Academic Council: / / 2015, R.No. ( )

T.Y. B.Sc.
PHYSICS

Sr. No.	Paper No.	Total Marks
301	Classical Mechanics, Quantum Mechanics & Mathematical Physics	75
302	Electrodynemics, Fiber Optics,Laser & X-Rays	75
303	Atomic Physics, Nuclear Physics, Solid State Physics	75
304	ELECTRONICS AND PROGRAMMING IN C	75
305	Electronics, Plasma Physics, Solar Physics	75
306	Practical	125
	TOTAL	**500**

T.Y.B.Sc.
(Physics)

Paper – 301
(Classical Mechanics, Quantum Mechanics & Mathematical Physics) **Total Marks: 75**

Unit:1 Lagrangian Formulation

Constraints, Generalized Co ordinates, D'Alembert's Principle, Lagrangian Equations, Application of Lagrange's: Motion of a particle using Cartesian co-ordinates, Motion of a particle using polar co-ordinates, Equation of motion of one dimension harmonic oscillator, Atwood's machine.Symmetries and laws of conservation, Cyclic co-ordinates, Velocity dependent potential, Rayleigh's dissipation function.

Unit:2 Variational Principle

Configuration Space, Some techniques of Calculus of variation, Brachistochrome problem, Geodesic, Hamilton's Principle, Equivalence of Lagrange's and Newton's Equations, Advantages of the lagrangian formulation, Lagrange's undetermined multipliers, Hamilton's Equations of motion.

Unit:3 Stationary states,Exactaly soluble Eigenvalue Problems

Ehrenfest's theorem and expectation values, The time independent Schrodinger Equation, The fundamental Postulates of wave mechanics, The Schrodinger Equation for simple harmonic Oscillator in one dimension and it's Eigen function and Eigen values, The Abstract Operator method – Problem, Ortho normal and Ortho gonal Eigen function, Schmidt Orthogonalization process, Few related theorems (I & II).

Unit:4 Operators

Types of operators, Algebra of operators, Linear operator, Vector operator, Laplacian Operator in Cartesian co-ordinate system, Laplacian Operator in spherical polar co-ordinate system, commutator of operators, Self Adjoint operator, Unitary operator, Angular momentum operator.

Unit:5 Differential Equations, Second order differential Equations & some important functions.

Some partial differential equations in physics, The method of separation of variables, separation of Helmholtz Equation in Cartesian co-ordinate system, separation of Helmholtz Equation in spherical polar co-ordinate system, Laplacian Equation in Cartesian co-ordinate system, Laplacian Equation in spherical polar co-ordinate system, Analytic function, Ordinary and singular points, Series solution around an ordinary point and its Problems, Gamma Function, Kroneker Delta Function and Dirac Delta function.

References:

1. Text Book : Introduction to classical mechanics - R G Takwale & Puranik. Pub: Tata McGraw Hill
2. Text Book : Quantum mechanics - Ahutinarayan Konar Pub: The Dacca Students' Library, Calcutta
3. Text Book: Quantum mechanics – P M Mathews & K Venkatesan Pub: TMH company ltd
4. Text Book : Mathematical Physics - P.K. Chatopadhyay.(Wiley Eastern Limited)

1. Classical mechanics - Rana & Jog
2. Classical mechanics - A.B.Bhatia
3. Quantum mechanics- G. Aruldhas
4. Mathematical Methods in Physical Sciences – M.L.Bose
5. Mathematical Physics – B.S.Rajput

T.Y.B.Sc.
(Physics)

Paper-302
(Electrodynemics, Fiber Optics,Laser & X-Rays) **Total Marks: 75**

Unit : 1 Electrostatics

Di-electric Polarization , Relative permittivity , Relation between **D, E** and **P** , Point charge in Di-electric fluid , Potential and field due to polarized sphere : At external and internal point, Di-electric sphere is placed in uniform electrostatic field : Resultant field inside and outside the Di-electric sphere , Molecular field in a Di-electric (Claussius- Mossotti Relation) : Validity of Claussius- Mossotti Relation , Polarization of Polar molecules (Debye's formula), Examples.

Unit : 2 Magnetostatic & Maxwell's Equation

MAGNETOSTATIC: Current density , Magnetic Induction , Force on a current element (Ampere's force law): Application of Ampere's law , Biot- Savert's law (Magnetic induction): Application of Biot-Savert's law , Divergence of magnetic induction B , The magnetic vector potential A , The Lorentz condition, The curl of magnetic induction B , Examples.

MAXWELL'S EQUATION(Propagation of EM waves in media):

Maxwell's equation (without derivation) : Differential and integral form, in free space and in Linear isotropic media , Propagation of EM waves in : Free space - Non-conducting media conducting media - Ionized gas , Boundary conditions for the electromagnetic field vectors: E,D,H & B (At the interface between two media).

Unit : 3 Fiber Optics

Introduction , Principle of light transmission in optical fiber , Effect of index profile on propagation , Modes of Propagation , Losses & Dispersion in optical fiber , Characteristic of optical fiber , Merits and Applications of optical fiber.

Unit : 4 Laser

Absorption - Spontaneous emission - stimulated emission , LASER principle and population inversion , Einstein's A and B co-efficient , Types of LASER: Ruby LASER - He-Ne LASER - Semiconductor LASER **,** Holography : Principle of Holography - Recording of hologram & Reconstruction of image - Practical Application of Holography - Difference between Photography & Holography , Applications of LASER.

Unit : 5 X-Ray

X-Ray scattering : Coherent scattering - Incoherent scattering , Continuous x-ray spectrum , Characteristic Emission spectrum , Characteristic Absorption spectrum , A close survey of emission spectrum , Explanation of emission and absorption spectra , Comparison of optical and X-ray spectra , Mosely's law , Auger effect , Applications of X-Ray .

Reference Book:

1. Electrodynamics by Gupta, Kumar & Singh
2. Introduction to Electrodynamics by Griffith.
3. Communication electronics by Rody & Coolin.
4. Principles of optics by Dr. N. Subramanyam, Brijlal.
5. Introduction to LASER by Tyagrajan.
6. Elements of Spectroscopy by Gupta, Kumar & Sharma.

T.Y.B.Sc.
(Physics)

Paper no. 303

(Atomic Physics, Nuclear Physics, Solid State Physics) **Total Marks: 75**

Unit-I Atomic Physics

Magneto Optical Effect of an Atom

Introduction ,The Magnetic Moment of the Atom ,Gyro magnetic Effect : Interaction of Atom with external Magnetic Field ,Vector Atom Model and Normal Zeeman Effect ,Vector Atom Model and Anomalous Zeeman Effect ,Selection Rule , Term and Term Multiplicity,Vector Atom Model and Paschen-Back Effect ,Quantum Mechanical treatment of Zeeman and Paschen–Back Effect

Testing the Validity of Zeeman Theory :

Analysis of the Normal and the Anomalous Pattern of some Concrete Lines ,such as the D lines of Sodium , the Green (5461 Å)and Violet (4358 Å) lines of Mercury. Lande's g factor ,Experimental verification Lande's g factor , Lande's g factor in L-S oupling (Two Valance electron System)Lande's g factor in J-J coupling

Electro Optical Effect of an Atom **:**

Introduction ,Stark Effect ,Experimental set up of Stark Effect (Hydrogen atom) ,Important Conclusions .

Unit-II Nuclear Physics

Nuclear Models

The Liquid Drop Model of a Nucleus: Introduction, Binding Energies of Nuclei : Plot of B/A versus A ,Weizsacher's Semi Empirical Binding Energy – Mass formula,Mass Parabolas: Prediction of Stability Against β decay for Members of an Isobaric–family

The Shell Model of a Nucleus:Introduction,the Evidence that Led to the Shell Model, main assumptions of the Single-Particle Shell Model, Concept of Spin-Orbit Coupling of an Electron bound in an Atom, Spin-Orbit Coupling in Nuclei, Predictions of the Shell Model, the Collective Model of a Nucleus

Introduction to Elementary Particles: Introduction, Fundamental Interactions -Nucleon Forces, Iso spin, Pions, Leptons,Strangeness, Families of Elementary Particles, Observed Interactions and Conservation Lows

Nuclear Physics in Other Areas of Physical sciences: Introduction, The Technique of NMR(Nuclear Magnetic Resonance), Some Experiments with NMR , the Mossbauer Effect , Some Experiments Using Mossbauer Effect, Natural Fusion-Energy Production in Stars,Possibility of Controlled Fusion

Unit-III Solid State Physics- 1

Lattice Vibrations : Introduction, the 'Balls and Springs' Model of Harmonic Crystal , Normal Modes of a One-dimensional Monatomic Chain , the Periodic Boundary Condition, Salient Features of the dispersion Curve, Normal Modes of One-dimensional Diatomic Chain, Salient Features of the dispersion Curves: Acoustic Branch, Optical Branch, the Reststrahlen Band ,quantization of Lattice Vibrations

Thermal Properties of Solids: Introduction, Classical Lattice Heat Capacity, quantum theory of lattice heat capacity, average Thermal Energy of a harmonic oscillator, Einstein Model, Phonon density of states, Debye Continuum Model

Unit-IV Solid State Physics- 2

Free Electron Theory of Metals :

Introduction, the Drude model, DC Electrical Conductivity of metals, thermal conductivity of metals , Lorentz Modification of the Drude model, Fermi-Dirac distribution function, the Sommerfeld model, the density of states, the Free Electron Gas at 0 K, energy of electron gas at 0K , the electron heat capacity, the Sommerfeld theory of electric conduction in metals

Electron Energy Bands (Band Theory of Solids):

Introduction, consequences of periodicity, proof of the Bloch theorem, the Periodicity of the Bloch functions and their Eigen values, wave mechanical interpretation of energy bands , the Kronig-Penney Model

Unit-V Superconductivity

Phenomena without observable quantization, zero resistance and persistent current perfect diamagnetism: Meissner effect , F-H London Equations, critical Field : Type I and Type II superconductors, Isotope effect , BCS Theory : A qualitative approach ,Cooper Pair formation, BCS Ground state, Coherence length, high temperature superconductors (HTS) Applications

Reference Books :

1. Elements of Spectroscopy by Gupta-Kumar-Sharma , Pub:Pragati Prakashan
2. Atomic Physics by J.B.Rajam , Pub: S.Chand
3. Introduction To Atomic Spectra by H.E.White , Pub:McGrawHill
4. Nuclear Physics An Introduction by S.B.Patel Pub: New Age International Private limited
   , New Delhi
5. Elements of Nuclear Physics by Pandya & Yadav Pub:Kedar Nath Ram Nath , Meerut
6. QUANTUM PHYSICS OFATOMS,MOLECULES,SOLIDS,NUCLEI, ANDPARTICLES by Robert
   Eisberg and Robert Resnick Student Edition Pub:John Wiley & Sons, New York
7. Modern Physics by Jeremy Bernstein , Paul M Fishbane, Stephen Gasiorowicz
   Pub: Pearson Education (Low Price Edition)
8. Elements of Solid state Physics by J.P.Srivastava Pub: Prentice-Hall of India, New Delhi
9. Solid state Physics by S.O.Pillai Pub: New Age International Private limited , New Delhi
10. Solid State Physics by R.L.Singhal Pub: Kedar Nath Ram Nath , Meerut
11. An Introduction to Solid State Physics by Charles Kittle Pub: Wiley Eastern Limited, New Delhi
12. Elementary Solid State Physics by M Ali Omar Pub: Pearson Education (Low Price Edition)

T.Y. B.Sc.
(PHYSICS)

Paper no. 304
(ELECTRONICS AND PROGRAMMING IN C) **Total Marks: 75**

Unit : 1 Digital -1

Logic fundamental ,Logic gates(Circuit and operation) : AND- OR- NOT - NAND –NOR, Laws of Boolean algebra , Reducing Boolean expression , Logic circuits : Using AND,OR and NOT gates- using universal gates , Half adder, Full adder

Unit : 2 Digital - 2

The diode as an ac switch, The bipolar transistor as a dc switch , The bipolar transistor as an ac switch , The FET as a switch , Logic family, Truth table and maps(four variables) , Solving digital problems using maps: Sum of product -Product of sum

Unit : 3 Solid state devices

DIAC : Construction – operation – characteristics- application, TRIAC: Construction-operation -characteristics – application , LED : Operation- application, Photo diode , IC : Classification - making of monolithic IC

Unit : 4 OP-AMP

Introduction to op-amp , Definition of op-amp , Block diagram , Schematic symbol , Different parameters of op-amp , Equivalent circuit of an OP-AMP , Ideal voltage transfer curve , Open loop configuration : 1)Inverting amplifier-Non inverting amplifier- Differential amplifier, block diagram representation of feedback configuration ,

Close loop configuration :

Inverting amplifier: Voltage gain with feedback - Input resistance with feedback - Output resistance with feedback

Non inverting amplifier

Differential amplifier

Summing amplifier : inverting configuration - Non inverting configuration , Difference amplifier: inverting configuration - Non inverting configuration Integrator , Differentiator,

I-V converter, V-I converter

Unit : 5 Programming in 'C'

Introduction to computer

Numeric constant : Constants - Scalar variables - Declaring variable names - Defining constant

Arithmetic Expressions : Arithmetic operators and modes of expressions - Integer expression -

Floating point expression - Operator precedence in expression - Assignment statements -

Defining variables - Arithmetic conversion - Assignment expression - Increment decrement statement - Multiple assignment , Input output statements , Conditional statements

Loops : The *while* loop - The *for* loop - The *do while* loop , Some simple program in 'C'

Reference book:

1. Principle of electronics by V K Mehta
2. Hand book of electronics by Kumar & Gupta
3. Computer Programing in C by V Rajaraman Pub.Prentice-Hall of India, New Delhi
4.. Programing in C by Balaguruswami
5. Digital electronics by Gothmann
6. Digital electronics by tokhein
7. Digital electronics by Malvino and leach

T.Y. B.Sc.
(PHYSICS)

Paper no. 305
(Electronics, Plasma Physics, Solar Physics) **Total Marks: 75**

Unit-1: Power amplifiers

Introduction, Series-fed class-A amplifier with analysis,Transformer coupled class-A amplifier with analysis, Class-B amplifier with analysis,Transformer coupled push-pull amplifier (only description),Complementary symmetry amplifier (only description),Distortion-harmonic distortion (graphical explanation),Thermal run-away,Need for heat sink.

Unit-2: Power supplies and Voltage Regulation

Introduction,Unregulated and regulated power supply (only explanation-in short),Ripple and reduction of ripple by filters (only explanation-in short),Zener diode as voltage regulator,Transistorised series regulator,Improved series regulator,Op-amp series regulator,Transistorised shunt regulator,Improved shunt regulator,Op-amp shunt regulator,Three terminal IC regulator (78-series of IC),Adjustable voltage regulator.

Unit-3: Opto electronics

Electromagnetic spectrum,Spectral response of human eye,Comparision with tungston lamp spectra,Illumination and irradiance,Photoconductive sensors-LDR, PN photodiodes, PIN diodes, Phototransistors,Photovoltaic sensors- Solar cell,Photoemissive sensors- LED, LASER diode,Light Activated silicon controlled rectifier (LASCR),Application of LASCR.

Unit-4: Multivibrators and digital flip-flops

Astable multivibrator,Monostable multivibrator,Bistable multivibrator,Timer IC-555, Astable and monostable operation,Memory elements-flip-flops- Introduction
R-S flip-flop,NAND and NOR latches,Gated flip-flop - clocked R-S flip-flop, clocked D flip-flop,Edge triggered R –S flip-flop,Edge triggered D flip-flop,
Edge triggered J-K flip-flop

Unit-5: Plasma Physics and Solar Physics

Introduction,Interaction of particles,Concept of collisions,Excitation of atoms and molecules,Dissociation of molecules,Ionizations of atoms and molecules, Recombination,Photo ionization,Excitation and ionization by stages,
Production of plasma,Plasma Oscillations,Properties of plasma,Plasma radiation
Introduction,Fundamental and application of Solar energy.,Solar constant and its examples,Determination of Solar time and its examples,Solar angles,Piranometer- the solar energy measuring equipment,Characteristic of flat-plate solar collectors and its examples,Solar pond – principle, operation, types of solar ponds and application.

References:

1. Hand book of Electronics,By Kumar and Gupta – Pragatiprakashan.
2. Principles of Electronics By V. K. Mehta and Rohit Mehta- S. Chand & Co.
3. Electronic principles By Malvino – TMH.
4. Electronic devices and circuits theory ,By Boylestad and Nashelsky.
5. Solar Physics ,By G. D. Rai
6. Fundamentals of Solid state physicsBy Saxena,Gupta and Saxena,Pragatiprakashan.
7. Introduction to Plasma physics,By Chen
8. Electronic devices and circuits,By Allen Motershed – PHI
9. Digital principles and applications ,By Malvino and Leach – TMH
10. Solid State Devices – By S.M.Sze.

T.Y. B.Sc.
(PHYSICS)

Paper no. 306
(PHYSICS PRACTICAL) **Total Marks : 125**

SECTION - A GENERAL PHYSICS AND HEAT

1. To determine "g " by Ka.ter's pendulum (Variation of Length)
2. To determine "Y" by Koening's method.
3. To determine "Y" of a rod by Newton's rings.
4. To determine Stefan's Constant σ.
5. To study variation of surface tension with temperature by Denou's method.
6. To determine young modulus Y and η using Flat spiral spring.
7. To determine "g " by Kater's pendulum (Variation of Mass).
8. To calibrate the platinum resistance thermometer and to finde out melting point of wax
9. To determine viscosity of liquid by log decrement method.
10. To determine poission ratio of glass plate by Cornu's Optical interference method.
11. To study the variation of moment of inertia of a system with the variation in the distribution of mass.
12. To determine the velocity of ultrasonic waves in liquid and the compressibility of the liquid.
13. To determine Young modulus of glass plate by Cornu's optical interference method.

SECTION – B OPTICS

1. To determine the wavelength of Sodium light using Lloyd's mirror.
2. To study the elliptical polarization of light.
3. To determine refractive index of liquid by method of total internal reflection.
4. To determine the separation between the plates of Febry-Perot etalon..
5. To determine wavelength of a given source by Michelson's interferometer.
6. To study elliptical polarized light by a Babinet's compensator .
7. To measure the divergence of a given LASER source.
8. To determine the wavelength monochromatic light by diffraction at straight edge.
9. To determine unknown wavelength using Hartmann's formula.
10. To calibrate spectrometer by Edser Butler plate and to determine unknown wavelength.
11. To determine the wavelength of given source using Fabry Perot interferometer.
12. To determine refractive index of liquid by Bi prism.
13. To determine the wavelength of given LASER beam using diffraction grating

SECTION - C ELECTRICITY AND MAGNETISM

1. To determine the capacitance and power factor of a capacitor by Schering Bridge.
2. To study charge and discharge of capacitor using Neon lamp.
3. To study L-C-R series circuit.
4. To determine absolute value of capacitor.
5. To obtain hysteresis curve for given material by magnetometer method.
6. To estimate the magnetic volume susceptibility of solution by Quink's method.
7. To determine dielectric constant of the medium.
8. To determine the self inductance of a given coil by Rayleigh's method.
9. To determine the self inductance of a given coil by Maxwell's bridge.
10. To determine the self inductance of a given coil by Owen's bridge.

11. To determine current sensitivity, charge sensitivity and total critical damping resistance of Ballistic Galvanometer.
12. To study variation of thermo-electric emf with temperature for thermo couple.
13. To study time constant of an R.C.circuit experimentally and verify result theoretically.

SECTION - D MODERN PHYSICS

1. To determine the value of (e/m) by helical method.
2. To determine the band gap energy of semiconductor.
3. To study the characteristics of solar cell.
4. To determine Absorption Co-efficient of a liquid.
5. To estimate charge of electron using Millican's oil drop method.
6. The platue of GM tube.
7. To determine magnetic sensitivity of cathode ray tube.
8. Absorption spectrum of Iodine molecule.
9. To determine the value of Rydberg's constant.
10. To study the absorption spectra of $KMnO_4$ solution by spectrometer.
11. To study intrinsic photoconduction of photovoltanic cell with following objectives.
    (a)To find value of planck radiation constant.
    (b) To determine the threshold frequency value thereby work funtion w_0 of photovoltanic cell.
    (c) To verify photoelectric equation.
12. To estimate the intensity of β rays when passing through different thickness of alumiuim and to determine the linear absorption coefficient of aluminium.

SECTION – E ELECTRONICS

1. To study frequency response curve of negative feed back amplifier
2. To study phase shift oscillator.
3. To determine the h parameter of transistor.
4. To study the characteristics of UJT and relaxation oscillator
5. To study FET as a voltmeter.
6. To study multivibrator
7. To study a.c.load line for a given transistor.
8. To study SCR characteristics.
9. To study inverting and Non inverting operational amplifier.
10. To study two stages RC amplifier..
11. To study operational amplifier as square wave generator.
12. To study a CE amplifier circuit with following objectives.
    I. To determine the quiescent operation condition.
    II. To plot overload characteristics.
    III. Frequency response.
    IV. Input output impedence.
13. To verify truthtable of OR , AND , NOR and NAND logic gates using discrete components.

Reference books:

1. B.Sc. Practical Physics by C L Arora
   Pub. S. Chand and co.
2. Practical Physics by Kumar and Gupta
   Pub. Pragati Prakashan.
3. Advanced practical Physics part-I and part-II by Singh