gain in a semiconductor, selective amplification and coherence, materials for laser diodes, quantum well lasers, surface emitting lasers, characterization and modulation of lasers. **5 hrs**

Optoelectronics-Introduction: Optoelectronics in the information technology, optoelectronic devices, optoelectronic materials - liquid crystals, semiconductors, ceramics, polymers and optical fibers, fabrication of Optoelectronic devices. **2 hrs**

Light emitting diodes: The electroluminescence process, materials for light emitting diodes, LED structures and efficiency, light output from LED, performance characteristics, manufacturing process. **5 hrs**

UNIT II

Photo Detectors: Specifications, Types – junction photodiodes, avalanche photodiodes, CCD Photo detectors, comparison of different detectors, performance characteristics and fabrication **6 hrs**

Photovoltaics – solar cell I -V characteristics, materials and device fabrication. **1 hr**

Fiber Optics and Dielectric wave guides

Wave Guide-Slab wave guide, modes, V number, Modal, material and waveguide dispersions **3 hrs**

Optical Fiber- Types, optical fiber functions. Light propagation, Optical power, velocity of Propagation, critical angle, acceptance angle, numerical aperture, mode of propagation, Index

profile. Single mode step-index optical fiber, multimode step- index fiber, graded index fibers advantages and disadvantages, energy losses in optical fiber, Bit rate, dispersion and optical bandwidth, absorption and scattering, Block diagram of optical fiber communication. construction of optical cables. Optocoupler. **11 hrs**

REFERENCE BOOKS:

1. John Wilson and John Hawkes, "Optoelectronics- An Introduction" - 3rd Edition, Prentice Hall, 1998

2. J Singh, "Optoelectronics: an introduction to materials and devices", McGraw Hill, New York

3. P Bhattacharya "Semiconductors, Optoelectronic devices", Prentice Hall International, 1997

4. KR Nambiar, Lasers –Principles, Types and Applications, New Age International, New Delhi.

5. Wayne Tomaal, Electronic Communication Systems-Fundamentals through advanced- 5th editions, Pearson Education, New Delhi

6. Dennis Roddy and John Coolen, Electronic Communication, 4th edition, Pearson Education, New Delhi

JSS College of Arts, Commerce & Science (Autonomous),
Ooty Road, Mysore-25

DEPARTMENT OF PHYSICS

SEMESTER I

Course code: DMA29001/ DMA29002/ DMA29003/ DMA29004
Credits: Theory – 04, Practical – 02 **Theories: 60 Lectures**

COURSE OUTCOME:

After successful completion of the course, the student is able to

CO1.Learn the details of Elasticity

CO2.Understand the classification and characteristics of motion of a point particle

CO3.Understand in details with examples Frames of reference and relative motion

CO4.Deliberate the classification and characteristics of Dynamics of particle in conservative field

CO5.Specify the classification and characteristics of Special theory of relativity and gravitation

CO6.Write down the characteristics of Surface tension and viscosity

MECHANICS: DSC1

Unit-1

Vectors: Vector algebra (with special reference to the rules of addition and multiplication), Scalar and vector products with specific examples.

Motion of a point particle: The position vector *r(t)* of a moving point particle and its Cartesian components. Velocity and acceleration as the vector derivatives. Derivatives of a vector with respect to a parameter; Derivation of planar vector of a constant magnitude. Radial and transverse components of velocity and acceleration for arbitrary planar motion, deduction of results for uniform circular motion-centripetal force. **(05 Lectures)**

Frames of references and relative motion:

Newton's laws of motion and inertial mass. Galilean transformation; Galilean principle of relativity, Plumb line accelerometer and a freely falling elevator, Non-inertial frames and fictitious force, uniformly rotating frame of reference and coriolis force. Effect of rotation of earth on acceleration due to gravity.

(07Lectures)

Dynamics of a particle in conservative fields:

Work done by force acting on a particle, work-energy theorem. Conservative and non conservative force field. Conservation of energy. Conservative force as a negative gradient of potential, central force as an example of conservative force field.

(05 Lectures)

Conservation of momentum: Conservation of linear momentum, centre of mass, rocket equation. Angular momentum and torque, law of conservation of angular momentum, angular momentum of a system taking centre of mass of the system.

(06 Lectures)

Dynamics of rigid bodies: Moment of inertia, radius of gyration, calculation of momentum of inertia of rectangular plate, circular plate and solid sphere, kinetic energy of rotation. **(04 Lectures)**

Oscillations: Simple harmonic motion. Differential equation of SHM and its solutions. Kinetic and Potential Energy, Total Energy and their time averages. Damped oscillations. (**03 Lectures)**

Unit-2

Gravitation: Newton's Law of gravitation. Motion of a particle in a central force field (motion is in a plane, angular momentum is conserved, areal velocity is constant). Kepler's Laws, derivations of Kepler's law, satellite in circular orbit and applications, geosynchronous orbits, weightlessness, basic idea of global positioning system (GPS).

(08 Lectures)

Special Theory of Relativity: Postulates of Special Theory of Relativity. Lorentz transformation equations, Length contraction, time dilation, relativistic addition of velocities.

Mass-Energy relation, energy-momentum relation**.**
(06 Lectures)

Elasticity:

Review of concepts of modulii of elasticity, Hooke's Law and Poisson's ratio(σ). Relation between the elastic constants ***q, k, n*** and ***σ***, limiting values for **σ.**Work done in stretching. Elastic potential energy. Bending moment. Theory of light single cantilever. I-section girders. Torsion; calculation of couple per unit twist. The Torsional pendulum, Static torsion, Searle's double bar experiment.

Surface Tension: Review of basic concepts. Pressure inside curved liquid surface. Surface tension and interfacial tension by drop-weight method. Surface tension and angle of contact of mercury by Quincke's method.

Viscosity: Review of basic concepts; Variation of Viscosity of liquids with temperature and pressure. **(16 Lectures)**

Reference Books:

- Halliday, Resnick, Jearl Walker, "Principles of Physics" 9th edition, Wiley, 2013.
- Berkeley Physics Course, Vol-1 "Mechanics", 2nd edition, Charles Kittle, Walter D Knight, Malvin A
- D S Mathur, "Elements of properties of matter", S Chand and company, New Delhi, Reprint-2007.
- D S Mathur, "Mechanics", S Chand and company, New Delhi, Reprint-2001.
- BrijLal and N Subrahmanyam, "Properties of matter", 6th edition, Eurasia publishing house Ltd. New Delhi, Reprint-1993.
- Mechanics by Shankara Narayana &Chopra.
- Mechanics by Bhargava and Sharma.

PHYSICS LAB: DSC 1A LAB: MECHANICS

Course code: DMA29101/ DMA29102/ DMA29103/ DMA29104

(Minimum of eight is to be conducted)

1. Bar pendulum: Determination of the acceleration due to gravity and radius of gyration (Both graphical and calculation methods).

2. To determine the Moment of Inertia of a Flywheel.
3. Determination of the Young's modulus by Dynamic method (graphical and calculation method).
4. Torsional pendulum; Determination of the rigidity modulus.
5. Oscillations of a spiral Spring and calculate a) Spring Constant b) Value of g
6. Young's modulus by the single cantilever method.
7. Determination of rigidity modulus by the static torsion method.
8. To determine g by Kater's Pendulum.
9. Determination of young's modulus by the method of uniform bending.
10. Drop weight method; Determination of surface tension of liquid and the interfacial tension between two liquids.
11. To determine the Elastic Constants of a Wire by Searle's method.
12. To determine the Modulus of Rigidity of a Wire by Maxwell's needle
13. To determine **g** and velocity for a freely falling body using Digital Timing Technique
14. To determine the Height of a Building using a Sextant.

Reference Books:

- Advanced Practical Physics for students, B.L.Flint and H.T.Worsnop, 1971, Asia Publishing House.
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
- Engineering Practical Physics, S.Panigrahi& B.Mallick,2015, Cengage Learning India Pvt. Ltd.
- A Text Book of Practical Physics, InduPrakash and Ramakrishna, 11th Edition, 2011, KitabMahal, New Delhi.

SEMESTER II

Course code: DMB29001/ DMB29002/ DMB29003/ DMB29004
Credits: Theory – 04, Practical – 02 **Theories: 60 Lectures**

COURSE OUTCOME:

After successful completion of the course, the student is able to

CO1.Deliberate in detail with examples vector analysis

CO2.Write down in detail with application, electrostatics and magneto static

CO3.Write down the classification and characteristics of AC Circuits

CO4.Specify in details with application, if applicable, properties of magnet material

CO5.Understand the characteristics of electromagnetic theory

CO6.Write down the characteristic of galvanometer

ELECTRICITY AND MAGNETISM: DSC 2

Unit-1

Vector Analysis: Review of vector algebra (Scalar and Vector product), Scalar and vector fields, gradient, divergence, Curl and their significance, Vector Integration, Line, surface and volume integrals of Vector fields, Gauss-divergence theorem and Stoke's theorem of vectors (statement only).
(07 Lectures)

Electrostatics: Electrostatic Field, electric flux, Gauss's theorem of electrostatics and applications; 1) infinite line of charge and 2)plane charged sheet. Electric potential as line integral of electric field, potential due to a point charge, electric dipole, uniformly charged

spherical shell and solid sphere. Calculation of electric field from potential.

Capacitance of an isolated spherical conductor. Parallel plate, spherical and cylindrical condenser. Energy per unit volume in electrostatic field.

Dielectric medium, Polarization, Displacement vector. Gauss's theorem in dielectrics. Parallel plate capacitor completely filled with dielectric.

Galvanometers: Construction, theory and working of Helmholtz galvanometer. **(15Lectures)**

Alternating current: R M S values, Response of LR, CR and LCR circuits to sinusoidal voltages (discussion using the j symbol), Series and parallel resonance, Half-power frequencies, bandwidth and Q-factor, Power in electrical circuits, power factor and Maximum power transfer theorem.

(08 Lectures)

Unit-2

Applications of ac circuits - ac bridges**;** Anderson's bridge and De-Sauty's bridge **(02 Lectures)**

Magneto statics: Biot-Savart's law & its applications; long straight conductor, circular coil and solenoid carrying current. Divergence and curl of magnetic field. Magnetic vector potential. Ampere's circuital law.

Magnetic properties of materials: Magnetic intensity, magnetic induction, permeability, magnetic susceptibility. Brief introduction of Dia-magnetic, Para-magnetic and Ferro-magnetic materials.

(10Lectures)

Electromagnetic Induction: Faraday's laws of electromagnetic induction, Lenz's law, self Inductance (L) and mutual inductance (M), L of single coil, M of two coils. Energy stored in magnetic field. **(06 Lectures)**

Electromagnetic Theory: Equation of continuity, Displacement current, setting up of Maxwell's equations, wave equation in free space, Poynting vector, energy density in electromagnetic field, electromagnetic wave propagation through free space and isotropic dielectric medium, Transverse nature of electromagnetic waves, polarization. **(12 Lectures)**

Reference Books:

- D. C. Tayal, Electricity and Magnetism, 1988, Himalaya Publishing House.
- K. K. Tewari: Electricity and magnetism, S. Chand Co. Ltd., New Delhi, Reprint 2007.
- B. B. Laud: Electrodynamics, Wiley Eastern Limited, New Delhi.
- David. J. Griffiths: Introduction to Electrodynamics, 3rd edition, Prentice-Hall of India Private limited, New Delhi.
- BrijLal and N. Subramanian:Electricity and Magnetism, 19th edition-RatanPrakashanMandir, Educational and University Publishers, Agra.
- D.N. Vasudeva: Fundamentals of Magnetism and Electricity, 12th edition-S.Chand and Co. Ltd., New Delhi

PHYSICS LAB- DSC 2A LAB: ELECTRICITY AND MAGNETISM

Course code: DMB29101 / DMB29102 / DMB29103 / DMB29104

(Minimum of eight is to be conducted)

1. LCR series circuits – Determination of L & Q factor
2. LCR parallel circuits – Determination of L & Q factor
3. Anderson's Bridge – Determination of the self-inductance of the coil.
4. De-Sauty's bridge – Verification of laws of combination of capacitances, unknown capacitance.
5. To verify the Thevinin's theorem.
6. Maximum Power Transfer Theorem.
7. Maxwell's bridge-determination of mutual inductance.
8. Low resistance-determination of the resistivity of the material.
9. Determination of capacitance by measuring impedance of RC circuit.
10. Determination of inductance by measuring impedance of RL circuit.
11. Low pass and High pass filters.
12. Black box – Identification of L,C & R .
13. Measurement of Magnetic field strength B and its gradient in a Solenoid (Determine dB/dx).
14. To determine a Low Resistance by Carey Foster's Bridge.
15. B_H using Helmholtz double coil galvanometer.

Reference Books

- Advanced Practical Physics for students, B.L.Flint&H.T.Worsnop, 1971, Asia

Publishing House.

- A Text Book of Practical Physics, InduPrakash and Ramakrishna, 11th Edition, 2011, KitabMahal, New Delhi.
- Edition, reprinted 1985, Heinemann Educational Publishers

SEMESTER III

Course code: DMC29001/ DMC29002/ DMC29003/ DMC29004

Credits: Theory – 04, Practical – 02 **Theories: 60 Lectures**

COURSE OUTCOME:

After successful completion of the course, the student is able to

CO1.Specify in details with examples kinetic theory of gases

CO2.Specify in depth low temperature physics

CO3.Identify in detail with application thermal conductivity and theory of radiation

CO4.write down the classification and characteristics of laws of thermodynamics

CO5.Have a clear understanding about reversible and irreversible process

CO6.Understand the classification and characteristics of entropy and thermodynamic potential

THERMAL PHYSICS AND STATISTICALMECHANICS: DSC 3

Unit-1

Laws of Thermodynamics: Thermodynamic description of system, Zeroth Law of thermodynamics and temperature. Applications of First Law; General Relation between C_P& C_V. Work Done during Isothermal and Adiabatic Processes. Compressibility & Expansion Coefficient. Reversible & irreversible processes; Carnot's theorem. Thermodynamic scale of temperature and its identity with perfect gas scale.

Entropy: The concept of entropy. Change of entropy in reversible and irreversible cycles. Entropy and non-available energy. Principle of increase of entropy; Clausius inequality. Second law of thermodynamics in terms of Entropy. Entropy of ideal gas, T-S diagram. Probability and entropy, Boltzmann relation. Concept of absolute zero and the third law of thermodynamics.
(15 Lectures)

Thermodynamic Potentials: Internal energy, Enthalpy, Helmholtz and Gibbs functions, Maxwell's thermodynamic relations & applications; Joule-Thompson Effect. Clausius-Clapeyron first Latent heat equation, effect of pressure on melting point of a solid, effect of pressure on boiling point of a liquid, Expression for $(C_P - C_V)$, C_P/C_V, T dS equations. **(08 Lectures)**

Kinetic Theory of Gases: Derivation of Maxwell's law of distribution of velocities and its experimental verification, Mean free path (Zeroth Order).Transport Phenomena; Viscosity, Conduction and Diffusion (for vertical case), Law of equipartition of energy (no derivation) and its applications to specific heat of gases; mono-atomic and diatomic gases. **(07 Lectures)**

Unit-2

Thermal conductivity: Equation of flow of heat through solid bar, determination of thermal conductivity of a bad conductor by Lee and Charlton method. **(03 Lectures)**

Theory of Radiation: Induced and spontaneous emission of radiation. Derivation of Planck's law of radiation using Einstein's A and B coefficients. Deduction of Rayleigh-Jeans law, Stefan's law and Wien's displacement law from Planck's law, Wien's formula. **(08 Lectures)**

Low temperature Physics: Ideal gas and real gas.Van-der Waals equation of state. Porous-plug experiment and its theory. Joule-Thomson expansion - expression for the temperature of inversion, inversion curve. Relation between Boyle temperature, temperature of inversion and critical temperature of a gas. Principle of regenerative cooling. Liquefaction of air by Linde's methods. Adiabatic demagnetization**.**

(07 Lectures)

Statistical Mechanics: Probability concept, Phase space, Microstate and Microstate, Entropy and Thermodynamic probability, Maxwell-Boltzmann law- distribution of velocity. Quantum statistics: Bose-Einstein, Maxwell-Boltzmann and Fermi-Dirac distribution law – electron gas-Bose-Einstein distribution law - photon gas - comparison of three statistics. **(12 Lectures)**

Reference Books:

- BrijLal, N. Subramanyam P.S. Hemne: Heat Thermodynamics and Statistical Physics, 1st edition. S Chand Publishing, 2007.
- S C Gupta: Thermodynamics, 1st edition, Pearson, 2005.
- C. L. Arora: Refresher Course in Physics Vol I, S Chand publishing, 2011.
- S. R. Shankara Narayana: Heat and Thermodynamics, 2nd edition, Sulthan Chand and Sons, 1990.
- A Treatise on Heat, MeghnadSaha, and B.N. Srivastava, 1969, Indian Press.
- Heat and Thermodynamics, M.W.Zemasky and R. Dittman, 1981, McGraw Hill

PHYSICS LAB-DSC 3A LAB: THERMAL PHYSICS AND STATISTICAL MECHANICS

Course code: DMC29101/ DMC29102/ DMC29103/ DMC29104

(Minimum of eight is to be conducted)

1. Verification of distribution law using Monte-Carlo Method.
2. Verification of Stefan's-Boltzmann law.
3. Specific heat of a liquid by cooling – graphical method.
4. To determine Stefan's Constant.
5. To determine the coefficient of thermal conductivity of a bad conductor by Lee and Charlton's disc method.
6. To determine the coefficient of thermal conductivity of copper by Searle's Apparatus.
7. To determine the Coefficient of Thermal Conductivity of Cu by Angstrom's Method.

8. Determination of moment of inertia of Irregular body by Torsional pendulum method.
9. Determine young's modulus of a material by Koenig's method.
10. To study the variation of thermo emf across two junctions of a thermocouple with temperature.
11. Measurement of Planck's constant using black body radiation.
12. Determine boiling point of a liquid using Platinum resistance thermometer.
13. To determine the temperature co-efficient of resistance by Platinum resistance thermometer.
14. To determine Mechanical Equivalent of Heat, J, by Callender and Berne's constant flow method.
15. To record and analyze the cooling temperature of a hot object as a function of time using a thermocouple and suitable data acquisition system.
16. To calibrate Resistance Temperature Device (RTD) using Null Method/Off-Balance Bridge.

Reference Books:

- Advanced Practical Physics for students, B.L.Flint&H.T.Worsnop, 1971, Asia Publishing House.
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
- A Text Book of Practical Physics, InduPrakash and Ramakrishna, 11th Edition, 2011, KitabMahal, New Delhi.
- A Laboratory Manual of Physics for Undergraduate Classes, D.P. Khandelwal, 1985, Vani Publication.

SEMESTER IV

Course code: DMD29001/ DMD29002/ DMD29003/ DMD29004

Credits: Theory – 04, Practical – 02 **Theories: 60 Lectures**

COURSE OUTCOME:

After the completion of the course, Students will be able to

CO1.Specify the classification and characteristics of Fourier theorem

CO2.Learn in detail with application, superposition of simple harmonic motion

CO3.Understand in detail with application of wave motion

CO4.Deliberate in detail with examples Sound, wave optics and transducers

CO5.Learn the details of Interference, diffraction and polarization

CO6.Learn in detail with application of acoustics

WAVES AND OPTICS: DSC 4

Unit-1

Analysis of Complex Waves: Fourier's Theorem- Application to saw tooth wave and square wave. **(03 Lectures)**

Superposition of simple harmonic motion:

Superposition of two simple harmonic motion; Lissajous' figures. Damped vibration; Equation for damped vibrations. Forced vibration; solution in exponential form, Resonance, Expression for amplitude and phase at resonance.

Superposition of two collinear harmonic oscillations: Linearity and Superposition Principle. (1) Oscillations having equal frequencies and (2) Oscillations having different frequencies (Beats).

(11 Lectures)

Wave Motion:

Progressive waves; Differential equation of wave motion; Relation between amplitude and intensity. Expression for velocity of progressive waves in a medium; Newton's formula, Laplace's correction.

Transverse waves on a string. Travelling and standing waves on a string. Normal Modes of a string. Expression for frequency of vibration of a stretched string, harmonics. Group velocity, Phase velocity. Longitudinal vibrations in a rod; Kundt's tube experiment. **(10 Lectures)**

Sound: Intensity and loudness of sound - Decibels - Intensity levels - musical notes - musical scale. Acoustics of buildings: Reverberation and time of reverberation, Absorption

coefficient, Sabine's formula, measurement of reverberation time. Acoustic aspects of halls and auditoria.

(06 Lectures)

Unit-2

Transducers: Types of transducers, dynamic microphone and loudspeaker-construction, working and their characteristics, Piezo electrical transducer.

(03 Lectures)

Wave Optics: Electromagnetic nature of light. Definition and Properties of wave front. Huygens Principle.

(03 Lectures)

Interference: Interference: Review of basic concepts, Coherent sources, and conditions for constructive and destructive interference.

Coherent source by division of amplitude: Interference in Thin Films: – reflected and transmitted light, color of thin films, theory of air wedge, theory of Newton's rings; measurement of wavelength and refractive index.

Coherent source by division of division of wave front: Lloyd's Mirror and Fresnel's Biprism. Michelson's interferometer; Measurement of λ and $d\lambda$. **(11 Lectures)**

Diffraction: Fresnel and Fraunhoffer diffraction. Explanation of rectilinear propagation of light. Theory of the zone plate and comparison with convex lens. Fresnel diffraction at a straight edge. Fraunhoffer diffraction at a single slit. Transmission grating: theory for the case of normal incidence**.**

(06 Lectures)

Polarization: Double refraction in uniaxial crystals. Huygens's theory. Positive and negative crystal. Principle refractive indices. Huygens's constructions of ordinary and extraordinary wave fronts in a uniaxial crystal, retarding plates. Production and analysis of linearly, circularly and elliptically polarized light. Optical activity, Fresnel's theory, Lorentz half shade polarimeter.

(07 Lectures)

Reference Books:

- Fundamentals of Optics, F A Jenkins and H E White, 1976, McGraw-Hill. Principles of Optics, B.K. Mathur, 1995, Gopal Printing
- Fundamentals of Optics, H.R. Gulati and D.R. Khanna, 1991, R. Chand Publication
- Brijlal and N Subramanyam: Waves and Oscillations, 2nd edition, Vikas publishing house Pvt. Ltd., New Delhi.
- S K Gupta, O P Varma: Waves and Oscillations, 3rd edition, R.Chand& Co., New Delhi.
- R.L. Saihgal, A Text Book of Sound, S.Chand& Company Ltd. New Delhi, Reprint 1990.

PHYSICS LAB-DSC 4A LAB: WAVES AND OPTICS

Course code: DMD29101/ DMD29102/ DMD29103/ DMD29104

(Minimum of eight is to be conducted)

1. To determine wavelength of sodium light using Newton's Rings.
2. To determine wavelength of sodium light using Fresnel Biprism.
3. To determine wavelength of Sodium light using plane diffraction Grating.
4. Air wedge – Determination of thickness of a thin paper/diameter of a thin wire
5. Cauchy's constants using spectrometer.
6. Polarization – Determination of unknown concentration of sugar solution by graphical method using a polarimeter.
7. Diffraction at a Straight wire -To determine the diameter of the Straight wire
8. Helmholtz resonator-determination of frequency of tuning fork
9. To determine the Refractive Index of the Material of a given Prism using Sodium Light.
10. To study Lissajous Figures
11. Kundt's tube experiment – Velocity of sound in air at room temperature
12. To investigate the motion of coupled oscillators
13. To determine the Frequency of an Electrically Maintained Tuning Fork by Melde's Experiment and to verify λ^2 – T Law

14. Familiarization with Schuster`s focusing; determination of angle of prism
15. To measure the intensity using photo sensor and laser in diffraction patterns of single and double slits.

Reference Books:

- Advanced Practical Physics for students, B.L. Flint & H.T. Worsnop, 1971, Asia Publishing House.
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
- A Text Book of Practical Physics, InduPrakash and Ramakrishna, 11th Edition, 2011, KitabMahal, New Delhi.

SEMESTER V

Course code: DME29201/ DME29202/ DME29203/ DME29204

Credits: Theory – 04, Practical – 02 **Theories: 60 Lectures**

COURSE OUTCOME:

After the completion of the course, Students will be able to

CO1.Write down in detail with application of crystal structure

CO2.Write down the details of Elementary lattice dynamics

CO3.Deliberate in detail with examples Magnetic properties of matter

CO4.Identify the characteristics of elementary band theory

CO5.Learn the classification and characteristics of superconductivity

CO6.Understand the elastic properties of solids and lattice vibrations

SOLID STATE PHYSICS: DSE 1B

Unit-1

Crystal Structure: Solids: Amorphous and Crystalline Materials. Lattice TranslationVectors.Lattice with a Basis – Central and Non-Central Elements. Unit Cell. Miller Indices. Reciprocal Lattice. Types of Lattices. Brillouin Zones. Diffraction of X-rays by Crystals. Bragg's Law. Bragg spectrometer. Continuous x-ray spectra, Duane and Hunt limit. Characteristic x-ray spectra. Mosley law and its significance.

(10 Lectures)

Elementary Lattice Dynamics: Lattice Vibrations and Phonons: Linear Monatomic and Diatomic Chains. Acoustical and Optical Phonons. Qualitative Description of the Phonon Spectrum in Solids. Dulong and Petit's Law, Einstein and Debye theories of specific heat of solids.

(09 Lectures)

Magnetic Properties of Matter: Dia, Para, Ferri and Ferromagnetic Materials. Classical Langevin Theory of dia – and Paramagnetic Domains. Quantum Mechanical Treatment of Paramagnetism. Curie's law, Weiss's Theory of Ferromagnetism and Ferromagnetic Domains. Discussion of B-H Curve. Hysteresis and Energy Loss.

(11 Lectures)

Unit-2

Electrical Properties of metals: Free electron theory, Quantum theory, Conductivity of metals on the basis of free electron theory- Ohm's law.

(04 Lectures)

Dielectric Properties of Materials: Polarization. Local Electric Field at an Atom. Depolarization Field. Electric Susceptibility.Polarizability.Clausius Mosotti Equation. Classical Theory of Electric Polarizability.Normal and Anomalous Dispersion.Cauchy and Sellmeir relations. Langevin-Debye equation. Complex Dielectric Constant. Optical Phenomena. Application: Plasma Oscillations, Plasma Frequency, Plasmon's.

(10 Lectures)

Elementary band theory: Kronig Penny model. Band Gaps.Conductors, Semiconductors and insulators. P and N type Semiconductors, carrier concentration in intrinsic semiconductor, Fermi energy, effect of temperature and concentration on Fermi energy, Conductivity of Semiconductors, mobility, Hall Effect, Hall coefficient.

(10 Lectures)

Superconductivity: Experimental Results. Critical Temperature. Critical magnetic field. Meissner effect. Type I and type II Superconductors, London's Equation and Penetration Depth. Isotope effect.BCS theory, application of Superconductors.

(06 Lectures)

Reference Books:

- Introduction to Solid State Physics, Charles Kittel, 8th Ed., 2004, Wiley India Pvt. Ltd.
- Elements of Solid State Physics, J.P. Srivastava, 2nd Ed., 2006, Prentice-Hall of India
- Introduction to Solids, Leonid V. Azaroff, 2004, Tata Mc-Graw Hill
- Solid State Physics, Neil W. Ashcroft and N. David Mermin, 1976, Cengage Learning
- Solid State Physics, Rita John, 2014, McGraw Hill
- Solid-state Physics, H. Ibach and H Luth, 2009, Springer
- Elementary Solid State Physics, 1/e M. Ali Omar, 1999, Pearson India
- Solid State Physics, M.A. Wahab, 2011, Narosa Publications

PRACTICALS-DSE LAB: SOLID STATE PHYSICS

Course code: DME29301/ DME29302/ DME29303/ DME29304

(Minimum of eight is to be conducted)

1. Determination of energy gap of a semiconductor using Meter Bridge.
2. Determination Fermi energy of metal (copper).
3. To measure the Dielectric Constant of a given solid Materials
4. Study of LDR characteristics.
5. Verification of Inverse square law for light Intensity using a Photo-diode.
6. Bridge rectifier with and without filters.
7. Clipping and clamping circuits using diodes.
8. Zener diode as a voltage regulator.
9. Study of powder X-ray photograph-the determination of inter planar distances.
10. To determine value of Planck's constant using LEDs of at least 4 different colors.
11. To determine value of Boltzmann constant using V-I characteristic of PN diode.

12. Study of Hall Effect.
13. To determine the refractive index of a dielectric layer using SPR
14. To study the PE Hysteresis loop of a Ferroelectric Crystal.
15. To measure the resistivity of a semiconductor (Ge) crystal with temperature by four-probe method (from room temperature to 150 ^{o}C) and to determine its band gap
16. To draw the BH curve of iron using a Solenoid and determine the energy loss from Hysteresis.
17. To determine the complex dielectric constant and plasma frequency of metal using Surface Plasmon resonance (SPR)
18. Measurement of Magnetic susceptibility of solids

Reference Books

- Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
- A Text Book of Practical Physics, InduPrakash and Ramakrishna, 11th Ed., 2011, KitabMahal, New Delhi
- Elements of Solid State Physics, J.P. Srivastava, 2nd Ed., 2006, Prentice-Hall of India

Skill Enhancement Course (SEC) (Credit: 02 each)

SEMESTER V

Course code: DME29601/ DME29602/ DME29603/ DME29604
Credits: Theory – 02 **Theories: 30 Lectures**

COURSE OUTCOME:

After the completion of the course, Students will be able to

CO1.Understand the characteristics of fossil fuel

CO2.Learn in detail with application of wind energy

CO3.Specify in detail with application of ocean energy and hydro energy

CO4.Identify the characteristics of geothermal energy

CO5.Deliberate the characteristics of electromagnetic energy

CO6.Deliberate the characteristics of piezoelectric energy harvesting

RENEWABLE ENERGY AND ENERGY HARVESTING: SEC 1A

Fossil fuels and Alternate Sources of energy: Fossil fuels and Nuclear Energy, their limitation, need of renewable energy, non-conventional energy sources. An overview of developments in Offshore Wind Energy, Tidal Energy, Wave energy systems, Ocean Thermal Energy Conversion, solar energy, biomass, biochemical conversion, biogas generation, geothermal energy tidal energy, Hydroelectricity.
(03 Lectures)

Solar energy: Solar energy, its importance, storage of solar energy, solar pond, non convective solar pond, applications of solar pond and solar energy, solar water heater, flat plate collector, solar distillation, solar cooker, solar green houses, solar cell, absorption air conditioning. Need and characteristics of photovoltaic (PV) systems, PV models and equivalent circuits, and sun tracking systems.
(06 Lectures)

Wind Energy harvesting: Fundamentals of Wind energy, Wind Turbines and different electrical machines in wind turbines, Power electronic interfaces, and grid interconnection topologies.
(03 Lectures)
Ocean Energy: Ocean Energy Potential against Wind and Solar, Wave Characteristics and Statistics, Wave Energy Devices. **(03 Lectures)**

Tide characteristics and Statistics, Tide Energy Technologies, Ocean Thermal Energy, Osmotic Power, Ocean Bio-mass.
(02 Lectures)

Geothermal Energy: Geothermal Resources, Geothermal Technologies. **(02 Lectures)**

Hydro Energy: Hydropower resources, hydropower technologies, environmental impact of hydro power sources.
(02 Lectures)

Piezoelectric Energy harvesting: Introduction, Physics and characteristics of piezoelectric effect, materials and mathematical description of piezoelectricity, Piezoelectric parameters and modeling piezoelectric generators, Piezoelectric energy harvesting applications, Human power **(04 Lectures)**

Electromagnetic Energy Harvesting: Linear generators, physics mathematical models, recent applications **(02 Lectures)**
Carbon captured technologies, cell, batteries, power consumption **(02 Lectures)**

Environmental issues and Renewable sources of energy, sustainability. **(01 Lecture)**

Demonstrations and Experiments

1. Demonstration of Training modules on solar energy, wind energy, etc.
2. Conversion of vibration to voltage using piezoelectric materials
3. Conversion of thermal energy into voltage using thermoelectric modules.

Reference Books:

- Non-conventional energy sources - G.D Rai - Khanna Publishers, New Delhi
- Solar energy - M P Agarwal - S Chand and Co. Ltd.
- Solar energy - Suhas P Sukhative Tata McGraw - Hill Publishing Company Ltd.
- Godfrey Boyle, “Renewable Energy, Power for a sustainable future”, 2004, Oxford University Press, in association with The Open University.
- Dr. P Jayakumar, Solar Energy: Resource Assesment Handbook, 2009

- J.Balfour, M.Shaw and S. Jarosek, Photovoltaics, Lawrence J Goodrich (USA).
- http://en.wikipedia.org/wiki/Renewable_energy

SEMESTER VI

Course code: DMF29201/ DMF29202/ DMF29203/ DMF29204
Credits: Theory – 04, Practical – 02 **Theories: 60 Lectures**

COURSE OUTCOME:

After the completion of the course, Students will be able to

CO1.Write down in detail with application and properties of nuclei

CO2.Learn in detail with application and nuclear models

CO3.Understand in detail with examples radioactivity

CO4.Identify the details of particle physics

CO5.Write down the details of particle accelerators

CO6.Write down the details of detector for nuclear radiator

Nuclear & Particle Physics: DSE 1B

Unit-1

General Properties of Nuclei: Constituents of nucleus and their Intrinsic properties, quantitative facts about size, mass, charge density (matter energy), binding energy, average binding energy and its variation with mass number, main features of binding energy versus mass number curve, N/A plot, angular momentum, parity, magnetic moment, electric moments, nuclear excites states.

(10 Lectures)

Nuclear Models: Liquid drop model approach, semi empirical mass formula and binding energy, significance of various terms, condition of nuclear stability. Concept of Nuclear force.

(06 Lectures)

Nuclear Reactions: Types of Reactions, Conservation Laws, kinematics of reactions, Q-value, Rutherford alpha scattering.

(04 Lectures)

Radioactivity decay :(a) Alpha decay: basics ofα-decay processes, Geiger Nuttall law, α-decay spectroscopy. (b) beta-decay: energy kinematics for beta-decay, positron emission, electron capture, neutrino hypothesis. (c) Gamma decay

(06 Lectures)

Nuclear fission and fusion: Estimation of the fission energy on the basis of liquid drop model, controlled and uncontrolled chain reaction, four factor formula, types of reactor

(04 Lectures)

Unit-2

Interaction of Nuclear Radiation with matter: Gamma ray interaction through matter, photoelectric effect, Compton scattering, pair production, neutron interaction with matter.

(06 Lectures)

Detector for Nuclear Radiations: GM Counter. Basic principle of Scintillation. Detectors and construction of photo-multiplier tube (PMT). Semiconductor Detectors (Si &Ge) for charge particle and photon detection (concept of charge carrier and mobility)

(06 Lectures)

Particle Accelerators: Linear accelerator, Cyclotron, Betatron.

(04 Lectures)

Particle physics: Particle interactions; basic features, types of particles and its families. Symmetries and Conservation Laws: energy and momentum, angular momentum, parity, baryon number, Lepton number, Isospin, Strangeness and charm, concept of quark model, color quantum number and gluons.

(14 Lectures)

PRACTICALS –DSE LAB: NUCLEAR AND PARTICLE PHYSICS

Course code: DMF29301/ DMF29302/ DMF29303/ DMF29304

(Minimum of eight is to be conducted)

1. Study of Characteristics of GM tube and determination of operating voltage, plateau length.
2. Verification of inverse square law of gamma rays.

3. Study of Absorption coefficient of gamma particle.
4. Verification of inverse square law of beta rays.
5. Half-life of K-40
6. Determine the ionization potential of Xenon.
7. Cockcroft Walton voltage multiplier.
8. Solar cell characteristics – To determine efficiency and fill factor.
9. Determine wavelength of laser light.
10. To determine the value of e/m by magnetic focusing.
11. Determination of range of electron in aluminum using GM counter
12. Study of Absorption coefficient of beta particle
13. To determine the wavelength of H-alpha emission line of Hydrogen atom.
14. Study of counting statistics using background radiation using GM counter
15. Study of radiation in various materials (e.g. KSO4 etc.). Investigation of possible radiation in different routine materials by operating GM at operating voltage.

Reference Books:

- Introductory nuclear Physics by Kenneth S. Krane (Wiley India Pvt. Ltd., 2008).
- Concepts of nuclear physics by Bernard L. Cohen. (Tata Mcgraw Hill, 1998).
- Introduction to the physics of nuclei & particles, R.A. Dunlap. (Thomson Asia, 2004)
- Introduction to Elementary Particles, D. Griffith, John Wiley & Sons
- Quarks and Leptons, F. Halzen and A.D. Martin, Wiley India, New Delhi
- Basic ideas and concepts in Nuclear Physics - An Introductory Approach by K. Heyde (IOP- Institute of Physics Publishing, 2004).
- Radiation detection and measurement, G.F. Knoll (John Wiley & Sons, 2000).
- Theoretical Nuclear Physics, J.M. Blatt &V.F.Weisskopf (Dover Pub.Inc., 1991)

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Ooty Road, Mysore-25

DEPARTMENT OF PHYSICS

SEMESTER I

Course code: DMA29001/ DMA29002/ DMA29003/ DMA29004
Credits: Theory – 04, Practical – 02 **Theories: 60 Lectures**

COURSE OUTCOME:

After successful completion of the course, the student is able to

CO1.Learn the details of Elasticity

CO2.Understand the classification and characteristics of motion of a point particle

CO3.Understand in details with examples Frames of reference and relative motion

CO4.Deliberate the classification and characteristics of Dynamics of particle in conservative field

CO5.Specify the classification and characteristics of Special theory of relativity and gravitation

CO6.Write down the characteristics of Surface tension and viscosity

MECHANICS: DSC1

Unit-1

Vectors: Vector algebra (with special reference to the rules of addition and multiplication), Scalar and vector products with specific examples.

Motion of a point particle: The position vector *r(t)* of a moving point particle and its Cartesian components. Velocity and acceleration as the vector derivatives. Derivatives of a vector with respect to a parameter; Derivation of planar vector of a constant magnitude. Radial and transverse components of velocity and acceleration for arbitrary planar motion, deduction of results for uniform circular motion-centripetal force. **(05 Lectures)**

Frames of references and relative motion:

Newton's laws of motion and inertial mass. Galilean transformation; Galilean principle of relativity, Plumb line accelerometer and a freely falling elevator, Non-inertial frames and fictitious force, uniformly rotating frame of reference and coriolis force. Effect of rotation of earth on acceleration due to gravity.

(07Lectures)

Dynamics of a particle in conservative fields:

Work done by force acting on a particle, work-energy theorem. Conservative and non conservative force field. Conservation of energy. Conservative force as a negative gradient of potential, central force as an example of conservative force field.

(05 Lectures)

Conservation of momentum: Conservation of linear momentum, centre of mass, rocket equation. Angular momentum and torque, law of conservation of angular momentum, angular momentum of a system taking centre of mass of the system.

(06 Lectures)

Dynamics of rigid bodies: Moment of inertia, radius of gyration, calculation of momentum of inertia of rectangular plate, circular plate and solid sphere, kinetic energy of rotation. **(04 Lectures)**

Oscillations: Simple harmonic motion. Differential equation of SHM and its solutions. Kinetic and Potential Energy, Total Energy and their time averages. Damped oscillations. (**03 Lectures)**

Unit-2

Gravitation: Newton's Law of gravitation. Motion of a particle in a central force field (motion is in a plane, angular momentum is conserved, areal velocity is constant). Kepler's Laws, derivations of Kepler's law, satellite in circular orbit and applications, geosynchronous orbits, weightlessness, basic idea of global positioning system (GPS).

(08 Lectures)

Special Theory of Relativity: Postulates of Special Theory of Relativity. Lorentz transformation equations, Length contraction, time dilation, relativistic addition of velocities.

Mass-Energy relation, energy-momentum relation**.**
(06 Lectures)

Elasticity:

Review of concepts of modulii of elasticity, Hooke's Law and Poisson's ratio(σ). Relation between the elastic constants ***q, k, n*** and ***σ***, limiting values for **σ.**Work done in stretching. Elastic potential energy. Bending moment. Theory of light single cantilever. I-section girders. Torsion; calculation of couple per unit twist. The Torsional pendulum, Static torsion, Searle's double bar experiment.

Surface Tension: Review of basic concepts. Pressure inside curved liquid surface. Surface tension and interfacial tension by drop-weight method. Surface tension and angle of contact of mercury by Quincke's method.

Viscosity: Review of basic concepts; Variation of Viscosity of liquids with temperature and pressure. **(16 Lectures)**

Reference Books:

- Halliday, Resnick, Jearl Walker, "Principles of Physics" 9th edition, Wiley, 2013.
- Berkeley Physics Course, Vol-1 "Mechanics", 2nd edition, Charles Kittle, Walter D Knight, Malvin A
- D S Mathur, "Elements of properties of matter", S Chand and company, New Delhi, Reprint-2007.
- D S Mathur, "Mechanics", S Chand and company, New Delhi, Reprint-2001.
- BrijLal and N Subrahmanyam, "Properties of matter", 6th edition, Eurasia publishing house Ltd. New Delhi, Reprint-1993.
- Mechanics by Shankara Narayana &Chopra.
- Mechanics by Bhargava and Sharma.

PHYSICS LAB: DSC 1A LAB: MECHANICS

Course code: DMA29101/ DMA29102/ DMA29103/ DMA29104

(Minimum of eight is to be conducted)

1. Bar pendulum: Determination of the acceleration due to gravity and radius of gyration (Both graphical and calculation methods).

2. To determine the Moment of Inertia of a Flywheel.
3. Determination of the Young's modulus by Dynamic method (graphical and calculation method).
4. Torsional pendulum; Determination of the rigidity modulus.
5. Oscillations of a spiral Spring and calculate a) Spring Constant b) Value of g
6. Young's modulus by the single cantilever method.
7. Determination of rigidity modulus by the static torsion method.
8. To determine g by Kater's Pendulum.
9. Determination of young's modulus by the method of uniform bending.
10. Drop weight method; Determination of surface tension of liquid and the interfacial tension between two liquids.
11. To determine the Elastic Constants of a Wire by Searle's method.
12. To determine the Modulus of Rigidity of a Wire by Maxwell's needle
13. To determine **g** and velocity for a freely falling body using Digital Timing Technique
14. To determine the Height of a Building using a Sextant.

Reference Books:

- Advanced Practical Physics for students, B.L.Flint and H.T.Worsnop, 1971, Asia Publishing House.
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
- Engineering Practical Physics, S.Panigrahi& B.Mallick,2015, Cengage Learning India Pvt. Ltd.
- A Text Book of Practical Physics, InduPrakash and Ramakrishna, 11th Edition, 2011, KitabMahal, New Delhi.

SEMESTER II

Course code: DMB29001/ DMB29002/ DMB29003/ DMB29004
Credits: Theory – 04, Practical – 02 **Theories: 60 Lectures**

COURSE OUTCOME:

After successful completion of the course, the student is able to

CO1.Deliberate in detail with examples vector analysis

CO2.Write down in detail with application, electrostatics and magneto static

CO3.Write down the classification and characteristics of AC Circuits

CO4.Specify in details with application, if applicable, properties of magnet material

CO5.Understand the characteristics of electromagnetic theory

CO6.Write down the characteristic of galvanometer

ELECTRICITY AND MAGNETISM: DSC 2

Unit-1

Vector Analysis: Review of vector algebra (Scalar and Vector product), Scalar and vector fields, gradient, divergence, Curl and their significance, Vector Integration, Line, surface and volume integrals of Vector fields, Gauss-divergence theorem and Stoke's theorem of vectors (statement only).

(07 Lectures)

Electrostatics: Electrostatic Field, electric flux, Gauss's theorem of electrostatics and applications; 1) infinite line of charge and 2)plane charged sheet. Electric potential as line integral of electric field, potential due to a point charge, electric dipole, uniformly charged spherical shell and solid sphere. Calculation of electric field from potential.

Capacitance of an isolated spherical conductor. Parallel plate, spherical and cylindrical condenser. Energy per unit volume in electrostatic field.

Dielectric medium, Polarization, Displacement vector. Gauss's theorem in dielectrics. Parallel plate capacitor completely filled with dielectric.

Galvanometers: Construction, theory and working of Helmholtz galvanometer.

(15Lectures)

Alternating current: R M S values, Response of LR, CR and LCR circuits to sinusoidal voltages (discussion using the j symbol), Series and parallel resonance, Half-power frequencies, bandwidth and Q-factor, Power in electrical circuits, power factor and Maximum power transfer theorem.

(08 Lectures)

Unit-2

Applications of ac circuits - ac bridges**;** Anderson's bridge and De-Sauty's bridge **(02 Lectures)**

Magneto statics: Biot-Savart's law & its applications; long straight conductor, circular coil and solenoid carrying current. Divergence and curl of magnetic field. Magnetic vector potential. Ampere's circuital law.

Magnetic properties of materials: Magnetic intensity, magnetic induction, permeability, magnetic susceptibility. Brief introduction of Dia-magnetic, Para-magnetic and Ferro-magnetic materials.

(10Lectures)

Electromagnetic Induction: Faraday's laws of electromagnetic induction, Lenz's law, self Inductance (L) and mutual inductance (M), L of single coil, M of two coils. Energy stored in magnetic field. **(06 Lectures)**

Electromagnetic Theory: Equation of continuity, Displacement current, setting up of Maxwell's equations, wave equation in free space, Poynting vector, energy density in electromagnetic field, electromagnetic wave propagation through free space and isotropic dielectric medium, Transverse nature of electromagnetic waves, polarization. **(12 Lectures)**

Reference Books:

- D. C. Tayal, Electricity and Magnetism, 1988, Himalaya Publishing House.
- K. K. Tewari: Electricity and magnetism, S. Chand Co. Ltd., New Delhi, Reprint 2007.
- B. B. Laud: Electrodynamics, Wiley Eastern Limited, New Delhi.
- David. J. Griffiths: Introduction to Electrodynamics, 3rd edition, Prentice-Hall of India Private limited, New Delhi.
- BrijLal and N. Subramanian:Electricity and Magnetism, 19th edition-RatanPrakashanMandir, Educational and University Publishers, Agra.
- D.N. Vasudeva: Fundamentals of Magnetism and Electricity, 12th edition-S.Chand and Co. Ltd., New Delhi

PHYSICS LAB- DSC 2A LAB: ELECTRICITY AND MAGNETISM

Course code: DMB29101 / DMB29102 / DMB29103 / DMB29104

(Minimum of eight is to be conducted)

1. LCR series circuits – Determination of L & Q factor
2. LCR parallel circuits – Determination of L & Q factor
3. Anderson's Bridge – Determination of the self-inductance of the coil.
4. De-Sauty's bridge – Verification of laws of combination of capacitances, unknown capacitance.
5. To verify the Thevinin's theorem.
6. Maximum Power Transfer Theorem.
7. Maxwell's bridge-determination of mutual inductance.
8. Low resistance-determination of the resistivity of the material.
9. Determination of capacitance by measuring impedance of RC circuit.
10. Determination of inductance by measuring impedance of RL circuit.
11. Low pass and High pass filters.
12. Black box – Identification of L,C & R .
13. Measurement of Magnetic field strength B and its gradient in a Solenoid (Determine dB/dx).
14. To determine a Low Resistance by Carey Foster's Bridge.
15. B_H using Helmholtz double coil galvanometer.

Reference Books

- Advanced Practical Physics for students, B.L.Flint&H.T.Worsnop, 1971, Asia Publishing House.
- A Text Book of Practical Physics, InduPrakash and Ramakrishna, 11th Edition, 2011, KitabMahal, New Delhi.
- Edition, reprinted 1985, Heinemann Educational Publishers

SEMESTER III

Course code: DMC29001/ DMC29002/ DMC29003/ DMC29004

Credits: Theory – 04, Practical – 02 **Theories: 60 Lectures**

COURSE OUTCOME:

After successful completion of the course, the student is able to

CO1.Specify in details with examples kinetic theory of gases

CO2.Specify in depth low temperature physics

CO3.Identify in detail with application thermal conductivity and theory of radiation

CO4.write down the classification and characteristics of laws of thermodynamics

CO5.Have a clear understanding about reversible and irreversible process

CO6.Understand the classification and characteristics of entropy and thermodynamic potential

THERMAL PHYSICS AND STATISTICALMECHANICS: DSC 3

Unit-1

Laws of Thermodynamics: Thermodynamic description of system, Zeroth Law of thermodynamics and temperature. Applications of First Law; General Relation between C_P& C_V. Work Done during Isothermal and Adiabatic Processes. Compressibility & Expansion Coefficient. Reversible & irreversible processes; Carnot's theorem. Thermodynamic scale of temperature and its identity with perfect gas scale.

Entropy: The concept of entropy. Change of entropy in reversible and irreversible cycles. Entropy and non-available energy. Principle of increase of entropy; Clausius inequality. Second law of thermodynamics in terms of Entropy. Entropy of ideal gas, T-S diagram. Probability and entropy, Boltzmann relation. Concept of absolute zero and the third law of thermodynamics.

(15 Lectures)

Thermodynamic Potentials: Internal energy, Enthalpy, Helmholtz and Gibbs functions, Maxwell's thermodynamic relations & applications; Joule-Thompson Effect. Clausius-Clapeyron first Latent heat equation, effect of pressure on melting point of a solid, effect of pressure on boiling point of a liquid, Expression for (C_P – C_V), C_P/C_V, T dS equations.

(08 Lectures)

Kinetic Theory of Gases: Derivation of Maxwell's law of distribution of velocities and its experimental verification, Mean free path (Zeroth Order).Transport Phenomena; Viscosity, Conduction and Diffusion (for vertical case), Law of equipartition of energy (no derivation) and its applications to specific heat of gases; mono-atomic and diatomic gases. **(07 Lectures)**

Unit-2

Thermal conductivity: Equation of flow of heat through solid bar, determination of thermal conductivity of a bad conductor by Lee and Charlton method. **(03 Lectures)**

Theory of Radiation: Induced and spontaneous emission of radiation. Derivation of Planck's law of radiation using Einstein's A and B coefficients. Deduction of Rayleigh-Jeans law, Stefan's law and Wien's displacement law from Planck's law, Wien's formula. **(08 Lectures)**

Low temperature Physics: Ideal gas and real gas.Van-der Waals equation of state. Porous-plug experiment and its theory. Joule-Thomson expansion - expression for the temperature of inversion, inversion curve. Relation between Boyle temperature, temperature of inversion and critical temperature of a gas. Principle of regenerative cooling. Liquefaction of air by Linde's methods. Adiabatic demagnetization**.**
(07 Lectures)

Statistical Mechanics: Probability concept, Phase space, Microstate and Microstate, Entropy and Thermodynamic probability, Maxwell-Boltzmann law- distribution of velocity. Quantum statistics: Bose-Einstein, Maxwell-Boltzmann and Fermi-Dirac distribution law – electron gas-Bose-Einstein distribution law - photon gas - comparison of three statistics. **(12 Lectures)**

Reference Books:

- BrijLal, N. Subramanyam P.S. Hemne: Heat Thermodynamics and Statistical Physics, 1st edition. S Chand Publishing, 2007.

- S C Gupta: Thermodynamics, 1st edition, Pearson, 2005.
- C. L. Arora: Refresher Course in Physics Vol I, S Chand publishing, 2011.
- S. R. Shankara Narayana: Heat and Thermodynamics, 2nd edition, Sulthan Chand and Sons, 1990.
- A Treatise on Heat, MeghnadSaha, and B.N. Srivastava, 1969, Indian Press.
- Heat and Thermodynamics, M.W.Zemasky and R. Dittman, 1981, McGraw Hill

PHYSICS LAB-DSC 3A LAB: THERMAL PHYSICS AND STATISTICAL MECHANICS

Course code: DMC29101/ DMC29102/ DMC29103/ DMC29104

(Minimum of eight is to be conducted)

1. Verification of distribution law using Monte-Carlo Method.
2. Verification of Stefan's-Boltzmann law.
3. Specific heat of a liquid by cooling – graphical method.
4. To determine Stefan's Constant.
5. To determine the coefficient of thermal conductivity of a bad conductor by Lee and Charlton's disc method.
6. To determine the coefficient of thermal conductivity of copper by Searle's Apparatus.
7. To determine the Coefficient of Thermal Conductivity of Cu by Angstrom's Method.
8. Determination of moment of inertia of Irregular body by Torsional pendulum method.
9. Determine young's modulus of a material by Koenig's method.
10. To study the variation of thermo emf across two junctions of a thermocouple with temperature.
11. Measurement of Planck's constant using black body radiation.
12. Determine boiling point of a liquid using Platinum resistance thermometer.
13. To determine the temperature co-efficient of resistance by Platinum resistance thermometer.
14. To determine Mechanical Equivalent of Heat, J, by Callender and Berne's constant flow method.
15. To record and analyze the cooling temperature of a hot object as a function of time

using a thermocouple and suitable data acquisition system.

16. To calibrate Resistance Temperature Device (RTD) using Null Method/Off-Balance Bridge.

Reference Books:

- Advanced Practical Physics for students, B.L.Flint&H.T.Worsnop, 1971, Asia Publishing House.
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
- A Text Book of Practical Physics, InduPrakash and Ramakrishna, 11th Edition, 2011, KitabMahal, New Delhi.
- A Laboratory Manual of Physics for Undergraduate Classes, D.P. Khandelwal, 1985, Vani Publication.

SEMESTER IV

Course code: DMD29001/ DMD29002/ DMD29003/ DMD29004

Credits: Theory – 04, Practical – 02 **Theories: 60 Lectures**

COURSE OUTCOME:

After the completion of the course, Students will be able to

CO1.Specify the classification and characteristics of Fourier theorem

CO2.Learn in detail with application, superposition of simple harmonic motion

CO3.Understand in detail with application of wave motion

CO4.Deliberate in detail with examples Sound, wave optics and transducers

CO5.Learn the details of Interference, diffraction and polarization

CO6.Learn in detail with application of acoustics

WAVES AND OPTICS: DSC 4

Unit-1

Analysis of Complex Waves: Fourier's Theorem- Application to saw tooth wave and square wave. **(03 Lectures)**

Superposition of simple harmonic motion:

Superposition of two simple harmonic motion; Lissajous' figures. Damped vibration; Equation for damped vibrations. Forced vibration; solution in exponential form, Resonance, Expression for amplitude and phase at resonance.

Superposition of two collinear harmonic oscillations: Linearity and Superposition Principle. (1) Oscillations having equal frequencies and (2) Oscillations having different frequencies (Beats).

(11 Lectures)

Wave Motion:

Progressive waves; Differential equation of wave motion; Relation between amplitude and intensity. Expression for velocity of progressive waves in a medium; Newton's formula, Laplace's correction.

Transverse waves on a string. Travelling and standing waves on a string. Normal Modes of a string. Expression for frequency of vibration of a stretched string, harmonics. Group velocity, Phase velocity. Longitudinal vibrations in a rod; Kundt's tube experiment. **(10 Lectures)**

Sound: Intensity and loudness of sound - Decibels - Intensity levels - musical notes - musical scale. Acoustics of buildings: Reverberation and time of reverberation, Absorption coefficient, Sabine's formula, measurement of reverberation time. Acoustic aspects of halls and auditoria.

(06 Lectures)

Unit-2

Transducers: Types of transducers, dynamic microphone and loudspeaker-construction,

working and their characteristics, Piezo electrical transducer.

(03 Lectures)

Wave Optics: Electromagnetic nature of light. Definition and Properties of wave front. Huygens Principle.

(03 Lectures)

Interference: Interference: Review of basic concepts, Coherent sources, and conditions for constructive and destructive interference.

Coherent source by division of amplitude: Interference in Thin Films: – reflected and transmitted light, color of thin films, theory of air wedge, theory of Newton's rings; measurement of wavelength and refractive index.

Coherent source by division of division of wave front: Lloyd's Mirror and Fresnel's Biprism. Michelson's interferometer; Measurement of λ and $d\lambda$. **(11 Lectures)**

Diffraction: Fresnel and Fraunhoffer diffraction. Explanation of rectilinear propagation of light. Theory of the zone plate and comparison with convex lens. Fresnel diffraction at a straight edge. Fraunhoffer diffraction at a single slit. Transmission grating: theory for the case of normal incidence**.**

(06 Lectures)

Polarization: Double refraction in uniaxial crystals. Huygens's theory. Positive and negative crystal. Principle refractive indices. Huygens's constructions of ordinary and extraordinary wave fronts in a uniaxial crystal, retarding plates. Production and analysis of linearly, circularly and elliptically polarized light. Optical activity, Fresnel's theory, Lorentz half shade polarimeter.

(07 Lectures)

Reference Books:

- Fundamentals of Optics, F A Jenkins and H E White, 1976, McGraw-Hill. Principles of Optics, B.K. Mathur, 1995, Gopal Printing
- Fundamentals of Optics, H.R. Gulati and D.R. Khanna, 1991, R. Chand Publication

- Brijlal and N Subramanyam: Waves and Oscillations, 2nd edition, Vikas publishing house Pvt. Ltd., New Delhi.
- S K Gupta, O P Varma: Waves and Oscillations, 3rd edition, R.Chand& Co., New Delhi.
- R.L. Saihgal, A Text Book of Sound, S.Chand& Company Ltd. New Delhi, Reprint 1990.

PHYSICS LAB-DSC 4A LAB: WAVES AND OPTICS

Course code: DMD29101/ DMD29102/ DMD29103/ DMD29104

(Minimum of eight is to be conducted)

1. To determine wavelength of sodium light using Newton's Rings.
2. To determine wavelength of sodium light using Fresnel Biprism.
3. To determine wavelength of Sodium light using plane diffraction Grating.
4. Air wedge – Determination of thickness of a thin paper/diameter of a thin wire
5. Cauchy's constants using spectrometer.
6. Polarization – Determination of unknown concentration of sugar solution by graphical method using a polarimeter.
7. Diffraction at a Straight wire -To determine the diameter of the Straight wire
8. Helmholtz resonator-determination of frequency of tuning fork
9. To determine the Refractive Index of the Material of a given Prism using Sodium Light.
10. To study Lissajous Figures
11. Kundt's tube experiment – Velocity of sound in air at room temperature
12. To investigate the motion of coupled oscillators
13. To determine the Frequency of an Electrically Maintained Tuning Fork by Melde's Experiment and to verify λ^2 – T Law
14. Familiarization with Schuster`s focusing; determination of angle of prism
15. To measure the intensity using photo sensor and laser in diffraction patterns of single and double slits.

Reference Books:

- Advanced Practical Physics for students, B.L. Flint & H.T. Worsnop, 1971, Asia

Publishing House.

- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
- A Text Book of Practical Physics, InduPrakash and Ramakrishna, 11th Edition, 2011, KitabMahal, New Delhi.

SEMESTER V

Course code: DME29201/ DME29202/ DME29203/ DME29204

Credits: Theory – 04, Practical – 02 **Theories: 60 Lectures**

COURSE OUTCOME:

After the completion of the course, Students will be able to

CO1.Write down in detail with application of crystal structure

CO2.Write down the details of Elementary lattice dynamics

CO3.Deliberate in detail with examples Magnetic properties of matter

CO4.Identify the characteristics of elementary band theory

CO5.Learn the classification and characteristics of superconductivity

CO6.Understand the elastic properties of solids and lattice vibrations

SOLID STATE PHYSICS: DSE 1B

Unit-1

Crystal Structure: Solids: Amorphous and Crystalline Materials. Lattice TranslationVectors.Lattice with a Basis – Central and Non-Central Elements. Unit Cell. Miller Indices. Reciprocal Lattice. Types of Lattices. Brillouin Zones. Diffraction of X-rays

by Crystals. Bragg's Law. Bragg spectrometer. Continuous x-ray spectra, Duane and Hunt limit. Characteristic x-ray spectra. Mosley law and its significance.

(10 Lectures)

Elementary Lattice Dynamics: Lattice Vibrations and Phonons: Linear Monatomic and Diatomic Chains. Acoustical and Optical Phonons. Qualitative Description of the Phonon Spectrum in Solids. Dulong and Petit's Law, Einstein and Debye theories of specific heat of solids.

(09 Lectures)

Magnetic Properties of Matter: Dia, Para, Ferri and Ferromagnetic Materials. Classical Langevin Theory of dia – and Paramagnetic Domains. Quantum Mechanical Treatment of Paramagnetism. Curie's law, Weiss's Theory of Ferromagnetism and Ferromagnetic Domains. Discussion of B-H Curve. Hysteresis and Energy Loss.

(11 Lectures)

Unit-2

Electrical Properties of metals: Free electron theory, Quantum theory, Conductivity of metals on the basis of free electron theory- Ohm's law.

(04 Lectures)

Dielectric Properties of Materials: Polarization. Local Electric Field at an Atom. Depolarization Field. Electric Susceptibility.Polarizability.Clausius Mosotti Equation. Classical Theory of Electric Polarizability.Normal and Anomalous Dispersion.Cauchy and Sellmeir relations. Langevin-Debye equation. Complex Dielectric Constant. Optical Phenomena. Application: Plasma Oscillations, Plasma Frequency, Plasmon's.

(10 Lectures)

Elementary band theory: Kronig Penny model. Band Gaps.Conductors, Semiconductors and insulators. P and N type Semiconductors, carrier concentration in intrinsic semiconductor, Fermi energy, effect of temperature and concentration on Fermi energy, Conductivity of Semiconductors, mobility, Hall Effect, Hall coefficient.

(10 Lectures)

Superconductivity: Experimental Results. Critical Temperature. Critical magnetic field.

Meissner effect. Type I and type II Superconductors, London's Equation and Penetration Depth. Isotope effect.BCS theory, application of Superconductors.

(06 Lectures)

Reference Books:

- Introduction to Solid State Physics, Charles Kittel, 8th Ed., 2004, Wiley India Pvt. Ltd.
- Elements of Solid State Physics, J.P. Srivastava, 2nd Ed., 2006, Prentice-Hall of India
- Introduction to Solids, Leonid V. Azaroff, 2004, Tata Mc-Graw Hill
- Solid State Physics, Neil W. Ashcroft and N. David Mermin, 1976, Cengage Learning
- Solid State Physics, Rita John, 2014, McGraw Hill
- Solid-state Physics, H. Ibach and H Luth, 2009, Springer
- Elementary Solid State Physics, 1/e M. Ali Omar, 1999, Pearson India
- Solid State Physics, M.A. Wahab, 2011, Narosa Publications

PRACTICALS-DSE LAB: SOLID STATE PHYSICS

Course code: DME29301/ DME29302/ DME29303/ DME29304

(Minimum of eight is to be conducted)

1. Determination of energy gap of a semiconductor using Meter Bridge.
2. Determination Fermi energy of metal (copper).
3. To measure the Dielectric Constant of a given solid Materials
4. Study of LDR characteristics.
5. Verification of Inverse square law for light Intensity using a Photo-diode.
6. Bridge rectifier with and without filters.
7. Clipping and clamping circuits using diodes.
8. Zener diode as a voltage regulator.
9. Study of powder X-ray photograph-the determination of inter planar distances.
10. To determine value of Planck's constant using LEDs of at least 4 different colors.
11. To determine value of Boltzmann constant using V-I characteristic of PN diode.
12. Study of Hall Effect.
13. To determine the refractive index of a dielectric layer using SPR
14. To study the PE Hysteresis loop of a Ferroelectric Crystal.

15. To measure the resistivity of a semiconductor (Ge) crystal with temperature by four-probe method (from room temperature to 150 ^{o}C) and to determine its band gap
16. To draw the BH curve of iron using a Solenoid and determine the energy loss from Hysteresis.
17. To determine the complex dielectric constant and plasma frequency of metal using Surface Plasmon resonance (SPR)
18. Measurement of Magnetic susceptibility of solids.

Reference Books

- Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
- A Text Book of Practical Physics, InduPrakash and Ramakrishna, 11th Ed., 2011, KitabMahal, New Delhi
- Elements of Solid State Physics, J.P. Srivastava, 2nd Ed., 2006, Prentice-Hall of India

Skill Enhancement Course (SEC) (Credit: 02 each)

SEMESTER V

Course code: DME29601/ DME29602/ DME29603/ DME29604
Credits: Theory – 02 **Theories: 30 Lectures**

COURSE OUTCOME:

After the completion of the course, Students will be able to

CO1.Understand the characteristics of fossil fuel

CO2.Learn in detail with application of wind energy

CO3.Specify in detail with application of ocean energy and hydro energy

CO4.Identify the characteristics of geothermal energy

CO5.Deliberate the characteristics of electromagnetic energy

CO6.Deliberate the characteristics of piezoelectric energy harvesting

RENEWABLE ENERGY AND ENERGY HARVESTING: SEC 1A

Fossil fuels and Alternate Sources of energy: Fossil fuels and Nuclear Energy, their limitation, need of renewable energy, non-conventional energy sources. An overview of developments in Offshore Wind Energy, Tidal Energy, Wave energy systems, Ocean Thermal Energy Conversion, solar energy, biomass, biochemical conversion, biogas generation, geothermal energy tidal energy, Hydroelectricity.
(03 Lectures)

Solar energy: Solar energy, its importance, storage of solar energy, solar pond, non convective solar pond, applications of solar pond and solar energy, solar water heater, flat plate collector, solar distillation, solar cooker, solar green houses, solar cell, absorption air conditioning. Need and characteristics of photovoltaic (PV) systems, PV models and equivalent circuits, and sun tracking systems.
(06 Lectures)

Wind Energy harvesting: Fundamentals of Wind energy, Wind Turbines and different electrical machines in wind turbines, Power electronic interfaces, and grid interconnection topologies.
(03 Lectures)
Ocean Energy: Ocean Energy Potential against Wind and Solar, Wave Characteristics and Statistics, Wave Energy Devices. **(03 Lectures)**

Tide characteristics and Statistics, Tide Energy Technologies, Ocean Thermal Energy, Osmotic Power, Ocean Bio-mass.

(02 Lectures)

Geothermal Energy: Geothermal Resources, Geothermal Technologies. **(02 Lectures)**

Hydro Energy: Hydropower resources, hydropower technologies, environmental impact of hydro power sources.

(02 Lectures)

Piezoelectric Energy harvesting: Introduction, Physics and characteristics of piezoelectric effect, materials and mathematical description of piezoelectricity, Piezoelectric parameters and modeling piezoelectric generators, Piezoelectric energy harvesting applications, Human power **(04 Lectures)**

Electromagnetic Energy Harvesting: Linear generators, physics mathematical models, recent applications **(02 Lectures)**

Carbon captured technologies, cell, batteries, power consumption **(02 Lectures)**

Environmental issues and Renewable sources of energy, sustainability. **(01 Lecture)**

Demonstrations and Experiments

1. Demonstration of Training modules on solar energy, wind energy, etc.
2. Conversion of vibration to voltage using piezoelectric materials
3. Conversion of thermal energy into voltage using thermoelectric modules.

Reference Books:

- Non-conventional energy sources - G.D Rai - Khanna Publishers, New Delhi
- Solar energy - M P Agarwal - S Chand and Co. Ltd.
- Solar energy - Suhas P Sukhative Tata McGraw - Hill Publishing Company Ltd.
- Godfrey Boyle, "Renewable Energy, Power for a sustainable future", 2004, Oxford University Press, in association with The Open University.
- Dr. P Jayakumar, Solar Energy: Resource Assesment Handbook, 2009
- J.Balfour, M.Shaw and S. Jarosek, Photovoltaics, Lawrence J Goodrich (USA).
- http://en.wikipedia.org/wiki/Renewable_energy

SEMESTER VI

Course code: DMF29201/ DMF29202/ DMF29203/ DMF29204
Credits: Theory – 04, Practical – 02 **Theories: 60 Lectures**

COURSE OUTCOME:

After the completion of the course, Students will be able to

CO1.Write down in detail with application and properties of nuclei

CO2.Learn in detail with application and nuclear models

CO3.Understand in detail with examples radioactivity

CO4.Identify the details of particle physics

CO5.Write down the details of particle accelerators

CO6.Write down the details of detector for nuclear radiator

Nuclear & Particle Physics: DSE 1B

Unit-1

General Properties of Nuclei: Constituents of nucleus and their Intrinsic properties, quantitative facts about size, mass, charge density (matter energy), binding energy, average binding energy and its variation with mass number, main features of binding energy versus mass number curve, N/A plot, angular momentum, parity, magnetic moment, electric

moments, nuclear excites states.

(10 Lectures)

Nuclear Models: Liquid drop model approach, semi empirical mass formula and binding energy, significance of various terms, condition of nuclear stability. Concept of Nuclear force.

(06 Lectures)

Nuclear Reactions: Types of Reactions, Conservation Laws, kinematics of reactions, Q-value, Rutherford alpha scattering.

(04 Lectures)

Radioactivity decay :(a) Alpha decay: basics ofα-decay processes, Geiger Nuttall law, α-decay spectroscopy. (b) beta-decay: energy kinematics for beta-decay, positron emission, electron capture, neutrino hypothesis. (c) Gamma decay

(06 Lectures)

Nuclear fission and fusion: Estimation of the fission energy on the basis of liquid drop model, controlled and uncontrolled chain reaction, four factor formula, types of reactor

(04 Lectures)

Unit-2

Interaction of Nuclear Radiation with matter: Gamma ray interaction through matter, photoelectric effect, Compton scattering, pair production, neutron interaction with matter.

(06 Lectures)

Detector for Nuclear Radiations: GM Counter. Basic principle of Scintillation. Detectors and construction of photo-multiplier tube (PMT). Semiconductor Detectors (Si &Ge) for charge particle and photon detection (concept of charge carrier and mobility)

(06 Lectures)

Particle Accelerators: Linear accelerator, Cyclotron, Betatron.

(04 Lectures)

Particle physics: Particle interactions; basic features, types of particles and its families. Symmetries and Conservation Laws: energy and momentum, angular momentum, parity, baryon number, Lepton number, Isospin, Strangeness and charm, concept of quark model, color quantum number and gluons.

(14 Lectures)

PRACTICALS –DSE LAB: NUCLEAR AND PARTICLE PHYSICS

Course code: DMF29301/ DMF29302/ DMF29303/ DMF29304

(Minimum of eight is to be conducted)

1. Study of Characteristics of GM tube and determination of operating voltage, plateau length.
2. Verification of inverse square law of gamma rays.
3. Study of Absorption coefficient of gamma particle.
4. Verification of inverse square law of beta rays.
5. Half-life of K-40
6. Determine the ionization potential of Xenon.
7. Cockcroft Walton voltage multiplier.
8. Solar cell characteristics – To determine efficiency and fill factor.
9. Determine wavelength of laser light.
10. To determine the value of e/m by magnetic focusing.
11. Determination of range of electron in aluminum using GM counter
12. Study of Absorption coefficient of beta particle
13. To determine the wavelength of H-alpha emission line of Hydrogen atom.
14. Study of counting statistics using background radiation using GM counter
15. Study of radiation in various materials (e.g. KSO4 etc.). Investigation of possible radiation in different routine materials by operating GM at operating voltage.

Reference Books:

- Introductory nuclear Physics by Kenneth S. Krane (Wiley India Pvt. Ltd., 2008).
- Concepts of nuclear physics by Bernard L. Cohen. (Tata Mcgraw Hill, 1998).
- Introduction to the physics of nuclei & particles, R.A. Dunlap. (Thomson Asia, 2004)
- Introduction to Elementary Particles, D. Griffith, John Wiley & Sons
- Quarks and Leptons, F. Halzen and A.D. Martin, Wiley India, New Delhi
- Basic ideas and concepts in Nuclear Physics - An Introductory Approach by K. Heyde (IOP- Institute of Physics Publishing, 2004).
- Radiation detection and measurement, G.F. Knoll (John Wiley & Sons, 2000).
- Theoretical Nuclear Physics, J.M. Blatt &V.F.Weisskopf (Dover Pub.Inc., 1991)

JSS College of Arts, Commerce & Science (Autonomous),
Ooty Road, Mysore-25

DEPARTMENT OF PHYSICS

SYLLABUS: 2021-2022

SEMESTER I

Course code: DMA29001/ DMA29002/ DMA29003/ DMA29004
Credits: Theory – 04, Practical – 02 **Theories:60 Lectures**

COURSE OUTCOME:

After successful completion of the course, the student is able to

CO1.Learn the details of Elasticity

CO2.Understand the classification and characteristics of motion of a point particle

CO3.Understand in details with examples Frames of reference and relative motion

CO4.Deliberate the classification and characteristics of Dynamics of particle in conservative field

CO5.Specify the classification and characteristics of Special theory of relativity and gravitation

CO6.Write down the characteristics of Surface tension and viscosity

MECHANICS: DSC1

Unit-1

Vectors: Vector algebra (with special reference to the rules of addition and multiplication), Scalar and vector products with specific examples.

Motion of a point particle: The position vector *r(t)* of a moving point particle and its Cartesian components. Velocity and acceleration as the vector derivatives. Derivatives of a vector with respect to a parameter; Derivation of planar vector of a constant magnitude. Radial and transverse components of velocity and acceleration for arbitrary planar motion, deduction of results for uniform circular motion-centripetal force. **(05 Lectures)**

Frames of references and relative motion:

Newton's laws of motion and inertial mass. Galilean transformation; Galilean principle of relativity, Plumb line accelerometer and a freely falling elevator, Non-inertial frames and fictitious force, uniformly rotating

frame of reference and coriolis force. Effect of rotation of earth on acceleration due to gravity.
(07Lectures)

Dynamics of a particle in conservative fields:
Work done by force acting on a particle, work-energy theorem. Conservative and non conservative force field. Conservation of energy. Conservative force as a negative gradient of potential, central force as an example of conservative force field. **(05 Lectures)**

Conservation of momentum: Conservation of linear momentum, centre of mass, rocket equation. Angular momentum and torque, law of conservation of angular momentum, angular momentum of a system taking centre of mass of the system. **(06 Lectures)**

Dynamics of rigid bodies: Moment of inertia, radius of gyration, calculation of momentum of inertia of rectangular plate, circular plate and solid sphere, kinetic energy of rotation. **(04 Lectures)**

Oscillations: Simple harmonic motion. Differential equation of SHM and its solutions. Kinetic and Potential Energy, Total Energy and their time averages. Damped oscillations. (**03 Lectures)**

Unit-2

Gravitation: Newton's Law of gravitation. Motion of a particle in a central force field (motion is in a plane, angular momentum is conserved, areal velocity is constant). Kepler's Laws, derivations of Kepler's law, satellite in circular orbit and applications, geosynchronous orbits, weightlessness, basic idea of global positioning system (GPS). **(08 Lectures)**

Special Theory of Relativity: Postulates of Special Theory of Relativity. Lorentz transformation equations, Length contraction, time dilation, relativistic addition of velocities. Mass-Energy relation, energy-momentum relation**.** **(06 Lectures)**

Elasticity:
Review of concepts of modulii of elasticity, Hooke's Law and Poisson's ratio(σ). Relation between the elastic constants ***q, k, n*** and ***σ***, limiting values for **σ.**Work done in stretching. Elastic potential energy. Bending moment. Theory of light single cantilever. I-section girders. Torsion; calculation of couple per unit twist. The Torsional pendulum, Static torsion, Searle's double bar experiment.

Surface Tension: Review of basic concepts. Pressure inside curved liquid surface. Surface tension and

interfacial tension by drop-weight method. Surface tension and angle of contact of mercury by Quincke's method.

Viscosity: Review of basic concepts; Variation of Viscosity of liquids with temperature and pressure. **(16 Lectures)**

Reference Books:

- Halliday, Resnick, Jearl Walker, "Principles of Physics" 9th edition, Wiley, 2013.
- Berkeley Physics Course, Vol-1 "Mechanics", 2nd edition, Charles Kittle, Walter D Knight, Malvin A
- D S Mathur, "Elements of properties of matter", S Chand and company, New Delhi, Reprint-2007.
- D S Mathur, "Mechanics", S Chand and company, New Delhi, Reprint-2001.
- BrijLal and N Subrahmanyam, "Properties of matter", 6th edition, Eurasia publishing house Ltd. New Delhi, Reprint-1993.
- Mechanics by Shankara Narayana &Chopra.
- Mechanics by Bhargava and Sharma.

PHYSICS LAB: DSC 1A LAB: MECHANICS

Course code: DMA29101/ DMA29102/ DMA29103/ DMA29104

(Minimum of eight is to be conducted)

1. Bar pendulum: Determination of the acceleration due to gravity and radius of gyration (Both graphical and calculation methods).
2. To determine the Moment of Inertia of a Flywheel.
3. Determination of the Young's modulus by Dynamic method (graphical and calculation method).
4. Torsional pendulum; Determination of the rigidity modulus.
5. Oscillations of a spiral Spring and calculate a) Spring Constant b) Value of g
6. Young's modulus by the single cantilever method.
7. Determination of rigidity modulus by the static torsion method.
8. To determine g by Kater's Pendulum.
9. Determination of young's modulus by the method of uniform bending.
10. Drop weight method; Determination of surface tension of liquid and the interfacial tension between two liquids.
11. To determine the Elastic Constants of a Wire by Searle's method.
12. To determine the Modulus of Rigidity of a Wire by Maxwell's needle
13. To determine **g** and velocity for a freely falling body using Digital Timing Technique

14. To determine the Height of a Building using a Sextant.

Reference Books:

- Advanced Practical Physics for students, B.L.Flint and H.T.Worsnop, 1971, Asia Publishing House.
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
- Engineering Practical Physics, S.Panigrahi& B.Mallick,2015, Cengage Learning India Pvt. Ltd.
- A Text Book of Practical Physics, InduPrakash and Ramakrishna, 11th Edition, 2011, KitabMahal, New Delhi.

SYLLABUS FOR OPEN ELECTIVE Time: 2 hrs. /week + 01 Hr tutorial Max Marks: 60 Marks

ವಕ್ತಿಯ ಮೂಲಗಳು No. of lectures	
ಘಟಕ 1:	ಅಧ್ಯಾಯ-1: ನವೀಕರಿಷಲಾಗದ ವಕ್ತಿ ಮೂಲಗಳು
ವಕ್ತಿಯ □ರಿಕಲ□ನೆ-ಸಾಮಾನಾವಾಗಿ ಮೂಲಗಳು, ಅದರ ಮಸತ್ವ ಮತ್ತಿ ಅ□ವಾಕತೆ. ವಕ್ತಿ ಮೂಲಗಳ □ಗೀೀಕರಣ: ಪ್ರಾಥಮಿಕ ಮತ್ತಿ ಮಾಧಾಮಿಕ ವಕ್ತಿ, ವಾಣಿಜ್ಾ ಮತ್ತಿ ವಾಣಿಜ್ಾೀತ್ರ ವಕ್ತಿ, ನವೀಕರಿಷಬಹುದಾದ ಮತ್ತಿ ನವೀಕರಿಷಲಾಗದ ವಕ್ತಿ, ಸಾ್ರಾಂ□ಾದಾಯಿಕ ಮತ್ತಿ ಅಸಾ್ರಾಂ□ಾದಾಯಿಕ ವಕ್ತಿ, ಮೂಲ-ಉದಾಸರಣೆಗಳು ಮತ್ತಿ ಮಿತಿಗಳ ಆಧ್ಯರದ ಮೇಲೆ. ವಾಣಿಜ್ಾೀತ್ರ ವಕ್ತಿ ಸಂ□ನ್ಮೂಲಗಳ ಪ್ರಾಮುಖ್ಾತೆ.	04
ಅಧ್ಯಾಯ-2: ಸಾ್ರಾಂ□ಾದಾಯಿಕ ವಕ್ತಿ ಮೂಲಗಳು	
□ಳೆಯುಳಿಕೆ ಇಾಂಧನಗಳು ಮತ್ತಿ □ರಮಾಣು ವಕ್ತಿ-ಉತ್ಪ□ದನೆ ಮತ್ತಿ ಹೊರತೆಗೆಯುವಕೆ, ಬಳಕೆಯ ದರ ಮತ್ತಿ ಮಿತಿಗಳು. □ರಿಷರದ ಮೇಲೆ □ಾಭಾ□ ಮತ್ತಿ ಅ□ರ ಷಮಸ್ಾಗಳು ಮತ್ತಿ ಷವಾಲುಗಳು. ಇತಿೀಚಿನ ಅಾಂಕ್ತಅಾಂವಗಳಾಂದಿಗೆ ಭಾರತೀಯ ಮತ್ತಿ ವವವ ಇಾಂಧನ ಷನ್ನನವೇವದ ಅ□ಲೀಕನ- ಬಳಕೆ ಮತ್ತಿ ಅ□ವಾಕತೆ. □ರಿಷರ ಸ್ಯನೀಹಿ ಮತ್ತಿ ಸಸಿರು ವಕ್ತಿ ಮತ್ತಿ ಅದಕೆೆ ಸಂಬಂಧಿಸಿದ ತಂತ್ಾಜ್ಞಾನದ ಅ□ವಾಕತೆ.	09
MlÄÖ	13

ಘಟಕ 2:	ನವೀಕರಿಷಬಹುದಾದ ವಕ್ತಿ ಮೂಲ
ಅಧ್ಯಾಯ-1: □ರಿಚಯ:	
ನವೀಕರಿಷಬಹುದಾದ ವಕ್ತಿಯ ಅ□ವಾಕತೆ, ಸಾ◌ಂ◌ಂ□◌ಾದಾಯಿಕ□ಲಲದ ಇಂಧನ ಮೂಲಗಳು. ಕಡಲಾಚೆಯ □□ನ ವಕ್ತಿ, ಉಬಬರವಳಿತ್ದ ವಕ್ತಿ, ಅಲೆಗಳ ವಕ್ತಿ □◌ಾ□ಸ್ಯೆಗಳು, ಸಾಗರ ಉಶಣ ವಕ್ತಿ □ರಿ□ತ್ೀನೆ, ಸೌರ ವಕ್ತಿ, ಜೀ□ರಾಸಾಯನ್ನಕ, ಜೀ□ರಾಸಾಯನ್ನಕ □ರಿ□ತ್ೀನೆ, ಜೈವಕ ಅನ್ನಲ ಉತ್ಪ□ದನೆ, ಭೂಶಾಖ್ದ ವಕ್ತಿ ಉಬಬರವಳಿತ್ದ ವಕ್ತಿ, ಜ್ಲವದ್ಯಾತ್ನಲ್ಲಲನ ಬೆಳ□ಣಿಗೆಗಳ ಅ□ಲೀಕನ.	05
ಅಧ್ಯಾಯ 2 : ಸೌರವಕ್ತಿ:	
ಸೌರವಕ್ತಿ-□◌ಾಮುಖ್ ವೈಶಿಶ್◌ಾಗಳು, ಅದರ ಪ್ರಾಮುಖ್◌ಾತೆ, ಸೌರವಕ್ತಿಯ ಅಸೀತೆಗಳು ಮತ್ತಿ ದೀಶಗಳು, ಸೌರವಕ್ತಿಯ ಅನವಯಗಳು. ಸೀಲಾರ್ ವಾಟರ್ ಹೀಟರ್, ಫ್ಲಲಟ್ ಪ್ಲೀಟ್ ಕಲೆಕ್ಟ್ರ, ಸೀಲಾರ್ ಡಿಸಿಲೇಶನ್, ಸೀಲಾರ್ ಕುಕೆರ್, ಸೀಲಾರ್ ಗಿಾೀನ್ ಹೌಸ್, ಸೀಲಾರ್ ಸ್ಯಲ್ - □◌ಾತಿಯಾಂದರ ಸಂಕ್ತಿ□ೆ ಚಚೀ. ದ್ಯಾತಿವದ್ಯಾಜ್ಞನಕ (PV) □◌ಾ□ಸ್ಯೆಗಳು, PV ಮಾದರಿಗಳು ಮತ್ತಿ ಷಮಾನವಾದ ಷರ್ಕ್◌ಾೀಟ್ಗಳು ಮತ್ತಿ ಸೂಯೀನ ಟ್ರ್ಯ◌ಾಕ್ತಾಂಗ್ □◌ಾ□ಸ್ಯೆಗಳ ಅಗತ್◌ಾತೆ ಮತ್ತಿ ಗುಣಲಕ್ಷಣಗಳು.	08
MlÄÖ	13
ಘಟಕ 3:	ಅಧ್ಯಾಯ-3: ಗಾಳಿ ಮತ್ತಿ ಉಬಬರವಳಿತ್ದ ವಕ್ತಿ ಕೊಯುಲ:
ಗಾಳಿ ವಕ್ತಿಯ ಮೂಲಭೂತ್ ಅಾಂವಗಳು, ವಾಂಡ್ ಟರ್ಬೀನ್ಗಳು ಮತ್ತಿ ವಾಂಡ್ ಟರ್ಬೀನ್ಗಳಲ್ಲಲನ ವವಧ ವದ್ಯಾತ್ ಯಂತ್◌ಾಗಳು, □□ರ್ ಎಲೆಕ್ಟ್ರ◌ಾನ್ನಕ್ ಇಾಂಟರ್ಫೇಸ್ಗಳು ಮತ್ತಿ ಗಿಾಡ್ ಇಾಂಟರ್ಕನೆಕ್ಷನ್ ಟೀಪೀಲಾಜಗಳು. ಗಾಳಿ ಮತ್ತಿ ಸೌರವಕ್ತಿಯ ವರುದಧ ಸಾಗರ ವಕ್ತಿಯ ಸಾಮಥಾೀ, ಅಲೆಗಳ ಗುಣಲಕ್ಷಣಗಳು ಮತ್ತಿ ಅಾಂಕ್ತಅಾಂವಗಳು, ತ್ರಂಗ ವಕ್ತಿ ಸಾಧನಗಳು. ಉಬಬರವಳಿತ್ದ ಗುಣಲಕ್ಷಣಗಳು ಮತ್ತಿ ಅಾಂಕ್ತಅಾಂವಗಳು, ಉಬಬರವಳಿತ್ದ ವಕ್ತಿ ತಂತ್◌ಾಜ್ಞಾನಗಳು, ಸಾಗರ.	08
ಅಧ್ಯಾಯ-4 : ಭೂಶಾಖ್ದ ಮತ್ತಿ ಜ್ಲವಕ್ತಿ	
ಭೂಶಾಖ್ದ ಸಂ□ನ್ಮೂಲಗಳು, ಭೂಶಾಖ್ದ ತಂತ್◌ಾಜ್ಞಾನಗಳು.	02
ಜ್ಲವದ್ಯಾತ್ ಸಂ□ನ್ಮೂಲಗಳು, ಜ್ಲವದ್ಯಾತ್ ತಂತ್◌ಾಜ್ಞಾನಗಳು, ಜ್ಲವದ್ಯಾತ್	02

SEMESTER II

Course code: DMB29001/ DMB29002/ DMB29003/ DMB29004
Credits: Theory – 04, Practical – 02 **Theories: 60 Lectures**

COURSE OUTCOME:

After successful completion of the course, the student is able to

CO1.Deliberate in detail with examples vector analysis

CO2.Write down in detail with application, electrostatics and magneto static

CO3.Write down the classification and characteristics of AC Circuits

CO4.Specify in details with application, if applicable, properties of magnet material

CO5.Understand the characteristics of electromagnetic theory

CO6.Write down the characteristic of galvanometer

ELECTRICITY AND MAGNETISM: DSC 2

Unit-1

Vector Analysis: Review of vector algebra (Scalar and Vector product), Scalar and vector fields, gradient, divergence, Curl and their significance, Vector Integration, Line, surface and volume integrals of Vector fields, Gauss-divergence theorem and Stoke's theorem of vectors (statement only). **(07 Lectures)**

Electrostatics: Electrostatic Field, electric flux, Gauss's theorem of electrostatics and applications; 1)

infinite line of charge and 2)plane charged sheet. Electric potential as line integral of electric field, potential due to a point charge, electric dipole, uniformly charged spherical shell and solid sphere. Calculation of electric field from potential.

Capacitance of an isolated spherical conductor. Parallel plate, spherical and cylindrical condenser. Energy per unit volume in electrostatic field.

Dielectric medium, Polarization, Displacement vector. Gauss's theorem in dielectrics. Parallel plate capacitor completely filled with dielectric.

Galvanometers: Construction, theory and working of Helmholtz galvanometer. **(15Lectures)**

Alternating current: R M S values, Response of LR, CR and LCR circuits to sinusoidal voltages (discussion using the j symbol), Series and parallel resonance, Half-power frequencies, bandwidth and Q-factor, Power in electrical circuits, power factor and Maximum power transfer theorem.

(08 Lectures)

Unit-2

Applications of ac circuits - ac bridges**;** Anderson's bridge and De-Sauty's bridge

(02 Lectures)

Magneto statics: Biot-Savart's law & its applications; long straight conductor, circular coil and solenoid carrying current. Divergence and curl of magnetic field. Magnetic vector potential. Ampere's circuital law.

Magnetic properties of materials: Magnetic intensity, magnetic induction, permeability, magnetic susceptibility. Brief introduction of Dia-magnetic, Para-magnetic and Ferro-magnetic materials.

(10Lectures)

Electromagnetic Induction: Faraday's laws of electromagnetic induction, Lenz's law, self Inductance (L) and mutual inductance (M), L of single coil, M of two coils. Energy stored in magnetic field. **(06 Lectures)**

Electromagnetic Theory: Equation of continuity, Displacement current, setting up of Maxwell's equations, wave equation in free space, Poynting vector, energy density in electromagnetic field, electromagnetic wave propagation through free space and isotropic dielectric medium, Transverse nature of electromagnetic waves, polarization. **(12 Lectures)**

Reference Books:

- D. C. Tayal, Electricity and Magnetism, 1988, Himalaya Publishing House.
- K. K. Tewari: Electricity and magnetism, S. Chand Co. Ltd., New Delhi, Reprint 2007.
- B. B. Laud: Electrodynamics, Wiley Eastern Limited, New Delhi.

- David. J. Griffiths: Introduction to Electrodynamics, 3rd edition, Prentice-Hall of India Private limited, New Delhi.
- BrijLal and N. Subramanian:Electricity and Magnetism, 19th edition-RatanPrakashanMandir, Educational and University Publishers, Agra.
- D.N. Vasudeva: Fundamentals of Magnetism and Electricity, 12th edition-S.Chand and Co. Ltd., New Delhi

PHYSICS LAB- DSC 2A LAB: ELECTRICITY AND MAGNETISM

Course code: DMB29101 / DMB29102 / DMB29103 / DMB29104

(Minimum of eight is to be conducted)

1. LCR series circuits – Determination of L & Q factor
2. LCR parallel circuits – Determination of L & Q factor
3. Anderson's Bridge – Determination of the self-inductance of the coil.
4. De-Sauty's bridge – Verification of laws of combination of capacitances, unknown capacitance.
5. To verify the Thevinin's theorem.
6. Maximum Power Transfer Theorem.
7. Maxwell's bridge-determination of mutual inductance.
8. Low resistance-determination of the resistivity of the material.
9. Determination of capacitance by measuring impedance of RC circuit.
10. Determination of inductance by measuring impedance of RL circuit.
11. Low pass and High pass filters.
12. Black box – Identification of L,C & R .
13. Measurement of Magnetic field strength B and its gradient in a Solenoid (Determine dB/dx).
14. To determine a Low Resistance by Carey Foster's Bridge.
15. B_H using Helmholtz double coil galvanometer.

Reference Books

- Advanced Practical Physics for students, B.L.Flint&H.T.Worsnop, 1971, Asia Publishing House.
- A Text Book of Practical Physics, InduPrakash and Ramakrishna, 11th Edition, 2011, KitabMahal, New Delhi.
- Edition, reprinted 1985, Heinemann Educational Publishers

SYLLABUS FOR OPEN ELECTIVE Time: 2 hrs. /week + 01 Hr tutorial Max Marks: 60 Marks

ಖಗೋಳಶಾಸ್ತ್ರ No. of lectures		
ಘಟಕ 1: ಇತಿಹಾಸ ಮತ್ತು ಪರಿಚಯ		
ಅಧ್ಯಾಯ-1:	ಪ್ರಾಚೀನ ಖಗೋಳಶಾಸ್ತ್ರ ಗಾರ್ೀಕ್ ಅ□ಲೀಕನಗಳು, ಸುಮೇರಿಯನ್ ಅ□ಲೀಕನಗಳು, ಮಾಯನ್ ಅ□ಲೀಕನಗಳು, ಅರೇಬಿಕ್ ಅ□ಲೀಕನಗಳು, ಚೀನ್ೀ ಅ□ಲೀಕನಗಳು.	02
ಅಧ್ಯಾಯ-2:	ಭಾರತೀಯ ಖಗೋಳಶಾಸ್ತ್ರ ವೈದಿಕ ಖಗೋಳಶಾಸ್ತ್ರ, ಪ್ರಾಚೀನ ಖಗೋಳಶಾಸ್ತ್ರ ಆಯೀಭಟ, □ರಾಸಮಿಹಿರ, ಭಾರತೀಯ ಗಾಂಾಂಥಗಳಲ್ಲಲ ಭಾಷೆರ ಖಗೋಳಶಾಸ್ತ್ರ, ವಷು□ತ್ ಸಂಕ್ಷ್ಾಂಾಂಾಂತಿಯ ಪೂ□ೀಭಾವ, ವಷು□ತ್ ಸಂಕ್ಷ್ಾಂಾಂಾಂತಿಯ ಆಚರಣೆಗಳು.	02
ಅಧ್ಯಾಯ-3:	ದೂರದವೀಕಗಳ ಮಧಾಕ್ಷ್ಲ್ಲೀನ ಮತ್ತು ಆಧುನ್ನಕ ಖಗೋಳಶಾಸ್ತ್ರದ ಆವಷ್ಕೆರ, ಸೌರವ್ಯಾಸ ಮತ್ತು ಬಾಹ್ಾಂಾಂಾಂಡದ ಮಾದರಿಗಳು, ಟೈಕೊೀ ಬ್ಯಾಹೆ, ಕೆ□ಲರ್, ಗೆಲ್ಲಲ್ಲಯೀ, ಸಶೀಲ್ ಮತ್ತು ಇತ್ರರಿಾಂದ ವೀಕ್ಷಣೆಗಳು, ಆಧುನ್ನಕ ಖಗೋಳವಜ್ಞಾನ.	02
ಅಧ್ಯಾಯ-4:	ಖಗೋಳಶಾಸ್ತ್ರದ ಪಿನ್ ಹೊೀಲ್, ದ್ಯಬೀೀನುಗಳು, ದೂರದವೀಕಗಳು ಮತ್ತು ಚಿತ್ಾಣಕ್ಷ್ರೆಗಿ ಆಪ್ಟಿಕಲ್ ಉ□ಕರಣಗಳು.	01
ಅಧ್ಯಾಯ-5:	ಅ□ಲೀಕನಗಳ ಗಣಿತ್ದ ವಧ್ಯನಗಳು ಕೊೀನ್ನೀಯ ಮಾ□ನ, ತಿಾಕೊೀನಮಿತಿಯ ಕಿಟ್ಯೀಗಳು, ನಾಕ್ಷತಿಾಕ ಭಾಾಂಾಂವ	01
ಅಧ್ಯಾಯ-6:	ವೀಕ್ಷಣಾ □ರಿಭಾಷೆಗಳು ಕೆಪ್ಲೀನಲ್ ನ್ನರ್ದೀವನಗಳು, ಅಜಮುತ್, ಎತ್ೆರ, ದಿರ್ಕ್ಾೂಚಿ ಮತ್ತು ಕೈಯನುನ ಬಳಸಿಕೊಾಂಾಂಡು ಅಳತೆಗಳು. ಈಕವಟೀರಿಯಲ್ ಕೊೀ-ಆಡಿೀನೇಟ್ಸಳು, ಬೆಳಕ್ತನ □ಶೀಗಳು, ಮಾಾಗಿನಟ್ಯಾಡ್, ಬಣಣಗಳು ಇತ್ಾಾದಿ.	02
ಘಟಕ 2: ಸೌರವ್ಯೂಹದ ಅ□ಲೋಕನಗಳು		

ಅಧ್ಯಾಯ-7:	ದಿ ಷನ್ ಎಕ್ತಲಪಿಕ್ ಮತ್ತಿ ಭೂಮಿಯ ದೃಷ್ಟೊ್ಕೀನ, ಋತ್ತಗಳು - ಅಯನ ಸಂಕ್ಟಾಂತಿಗಳು ಮತ್ತಿ ವಷು□ತ್ ಸಂಕ್ಟಾಂತಿ, ಋತ್ತಗಳಲ್ಲಲ ಭೂಮಿಯಿಂದ ಸೂಯೀನ ವೀಕ್ಷಣೆಗಳು. ಗಾಸಣಗಳು, ಶೂನಾ ನೆರಳು ದಿನ, ಸೂಯೀನ ಕಲೆಗಳು	01
ಅಧ್ಯಾಯ-8:	ಚಂದಾನ ಭೂಮಿ-ಚಂದಾ □ಾ□ಸ್ಯೆಯ ಹಂತ್ಗಳು, ಚಂದಾಗಾಸಣಗಳು, ಎಕ್ತಲಪಿಕ್ ಮತ್ತಿ ಚಂದಾನ ಕಕೆಿಯ ಪ್ಲೀನ್ ನೀಡ್ಗಳು, ಚಂದಾನ ತಿಾಂಗಳು, ಹುಣಿಣಮೆಯ ಹೆಷರುಗಳು.	01
ಅಧ್ಯಾಯ-9:	ಒಳ ಗಾಸಗಳು: ಬುಧ ಮತ್ತಿ ಶುಕಾ ವೀಕ್ಷಣಾ ಇತಿಹ್ಪ, ವೀಕ್ಷಣಾ ಕ್ತಟಕ್ತಗಳು, ಗೀಚರತೆ, ಗೀಚರತೆಗಳು, ಉದದಗಳು, ಉನನತ್ ಸಂಯೀಗಗಳು, ಕೆಳಮಟ್ಟ ಸಂಯೀಗಗಳು, ಸಾಗಣೆಗಳು.	02
ಅಧ್ಯಾಯ-10:	ಹೊರಗಿನ ಗಾಸಗಳು ಹೊರ ಗಾಸಗಳು: ಮಂಗಳ, ಗುರು ಮತ್ತಿ ವನ್ನ ವೀಕ್ಷಣಾ ಇತಿಹ್ಪ ವೀಕ್ಷಣಾ ಕ್ತಟಕ್ತಗಳು, ಗೀಚರತೆ, ವರೀಧಗಳ ಆ□ತ್ೀನಗಳು ವರೀಧಗಳು, ಸಂಯೀಗಗಳು, ಚಂದಾಗಾಸಣಗಳು. ಗೆಲ್ಲಲ್ಲಯನ್ ಚಂದಾರು, ವನ್ನಗಳ ಉಾಂಗುರಗಳು	02

SEMESTER III

Course code: DMC29001/ DMC29002/ DMC29003/ DMC29004

Credits: Theory – 04, Practical – 02 **Theories: 60 Lectures**

COURSE OUTCOME:

After successful completion of the course, the student is able to

CO1.Specify in details with examples kinetic theory of gases

CO2.Specify in depth low temperature physics

CO3.Identify in detail with application thermal conductivity and theory of radiation

CO4.write down the classification and characteristics of laws of thermodynamics

CO5.Have a clear understanding about reversible and irreversible process

CO6.Understand the classification and characteristics of entropy and thermodynamic potential

THERMAL PHYSICS AND STATISTICALMECHANICS: DSC 3

Unit-1

Laws of Thermodynamics: Thermodynamic description of system, Zeroth Law of thermodynamics and temperature. Applications of First Law; General Relation between C_P& C_V. Work Done during Isothermal and Adiabatic Processes. Compressibility & Expansion Coefficient. Reversible & irreversible processes; Carnot's theorem. Thermodynamic scale of temperature and its identity with perfect gas scale.

Entropy: The concept of entropy. Change of entropy in reversible and irreversible cycles. Entropy and non-available energy. Principle of increase of entropy; Clausius inequality. Second law of thermodynamics in terms of Entropy. Entropy of ideal gas, T-S diagram. Probability and entropy, Boltzmann relation. Concept of absolute zero and the third law of thermodynamics.

(15 Lectures)

Thermodynamic Potentials: Internal energy, Enthalpy, Helmholtz and Gibbs functions, Maxwell's thermodynamic relations & applications; Joule-Thompson Effect. Clausius-Clapeyron first Latent heat equation, effect of pressure on melting point of a solid, effect of pressure on boiling point of a liquid, Expression for ($C_P - C_V$), C_P/C_V, T dS equations. **(08 Lectures)**

Kinetic Theory of Gases: Derivation of Maxwell's law of distribution of velocities and its experimental verification, Mean free path (Zeroth Order).Transport Phenomena; Viscosity, Conduction and Diffusion (for vertical case), Law of equipartition of energy (no derivation) and its applications to specific heat of gases; mono-atomic and diatomic gases. **(07 Lectures)**

Unit-2

Thermal conductivity: Equation of flow of heat through solid bar, determination of thermal conductivity of a bad conductor by Lee and Charlton method. **(03 Lectures)**

Theory of Radiation: Induced and spontaneous emission of radiation. Derivation of Planck's law of radiation using Einstein's A and B coefficients. Deduction of Rayleigh-Jeans law, Stefan's law and Wien's displacement law from Planck's law, Wien's formula. **(08 Lectures)**

Low temperature Physics: Ideal gas and real gas.Van-der Waals equation of state. Porous-plug experiment and its theory. Joule-Thomson expansion - expression for the temperature of inversion, inversion curve. Relation between Boyle temperature, temperature of inversion and critical temperature of a gas. Principle of regenerative cooling. Liquefaction of air by Linde's methods. Adiabatic demagnetization**.**
(07 Lectures)

Statistical Mechanics: Probability concept, Phase space, Microstate and Microstate, Entropy and Thermodynamic probability, Maxwell-Boltzmann law- distribution of velocity. Quantum statistics: Bose-Einstein, Maxwell-Boltzmann and Fermi-Dirac distribution law – electron

gas-Bose-Einstein distribution law - photon gas - comparison of three statistics. **(12 Lectures)**

Reference Books:

- BrijLal, N. Subramanyam P.S. Hemne: Heat Thermodynamics and Statistical Physics, 1st edition. S Chand Publishing, 2007.
- S C Gupta: Thermodynamics, 1st edition, Pearson, 2005.
- C. L. Arora: Refresher Course in Physics Vol I, S Chand publishing, 2011.
- S. R. Shankara Narayana: Heat and Thermodynamics, 2nd edition, Sulthan Chand and Sons, 1990.
- A Treatise on Heat, MeghnadSaha, and B.N. Srivastava, 1969, Indian Press.
- Heat and Thermodynamics, M.W.Zemasky and R. Dittman, 1981, McGraw Hill

PHYSICS LAB-DSC 3A LAB: THERMAL PHYSICS AND STATISTICAL MECHANICS

Course code: DMC29101/ DMC29102/ DMC29103/ DMC29104

(Minimum of eight is to be conducted)

1. Verification of distribution law using Monte-Carlo Method.
2. Verification of Stefan's-Boltzmann law.
3. Specific heat of a liquid by cooling – graphical method.
4. To determine Stefan's Constant.
5. To determine the coefficient of thermal conductivity of a bad conductor by Lee and Charlton's disc method.
6. To determine the coefficient of thermal conductivity of copper by Searle's Apparatus.
7. To determine the Coefficient of Thermal Conductivity of Cu by Angstrom's Method.
8. Determination of moment of inertia of Irregular body by Torsional pendulum method.
9. Determine young's modulus of a material by Koenig's method.
10. To study the variation of thermo emf across two junctions of a thermocouple with temperature.

11. Measurement of Planck's constant using black body radiation.
12. Determine boiling point of a liquid using Platinum resistance thermometer.
13. To determine the temperature co-efficient of resistance by Platinum resistance thermometer.
14. To determine Mechanical Equivalent of Heat, J, by Callender and Berne's constant flow method.
15. To record and analyze the cooling temperature of a hot object as a function of time using a thermocouple and suitable data acquisition system.
16. To calibrate Resistance Temperature Device (RTD) using Null Method/Off-Balance Bridge.

Reference Books:

- Advanced Practical Physics for students, B.L.Flint&H.T.Worsnop, 1971, Asia Publishing House.
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
- A Text Book of Practical Physics, InduPrakash and Ramakrishna, 11th Edition, 2011, KitabMahal, New Delhi.
- A Laboratory Manual of Physics for Undergraduate Classes, D.P. Khandelwal, 1985, Vani Publication.

SEMESTER IV

Course code: DMD29001/ DMD29002/ DMD29003/ DMD29004

Credits: Theory – 04, Practical – 02 **Theories: 60 Lectures**

COURSE OUTCOME:

After the completion of the course, Students will be able to

CO1.Specify the classification and characteristics of Fourier theorem

CO2.Learn in detail with application, superposition of simple harmonic motion

CO3.Understand in detail with application of wave motion

CO4.Deliberate in detail with examples Sound, wave optics and transducers

CO5.Learn the details of Interference, diffraction and polarization

CO6.Learn in detail with application of acoustics

WAVES AND OPTICS: DSC 4

Unit-1

Analysis of Complex Waves: Fourier's Theorem- Application to saw tooth wave and square wave. **(03 Lectures)**

Superposition of simple harmonic motion:

Superposition of two simple harmonic motion; Lissajous' figures. Damped vibration; Equation for damped vibrations. Forced vibration; solution in exponential form, Resonance, Expression for amplitude and phase at resonance.

Superposition of two collinear harmonic oscillations: Linearity and Superposition Principle. (1) Oscillations having equal frequencies and (2) Oscillations having different frequencies (Beats).

(11 Lectures)

Wave Motion:

Progressive waves; Differential equation of wave motion; Relation between amplitude and intensity. Expression for velocity of progressive waves in a medium; Newton's formula, Laplace's correction.

Transverse waves on a string. Travelling and standing waves on a string. Normal Modes of a string. Expression for frequency of vibration of a stretched string, harmonics. Group velocity, Phase velocity. Longitudinal vibrations in a rod; Kundt's tube experiment.

(10 Lectures)

Sound: Intensity and loudness of sound - Decibels - Intensity levels - musical notes - musical scale. Acoustics of buildings: Reverberation and time of reverberation, Absorption coefficient, Sabine's formula, measurement of reverberation time. Acoustic aspects of halls and auditoria.

(06 Lectures)

Unit-2

Transducers: Types of transducers, dynamic microphone and loudspeaker-construction, working and their characteristics, Piezo electrical transducer.

(03 Lectures)

Wave Optics: Electromagnetic nature of light. Definition and Properties of wave front. Huygens Principle.

(03 Lectures)

Interference: Interference: Review of basic concepts, Coherent sources, and conditions for constructive and destructive interference.

Coherent source by division of amplitude: Interference in Thin Films: – reflected and transmitted light, color of thin films, theory of air wedge, theory of Newton's rings; measurement of wavelength and refractive index.

Coherent source by division of division of wave front: Lloyd's Mirror and Fresnel's Biprism. Michelson's interferometer; Measurement of λ and $d\lambda$. **(11**

Lectures)

Diffraction: Fresnel and Fraunhoffer diffraction. Explanation of rectilinear propagation of light. Theory of the zone plate and comparison with convex lens. Fresnel diffraction at a straight edge. Fraunhoffer diffraction at a single slit. Transmission grating: theory for the case of normal incidence**.**
(06 Lectures)

Polarization: Double refraction in uniaxial crystals. Huygens's theory. Positive and negative crystal. Principle refractive indices. Huygens's constructions of ordinary and extraordinary wave fronts in a uniaxial crystal, retarding plates. Production and analysis of linearly, circularly and elliptically polarized light. Optical activity, Fresnel's theory, Lorentz half shade polarimeter.

(07 Lectures)

Reference Books:

- Fundamentals of Optics, F A Jenkins and H E White, 1976, McGraw-Hill. Principles of Optics, B.K. Mathur, 1995, Gopal Printing
- Fundamentals of Optics, H.R. Gulati and D.R. Khanna, 1991, R. Chand Publication
- Brijlal and N Subramanyam: Waves and Oscillations, 2nd edition, Vikas publishing house Pvt. Ltd., New Delhi.
- S K Gupta, O P Varma: Waves and Oscillations, 3rd edition, R.Chand& Co., New Delhi.
- R.L. Saihgal, A Text Book of Sound, S.Chand& Company Ltd. New Delhi, Reprint 1990.

PHYSICS LAB-DSC 4A LAB: WAVES AND OPTICS

Course code: DMD29101/ DMD29102/ DMD29103/ DMD29104

(Minimum of eight is to be conducted)

1. To determine wavelength of sodium light using Newton's Rings.
2. To determine wavelength of sodium light using Fresnel Biprism.

3. To determine wavelength of Sodium light using plane diffraction Grating.
4. Air wedge – Determination of thickness of a thin paper/diameter of a thin wire
5. Cauchy's constants using spectrometer.
6. Polarization – Determination of unknown concentration of sugar solution by graphical method using a polarimeter.
7. Diffraction at a Straight wire -To determine the diameter of the Straight wire
8. Helmholtz resonator-determination of frequency of tuning fork
9. To determine the Refractive Index of the Material of a given Prism using Sodium Light.
10. To study Lissajous Figures
11. Kundt's tube experiment – Velocity of sound in air at room temperature
12. To investigate the motion of coupled oscillators
13. To determine the Frequency of an Electrically Maintained Tuning Fork by Melde's Experiment and to verify λ^2 – T Law
14. Familiarization with Schuster`s focusing; determination of angle of prism
15. To measure the intensity using photo sensor and laser in diffraction patterns of single and double slits.

Reference Books:

- Advanced Practical Physics for students, B.L. Flint & H.T. Worsnop, 1971, Asia Publishing House.
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
- A Text Book of Practical Physics, InduPrakash and Ramakrishna, 11th Edition, 2011, KitabMahal, New Delhi.

SEMESTER V

Course code: DME29201/ DME29202/ DME29203/ DME29204

Credits: Theory – 04, Practical – 02 **Theories: 60 Lectures**

COURSE OUTCOME:

After the completion of the course, Students will be able to

CO1.Write down in detail with application of crystal structure

CO2.Write down the details of Elementary lattice dynamics

CO3.Deliberate in detail with examples Magnetic properties of matter

CO4.Identify the characteristics of elementary band theory

CO5.Learn the classification and characteristics of superconductivity

CO6.Understand the elastic properties of solids and lattice vibrations

SOLID STATE PHYSICS: DSE 1B

Unit-1

Crystal Structure: Solids: Amorphous and Crystalline Materials. Lattice TranslationVectors.Lattice with a Basis – Central and Non-Central Elements. Unit Cell. Miller Indices. Reciprocal Lattice. Types of Lattices. Brillouin Zones. Diffraction of X-rays by Crystals. Bragg's Law. Bragg spectrometer. Continuous x-ray spectra, Duane and Hunt limit. Characteristic x-ray spectra. Mosley law and its significance.

(10 Lectures)

Elementary Lattice Dynamics: Lattice Vibrations and Phonons: Linear Monatomic and Diatomic Chains. Acoustical and Optical Phonons. Qualitative Description of the Phonon Spectrum in Solids. Dulong and Petit's Law, Einstein and Debye theories of specific heat of solids.

(09 Lectures)

Magnetic Properties of Matter: Dia, Para, Ferri and Ferromagnetic Materials. Classical Langevin Theory of dia – and Paramagnetic Domains. Quantum Mechanical Treatment of Paramagnetism. Curie's law, Weiss's Theory of Ferromagnetism and Ferromagnetic Domains. Discussion of B-H Curve. Hysteresis and Energy Loss.

(11 Lectures)

Unit-2

Electrical Properties of metals: Free electron theory, Quantum theory, Conductivity of metals on the basis of free electron theory- Ohm's law.

(04 Lectures)

Dielectric Properties of Materials: Polarization. Local Electric Field at an Atom. Depolarization Field. Electric Susceptibility.Polarizability.Clausius Mosotti Equation. Classical Theory of Electric Polarizability.Normal and Anomalous Dispersion.Cauchy and Sellmeir relations. Langevin-Debye equation. Complex Dielectric Constant. Optical Phenomena. Application: Plasma Oscillations, Plasma Frequency, Plasmon's.

(10 Lectures)

Elementary band theory: Kronig Penny model. Band Gaps.Conductors, Semiconductors and insulators. P and N type Semiconductors, carrier concentration in intrinsic semiconductor, Fermi energy, effect of temperature and concentration on Fermi energy, Conductivity of Semiconductors, mobility, Hall Effect, Hall coefficient.

(10 Lectures)

Superconductivity: Experimental Results. Critical Temperature. Critical magnetic field. Meissner effect. Type I and type II Superconductors, London's Equation and Penetration Depth. Isotope effect.BCS theory, application of Superconductors.

(06 Lectures)

Reference Books:

- Introduction to Solid State Physics, Charles Kittel, 8th Ed., 2004, Wiley India Pvt. Ltd.
- Elements of Solid State Physics, J.P. Srivastava, 2nd Ed., 2006, Prentice-Hall of India

- Introduction to Solids, Leonid V. Azaroff, 2004, Tata Mc-Graw Hill
- Solid State Physics, Neil W. Ashcroft and N. David Mermin, 1976, Cengage Learning
- Solid State Physics, Rita John, 2014, McGraw Hill
- Solid-state Physics, H. Ibach and H Luth, 2009, Springer
- Elementary Solid State Physics, 1/e M. Ali Omar, 1999, Pearson India
- Solid State Physics, M.A. Wahab, 2011, Narosa Publications

PRACTICALS-DSE LAB: SOLID STATE PHYSICS

Course code: DME29301/ DME29302/ DME29303/ DME29304

(Minimum of eight is to be conducted)

1. Determination of energy gap of a semiconductor using Meter Bridge.
2. Determination Fermi energy of metal (copper).
3. To measure the Dielectric Constant of a given solid Materials
4. Study of LDR characteristics.
5. Verification of Inverse square law for light Intensity using a Photo-diode.
6. Bridge rectifier with and without filters.
7. Clipping and clamping circuits using diodes.
8. Zener diode as a voltage regulator.
9. Study of powder X-ray photograph-the determination of inter planar distances.
10. To determine value of Planck's constant using LEDs of at least 4 different colors.
11. To determine value of Boltzmann constant using V-I characteristic of PN diode.
12. Study of Hall Effect.
13. To determine the refractive index of a dielectric layer using SPR
14. To study the PE Hysteresis loop of a Ferroelectric Crystal.
15. To measure the resistivity of a semiconductor (Ge) crystal with temperature by four-probe method (from room temperature to 150 ^{o}C) and to determine its band gap
16. To draw the BH curve of iron using a Solenoid and determine the energy loss from Hysteresis.
17. To determine the complex dielectric constant and plasma frequency of metal using Surface Plasmon resonance (SPR)
18. Measurement of Magnetic susceptibility of solids.

Reference Books

- Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
- A Text Book of Practical Physics, InduPrakash and Ramakrishna, 11th Ed., 2011, KitabMahal, New Delhi
- Elements of Solid State Physics, J.P. Srivastava, 2nd Ed., 2006, Prentice-Hall of India

Skill Enhancement Course (SEC) (Credit: 02 each)

SEMESTER V

Course code: DME29601/ DME29602/ DME29603/ DME29604
Credits: Theory – 02 **Theories: 30 Lectures**

COURSE OUTCOME:

After the completion of the course, Students will be able to

CO1.Understand the characteristics of fossil fuel

CO2.Learn in detail with application of wind energy

CO3.Specify in detail with application of ocean energy and hydro energy

CO4.Identify the characteristics of geothermal energy

CO5.Deliberate the characteristics of electromagnetic energy

CO6.Deliberate the characteristics of piezoelectric energy harvesting

RENEWABLE ENERGY AND ENERGY HARVESTING: SEC 1A

Fossil fuels and Alternate Sources of energy: Fossil fuels and Nuclear Energy, their limitation, need of renewable energy, non-conventional energy sources. An overview of developments in Offshore Wind Energy, Tidal Energy, Wave energy systems, Ocean Thermal Energy Conversion, solar energy, biomass, biochemical conversion, biogas generation, geothermal energy tidal energy, Hydroelectricity.
(03 Lectures)

Solar energy: Solar energy, its importance, storage of solar energy, solar pond, non convective solar pond, applications of solar pond and solar energy, solar water heater, flat

plate collector, solar distillation, solar cooker, solar green houses, solar cell, absorption air conditioning. Need and characteristics of photovoltaic (PV) systems, PV models and equivalent circuits, and sun tracking systems.
(06 Lectures)

Wind Energy harvesting: Fundamentals of Wind energy, Wind Turbines and different electrical machines in wind turbines, Power electronic interfaces, and grid interconnection topologies.
(03 Lectures)
Ocean Energy: Ocean Energy Potential against Wind and Solar, Wave Characteristics and Statistics, Wave Energy Devices. **(03 Lectures)**

Tide characteristics and Statistics, Tide Energy Technologies, Ocean Thermal Energy, Osmotic Power, Ocean Bio-mass.
(02 Lectures)

Geothermal Energy: Geothermal Resources, Geothermal Technologies. **(02 Lectures)**

Hydro Energy: Hydropower resources, hydropower technologies, environmental impact of hydro power sources.
(02 Lectures)

Piezoelectric Energy harvesting: Introduction, Physics and characteristics of piezoelectric effect, materials and mathematical description of piezoelectricity, Piezoelectric parameters and modeling piezoelectric generators, Piezoelectric energy harvesting applications, Human power **(04 Lectures)**

Electromagnetic Energy Harvesting: Linear generators, physics mathematical models, recent applications **(02 Lectures)**
Carbon captured technologies, cell, batteries, power consumption **(02 Lectures)**

Environmental issues and Renewable sources of energy, sustainability. **(01 Lecture)**

Demonstrations and Experiments

1. Demonstration of Training modules on solar energy, wind energy, etc.
2. Conversion of vibration to voltage using piezoelectric materials
3. Conversion of thermal energy into voltage using thermoelectric modules.

Reference Books:

- Non-conventional energy sources - G.D Rai - Khanna Publishers, New Delhi
- Solar energy - M P Agarwal - S Chand and Co. Ltd.
- Solar energy - Suhas P Sukhative Tata McGraw - Hill Publishing Company Ltd.
- Godfrey Boyle, “Renewable Energy, Power for a sustainable future”, 2004, Oxford University Press, in association with The Open University.
- Dr. P Jayakumar, Solar Energy: Resource Assesment Handbook, 2009
- J.Balfour, M.Shaw and S. Jarosek, Photovoltaics, Lawrence J Goodrich (USA).
- http://en.wikipedia.org/wiki/Renewable_energy

SEMESTER VI

Course code: DMF29201/ DMF29202/ DMF29203/ DMF29204
Credits: Theory – 04, Practical – 02 **Theories: 60 Lectures**

COURSE OUTCOME:

After the completion of the course, Students will be able to

CO1.Write down in detail with application and properties of nuclei

CO2.Learn in detail with application and nuclear models

CO3.Understand in detail with examples radioactivity

CO4.Identify the details of particle physics

CO5.Write down the details of particle accelerators

CO6.Write down the details of detector for nuclear radiator

Nuclear & Particle Physics: DSE 1B

Unit-1

General Properties of Nuclei: Constituents of nucleus and their Intrinsic properties, quantitative facts about size, mass, charge density (matter energy), binding energy, average binding energy and its variation with mass number, main features of binding energy versus mass number curve, N/A plot, angular momentum, parity, magnetic moment, electric moments, nuclear excites states.

(10 Lectures)

Nuclear Models: Liquid drop model approach, semi empirical mass formula and binding energy, significance of various terms, condition of nuclear stability. Concept of Nuclear force.

(06 Lectures)

Nuclear Reactions: Types of Reactions, Conservation Laws, kinematics of reactions, Q-

value, Rutherford alpha scattering.

(04 Lectures)

Radioactivity decay :(a) Alpha decay: basics ofα-decay processes, Geiger Nuttall law, α-decay spectroscopy. (b) beta-decay: energy kinematics for beta-decay, positron emission, electron capture, neutrino hypothesis. (c) Gamma decay

(06 Lectures)

Nuclear fission and fusion: Estimation of the fission energy on the basis of liquid drop model, controlled and uncontrolled chain reaction, four factor formula, types of reactor

(04 Lectures)

Unit-2

Interaction of Nuclear Radiation with matter: Gamma ray interaction through matter, photoelectric effect, Compton scattering, pair production, neutron interaction with matter.

(06 Lectures)

Detector for Nuclear Radiations: GM Counter. Basic principle of Scintillation. Detectors and construction of photo-multiplier tube (PMT). Semiconductor Detectors (Si &Ge) for charge particle and photon detection (concept of charge carrier and mobility)

(06 Lectures)

Particle Accelerators: Linear accelerator, Cyclotron, Betatron.

(04 Lectures)

Particle physics: Particle interactions; basic features, types of particles and its families. Symmetries and Conservation Laws: energy and momentum, angular momentum, parity, baryon number, Lepton number, Isospin, Strangeness and charm, concept of quark model, color quantum number and gluons.

(14 Lectures)

PRACTICALS –DSE LAB: NUCLEAR AND PARTICLE PHYSICS

Course code: DMF29301/ DMF29302/ DMF29303/ DMF29304

(Minimum of eight is to be conducted)

1. Study of Characteristics of GM tube and determination of operating voltage, plateau length.

2. Verification of inverse square law of gamma rays.
3. Study of Absorption coefficient of gamma particle.
4. Verification of inverse square law of beta rays.
5. Half-life of K-40
6. Determine the ionization potential of Xenon.
7. Cockcroft Walton voltage multiplier.
8. Solar cell characteristics – To determine efficiency and fill factor.
9. Determine wavelength of laser light.
10. To determine the value of e/m by magnetic focusing.
11. Determination of range of electron in aluminum using GM counter
12. Study of Absorption coefficient of beta particle
13. To determine the wavelength of H-alpha emission line of Hydrogen atom.
14. Study of counting statistics using background radiation using GM counter
15. Study of radiation in various materials (e.g. KSO4 etc.). Investigation of possible radiation in different routine materials by operating GM at operating voltage.

Reference Books:

- Introductory nuclear Physics by Kenneth S. Krane (Wiley India Pvt. Ltd., 2008).
- Concepts of nuclear physics by Bernard L. Cohen. (Tata Mcgraw Hill, 1998).
- Introduction to the physics of nuclei & particles, R.A. Dunlap. (Thomson Asia, 2004)
- Introduction to Elementary Particles, D. Griffith, John Wiley & Sons
- Quarks and Leptons, F. Halzen and A.D. Martin, Wiley India, New Delhi
- Basic ideas and concepts in Nuclear Physics - An Introductory Approach by K. Heyde (IOP- Institute of Physics Publishing, 2004).
- Radiation detection and measurement, G.F. Knoll (John Wiley & Sons, 2000).
- Theoretical Nuclear Physics, J.M. Blatt &V.F.Weisskopf (Dover Pub.Inc., 1991)