B.Sc Semester - V

(Session: 2018-19, 2019-20)

(Credits–3, Hours:45, Max. Marks.-60 Min. Pass Marks-21)

18005

RELATIVITY, QUANTUM MECHANICS, ATOMIC, MOLECULAR AND NUCLEAR PHYSICS

UNIT-I

Reference systems, inertial frames, Galilean invariance and conservation laws, propagation of light, Michelson - Morley experiment, search for ether Postulates for the special theory of relativity, Lorentz transformations, length contraction, time dilation, velocity addition theorem, variation of mass with velocity, mass - energy equivalence, particle with a zero rest mass Compton effect. (9 Hrs)

UNIT-II

Origin of the quantum theory : Failure of classical physics to explain the phenomena such as black body spectrum, photoelectric effect Wave particle duality and uncertainty principle , de Broglie's hypothesis for matter waves; the concept of wave and group velocities, evidence for diffraction and interference of particles, experimental demonstration of matter waves. Davisson and Germer's experiment. Consequence of de - Broglie's concepts , quantisation in hydrogen atom, energies of a particle in a box, wave packets. Consequence of the uncertainty relation: gamma ray microscope, diffraction at a slit. (9 Hrs)

UNIT-III

Quantum Mechanics: Schrodinger's equation, postulatory basis of quantum mechanics; operators, expectation values, transition probabilities, application to particle in one and three dimensional boxes, harmonic oscillator in one dimension, reflection at a step potential, transmission across a potential barrier. Hydrogen atom: Natural occurrence of n , l and m quantum numbers, The related physical quantities. (9 Hrs)

UNIT- IV

Spectra of hydrogen, deuteron and alkali atoms spectral terms, doublet fine structure, screening constants for alkali spectra for s, p , d and f states, selection rules. Discrete set of electronic energies of molecules, quantization of vibrational and rotational energies. Determination of internuclear distance, pure rotational and rotation vibration spectra. Dissociation limit for the ground and other electronic states, transition rules for pure vibration and electronic vibration spectra. Raman effect, Stokes and anti - Stokes lines, complementary character of Raman and infrared spectra, experimental arrangements for Raman Spectroscopy. (9 Hrs)

UNIT-V

Interaction of charged particle and neutrons with matter, working of nuclear detectors, G - M counter, proportional counter and scintillation counter, cloud chambers, spark chamber, emulsions. Structure of nuclei, basic properties (I, u,Q and binding energy), deuteron binding energy, p – p and n – p scattering and general concepts of nuclear forces. Beta decay, range of alpha particle, Geiger - Nuttal law. Gamow's explanation of beta decay, alpha decay and continuous and discrete spectra. Nuclear reactions, channels, compound nucleus, direct reaction (concepts). Shell model: Liquid drop model, fission and fusion (concepts), energy production in stars by p – p and carbon cycles (concepts). (9 Hrs)

Reference Books:

1. H.S.Mani and G.K.Mehta: Introduction to Modern Physics (Affiliated East West Press 1989)
2. A Beiser: Prospective of modern Physics
3. H.E.White: Introduction to Atomic Physics
4. Barrow : Introduction to Molecular Physics
5. R.P.Feynmann, R.B.Lighton and M. Sand: The Feynmann lectures on Physics (B.I.Publication Bombay, Delhi, Calcutta, Madras)
6. T.A.Littlefield and N. Thorley: Atomic and Nuclear Physics (Engineering Language Society)
7. H.A. Enge: Introduction to Nuclear Physics (Addision Wesly)
8. Eisenberg and Resnik: Quantum Physics of Atoms, Molecules, Solids, Nuclear Particles (John Wiley)
9. D.P.Khandelwal: Optics and Atomic Physics (Himalaya Publishing House, Bombay, 1988)

B.Sc Semester VI th

18006 - (Session: 2018-19, 2019-20)
(Credits–3, Hours:45, Max. Marks.-60 Min. Pass Marks-21)

SOLID STATE PHYSICS, SOLID STATE DEVICES AND ELECTRONICS

UNIT-I

Amorphous and crystalline solids, Elements of Symmetry, Seven system, cubic lattices, crystal planes, miller indices, Laue's equation of X - Ray diffraction, Bragg's law. Bonding in solids classification. Cohesive energy of solid. Madelung constant, evaluation of parameters. Specific heats of solids, classical theory (Dulong – Pet it's law). Einstein and Debye theories, vibrational modes of one dimentional monoatomic lattice, Dispersion relation, Brillouin Zone. (9 Hrs)

UNIT-II

Free electron model of a metal, solution of one dimentional Schrodinger equation in a constant potential I. Density of states. Fermi energy, Energy bands in a solid (Kronig - Penny model without mathematical details). Metals, Insulators and Semiconductors. Hall effect. Dia, para and ferromagnetism, Langevin's theory of dia and paramagnetism. Curie - Weiss's law. Qualitative description of Ferromagnetism (Magnetic domains), B-H curve and Hysteresis loss (9 Hrs)

UNIT-III

Intrinsic semiconductors, carrier conce ntration in thermal equilibrium, fermi level, impurity semiconductor, donor and acceptor levels, diode equation, junctions, junction breakdown, Depletion width and junction capacitance, abrupt junction, tunnel diode, Zener diode, Light emitting diode, sola r cell, Bipolar transistors, p n p and n p n transistors, characteristics of transistors, different configurations, current amplification factor, FET(9 Hrs)

UNIT-IV

Half and full wave rectifier, rectifier efficiency ripple factor, Bridge rectifier, filters, inductor filter, L and TT filters, Zener diode, regulated power supply, Applications of transistor : Bipolar transistor as amplifier. Single stage and CE small signal amplifiers, Emitter followers, Transistor as power amplifier, transistor as oscillator, W e in - Bridge Oscillator and Hartley oscillator (9 Hrs)

UNIT -V

Introduction to computer organization, time sharing and multiprogramming systems, Window based word processing packages, MS word. Introduction to 'C' programming and application to simple problems of arranging numbers in ascending/ descending orders: sorting a given data in an array, solution of simultaneous equation. (9 Hrs)

Reference Books:

1. Introduction to Solid state Physi9cs: C.Kitttel
2. Solid state Physics: A.J.Dekker
3. Electronic Circuits: Mottershead
4. Electronic Circuits Millmann and Halkias
5. Principles of Electronics : V.K.Mehta
6. Computer Fundamentals: Balaguruswami

1.9.18

B Sc Semester V (Physics Practicle)

(Session: 2018-19, 2019-20)

18019 - (Credits:2,Hours :30)

(Note: Practical classes will be held round the year but practical examination shall be conducted only in semester-VI . Duration of Practical Examinations shall be of 4 hours)

1.Determination of Planck's constant.

2.Determination of e/m using Thomson's tube.

3.Determination of e by Millikan'smethod.

4.Study of spectra of hydrogen and deuterium (Rydberg constant and ratio of masses of electron proton).
5.Absorption spectrum of iodine vapour.
6.Study of alkali or alkaline earth spectra using a concave grating.
7.Study of Zeeman effect for determination of Lande g-factor.
8.Analysis of a given band spectrum.
9.Study of Raman spectrum using laser as an excitation source.
10.Study of absorption of alpha and beta rays.
11.Study of statistics in radioactive measurement.
12.Goniometric study of crystal faces.
13.Determination of dielectric constant.
14.Hysteresis curve of transformer core.
15.Hall probe method for measurement of magnetic field.
16.Specific resistance and energy gap of a semiconductor.
17.Characteristics of transistor.

B.Sc. Semester VI (PHYSICS EXPERIMENTS)

(Session: 2018-19, 2019-20)

Credits:2,Hours :30)

1.Characteristics of tunnel diode.
2.Study of voltage regulation system.
3.Study of regulated power supply.
4.Study of Lissajous figures using a CRO.
5.Study of VTVM.
6.Study of RC and TC coupled amplifiers.
7.Study of AF and R Foscillators.
8.Find roots of f(x) = 0 by using Newton Raphson method.
9.Find roots of f(x) = 0 by using secant method.
10. Determination of Planck's constant.
17.Determination of e/m using Thomson's tube.
18.Determination of e by Millikan's method Integration by Simpson rule.
11.To find the value of y at a given value of x by Runga- kutta method.
12.String manipulations.
13.Towers of Honoi (Nonrecursive).
14.Finding first four perfect numbers.
15.Quadratic interpolatian using Newton's forward difference formula of degree two.

Practical marks scheme

Work Marks distribution Laboratory note book/project :10,Viva voce: 10
Experiments (2) 30 (each 15 marks) Total Marks: 50

19.18

B.Sc. Semester III (PHYSICS)
(Session: 2018-19, 2019-20)

(Credits–3, Hours–45, Max.Marks.-60 Min. Pass Marks-21)

18003- WAVES, ACOUSTICS AND OPTICS

UNIT-I

Waves in media: One dimensional wave equation and its solution.Speed of transverse waves on a uniform string, speed of longitudinal waves in a fluid, energy density and energy transmission in waves, typical measurements. Waves over liquid surface: gravity waves and ripples. Group velocity and phase velocity, their measurements. Harmonics and the quality of sound, examples. Production and detection of ultrasonic and infrasonic waves and applications. Reflection, refraction and diffraction of sound: Acoustic impedence of a medium, percentage reflection and refraction at a boundary, impedence matching for transducers, diffraction of sound, principle of a sonar system, sound ranging. (9 Hrs)

UNIT-II

Fermat's principle of extremum path, the aplantic points of a sphere and other applications.Cardinal points of an optical system, thick lens combinations, Lagrange equation of magnification, telescopic combinations, telephoto lenses.

Monochromatic aberrations and their reduction, spherical mirrors and Schmidt corrector plates, aplantic points, oil immersion objectives, meniscus lens.

Optical instruments: Entrance and exit pupils, need for a multiple lens eyepiece. Common types of eye pieces. (Ramsden's and Hygen's eyepieces). (9Hrs)

UNIT-III

Interference of light: The principle of superposition. Two slit interference. Coherence requirement for the sources, optical path retardations, lateral shift of fringes, Rayleigh refractometer. Localized fringes, thin films. Haidinger fringes: Fringes of equal inclination. Michelson interferometer, its application for precision

determination of wavelength. Wavelength difference and the width of spectral lines. Intensity distribution in multiple beam interference. Tolansky fringes, Fabry- Perot interferometer and etalon. Twymann-Green interferometer and its uses,Fresnel's biprism, Lloyd mirror. (9Hrs)

UNIT-IV

Diffraction,Double refraction and optical rotation, Fresnel's and Frounhofer diffraction.

Fresnel diffraction: Fresnel's half-period zones, zone plates, straight edge, rectilinear propagation. Fraunhofer diffraction: Diffraction at a slit, half period zones, phasor diagram and integral calculus methods, the intensity distribution, diffraction at a circular aperture and a circular disc, resolution of images, Rayleigh criterion, resolving g power of telescope and microscope systems. Diffraraction gratings: Diffraction at N parallel slits, intensity distribution, plane diffraction grating, reflection grating and blazed gratings. Concave grating and different mountings resolving power of a grating and comparison with resolving power of prism and of a Fabry - Perot etalon.
Double refraction and optical rotation: Reflection in uniaxial crystals, phase retardation plates, double image prism. Rotation of plane of polarization . Origin of optical rotation in liquids and in crystals. (10 Hrs)

Unit-V

Laser system: Purity of a spectral line. Coherence length and coherence time, spatial coherence of a source, Einstein's A and B coefficients, Spontaneous and induced emissions, condition for Laser action, population inversion. Types of Laser: Ruby and He-Ne lasers and semiconductor lasers. Application of lasers: Application in communication, Holography and non linear optics. (Polarization P including higher order terms in E and generation of harmonics). (8 Hrs)

TEXT AND REFERENCE BOOKS :

1.A.K.Ghatak, Physical Optics.
2.D.P.Khandelwal Optics and Atomic Physics (Himalaya Publishing House,Bombay,1988)
3.F.Smith and J.H.Thomson : Manchester Physics series : Optics (English language book society andjohn wiley,1971)
4.Born and Wolf : Optics
5.K.D.Moltev : Optics (Oxford University Press)
6.Sears ; Optics
7.Jenkins and White : Fundamental of Optics (Mc Graw Hill)
8.B.B.Laud : Lasers and Non Linear optics (Wiley Eastern 1985)
9.Smith and Thomson : Optics (John Wiley and sons)
10.Berkely Physics course : Vl. III Waves and Oscillations
11.I.G.Main, Vibrations and Waves (Cambridge University Press)
12.H.J.Pain ' The Physics of Vibration and Waves (Macmillan 1975)
13.Text book of Optics : B.K.Mathur
14.B.Sc. (Part III) Physics : Editor : B.P.Chandra, MP Hindi Granth Academy

K.G. ARTS & SCIENCE (AUTONOMOUS) COLLEGE, RAIGARH (C.G.)

DEPARTMENT OF PHYSICS

SYLLABUS BASED ON SEMESTER SYSTEM
(Three Year Pass Course/Honors Degree Course)
SESSION : 2018-2019 & 2019-2020

FACULTY: SCIENCE

SUBJECT: PHYSICS (PRACTICAL SUBJECT)

SEMESTER: IV

TITLE OF THE PAPER: Thermodynamics, Kinetic theory and Statistical Physics

Scheme for Theory Paper:

- The syllabus comprises of one theory paper in I semester.
- Each paper is divided into five units.
- Each theory paper will be of 75(60 external+15 internal) marks.
- Theory question paper will be unit wise and section wise i.e. section A, B and C.

SECTION- A : Objective Type (in few words) 30words.

There will be 15 Questions to be set, 3 questions from each unit and 10 questions to be attempted, each question carries 2 marks.

SECTION – B: Short answer type 60 words.

There will be 7 questions to be set, 1 from each unit and five questions to be attempted each question carries 4 marks.

SECTION- C : Long answer/Essay type Question

There will be 5 questions to be set, 1 from each unit and 2 to be attempted each question carries 10 marks.

MARKS SCHEME-

Type of Questions	Questions to be set from each unit	Total no. of Questions	Questions to be solved from set	Marks assigned	Total marks
Objective(a few words)	03	15	10	02	20
Short answer type questions	01	07	05	04	20
Long/Essay type questions	01	05	02	10	20
					Total= 60

1.9.18

B.Sc.Semester IV(PHYSICS)
(Session: 2018-19, 2019-20)

(Credits–3, Hours:45, Max. Marks.-60 Min. Pass Marks-21)

Elective A: 18004 - A

THERMODYNAMICS, KINETIC THEORY AND STATISTICAL PHYSICS

UNIT-I

The laws of thermodynamics-The Zeroth law, concept of path function and point function, various indicator diagrams, work done by and on the system, first law of thermodynamics, internal energy as a state function, Reversible and irreversible change, Carnot theorem and the second law of thermodynamics. Different versions of the second law. Claussius theorem inequality. Entropy, change of entropy in simple cases. (i) Isothermal expansion of an ideal gas,
(ii) Reversible isochoric process, (iii) Free adiabatic expansion of an ideal gas, Entropy of the universe. Principle of increase of entropy, The thermodynamics scale of temperature, its identity with the perfect gas scale. Impossibility of attaining the absolute zero, third law of thermodynamics. (9 Hrs)

UNIT-II

Thermodynamic relationships: thermodynamics variables.. extensive and intensive. Maxwell's general relationships, application to Joule Thomson cooling and adiabatic cooling in a general system. Vander Waals gas. Clausius-Clapeyron heat equation. Thermodynamic potentials and equilibrium of thermodynamical systems relation with thermodynamical variables. Cooling due to adiabatic demagnetization, production and measurement of very low temperatures. Black body radiation: Pure temperature dependence, Stefan-Boltzman law, pressure of radiation.Special distribution of BB radiation. Weins displacement law, Rayleigh-Jean's law, the ultraviolet catastrophy, Planck's quantum postulates. Planck's law, complete fit with experiment. (9 Hrs)

UNIT-III

Maxwellian distribution of speeds in an ideal gas: Distribution of speeds and of velocities, experimental verification, distinction between mean, rms and most probable speed value. Doppler broadening of spectral lines. Transport phenomena in gases: Molecular collisions, collision cross section, estimate of molecular diameter and Mean free path Transport of mass, momentum and energy and interrelationship, dependence on temperature and pressure.(8Hrs)

UNIT-IV

The statistical basic of thermodynamics: Probability and thermodynamic probability, principle of equal a priori probabilities, statically postulates. Concept of Gibbs's ensemble. Accessible and inaccessible states. Concept of

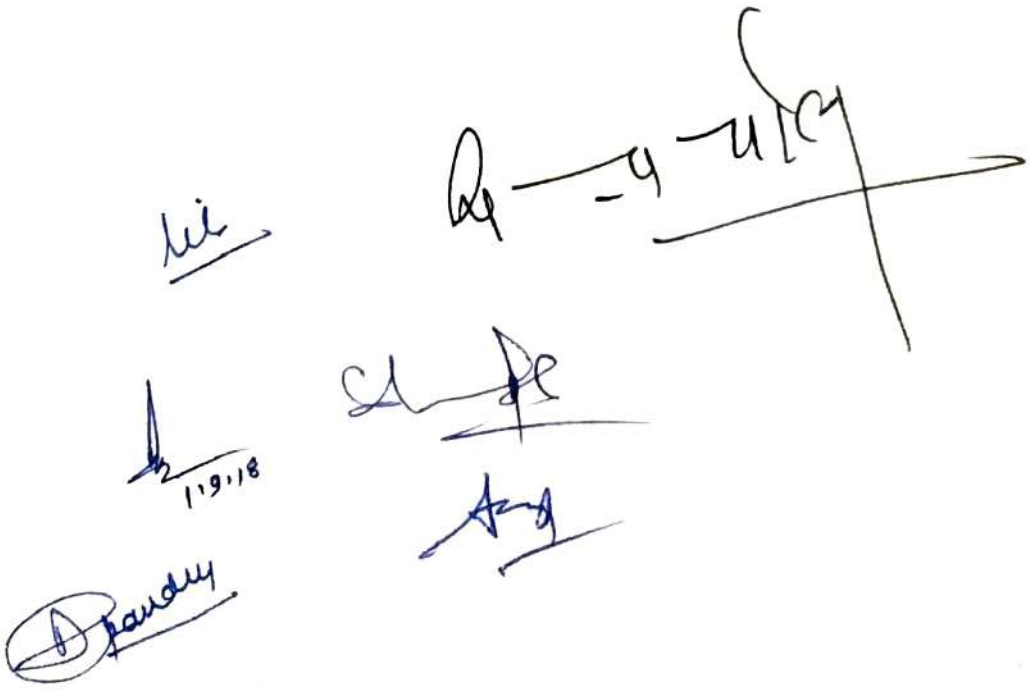
phase space, canonical phase space. Gamma phase space and mud phase space. Equilibrium before two systems in thermal contact, Probability and entropy. Boltzman entropy relation. Boltzman Canonical distribution law and its applications. Law of equipartition of energy. Transition to quantum statistics. 'H' as a natural constant and its implication, cases of particle in a one - dimensional box and one - dimensional harmonic oscillator. (9 Hrs)

UNIT-V

Indistinguishability of particles and its consequences. Bose – Einstein's and Fermi – Dirac conditions, concept of partition function, Derivation of Maxwell- Boltzmann, Bose - Einstein and Fermi - Dirac, Statistics through Canonical partition function . Limits of B -E and F -D statistics to M - B statistics, Application of B - E statistics to black body radiation. Application of F -D statistics to free electron in a metal. (10Hrs)

TEXT AND REFERENCE BOOKS :

1.B.B. Laud "Introduction to statistical mechanics"(Macmillan 1981)
2.F. Reif : "Statistical Physics"(Mcgraw Hill,1988)
3.K.Haung: "Statistical Physics"(Wiley Eastern 1988)
4.thermal and Statistical Physics : nR.K.Singh Y.M.Gupta and S. Sivaraman
5.Physics (Part-2): Editor, Prof. : B.P.Chandra, M.P.Hindi Granth Academy



B.Sc. Semester III (PHYSICS EXPERIMENTS)

18018- (Session: 2018-19, 2019-20)

(Credits:2,Hours :30)

(Note: Practical classes will be held round the year but practical examination shall be conducted only in semester- IV

Duration of Practical Examinations shall be of 4 hours)

1.Study of monochromatic defects of images.
2.Determining the principle points of a combination of lenses.
3.Study of interference of light (biprism or wedge film).
4.Study of diffraction at a straightedge or a single slit.
5.Study of F-P etalon fringes.
6.Use of diffraction grating and resolving limit.
7.Resolving limit of a telescope system.
8.Polarization of light by reflection: also cos-squared law
9.Study of optical rotation for any system.
10.Study of laser asa monochromatic coherent source.
11.Study of divergence of a laser beam.

Session 20 20 **B.Sc. Semester IV** (Session 2018-19, 2019-20)

PHYSICSPRACTICALS(Credits : 2, Hours : 30)

1.Study of Brownian motion
2.Study of conversion of mechanical energy into heat.
3.Study of adiabatic expansion of a gas.
4.Heating efficiency of electrical kettle with varying voltages
5.Resistance thermometry.
6.Thermo emf thermometry
7.Conduction of heat through poor conductors of different geometries
8.Experimental study of probability distribution for a two option system using a colored dice.
9.Speed of waves on a streches string.
10.Studies on torsonialwaves in a lumped system.
11.Studies of interference with two concurrent sources of sound
12.Chaladni's figures with varying excitation and loading points.
13.Measurement of sound intensities with different situation.
14.Characteristics of a microphone loudspeaker system.

Practical marks scheme.

Work Marks distribution
Laboratory note book/project 10
Viva voce 10
Experiments (2) 3 0 (each 15 marks) Total 50

TEXT AND REFERENCE BOOKS:

D.P.Khandelwal : Optics and Atomic Physics (Himalaya Publishing House,Bombay,1988)
D.P.Khandelwal : " A Laboratoryr5 Manual for Undergraduate Classes (Vanui Publication, House, NewDelhi)

B.Sc.Semester IV(PHYSICS)

(Session: 2018-19, 2019-20)

(Credits–3, Hours:45, Max. Marks.-60 Min. Pass Marks-21)

18004-B Elective B: **Medical Physics**

Unit–I

PHYSICS OF THE BODY-I

Mechanics of the body: Skeleton, forces, and body stability. Muscles and the dynamics of body movement Physics of body crashing; Energy household of the body: Energy balance in the body, Energy consumption of the body, Heat losses of the body, Pressure system of the body: Physics of breathing, Physics of the cardiovascular system PHYSICS OF THE BODY-II Acoustics of the body: Nature and characteristics of sound, Production of speech, Physics of the ear, Diagnostics with sound and ultrasound Optical system of the body: Physics of the eye. Electrical system of the body: Physics of the nervous system, Electrical signals and information transfer (10 Hrs)

Unit–II

PHYSICS OF DIAGNOSTIC AND THERAPEUTIC SYSTEMS:X-RAYS: Electromagnetic spectrum–production of x-rays–x-ray spectra-Brehmsstrahlung- Characteristic x-ray–X-ray tubes–Coolidge tube–x-ray tube design–tube cooling stationary mode – Rotating anode x - ray tube –Tube rating – quality and intensity of x - ray. X - ray generator circuits – half wave and full wave rectification–filament circuit–kilo voltage circuit–high frequency generator– exposure timer – HT cables.

RADIATION PHYSICS: Radiation units-exposure-absorbed dose–units: rad, gray-relative biological effectiveness-effective dose-inverse square law - interaction of radiation with matter-linear attenuation coefficient. Radiation Detectors–Thimble chamber-condenser chambers–Geiger counter–Scintillation counter–ionization chamber–Dosimeters–survey methods– area monitors–TLD and semiconductor detectors. (9 Hrs)

Unit-III

MEDICAL IMAGING PHYSICS:X-ray diagnostics and imaging, Physics of nuclear magnetic resonance (NMR) – NMR imaging – MRI Radiological imaging – Radiography – Filters – grids – cassette – X - ray film – film processing – fluoroscopy – computed tomography scanner – principle function – display – generations – 34 mammography. Ultrasound imaging – magnetic resonance imaging – thyroid uptake system – Gamma camera (Only Principle, function and display) (8 Hrs)

1.9.18

Unit-IV

RADIATION THERAPY PHYSICS: Radiotherapy – kilo voltage machines– deep therapy machines – Telecobalt machines – Medical linear accelerator. Basics of Teletherapy units – deep x - ray, Telecobalt units, medical linear accelerator – Radiation protection – external beam characteristics – phantom – dose maximum and build up – bolus – percentage depth dose – tissue – air ratio – back scatter factor. (8 Hrs)

Unit – V

RADIATION AND RADIATION PROTECTION: Principles of radiation protection – protective materials - radiation effects – somatic, genetic stochastic & deterministic effect , Personal monitoring devices – TLD film badge – pocket dosimeter. Radiation dosimetry, Natural radioactivity, Biological effects of radiation, Radiation monitors.

PHYSICS OF DIAGNOSTIC AND THERAPEUTIC SYSTEMS-II

Diagnostic nuclear medicine: Radiopharmace uticals for radioisotope imaging, Radioisotope imaging equipment, Single photon and positron emission tomography Therapeutic nuclear medicine: Interaction between radiation and matter Dose and isodose in radiation treatment (10 Hrs)

Reference Books:

Physics, J.R. Cameron and J.G.Skofronick, Wiley (1978) - Jayapee Brothers Medical Publishing Pvt. Ltd. New Delhi (2003) - Lippincot Willia ms and Wilkins (1990) - Williams and Wilkins, Third edition (2003) Boone Lippincot Williams and Wilkins, Second Edition (2002) - H E Johns and Cunningham.

B.Sc.Semester IV (PHYSICS)

18004-C (Session: 2018-19, 2019-20)

(Credits–3, Hours:45, Max. Marks.-60 Min. Pass Marks-21)

Elective C: Bio-Physics

Unit-I

Building Blocks & Structure of Living State: Atoms and ions, molecules essential for life, what is life. Living state interactions: Forces and molecular bonds, electric & thermal interactions, electric dipoles, casimir interactions, domains of physics in biology. (9 Hrs)

Unit- II

Heat Transfer in biomaterials: Heat Transfer Mechanism, The Heat equation, Joule heating of tissue. Living State Thermodynamics: Thermodynamic equilibrium, first law of thermodynamics and conservation of energy. Entropy and second law of thermodynamics, Physics of many particle systems, Two state systems, continuous energy distribution, Composite systems, Casimir contribution of free energy, Protein folding and unfolding. (11 Hrs)

Unit- III

Open systems and thermodynamics: Enthalpy, Gibbs Free Energy and chemical potential, activation energy and rate constants, enzymatic reactions, ATP hydrolysis & synthesis, Entropy of mixing, The grand canonical ensemble, Hemoglobin. (7 Hrs)

Unit-IV

Diffusion and transport Maxwell - Boltzmann statistics, Fick's law of diffusion, sedimentation of Cell Cultures, diffusion in a centrifuge, diffusion in an electric field, Lateral diffusion in membranes, Navier stokes equation, low Reynold's Number Transport, Active and passive membrane transport. (7 Hrs)

Unit-V

Fluids: Laminar and turbulent fluid flow, Bernoulli's equation, equation of continuity, venture effect, Fluid dynamics of circulatory systems, capillary action. Bioenergetics and Molecular motors: Kinesins, Dyneins, and microtubule dynamics, Brownian motion, ATP synthesis in Mitochondria, Photosynthesis in Chloroplasts, Light absorption in biomolecules, vibrational spectra of bio - biomolecules. (11 Hrs)

Reference Books:

B.Sc. Semester V (PHYSICS)

(July 2016, 2017, 2018)

(Credits–3, Hours:45, Max. Marks.-60 Min. Pass Marks-21)

18005-

RELATIVITY, QUANTUM MECHANICS, ATOMIC, MOLECULAR AND NUCLEAR PHYSICS

UNIT-I

Reference systems, inertial frames, Galilean invariance and conservation laws, propagation of light, Michelson - Morley experiment, search for ether Postulates for the special theory of relativity, Lorentz transformations, length contraction, time dilation, velocity addition theorem, variation of mass with velocity, mass - energy equivalence, particle with a zero rest mass Compton effect. (9 Hrs)

UNIT-II

Origin of the quantum theory : Failure of classical physics to explain the phenomena such as black body spectrum, photoelectric effect Wave particle duality and uncertainty principle , de Broglie's hypothesis for matter waves; the concept of wave and group velocities, evidence for diffraction and interference of particles, experimental demonstration of matter waves. Davisson and Germer's experiment. Consequence of de - Broglie's concepts , quantisation in hydrogen atom, energies of a particle in a box, wave packets. Consequence of the uncertainty relation: gamma ray microscope, diffraction at a slit. (9 Hrs)

UNIT-III

Quantum Mechanics: Schrodinger's equation, postulatory basis of quantum mechanics; operators, expectation values, transition probabilities, application to particle in one and three dimensional boxes, harmonic oscillator in one dimension, reflection at a step potential, transmission across a potential barrier. Hydrogen atom: Natural occurrence of n , l and m quantum numbers, The related physical quantities. (9 Hrs)

UNIT- IV

Spectra of hydrogen, deuteron and alkali atoms spectral terms, doublet fine structure, screening constants for alkali spectra for s, p , d and f states, selection rules. Discrete set of electronic energies of molecules, quantization of vibrational and rotational energies. Determination of internuclear distance, pure rotational and rotation vibration spectra. Dissociation limit for the ground and other electronic states, transition rules for pure vibration and electronic vibration spectra. Raman effect, Stokes and anti - Stokes lines, complementary character of Raman and infrared spectra, experimental arrangements for Raman Spectroscopy. (9 Hrs)

26.9.15

22.3.17

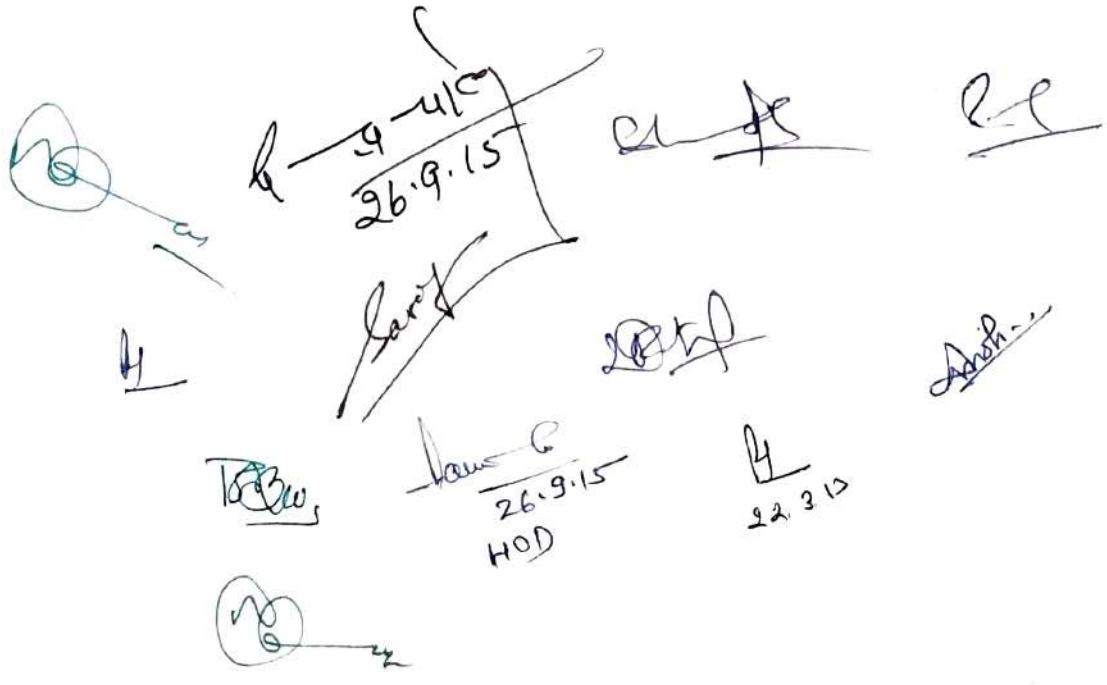
26.9.15
HOD

UNIT-V

Interaction of charged particle and neutrons with matter, working of nuclear detectors, G - M counter, proportional counter and scintillation counter, cloud chambers, spark chamber, emulsions. Structure of nuclei, basic properties (I, u,Q and binding energy), deuteron binding energy, p – p and n – p scattering and general concepts of nuclear forces. Beta decay, range of alpha particle, Geiger - Nuttal law. Gamow's explanation of beta decay, alpha decay and continuous and discrete spectra. Nuclear reactions, channels, compound nucleus, direct reaction (concepts). Shell model: Liquid drop model, fission and fusion (concepts), energy production in stars by p – p and carbon cycles (concepts). (9 Hrs)

Reference Books:

1. H.S.Mani and G.K.Mehta: Introduction to Modern Physics (Affiliated East West Press 1989)
2. A Beiser: Prospective of modern Physics
3. H.E.White: Introduction to Atomic Physics
4. Barrow : Introduction to Molecular Physics
5. R.P.Feynmann, R.B.Lighton and M. Sand: The Feynmann lectures on Physics (B.I.Publication Bombay, Delhi, Calcutta, Madras)
6. T.A.Littlefield and N. Thorley: Atomic and Nuclear Physics (Engineering Language Society)
7. H.A. Enge: Introduction to Nuclear Physics (Addision Wesly)
8. Eisenberg and Resnik: Quantum Physics of Atoms, Molecules, Solids, Nuclear Particles (John Wiley)
9. D.P.Khandelwal: Optics and Atomic Physics (Himalaya Publishing House, Bombay, 1988)



18006–

B.Sc. Semester VI (Physics)

(Jan. 2017, 2018, 2019) (Credits–3, Hours:45, Max. Marks.-60 Min. Pass Marks-21)

SOLID STATE PHYSICS, SOLID STATE DEVICES AND ELECTRONICS

UNIT-I

Amorphous and crystalline solids, Elements of Symmetry, Seven system, cubic lattices, crystal planes, miller indices, Laue's equation of X - Ray diffraction, Bragg's law. Bonding in solids classification. Cohesive energy of solid. Madelung constant, evaluation of parameters. Specific heats of solids, classical theory (Dulong – Pet it's law). Einstein and Debye theories, vibrational modes of one dimentional monoatomic lattice, Dispersion relation, Brillouin Zone. (9 Hrs)

UNIT-II

Free electron model of a metal, solution of one dimentional Schrodinger equation in a constant potential l. Density of states. Fermi energy, Energy bands in a solid (Kronig - Penny model without mathematical details). Metals, Insulators and Semiconductors. Hall effect. Dia, para and ferromagnetism, Langevin's theory of dia and paramagnetism. Curie - Weiss's law. Qualitative description of Ferromagnetism (Magnetic domains), B-H curve and Hysteresis loss (9 Hrs)

UNIT-III

Intrinsic semiconductors, carrier conce ntration in thermal equilibrium, fermi level, impurity semiconductor, donor and acceptor levels, diode equation, junctions, junction breakdown, Depletion width and junction capacitance, abrupt junction, tunnel diode, Zener diode, Light emitting diode, sola r cell, Bipolar transistors, p n p and n p n transistors, characteristics of transistors, different configurations, current amplification factor, FET(9 Hrs)

UNIT-IV

Half and full wave rectifier, rectifier efficiency ripple factor, Bridge rectifier, filters, inductor filter, L and TT filters, Zener diode, regulated power supply, Applications of transistor : Bipolar transistor as amplifier. Single stage and CE small signal amplifiers, Emitter followers, Transistor as power amplifier, transistor as oscillator, W e in - Bridge Oscillator and Hartley oscillator (9 Hrs)

UNIT -V

Introduction to computer organization, time sharing and multiprogramming systems, Window based word processing packages, MS word. Introduction to 'C' programming and application to simple problems of arranging numbers in ascending/ descending orders: sorting a given data in an array, solution of simultaneous equation. (9 Hrs)

Reference Books:

1. Introduction to Solid state Physi9cs: C.Kitttel
2. Solid state Physics: A.J.Dekker
3. Electronic Circuits: Mottershead
4. Electronic Circuits Millmann and Halkias
5. Principles of Electronics : V.K.Mehta
6. Semiconductor Devices : S.M. Sze
7. Computer Fundamentals: Balaguruswami

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B.Sc. Semester V (PHYSICS EXPERIMENTS)

18019- (July 2016, 2017, 2018) (Credits:2,Hours :30)

(Note: Practical classes will be held round the year but practical examination shall be conducted only in semester-VI . Duration of Practical Examinations shall be of 4 hours)

1. Determination of Planck's constant.
2. Determination of e/m using Thomson's tube.
3. Determination of e by Millikan'smethod.
4. Study of spectra of hydrogen and deuterium (Rydberg constant and ratio of masses of electron proton).
5. Absorption spectrum of iodine vapour.
6. Study of alkali or alkaline earth spectra using a concave grating.
7. Study of Zeeman effect for determination of Lande g-factor.
8. Analysis of a given band spectrum.
9. Study of Raman spectrum using laser as an excitation source.
10. Study of absorption of alpha and beta rays.
11. Study of statistics in radioactive measurement.
12. Goniometric study of crystal faces.
13. Determination of dielectric constant.
14. Hysteresis curve of transformer core.
15. Hall probe method for measurement of magnetic field.
16. Specific resistance and energy gap of a semiconductor.
17. Characteristics of transistor.

B.Sc. Semester VI (PHYSICS EXPERIMENTS)

(Jan. 2017, 2018, 2019)(Credits:2,Hours :30)

1. Characteristics of tunnel diode.
2. Study of voltage regulation system.
3. Study of regulated power supply.
4. Study of Lissajous figures using a CRO.
5. Study of VTVM.
6. Study of RC and TC coupled amplifiers.
7. Study of AF and R Foscillators.
8. Find roots of f(x) = 0 by using Newton Raphson method.
9. Find roots of f(x) = 0 by using secant method.
10. Integration by Simpson rule.
11. To find the value of y at a given value of x by Runga- kutta method.
12. String manipulations.
13. Towers of Honoi (Nonrecursive).
14. Finding first four perfect numbers.
15. Quadratic interpolatian using Newton's forward difference formula of degree two.
16. Determination of Planck's constant.
17. Determination of e/m using Thomson's tube.
18. Determination of e by Millikan's method

Practical marks scheme

Work Marks distribution Laboratory note book/project :10,Viva voce: 10
Experiments (2) 30 (each 15 marks) Total Marks: 50

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DEPARTMENT OF PHYSICS

PHYSICS SYLLABUS

B. Sc.(Semester System)

Session 2016-17 & 2017-18

B.Sc., Semester- I(July-2016 & 2017)

PHYSICS(Credits–3, Hours–45) M.M.-60, Min. Passing Marks-21

18001- MECHANICS, OSCILLATIONS AND PROPERTIES OF MATTER

UNIT-1

Scalars and vectors, dot and cross products, triple vector products, gradient of a scalar field and its geometrical interpretation, divergence and curl of a vector field, line, surface and volume integrals, flux of a vector field. Gauss's divergence theorem, Green's theorem and Stokes theorem.

Functions of two and three variables, partial derivatives, geometrical interpretation of partial derivatives of functions of two variables.

Total differential of a function of two and three variables. Repeated integrals of a function of more than one variables, definition of a double and triple integral.

(8 Hrs)

UNIT-2

Laws of Motion, motion in a uniform field, components of velocity and acceleration in different coordinate systems (Cartesian, Cylindrical and Spherical) Uniformly rotating frame, centripetal acceleration,

Coriolis force and its application. Motion under a central force, Kepler's law. Gravitational law and field.

Potential due to a spherical body. Systems of particles. Center of mass, equation of motion, conservation of

linear & angular momentum, conservation of energy.

(10Hrs)

UNIT-3

Rigid body motion, rotational motion, moments of inertia and their products, principal moments & axes, introductory idea of Euler's equations. Potential well as periodic oscillations, case of harmonic oscillations, differential equation and its solution, kinetic and potential energy, examples of simple harmonic oscillations, spring and mass system, simple and compound pendulum, torsional pendulum.

(8 Hrs)

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JNIT-4

Bifilar oscillations, Helmholtz resonator, LC circuit, vibrations of a magnet, oscillations of two masses connected by a spring. Superposition of two simple harmonic motions of the same frequency,
Lissajous figures, case of different frequencies. Damped harmonic oscillator, power dissipation, quality factor, examples, driven (forced) harmonic oscillator, transient and steady states, power absorption, resonance,
resonance in systems with many degrees of freedom.

(9Hrs)

Note: (The emphasis here should be on the mechanical aspects and not on the details of the apparatus mentioned, which are indicated as applications of principle involved.)

UNIT-5

Elasticity, small deformations, Hooke's law, elastic constants for an isotropic solid and relations between them, beam supported at both the ends, cantilever, torsion of a cylinder, bending moment andshearing forces. Kinematics of moving fluids, equation of continuity. Euler's equation. Bernaulli's theorem,
viscous fluids, streamline and turbulent flow. Poiseulle's law. Capillary tube flow, Reynold's number, Stokes law. Surface tension. Pressure on a curved liquids surface, wetting.

(10Hrs)

TEXT AND REFERENCE BOOKS:

E.M. Purcell. Ed. Berkeley Physics Course Vol. Mechanics (Mc. Gr. Hill)
R.P. Feymman, R.B.Lighton and M. Sands,
The Feymman Lectures in Physics, VOL. I (B.P. Publication, Bombay, Delhi, Calcutta, Madras)
D.P.Khandelwal, Oscillations and Waves (Himalaya publishing House Bombay)
R.K.Ghose, The Mathematics of Waves and Vibrations (Macmillan 1975)
J.C.Upadhyaya –Mechanics (Hindi and English Edutional)
D.S.Mathur –Mechanics and properties of matter
Brij lal and sub ramanium –Oscillations and waves.
Resnick and Helliday –Volume –I.

26.11.16 26/11/16 26.11.2016

Session 2016-17 & 2017-18
B.Sc. Semester II(January-2017&2018)
PHYSICS(Credits –3, Hours –45) M.M.-60, Min. Passing Marks -21

18002- ELECTRICITY, MAGNETISM AND ELECTROMAGNETIC THEORY

UNIT-1

Coulombs law in vacuum expressed in vector forms, calculations of E for simple distributions of charge at rest, dipole and quadrupole fields. Work done on a charge in an electrostatic field expressed as a line integral conservative nature of the electrostatic field. Electric potentialϕ , $E = -\nabla\phi$
torque on a dipole ina uniform electric field and its energy, flux of the electric field. Gauss's law and its application for finding E for symmetric charge distributions, Gaussian pillbox, fields at the surface of a conductor, screening ofE field by a conductor, capacitors, electrostatic field energy, force per unit area of the surface of a conductor in an electric field, conducting sphere in a uniform electric field, point charge in front of a grounded infinite conductor.

(9 Hrs)

UNIT-2

Dielectrics, parallel plate capacitor with a dielectric, electric susceptibility, permittivity and dielectric constant, polarization and polarization vector, displacement vector D, molecular interpretation of Claussius-Mossotti equation.
Steady current, current density J, non steady current and continuity equation, Kirchoff's law and analysis of multi-loop circuits, rise and decay of current in LR and CR circuits, decay constants, transient in LCR circuits, AC circuits, complex numbers and their applications in solving AC circuits problems,complex impedance and reactance, series and .parallel resonance, Q- factor, power consumed by an AC circuit, power factor.

(9 Hrs)

UNIT-3

(Note: The emphasis here should be on the mechanical aspects and not on the details of the apparatus mentioned, which are indicated as applications of principle involved.)
E as an accelerating field, electron gun, case of discharge tube, linear accelerator, E as deflecting field, CRO, sensitivity. Transverse magnetic field B, 180° deflection , Mass spectrograph, curvatures of tracks for energy determination, principle of a cyclotron. Mutually perpendicular E & B fields, velocity selector, its resolution. Parallel E and B fields, positive ray parabolas,

discovery of isotopes, elements of mass spectrography, principle of magnetic focusing (lens). (9 Hrs)

UNIT-4

Force on a moving charge, Lorentz force equation and definition of B, force on a straight conductor carrying current in a uniform magnetic field, torque on a current loop, magnetic dipole moment, angular momentum and gyro-magnetic ratio. Biot's and Savart's law,calculation of H for simple geometrical situations. Ampere's law, Field due to a magnetic dipole, magnetization current, magnetization vector.

(9 Hrs)

UNIT-5

Electromagnetic induction, Faraday's law, electromotive force, $e = \int E.dr$, integral and differential forms of Faraday's law, Mutual and self inductance, Transformers, energy in a static magnetic field, Maxwell's displacement current, Maxwell's equations, Electromagnetic field energy density. The Wave equation satisfied by E and B, plane electromagnetic, waves in vacuum, Poynting's vector.

(9 Hrs)

TEXT AND REFERENCE BOOKS :

Berkeley Physics Course, Electricity and Magnetism, Ed E.M. Purcell (Mc Graw Hill)
Halliday and Resnik, Physics, Vol. II
D.J.Griffith, Introduction to Electrodynamics (Prentice–Hall of India)
Reitz an Milford, Electricity and Magnetism (Addison -Wesley)

18017 –

B.Sc.Semester I (PHYSICS EXPERIMENTS)

(July -2015,~~2016~~,~~2017~~) (Credits:2,Hours :30)

(Note: Practical classes will be held round the year but practical examination shall be conducted only in semester II. Duration of Practical Examinations shall be of 4 hours.)

1. Study of laws of parallel and perpendicular axes for moment of inertia.
2. Study of conservation of momentum in two dimensional oscillations.
3. Study of compound pendulum.
4. Study of damping of a bar pendulum under various mechanics.
5. Study of oscillations under a bifilar suspension.
6. Potential energy curves of a 1-Double system and oscillations in it for various amplitudes.
7. Study of oscillations of a mass under different combinations of springs.
8. Study of bending of a cantilever or a beam.
9. Study of torsion of wire (static and dynamic methods)
10. Study of flow of liquids through capillaries.
11. Determination of surface tension of a liquid by different methods.
12. Study of viscosity of a fluid by different methods.

B.Sc.Semester II (PHYSICS EXPERIMENTS)

(January-2016,~~2017~~,~~2018~~) (Credits : 2, Hours:30)

1. Characteristics of a ballistic galvanometer.
2. Setting up and using an electroscope or electrometer.
3. Use of a vibration magnetometer to study a field.
4. Study of B field due to a current.
5. Measurement of low resistance by Carey-Foster bridge or otherwise.
6. Measurement of inductance using impedance at different frequencies.
7. Study of decay of currents in LR and RC circuits.
8. Response curve for LCR circuit and resonance frequency and quality factor.
9. Senstivity of a cathode ray oscilloscope.
10. Characteristics of a choke.
11. Measurement of capacitance using impedance at different frequencies

Practical marks scheme.

Work Marks distribution: Laboratory note book/project:10, Viva voce:10 Experiments(2):30 (each15marks), Total Marks: 50

TEXT AND REFERENCE BOOKS :

1. B.Saraf et al, Mechanical Systems, (Vikas Publishing House, New Delhi.)
2. D.P.Khandelwal, A. Laborotatory manual of Physics for Undergraduate Classes(Vanui Publication,House, New Delhi)
3. C.G. L:ambe, Elements of Statistics (Longmans Green and Co London New York, Toronto)
4. C.Dixon, Numerical AnalysisS Lipsdutz and A poe, schaum's Outline of theory and Problems of programming with Fortran (McGraw–Hill Book Company, Singapore1986.)

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Code 18001

B.Sc. Semester I (PHYSICS)

(Session: 2018-19, 2019-20)

(Credits–3, Hours–45, Max.Marks.-60 Min. Pass Marks-21)

MECHANICS, OSCILLATIONS AND PROPERTIES OF MATTER

UNIT-1

Scalars and vectors, dot and cross products, triple vector products, gradient of a scalar field and its geometrical interpretation, divergence and curl of a vector field, line, surface and volume integrals, flux of a vector field. Gauss's divergence theorem, Green's theorem and Stokes theorem. Functions of two and three variables, partial derivatives, geometrical interpretation of partial derivatives of functions of two variables. Total differential of a function of two and three variables. Repeated integrals of a function of more than one variables, definition of a double and triple integral. (8 Hrs)

UNIT-2

Laws of Motion, motion in a uniform field, components of velocity and acceleration in different coordinate systems (Cartesian, Cylindrical and Spherical) Uniformly rotating frame, centripetal acceleration, Coriolis force and its application. Motion under a central force, Kepler's law. Gravitational law and field. Potential due to a spherical body. Systems of particles. Center of mass, equation of motion, conservation of linear & angular momentum, conservation of energy. (10Hrs)

UNIT-3

Rigid body motion, rotational motion, moments of inertia and their products, principal moments & axes, introductory idea of Euler's equations. Potential well as periodic oscillations, case of harmonic oscillations, differential equation and its solution, kinetic and potential energy, examples of simple harmonic oscillations, spring and mass system, simple and compound pendulum, torsional pendulum. (8 Hrs)

UNIT-4

Bifilar oscillations, Helmholtz resonator, LC circuit, vibrations of a magnet, oscillations of two masses connected by a spring. Superposition of two simple harmonic motions of the same frequency, Lissajous figures, case of different frequencies. Damped harmonic oscillator, power dissipation, quality factor, examples, driven (forced) harmonic oscillator, transient and steady states, power absorption, resonance, resonance in systems with many degrees of freedom. (9Hrs)

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(Note: The emphasis here should be on the mechanical aspects and not on the details of the apparatus mentioned, which are indicated as applications of principle involved.)

UNIT-5

Elasticity, small deformations, Hooke's law, elastic constants for an isotropic solid and relations between them, beam supported at both the ends, cantilever, torsion of a cylinder, bending moment and shearing forces. Kinematics of moving fluids, equation of continuity. Euler's equation. Bernaulli's theorem, viscous fluids, streamline and turbulent flow. Poiseulle's law. Capillary tube flow, Reynold's number,Stokes law. Surface tension. Pressure on a curved liquids surface, wetting. (10Hrs)

TEXT AND REFERENCE BOOKS:

1. E.M. Purcell. Ed. Berkeley Physics Course Vol. Mechanics (Mc. Gr. Hill)
2. R.P. Feymman, R.B.Lighton and M. Sands,The Feymman Lectures in Physics, VOL. I (B.P. Publication,Bombay, Delhi, Calcutta, Madras)
3. D.P.Khandelwal, Oscillations and Waves (Himalaya publishing House Bombay)
4. R.K.Ghose, The Mathematics of Waves and Vibrations (Macmillan 1975)
5. J.C.Upadhyaya– Mechanics (Hindi and English Edition)
6. D.S.Mathur–Mechanics and properties of matter
7. Brijlal and subramanium – Oscillations and waves.
8. Resnick and Helliday,Physics, Volume – I.

B.Sc. Semester II (PHYSICS) 18002
(Session: 2018-19, 2019-20)
(Credits–3, Hours–45, Max.Marks.-60 Min. Pass Marks-21)

ELECTRICITY, MAGNETISM AND ELECTROMAGNETIC THEORY

UNIT-1

Coulombs law in vacuum expressed in vector forms, calculations of E for simple distributions of charged at rest, dipole and quadrupole fields. Work done on a charge in an electrostatic field expressed as a line integral conservative nature of the electrostatic field. Electric potential ϕ, $E = -\nabla \phi$ torque on a dipole in a uniform electric field and its energy, flux of the electric field. Gauss's law and its application for finding E for symmetric charge distributions, Gaussian pillbox, fields at the surface of a conductor, screening of E field by a conductor, capacitors, electrostatic field energy, force per unit area of the surface of a conductor in an electric field, conducting sphere in a uniform electric field, point charge in front of a grounded infinite conductor.

(9 Hrs)

UNIT - 2

Dielectrics, parallel plate capacity or with a dielectric, electric susceptibility, permittivity and dielectric constant, polarization and polarization vector, displacement vector D, molecular interpretation of Claussius – Mossotti equation. Steady current, current density J, non steady curren ts and continuity equation, Kirchoff's law and analysis of multiloop circuits, rise and decay of current in LR and CR circuits, decay constants, transient in LCR circuits, AC circuits, complex numbers and their applications in solving AC circuits problems, complex impedence and reactance, series and .parallel resonance, Q factor, power consumed by an AC circuit, power factor. (9 Hrs)

UNIT-3

(Note: The emphasis here should be on the mechanical aspects and not on the details of the apparatus mentioned, which are indicated as applications of principle involved.)

E as an accelerating field, electron gun, case of discharge tube, linear accelerator, E as deflecting field, CRO, sensitivity. Transverse magnetic field B, 180° deflection , Mass spectrograph, curvatures of tracks for energy determination, principle of a cyclotron. Mutually perpendicular E & B fields, velocity selector, its resolution. Parallel E and B fields, positive ray parabolas, discovery of isotopes, elements of mass spectrography, principle of magnetic focusing (lens).

(9 Hrs)

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UNIT-4

Force on a moving charge, Lorentz force equation and definition of B, force on a straight conductor carrying current in a uniform magnetic field, torque on a current loop, magnetic dipole moment, angular momentum and gyromagnetic ratio. Biot and Savart's law, calculation of H for simple geometrical situations. Ampere's law, Field due to a magnetic dipole, magnetization current, magnetization vector. (9 Hrs)

UNIT-5

Electromagnetic induction, Faraday's law, electromotive force, $e=\int E.dr.$, integral and differential forms of Faraday's law, Mutual and self inductance, Transformers, energy in a static magnetic field, Maxwell's displacement current, Maxwell's equations, Electromagnetic field energy density. The Wave equation satisfied by E and B , plane electromagnetic, waves in vacuum, Poynting's vector. (9 Hrs)

TEXT AND REFERENCE BOOKS :

1. Berkeley Physics Course, Electricity and Magnetism, Ed E.M. Purcell (Mc Graw Hill)
2. Halliday and Resnik, Physics, Vol. II
3. D.J.Griffith, Introduction to Electrodynamics (Prentice – Hall of India)
4. Reitz an Milford, Electricity and M agnetism (Addison - Wesley)

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B.Sc.Semester I (PHYSICS EXPERIMENTS)

18017 - (Session: 2018-19, 2019-20)

(Credits:2,Hours :30)

(Note: Practical classes will be held round the year but practical examination shall be conducted only in semester II. Duration of Practical Examinations shall be of 4 hours.)

1.Study of laws of parallel and perpendicular axes for moment of inertia.
2.Study of conservation of momentum in two dimensional oscillations.
3.Study of compound pendulum.
4.Study of damping of a bar pendulum under various mechanics.
5.Study of oscillations under a bifilar suspension.
6.Potential energy curves of a 1-Double system and oscillations in it for various amplitudes.
7.Study of oscillations of a mass under different combinations of springs.
8.Study of bending of a cantilever or a beam.
9.Study of torsion of wire (static and dynamic methods)
10.Study of flow of liquids through capillaries.
11.Determination of surface tension of a liquid by different methods.
12.Study of viscosity of a fluid by different methods.

B.Sc.Semester II (PHYSICS EXPERIMENTS)

(Session: 2018-19, 2019-20)

(Credits : 2, Hours:30)

1.Characteristics of a ballistic galvanometer.
2.Setting up and using an electroscope or electrometer.
3.Use of a vibration magnetometer to study a field.
4.Study of B field due to a current.
5.Measurement of low resistance by Carey-Foster bridge or otherwise.
6.Measurement of inductance using impedance at different frequencies.
7.Study of decay of currents in LR and RC circuits.
8.Response curve for LCR circuit and resonance frequency and quality factor.
9.Senstivity of a cathode ray oscilloscope.
10.Characteristics of a choke.
11.Measurement of capacitance using impedance at different frequencies

Practical marks scheme.

Work Marks distribution: Laboratory note book/project:10, Viva voce:10 Experiments(2):30 (each15marks), Total Marks: 50

TEXT AND REFERENCE BOOKS :

1. B.Saraf et al, Mechanical Systems, (Vikas Publishing House, New Delhi.)
2. D.P.Khandelwal, A. Laborotatory manual of Physics for Undergraduate Classes(Vanui Publication,House, New Delhi)
3. C.G. L:ambe, Elements of Statistics (Longmans Green and Co London New York, Toronto)

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nd half) hours.
cided by the BOS)

B.Sc. Semester III (PHYSICS)
(July 2015, 2016, 2017)

(Credits–3, Hours–45, Max.Marks.-60 Min. Pass Marks-21)

18003- WAVES, ACOUSTICS AND OPTICS

UNIT-I

Waves in media: One dimensional wave equation and its solution.Speed of transverse waves on a uniform string, speed of longitudinal waves in a fluid, energy density and energy transmission in waves, typical measurements. Waves over liquid surface: gravity waves and ripples. Group velocity and phase velocity, their measurements. Harmonics and the quality of sound, examples. Production and detection of ultrasonic and infrasonic waves and applications. Reflection, refraction and diffraction of sound: Acoustic impedence of a medium, percentage reflection and refraction at a boundary, impedence matching for transducers, diffraction of sound, principle of a sonar system, sound ranging. (9 Hrs)

UNIT-II

Fermat's principle of extremum path, the aplantic points of a sphere and other applications.Cardinal points of an optical system, thick lens combinations, Lagrange equation of magnification, telescopic combinations, telephoto lenses.

Monochromatic aberrations and their reduction, spherical mirrors and Schmidt corrector plates, aplantic points, oil immersion objectives, meniscus lens.

Optical instruments: Entrance and exit pupils, need for a multiple lens eyepiece. Common types of eye pieces. (Ramsden's and Hygen's eyepieces). (9Hrs)

UNIT-III

Interference of light: The principle of superposition. Two slit interference. Coherence requirement for the sources, optical path retardations, lateral shift of fringes, Rayleigh refractometer. Localized fringes, thin films. Haidinger fringes: Fringes of equal inclination. Michelson interferometer, its application for precision
determination of wavelength. Wavelength difference and the width of spectral lines. Intensity distribution in multiple beam interference. Tolansky fringes, Fabry- Perot interferometer and etalon. Twymann-Green interferometer and its uses,Fresnel's biprism, Lloyd mirror. (9Hrs)

UNIT-IV

Diffraction,Double refraction and optical rotation, Fresnel's and Frounhofer diffraction.

Fresnel diffraction: Fresnel's half-period zones, zone plates, straight edge, rectilinear propagation. Fraunhofer diffraction: Diffraction at a slit, half

26-9-15

period zones, phasor diagram and integral calculus methods, the intensity distribution, diffraction at a circular aperture and a circular disc, resolution of images, Rayleigh criterion, resolving g power of telescope and microscope systems. Diffraction gratings. Diffraction at N parallel slits, intensity distribution, plane diffraction grating, reflection grating and blazed gratings. Concave grating and different mountings resolving power of a grating and comparison with resolving power of prism and of a Fabry - Perot etalon. Double refraction and optical rotation: Reflection in uniaxial crystals, phase retardation plates, double image prism. Rotation of plane of polarization. Origin of optical rotation in liquids and in crystals. (10 Hrs)

Unit-V

Laser system: Purity of a spectral line. Coherence length and coherence time, spatial coherence of a source, Einstein's A and B coefficients, Spontaneous and induced emissions, condition for Laser action, population inversion. Types of Laser: Ruby and He-Ne lasers and semiconductor lasers. Application of lasers: Application in communication, Holography and non linear optics. (Polarization P including higher order terms in E and generation of harmonics). (8 Hrs)

TEXT AND REFERENCE BOOKS :

1. A.K.Ghatak, Physical Optics.
2. D.P.Khandelwal Optics and Atomic Physics (Himalaya Publishing House,Bombay,1988)
3. F.Smith and J.H.Thomson : Manchester Physics series : Optics (English language book society andjohn wiley,1971)
4. Born and Wolf : Optics
5. K.D.Moltev : Optics (Oxford University Press)
6. Sears : Optics
7. Jenkins and White : Fundamental of Optics (Mc Graw Hill)
8. B.B.Laud : Lasers and Non Linear optics (Wiley Eastern 1985)
9. Smith and Thomson : Optics (John Wiley and sons)
10. Berkely Physics course : Vl. III Waves and Oscillations
11. I.G.Main, Vibrations and Waves (Cambridge University Press)
12. H.J.Pain : The Physics of Vibration and Waves (Macmillan 1975)
13. Text book of Optics : B.K.Mathur
14. B.Sc. (Part III) Physics : Editor : B.P.Chandra, MP Hindi Granth Academy

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Syllabus chosen by the students under CBCS.

half) hours.
decided by the BOS)

18004A- **B.Sc.Semester IV(PHYSICS)**
(January-2016, 2017, 2018)
(Credits–3, Hours:45, Max. Marks.-60 Min. Pass Marks-21)
Elective A:

THERMODYNAMICS, KINETIC THEORY AND STATISTICAL PHYSICS

UNIT-I

The laws of thermodynamics-The Zeroth law, concept of path function and point function, various indicator diagrams, work done by and on the system, first law of thermodynamics, internal energy as a state function, Reversible and irreversible change, Carnot theorem and the second law of thermodynamics. Different versions of the second law. Claussius theorem inequality. Entropy, change of entropy in simple cases. (i) Isothermal expansion of an ideal gas,
(ii) Reversible isochoric process, (iii) Free adiabatic expansion of an ideal gas, Entropy of the universe. Principle of increase of entropy, The thermodynamics scale of temperature, its identity with the perfect gas scale. Impossibility of attaining the absolute zero, third law of thermodynamics. (9 Hrs)

UNIT-II

Thermodynamic relationships: thermodynamics variables.. extensive and intensive. Maxwell's general relationships, application to Joule Thomson cooling and adiabatic cooling in a general system. Vander Waals gas. Clausius-Clapeyron heat equation. Thermodynamic potentials and equilibrium of thermodynamical systems relation with thermodynamical variables. Cooling due to adiabatic demagnetization, production and measurement of very low temperatures. Black body radiation: Pure temperature dependence, Stefan-Boltzman law, pressure of radiation.Special distribution of BB radiation. Weins displacement law, Rayleigh-Jean's law, the ultraviolet catastrophy, Planck's quantum postulates. Planck's law, complete fit with experiment. (9 Hrs)

UNIT-III

Maxwellian distribution of speeds in an ideal gas: Distribution of speeds and of velocities, experimental verification, distinction between mean, rms and most probable speed value. Doppler broadening of spectral lines. Transport phenomena in gases: Molecular collisions, collision cross section, estimate of molecular diameter and Mean free path Transport of mass, momentum and energy and interrelationship, dependence on temperature and pressure.(8Hrs)

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HOD
22.3.17

UNIT-IV

The statistical basis of thermodynamics Probability and thermodynamic probability Principle of equal a priori probabilities Statically independent Concept of Gibbs ensemble Accessible and inaccessible states Concept of phase space Canonical phase space Gamma phase space and mu phase space Equilibrium between systems in thermal contact Irreversibility and entropy Boltzman entropy relation Boltzman Canonical distribution law and its applications Law of equipartition of energy Transition to quantum statistics H as a natural constant and its implication Cases of particle in a one - dimensional box and the one dimensional harmonic oscillator (9 Hrs)

UNIT-V

Indistinguishability of particles and its consequences Bose – Einstein's and Fermi – Drac conditions Concept of partition function Derivation of Maxwell Boltzmann Bose - Einstein and Fermi - Drac Statistics through Canonical partition function Limits of B -E and F -D statistics to M - B statistics Application of B - E statistics to black body radiation Application of F -D statistics to free electron in a metal (10 Hrs)

TEXT AND REFERENCE BOOKS

1 B B Laud "Introduction to statistical mechanics" (Macmillan 1981).
2 F Reif "Statistical Physics" (Mcgraw Hill 1965)
3 K Huang "Statistical Physics" (Wiley Eastern 1963)
4 Thermal and Statistical Physics - R K Singh, K M Gupta and S Singhania

B.Sc.Semester IV(PHYSICS)

(January-2016, 2017, 2018)

(Credits–3, Hours:45, Max. Marks.-60 Min. Pass Marks-21)

18004-B Elective B: **Medical Physics**

Unit–I

PHYSICS OF THE BODY-I

Mechanics of the body: Skeleton, forces, and body stability. Muscles and the dynamics of body movement Physics of body crashing; Energy household of the body: Energy balance in the body, Energy consumption of the body, Heat losses of the body, Pressure system of the body: Physics of breathing, Physics of the cardiovascular system PHYSICS OF THE BODY-II Acoustics of the body: Nature and characteristics of sound, Production of speech, Physics of the ear, Diagnostics with sound and ultrasound Optical system of the body: Physics of the eye. Electrical system of the body: Physics of the nervous system, Electrical signals and information transfer (10 Hrs)

Unit–II

PHYSICS OF DIAGNOSTIC AND THERAPEUTIC SYSTEMS:X-RAYS: Electromagnetic spectrum–production of x-rays–x-ray spectra-Brehmsstrahlung- Characteristic x-ray–X-ray tubes–Coolidge tube–x-ray tube design–tube cooling stationary mode – Rotating anode x - ray tube –Tube rating – quality and intensity of x - ray. X - ray generator circuits – half wave and full wave rectification–filament circuit–kilo voltage circuit–high frequency generator– exposure timer – HT cables.

RADIATION PHYSICS: Radiation units-exposure-absorbed dose–units: rad, gray-relative biological effectiveness-effective dose-inverse square law - interaction of radiation with matter-linear attenuation coefficient. Radiation Detectors–Thimble chamber-condenser chambers–Geiger counter–Scintillation counter–ionization chamber–Dosimeters–survey methods– area monitors–TLD and semiconductor detectors. (9 Hrs)

Unit-III

MEDICAL IMAGING PHYSICS:X-ray diagnostics and imaging, Physics of nuclear magnetic resonance (NMR) – NMR imaging – MRI Radiological imaging – Radiography – Filters – grids – cassette – X - ray film – film processing – fluoroscopy – computed tomography scanner – principle function – display – generations – 34 mammography. Ultrasound imaging – magnetic resonance imaging – thyroid uptake system – Gamma camera (Only Principle, function and display) (8 Hrs)

Unit-IV

RADIATION THERAPY PHYSICS: Radiotherapy – kilo voltage machines–deep therapy machines – Telecobalt machines – Medical linear accelerator. Basics of Teletherapy units – deep x - ray, Telecobalt units, medical linear accelerator – Radiation protection – external beam characteristics – phantom

– dose maximum and build up – bolus – percentage depth dose – tissue – air ratio – back scatter factor. (8 Hrs)

Unit – V

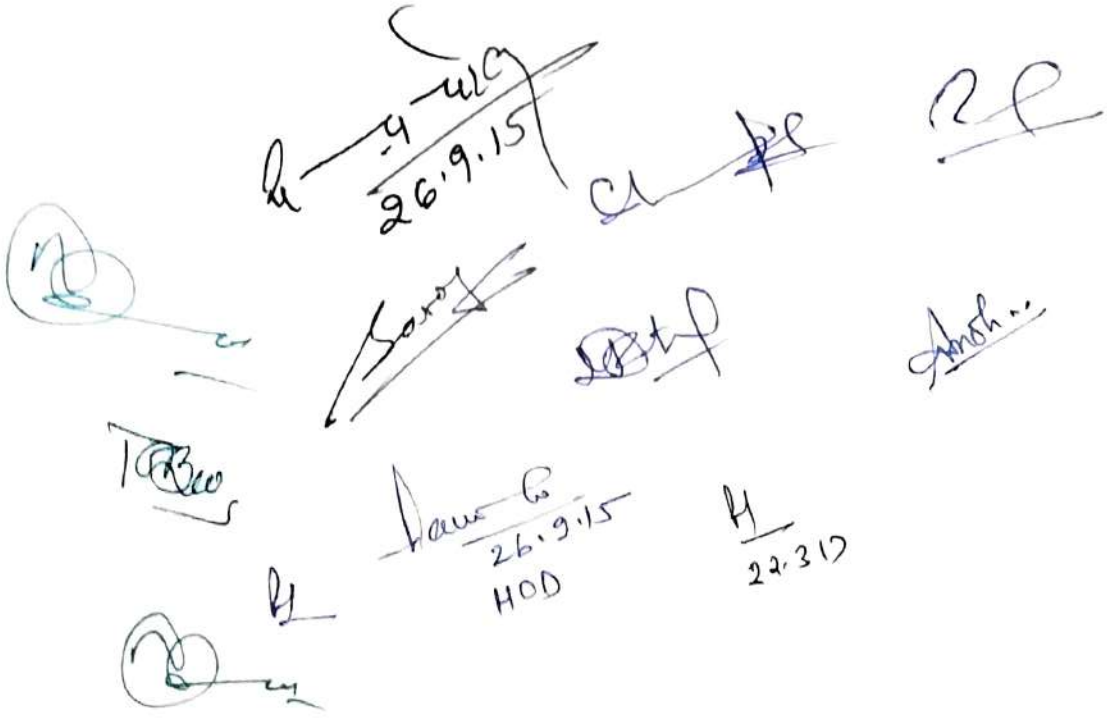
RADIATION AND RADIATION PROTECTION: Principles of radiation protection – protective materials - radiation effects – somatic, genetic stochastic & deterministic effect , Personal monitoring devices – TLD film badge – pocket dosimeter. Radiation dosimetry, Natural radioactivity, Biological effects of radiation, Radiation monitors.

PHYSICS OF DIAGNOSTIC AND THERAPEUTIC SYSTEMS-II

Diagnostic nuclear medicine: Radiopharmace uticals for radioisotope imaging, Radioisotope imaging equipment, Single photon and positron emission tomography Therapeutic nuclear medicine: Interaction between radiation and matter Dose and isodose in radiation treatment (10 Hrs)

Reference Books:

Physics, J.R. Cameron and J.G.Skofronick, Wiley (1978) - Jayapee Brothers Medical Publishing Pvt. Ltd. New Delhi (2003) - Lippincot Willia ms and Wilkins (1990) - Williams and Wilkins, Third edition (2003) Boone Lippincot Williams and Wilkins, Second Edition (2002) - H E Johns and Cunningham.



B.Sc.Semester IV (PHYSICS)

(January-2016, 2017, 2018)

18004 - C (Credits–3, Hours:45, Max. Marks.-60 Min. Pass Marks-21)

Elective C: Bio-Physics

Unit-I

Building Blocks & Structure of Living State: Atoms and ions, molecules essential for life, what is life. Living state interactions: Forces and molecular bonds, electric & thermal interactions, electric dipoles, casimir interactions, domains of physics in biology. (9 Hrs)

Unit- II

Heat Transfer in biomaterials: Heat Transfer Mechanism, The Heat equation, Joule heating of tissue. Living State Thermodynamics: Thermodynamic equilibrium, first law of thermodynamics and conservation of energy. Entropy and second law of thermodynamics, Physics of many particle systems, Two state systems, continuous energy distribution, Composite systems, Casimir contribution of free energy, Protein folding and unfolding. (11 Hrs)

Unit- III

Open systems and thermodynamics: Enthalpy, Gibbs Free Energy and chemical potential, activation energy and rate constants, enzymatic reactions, ATP hydrolysis & synthesis, Entropy of mixing, The grand canonical ensemble, Hemoglobin. (7 Hrs)

Unit-IV

Diffusion and transport Maxwell - Boltzmann statistics, Fick's law of diffusion, sedimentation of Cell Cultures, diffusion in a centrifuge, diffusion in an electric field, Lateral diffusion in membranes, Navier stokes equation, low Reynold's Number Transport, Active and passive membrane transport. (7 Hrs)

Unit-V

Fluids: Laminar and turbulent fluid flow, Bernoulli's equation, equation of continuity, venture effect, Fluid dynamics of circulatory systems, capillary action. Bioenergetics and Molecular motors: Kinesins, Dyneins, and microtubule dynamics, Brownian motion, ATP synthesis in Mitochondria, Photosynthesis in Chloroplasts, Light absorption in biomolecules, vibrational spectra of bio - biomolecules. (11 Hrs)

Reference Books:

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B.Sc. Semester III (PHYSICS EXPERIMENTS)

(July -2015,2016,2017) (Credits:2,Hours :30)

te: Practical classes will be held round the year but practical examination
ll be conducted only in semester- IV
ation of Practical Examinations shall be of 4 hours)
tudy of monochromatic defects of images.
etermining the principle points of a combination of lenses.
tudy of interference of light (biprism or wedge film).
tudy of diffraction at a straightedge or a single slit.
tudy of F-P etalon fringes.
se of diffraction grating and resolving limit.
esolving limit of a telescope system.
olarization of light by reflection: also cos-squared law
tudy of optical rotation for any system.
Study of laser asa monochromatic coherent source.
Study of divergence of a laser beam.

ession 2015-2016B.Sc. Semester IV (Jan-2016) & 2017

HYSICSPRACTICALS(Credits : 2, Hours : 30)

Study of Brownian motion
Study of conversion of mechanical energy into heat.
Study of adiabatic expansion of a gas.
Heating efficiency of electrical kettle with varying voltages
Resistance thermometry.
Thermo emf thermometry
Conduction of heat through poor conductors of different geometries
Experimental study of probability distribution for a two option system using a colored dice.
Speed of waves on a streches string.
Studies on torsonialwaves in a lumped system.
Studies of interference with two concurrent sources of sound
Chaladni s figures with varying excitation and loading points.
Measurement of sound intensities with different situation.
Characteristics of a microphone loudspeaker system.

Practical marks scheme.

Work Marks distribution
Laboratory note book/project 10
Viva voce 10
Experiments (2) 3 0 (each 15 marks) Total 50

TEXT AND REFERENCE BOOKS:

D.P.Khandelwal : Optics and Atomic Physics (Himalaya Publishing House Bombay,1988)
D.P.Khandelwal " A Laboratoryr5 Manual for Undergraduate Classes (Vanui Publication House, NewDelhi) S.Lipschutz and A Poe " Schaum's Outline of theory and problems of Programming with Fortran "(McGraw–Hill Book Company, 1986)

M.Sc. (Physics)

Semester-II, Paper -I

Session: 2016-17 & 2017-18

1805 - QUANTUM MECHANICS II

Variational method, applications to problem like H atom, ground state of helium atom Harmonic oscillator,WKB approximation, Solution for one dimensional problem, connecting formulae. Energy levels of potential well, quantization rule. Application to barrier penetration and α decay.

Time-dependent perturbation theory, harmonic perturbation, Fermi's golden Rule. Adiabatic and sudden approximations. Semi-classical theory of radiation; transition probability for absorption and induced emission, electric dipole and forbidden transitions; selection rules.

Collision in 3-D and scattering, Laboratory and CM reference frames; scattering amplitude, differential scattering cross section and total scattering cross section, scattering by spherically symmetric potentials. Partial waves and phase shifts, scattering by a perfectly rigid sphere and by square well potential, complex potential and absorption.

Identical Particles, symmetric and anti-symmetric wave function, ,Exclusion principle, collision of identical particles, electron spin function, spin function, the He –atom, spin functions for a many electron system.

Text and Reference Books

1. Quantum Mechanics by L.I. Schiff (McGraw-Hill)
2. Quantum Mechanics by B. Craseman and J.D. Powell (Addison Wesley)
3. Quantum Mechanics by A.P. Messiah
4. Modern Quantum Mechanics by J.J. Sakurai
5. Quantum Mechanics by A.K. Ghatak & S. Lokanathan
6. Quantum Mechanics by Satya Prakash
7. Quantum Mechanics by Gupta and Kumar
8. Advanced Quantum Mechanics by B.S. Rajput
9. Quantum Mechanics by Mathew and Venkateshan

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M.Sc. (Physics)

Semester-II, Paper – III

Session: 2016-17 & 2017-18

1807- ELECTRODYNAMICS & PLASMA PHYSICS

Review of Maxwell's equation, wave equation in terms of vector and scalar potential and solution, four vectors, Lorentz transformation in terms of four vectors, covariant formulation of electrodynamics, electromagnetic field tensor, transformation of field

Retarded potential Radiation from an oscillating dipole, Lienard-Wiechert Potential Potential for charge in uniform motion (Lorentz formula), electric and magnetic fields due to uniformly moving charge and an accelerated charge, Linear and Circular acceleration and angular distribution of power radiated, Bremsstrahlung, Synchrotron Radiation and Cerenkov Radiation, Reaction Force of radiation.

Motion of charged particles in (i) uniform electric field (ii) uniform magnetic field (iii) Simultaneous uniform electric and magnetic field (iv) electric field with arbitrary time variation. physical interpretation, cyclotron resonance (iv) time varying magnetic field and space varying electric field, equation of motion and adiabatic invariance. Poynting's theorem,

Elementary concept of plasma- Electric neutrality of plasma, particle orbits and drift motion in plasma.: Derivation of moment equation from Boltzmann Equation Plasma Oscillation, Debye Shielding, plasma parameters, magneto plasma, plasma confinement.

Hydro-dynamical description of plasma; fundamental equations. hydro- magnetic waves. Magneto-sonic and Alfven waves, hydro-magnetic eq., pinch effect, probes for plasma measurement.

Text and Reference Books

1. Classical Electricity and Magnetism by Panofsky & Phillips.
2. Classical Electrodynamics by Jackson.
3. Electrodynamics by Gupta, Kumar, Singh.
4. Plasma Physics by Bittencourt.
5. Plasma Physics by Chen.
6. Plasma Physics by S.N.sen

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M.Sc. (Physics)

Semester-II, Paper – IV

Session: 2016-17 & 2017-18

1808 - ATOMIC AND MOLECULAR PHYSICS

Quantum States of one electron atom-atomic orbitals-hydrogen spectrum atom of alkaline elements and the equation characteristics of spectral terms

Pauli's Principle-Spectra of alkali elements-spin orbit interaction and fine structure in alkali spectra, atom with one outer electron.

Normal and anomalous Zeeman effect-Paschen back effect Stark effect- two electron system's-interaction energy in LS and JJ coupling-hyperfine structure (Qualitative) – line broadening mechanism (general ideas)

Types of molecules- diatomic linear symmetric top, asymmetric top and spherical top molecules –Rotational Spectra of diatomic molecules as a rigid rotator-energy levels and spectra of non rigid rotor-intensity of rotational lines – Stark modulated microwave spectrometer (qualitative)

Vibrational energy of diatomic molecule-diatomic molecule as a simple harmonic oscillator-energy levels and spectrum. Morse potential energy curve- molecules as vibrating rotator- vibration spectrum of diatomic molecule-PQR branches IR spectrometer (qualitative)

Text and Reference Books

1. Introduction to Atomic Spectra by H.E.White (T)
2. Introduction to Molecular Spectroscopy by G.M.Borrow
3. Molecular Spectra and Molecular structure by G.Herzberg
4. Modern Spectroscopy by Brown
5. Atomic Physics by S.N.Ghoshal
6. Spectra of atoms and molecules by P.E.Bemeta
7. Modern Spectroscopy by J.M. Holias

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M.Sc. (Physics)

Semester-II

Session: 2016-17 &2017-18

1819- LAB. COURSE - A (Electronics II)

Time: 5 Hrs. **Max. Marks: 100**

Marks Distribution:

Experiment	:60
Viva Voce	:20
Internal Assessment	:20

Note: Following experiments are recommended-

1. Characteristics of transistor in different modes.
2. To study the stability of Q - point of a CE amplifier with different biasing methods.
3. To determine, different h-parameters of transistors.
4. To study the emitter follower.
5. Network analysis- Thevenin and Norton equivalent circuits.
6. Study of varactor diode
7. To study characteristic curve of U.J.T.
8. Experiment on FET characterization and application as an amplifier.
9. Design of common emitter transistor amplifier.
10. Study of FET amplifier.

M. Sc. (Physics)

Semester-II

Session: 2016-17 &2017-18

1820 - LAB.COURSE - B (Electronics III)

Time: 5 Hrs. **Max. Marks: 100**

Marks Distribution:

Experiment	:60
Viva Voce	:20
Internal Assessment	:20

Note: Following experiments are recommended-

1. Experiment on MOSFET characterization and application as an amplifier.
2. To study characteristic curve of S.C.R.
3. To study the characteristics of tunnel diode.
4. BCD to seven segment display.
5. To study basic logic gates and to verify their truth table by TTL: AND,OR, NAND, NOR.

   Ex-OR, Ex-NOR
6. Verification of the deMorgan's theorem.
7. Study of an up-down counter.
8. (a) To study the leakage current variation with temperature.

   (b) To see the shift in Q point at different operating temperatures.

   (c) To see the effect of temperature on stability of an amplifier.

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M.Sc. (Physics)

Semester-II, Paper – II

Session: 2016-17 &2017-18

1806- STATISTICAL MECHANICS

Foundation of Statistical Mechanics; specification of states of a system. Contact between statistics and thermodynamics, classical ideal gas, entropy of mixing and Gibb's paradox.

Micro Canonical ensemble, phase space, trajectories and density of states, Liouville's theorem, canonical and grand canonical ensembles, partition function, calculation of statistical quantities, energy and density fluctuations.

Density matrix, statistics of ensembles, statistics of indistinguishable particles, Maxwell-Boltzman, Fermi-Dirac and Bose – Einstein Statistics, properties of ideal Bose and Fermi gases, Bose Einstein Condensation.

Landau theory of phase transition, Critical indices.

Fluctuations and transport phenomena, Brownian motion. Langevin theory. Fluctuation dissipation theorem. Fokker plank equation.

Text and Reference Books

1. Statistical Mechanics by K. Huang
2. Statistical Physics by Landau and Lifshitz.
3. Statistical Mechanics by R.K. Pathria.
4. Statistical Mechanics by Gupta and Kumar
5. Statistical and Thermal Physics by RiefS

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M.Sc. (Physics)

Semester-I, Paper – I

Session: 2016-17 & 2017-18

1801- MATHEMATICAL PHYSICS

Vector Spaces and Matrices, Linear independence, Bases, Dimensionality, Inner product Linear transformation;

Matrices; Inverse; Orthogonal and unitary matrices; Independent element of matrix. Eigenvalues and eigenvectors; Diagonalisation; Complete orthonormal set of functions.

Special Functions Solution by series expansion; Legendre Polynomial Generating functions, recursion relation, Rodrigues formula. Orthogonal properties, Associated Legender polynomial, Recurrence formula. Orthogonal properties.

Laguerre Polynomial Generating functions, recursion relation, Rodrigues formula. Orthogonal properties, Associated Laguerre differential equation and polynomial.

Bessel differential equations, First and second kind, Recurrence formulae and generating function for Jn(x), Jacobi series, Bessels integrals, Orthonormality of Bessel's function.

Hermite differential equations and polynomials, Generating functions, recurrence relation. Rodrigues formula. Orthogonal properties

Integral Transforms:Laplace transform; First and second shifting theorem; Inverse LT by partial fractions; LT of derivative and integral of a function; Solution of initial value problems by using Laplace transforms; LT and inverse LT of various function

Fourier series; FS or orbitrary period Half wave expansion, partial sums. Fourier integral and transforms.

Text and Reference Books

1. Mathematical Method for Physics by G. Arfken
2. Matrices and tensors for Physicists, by A.W. Joshi
3. Advanced Engineering Mathematics, by E.Kreszing
4. Special Function, by E.D. Rainville
5. Mathematical Physics, by Satya Prakash
6. Mathematical Physics by B.S.Rajput

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M.Sc. (Physics)

Semester-I, Paper – II

Session: 2016-17 & 2017-18

1802- CLASSICAL MECHANICS

Newtonian Mechanics of one, many particle systems; Laws of conservation. Degrees of freedom, Constraints, their classification; Generalized coordinates. Generalised displacement,velocity, acceleration, momentum, force, and potential. Limitations of Newton's laws. D'Alembert's Principle, Lagrange's equations from D'Alembert's Principle; Application of Langrange's equationin (i) Linear harmonic oscillator (ii)Simple pendulum

Gyroscopic forces, dissipative system, Jacobi integral, gauge invariance,integral of motion, symmetries of space and time with conservation law, invariance under Galilean transformations. Rotating frames; Coriolis force. Terrestrial and astronomical applications of Coriolis force. Central force; definition and characteristics; two-body problem; closure and stability of circular orbits; general analysis of orbits; Kepler's laws and equation; Rutherford scattering.

Principle of least action; derivation of equation of motion, variation and end points. Hamilton's principle and characteristic function, Hamilton's canonical equation of motion, Applications of Hamilton equation of motion in (i) Simple pendulum (ii) Compound Pendulum (iii) Linear Harmonic Oscillator (iv) Particle in central field of force. Moments and products of inertia, Euler's equation of motion for rigid body.

Canonical or constant transformation; advantage and example of canonical transformation. Necessary and sufficient condition for a transformation to be canonical. Hamilton- Jacobi partial differential equation for Hamilton's principle function. Solution of Harmonic oscillator problem by Hamilton Jacobi method. generating function; Poisson bracket : definition and properties. Invariance of Poisson bracket with respect to canonical transformation

Text and Reference Books

1. Classical Mechanics, by H. Goldstein
2. Mechanics, by A Sommerfeld
3. Classical Mechanics, by Gupta, Kumar, Sharma
4. Classical Mechanics, by N.C. Rana and P.S. Joag
5. Classical Mechanics, by Satya Prakash
6. Classical Mechanics by Takwale and Puranik

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M.Sc. (Physics)

Semester-I, Paper - III

Session: 2016-17 & 2017-18

1803- QUANTUM MECHANICS-I

Why Q.M.? Revision; Inadequacy of classical mechanics. Schrodinger Equation. Continuity equation, Ehrenfest theorem. Admissible wave function, stationary state.

One dimensional problems, wells and barriers; harmonic oscillator by Schrodinger equation and by operator method.

Uncertainty relation of x and p. States with minimum uncertainty product. General formalism of wave mechanics, Commutation relation, representation of states and dynamical variables, completeness of Eigen-function Dirac-Delta function, bra and ket notation. Matrix representation of an operator, Unitary transformation.

Angular momentum in Quantum mechanics. Angular momentum operator, eigen value equation for L^2. Central force problem. Solution of Schrodinger equation for spherically symmetric potential: Hydrogen atom. Three dimensional square well potential and energy levels.

Time-independent perturbation theory, non-degenerate cases. First order perturbation with the example of an oscillator. Degenerate cases. Applications such as Stark effect . Zeeman effect without electron spin. First order Stark effect in hydrogen.

Text and Reference Books

1. Quantum Mechanics by L.I. Schiff (McGraw-Hill)
2. Quantum Mechanics by B. Craseman and J.D. Powell (Addison Wesley)
3. Quantum Mechanics by A.P. Messiah
4. Modern Quantum Mechanics by J.J. Sakurai
5. Quantum Mechanics by A.K. Ghatak & S. Lokanathan
6. Quantum Mechanics by Satya Prakash
7. Quantum Mechanics by Gupta and Kumar
8. Quantum Mechanics by Aruldhas
9. Advanced Quantum Mechanics by B.S. Rajput

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M.Sc. (Physics)

Semester-I, Paper – IV

Session: 2016-17 & 2017-18

1804- ELECTRONIC DEVICES

BJT : structure, basic working principle of NPN and PNP transistor, characteristic curves in different modes of transistor. Current gain in different modes and relation among them.

Different methods of Biasing a transistor, thermal stabilization and stabilization factor, low frequency h-parameter for transistor amplifier,

Feedback amplifier, different types of feed back in amplifier, condition of Oscillation. Hartley, Wein bridge and phase shift oscillator.

JFET, MOSFET and MESFET : structure, working derivation of the equation for I-V Characteristics under different conditions. Unijunction transistor (UJT) – Basic structure, working principle, I-V characteristics and important parameters.

Microwave devices: tunnel diode, transfer electron devices (Gunn diode), Avalanche transit time devices.

Photonic devices, photoconductive devices (LDR), diode photodetectors, solar cell (open circuit voltage and short circuit current, fill factor), LED (high frequency limit, effect of surface and recombination current, operation of LED), LCD.

Microwave devices: Tunnel diode- Introduction, definition, tunneling phenomenon, energy band diagram, I-V characteristics, Negative resistance of tunnel diode. Backward diode: Introduction and characteristics.

Memory device; static and dynamic random access memories SRAM and DRAM, CMOS and NMOS, non-volatile- NMOS, magnetic, optical and ferroelectric memories, charge coupled devices (CCD).

Text and Reference Books

1. Semi-conductor devices-Physics and Technology by S.M.Sze: Wiley
2. Introduction to Semi conductor devices by M.S. Tyagi :John Wiley and Sons
3. Hand Book of Electronics by Gupta & Kumar: Pragati
4. Principles of Electronics- V.K.Mehta, Rohit Mehta: S.Chand & Company
5. Basic Electronics (Solid State)- B.L.Theraja: S.Chand & Company
6. Foundation of Electronics- D. Chattopadhyay,P.C.Rakshit, B. Saha, N.N.Purkait

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M.Sc. (Physics)

Semester-I ..

Session: 2016-17 &2017-18

1817- **LAB. COURSE-A (General)**

Max. Marks: 100

Time: 5 Hrs.

Marks Distribution:

Experiment :60

Viva Voce :20

Internal Assessment :20

Note: Following experiments are recommended-

1. To determine Young's modulus of glass by Carnu's method.
2. Study of B-H curve.
3. Verification of Stefan's Law.
4. Measurement of ionization potential of mercury.
5. To determine Richardson's constant.
6. Measurement of Plank's constant.
7. Measurement of high temperature using thermister and thermo-couple.
8. Measurement of velocity of ultrasonic waves in liquid.
9. Measurement of susceptibility by Quinke's method.
10. Measurement of magnetic field using Hall Effect.
11. Thickness of mica sheet by Fresnel's biprism

M.Sc. (Physics)
Semester-I

Session: **2016-17 &2017-18**

1818 - LAB.COURSE-B (Laser& Electronics-I)

Max. Marks: 100

Time: 5 Hrs.

Marks Distribution:

Experiment	:60
Viva Voce	:20
Internal Assessment	:20

Note: Following experiments are recommended-

1. Measurement of width of single slit using LASER.
2. Measurement of wavelength of He-Ne laser light using ruler.
3. Study of Faraday Effect using He-Ne laser.
4. Measurement of e/m by Thomson method.
5. Measurement of resistivity of a semiconductor by four-probe method at different temperatures and determination of band gap.
6. Measurement of Hall coefficient of given semiconductor, identification of type of semiconductor and estimation of charge carrier concentration.
7. Zener Diode- Characteristics and voltage regulation.
8. Study of regulated power supply
9. Study of two stage R.C. coupled amplifier

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M.Sc. Physics

session: 2018-19& 2019-20, ~~202~~ 2021

Semester-3, Paper-1

1809- Condensed Matter Physics-

Crystalline solids: Unit cells, symmetry elements, 2-D and 3-D Bravaislattices, Crystal structures-sc; bcc; fcc; hcp, Miller Indices, Interplanar spacing, Atomic packing in 2-D and 3-D, Closed packed structures, Elastic constants and elastic waves in cubic crystals.

Interaction o f X-ray with matter, Absorption of x-ray, Diffraction of X-rays by lattice, the Laue equation, Bragg's law, Ewald construction, Reciprocallattice and its applications to diffraction techniques, Brillouinzones. The Laue powder and rotating crystal methods, crystal structure factor.

Electrons in a periodic lattice: Bloch theorem, band theory, classificationof so lids,effective mass. Tight -binding approximation, cellular, APW, OPW and pseudopotential methods. Fermi surface, De Hass van alfen effect, cyclotron resonance. Superconductivity: crit ical temperature, persistent current, Meissner effect, energy gap, coherence length, London equat ion.

Classical Langevin's theor y of diamagnetism, paramagnetism, andferromagnetism. Weiss theory of paramagnetism. Antiferromagnetism, neel temperature. Point defects, line defects and planer (stacking) fault s. Co lour centers, the role of dislocations in crystal growth. The observation of imperfect ions in crystals, X-ray and electron microscopic techniques.

Text and Reference Books

1. Aschro ft & Mer min : Solid State Physics
2. C Kittel : So lid State Physics
3. Chaikin and lubensky : Principles of Condensed Matter Physics
4. M A Wahab: So lid State Physics
5. Azaro ff : Introduction to solids
6. Omar : Elementary Solid State physics

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M.Sc. Physics

session: 2018-19& 2019-20

Semester-3, Paper-2

1810- Nuclear and Particle Physics

Static properties of Nuclei: Nuclear size determination from electron scattering, nuclear charge distribution. Angular momentum, spin and moments of nuclei. Binding energy, semi-empirical mass formula, Liquid drop model, fission and fusion

Two Nucleon Systems & Nuclear Forces: Dipole and quadrupole moments of the deuteron, Central forces, Evidence for saturation property, Neutron-proton scattering, Proton-proton scattering, S-wave effective range theory. charge independence and charge symmetry , exchange character, spin dependence. Isospin formalism. General form of the nucleon-nucleon force. Yukawa interaction

Nuclear Decays: Alpha decay: Geiger-Nuttall law, Electromagnetic decays: selection rules,Fermi theory of beta decay. Kurie plot. Fermi and Gamow-Teller transitions. parity violation in beta-decay. Nuclear Models: Liquid drop model, Collective model o f Bohr and Mottelson, rotational spectra, nuclear shapes. Experimental evidence for shell effects, shell model, spin Orbit coupling, Magic numbers, angular momenta and parities of nuclear ground states, Qualitative discussion and estimates of transition rates, Magnetic moments and Schmidt lines,

Introduction to Nuclear Reactions. Direct and compound nuclear reaction mechanism-cross sections in terms of partial wave amplitudes -compound nucleus -scattering matrix-Reciprocity theorem. Breit-Wigner one Level formula-Resonance scattering.

Elementary Particles (quarks, baryons, mesons, leptons). Classification: spin and parity assignments; isospin, strangeness. Elementary ideas of SU(2) & SU(3). Gell-Mann-Nishijima scheme. C, P and T invariance and application of symmetry arguments to particle reaction. Properties of quarks and their classification., Electroweak interaction-W & Z Bosons. Parity non-conservation in weak interactions, Relativistic kinematics.

Text and Reference Books

1. Nuclear Physics by S.N. Ghoshal, S. Chand & Company Ltd,2004

2. Introducing Nuclear Physics by K. S. Krane (Wiley India., 2008) .

3. Nuclear Physics - Theory & Experiments by R.R. Roy & B.P.Nigarn (New Age International, 2005)

4. Nuclear & Particle Physics: An Introduction by B. Martin (Willey,2006)

M.Sc. Physics

session: 2018-19& 2019-20

Semester-3, Paper-3

Special paper-1

1811- OPEATIONAL AMPILIFERS & DIGTTAL ELECTRONICS

Differential amplifier-circuit configurations working principle, Block digram of Operational Op-Amp,DC analysis-Ac analysis, dualinput balanced output diffrential amplifier -Inverting and non-invertig input,Op-AMP parameter as input biased voltage, inputoff-set current, inputoff-set voltage, openloop gain, common mode rejection ratio (CMRP)slow rate, use of OP-AMP as inverting and non-inverting amplifier, adder,subtractor, integrater and differentiator comparator.

Communication Electronics:

Amplitude modulation-generation of AM waves-Demodulation of AM waves ,DSBSC modulation Generation of DSBSC,Coherent detection of DSBSC waves. SSBmodulation, Genration and detection of SSB waves. Vestigial side band modulation. Fequencydivision multiplexing (FDM),FM, AM Genration and detection.

Number system:

Decimal, binary, octal and hexadecimal number system with mutual conversion, BCD

Addition and subtraction, 1's and 2's compliments, multiplication and division BCD code (8421)

Combinational Logic:

The transistor as a switch, OR, AND and NOT gates-NO and NAND gates, Boolean algebra

De-Morgan'stheorems-Exclusive OR gate, Decoder/Demultiplexer Dataselector/multiplexer-Encoder.

Sequential Logic:

Flip-Flop as 1- bit memory- RS Flip-Flop, JK Flip-Flop, JK master slave flip-flop,T flip-flop, D flip-flop,shift register- synchronous and asynchronous counters-cascade counter..

Text and Reference Books

1. Electronic Devices and Circuit Theory by Robert Boylested and Louis Nashdsky:PHI New Delhi.

2. Op-Amps & Linear integrated circuits by Ramakanth A. Gayakwad PHI 2ndn.Malvino and Donald P. Leach

M.Sc. Physics

session: 2018-19& 2019-20

Semester-3, Paper-4

Special paper-2

1812- ELECTRONICS AND ITS APPLICATIONS

Analog and Digital Systems: Analog computation active filter,comparator, logarithmic and anti-logarithmiSample and holdamplifiers wave form generators, square and triangular wave generators,Digital to analog converters, ladder and weighted resister types, successive approximation and dual slop converter

Pulse generator converters, applications of DACs and ADC

Optoelectronics: Luminescence, photo-luminescence, electroluminesence, mechenoluminescence,luminescence, radiative recombination process: inter-band transition, impurity centre.recombination.

Photo- detectors: Photo detectors with extrnal photo effect, Photo detectors withinternal photo effect, photo conductors and photo resistors, junction photo detectophotodiode response time of photodiode, avalanche photodiode, phototransistor

Microwave Devices:

Klystrons. Velocity modulation, bunching process, Basic principles two cavity Kiystrons.

principle of operation of magnetrons. Hellix travelling wave Tubes, Wave Modes.PIN Diode

Transferred electron devices, Gunn effect, principle of operation. Mode of operationRadar Systems: Radar block diagram and operation, radar frequencies, pulsRead diode.

Radar system: radar block diagram,and operation,radar fequncy, pulse consideration, Radar range equation, derivation of radar range equation, minimudetectable signal, receiver noise, signal to noise ratio, integration of radar pulsecross section, pulse repletion frequency. Antenna parameters,

Satellite Communications: Orbital satellites, geostationary satellites, orbital pattern look angles, orbital spacing, satellite systems, Link modules.

Text and Reference Books

1. Microclectronics by Jacob Millman : Mc Graw Hill

2. Optoelectronics: Theory and Practice, edited by Alien Chappal, Mc Graw Hillta, Wiley Eastern Ltd. New Delhi.

4. Advanced Electroni ie Communication Sysems by Wayne Tomas, PMicoaess

5. Microwave Device by Sen, Kennedy

6. Satellite Communication by D.C.Agrawal

7.Microwaves by K.L.gupta

M.Sc. Physics

session: 2018-19& 2019-20

Semester-3

1821- LAB.COURSE-A (Solid state physics and Electronics-4)

Following experiments are recommended:

1.To construct and study the half adder and full adder and verify its truth table.

2.To study of a left shift, right shift register and its operatiion.

3.Study of R-S and J-K flip flop using NAND gate.

4.To use Op-Amp as) adder (i subtrctor (i) mutiplier (v) diffrentiator(v) integrator

5. To use Op-Amp as (i) Hartley and (i) Colpitt oscillator.

6. To use Op-Amp as (i) Wien bridge and (ii) Phase shift oscillator

7. To study the uracteristics of Photo diode.

8. To study the lattice dynamics

9. Determination of Hall coefficient of semiconductor

10. Determination of Curie temperature of Ferro-electric material.

11. To Study the characteristics of Solar cell.

12. Crystal/phosphor preparation by solid state diffusion method.

13. To measure the dislocation density of a crystal by etching.

14. ML study of crystal/phosphor.

15. Microwave chareterstics and measurement.

Note: Experiments can be replaced by other experiment of equal standard.

M.Sc. Physics

session: 2018-19& 2019-20

Semester-3

1822- LAB.COURSE-B (Electronics-5)

Following experiments are recommended:

1.Study of Pulse Amplitude Modulation, Pulse Width Modulation.

2. Study of A/D and D/A conversion.

3.To study Multiplexing and De-Multiplexing.

4.Wave form generation and storage oscilloscope.

5.To use Op-Amp as function generator.

6.To study diffrent types of multi vibrator.

7.Experiment on microprocessor - Addition, subtraction using S085/8OR6.

8. Experiment on microprocessor Multiplication, Division using 8085/sU86.

9.To study diffrentiating,integrating,clipping,clamping circuits.

10.To study push-pull amplifier.

Note: Experiments can be replaced by other experiment of equal standard.

M.Sc. Physics

session: 2018-19& 2019-20

Semester-1, Paper-1

1801- MATHEMATICAL PHYSICS

Vector algebra and vector calculus, linear independence, basis expansion, Schmidt orthogonalisation. Matrices: Representation of linear transformations and change of base; Eigen values and eigenvectors; Functions of a matrix; Cayley-Hamilton theorem; Commuting matrices with degenerate eigenvalues; Orthonormality of eigenvectors,

Recapitulation: Complex numbers, triangular inequalities, Schwartz inequality. Function of a complex variable : single and multiple-valued function, limit and continuity; Differentiation; Cauchy-Riemann equations and their applications; Analytic and harmonic function; Complex integrals ,Cauchy's theorem (elementary proof only), converse of Cauchy's theorem, Cauchy's Integral Formula and its corollaries; Series - Taylor and Laurent expansion; Classification of singularities; Branch point and branch cut; Residue theorem and evaluation of some typical real integrals using this theorem.

Theory of second order linear homogeneous differential equationsSingular points: regular and irregular singular points; Frobenius method; Fuch's theorem; Linearindependenceofsolutions:Wronskian,
secondsolution.Sturm-Liouvilletheory;Hermitianoperators;Completeness. Inhomogeneous differential equations: Green's functions

Special functions

Basic properties (recurrence and orthogonality relations, series expansion) of Bessel, Legendre, Hermite and Laguerre functions., generating function Integral transforms Fourier and Laplace transforms and their inverse transforms, [use of partial fractions in calculating inverse Laplace transforms]; Transform of derivative and integral of a function; Solution of differential equations using integral transforms, Delta function.

Text and Reference Books

1. Mathemat ical methods for physics, by G ARFE KEN
2. Matrices and Tensors for physicists, by A W JOSHI
3. Advancedengineer ing mathemat ics, by E KREYSZIG
4. Special functions , by E D RAINVILLE
5. Mathematical physics, by Satyaprakash
6. Mathematical physics, by B.S Rajp

M.Sc. Physics

session: 2018-19& 2019-20

Semester-1, Paper-2

1802

CLASSICAL MECHANICS

Preliminaries, Newtonian mechanics of one and many particle systemsconservation laws, work energy theorem, open system (with variable mass). Constraints and their classifications, D'Alembert's principle's, generalized coordinates, Lagrange equation and its application 1).linear harmonic oscillator 2)simple pendulum

Gyroscopic forces, dissipative systems, Jacobi integral, gauge invariance,generalized coordinates and momenta, integrals of motion, symmetry of space and time with conservation laws, invariance under Galliean transformations.

Rotating frames, inerial frames, terrestrial and astronomical applications,Coriolis force. Central forces, definition and charactersitics, Two -body problem, closure and stability of circuler orbits, general analysis of orbit s, Kepler 's laws and equations, artificial satellites, Rutherford scattering.

Principle of least action, derivation of equation of motion, variation andend points, Hamilton's principles and characteristics functions, Hamilton – Jaccobi equations and its application 1)Simple pendulum 2) Compound pendulum 3) linear harmonic oscillator.Euler's equation of motion for rigid body,moment and product of inertia.

Canonical transformations, generating functions, properties, group properties, example's. Infinitesimal generators, Poison bracket ,Poison theorems, angular momentum PBs, small oscillations, normal modes and coordinates.

TEXT AND REFERENCE BOOKS

1. Classical Mechanics by N C RANA and P S JOAG (T ATA Mc Graw-Hill,1991)
2. Classical Mechanics byH GOLDSTEIN (Addit io n Wesle y, 1980)
3. Mechanics byA. SOMMERFELD
4. Introduction to dynamics by I. PERCEI VAL and D. RICHARDS(Cambridge Univ.)
5. Classical Mechanics by Gupta Kumar Sharma
6. Classical Mechanics by Satya Prakash

1.9.18

M.Sc. Physics

session: 2018-19& 2019-20

Semester-1, Paper-2

1802

CLASSICAL MECHANICS

Preliminaries, Newtonian mechanics of one and many particle systemsconservation laws, work energy theorem, open system (with variable mass). Constraints and their classifications, D'Alembert's principle's, generalized coordinates, Lagrange equation and its application 1).linear harmonic oscillator 2)simple pendulum

Gyroscopic forces, dissipative systems, Jacobi integral, gauge invariance,generalized coordinates and momenta, integrals of motion, symmetry of space and time with conservation laws, invariance under Galliean transformations.

Rotating frames, inerial frames, terrestrial and astronomical applications,Coriolis force. Central forces, definition and charactersitics, Two -body problem, closure and stability of circuler orbits, general analysis of orbit s, Kepler 's laws and equations, artificial satellites, Rutherford scattering.

Principle of least action, derivation of equation of motion, variation andend points, Hamilton's principles and characteristics functions, Hamilton – Jaccobi equations and its application 1)Simple pendulum 2) Compound pendulum 3) linear harmonic oscillator.Euler's equation of motion for rigid body,moment and product of inertia.

Canonical transformations, generating functions, properties, group properties, example's. Infinitesimal generators, Poison bracket ,Poison theorems, angular momentum PBs, small oscillations, normal modes and coordinates.

TEXT AND REFERENCE BOOKS

1. Classical Mechanics by N C RANA and P S JOAG (T ATA Mc Graw-Hill,1991)
2. Classical Mechanics byH GOLDSTEIN (Addit io n Wesle y, 1980)
3. Mechanics byA. SOMMERFELD
4. Introduction to dynamics by I. PERCEI VAL and D. RICHARDS(Cambridge Univ.)
5. Classical Mechanics by Gupta Kumar Sharma
6. Classical Mechanics by Satya Prakash

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M.Sc. Physics

session: 2018-19& 2019-20

Semester-1, Paper-3

1803- QUANTUMMECHANICS - I

Why QM Revision; inadequacy of classical mechanics; Schrodingerequation; continuit y equation; Ehrenfest theorem; Admissible wave function Stationary states, One dimensional problems, wells and barriers; Harmonic oscillators by Schrodinger Equation

Uncertainty relation of x and p, States with minimum uncertaintyproduct; General For malism of wave mechanics; Commutation Relations; Representation o f states and dynamical var iables; Completeness of eigen functions ; Dirac delta function ;Bra and ket Notation; Matrix r epresentation of an operator ; Unitary transformation. Solution of Harmonic oscillator by operator method.

Angular momentum in QM, central forces problem, solution of schrodinger equation for spherically symetric potential,Hydrogen atom.

Time independent perturbation theory; Non-degenerate and degeneratecases; Applicat ions such as Stark effect, Zeeman effect etc.

Text and Reference Books

1. Quantum mechanics, by L I Schiff
2. Quantum phys ics by S Gasiorowicz
3. Quantum mechanics by B Craseman and J D Powell
4. Quantum mechanics by A K Ghatak & S.loknathan
5. Quantum mechanics by Aruldhas
6. Quantum mechanics, by Sayyaprakash
7. Quantum mechanics by, Gupta and kumar

M.Sc. Physics

session: 2018-19& 2019-20

Semester-1, Paper-4

1804- Electronic devices

Basic ideas of bipolar devices PNP and NPN ,operation, different configuration and characteristics, Transistor h-parameters, Concept of d.c. and a.c. load lines, cut off saturation, Transistor as a switch, as a current source, transistor biasing circuits: base bias, collector and emitter feedback bias and voltage divider method, F.E.T.

Transistor Amplifiers: classification of amplifier, CE, CC and CB Amplifier and theirapproximate analysis for gain, input and output impedance in terms of h-parameters, coupling of amplifiers, RC coupled amplifier, transformer coupled amplifier, frequency response curve. F.E.T. Amplifier,JFET,MOSFET and MESFET, UJT.

Microwave Device

Varactor diode- equivalent circuit and device parameters, P-I-N diode- reverse and forward V-I characteristics, IMPATT diode, TRAPATT diode, BARITT diode and their principle of operation, Basic ideas about transferred Electron devices and their applications as oscillator and amplifier

Optoelectronic devices

Photocondutive device (LDR), photodetector ,Solar cell,LED,OLED,LCD, Diode lasers,(construction ,working,chraterstics curves,diffrent qualitative and quntative parameters)

Memory device:

Static and dynamic RAM,SRAM and DRAM,CMOS and NMOS,non volatile-NMOS, magnetic,optical and ferroelectric memories,CCD

Text and Reference Books

1.Principles of Electronics by Mehta V.K.

2.Semicondutor devices- Physics and Technology by S.M Sze;Wiley

3. Basic Electronics by Thareja B.L.

4. Basic Electronics, by Grob B., McGraw Hill, NY,1989 Edition

5. Electronics principles by Malvino

6. Semiconductor Electronics by Sharma A.K.

7. Handbook of electronics by Gupta and Kumar

M.Sc. Physics

session: 2018-19& 2019-20

Semester-1

1817- **LAB.COURSE -A (General)**

Following experiments are recommended:

1. To determine Young's modulus of glass by Carnu's methord.
2. Study B-H curve.
3. Verification of stefen's law.
4. Measurment of ionization potential of Mercury.
5. To determine Richardson,s constant.
6. Determine plank constant by photo cell and verification of inverse square law.
7. Measeurment of high temprature using thermister and thermo-couple.
8. Measurment of velocity of ultrasonic waves in liquid.
9. Measurment of susceptibility by Quiinke Methord.
10. Measurment of magnetic feild by Hall effect.
11. To study photoconductivity of thin film.
12. To study the absorption spectra of iodine.
13. To determine heat capacity of given solid
14. Wavelenght by Fresenl's biprism and thickness of mica sheet

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M.Sc. Physics

session: 2018-19& 2019-20

Semester-1

1818 - **LAB.COURSE -B (Laser and Electronics-1)**

Following experiments are recommended:

1. Measurement of width of single slit using LASER.
2. Measurment of wavelenghth of He-Ne laser light using ruler.
3. Study of faradeu effect using He-Ne LASER.
4. Measurmnt of e/m by thomson methord.
5. Measeurment of resitivity of semicondutor by four-probe methord at diffrent temprature and determine the band gap.
6. Measerment of Hall cofficent of cofficent of given semicondutor ,identification of type of matarieal and estimation of charge carrier concentration.
7. Zener diode chareterstic and voltage regulation.
8. Study of regulated piower supply.
9. Study of two stage RC coupled amplifier .
10. Study of variation of impedence of RC circuite wiyh frequncy and determination of caoacitance.
11. To draw a phaser diagram and to determine the inductance and resistance of LR circuit.

Note: Experiments can be replaced by other experiment of equal standard.

M.Sc. Physics

session: 2018-19& 2019-20

1805- Semester-2, Paper-1 Quantum Mechanics-2

Approximation methods, higher order time independent perturbation, Variationalmethod, WKB approximation, turning points, applications- H atom, He atom,LHO, Potential well and Barrier.

Time dependent perturbation theory, harmonic perturbation, Fermi's golden rule,Adiabatic and sudden approximation. Semi-classical theory of radiation, transition probability for absorption and induced emission, electric dipole and forbidden transitions, selection rules.

Collision in 3-D and scattering, laboratory and CM reference frames, scatteringamplitude, differential scattering cross section and total scattering cross section, scattering by spherically symmetric potential, partial waves and phase shifts, scattering by perfectly rigid sphere and by square well potential

Identical particles, symmetric and anti-symmetric wave functions, collision ofidentical particles, spin angular momentum, spin function for a many electron system.

Relativistic Quantum Mechanics: Klein-Gordon and Dirac equations; Properties of Dirac matrices. Plane wave solutions of Dirace quation; Spin and magnetic moment of the electron. Nonrelativistic reduction of the Dirac equation.

Text and Reference Books

1. L I Schiff, Quantum Mechanics (McGraw- Hill).
2. J. J. Sakurai, Moder n Quantum Mechanics
3. Gr iffit hs, Introduction to Quantum Mechanics
4. A. P. Messiah, Quantum Mechanics Vo l 2, (North-Holland, 1962).
5. R.Shankar, Principles of Quantum Mechanics (Plenum 1994)
6. James D. Bjorken and Sidney D. Drell, Relativist ic Quantum Mechanics (MoGraw-Hill 1964)
7. B. K. Agarwal and Har i Praksssash, Quantum Mechanics (Prent ice-Hall 2007)
8. Quantum mechanics by A K Ghatak & S.loknathan
9. Quantum mechanics by Aruldhas
10. Quantum mechanics, by Sayyaprakash

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M.Sc. Physics

session: 2018-19& 2019-20

Semester-2, Paper-2

1806- Statistical Mechanics

Connection between statistics and thermodynamics, classical ideal gas,entropy of mixing and Gibbs paradox.

Micro -canonical ensemble, phase space, trajectories and density of states, Lioville theorem, canonical and grand canonical ensembles, partition function, calculation of statistical quantities, energy and density fluctuations.

Density matrix, statistics of ensembles, statistics of indistinguishableparticles. Maxwell-Boltzman, Fermi-Dirac and Bose-Einstein statistics, properties of ideal Bose and Fer mi gases, Bose-Einstein condensation.

Landau theory of phase transition, critical indices, scale transformationand dimensional analysis.mean feil theory of isiling model.

Correlation of space-time dependent fluctuations, fluctuations andtransport phenomena, Brownian moion, Langevin theory, fluctuation-dissipation theorem.

Text and Reference Books

1. Statistical and ther mal physics, By F. Reif.
2. Statistical Mechanics, By K Huang.
3. Statistical Mechanics, By R K Pathar ia.
4. Statistical Mechanics, By Gupta and Kumar
5. Statistical Phys ics, By Landau and Lifshitz.

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M.Sc. Physics

session: 2018-19& 2019-20

Semester-2, Paper-3

1807- ELECTRODYNAMICS AND PLASMA PHYSICS

Review of Four-vector and Lorentz transformation in four dimensionalspace, electromagnetic field tensor in four dimensions and Maxwell's equations, Dual field tensor, Wave equation for vector and scalar potential and solution retarded potential, Lienard- Wienchert Potent ial, Electric and magnetic fields due to a uniformly moving charge and accelerated charge, linear and circular acceleration and angular distribution of power radiated, Bremsstralung,

Moion of charged particle in electromagnetic field, Uniform E and Bfields, Nonunifor m fields, Diffusion across magnetic fields, Time varying E and B fields, Adiabatic invariants, Fir st, second and third adiabatic invariant .

Elementary concepts o f plasma, derivation of moment equation fro mBoltzman equat ion, plasma oscillations, Debye shielding, plasma parameters,

Hydrodynamical description of plasma, Fundamental equations,hydrodynamic waves, magnetosonic Alfven waves, Wave phenomena in magneto plasma, polarization, phase velocity, group velocity, cut-offs, resonance for electromagnetic wave propagating parallel and perpe ndicular to the magnetic field, Appleton-Hartee formula and propagation through ionosphere and magnetosphere,

Text and Reference Books

1. Peno fsky and Philips, Classical electr icit y and Magnet ism.
2. Bittencourt, Plasma Phys ics
3. Chen, Plasma Phys ics.
4. Jackson, Classical E lectrodynamics.
5. S. N. Sen, Plasma Physics.
6. Elements of plasma physics:S.N Goswami
7. Principal of plasma physics:B chakraborty
8. Electomagnetic theory and electrodynamics:satyaprakash

M.Sc. Physics

session: 2018-19& 2019-20

1809- **Semester-2, Paper-4**

ATOMIC AND MOLECULAR PHYSICS

Quantum state of one electron atoms, Atomic orbits, Hydrogen spectrumPauli's princ iple, Spectra of alkali elements, Spin orbit interaction and fine structure in alkali spectra.

Equivalent and non equivalent electrons, normal and anomalous Zeemaneffect - Paschen Back effect -Stark effect, Two electron systems – interaction energy in LS and JJ coupling –Hyper fine structure (qualitative), Line broadening mechanisms (general ideas).

Type of molecules-Diatomic linear symmetric top, asymmetric top andspherical top molecules, Rotational spectra of diatomic molecules as a rigid rotor.

Vibration energy of diatomic molecule –PQR branches, IR spectrometer(qualitative). General idea of I R and Raman spectroscopy, analys is of simple diatomic molecules, Intensities o f vibrational lines. Selection rules.ESR,NMR(Qualitative)

Text and Reference Books

1 . Introduction to atomic spectra -H. E. Whit e (T)

2. Fundamentals of molecular spectrosco y-C . B. Benwell (T).

3. Spectroscopy Vol. I II III- Walker & Straughen.

4. Introduction of molecular spectroscopy- G. M. Barrow.

5. Spectra of diatomic molecules –Herzberg

6. Molecular spectroscopy J eanne L M ichele

7. Molecular spectroscop y –J. M. Brown.

8. Spectra of atoms and molecu les -P . F . Bernat h.

M.Sc. Physics

session: 2018-19& 2019-20

Semester-2

1819- LAB.COURSE -A (Electronies 2)

Following experiments are recommended:

1.To study Characteristics of transistor in different modes

2. Study of bias stability of Q point of a CE amplifier with diffrent biasing methord

3.To determine, different h-parameter of transistors

4.To study the emitter follower.

5. Network analysis- Thevenin and Norton equivalent circuits.

6 Study of varactor diode

7. To study characteristic curve of U.JT.

8. Experiment on FET characterization and application as an amplifier.

9. Design of common emitter transistor amplifier.

Note: Experiments can be replaced by other experiment of equal standard.

M.Sc. Physics

session: 2018-19& 2019-20

Semester-2

1820- LAB.COURSE-B(Electronics-3)

Following experiments are recommended:

1.Experiment on MOSFET characterization and application as an amplifier.

2. To study characteristic curve of S.C.R.

3.To study the characteristics of LED diode.

4. Tostudy BCD to seven segment display.

5. To study basic logic gates and to verify their truth table: TTL,NAND and NOR.

6.Verification of the Demorgan's theorem.

7. Study of an up-down counter.

8.(a)To study leakage current variation with temprature

(b) To see the shift in Q-point at diffrent oprating temprature.

(c) to see the effect of temprature on stability of an amplifier,

Note: Experiments can be replaced by other experiment of equal standard.

M.Sc. (Physics)

Semester-III, Paper - I

Session: 2017-18 & 2018-19

1809 - CONDENSED MATTER PHYSICS

Crystal Physics and Defects in Crystals

Crystalline Solids, Unit Cells and Direct lattice, Two and three dimensional Bravais lattice, closed packed structure.

Interaction of X-ray with matter, absorption of X-ray, Elastic Scattering from a perfect lattice. The reciprocal lattice and its applications to diffraction techniques. The Laue powder and rotating crystal methods, crystal structure factor and intensity of diffraction maxima. Extinctions due to lattice.

Point defects, line defects and planer (Stacking) faults, The role of dislocations in plastic deformation and crystal growth. The observation of imperfections in crystals,

X-ray and electron microscopic techniques.

Electronic Properties of Solid

Electrons in a periodic lattice: Bloch theorem, band theory classification of solids, effective mass, tight binding. Cellular and pseudopotential methods, Fermi surface, de Hass von Alfen effect, cyclotron resonance magneto-resistance, quantum Hall effect.

Weiss theory of ferromagnetism, Heisenberg model and molecular field theory, Spin waves and magnons. Curie-Weiss law of susceptibility, ferro- and antiferro -magnetic order. Domain and Bloch wall energy. Susceptibility below Neel temperature

Super Conductivity:

Critical temperature, persistent current, Meissner effect, type 1 and type-2

superconductors, London equations.

Text and Reference Books

1. Crystallography for Solid State Physics by Verma and Srivastava.
2. Introduction to Solids by Azaroff.
3. Elementary Solid State Physics by Omar
4. Solid State Physics by Kittel
5. Condensed Matter Physics by Kittel
6. Quantum Theory of Solids by Kittel

26/11/16

26/11/16

PG Nodal

Ahalapatra 26.11.2016

M.Sc. (Physics)

Semester-III, Paper - II

Session: 2017-18 & 2018-19

1810- NUCLEAR AND PARTICLE PHYSICS

Nuclear Interactions and Nuclear Reactions

Nucleon-nucleon interaction-Exchange forces and tensor forces, menson theory of nuclear forces – Nucleon – nucleon scattering effective range theory spin dependence of nuclear forces – charge independence and charge symmetry of nuclear forces, Isospin formalism, Yukawa interaction.

Direct and compound nuclear reaction mechanism – Cross Sections in terms of partial wave amplitudes, compound nucleus- scattering matrix, Reciprocity theorem, Breit- Weigner one – level formula – Resonance Scattering.

Nuclear Models

Liquid drop model, Bohr-Wheeler theory of fission. Experimental evidence for shell effects. model. Spin-orbit coupling, Magic numbers, Angular momenta and parities of nuclear ground states. Qualitative discussion and estimates of transition rates. Magnetic moments and Schmidt lines, Collective model of Bohr and Mottelson.

Nuclear Decay

Beta decay, Fermi theory of beta decay, Shape of the beta spectrum, total decay rate, Angular momentum and parity, selection rules, Comparative half-lives, allowed and forbidden transitions. Section Rules, parity violation, two-component theory of neutrino decay. Detection and properties of neutrino, Gamma decay, multipole transition in nuclei, Angular momentum and parity Selection rules, internal Conversion, Nuclear isomerism.

Elementary Particle Physics

Types of interaction between particles – Hadrons and leptons- symmetry and conservation laws. Elementary ideas of CP and CPT invariance. Classification of hadrons.

Text and Reference Books

1. Introductory Nuclear Physics by Kenneth S. Kiane :Wiley, New York, 1988
2. Introductory Nuclear Physics by H.A. Enge :Addison -Wesley 1975
3. Theory of Nuclear Structure by M.K. Pal: Affiliated East-West, Madras, 1982
4. Elementary Particles by J.M. Longo : Mc Graw- Hill, New York 1971.
5. Nuclear Physics by I. Kaplan, 2nd Ed. : Narosa Madres 1989.
6. Nuclear Physics by Roy and Nigam, Wiley Eastern Ltd.
7. Atomic and Nuclear Physics Vol. II by Ghoshal
8. Concept of Nuclear Physics by B.L.Cohen, Tata Mc Graw Hill
9. Introduction to high Energy Physics by P.H.Perkins, Addison- Wesley, London 1982

Semester-III, Paper – III

Session: 2017-18 & 2018-19

SPECIAL PAPER I

1811- OPERATIONAL AMPLIFIERS & DIGITAL ELECTRONICS

Operational Amplifiers:

Differential amplifier-circuit configurations working principle, Block diagram of a typical Op-Amp, DC analysis-AC analysis, dual input, balanced output differential amplifier-inverting and non-inverting inputs Op-amp parameters as input bias current, input off set current, input off-set voltage, open loop gain, common mode rejection ratio(CMRR), slow rate Use of OP-AMP as inverting and non-inverting amplifier, Adder, subtractor, integrator and differentiator comparator.

Communication Electronics:

Amplitude modulation – generation of AM waves-Demodulation of AM waves- DSBSC modulation. Generation of DSBSC waves, Coherent detection of DSBSC waves. SSB modulation, Generation and detection of SSB waves. Vestigial sideband modulation. Frequency division multiplexing (FDM).

Number system:

Decimal, binary octal and hexadecimal number system with mutual conversion, BCD addition and subtraction, 1's and 2's compliments, multiplication and division BCD code(8421)

Combinational Logic:

The transistor as a switch, OR, AND and NOT gates-NOR and NAND gates, Boolean algebra- de Morgan's theorems-Exclusive OR gate, Decoder/Demultiplexer Data selector/multiplexer-Encoder.

Sequential Logic:

Flip-Flop as 1- bit memory- RS Flip-Flop, JK Flip-Flop, JK master slave Flip-Flop- T Flip-Flop, D- Flip-Flop, Shift registers- synchronous and asynchronous counters- cascade counters.

Text and Reference Books

1. Electronic Devices and Circuit Theory by Robert Boylested and Louis Nashdsky PHI New Delhi.
2. Op-Amps & Linear integrated circuits by Ramakanth A. Gayakwad :PHI 2nd Edn
3. Digital principles and Applications by A.P.Malvino and Donald P. Leach:Tata Mc. Graw Hill company, New Delhi.
4. Principle of communication system by Taub and Schilling
5. Digital and Analogue techniques by Navneet, Gokhale and Kale
6. Semiconductor device and circuit by B.P.Singh

26/11/16 26/11/16 26.11.2016

Semester-III, Paper – IV

Session: 2017-18 & 2018-19

SPECIAL PAPER II

1812- ELECTRONICS AND ITS APPLICATIONS

Analog and Digital Systems: Analog computation, active filters, comparators, logarithmic and anti-logarithmic amplifiers, sample and hold amplifiers, waveform generators, square and triangular wave generators, pulse generator. Digital to analog converters, ladder and weighted resister types, successive approximation and dual slope converters, applications of DACs and ADCs.

Optoelectronics: Luminescence, photo-luminescence, cathodo-luminescence, electro luminescence, radiative recombination process: inter-band transition, impurity centre recombination.

Photo-detectors: Photo detectors with external photo effect, Photo detectors with internal photo effect, photo conductors and photo resistors, junction photo detector photodiode, response time of photodiode, avalanche photodiode, phototransistor.

Microwave Devices

Klystrons, Velocity modulation, bunching process, Basic principles two cavity Klystrons principle of operation of magnetrons. Hellix travelling wave Tubes, Wave Modes.

Transferred electron devices, Gunn effect, principle of operation. Mode of operation Read diode IMPATT diode, TRAPATT diode.

Radar Systems: Radar block diagram and operation, radar frequencies, pulse considerations, Radar range equation, derivation of radar range equation, minimum detectable signal, receiver noise, signal to noise ratio, integration of radar pulses, Radar cross section, pulse repletion frequency. Antenna parameters,

Satellite Communications: Orbital satellites, geostationary satellites, orbital patterns look angles, orbital spacing, satellite systems, Link modules.

Text and Reference Books

1. Microelectronics by Jacob Millman : Mc Graw Hill
2. Optoelectronics: Theory and Practice, edited by Alien Chappal, Mc Graw Hill
3. Microwaves: K.L.Gupta, Wiley Eastern Ltd. New Delhi.
4. Advanced Electronic Communication Systems by Wayne Tomasi, PHI Edn.
5. Microwave Device by Sen, Kennedy
6. Satellite Communication by D.C.Agrawal
7. Microwaves by K.L.gupta

26.11.16

26/11/16

Anekapalra 26.11.2016

M.Sc. (Physics)

Semester-III

Session: 2017-18 & 2018-19

1821- **LAB. COURSE-A (Solid State Physics & Electronics IV)**

Time: 5 Hrs. **Max. Marks: 100**

Marks Distribution:

Experiment	:60
Viva Voce	:20
Internal Assessment	:20

Note: Following experiments are recommended-

1. To construct and study the half adder and full adder and verify its truth table.
2. To study of a left shift, right shift register and its operation.
3. Study of R-S and J-K flip flop using NAND gate.
4. To use Op-Amp as (i) adder (ii) subtractor (iii) multiplier
   (iv) differentiator (v) integrator
5. To use Op-Amp as (i) Hartley and (ii) Colpitt oscillator.
6. To use Op-Amp as (i) Wien bridge and (ii) Phase shift oscillator
7. Crystal/phosphor preparation by solid state diffusion method.
8. To measure the dislocation density of a crystal by etching.
9. ML study of crystal/phosphor.
10. Microwave characterization and measurements

26.11.16 26/11/16 26.11.2016

M. Sc. (Physics)

Semester-III

Session: 2017-18 & 2018-19

1822. LAB. COURSE-B (Electronics V)

Time: 5 Hrs. **Max. Marks: 100**

Marks Distribution:

Experiment	:60
Viva Voce	:20
Internal Assessment	:20

Note: Following experiments are recommended-

1. Study of Pulse Amplitude Modulation, Pulse Position modulation and Pulse Width Modulation.
2. Study of A/D and D/A conversion.
3. To study Multiplexing and De-Multiplexing.
4. Wave form generation and storage oscilloscope.
5. To use Op-Amp as function generator.
6. To study different types of multivibrators.
7. Experiment on microprocessor - Addition, subtraction using 8085/8086.
8. Experiment on microprocessor - Multiplication, Division using 8085/8086.
9. Study of integrating , differentiating, clipping and clamping circuits.
10. Study of transistor push pull amplifier.

M. Sc. (Physics)

Semester-IV, Paper- I

Session: 2017-18 & 2018-19

1813- COMPUTATIONAL METHODS AND PROGRAMMING

Computational Method

Method of determination of Zeros of linear algebraic and transcendental equations; bisection method, method of false position, iteration method, Newton-Raphson method, Methods of determination of Zeros of nonlinear equations, method of iteration, Newton-Raphson method.

Solution of simultaneous linear equations, Gaussian elimination, pivoting, iterative method, matrix inversion.

Eigen values and eigen vectors of matrices, power and Jocabi method.

Finite differences, interpolation with equally spaced and unevenly spaced points, Curve fitting, Polynomial least squares and cubic spline fitting.

Numerical differentiation and integration, Newton-Cotes formulae, error estimates, Gauss method.

Random variate, Monte Carlo evaluation of integrals, Method of importance sampling Random walk and Metropolis method.

Numerical solution of ordinary differential equations, Euler and Runge Kutta Methods, Predictor and corrector method, Elementary ideas of solutions of partial differential equations.

Programming

Elementary information about digital computer principles, compilers, interpreters and operating systems.

"C" programming, structure, data types constant, Variables, Assignment, declaration & expression, statement, symbolic. Constants Different types of operators, Integers, Floating points in "C" Data input and output controls printf and scanf function, putchar, getchar, Array.

Control statement and Decision marking in "C" if, if- else, statement, Nesting of if in statement, while loop, do-while loop, for loop, Nesting of for loop, Newton Raphson integration methods as an example of "C" program. User defined function, function and structured programming local and global variables, Declaration of function, Array, Declaration, Initialization and processing of array statement.

Text and Reference Books:

1. Introductory methods of Numerical analysis by Sastry.
2. Numerical Analysis by Rajaraman.
3. Let us "C" byKanetkar
4. Numerical Methods byB.S. Grewal.
5. Press and flannery: Numericals Recipes byVetterming, Teukolsky.
6. Programming in C and Numerical Analysis by S.S.Shrivastava

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M.Sc. (Physics)

Semester-IV, Paper -II

Session: 2017-18 & 2018-19

ELECTIVE PAPER

1814- LASER AND ITS APPLICATIONS

Basic principle of Laser: Population inversion, Laser pumping,. Stable Two-Mirror Optical Resonators, Longitudinal and Transverse Mode of Laser Cavity. Mode Selection, Vibrational modes of a resonator, number of modes per unit volume, Losses inside the cavity, Gain in a Regenerative Laser Cavity. Threshold for 3 and 4 level Laser Systems. Mode Locking, Pulse Shortening- Picoseconds & femtosecond operation Spectral Narrowing and Stabilization. Gaussian beam and its properties.

Ruby laser, semi-conductor laser, Nd-YAG Laser, Diode-Pumped solid state lasers, Nitrogen laser, Carbon - dioxide laser. Excimer laser, Dye laser, high power laser systems.

Nonlinear optics: Harmonic generation, Second harmonic generation, Phase matching, Third harmonic generation, Optical mixing. Nonlinear interaction of light with matter, Laser induced multiphoton processes :Theory of two photon process, parametric generation of light.

Applications of Laser: Laser Fluorescence and Raman Scattering and their use in pollution studies. Ultra high resolution spectroscopy with lasers and its applications. Light wave communication: Optical fibers, Modulator and detectors

Applications of laser in medical and engineering fields, Counting of atoms, Isotopes separation, Ether drift, absolute rotation of earth, Holography.

Text and Reference Books

1. Lasers by Svelto
2. Optical Electronics by Ajay Ghatak and Thyagrajan
3. Optical Electronics by Yariv
4. Laser Spectroscopy by Demtroder
5. Nonlinear Laser Spectroscopy by Letekhov
6. LASER System and Applications by Satyaprakash

M.Sc. (Physics)
Semester-IV, Paper - III
Session: 2017-18 & 2018-19
SPECIAL PAPER III
1815- DIGITAL COMMUNICATION

gital communications : Pulse modulation systems: sampling theorem- low pass and band pass signal, Pam, annel BW for a PAM signal, Natural sampling. Flat top sampling. Signal recovery through holding, uantization of signals. Quantisation. Differential PCM, Delta modulation, Adoptive delta modulation, CVSD.

igital Modulation :BPSK, DPSK, QPSK,PSK, QASK, BFSK, FSK, MSK,.

lathematical Representation of Noise :Sources of noise, frequency domain representation of noise, Effect of ltering on the probability density of Gaussian noise, spectral component of noise, Effect of a filter on

ne power spectral density of noise, superposition of noises, Mixing involving noise, Linear filtering Noise band vidth, Quadrature components of noise, power spectral density of nc(t), ns(t) and their time derivatives.

Data Transmission : Base band signal receiver, probability of error, optimum filter, white noise, Matched filter and probability of error, Coherent reception, Correlation, PSK, FSK, Non coherent detection of FSK, Differential PSK, QPSK, Calculation of error probability for BPSK, BFSK and QPSK.

Noise in Pulse-code and Delta-modulation systems : PCM, transmission, calculation of quantization noise, output signal power, Effect of thermal noise, output signal-to-noise ratio in PCM, DM, Quantization noise in DM, Output signal power, DM output signal-to quantization-noise ratio, Effect of thermal noise in delta modulation, output signal- to-noise ratio in DM.

Computer Communication Systems : Types of network, Design features of a communication network, examples, TYMNET, APRANET, ISDN, LAN.

Mobile Radio and Satellites : Time division multiple access (TDMA), Frequency division multiple access (FDMA), Slotted ALOHA, Carrier sense multiple access(CSMA),. Poisson distribution, protocols.

Text and Reference Books

1. Principles of Communication Systems by Taub and Schillin : TMH
2. Communication Systems by Simon Haykin : John Wiley and Sons.
3. Electronic Communication System:Kennedy and Devis
4. Electronic Communication System:Roddy and Coolen

26.11.16 26/11/16 26.11.2016

M.Sc. (Physics)

Semester-IV, Paper – IV

Session: 2017-18 & 2018-19

SPECIAL PAPER IV

1816- MICROPROCESSOR AND OPTICAL FIBRE

Microprocessor: Introduction and evolution.

Digital Computer: Generation of computer, Input and output devices, central processing unit (CPU)

Primary memory: Introduction, RAM, ROM, EROM, EPROM

Secondary memory: Hard disc, Floppy disc, optical disc, Magnetic bubble memory (Construction and working principle), Cache memory, Real and Virtual memory.

Networking: Wide area Networking (WAN), Local Area Networking (LAN). LAN topology (Bus, Star, Ring)

Intel 8085: Introduction, Construction, ALU, Timing and control unit, Registers, data and address bus, Pin configuration of 8085.

Opcode and operand, Instruction word size, Instruction cycle, fetch operation, execute operation, machine cycle.

Timing diagram: Opcode fetch cycle, Memory read, I/O read, Memory write, I/O write

Instruction set of 8085: data transfer group,, Arithmetic group, Logical group.

Machine and Assembly language, High and low level language, Modular and structural programming.

Assembly language programs: addition of two 8-bit numbers, sum 8-bit, addition of two 8-bit numbers, sum 16-bit, 8-bit subtraction, To find the largest number in a data array. To arrange a series of numbers in descending order, To find the smallest number in a data array. To arrange a series of numbers in ascending order, shift of 8-bit number of left by one bit and two bit, shift of 16-bit number of left by one bit and two bit.

Optical Fibres: Introduction, Structure, Classification, Refraction and snell's law, Total internal refraction, Light propagation through an optical fibre. Acceptance angle for incident ray, Numerical aperture, Skew rays and Acceptance angle for skew ray, Number of modes and cut-off parameter, single mode propagation, comparison of step and graded index fibre.

Types of Optical fibre: HPSUU, HPSIR, Halide fibre.Optical fibre cables: multifibre cable, Splicing and connectors

Advantage and disadvantage of optical fibre.

26.11.16

26/11/16

26.11.2016

Text and Reference Books:

1. Fundamentals of Microprocessor and Microcomputer by B. Ram, Dhanpat [illegible] Publication , New Delhi.
2. Introduction to Microprocessor by Aditya Mathur, Tata Mc. Graw Hills, New Delhi.
3. Microprocessor Architecture, Programming and Applications with 8085/8065 by Ram S. Gaonkar, Wiley Eastern Ltd. 1987.
4. Optical Fibres and Fibre Optic Communication System by Subir Kumar Sarkar, S. Chand & Company Ltd.
5. Optical Fibre Communications (Principle and Practice) by John M. Senior, Prentice Hall of India Pvt. Ltd.

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26.11.2016

M. Sc. (Physics)

Semester-IV

Session: 2017-18 & 2018-19

1823- LAB. COURSE (Computer Programming)

Time: 5 Hrs. **Max. Marks: 100**

Marks Distribution:

Experiment	:60
Viva Voce	:20
Internal Assessment	:20

Note: Following programmes in C language are recommended-

1. Programme to calculate simple interest.
2. Programme to print two numbers.
3. Programme for simple interest of three sets of principal amount, rate and number of years.
4. Programme to sort numbers in ascending order.
5. Programme to sort numbers in descending order.
6. Programme for sorting a data from an array.
7. Programme for solving the simultaneous equations.
8. Programme to accept three numerical values and print the biggest number out of these.
9. Programme to find out the roots of an equation by Newton-Raphson method.
10. Programme to find out the roots of an equation by Bisection method.
11. Programme to find out the roots of quadratic equation by Secant's method.
12. Programme for integration by Simpson's rule.
13. Programme for Runge-Kutta method.
14. Programme for String manipulation.
15. Programme to find out solution of Laplace Equation.

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For M.Sc.

M. Sc. (Physics)

Semester-IV

Session: 2017-18 & 2018-19

1824- PROJECT WORK

This work will be based on preliminary research oriented topics both in theory and experimental.

OR

The student shall be assigned a project work involving the design and study of some electronic circuit/devices etc. so as to provide them experience in designing and understanding the aspects. It is aimed at generating self confidence and giving practical experience.

The teachers who will act as supervisors for the projects will float projects and any one of them will be allocated to the student. At the completion of the project by the semester end, the student will submit Project Report in the form of Dissertation which will be examined by the examiners. The examination shall consist of (a) Presentation and (b) Comprehensive viva-voce.

26.11.16 26/11/16 26.11.2016

M.Sc. Physics

session: 2018-19& 2019-20

Semester-4, Paper-1

1813- Computational methods and Programming

Basic computer programming, Flow chart, Object oriented programmingpreliminaries, C constants & variables,compiler ,interpreter,data type ,declaration and assignment,symbolic,

Arithmetic expression, I/O statements, control statements (Do, if, while loop), nesting,formatspecification, logical expression, Function/subroutines. File processing,local and global declaratioon,user defined function, declariation, Array declariation and initilization

Methods for determination of Zeroes of linear and nonlinear algebraicequations and transcendental equations ,bisection methord,newton rapson methord of false position,convergence of solutions.

Solution of simultaneous linear equations, Gaussian elimination, pivoting, iterative Method, Matrix inversion.

Eigen values and vector of matrices ,power and Jacobi methodFinite Differences , interpolation with equally spaced and unevenly spaced po int, Curve fitting Polynomial least squares, Numerical solution of ordinary differential equation, Euler & Runga- Kutta method. Numerical integration, Trapezoidal rule, Simpson's method.

Text and Reference Books

1 .Sastry : Introducto y methods of Numerical Analysis

2. Rajaraman : Numerical Analysis and Fortran Programming

2. ANSI C By E Balagoswami

3. Let us C by Yaswant Kanetkar

4. Mathematical physics for Physist by Arfken and Weber

5. Mathmatical physics by Satyaprakash

6. Higher engineering mathmatics by H K Dass

1.9.18

M.Sc. Physics

session: 2018-19& 2019-20

Semester-4, Paper-2

1814 - Laser Physics and Spectroscopy

Basic Principles of Laser, Two level, Three and Four level laser system, Rate equations for three and four level system, threshold pump power, Relative merits and de-merits of three and four level system, Gas and dye lasers, Application of Laser in Material Processing.

Optical resonators, Stability of resonators, Characteristics of Gaussian beam, Transverse and longitudinal modes, mode selection, losses in a resonator, mirror mounts, optical coating etc., Q-switching and Mode locking. Non-linear polarization of lasers and some applications: Second harmonic generation using non-linear optical methods.

Concepts of spectroscopy, Process of Absorption, Emission and Scattering, Dispersing devices and detectors: Dispersion and resolution of a prism and a grating spectrometer. Single and double monochromators, Photomultiplier tube, Charge coupled detectors (CCD).

UV-visible molecular absorption spectroscopy, Molecular luminescence spectroscopy (fluorescence, phosphorescence, chemiluminescence), Infrared Spectroscopy: Instrumentation and typical applications of infrared spectroscopy (qualitative and quantitative), Raman Spectroscopy: Instrumentation, Applications of Raman spectroscopy.

Text and Reference Books

1. Laser Theory and Applications: K. Thyagarajan and A.K. Ghatak
2. Principles of Lasers : O. Svelto.
3. Laser Spectroscopy and Instrumentation : W. Demtroder.
4. Laser Material Processing : William M. Steen
5. Modern Spectroscopy, J. M. Hollas
6. Fundamentals of Molecular Spectroscopy, C. N. Banwell and E.M. Mc Cash.
7. Advances in Laser spectroscopy: Edited by F.T.Arecchi
8. Laser Applications: Monte Ross

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M.Sc. Physics

session: 2018-19& 2019-20

Semester-4, Paper-3

Special paper -3

1815 - DIGITAL COMMUNICATION

Digital communications:Pulse modulation systems: sampling theorem- low pass and band passSignal,Pam channel BW for a PAM signal. Natural sanmpling. Flat top sampling. Signalrecovery through holding. Quantization of signals. Quantisation. Differential PCM Deltamodulation, Adoptive delta modulation, cvSD

Digital Modulation techniques:BPSK, DPSK. QPSK,PSK.QASK. BFSK. FSK. MSK.

Data Transmission: Base band signal receiver, probability of error, optimum filter. white noise,Matched filter and probability of error, Coherent reception, Correlation, PSK. FSK. Noncoherent detection of ESK. Differential PSK, QPSK, Calculation of error probability for BPSK,BFSK and QPSK.

Mathematical Representation of Noie: Sources of noise, frequency domain representation ofnoise, Effect of filtering on the probability density of Gaussian noise, spectral componen ofnoise, Effect of a filter on the power spectral density of noise, superpposition of noises, Mixinginvolving noise, Linear filtering Noise band width, Quadrature components of noise, power spectral density of nc(t), ns(t) and their time derivatives.

Noise in Pulse-code and Delta-modulation systems .PCM. transmission, calculation ofquantization noise, output signal power, Effect of thermal noise, output signal-to-noise ratio inPM DM Ouantization noise in DM, Output signal power, DM output signal-to quantizationnoise ratio, Effect of thermal noise in delta modulation, output signal- to-noise ratio in DM.

Computer Communication Systems: Types of network, Design features of a communicationnetwork, examples. TYMNET, APRANET, ISDN, LAN,WAN,Wi-Fi,Li-Fi

Mobile Radio and Satellites:Time division multiple access (TDMA), Frequency divisionmultiple access (FDMA), Slotted ALOHA, Carrier sense multiple access(CSMA),. Poissondistribution, protocols.

Text and Reference Books

1. Principles of Communication Systems by Taub and Schilling: TMH

2. Communication Systems by Simon Haykin: John Wiley and Sons.

3. Electronic communication system by Kennedy and Davis

4Electronie Communication by Roddy, Coolen.

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M.Sc. Physics

session: 2018-19& 2019-20

Semester-4, Paper-4

Special paper -4

1816 - MICROPROCESSOR

Microprocessor:introduction and evaluation,introduction to microprocessor Intel 8085,principal and PIN diagram, archetechure and working og Microprocessor.

Digital Computer: Generation of computer Input and output device central processing unit (CPU)Primary memory Introduction, RAM, ROMs, EROM,EPROM,

Secondary memory: hard disk, Floppy disc, optical disc, Magnetic bubble memory (Construction and working principle), Cache memory, Real and Virtual memory

Networking: loaal Area Networking (LAN), Wide area Networking (WAN), LAN topology(Bus, Star, Ring)

Intel SO85: Introduction, Construction, ALU, Timing and control unit, Registers data address bus. Pinconfiguration of 8085.

Opcode and operand Instruction word size, Instruction cycle, fetch operation, executive opration, machine cycle.

Timing diagram: Opcode fetch Cycle, Memory read, I/O read, Memory write, I/O write

Machine and Assembly language: High and low level language. Modular and structural programmingInstruction set of 8085: data transfer group Arithmetic group, Logical group.

Assembly language programsaddition of two 8 bit number,sum 8 bit,sum 16 bit, 8-bit subtraction,To find the largest number in Data array,To arrange a series of numbers in descending order, To arrange a series of numbers in ascending order,To finethe smallest number in a data array shift of 8-bit number of left byone bit and two bit, shift of 16-bit number of left by one bit and two bit.

Optical fibre: Introduction. Structure, Classification, Refraction and snell's law, Total internal reflection,Light propagation through an optical fibre. Acceptance angle for incident ray, numerical apertureskew raysand Acceptance angle for skew ray,of modes and cut-off parameter, single mode propagation, comparison of step and graded

Type of Opticalfiber: HPSUU. HPSIR, Halide fibre.Optical fibre cables: multifibre cable,Splicing and connectors,Advantage and disadvantage of optical fibre.

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Text and Reference Books:

1. Fundamentals of Microprocessor and Microcomputer by B. Ram, Dhanpat Rai Publication , New Delhi.
2. Introduction to Microprocessor by Aditya Mathur, Tata Mc. Graw Hills, New Delhi
3. Microprocessor Architecture, Programming and Applications with 8085/8065 by Ramesh S. Gaonkar, Wiley Eastern Ltd. 1987.
4. Optical Fibres and Fibre Optic Communication System by Subir Kumar Sarkar, S. Chand & Company Ltd.
5. Optical Fibre Communications (Principle and Practice) by John M. Senior. Prentice Hall of India Pvt. Ltd.

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M.Sc. Physics

session: 2018-19& 2019-20

Semester-4

1823- LAB.COURSE (Computer Programming)

Note: Following programme in Clanguage are recommended-

1. Programme to calculate simple interest.

2. Programme to print two numbers.

3. Programme for simple interest of three sets of principal amount, rate andnumber of years.

4. Programme to sort numbers in ascending order

5.Program to sort numbers in descendingorder.

6. Programme for sorting a data from an array.

7. Programme for solving the simultaneous equations.

8. Programme to accept three numerical values and print the biggest number outof these.

9, Programme to find out the roots of an equation by Newton-Raphson method.

10. Programme to find out the roots of quadratic equation by Secant's method.

11. Programme for integration by Simpson's rule.

2. Programme for Runge-Kutte method.

13. Programme for String manipulation.

Note: Experiments can be replaced by other experiment of equal standard.

session: 2018-19& 2019-20

Semester-4

1824 - PROJECT WORK

The work will be based on priminary research oriented topics both in theory and experiment.

OR

The student shall be assigned a project work involving the design a and study of someelectronic circuit/devices etc. so as to provide themexperience in designing and understandingthe aspects. It is aimed at generating self confidence and giving practicalexperience

The teachers who will act as supervisors for the projects will flot projects anany one of will be allocated to the student.. At the completion of the project by the semester endstudent willsubmit Project Report in the form of Dissertation which will be examined by theexaminers.The examination shall consist of (a) Presentation and (b) Comprehensive viva-vice.