



# **St. PETER'S UNIVERSITY**

**St. Peter's Institute of Higher Education and Research**

**(Declared Under Section 3 of the UGC Act, 1956)**

**AVADI, CHENNAI – 600 054**

**TAMIL NADU**

**B.Sc. (PHYSICS)**

**Code No. - 312**

**(Effective From 2009 – 2010)**

**(Distance Education)**

**Regulations and Syllabi**

**(I & II & III Year)**

**St. PETER'S INSTITUTE OF DISTANCE EDUCATION**

**Recognized by Distance Education Council and**

**Joint Committee of UGC – AICTE - DEC, New Delhi**

**(Ref. F. No. DEC/SPU/CHN/TN/Recog/09/14 dated 02.04.2009 and**

**Ref.F.No.DEC/Recog/2009/3169 dated 09.09.2009)**

**St. PETER'S UNIVERSITY**  
**St. PETER'S INSTITUTE OF DISTANCE EDUCATION**  
Chennai – 600 054.

**Code No. – 312**  
**B.Sc. (PHYSICS)**  
(Distance Education)

**Regulations and Syllabi**  
(Effective from 2009 – 2010)

- 1. Eligibility:** Candidates who have passed the Higher Secondary Examination conducted by the Government of Tamilnadu with Mathematics, Physics and Chemistry as one of the subjects, or any other examination recognized as equivalent thereto are eligible for admission to Three Year B.Sc Programme in Physics.
- 2. Duration:** Three Years.
- 3. Medium:** English is the medium of instruction and examination.
- 4. Methodology:** The methodology of distance education includes the supply of self-instructional study materials in print format and in CD, face-to-face instruction for theory and practicals for a limited period during week ends and on holidays, provision of virtual class in phased manner, dissemination of information over e-mail, Student - Support Service at various Centres of the University, Continuous Assessment and End Assessment conducted by the University at various parts of India.
- 5. Weightage for Continuous and End Assessment:** There is no weightage for Continuous Assessment unless the ratio is specifically mentioned in the scheme of Examinations. The End Assessment (EA) has 100% weightage.

**6. Credit System:** Credit system be followed with 36 credits for each Year and each credit is equivalent to 25 hours of effective study provided in the Time Table of the formal system.

## 7. Scheme of Examinations

### First Year

Code No.	Course Title	Credit	Marks	
			EA	Total
<b>Theory</b>				
109UTMT01 109UHIT01	Tamil - I Hindi - I	6	100	100
109UEHT02	English - I	6	100	100
109UPHT03	Mechanics and Sound	6	100	100
109UPHT04	Thermal Physics and Properties of matter	6	100	100
109UPHT05	Allied – I: Mathematics	6	100	100
109UPHP01	Major Practical Record	6	90 10	100
<b>Total</b>		<b>36</b>	<b>600</b>	<b>600</b>

### Second Year

Code No.	Course Title	Credit	Marks	
			EA	Total
<b>Theory</b>				
209UTMT01 209UHIT01	Tamil - II Hindi - II	6	100	100
209UEHT02	English - II	6	100	100
209UPHT03	Optics and Spectroscopy	6	100	100
209UPHT04	Mathematical Physics	6	100	100
209UPHT05	Allied – II: Chemistry	3	100	100
209UPHP01	Major Practical – II Record	6	90 10	100
209UPHP02	Allied Chemistry Practical Record	3	90 10	100
<b>Total</b>		<b>36</b>	<b>700</b>	<b>700</b>

### Third Year

Code No.	Course Title	Credit	Marks	
			EA	Total
<b>Theory</b>				
309UPHT01	Electricity and Magnetism	5	100	100
309UPHT02	Atomic and Nuclear Physics	5	100	100
309UPHT03	Quantum mechanics and relativity	5	100	100
309UPHT04	Electronics	5	100	100
309UPHT05	Elective: Electronics and Communication	6	100	100
309UPHP01	Major Practical – III Record	5	90 10	100
309UPHP02	Major Practical – IV Record	5	90 10	100
<b>Total</b>		<b>36</b>	<b>700</b>	<b>700</b>

**8. Passing Requirements:** The minimum pass mark (raw score) be 40% in End Assessment.

**9. Grading System:** Grading System on a 10 Point Scale be followed with 1 mark = 0.1 and the conversion of the Grade point as given below.

$$\begin{aligned} \text{Overall Grade Point Average (OGPA)} &= \frac{\text{Sum of Weighted Grade Points}}{\text{Total Credits}} \\ &= \frac{\sum (EA)C}{\sum C} \end{aligned}$$

**The Overall Grade:** The Overall Grade and Classification of all successful candidates be arrived at from the Overall Grade Point Average as stipulated in the following conversion Table.

<b>Grade</b>	<b>Over all Grade Point Average(OGPA)</b>	<b>Over all weighted Average marks</b>	<b>Classification</b>
0	9.0 to 10.0	90 to 100	First Class
A	8.0 to 8.9	80 to 89	First Class
B	7.0 to 7.9	70 to 79	First Class
C	6.0 to 6.9	60 to 69	First Class
D	5.0 to 5.9	50 to 59	Second Class
E	4.0 to 4.9	40 to 49	Third Class
<b>F</b>	0.0 to 3.9	0 to 39	<b>Reappearance</b>

The Grade Sheets of successful candidates provide particulars such as (1) Overall weighted Average Marks and (2) Overall Grade.

**10. Pattern of the Question Paper:** The question paper for the End Assessment will be set for three hours and for a maximum of 100 marks with following divisions and details.

**Part A:** 10 questions (with equal distribution to all units in the syllabus). Each question carries 2 marks.

**Part B:** 5 questions with either or type (with equal distribution to all the units in the syllabus). Each question carries 16 marks.

The total marks scored by the candidates will be calculated to the maximum prescribed in the Regulations.

## **11. Syllabus**

## 109UPHT03: MECHANICS AND SOUND

### **UNIT:I**

**PROJECTILE:** Range up and down and inclined plane-maximum range-two directions of projection for a given velocity and range.

**IMPULSE-IMPACT:** Laws of impact – coefficient of restitution –impact of a smooth sphere on a fixed smooth plane-Direct impact between two smooth spheres-Losses in kinetic energy in direct impact-Oblique impact between two smooth spheres.

### **UNIT:II**

**SHM:** Composition of two SHM's of same period along a straight line and at right angles to each other-Lissajous figures.

**DYNAMICS OF RIGID BODIES:** Compound pendulum-theory-condition for minimum period-interchangeability of center of suspension and center of oscillation-g using compound pendulum-Bifilar pendulum-parallel and non-parallel threads.

### **UNIT:III**

**CENTER OF GRAVITY:** Center of gravity of a solid cone, Solid hemisphere, hollow hemisphere and a tetrahedron.

**FRICTION:** Laws of friction-angle of friction-resultant reaction and cone of friction-equilibrium of a body on an inclined plane under the action of a force.

**CENTER OF PRESSURE:** Definition-center of pressure of a rectangular lamina and triangular lamina.

**ATMOSPHERIC PRESSURE:** Variation of atmospheric pressure with altitude-height of homogenous atmosphere.

### **UNIT:IV**

**CLASSICAL MECHANICS:** Mechanics of system of particles-conservation theorem for angular momentum and energy- constraints-classification- generalized coordinates-transformation equations-principle of virtual work-D'Alembert's principle-derivation of Lagrangian formulation of conservation theorems - generalized momentum-energy and linear momentum.

### **UNIT:V**

**SOUND:** Theory of damped and forced vibrations-sharpness of resonance-Fourier theorem -application for saw tooth wave and square wave.

**ULTRASONICS:** Production-piezoelectric crystal method-magnetostriction method-detection properties-applications.

**ACOUSTICS OF BUILDINGS:** Reverberation-derivation of Sabine's formula-determination of absorption coefficient.

**BOOKS FOR STUDY:**

1. Mechanics and Mathematical Methods(2005) by R.Murugesan. S.Chand and Co.
2. Dynamics by M.Narayanamurti and M Nagarathnam. (2005) The National Publishing Company.
3. Statics, Hydrostatics and Hydrodynamics. (2005) By M.Narayanamurti and M.Nagarathnam. The National Publishing Company
4. Properties of matter and Acoustics. (2005) By R.Murugesan. S.Chand and Co.

**BOOKS FOR REFERENCE:**

1. Sound by Khanna and Bedi. (2005), Atmaram and Sons.
2. A Text Book of Sound(2005), By M.Ghosh.S.Chand & Co
3. 3.A Text Book of Sound(2005), By R.L.Saighal.S.Chand & Co
4. A Text Book of Sound(2005), By N. Subrahmanyam and Brijlal S.Chand and Co.,
5. Classical Mechanics by H.Goldstein(2005), Addison Wesley Publications.
6. Mechanics (2005)by D.S.Mathur.S.Chand and Co.,

## **109UPHT04 - THERMAL PHYSICS AND PROPERTIES OF MATTER**

### **UNIT-I: LOW TEMPERATURE PHYSICS**

Joule- Thomson effect- porous plug experiment- Theory- Adiabatic demagnetisation Liquefaction of air, nitrogen, Helium gases- Practical applications of low temperature- Refrigerators- Air conditioning machines- effect of chloro fluoro carbon on ozone layer.

### **Unit-II: THERMODYNAMICS**

Zeroth, first, second and third laws of thermodynamics- Heat engines- Carnot, Otto and Diesel engines- Working and efficiency-entropy- Change in entropy in reversible and irreversible process- temperature -entropy diagram- Maxwell's thermodynamic relations-applications- Tds equations- Clausius - Clayperon latent heat equations

### **Unit- III: CONDUCTION AND RADIATION**

Thermal conductivity- Forbes method- Lee's disc method- Black body radiation- Wien's law- Rayleigh Jeans law- Planck's law-Stefan's law- Determination of Stefan's constant- Pyrometers- Pyrheliometers- Solar constant- determination of temperature of sun.

### **Unit-IV: ELASTICITY**

Bending of beams- expression for bending moment-depression of the loaded end of cantilever -uniform and nonuniform bending- theory and experiment- Koenigs method- theory and experiment- I form of girders- Torsion- expression for couple per unit twist- Torsion pendulum theory and experiment- Static torsion method of determining rigidity modulus.

### **Unit V: VISCOSITY AND SURFACE TENSION**

Coefficient of viscosity- Oswald's viscometer-Searle's viscometer-Theory and experiment- Viscosity of gases- Meyer's formula-Rankine's method

Surface tension- excess pressure inside a curved surface-surface tension and interfacial surface tension- method of drops- Quincke's method- surface tension and angle of contact of mercury-variation of surface tension with temperature.

### **Books for study and reference.**

1. Heat and Thermodynamics Brijlal and Subramaniam S.Chand & Co New Delhi (2007)
- 2.Heat and Thermodynamics D. S. Mathur S Chand & Co New Delhi 2005.
3. Heat and Thermodynamics J.B Rajam & C.L. Arora S Chand & Co New Delhi 2004.
- 4.Properties of Matter R Murugesan S Chand & Co New Delhi 2007.
- 5.Properties of matter Brijlal & Subramani S Chand & Co New Delhi (2005).
- 6.Elements of Properties of matter D. S Mathur S Chand & Co New Delhi ( 2006).



**ALLIED -I**  
**109UPHT05: MATHEMATICS**

**Unit – I**  
**Matrices**

**Characteristic equation – Eigen values and Eigen vectors – properties – problems – rank of a matrix – problems – solution of simultaneous equations using matrices – consistency condition.**

**Unit – II**  
**Theory Of Equations**

Polynomial equations – relation between roots and coefficients – imaginary roots and irrational roots – solving equations under given conditions – transformation of equations – Descarte’s rule of signs.

**Unit – III**  
**Differential Calculus**

Definition of a derivative, different types of differentiation – standard formula – successive differentiation – nth derivative – Leibnitz formula – problems.

**Unit –IV**

Partial differentiation – Euler’s theorem – Curvature – Radius of Curvature in Cartesian and polar co – ordinates.

**Unit – V**  
**Vector Analysis**

Gradient $\phi$ , divergence and curl of a vector point function – solenoid and irrotational vectors – unit normal vector – directional derivative – problems - Second order derivatives.

**Text books**

1. T.K. Manickavasagam pillai – Allied mathematics
2. P.R. Vittal – Allied Mathematics
3. S.P. Rajagopalan – Allied Mathematics.

## 109UPHP01 - PHYSICS MAIN PRACTICALS –I

1. Young's modulus – Non uniform Bending – pin & microscope method
2. Young's modulus – uniform bending – scale and telescope method
3. Torsion pendulum - dynamic method –Rigidity Modulus
4. Surface tension and interfacial surface tension – Drop Weight method
5. Sonometer - frequency of a fork
6. Sonometer – R.D of a solid and liquid
7. Specific heat capacity of a liquid – Method of a mixtures – Barton's correction
8. Spectrometer  $i - d$  curve
9. Spectrometer – Grating – Standardization – normal incidence measurement of Wavelength
10. Potentiometer – calibration of low range Voltmeter
11. Potentiometer – Internal resistance of a cell
12. Field along the axis of a coil – deflection magnetometer
13. P O Box – Temperature coefficient of resistance
14. Joule's calorimeter – Specific heat capacity of a liquid – Barton's correction
15. B. G current and voltage sensitive
16. B. G charge sensitivity
17. Bridge rectifier
18. Zener diode – Voltage regulator
19. Low range power pack
20. NAND , NOR gates as Universal Building Block

## **209UPHT03 - OPTICS AND SPECTROSCOPY**

### **UNIT-I**

Newton's rings in reflected light-determination of wavelength and refractive index-Michelson interferometer-construction and working-types and visibility of fringes-determination of wavelength, resolution of spectral lines, refractive index and thickness of a thin sheet.

### **Unit II**

Fresnel's assumptions- rectilinear propagation of light-zone plate- action for plane and spherical wave fronts-comparison of zone plate and convex lens- Fresnel and Fraunhofer diffraction-Plane diffraction grating-normal and oblique incidence-determination of wavelength using grating-dispersive power of grating- resolving power of telescope, microscope, prism and grating.

### **Unit III**

Double refraction- Nicol prism- Optical activity- Fresnel's explanation-specific rotatory power by Laurent's half shade polarimeter  
Optical fibres-propagation of light- acceptance angle- numerical aperture- mode propagation-step and grade index fibres-absorption, scattering and bending losses-core and cladding losses-fibre communication advantages- light sources.

### **UNIT-IV**

Rotation spectra of molecules-Theory- instrumentation- applications-Infrared spectroscopy- energy of diatomic molecule- vibration rotation spectrum- IR spectrometer- Raman effect- Classical and quantum theory-Pure rotational and vibrational Raman spectra- Techniques and instrumentation- Applications.

### **Unit V**

Basic theory of NMR, ESR and NQR- Techniques and instrumentation – applications

### **Books for study and reference**

1. A text book of Optics Brijlal and Subramani, S Chand & Co (2007).
2. Optics R Murugesan, S Chand & Co (2006).
3. Optic fibres and Fibre Optic Communication systems Subir Kumar Sarkar SChand & Co (2003).
4. Fundamentals of molecular Spectroscopy, Banwell & McGagh TMH.
5. Vibrational spectroscopy D N Sathyanarayana, New Age International (2004).

## **209UPHT04 - MATHEMATICAL PHYSICS**

### **UNIT-I Vector space and Tensors**

Vector Space-Definitions-Linear independence of Vector-Bilinear and quadratic forms-change of basis-Schmidt's orthogonalisation processes-Swartz inequality-Application of vectors to hydrodynamics the equation of flow in solids.

Tensors- definitions- N-dimensional space-superscripts-subscripts-coordinate-transformations kronecker delta symbol-properties of kronecker generalized kronecker delta Tensors of higher ranks-Algebraic operation of Tensors-symmetric and asymmetric Tensors-Application of Tensors-Dynamics of a particle-Elasticity-Rigid bodies

### **UNIT-II Laplace and Fourier Transforms**

Laplace transforms – definitions and properties- methods of finding Laplace transforms- inverse transform and its properties- methods of finding inverse Laplace transform – applications of Laplace transforms- solution to differential equations. Fourier transform – properties of Fourier's transform-Fourier transform of a derivative- Fourier's Sine and cosine transform of a derivative-Finite Fourier transforms-Simple application of Fourier transforms.

Unit III Matrices

Solutions to linear equations- Cramer's rule- Characteristic matrix and characteristic equations of a matrix – eigen values and eigen vectors – sub space and null spaces- transformations-Hermitian form- diagonalisation of 3 by 3 symmetric matrices.

### **Unit IV Special Functions**

Beta functions - definitions – properties, Gamma functions- definitions- properties- relation between beta and gamma functions- reduction of definite integrals using these functions – Applications

Bessel-Legendre-Lagure and Hermite differential equation-properties-Generating functions-Rodrigue's formula-orthogonal properties-recurrence relations

### **Unit V Numerical Methods**

Cure fitting- principle of least squares- fitting a straight line – linear regression-fitting a parabola- fitting an exponential curve. Solving non liner equations-bisection method- successive approximation method- Euler's method- Newton Rapson method- R.K method.

### **Books For Study**

1. P.K.Chattopadhyay Mathematical Physics,Wiley Eastern Ltd, N.Delhi(1990).
2. B.D.Gupta,Mathematical Physics Vikar Publishing House Pvt. Ltd., (1995).
3. Sathyaprakash,Mathematical Physics,Sultan Chand & Sons,New Delhi(2004)
4. M.K.Venkataraman, Numerical methods in Science and Engineering- PHI , New Delhi – 1997.
5. S.S. Sastry , Introductory methods of numerical analysis- PHI, New delhi-2000.

## **209UPHT05 – ALLIED – II: CHEMISTRY**

### **UNIT – I: CHEMICAL BONDING**

Molecular Orbital theory – bonding, anti-bonding and non-bonding orbitals. Bond order. M.O configurations of  $H_2$ ,  $He_2$ ,  $N_2$ ,  $O_2$ ,  $F_2$ , Diamagnetism and paramagnetism. VSEPR theory – Shapes of  $H_2O$ ,  $NH_3$ ,  $CH_4$ ,  $BrF_3$ ,  $IF_5$  and  $IF_7$  molecules.

Orbital overlap hybridization and geometry of  $CH_4$ ,  $CH_2$ ,  $H_4$ ,  $C_2H_2$  and  $C_6H_6$  molecules. Inductive effect, electromeric effect, mesomeric effect and steric effects – examples.

### **UNIT – II: THERMODYNAMICS AND SOLUTIONS**

Types of systems, reversible and irreversible processes, isothermal and adiabatic processes and spontaneous processes. Statements of I law, Need for the II law of thermodynamics and statements. Carnot's cycle and efficiency of a heat engine. Entropy and its significance. Entropy changes in physical transformations. Free energy change and its importance. (no derivation) Conditions for spontaneity in terms of S and G. Relationship between changes in G, H, T and S.

Liquid in liquid type Raoult's law for ideal solutions. Positive and negative deviation from Raoult's law-reasons and examples, Fractional distillation and azeotropic distillation.

### **UNIT – III: AROMATIC COMPOUNDS AND STEREOISOMERISM:**

Aromaticity – Huckes rule – Mechanism of nitration, halogenation, alkylation, acylation and sulphonation of benzene. Properties and structural elucidation of naphthalene – Haworht's synthesis.

Elements of symmetry – symmetry and asymmetry – cause of optical activity. Isomerism of tartaric acid – racemisation and resolution. Geometrical, isomerism of Maleic and Fumaric acids. Keto-enol tautomerism. Conformers of n-butane with brief explanation.

## **UNIT – IV: CARBOHYDRATES AND AMINO ACIDS**

Classification – properties of glucose and fructose – discussion about open – chain and ring structures of glucose and fructose. Properties and structure of sucrose. Properties and uses of starch and cellulose and their derivatives.

Classification – preparation and properties of alpha amino acids. Peptide synthesis. Classification of proteins by physical properties and biological functions – Biological functions of peptide hormones, protein hormones – Elementary ideas about RNA and DNA.

## **UNIT – V: INDUSTRIAL CHEMISTRY**

Fuel gases – Natural gas, water gas, semi-water gas, carbureted water gas, producer gas, oil gas (composition and uses only) Synthesis, properties and uses of silicones.

Hardness – types and estimation by EDTA method – Alkalinity – types of alkalinity and determination

Pollution of air, water and soil by chemicals and chemical industries – sources consequences and controlling methods.

## **209UPHP01: MAJOR PRACTICAL –II**

1. Young's modulus – non uniform bending – pin and microscope
2. Young's modulus – uniform bending – scale and telescope method
3. Torsion pendulum- MI and rigidity modulus – symmetrical masses
4. Coefficient of viscosity of a liquid – graduated burette – radius by mercury pellet method.
5. Melde's apparatus – frequency – transverse and longitudinal modes.
6. Specific heat capacity of a liquid by cooling – verification of Newton's law of cooling .
7. Melde's apparatus – RD of a solid and liquid .
8. Air wedge thickness of a wire and its insulation.
9. Spectrometer – dispersive power of a prism.
10. Spectrometer – grating – minimum deviation.
11. Potentiometer – ammeter calibration..
12. Potentiometer – specific resistance.
13. M and BH – Deflection Magnetometer – TAN A and TAN B positions
14. Cary Foster's bridge – specific resistance.
15. BG Comparison of capacities.
16. BG comparison if EMF's of two cells.
17. Half and Full adder.
18. Half and Full subtractor.
- 19.Verification of DeMorgan's theorems .
20. OPAMP- Integrator and differentiator.

## **209UPHP02 – PRACTICAL (ALLIED CHEMISTRY)**

### **VOLUMETRIC ANALYSIS**

1. Estimation of sodium hydroxide using std. carbonate.
2. Estimation of HCL using std. oxalic acid.
3. Estimation of oxalic acid using std. sulphuric acid.
4. Estimation of alkalinity of water sample.
5. Estimation of temporary and permanent hardness of water.
6. Estimation of ferrous sulphate – std. Mohr salt solution.
7. Estimation of oxalic acid – std.  $\text{FeSO}_4$ .
8. Estimation of  $\text{KMnO}_4$  – std.  $\text{NaOH}$ .
9. Estimation of ferrous ion using diphenylamine as internal indicator.
10. Estimation of Zinc using EDTA – std.  $\text{MgSO}_4$ .

### **ORGANIC ANALYSIS**

Reaction of aldehyde (aromatic), Ketone (aliphatic and aromatic), carbohydrate, carboxylic acid (mono and dicarboxylic), phenol, aromatic primary amine, amide and diamide. Systematic analysis of organic compounds containing one functional group and characterization by confirmatory tests or derivatives.



## **309UPHT01 - ELECTRICITY AND MAGNETISM**

### **Unit I**

Carey Foster's bridge-theory- determination of temperature coefficient – Thermoelectricity- determination of Peltier coefficient- thermodynamics of thermocouple-expression for Peltier and Thomson coefficients-uses of thermoelectric diagrams-Gibbs- Helmholtz equation for the emf of a reversible cell- calculation of emf of Daniel cell- emf of thermocouple using potentiometer- calibration of high range voltmeter.

### **Unit-II**

Magnetic induction on the axis of a solenoid-Moving coil ballistic galvanometer-theory-damping correction-charge sensitivity of a BG-determination of absolute capacity of a condenser-thermo emf of a thermocouple using BG- absolute mutual inductance between pair of coils using BG- coefficient of coupling between pair of coils- induction coil and its uses.

### **Unit- III**

Growth and decay of currents in LR circuits-growth and decay of charge in CR circuits-determination of high resistance by leakage- growth and decay of charge in LCR circuit-condition for growth and decay to be oscillatory-expression for frequency of oscillation-series and parallel resonant circuits-theory- comparison- Power in LCR circuit-skin effect-Tesla coil.

### **Unit IV**

Different types of magnetic materials-classical theory of diamagnetism- Langevin theory of paramagnetism- Weiss theory of paramagnetism-molecular field theory of ferromagnetism-quantum theory of ferromagnetism-domain theory of ferromagnetism- applications of soft magnetic materials and ferrites.

### **Unit- V**

Fundamental definitions in dielectrics-types of electric polarization-frequency and temperature effects on polarization- Clausius – Mosotti relation-determination of dielectric constant-dielectric breakdown-properties and different types of insulating materials.

### **Books for study:**

1. Electricity and Magnetism - R Murugesan, S . Chand & Co.
2. Electricity and Magnetism- Narayanamurthy and Nagarrthnam  
National Publishing Company.
3. Material Science, Dr M Arumugam, Anuradha Agencies.

### **Books for reference:**

1. Electricity and Magnetism D N Vasudeva S Chand & Co.
2. Electricity and Magnetism K K Tiwari S Chand & Co.
3. Introduction to Solid State Physics C Kittel John Wiley.
4. Solid state Physics Deckker.

## **309UPHT02 - ATOMIC AND NUCLEAR PHYSICS**

### **Unit- I**

Vector atom model-quantum numbers-coupling schemes-j-j coupling and L-S coupling- application of spatial quantization-Pauli's exclusion principle-selection rule-intensity rule-interval rule- Lande's g factor-Bohr magneton-applications of vector atom model-periodic classification – electronic configurations- magnetic dipole moment due to spin- Stern- Gerlach experiment.

### **Unit- II**

Spectral terms and notations-fine structure of sodium D lines-fine structure of H $\alpha$  line- effect of electron spin on fine structure of spectral lines- fine structure of alkali spectra and ionized He- Zeeman effect-Larmor's theorem- quantum mechanical explanation of normal Zeeman effect- anomalous Zeeman effect of D1, D2 lines of sodium- Paschen Bach effect- Stark effect.

### **Unit III**

Nuclear detectors- solid state detector- proportional counter-cloud chamber- Bubble chamber- scintillation counter-Accelerators-cyclotron-synchrocyclotron- betatron.

Artificial transmutation- Rutherford's experiment-theory of nuclear disintegration- Q value –threshold energy- types of nuclear reaction- energy balance and Q value-threshold energy of endo energetic reaction- scattering crosssection.

### **Unit IV**

Nuclear structure- nuclear size-experimental measurement of nuclear radius- neutron interaction method- isotope structure method-mirror nuclei method- nuclear charge- measurement by the method of alpha scattering-Meson theory of nuclear forces-nuclear models- liquid drop model- Weiszacker's semi empirical mass formula- shell model.

### **Unit V**

Nuclear fission- types of nuclear fission-Bohr Wheeler theory-chain reaction-critical size-critical mass-nuclear fusion- source of stellar energy- Carbon – nitrogen cycle- proton- proton cycle-thermonuclear reaction- controlled thermo nuclear reaction .

Elementary particles-types of interactions-classification of elementary particles-elementary particle quantum number- Baryon number-lepton number-strangeness number-hypercharge-isospin and isospin quantum numbers-conservation laws and symmetry-parity, charge conjugation symmetry- time reversal symmetry-combined inversion of CPT.

### **Books for study;**

1. Modern Physics - R Murugesan, S Chand & Co.
2. Atomic Physics - J B Rajam, S Chand & Co.
3. Nuclear Physics - D C Tayal, Himalaya Publishing Co.

### **Books for reference:**

1. A Source book of atomic energy Samuel Glasstone East West Press.
2. Atomic and Nuclear Physics- Albright Semat Chapman and Hall.
3. Basic Nuclear Physics and Cosmic rays - B N Srivatsava Pragati Prakashan.

## **309UPHT03 -QUANTUM MECHANICS & RELATIVITY**

### **UNIT – I**

Breakdown of classical mechanics – inadequacy of old quantum theory – Matter waves – wave packet – G.P. Thomson's verification – Heisenberg's uncertainty principle – illustrations - Wave function – physical significance – well-behaved wave functions – Operators – Postulates of quantum mechanics - normalization – expectation value and Ehrenfest's theorem – Schrodinger's time dependent and time independent wave equation – derivation.

### **UNIT – II**

One dimensional problems – particle in a box – eigen functions and eigen values – linear harmonic oscillator – rectangular potential barrier – one dimensional potential well and infinitely deep potential well – note on tunneling and alpha decay.

### **UNIT – III**

Three dimensional problems – separation of variables – rigid rotator – rotational energy levels and eigen functions – hydrogen atom – separation of variables – azimuthal, polar and radial equations – energy levels and eigen functions – quantum numbers.

### **UNIT – IV**

Statistical equilibrium – phase space – microstates and macrostates – Maxwell – Boltzmann distribution law – application to ideal gas – Quantum statistics – Fermi – Dirac distribution law – application to electron gas – Bose-Einstein distribution law – application to photon – comparison of the three statistics.

### **Unit V: Special theory of Relativity**

Postulates – Lorenz transformations – Time dilation – Length contraction – Doppler effect – Twin paradox – velocity addition – relativistic momentum – Mass energy equivalence – Electricity and Magnetism in relativity – Introduction to general relativity.

### **TEXT BOOK:**

1. R. Murugesan, Modern Physics, S.Chand & Co., New Delhi, 2005.
2. Brijlal and Subramaniam, Heat and thermodynamics, S.Chand & Co., New Delhi, 2005.

### **Reference Book:**

1. J.B.Rajam, Modern Physics, S.Chand & Co., New Delhi.

## **309UPHT04 - ELECTRONICS**

### **Unit I Semiconductor Special Devices**

JFET – Construction, characteristics - common source amplifier-Design guide lines  
– MOSFETS – depletion and enhancement mode MOSFETS – MOSFETS as switches  
–UJT - relaxation oscillator – SCR – Tunnel diode, Gunn diode, PIN diode – IMPATT  
diode – DIAC and TRIAC – construction and characteristics.

#### **UNIT – II**

Wave form generators and Active filters

Sine wave oscillation with phase shift and wein's networks-Comparator-Schmitt  
Trigger-Astable and Monostable operations-Triangular wave generator.

Active filters-Butterworth filters design-Second order low,High and Band pass  
filters-Band notch filter.

### **UNIT – III Operational amplifier and analog computation**

Operational amplifiers –characteristics and parameters– Mathematical operations –  
logarithmic – antilog amplifiers – Analog multiplier and divider – solutions to  
simultaneous equations –differential equations, harmonic oscillator, damped  
harmonic oscillator, rocket launching.

### **Unit –IV Digital Electronics**

Number systems- binary, octal hexa- logic gates- Universality of NAND and NOR  
gates- binary adder and subtractors – Half adder – full adder – half subtractor- Full  
subtractor- Boolean algebra – simplification of Boolean expressions- K.Maps  
(Simple systems only)-

### **Unit – V Registers and Counters**

Flip-flops- RS – Clocked RS- D- T- JK – JK M/S flip flops- binary counters- decade  
counters- Up/Dn counters - Shift registers- Digital to analog Converters - Binary  
weighted – Resistor, DAC – R/2R ladder DAC – Successive approximation method –  
Single slope and Dual slope ADC-- counter type-Resolution, Accuracy and  
Linearity.

### **Books For Study**

1. Electronic devices and Circuits – G.K. Mithal Khanna Publishers – New Delhi.
2. Integrated Circuits – K.R. Bothkar.
3. Integrated Electronics – Analog & Digital Circuits and Systems –  
Tata Mc Graw Hill – Jacob Millman & Christor. S.C. Halkias.
4. Operational amplifier – Gayakwad – TMG Hill

## **309UPHT05 – ELECTRONICS AND COMMUNICATION**

### **UNIT – I**

Modulation – definition – types of modulation AM, Fm, Pm – expression for amplitude modulated voltage – Wave form of amplitude modulated – wave – collector modulation circuit – single side band generation – balanced modulator – Am transmitter – block diagram and explanation – frequency modulation – expression for frequency modulated voltage – side bands in FM, FM production by transistor reactance modulator – expression for phase modulation – Comparison of AM, FM, PM

### **UNIT – II**

Demodulation – definition – Diode detection of AM signals – FM detection – Foster Seely discriminator  
Radio receivers – straight receivers – TRF receivers – super heterodyne receivers – Block diagram – explanation of each stage – FM receivers – Block diagram – AGC

### **UNIT – III**

TV- plumbicon – vidicon – scanning – simple and interlaced scanning – composite video signal – horizontal, vertical and synchronizing pulses – block diagram of TV transmitter and receiver – Color TV – generation R, G, B signals – Simplified block diagram of color TV transmitter and receiver – TV transmitting antennas – turnstile array- dipole panel – TV receiving antenna – Yagi antenna – log periodic antenna

### **UNIT – IV**

RADAR – principle of radar- azimuth and range measurement – radar-transmitting systems – radar antennas – duplexer – radar receivers – uses of radar Opto electronic devices – photoconductive cell – solar cell – phototransistor – LED- LCD construction and working

### **UNIT-V**

Digital communications – digital technology – fundamentals of data communication systems – characteristics of data transmission circuits – digital codes – error detection and correction – data sets and inter connection requirements – modem classification – modem interfacing

### **Books for study:**

1. Hand book of electronics – Gupta & Kumar Pragati Prakashan(2005).
2. Electronics communication systems – Kennedy and Davis, TMH.

### **309UPHP01 - MAJOR PRACTICAL III**

1. Cantilever- Young's modulus – mirror and Telescope
2. Static torsion – Rigidity modulus
3. Compound pendulum
4. Coefficient of viscosity – ungraduated burette – radius by mercury pellet
5. Kundt's tube – Young's modulus – velocity of sound
6. Lee's disc – thermal conductivity of a bad conductor and emissivity
7. Newton's rings – refractive index of a lens
8. Spectrometer – I-I' curve
9. Spectrometer – small angled prism
10. Potentiometer – calibration of high range voltmeter
11. Deflection magnetometer –  $m$  and  $B_H$  – TAN C position
12. Copper Voltmeter -  $B_H$
13. Principle of multimeter
14. BG – Determination of absolute capacity
15. Determination of Thermo emf- direct method – BG
16. FET characteristics
17. UJT characteristics
18. SCR characteristics
19. Hartley oscillator
20. Colpitt oscillator

## **309UPHP02 - MAJOR PRACTICAL – IV**

1. Koenig's method – non uniform bending
2. Koenig's method – uniform bending
3. Cantilever – dynamic method
4. Bifilar pendulum – parallel threads
5. Viscosity of highly viscous liquid – Searle's viscometer
6. Thermal conductivity of good conductor – Forbes method
7. Newton's rings – Refractive index of a liquid
8. Spectrometer – dispersive power of a grating
9. Spectrometer – Cauchy's constant
10. Potentiometer- emf of a thermocouple
11. Field along the axis of a coil – Vibration magnetometer
12. Carey Foster's bridge – temperature of coefficient of resistance
13. BG comparison of Capacities – De Sauty's bridge
14. BG comparison of mutual inductances
15. BG absolute determination of mutual inductance
16. Astable multivibrator using 555 timer
17. Monostable multivibrator using 555 timer
18. Bistable multivibrator using 555 timer
19. Flip flops using gates
20. RC coupled amplifier – single stage