B.Sc. First Year Physics Paper – II (Paper code-102)

Heat and Thermodynamics :

To understand coefficient of thermal conductivity, temperature gradient, thermal resistance, thermal diffusivity.

To get knowledge of rectilinear flow of heat along metal bar (expression) before steady state reached & after steady state reached.

To know radial flow of heat 1)Spherical shell method 2)Wall of a cylindrical cell.

To know comparison of conductivities of different metal (ingen hausz experiment) experiment & expression.

Real gases and Transport Phenomena

- To study the reason for modification of gas equation.
- To understand Vander Waal's gas equation 1)Pressure correction 2)Correction for volume expression, comparison with experimental curves, Andrew's experiment.
- To know expression for critical constant Vander Waal's equation
- To understand mean free path & expression for mean free path, variation of mean free path with temperature and pressure.
- To understand transport phenomena, transport of mass, viscosity of gas (momentum) detail expression.
- Expression for thermal conductivity of gas.

Thermodynamics :

- To know meaning of 1)Adiabatic process & adiabatic equation of perfect gas, isothermal process, indicator diagram, work done during & isothermal process, work done during an adiabatic process.
- To understand reversible and irreversible process examples.
- To know statement of second law of thermodynamics, Kelvin and Clausius statement.
- To understand heat-engine, Carnot's ideal heat engine, Carnot's cycle and work done in Carnot's cycle & efficiency.

Entropy and Thermodynamic Relation:

- To understand general notation of entropy and definition example.
- To get knowledge change in entropy (fig.) and detail equation.

- To understand change of entropy is independent path, graph V verses P and expression.
- Detail study of change of entropy in reversible and irreversible process change of entropy in reversible process (V-P dia) 1)isothermal expansion 2)adiabatic expansion 3)isothermal compression 4)adiabatic compression its equation.
- To understand change of entropy in irreversible process detail explanation & expression in an irreversible cycle. There is always net gain of entropy.
- To understand formulation of second law in term of entropy clausius statement of second law & equation.
- To understand Maxwell's thermodynamic relation
  Dq = du + dw
  Dq = du + pdv
  Dq = dq – pdv -------- 1
- To understand by using first & second law of thermodynamic Maxwell derive four fundamental thermodynamical relation.
- To get knowledge of application of Maxwell's relation. 1)Clasius clapeyron equation its expression.
- To understand effect of pressure on boiling point of liquid & effect of pressure on melting point of solid.
- To understand T-ds equation entropy of pure substance can be taken as function of temperature & volume 1)first T-ds equation (expression) 2)second T-ds equation (expression).

B.Sc. First Year Physics (Paper IV)

Geometrical & physical optics:

- To understand cordial point, in these six points characterizing and optical system i.e. two focal point, two principal point and two nodal point detail expression with fig. (ray, lens)
- To know meaning of nodal points and nodal planes definition, ray diagram and show giving expression principal points coincides with the nodal point if optical system is in same medium.
- To understand cardial point of two thin lenses separate by distance a)object at infinity, focal length of system (expression), second principal point, first principal point, second focal point, first focal point, nodal points
- To understand figure & expression an exial point object, eye piece, aberration, chromatic, spherical
- To get knowledge Huygens eye piece & their cordial point equivalent focal length 1)first principal point 2)second principal point, first focal point, second focal point
- To understand Ramsden's eye piece & their cardical point, equivalent focal length, first principal point, second principal point, first focal point, second focal point

Interference :

- Principal of superposition of wave its correct meaning
- To understand interference of thin film (with ray diagram) its expression and condition for brightness (maxima) and darkness (minima)
- To get knowledge colors in thin film
- To understand interference in wedge shaped film (fig. & expression for fringe width
- Learners to know about Newton's ring (diagram) & condition for bright & dark rings radii of dark rings
- Determination of wave length of monochromatic light using Newton's ring
- To understand Michelson interferometer its principal construction & types of fringes 1)Circular fringes 2)straight fringes 3)white light fringes
- To know how wave length is determined of monochromatic light

Diffraction :

- To know meaning of Diffraction examples, types 1)Fresnel 2)fraunhoper Fresnel's assumption

- To understand diffraction at thin wire – diffraction band, interference bands
- To get knowledge fraunhoper diffraction at double slit it consist two parts 1)interference due to secondary waves 2)diffraction due to secondary waves
- To understand diffraction of thin wire, diffraction band, interference band
- To understand interference maxima & minima, diffraction maxima & minima
- To get knowledge of plane transmission grating, theory of grating
- To determine of wave length (normal incidence), grating element
- To understand resolving power of optical instrument, Rayleigh criterion
- To understand expression for R.P of 1)Prism 2)R.P of grating

Polarization of light :

- To understand fig. ordinary light, polarizer, analyzer, plane polarize light. Analyzer (no light terms plane of vibration, plane of polarization
- To get knowledge Malus law its expression
- Theory of double refraction, uniaxial crystal two types negative & positive
- To understand hygiene's theory of double refraction
- Nicole prism its working
- To understand property of optical activity. Optically active substance are two types 1)dextrorotatory 2)laevorotatory
- To understand Fresnel's theory of optical rotation, mathematical treatment
- Understand specific rotation, Laurent's half shade polari meter its construction working principal
- Determination of specific rotation of sugar solution

B.Sc. Second Year Course Code Phy-206
Semester IV Paper XII
Crystal Structure :

- To understand crystal lattice, plane lattice, space lattice three dimensional cubic lattices and its unit cell
- To get knowledge translation group explain 2-D array of point translation group of crystal, axis or basis vectors
- To understand unit cell the size and shape of unit cell and its characterized
- To get knowledge of unit cell, definition diagram & unit cell with their edges and angels
- To understand primitive and non-primitive cell, construction of weigner-seitz cell method
- Learners to know symmetry operations 1)translation symmetry 2)Rotational symmetry 3)Reflection symmetry inversion symmetry
- To get knowledge point group and space group & distribution of Bravais lattice, point group and space group over seven crystal system
- To understand bravais lattice in 2-D its axial length, axial angel system such as square, oblique, hexagonal, rectangular, primitive rectangular, three dimensional lattices, fourteen types of lattice
- To get knowledge of lattice direction and plane. Miller indices and rules for determining of miller indices important features of M.I.
- To understand interplanner spacing and expression for finding 'd'
- To know simple crystal structure 1)body centered cubic structure 2)close packed structure, hexagonal closed packed structures 3)face centered cubic structure
- To understand simple crystal structure 1)sodium chloride 2)Cesium chloride crystal
- Finding the packing fraction of some crystal structure

Bonding & band theory of solids :

- To understand concept of inter atomic forces, fig. potential energy verses function distance between two items, expression for minimum energy that is binding energy
- To get knowledge of cohesive energy types of bonding, primary bonds 1)ironic bond (NaCl), covalent bond (H_2Cl_2), metallic bond in Ag, cu
- Secondary bonds these bonds formation takes place in inert gases such as He, Ne, Ar (due to dipolar reaction) properties and characteristics.
- To know and understand Kroning-penny model detail expression & conclusion

- To know about energy verses wave vector relationship. Representation of Brillion zone 1)external zone scheme 2)the reduced zone scheme two dimensional lattice is square lattice (diagram) boundaries is given by condition $K_x = \pm\frac{\pi}{a}$. $K_y = \pm\frac{\pi}{a}$ the boundaries of second Brillion zone represented for which two dimension lattice will be $K_x = K_y = \pm\frac{\pi}{a}$
- To know the three dimensional Brillion zone (from diagram)

Thermal properties of solids :

- To get knowledge of classical theory of lattice heat capacity its concept & comparison with experimental values. Detail expression for $E = 3NK_BT$ Dulong and Petit law
- To understand Einstein's theory of lattice heat capacity detail expression for $\theta E = \frac{h\omega 0}{KB}$ where θE is characteristic temperature also known as Einstein's temperature case 1)high temperature behavior 2)low temperature behavior. Silent features of Einstein's theory.
- Learners get knowledge Debye's model of lattice heat capacity comparison of specific heat obtained from Einstein and Debye model.
- Learners to know density mode 1)in one dimensional case its detail expression and figure frequency spectrum of continuous string
- To know also three dimensional case its expression and diagram of frequency spectrum of three dimensional
- To know limitations of Debye model and drawbacks of Debye model

Free electron theory of metals and transport properties :

- To understands Drude-Lorentz's classical theory postulates of classical free electron theory, success of classical free electron theory
- To know definition electrical conductivity, expression for electrical conductivity, definition of thermal conductivity and expression for thermal conductivity to get formula.
- To understand Weidman and Franz empirical law, statement expression for Weidman and Franz relation
- Learners get knowledge significance of Fermi energy level 1)Fermi level in continuous band : Fermi level in large band : insulator and small gap : semi conductors
- To know definition of Hall effect and detail explanation
- Expression for Hall voltage and Hall Coefficient
- Set up of experimental determination of Hall coefficient and expression for measuring hall voltage hall coefficient
- To understand importance of Hall effect

B.Sc. III semester Phy-201

Differential & ordinary differential equation:

- To understand partial differentiation, chain rule successive differentiation, exact differentiation, total differentiation, total differentiation equation solved by following method 1)reduction 2)auxiliary equation method
- To understand ordinary differential equation and order, degree of differential equation
- To understand knowledge of solution of first order differential equation
- To understand solution of second order linear differential equation with constant coefficient
- To understand homogeneous equation and its meaning

- To know meaning of in homogeneous equation with special case of exponential right hand to find P.I.

Statistical and classical statistics :

- To know what is probability theorems of probability e.g. addition, multiplication
- To understand principal of equal priori, probability by considering two equal size compartment
- To understand arrangement (permutation) how many ways 4 objects arranged taking two object at a time a, b, c, d are 4 object they can arrange 12, arrangements (ways) i.e. ${}^4P_2=12$
- Learners understand that concept of n distinguishable object by taking r at a time is given by ${}^nP_r$
- Combination to know the group of objects (say 4) without considering the order of their placement i.e. only meaningful arrangement
- Learners to know microstate i.e. compartment wise distribution
- To know microstate in this particles are distinguishable of 4 distinguishable objects and two compartment no. of microstate (0,4)(1,3)(2,2)(3,1)(4,0) i.e. 5 macro state & 16 microstate.
- To know phase space
- Understand Maxwell Boltzmann energy distribution law
- Explain for evaluation of g_i, α and β
- Expression for distribution of function of ideal gas (M.B. distribution)
- To know expression for M.B. speed distribution law

Quantum statistics :

- To understand need of quantum statistics
- To understand Bose-Einstein distribution law & its expression
- To know planks radiation law
- To get knowledge of Fermi-Dirac distribution law & its expression
- To understand concept of electron gas
- Learners get knowledge of Fermi level & Fermi energy for element in a metal
- To understand the comparison of three statistics i.e. Fermi-Dirac, Maxwell Boltzmann and Bose Einstein
- To know what is difference between classical and quantum statistics

Theory of relativity :

- To understand concept of space, concept of time, concept of mass
- To know frame of reference accelerated (non-inertial frame) and un accelerated reference frame is Galilean frames or inertial frame

* To exact relation given by Galilean transformation equation
* To understand this concept two frame one at rest & other in motion & the equation obtained
* Learner to know Michelson-Morley experiment presence of ether could not be detected. Also why ether medium is not present i.e. negative result explained by 1) Michelson-Morley 2)Lorentz & Fitzgerald & proper explanation is given by Einstein
* To understand postulates of special theory of relativity & its explanation
* It is important to Lorentz transformation equation and expression for X, Y, Z & T from the above equation understand to find out expression 1)length contradiction 2)time dilation
* To understand addition of velocities from it observe velocity of light is larger
* The idea how mass converted into energy is given by Einstein mass energy equivalence ($E=mc^2$)

B.Sc. T.Y. Course Phy-301 Paper XV

Classical & quantum Mechanics :

* To learns know mechanic of particle a)conservation linear of momentum in absence of external force acting on particle is zero (detail expression) b)expression of conservation angular momentum i.e. in absence of external torque angular momentum is conserved
* To understand by expression K.E. and work energy i.e. work energy theory and change in P.E. when particle moves
* Learners to know the expression conservation energy theorems
* To meaning of machines of system of practical & total linear momentum
* Learners to know by expression conservation for linear momentum of system of particle 1)total work 2)total P.E.
* To understand constraint classification of constraint description and example of holonomic & non-holonomic constraints example vertical disc rolling on a horizontal XY plane
* To understand principal of virtual work (expression)

- To understand expression for D'Alembert's principal & obtained Lagrange's equation from from D'Alembert's principal
- Learners to know about application of Lagrange's formulation a)simple pendulum its harmonic motion of period b)motion of particle using Cartesian co-ordinates & using polar co-ordinates c)linear harmonic oscillator expression in one dimensional harmonic oscillator
- To understand Atwood's machine i.e. conservation system

Origin of quantum theory :

- To understand failure of classical mechanics as many experimental results could not explain on basis of classical mechanics
- Understanding of black body radiation, distribution of energy experimental arrangement, graph wavelength verses intensity of radiation
- To learners know Plank's quantum theory, Plank's postulate energy distribution theory the relation obtained agrees experimental curve obtained in Lumer experiment
- To understand Plank's quantum postulates & expression for linear momentum of photon in term of wave vector detail expression
- To understand Plank's radiation law expression for it
- To get knowledge about Wein's law of radiation
- To understand Einstein equation : quantum theory of photoelectric effect assumption & variation of equation $1/2mv^2=hc(1/ - 1/)$
- Detail explanation with fig. why all the photo electron do not have same energy
- To understand & explanation of law of photo-electric emission
- To understand Compton effect of scattering detail expression & fig. presence of unmodified radiation observed by Compton

Wave particle duality :

- To understand hydrogen atom and the Bohr model 1)stability of hydrogen atom 2)the spectrum of its radiation in hydrogen atom in black body radiation
- To get knowledge of De-Broglie's hypothesis for matter wave, matter
- Expression for De-Broglie's wavelength in term of energy and temperature
- To learners know De-Broglie phase velocity and particle velocity and relation between them
- To understand group velocity, phase velocity or wave velocity equation for group velocity, another wave of frequency $\frac{\Delta\omega}{2}$, propagation
- To understand between group velocity & phase velocity

- To understand experimental setup of Davisson and germer experiment study of various curve at various voltage & expression also study for oblige , diagram 1)Bragg's law, relation between current & 1/
- To understand Heisenberg uncertainty principle explanation and mathematical proof
- Uncertainty in time and energy & its equation. Uncertainty in angular momentum & angular position
- To understand application of uncertainty principle 1)non-existence of electron in nuclear 2)binding energy of an electron in an atom

Schrodinger equation and its application :

- To understand wave function ψ of moving particle
- To understand expression for the time dependent Schrodinger wave function
- To get knowledge expectation values it its mathematical average for the result of the single measurement
- To understand operator : an operator is a rule by means of which is given function is change into another function
- To understand expression of Schrodinger time dependent equation (steady state form)
- To know about particle in one dimension box. Expression for energy values of particle within the box are discrete i.e. quantized
- To understand quantization of energy and momentum

B.Sc. III year non-conventional energy sources & optical fiber
Phy course-306 Paper XX

Non-conventional energy sources :

- Energy demand is increasing due to rapid industrialization and population. Conventional sources are non-renewable and are bound to finish up due to this non-conventional resources it available in nature in free cost they are environmental friendly
- To understand Bio-mass energy available from animal and vegetation to know advantage of bio-mass energy and disadvantage of bio-mass
- To understand wind energy it is available continuously throughout 24 hours day for longer period. Wind energy is supposed to be mechanical energy with help of wind turbine. The mechanical energy used to convert electrical power
- To understand tidal energy, the natural rise and fall by interaction of gravitational field of sun and moon. Tidal energy is a form of hydro power that convert energy of ocean tides into electricity or other useful forms of power
- To understand geothermal energy, generally available deep inside the earth at a depth more than 20km. its advantage & disadvantage
- To know the solar energy it is abundant, direct passive heating solar thermal electric power plants using steam cycle solar photo voltaic power plant using several PV cells connected in series arrays
- To understand biogas plant 1)fixed dome type 2)modified fixed dome type bio-gas plant
- Wind energy : to know definition of wind form, wind turbine generator unit, vertical axis & horizontal axis (VAWT & HAWT) wind turbine propeller (wheel), wind mill
- To understand types of wind turbine generator & characteristics

* To understand monoblade (HAWT) its advantage & disadvantage
* To understand twin blade (HAWT) merits & limitations of wind energy

Solar photovoltaic system :

* To understand solar cells, efficiency, all desired generator size can be realized, from MW range for the supply wrist watch calculator megawatt for public electricity
* To know advantage of solar cell over conventional method of power system & disadvantage such as conversion efficiency is limited ~30%
* To understand solar cell fundamentals, knowledge of energy level in metal conduction band, forbidden band, valance band
* To get knowledge semi conductor to know displaced electron (free electron) & the valance orbit known as hole, diagram of orbit & energy level
* To understand P-N junction, depletion layer due to P(-) & N(+) potential barriers, width, height
* To get knowledge generation of electron hole pair by photon absorption
* To illustrate photon absorption in an indirect band gap semi conductor (by fig.)
* Learners to know forward bias i.e. P-N junction P connected positive & N connected negative from this I-V characteristics be known
* To get correct knowledge of I-V characteristics at different isolation level i.e. longer and lesser
* To understand I-V characteristics of solar cell and maximum power
* To understand electrical storage lead acid battery in which consist of positive & negative these basic theory with fig. advantage of storage battery & limitations

Introduction of optical fiber :

* To understand importance of optical fiber the advantage of itemized below explain why optical fiber become such & attractive to conventional transmission media such as application of telecommunication 1)broad band width 2)immunity to electromagnetic interference 3)low attenuation loss over long distance 4)signal security and no cross talk 5)light weight & small diameter cables 6)electrical insulator as optical fiber made & drawn from silica, silica glass is bad conductor of electricity so no ground loops and leakage of any type of current 7)low cost for long distance communication
* To get knowledge of classification of optical fiber depending upon material used in manufacture of optical fiber cable.

* To understand three types of optical fiber according to material used these are 1)glass fiber : these fiber consist of glass as core also glass as cladding 2)plastic clad silica : by replacing the cladding with plastic coating of R.I. lower than core plastic clad fiber achieved. There are some limitations 3)plastic fiber : for higher temperature this fiber are not used.
* To understand classification of optical fiber on no. Of modes 1)monomade or single mode fiber – transmitting only one mode 2)multi mode fiber :- this fiber is capable of transmission more than one mode
* To understand classification of optical fiber depending on the index profile 1) multi mode step index fiber, diagram index profile of multi mode step index and explanation (diagram) of propagation in multi mode step index fiber. 2)multi mode graded index fiber : in this type, the material in the core is modified so R.I. profile does not exhibit step index change. Diagram index profile of multi mode graded index & fig. propagation in a malti mode graded index fiber. 3)mono (single) mode step index fiber (dia.) it is mostly used in india for major reasons i.e. advantage & disadvantage of mono mode fiber.
* To u
* To understand latest developed optical fiber & characteristics 1)high purity silica fiber : the main characteristics of HPSUV fibers.
* To get knowledge high purity silsica fiber (HPSIR), graph wavelength verses attenuation.
* To understand halide fibers : characteristics of such fiber.
* To get knowledge tapered optical fiber & its characteristics.

4) Fiber cables and fabrication :

* To understand classification of fiber fabrication techniques : fiber can be fabricated
* To know fiber can be fabricated by techniques such as 1)external chemical vapor deposition of spoot (external CVD) 2)internal chemical vapor deposition of glass (internal CVD) 3)external chemical vapor deposition of glass (plasma CVD) 4)multi element glass 5)phasil system
* To understand axial vapor deposition (with diagram), internal chemical vapor deposition (internal CVD) detail process
* To understand second process of internal CVD its characteristics, third process
* To know in fiber cables outer jacket provides the fiber reliability and longevity 1)polyvinyl chloride (PVC) 2)polyethylene 3)polyurethane 4)glass 5)silica

- To get knowledge why strong in members added cable tensile loading, for straight section of cable, for curved section of fiber cable, minimum bend radios
- To understand losses secure during installation of cable
- To learner know crackles due to manufacturing process & mathematical relation for such controlling empirical constant, terminal stress and stress susceptibility
- Knowledge of testing of cables such as environmental evaluation mechanical evaluation of tensile strength test, bend test, twist test impact resistance test, moisture resistance test
- To understand cable selection criteria i.e. maximum db loss, by formula, bandwidth calculated & explanation of types of loss in db
- Optical fiber laying in telephones.