B.Sc. Physics(Main) Theory (PT M) Syllabus

Paper(i) PTM-I- Solidstate Physics & Thermodynamics

Unit I-Solid state physics

Solid State Physics

1.X-ray diffraction: X-ray diffraction--Bragg's law--Bragg's X-ray spectrometer--Powder crystal method. (Book 1,Ch. 5)

2 Electrical properties of metals: Classical free electron theory--drawbacks of classical theory--relaxation time--collision time and mean free path--electrons scattering and source of resistance in metals--electron scattering mechanisms and variation or resistivity with temperature--distinction between metals, insulators and semiconductors on the basis of Band theory--Effect of magnetic fields--Hall effect--Hall coefficient. (Book 1,Ch. 6,10)

3.Superconductivity: (No mathematical derivations required)

Historical introduction--A Survey of superconductivity--An account of the mechanism of superconductors--effects of magnetic field--AC resistivity--critical currents--flux exclusion: The Meissner effect--Thermal properties--the energy gap--Isotop effect--Mechanical effects--the penetration depth--Type I and tytpe II superconductors--a Survey of B.C.S. theory--B.C.S. theory--Quantum tunneling--Josephson's tunneling--New superconductors--potential applications of superconductivity--power applications of superconductors (Book 1, Ch 8)

4. magnetic properties: Magnetic permeability--Magnetization--electric current in atom--Bohr magneton--electron spin and magnetic moment--diamagnetism--theory of diamagnetism--Paramagnetism. (Book 1, Ch.9)

Unit II - Thermodynamics

5.Temperature

Thermal equilibrium--zeroth law of thermodynamics (Book 2, Ch1)

6. Heat

Thermodynamic coordinates--Concept of heat--Quasistatic process--Work and Heat--Adiabatic work--Internal energy function--Mathematical form of First law of thermodynamics-- Differential form of first law--Heat capacity of water--Equation for a hydrostatic system (Book 2 , Ch. 4)

7. Ideal gases

Equation of state of a gas--Internal energy of a gas--Ideal gas--Quasistatic adiabatic process--Equation of state of an ideal gas(Kinetic theory of ideal gas) (Book2 ,Ch 5)

8. Second law of Thermodynamics

Conversion of work in to heat and vice versa -- Kelvin-planck and Clausius statements of Second law of Thermodynamics and their equivalence -- Carnot's cycle-- Carnot's theorem and coreollary--thermodyanamic scale of temperature -- absolute zero and efficiency-- gasoline engine(Otto) -- Diesel engine--reversibility and irreversibility--condition for reversibility.

(Book2, Ch6)

9.Entropy

Reversible part of the second law--Entropy --principle of carateodory- -- entropy of an ideal gas -- T-S diagram of entropy and reversability--entropy and irreversibility--irreversible part of second law--heat and entropy of irreversible processes--entropy and nonequilibrium states--principle of increase of entropy--applications of entropy principle--entropy and disorder--enthalpy--Helmholtz and Gibb's functions--maxwell's relations--T DS equations--internal energy equation--heat capacity equation

(Book 2, Ch 8)

11. Low temperatures

Joule Kelvin effect -- liquefaction of gases -- third law of thermodyanamics

(Book3 , Ch.8)

Books for study

1.Solid state Physics--S.O.Pillai (5th edn.) (New age)
2 Heat and Thermodyanamics - Mark W.Zemansky and Richard H. Dittman (6th edn)-Mc Graw hill
3. Basic Thermodynamics--Evelyn Guha (Narosa)

Books for reference

4. Modern Physics-- R.Murugeshan & Kiruthiga sivaprasad (13th edn.)(S.Chand & Co.)
5.Problems and solutions in solid state physics--S.O.Pillai (New age)
6.Theory and experiment onThermal Physics- P.K.Chakrabarti(New central Book agency)

Paper (ii) - PT(M)-2- Electrodynamics

Unit- I - Electrodynamics I

1. Vector Analysis

Differential calculus -- Integral calculus--Curvilinear coordinates--Cylindrical coordinates--Dirac delta function--divergence of r/r^2--One dimensional Dirac delta function, three dimensional Dirac delta function-

(Ch 1, Book 1 ; Ch 2, Book 2; Ch1, Book3)

2. Electrostatics

Coulomb's law--Electric field-- continuous charge distribution--Divergence and curl of electric fields--field lines--Electric flux and Gauss,s law -- Divergence of **E** -- applications of Gauss law -- curl of **E** -- electric potential -- Potential concept -- Poisson's and Laplace's equation -- potential of a localized charge distribution -- electrostatic boundary condition -- work and energy in electrostatics -- work done to move a charge -- energy of a point charge and continuous charge distribution -- electrostatic energy -- conductors -- basic properties -- induced charges -- surface charge and force on a conductor -- capacitors (Ch.2, Book1)

3. Special Techniques

Laplace's equations in one, two and three dimensions, boundary conditions and uniqueness theorem, conductors and second uniqueness theorem -- method of images - the classic image problem, induced surface charge, force and energy problem -- seperation of variables in cartesian coordinates and spherical polar coordinates -- multipole expansion - approximate potentials at large distances, origin of coordinates in multipole expansions, electric field of a dipole. (Ch.3, Book 1)

4. Electric fields in matter

Polarization - dielectrics, induced dipoles, alignment of polar molecules, polarization -- the field of a polarized object - bound charges,physical interpretation of bound charges, the field inside a dielectric -- electric displacement - Gauss law in the presence of dielectrics, boundary conditions -- Linear dielectrics - succeptibility, permitivity, dielectric constant - boundary value problems with linear dielectrics, energy in dielectric systems, forces on dielectrics (Ch.4, Book1)

Unit- II - Electrodynamics II

5. Magnetostatics

The Lorentz force law - magnetic fields, magnetic forces, currents -- The Biot-Savart law - steady currents, the magnetic field of a steady current --The divergence and curl of **B** - straight line currents, the divergence and curl of **B** -- applications of Ampere's law -- comparison of Magnetostatics and Electrostatics -- Magnetic vector potential -- The vector potential- magnetostatic boundary conditions, multipole expansion of vector potential
(Ch.5, Book1)

6. Magnetic fields in matter

Magnetisation - diamagnets, paramagnets, ferromagnets -- Torque and forces on Magnetic dipoles--Effect of a magnetic field on Atomic orbits-Magnetization-- The field of a magnetized object-bound currents-Physical interpretation of bound currents-The magnetic field inside matter--The auxiliary field **H** -Ampere's law in Magnetized materials-A Deceptive parallel--Linear and nonlinear media-Magnetic Susceptibility and Permeability-ferromagnetism (Ch 6, Book 1)

7. Electrodynamics

Electromotive force- Ohm's law -electromotive force--motional emf-- Electromagnetic induction-Faraday's law-The induced electric field-inductance-Energy in Magnetic fields--Maxwell's equations-Electrodynamics before Maxwell-How maxwell fixed Ampere's law-Maxwell's equations - Magnetic charge-Maxwell's equations in matter--Boundary conditions (Ch. 7, Book 1)

8. Conservation laws

Charge and energy--The continuity equation--Poynting's theorem--Momentum--Newton's third law in Electrodynamics--Conservation of momentum--Angular momentum

(Book1, Ch 7)

9. Electromagnetic waves

Waves in one dimension--The wave equation--Sinusoidal waves--Boundary conditions: Reflection and Transmission-- Polarization--Electromagnetic waves in vacuum--The wave equation for **E** and **B --**Monochromatic plane waves-- Energy and momentum of Electromagnetic waves--Electromagnetic waves in matter--Propagation in linear media- Reflection and Transmission at normal incidence (Ch 9 , Book I)

Book for study

1. Introductiuon to Electrodynamics--David J. Griffiths- (PHI) (3rd edn.)

Books for reference

2. Electromagnetic field theory fundamentals- Guru& Hiziroglu (Vikas)
3. Elements of Electromagnetics(3rd edn.)- Mathew N.O. Sadiku (Oxford)

Paper(iii) - PT(M) - III - Physical Optics and Photonics

Unit- I - Physical Optics

1. Matrix Method in Paraxial Optics :

Introduction—the matrix method—effect of translation—effect of refraction— imaging by a spherical refracting surface—coaxial optical systems—unit planes—nodal planes—a system of two thin lenses. (Book1, Ch 4)

2. Interference by Division of Amplitude

Interference in thin films — the cosine law — nonreflecting films — high reflectivity by thin film deposition – interference by wedge shaped film—Newton's rings—the Michelson interferometer. (Book 1, Ch13)

3. Fraunhoffer Diffraction :

Single slit, double slit, N slit diffraction patterns—positions of maxima and minima—width of the principal maxima—the diffraction grating—resolving power of grating—resolving power of a prism (Book 1, Ch16)

4. Fresnel Diffraction :

Fresnel half period zones—zone plate—diffraction at a straight edge—Fresnel diffraction by a circular aperture.

(Book 1, Ch 17)

5. Fermats' Principle and its Applications:

Introduction—laws of reflection and refraction—refraction of rays at the interface between an isotropic medium and an anisotropic medium—optic axis normal to the surface—ray paths in an inhomogeneous medium—the ray equation and its solutions. (Book 1, Ch 2)

6. Polarization and double refraction

Introduction-production of polarized light -- polarization by reflection -- polarization by double refraction -- polarization by scattering -- Malus law -- Superposition of two disturbances -- Mathematical analysis -- Double refraction -- Normal incidence -- oblique incidence -- interference of polarized light -- QWP -- HWP -- Analysis of Polarised light -- Optical activity

(Book 1,Ch 19)

Unit - II - Photonics

7. Lasers:

Introduction—the Einsteins coefficients—population inversion—threshold condition— optical resonator—line broadening mechanisms (natural, collision, Doppler qualitative ideas)

(Book 1,Ch23)

Laser systems—Ruby laser—Nd based lasers—(Nd-YAG, Nd-Glass) – He-Ne laser -- Argon ion laser—CO_2 laser—excimer lasers—semiconductor lasers.

(Book2)

Application of lasers—Laser induced fusion—application in material processing (laser welding, hole drilling, laser cutting) – lidar—lasers in medicine.

(Book 3)

9. Holography:

Introduction—recording and reconstruction process—applications— holographic interferrometry holographic memories. (Book 4)

10. Fibre Optics :

Introduction—step index fibre – numerical aperture—pulse dispersion in step index fibres – graded index fibres—material dispersion—single mode fibres—fibre optic sensors—multimode and single mode fibre sensors (Book 1,Ch 24)

Fibre materials and manufacture—glass fibres—plastic fibres—losses in fibres—bending losses—intrinsic fibre losses—scattering losses and absorption losses. (Book 4)

11(. Optical Communication Systems:(Qualitative study only)

Modulation schemes—analog modulation—digital modulation—free space communication—fibre optical communication systems—operating wavelength—local area networks—integrated optics—slab and strip waveguides—devices—emitters (sources) and detectors. (Qualitative idea only) (Book 4)

Books

1. Optics--Ajoy Ghatak--TMH Publishing Co.
2 Optical Electronics-- Ajoy Ghatak and K. Thyagarajan -- Cambridge Uty Press
3. Lasers Theory and Applications -- K. Thyagarajan and A.K. Ghatak--Mac Millan India Ltd
4. Optoelectronics an Introduction -- J. Wilson and J.F.W. Halkes -- Prentice-Hall of India

Book for reference

5.High Power Lasers and their applications-- Dr.M.Premasundaran (Law and commercial Publishers, New Delhi)

Paper (iv) - PTM-4 - Classical and Quantum mechanics

Unit I - Classical Mechanics

1.Particle Dynamics

Newtons laws of motion--dynamical concept--Mechanics of a system of particle (Book 1, Ch.4)

2.Conservation laws and properties of space and time

Linear uniformity of space and conservation of linear momentum--Rotational invariance space and law of conservation of angular momentum--homogeneity of flow of time and conservation of energy. (Book1, Ch 5)

3.Inverse square law force

Forces in the universe--gravitational field and potential--Electric field and potential--Gravitational field due to i)thin spherical shell ii)solid sphere-Earth's gravitational field, escape and orbiting velocities--existance of atmosphere around a planet--gravitational self energy--elerctrostatic self energy--motion under force obeying inverse square law--Equivalent one body problem--motion under central forces--Some physical insights in to the nature of motion under central forces--trajectory of a particle and turning points--Kepler's laws--satellite motion. (Book1, Ch 6)

4. Elastic and Inelastic collision

Conservation laws--Laboratory and centre of mass systems--kinetic energies in the lab and cm systems--Cross section of elastic scattering--Rutherford scattering (Book 1, Ch7)

5. Dynamics of rigid bodies

Elementary treatment of rigid bodies--Angular momentum of a rigid body and inertia tensor--Angular momenta and rotational kinetic energy. (Book 1, Ch. 8)

6.Oscillatory motion

Simple Harmonic motion--Energy of a simple harmonic motion--damped harmonic oscillator--energy of a damped oscillator--the quality factor--examples of damping in physical system--forced harmonic oscillator--resonance--quality factor of a driven oscillator--electrical resonance--superposition principle. (Book1,Ch 9)

Unit II - Quantum Mechanics

7. Inadequacy of classical mechanics and the Empirical foundation of quantum theory

Inadequacy of classical mechanics -- Atomic structure and atomic spectra--The Franck-Hertz experiment-- Spacial(space) quantisation: Stern and Gerlach experiment--The wave nature of particles : matter waves--Particle nature of waves-- Compton effect--Davisson and Germer experiment--G..P.Thomsons experiment--Applications of electron diffraction--velocities of De-Broglie waves--Uncertainty principle--Uncertainty and measurements--Elementary proof of uncertainty principle--Applications of uncertainty principle (Book 2, Ch 1)

8. Wave packets

One-dimensional wave packets -- principle of superposition -- wave packet -- wave packets and material particles (Book2, Ch2)

9. Schrodinger wave equation

Need for a wave equation -- wave equation -- Schrodinger's equation ; time dependent form -- expectation values -- Schrodinger's equation : steady state form -- particle in a box -- finite potential well -- tunnel effect -- harmonic oscillator -- Appendix to chapter 5 (Book 3, Ch 5)

Books for study

1. Mechanics - Hans and Puri(2nd edn) - TMH
2. Quantum mechanics - Theory and problems - S.L. Kakani and H.M. Chandalia (4th edn 2004) - Sultan Chand and sons
3. Concepts of Modern physics (5th edn) - Arthur Beiser - TMH

Paper (v) - PT(M)-5 - Modern Physics

Unit I- Nuclear, Molecular Physics & Elementary particles

1.Introduction

The vector atom model--Quantum Number assoiated with the vector atom model--coupling schemes-- Optical spectra--Zeeman effect--Quantum mechanical explanation of the normal Zeeman effect--Anamolous Zeeman effect--Paschen-Back effect--Stark effect (Book 2, Ch 6)

2. Nucleus

Binding energy--Meson theory of nuclear forces--The liquid drop model--The shell model--The collective model (Book2,Ch 27)

3. Spectroscopy

Regions of spectrum--The width and intensity of spectral transitions (Book 1 , Ch1)

Microwave spectroscopy:-- The rotation of molecules--Rotational spectra--Spectrum of rigid diatomic molecules--The intensities of spectral lines--The effect of isotopic substitution--The spectrum of non-rigid rotator--The microwave oven (Book1, Ch 2)

Infra-red spectroscopy:--The vibrating diatomic molecule--The energy of a diatomic molecule--The simple Harmonic oscillator--The Anharmonic oscillator--The diatomic vibrating rotator--the vibration--rotation spectrum of carbon monoxide (Book 1 , Ch..3)

4. Raman effect

Discovery--Experimental study of Raman effect--Quantum theory of Raman effect--Applications--Laser Raman spectroscopy (Book 2 ,19.11--19.15)

Complementary character of Raman and infra-red spectra (Book 2 ,24.16)

5. Elementary particles

Interactions of charged particles--Leptons--Hadrons--Elementary particle quantum Numbers--Quarks--Fundamental interactions--History of the universe--The future (Book 3 ,Ch 13)

Unit II-Relativity, Astrophysics,Statistical physics Nanotechnology

6. Theory of Relativity

Frame of reference--Newtonian relativity--Galilean Transformation equations--Ether hypothesis--Michelson-Morley experiment--special theory of relativity--Lorentz transformation equations--Length contraction--Time dilation--Relativity of simultaneity--addition of velocities--variation of mass with velocity--Mass-energy equivalence--Minkowski's four dimensionalspace-time continuum--The general theory of relativity

Particle with a zero rest mass (Book2, Ch 1&2)

Transformation of momentum and energy--Trasformation equations for force--Geometrical representation of Simultaneity, contraction and dilation--Non-inertial frames and fictitious forces (Book 2, Ch 3)

7. Astrophysics

Introduction--Classification of stars-The Harward classification system--H-R diagram--Luminosity of a star--Stellar evolution--White dwarfs--Electrons in a white dwarf star--Chandrasekhar limit--Neutron stars--Black holes--supernova explosion--Photon diffusion time--Gravitational Potential energy of a star--Internal temperature of a star--Internal pressure of a star (Book 2,Ch 78)

8.Statistical Mechanics

Introduction--Phase space--Maxwell-Boltzmann Distribution law--Molecular energies in an ideal gas--Bose-Einstein distribution law--Fermi-Dirac Distribution law--Comparison of the three distribution laws--Black-Body radiation--Rayleigh-Jeans formula--Planck Radiation formula--Stefan-Boltzmanlaw from Planck's formula--Application of Fermi-Dirac distribution to White dwarfs and Neutron stars--

Macroscopic and Microscopic distributions--Ensembles--Probability--Thermodynamic probability--Boltzmann's theorem on Entropy and probablity--Fundamental postulates of statistical mechanics--Statistiocal equilibrium--Quantum statistics--Electron gas--Degenerate and Nondegenerate ensembles.

(Book2, Ch.75,76)

9. **Nanoscience**

Introduction--Nanostructured materials--classification--features--quantum size effect--applications

(Book4,Ch)

Books for study

1.Fundamentals of Molecular spectroscopy--C.N.Banwell&E.M.McCash (4th edn0 (TMH)
2.Modern Physics--R. Murugeshan& Kiruthiga Sivaprasad(13th edn.) (S.Chand&Co.)
3.Concepts of Modern Physics--Arthur Beiser (5th edn) (TMH)
4.Nanostructures-Theory and modelling--C-De lerue &M. Lannoo (Springer Publishers)

Books for reference

5.Modern physics--Kenneth Crane (TMH)
6.Physics Education (Journel) --2002 April-June Vol. 19. (for Nanotechnology)
7.Nanotechnology--Richard Booker, Earl Boysen (Wiley)

Paper (vi) - PTM-6 - Electronics and Computer Science

Unit-I-Electronics

1. Network Theorems

Voltage and current divider rules--Source conversion--Constant voltage and current sources--Super-position theorem--Thevenin's and Nortan's theorems--Equivalent circuits--Maximumpower transfer theorem--star` /Delta, Delta/star transformations--Two port analysis of an electrical network--Millers theorem. (Book 2, Ch 2 , Book 6 Ch.8)

2. Bipolar junction transistors

CE, CB, CC configurations--Limits of operation-- (Book1, Ch3)
Operating point--Biasing circuits--Fixed bias ckt.--Emitter bias--Voltage divider bias--DC bias with voltage feedback--Design operations--Transistor switching networks--Trouble shooting techniques--Bias stabilisation (Book 1, Ch4)

3.BJT ac analysis

Amplification in the ac domain--BJT transistor modelling--Important parameters- Zi,Zo,Av,Ai--The re transistor model--The hybrid equivalent model--Voltage devider bias-- CE emitter bias configuration--CB configuration--Effect of R_L and R_f (Book 1, Ch. 5)

4.FET

Introduction--Construction and characteristics of JFET--Transfer characteristics--Depletion type MOSFET--Enhancement type MOSFET--VMOS--CMOS--MESFETS--Summary table (Book1,Ch.6)

5.BJT-Frequency response

Logarithm--Decibels--General frequency considerations--Low frequency analysis-Bodeplots--Low frequency response--BJT Amplifier. (Book1, Ch.9)

6. Operational Amplifier

Introduction--Differential amplifier circuit--Op-Amp basics--Practical Op-Amp circuits--Op-Amp specifications--DC offset parameters--frequency parameters--Differential and common mode operation (Book1, Ch.10)

7.Power Amplifiers

Introduction--Classification of Class A,B,AB,C,D amplifiers--Class A amplifier--Class B amplifier--Push pull amplifiers -- Amplifier distorsion--Class C amplifier (Book 1, Ch.12)

8. Feedback and oscillator circuits

Feedback concepts--Feedback connection types--Oscillator operation (Book 1 ,Ch 14)

9. Power supplies (Voltage regulators)

Introduction-- General filter considerations--Capacitor filter-- RC filter--Transistor voltage regulation (Book 1, Ch15)

Unit -II Digital electronics and Computer Science

10.Digital Electronics

Number systems : Binary--Hexadecimal
Arithmetic Operations:Binaryaddition,subtraction,multiplication,division--Unsigned binary numbers--Integer representation--1's, 2's complements--2's complement arithmetic--Hexadecimal addition,subtraction,multiplication, division-- BCD addition, Subtraction.
Boolean Algebra and Logic gates: TTL OR gates--TTL AND gates--TTL NOT circuits--Basic laws of boolean algebra--DeMorgan's Theorems--Universal Logic gates
Combinational logic: Sum of Products and Product of sums--Karnaugh map(complete).
Arithmetic circuits: The arithmetic unit-- Half adder-- Full adder
Logic families: Characteristics of digital ICs--Current-sourcing and current-sinking logic--Resistor-Transistor logic--Diode transistor logic--Transistor-Transistor Logic.

(Book 3, 1-6)

11. Linear digital ICs

Digital to Analog convertors--Analog to digital conversion--Timer IC unit operation--VCO--PLL

(Book 1, Ch-13)

12. C^{++} Programming

Section (1) Object oriented programming - Advantages - Characteristics - Objects - classes - datatypes - inheritance- creating new data types - polymorphism - overloading - cin and count functions
Section (2) Operator and expressions - control statements - if else statement - looping - for while - do while - switch, break and continue statements - go to statement - nested control statements
Section (3) array - structures and unions - enumerated data type - functions - storage classes - over loaded functions (Book 4, Ch)

Books for study

1.Electronic Devices and Circuit Theory (9th edn.) --Robert L. Boylestad & Louis Nashelsky (PHI)
2. A Text book of Electrical Technology --B.L.Theraja& A.A. Theraja(Nirja C&D Co.)
3.Digital Fundamentals--B. Basavaraj (Vikas publishing house)
4.Object oriented programming with C^{++} - E. Balaguruswami

Books for reference

5. Basic Electronics-Solidstate--B.L.Theraja (S.Chand)
6. Integrated electronics- Jacob Millman& Christos C. Halkias (TMH)

B.Sc. Physics (Main)-- PRACTICALS

Practicals should be of graduate level. The student has to familiarize each and every experiment given below. For the external evaluation , the questions may be asked from any part of the syllabus of practicals of each paper.The final formula is to be derived. All experiments given in the list are to be done in the lab.and to be recorded in each paper and the record is to be valued and certified by the lecturer in charge.There is no need of preparing a fair record. The proportionate marks are to be deducted from the internal assessment part for lesser number of experiments.The standard of the experiments is to be evaluated by the external examiner for giving the higher grade. Necessary theory is to be given by the teacher in the practical class before conducting the experiment.The circuit design works and soldering should be done in electronic experiments, wherever necessary.(All experiments and three activities should be done in each paper)

PPM-I :Paper-I Properties of Matter, Heat & Optics

1.Moment of Inerta--Torsion pendulum-Moment of Inertia of the disc
2.Moment of Inertia--Fly Wheel
3.Rigidity modulus --Static Torsion
4.Young's modulus --Uniform bending--Using optic lever
5.Young's modulus --Non uniform bending--Using pin and microscope
6.Young's modulus --Cantilever--Angle between the tangents.
7.Young's modulus --Koenig's method
8.Surface tension --Capillary rise method (radius by using vernier microscope)
9.Viscosity --Poiseuille's method (radius by mercury pallet method)
10.Compound Pendulum--Acceleration due to gravity,Radius of gyration
11.Spectrometer --i-d curve
12.Spectrometer --Dispersive power of a prism
13.Spectrometer --i_1-i_2 curve
14.Spectrometer --Couchy's constants assuming wavelength
15.Spectrometer --Diffraction grating--Normal incidence
16.Spectrometer --Diffracion grating--Minimum deviation
17.Liquid lens --Refractive index of liquid and glass (Two methods- Hg given & not given)
18.Newton's rings --Wavelength of Sodium light
19.Melde's string arrangement--Frequency, R.D. of solid and liquid
20.LASER --Diffraction at a single slit--slitwidth
21.Small angled prism-Refractive index of a material (by normal incidence & by normal emergence)
22.Air wedge -- Diameter of a thin wire
23.Newtons law of cooling--Specific heat of liquid.
24. Lee's disc --Thermal conductivity of a bad conductor

Activities (any three)

1.Resolving power of a grating --using spectrometer
2Verify Newton's formula $x_1x_2 = f^2$ for lenses separated by a given distance
3.Edser-Butler fringes--thickness of air film
4.Vibrations of a clamped free bar-mode constants (Y given)
5.Optical bench--Biprism--Wavelength of sodium light
6 Surface tension--Jaegers method
7.Optical constants of a lens with the aid of paraxial optics
8.Refractive index of different liquids using any relevant method.
9.Verification of cosine square law (Malus law) for plane polarised light with the help of a photovol taic cell(Book 7)
10.Determination of refractive indices of calcite or quartz crystal for the ordinary and extra ordinary rays using spectrometer and sodium light (Book 7).

B.Sc. Physics Main-Practical- PP(M) -IIPaper-II-Electricity and Magnetism

1.Potentiometer : Measurement of resistance and resistivity
2 Potentiometer : Reduction factor of T.G.
3. Potentiometer : Calibration of low range voltmeter (Null method)
4.Potentiometer : Calibration of high range voltmeter
5.Potentiometer : Calibration of ammeter
6.Carey Foster's bridge : Resistance and resistivity
7.Carey Foster's bridge : Temperature coefficient of resistance
8.Conversion of Galvanometer to Ammeter --checking using potentiometer
9.Conversion of Galvanometer to Voltmeter --checking using potentiometer
10.Deflection Magnetometer : Moment & polestrength of magnet-Tan A and Tan B
11. Deflection Magnetometer: Tan C position- Moment of magnet
12. Searl's vibration magnetometer: moment & ratio of moments
13.Determination of M & B_0 using Deflection magnetometer and box type vibration magnetometer
14.Circular coil: Determination of B_0
15 Mirror Galvanometer--figure of merrit
16 Ballistic galvanometer--Absolute value of capacitance
17. Circular coil :Determination of dipolemoment of magnet
18. Ballistic Galvanometer :Ballistic constant using HMS
19. Ballistic Galvanometer :Ballistic constant using solenoid inductor
20. Ballistic Galvanometer : High resistance by leakage
21. Ballistic galvanometer: Mutual inductance
22. Ballistic galvanometer : Self inductance of the given coil by Rayleigh's method
23. Circuit theorems : i) Verification of Thevenin's theorem
ii) Verification of Norton's theorem
24. Magnetic flux density of an electromagnet for different current by using a search coil

Activities(any three)

1.Post-Office box-Resistance of the wire.
2.Study of resistance in a series LCR circuit- Quality factor
3.Single phase transformer--Resistance,Impedance & inductance of primary
Resistance,Impedance & inductance of secondary
Efficiency of transformer, copper loss. (Book 1)
4.Thermocouple: To study the variation of thermo e.m.f .with temperature using multimeter
Find Neutral temp., Temp. of inversion,thermoelectric power
Draw thermoelectric power- temp. graph
Find constants of thermocouple.
5. Construction of search coil
6. B-H curve
7. B.G.-- earth inductor--angle of dip
8. Construction of copper/zinc galvanic (Daniel) cells and study of cell voltage with the variation of load resistance.
9. Study of indutance in series and parallel
10. Study of maximum power transfer theorem

B.Sc. Physics (Main)
PRACTICAL PPM- III Paper III - Electronics and Computer Science

1. Junction diodes : Clippers and clampers
2. Junctiondiodes : Voltage multiplier circuits - doubler, trippler, quadrupler etc.
3. Transistor (BJT) : Realisation of two input gates
4 ,, : Characteristics of common emitter Transistor
5. ,, : Characteristics of common base transistor
6 ,, : Astable multivibrators using transistors
7. Voltage Regulator : Construction of Zener voltage regulator after plotting the reverse characteristic curve (constructing full wave rectifier using two diodes) .
8. ,, : Construction of IC Voltage regulator usng the bridge circuit and IC 7805 (The ripple factor of the Bridge rectifier circuit is to be found with and without filters)
9. ,, : Construction of single transistor regulator
10. Cathode Ray Oscilloscope :1) Familiarisation
2) Voltage sweep operation
3) Synchronization and triggering
4) Measurement using calibrated CRO scales
11. JFET : Characteristics of FET
12. ,, : FET Biasing- Fixed bias- Self bias-Voltage divider biasing
13. Feedback 1)Voltage series feedback using transistor
2)Current series feedback using transistor
14. Amplifier : CE Amplifier-- Frequency response
15 ,, : Two stage R-C coupled Amplifier -- gain
16. Oscillators : Phase shift oscillator using transistor
17. ,, : Transistor Hartley oscillator using transistor
18.. Operational Amplifier : Inverting, Noninverting, Voltage follower (unity follower)
19 ,, : Integrator, Differentiator
20. Multivibrators : Astable & Monostable multivibrators using Timer IC 555
21. C^{++} Programe : Set of quadratic equation (real and Imaginary)
22. ,, : To calculate Standard deviation
23. ,, : Transpose of a matrix
24. ,, : Matrix Multiplication

Activities (Any three)

1.Realisation of gates using ICs
2.Verification of DeMorgan's theorems
3Study of trouble shooting --Transistor (BJT)
4.Cathode ray oscilloscope-- Lissagos figures
5. study of pre Amplifier for a dynamic microphone
6. Votage buffer using Op-Amp.
7.Construction of an audio Mixer circuit
8 Study of collector DC feedback configuratiuon of BJT
9. Study of Emitter follower
10.Parallel and series diode configurations. (Book 2)

Reference Books for practicals and activities

1) Electronic Lab Manual --- K.N. Nawas (Rajath Publishers)
2) Electronic Devices and Circuit Theory (8th edn.)--Robrt L.Boylestad & Louis Nashelsky(PHI)
3) Electronic Laboratory Primer- a design approach--S. Poornachandra& B. Sasikala (Wheeler publishing, N. Delhi)
4) Electyronic circuits-- B. Somanathan Nair (Wheeler)
5) Object oriented programme with C^{++} - Balaguruswami
6) Lab Manual -- C.J. Babu (Calicut University)
7) Practical physics--Guptha & Kumar (Pragathi)
8) LE--Lab experiments (Kamaljeet)

Note :- For Paper III - Electronics and Computer Science, questions can be set as 3 hr. questions and $1^1/_2$ hr. questions. One 3 hr question or two $1^1/_2$ hr. questions can be asked for the external practical examination.

Sd/-
Sri. M.P. Narayanan
Chairman, BOS Physics U.G.

Appendix to U.O. No. Acad/C2/302/2007 dated 22/08/2007

Kannur University

B.Sc. Physics curriculam

(To be followed from 2007 admission onwards)

B.Sc. Physics programme is an ambitious programme, intended for selected and motivated students who are really interested in pursuing careers in physics or taking up Physics-related jobs.

The B.Sc. Physics course of Kannur University spread over **three** academic years .Each year shall have a minimum of 196 working days with 5 hours of instruction per day. A five day week will be followed.

The student registering for this course will study Physics as a major component, two ancillary or supporting subjects (mathematics is compulsory). Tutorial work should be done in addition to the regular work, in both theory and laboratory works. Theory tutorials should supplement classroom teaching and should contain problem solving , assignments, seminars, library and computer software usage, internet searching etc. Laboratory tutorials should supplement laboratory practicals and should contain variations or extensions of experiments and activities, history of experiments, computer simulations etc. In every paper, theory and corresponding practicals or activities should go together as far as possible.(For example, the four components of Electronics and computer science course (Paper VI) are i) theory, ii) theory tutorials, iii) laboratory and iv) laboratory tutorials). These four should be merged together in this particular course, and there should be a common thread running through these components defined by the title of the paper.

General regulations for B.Sc. Physics (Main &Subsidiary) under the faculty of science

Eligibility for admission

Candidates for the Bachelor of Science degree examination shall be required to have passed the higher secondary (+2, VHSC, CBSE etc.) examination stipulated by Kannur University as equivalent thereto.

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Criteria for indexing of marks for admission

The criteria for pattern I (general regulations) of B.Sc. are to be followed.

For Physics main subject Mathematics is the compulsory subsidiary subject.There shall be an optional subsidiary subject also.

Scheme of examinations

Physics (Main) Theory

There shall be **six** theory papers for part III main subject-Physics. The total marks is 600 for main. Out of the 600marks, 480 marks shall be awarded through external evaluation and 120 marks through internal assessment. Besides this there is a theory paper on 'Environmental Studies' for 100 marks. For this an internal examination will be conducted for 100 marks.The syllubus for this is common for all subjects.The marks obtained in Environmental studies will not be counted for evaluating the overall performance of the student. Teaching of environmental studies shall be the responsibility of the department concerned.

Physics Subsidiary : Subsidiary Physics has two theory papers .Examination for the I paper with 3 hr. duration and carrying a maximum of 60 marks (50 external + 10 internal) shall be conducted at the end of the first year and paper II with 3 hr. duration and carrying a maximum of 60 marks(50 external+10 internal) shall be conducted at the end of the second year. The practical exam. for the subsidiary shall be conducted at the end of the second year. There shall be one practical paper for the subsidiary subject with 3 hr. duration and carrying a max. of 80 marks out of which 20 marks shall be given through internal assessment.

Attendance

Minimum attendance required is **75%** of the total number of classes. Marks for attendance for the **theory** papers(internal) may be distributed as

90% and above attendance : 2 marks; 75% to 89 % : 1 mark

For Main practicals, Record work: 5 marks ; Activities :5 marks

Assignments

For each paper there are two units.Each student is required to do an assignment for each unit of each paper The assignment may include different types of problems(both theoretical and experimental) given by the teachers. Valued assignments are to be returned to the students.

Tests

Each test may have a duration of minimum 1 hour.For each paper there shall be atleast three class tests and average of the best two are to be taken. Valued answer scripts shall be returned to the students for persual within 10 working days from the date of the test.The results of the tests are to be exhibited on the notice board.

Seminar(for Main only)

Students shall be required to present a seminar on a selected topic in the third year . The evaluation of the seminar shall be done by the concerned teacher/ teachers in charge, based on the presentation, content and participation in discussion. The subject of the seminar should be based on the modern developement in Physics. The schedule of the seminar may be exhibited on the notice board atleast one week before the presentation.

Project

Project should be research oriented. New frontiers in Physics may be selected as the innovative subject. Each student must have a separate project report. Project to be submitted at the end of the third year shall be valued by two internal examiners. A viva-voce exam. based on the project work shall also be conducted by the same examiners. The report of the project is to be endorsed by the external examiners at the time of external practical exam.

Viva-voce(general)

A Viva-voce internal examination based on the theory shall be conducted by a team of atleast two teachers of the department. 10 marks will be awarded for the same.The viva-voce may be conducted in an open forum in the presence of all students and selection of students may be at random.

Record of laboratory experiments

For each practical paper, the laboratory record is the observation book itself, which is used in the laboratory to record the observations. The book may contain an index and a certificate page at the begining. For the three practical papers, three observation books are necessary for the main course. The observation book may contain the final equation which may be derived from the fundamental theorems involved in the respective experiment.(For subsidiary course a fair record is to be prepared by the student).

Eventhough the evaluation of practical record is made through internal assessment, a candidate shall be permitted to attend the practical exam., only if he/she submits a certified bonafied record of practical work at the time of practical examination. This is to be endorsed by the external examiners.

Activities

This is to motivate students to carry out experiments in Physics with their own interest inorder to realise the physics involved in the experiment. Teachers may provide them support and necessary infrastructure to conduct activities. A minimum of 3 activities in each paper is to be done by the student.(i.e., each student should do 9 activities within a span of three years). The avtivities shall be recorded in a book which should be valued internally and endorsed by external examiners at the time of practical examination.

Study tour

A study tour may be conducted by the department for the final year students for visiting prominent scientific institutions to witness the application of physics which in turn motivate students to pursue higher learning in Physics.

Passminimum

A student shall be declared to have passed the examination for the degree of Bachelor of Science if he obtains-

a) Not less than 35 % of the aggregate marks in the three papers comprised in part I English

b) Not less than 35 % of the aggregate marks in the three papers comprised in part II- additional language.

c) Not less than 35 % of the total marks for the main subject with not less than 30 % for theory and 30 % for the practical examinations in main and 30 % for the theory, 30% for the practical and 35% of the aggregate for theory and practical in subsidiary.

Classes for successful candidates

First class- If 60% or above of the total marks is obtained

Second class-If 50% or above and less than 60 % of the total marks is obtained

Third class- If less than 50% of the total marks is obtained in the concerned part.

Results of each year

A candidate who have been registered for the examination at the end of the first year and second year shall be permitted to continue the course of study in the second year class and third year class respectively, irrespective of the results of the first year and second year examination.

Divisions of the Examination

There shall be 2 divisions under several groups of the Part III optional subjects:-

Division A- All papers including practical and record marks under the main section
Division B- All papers including practical and record marks under the subsidiary section

Supplementary exam

A candidate who fails in part I, Part II and or subsidiary subjects under Part III in the examinations at the end of the second year shall be permitted to take the examination in the failed part or parts in September following the second year examination or along with the final year examination at the end of the third year.

Improvement of examination papers

Regulations relating to re-appearence for betterment of marks for undergraduate course under the faculty of science:-

Part III - Subsidiary subjects:

A candidate shall be permitted to re-appear for betterment of marks (retaining his/her original marks) under Part III- Subsidiary subjects either paper wise or part wise during the course of study either at the end of the second year or at the supplimentary examinations following the second year examinations provided reappearence in one or more papers of a part shall be treated as re-appearence in that part.

Part III- Main

A candidate shall be permitted to reappear for betterment of marks (retaining his/her original marks) in each division Main and subsidiaries separately under part III subjects either at the end of the third year examination or within one year from the first appearence at the third year examinations (irrespective of the result of the examinations under part I or part II) provided re-appearence in one or more papers of a division shall be treated as re-appearence in that division.

Re-appearence for betterment of marks is not permitted for Internal assessment, Practical record etc. and the marks secured by the candidate in the previous appearence will be carried over.

Re-appearence for betterment of marks under Part I or Part II or Part III shall be further subject to the following conditions:

a)Re-appearence shall not be allowed more than once in each part/division of examination.

b)The results of a failed candidate in a Part/Division shall not be modified through paper wise/ division wise re-appearence for betterment of results.

c)A candidate who re-appeares has to take the examination as per the scheme and syllabus in force at the time of his/her re-appearence.

d)Registration of the name of the candidate for the examination shall be treated as permission for re-appearence and the candidate who registered the name for re-appearence shall not be permitted to re-appear again even if such a candidate does not write the examination.

e)A candidate who joins another courses, especially for higher studies, or who fails to produce his/her TC or who applied for his/her original degree certificates shall not be eligible for re-appearence.

f)A candidate who utilized the chance to re-appear after completion of the course shall not be eligible for the award of prize/medal or rank certificate.

g)Those candidate who fail in theory papers should appear for practical examination also, theory and practical shall be taken as one unit.

h)Those candidates who got readmission to a course of study after having discontinued,will not be permitted to reappear for improvement of marksfor those papers in which the candidate had appeared/passed befere discontinuation of the course of study.

B.Sc. Physics Main

Detailed Scheme of course (2007 Admission onwards)

Theory

Paper No	Name of the paper	Unit No	Title	Duration of exam hrs.	Internal Marks	Ext. Marks	Total Marks
PTM-I	Solid State Physics & Thermodyanamics	Unit I Unit II	Solid state physics Thermodyanamics	3	10	60	70
PTM-II	Electrodyanamics	Unit I Unit II	Electrodyanamics I Electrodyanamics II	3	10	60	70
PTM-III	Physical Optics & Photonics	Unit I Unit II	Physical Optics Photonics	3	10	60	70
PTM-IV	Classical and Quantum Mechanics	Unit I Unit II	ClassicalMechanics QuantumMechanics	3	10	60	70
PTM-V	Modern Physics	Unit I Unit II	Nuclear ,Molecular physics&Elementary particles Relativity, Astrophysics, Statistical Physics, Nanotechnology	3	10	60	70
PTM-VI	Electronics & Computer Science	Unit I Unit II	Electronics Digital Electronics & Computer Science	3	10	60	70

Internal marks of 10 for each theory paper may be distributed as follows:

Attendance - 2 marks

Assignment (Theoretical problems shall be given) 4 Marks (2 marks for each unit)

Two tests for each unit 4 Marks (2 marks for each unit)

Total 10 Marks

Pattern of Question paper (external) of each unit is as follows

Section	Type of question	Total No. of questions	No. of questions to be answered	Marks for each question	Total Marks for the Section	Grant total for each unit
A	Essay	2	2	6	12	60
B	a,b,c (Three types)	12	8	6	48	

Each question in section B carries

a) Direct type : 1 Mark

b) Understanding type : 2Marks

c) Problems : 3Marks

Practical, viva-voce,Seminar and Project

Paper No.	Title	Duration of Exam.(in Hrs.)	Internal marks	External marks	Total marks
PPM-I	Properties of mater Heat and Optics	3	10	40	50
PPM-II	Electricity & Mag-netism	3	10	40	50
PPM-III	Electronics & Computer Science	3	10	40	50
	Viva-voce		10		10
	Seminar		10		10
	Project / Innovative experiment		10		10
Total			60	120	180
Grant total (Theory + Practical)			120	480	600

Practical examination at the end of the third year

Each student has to maintain a record of laboratory observations for each practical paper.

The evaluation of records of practicals, project work and activities are made through internal assessment. The candidate shall be permitted to attend the practical exam only if he/she submits a certified bonafied record (observation book) of practical work done along with valued reports of i)project and ii) activities.

Internal marks distribution

No.of Experiments recorded : 5 marks(for 24 expts.)

Activities : 5 marks Total : **10**marks

(for one-1 mark, for two-3 marks, for three- 5 marks)

External marks distribution

Paper I & II

a) Formula with symbols explained,diagrams,etc..... 8marks

b)Adjustments, connections,performance..... 8marks

c)Observation and tabulation,graph etc..... 16marks

d)Calculation (with substitution shown clearly) and result.. 8 marks Total : **40** marks

Paper III-Electronics (3 hr. or $1\frac{1}{2}$ hr. expt.)

	3 hr expt.	$1\frac{1}{2}$ hr expt.
a)Circuit designing ,diagram , formula.....	10 marks	5 marks
b)Good circuit layout, correct connection,good soldering	20 scores	10 marks
c)Measurements of quantities,calculation, graph ,result.....	10 scores	5 marks
	Total : **40**	**20** marks

Paper III- Computer Science(Only $1\frac{1}{2}$ hour expt.)

a)Writing the correct program.....10 marks

b) Correct execution and result..... 10 marks Total : **20** marks

Work distribution- B.Sc. Physics

B.Sc. Main

	Theory (hrs)	Practical (hrs)	Total (hrs)
B.Sc. Main Ist year	2	2	4
B.Sc. Main IInd year	3	2	5
B.Sc. Main IIIrd year	17	8	25

B.Sc. Subsidiary

B.Sc. Sub. Ist year	2	2	4
B.Sc. Sub. IInd year	3	2	5