MADURAI KAMARAJ UNIVERSITY

(University with Potential for Excellence)

NEW SYLLABUS FOR B.Sc., (PHYSICS)

(Non – Semester)

(With effect from the academic year 2013 - 2014)

1. **Objective:**

   The Syllabus for B.Sc. Physics degree under Non-semester system has been designed on the basis which would focus on job oriented programmes. It will effect from the academic year 2013-2014.

2. **Eligibility:**

   A pass in +2 examination conducted by the Board of Higher Secondary Education, Govt of Tamil Nadu with Physics and Mathematics OR any other examination accepted by the syndicate, as equivalents there to are eligible to join this course.

3. **Duration of the course:**

   The students who are joining the B.Sc., (Physics) degree shall undergo a study period of three academic years.

4. **Subjects of study and scheme of examination:**

   The subjects offered in major physics for three years and the schemes of examination are given.

5. **Question Paper Pattern:**

   Total mark in each paper is 100

Exam Pattern

The pattern of Question paper will be as follows:

Time: 3 Hours **Max. Marks: 100**

Section A: (10x3 = 30 marks)

Short Answers

1. At least two questions from each unit
2. Maximum 12 questions in this section
3. Answer any 10 out of 12 questions

Section B: (5x6 = 30 marks)

1. Answer 5 questions choosing out of 8 questions
2. Answer not exceeding two pages.

3. At least one question from each unit
4. At least one problem from any unit

Section C: (4x10 = 40 marks)

1. Answer not exceeding four pages.
2. Answer any four out of six questions
3. At least one question from each unit
4. There must be at least one problem from any unit

Blue Print of the Question Paper – Core Subjects

Maximum Marks: 100

Section	Types of Questions	No. Of Questions	No. Of Questions to be answered	Marks for each question	Total Marks
A	Short Answers at least Two questions from each unit	12	10	3	30
B	Not exceeding 2 pages at least One from each unit*	8	5	6	30
C	Not exceeding 4 pages (any four out of six) at least one from each unit	6	4	10	40

*There must be atleast one problem in Section B and Section C.There will be Two Allied subjects to fulfil the course during three years.

Subject	Year of Study
Mathematics	I & II
Applied Electronics	II & III

- The syllabus for the ancillary subjects can be got from the Ancillary Department of Mathematics, Chemistry / Applied electronics.

- Practical:
  Record Note Book / = 25

  Examination external = 75

Total 100

---

5. Eligibility for the degree:
   i. A candidate will be eligible for the B.Sc., degree by completing three years and passing all the prescribed examinations.
   ii. A candidate shall be declared as passed the course, if she / he scored a minimum of 35% marks in each paper of all the subjects.

YEAR	LANGUAGE	MAJOR	ANCILLARY I	ANCILLARY II
I	Tamil - I English - I	1. Mechanics and Properties of Matter, 2.Heat, thermo-dynamics & statistical mechanics. 3. Electricity and Electromagnetism. 4. Practical-I	1. Mathematics - I 2. Mathematics - II	
II	Tamil –II English – II	1. Optics and Spectroscopy, 2. Atomic and Nuclear Physics. 3. Practical-II	1. Mathematics – III 2. Mathematics-IV	1. Electronics – I 2. Electronics Practical – I (Analog Electronics)
III		1. Classical and Quantum mechanics. 2. Programming in C and C^{++}. 3. Analog and Digital Electronics, 4. Materials and Nano Science. 5. Practical - III (Analog Electronics) 6. Practical - IV (Digital Electronics)		1. Electronics II 2. Electronics Practical- II (Digital Electronics)

- **Environmental Science is a Compulsory Paper for all Third Year Students.**

B.Sc. I Year

Paper – I - Mechanics and Properties of Matter

Unit – I

Newton's law of motion – Force – Mass – Momentum and Impulse, Law of Conservation of Linear Momentum – Collision – Elastic and Inelastic collision – Newton's law of impact. Coefficient of restitution – Impact of moving sphere on a fixed plane – Direct and Oblique impact of moving two smooth spheres – Calculation of final velocities – Laws of Kinetic energy – Projectile motion – Frictional forces – Center of mass of solid objects – Conservation of Momentum in a system of particles.

Unit – II

Uniform circular motion – The dynamics of uniform circular motion – Moment of inertia of circular disc about an axis passing through its center and perpendicular to its plane, through its diameter, through its tangent – Moment of inertia of a solid sphere about all axes- Angular momentum and angular velocity and torque – Relation between angular momentum and torque – Kinetic energy of rotation and the work energy theorem – Conservation of angular momentum – Work done by constant force – work done by variable force – work and kinetic energy in rotational motion – Expression for the acceleration of a body rolling down an inclined plane.

Unit – III

Gravitation – Newton's law of gravitation – kepler's law of planetary motion – Mass of earth – Gravitational field and potential at a point inside and outside a spherical shell – Mass and density of earth – Determination of G (Boy's method) – Variation of 'g' with altitude, depth and latitude- Earthquake – seismograph – modern application of seismology – Satellites – Orbital velocity – Escape velocity – Stationary satellite – Jet plane – Rocket – Principle, theory – Velocity of rocket at any instant – Rocket propulsion systems – specific impulse – multistage rocket – Shape of the rocket.

Unit – IV

Elasticity – Stress, strain – Poisson's ratio – Hooke's law –Moduli of elasticity – Young's modulus, Bulk modulus, rigidity modulus – Bending of a beam – Bending moment – Uniform and Non uniform Bending – Theory and experiment – Determination of Poisson's ratio – Torsional Pendulum – Determination of Coefficient of Rigidity (η) for a wire I - section griders.

Unit – V

Fluids – Flow of a Fluid – Rate of flow – Vicosity – Coefficient of Viscosity – Critical velocity – Laminar and Vortex flow – Poiseuille equation for flow of liquid through a tube – Experimental determination of 'η' - Poiseuille's method and Stoke's method – Ostwald Viscometer – Determination of Viscosity of gases – Rankine's method for the determination of Viscosity of a gas – Surface tension – Free energy of a surface and surface tension – Excess pressure inside a liquid drop and inside a soap bubble – Work done in blowing a bubble – Angle of contact – Capillary rise – Experimental

determination of surface tension by capillary rise – Pitot tube and Venturi meter – Bernoullie's theorem.

Text Books:

1. Mechanics and Properties of Matter by R. Murugeasan – Retd. Prof., Vivekananda College, Thiruvedagam West.
2. David Halliday, Robert Resnick, Kenneth S. Krane 2002, fifth edition, volume 1, physics, John Wiley and Sons, INC.

Paper – II Heat, thermodynamics &statistical mechanics

Unit I

Isothermal and adiabatic changes. Definition – Specific heat capacity (Cv and Cp) – derivation of equations for both Cv and Cp of gas – relation between Cp and Cv. Calorimetry – Joly's differential steam calorimeter for finding Cv –Callender and Barnes continuous flow method to determine Cp.

Unit II

Kinetic theory of gases – Mean free path –Transport phenomena –diffusion, viscosity and thermal conductivity. Maxwell's law of distribution of molecular velocities (no derivation) –expression for mean velocity, mean square velocity, most probable velocity – experimental verification by toothed wheel method. Degrees of freedom – Law of equipartition of energy – Liquefaction of gases –Liquefaction of air by Linde's method – properties of Helium I and Helium II – Adiabatic demagnetization.

Unit III

Transmission of heat – thermal conductivity –thermal diffusivity. Rectilinear flow of heat –Ingen Hausz experiment – Lees' disc method of determination of thermal conductivity of bad conductor. Radiation –Black body Radiation – Wien's law, Rayleigh-Jeans law and Planck's law (no derivation) –Stefan's law and its experimental verification – solar constant and experimental determination

Unit IV

Zeroth first law of thermodynamics – Reversible and Irreversible process – Second law of thermodynamics – Carnot's engine – derivation of efficiency – Carnot's theorem – statement. Entropy –change of entropy in reversible and irreversible process – change of entropy in conversion of ice into steam. Third law of thermodynamics.

Unit V

Probability –phase space – elements of phase space – microstate and macro state – probability distribution –fundamental postulates of statistical mechanics – entropy and probability – elementary ideas of Maxwell-Boltzmann, Fermi –Dirac and Bose -Einstein statistics.

Text Book

1. Heat &, thermodynamics by Brijilal and Subramininan.S.chand &Co.1999.
2. Elements of Mechanics D.S Mathur, 1999, Tata McGraw Hill.

Reference Book

1. Thermal Physics- R.Murugesan, S. chand & Co
2. Fundamentamentals of Statiscal mechanics A.K.Dasgupta NCBA (p) LTD, Calcutta.

Paper – III - Electricity and Electromagnetism

Unit – I

Coulomb's law – Gauss law – Its proof and applications – Electric field due to a charged sphere – Electric field due to a plain sheet of charged conductor – Coulomb's theorem – Mechanical force on the surface of the charged conductor – Electric field, Electric potential, Relation between them - Electric field due to electric dipole, on the axial line and equatorial line – Potential due to a charged conductor – Capacitance – Principle – Expressions for the capacitance – Spherical capacitor – Cylindrical capacitor – Parallel plate capacitor with and without the dielectric – Energy of capacitor – Loss of energy due to sharing of charges – Types of capacitors, fixed capacitor, variable capacitor, Electrolytic capacitor and sliding capacitor**.**

Unit – II

Kirchoff 's laws - Application to wheatstone's bridge – Sensitiveness of bridge – Carey Foster's bridge – Determination of the resistance – Theory – Principle of potentiometer – Determination of internal resistance of the cell using potentiometer – Calibration of ammeter and voltmeter – Low & high range – Seeback effect – Thermoe.m.f – Neutral temperature – Temperature of inversion – Law of intermediate metals – Law of intermediate temperature – Measurement of e.m.f of a thermocouple with a potentiometer – Peltier effect - Peltier coefficient – Thomson coefficient – Thermoelectric power.

Unit – III

Biot-savart's law – Its application – Long straight wire of infinite length – Ampere's theorem – Magnetic field at the center of current carrying circular coil – Solenoid – Ballistic galvanometer – Theory – Damping correction - comparison between deadbeat and aperiodic galvanometer Determination of absolute capacity of a conductor, Comparison of capacitance using B.G.(theory &experiment) – Faraday's laws of electromagnetic induction – Lenz's law – Self-inductance – Energy stored in an inductor – Self-inductance by Rayleigh's bridge method – Mutual inductance – Determination using B.G. theory – Coefficient of coupling Eddy current.

Unit – IV

Growth and decay of current in LR circuit – Growth and decay of charges in CR circuit – Growth and decay of charge in a circuit with inductance, Capacitance and resistance in series – Determination of High resistance by leakage (B.G) – Mean value of alternating e.m.f – RMS value of alternating current / voltage – Alternating current applied to LR, CR and LCR circuits – Series resonance circuit – Parallel resonance circuit – Power in an A.C. circuit – Wattless current – Power factor – Q – factor – Choke – Skin effect – A.C. bridges – Maxwell's bridge – Anderson's bridge and Owen's bridge.

Unit – V

Definition of B, H, M and magnetic susceptibility – Magnetic materials and magnetization – Hysterics – Work done in taking unit volume of magnetic materials through complete cycle of magnetization –Area of Hysteresis loop – Ballistic method, Ferro magnets, Ferri magnets and determination of susceptibility – Guoy's method – Derivations of Maxwell's equations – Types of currents – Displacement current – Significance of displacement of current – Maxwell's equations in material media and free space – Electromagnetic waves in free space – Electromagnetic waves in isotropic non conducting media.

Text Books:

1. Mechanics and Properties of Matter by R. Murugeasan – Retd. Prof., Vivekananda College, Thiruvedagam West.
2. Electricity and Magnetism 20^{th} revised edition – Brijlal and Subramaniyam, S. chand and Co. 2007.

OPTICS AND SPECTROSCOPY

UNIT I :

Geometrical optics. Convex lens –principal focus and focal planes – Cardinal points –Nodal points and nodal planes. dispersion produced by a thin prism –angular dispersion –dispersive power –Cauchy's formula (no derivation of formula)-dispersion-without deviation-deviation without dispersion-achromatic prisms-direct vision spectroscope – determination of refractive index of the material of small angled prism. aberrations in lenses and optical instruments-spherical aberration in lenses-methods of minimizing spherical aberration –aplanatic points in lenses-condition for minimum spherical aberration in the case of two lenses separated by a distance-chromatic aberration in lenses-condition for achromatism of two thin lenses (in contact and out of contact), achromatic lenses. Huygens and Ramsden eyepieces-velocity of light-Houson's method(piezoelectric grating method).

UNIT II :

Interference: Introduction -theory of interference fringes - Fresnel's biprism-determination of thickness of thin transparent film by biprism arrangement-interference in thin films-colors of thin films-air wedge, determination of the diameter of a thin wire by air wedge. Test for optical flatness-Newton's rings-determination of λ and μ of liquid, Newton's ring due to two curved surface – interferometer - Michelson' interferometers, determination λ and *d*λ – uses. Jamin's Rayleigh's interferometer.

UNIT III

Diffraction : Explanation of diffraction – Fresnel's explanation of rectilinear propagation of light – zone plate – Fresnel's and fraunhofer diffraction .diffraction at circular aperture – straight edge- narrow slit and thin wire. Fraunhofer diffraction at a single slit, double slit and *N*- slit. Plane diffraction grating– dispersive power of a grating. Absent Spectra – overlapping spectra. Concave reflection grating (no derivation) – egle mounting . resolving power of telescope, Microscope, prism and grating. Relation between magnifying power and resolving power of a telescope.

UNIT IV

Polarization: Polarization by reflection- Brewster's law - polarization by reflection – mauls law. Double refraction – nicol prism as a polarizer and analyzer – Huygens ' explanation of double refraction in uniaxial crystals. Polarizing prism – quarter and half wave plates. Production and detection of plane, circularly and elliptically polarized light. Optical activity – Fresnel's explanation – specific rotatory power – determination of specific rotator power by Laurent's half Shade polarimeter – optical rotation by magnetic and electric field – Faraday effect.

UNIT V

Spectroscopy: classification as line, banded continues spectra – spectrum – fraunhofer lines. Infrared spectroscopy – applications – scattering of light – Raman effect, experimental set up, characteristic of Raman lines – molecular structure. Basic concept of resonance spectroscopy – nuclear magnetic resonance – nuclear quadruple resonance – Mossbauer spectroscopy – electron spin resonance : Experimental set up and any one of the applications – (qualitive treatment) – Laser – ruby laser, He-Ne gas laser, construction and working – application of laser. Fiber optic

Paper – IV - Atomic and Nuclear physics

Unit I

Introduction – Bohr atom model (no derivation) – application of Bohr's theory –Excitation and ionization of atoms. Sommer field relativistic atom model –Elliptical orbits – relativistic variation of atomic mass– application to the fine structure of spectral lines, vector atom model –spatial quantization and spinning electron hypothesis –Stern and Gerlach experiment –Quantum numbers –coupling schemes –Pauli's exclusion principles – electronic structure of atoms.

Unit II

X rays –characteristics and continuous X ray –its prosperities- application – Duane and Hunt law –Mosley's law and its importance. Compton effect- theory and experimental verification. Zeeman effect-theory and experiment – Anomalous Zeeman effect – stark effect (Quantitative only)

Unit III

Isotopes –isotones –isobars–Atomic mass unit –properties of the nucleus –nuclear binding energy –Nuclear forces –Yukawa's theory (no derivation).Models of Nuclear structure – Liquid drop model –Binding Energy formula – Shell Model –Collective Model.

Unit IV

Laws of radio activity –half life period –mean life –Radio carbon dating. α ray – range of α particle – Geiger Nuttal law-experimental determination by Geiger Nuttal law disintegration energy – theory of α decay. β rays, β- rays spectra – origin-neutrino theory of β decay-electron capture. ϒ rays- determination of wavelengths by diamond crystal spectrometer – origin of rays –internal conversion.

Unit V

Nuclear transmutations by α particles, protons, deuterons, neutrons and electrons –photo disintegration –nuclear fission –energy release. Nuclear fusion –Thermo nuclear reactions-controlled thermo nuclear reaction. Principle and action of atom bomb and hydrogen bomb. Nuclear reactors –General features of nuclear reactors – different types of nuclear reactors – pressurized water reactor –boiling water reactor – fast breeder reactor.

Reference Book

1. Modern Physics- Seghal Chopra & Seghal, Sultan chand 1998
2. Perspective of Modern Physics-Arther Beiser

Book for study

1. Modern Physics- R.Murugesan, S. chand & Co

CLASSICAL AND QUANTUM MECHANICS

UNIT I

Introduction – Mechanics of system of particles – conservation of linear momentum – conservation of angular momentum – conservation of energy – Work energy theorem – conservative forces – examples – constraints – Degrees of freedom under constraints – forces of constraints – generalized co-ordinates – generalized velocities – generalized momentum.

UNIT II

Introduction – D'Alemberts principle – Lagrange's equations of motion from D'Alemberts principle – simple applications – simple pendulum, compound pendulum, Atwood's machine – Hamilton's principle – Lagrange's equations of motion from Hamilton's principle – Deduction of Hamilton's principle from D'Alemberts principle- Deduction of Lagrange's equation of motion using variation principle for system involving forces – derivable from potential function.

UNIT III

Hamiltonian function H – physical significance – Hamilton's equations of motion – variational principle – Hamilton's equations of motion from variational principle – simple applications – Harmonic oscillator, compound pendulum, motion of a particle in central force field.

UNIT IV

Introduction – Limitations of classical theory –Dual nature of matter and radiation – De Broglie's hypothesis of matter waves – Davisson's and Germer experiment – G.P Thomson's experiment with relativistic correction – Heisenberg's uncertainty principle – Basic postulates of wave mechanics – Derivation of time dependent and time independent Schrodinger equation – wave function - physical significance of wave function.

UNIT V

Eigen function and Eigen value – Energy Eigen function – expectation value – properties of wave function – Applications of Schrodinger wave equation – particle in one dimensional box – barrier penetration problem – Linear harmonic oscillator – zero point energy.

Books for Study:

1. Modern Physics - R. Murugesan, S. Chand & Co.
2. Modern Physics - Seghal Chopra & Seghal, Sultan Chand.

Paper – VII - Computer Programming in C and C++

Unit I Introduction to Computer and C Programming: Evolution of computers – computer generations – classification of computers – basic computer organization - computer software. Introduction to C – History of C – characters of C – character set and tokens – key words and Identifiers – constants and variables – Data types - declaration of variables – declaration of storage class – operators and expressions – decision making, branching and looping statements.

Unit II Arrays, Functions and Pointers: Arrays – one, two and multi dimensional arrays – declaring and Initializing string variables. Functions – Library functions – user defined functions – nesting of functions – Recursion – passing arrays to functions – passing strings to functions. Structures – defining a structure – declaring a structure variables – accessing structure members – structure initialization – arrays of structures – arrays within structures and functions – unions. Pointers – declaring pointer variables – Initialization of pointer variables – accessing a variable through its pointers – pointers to pointers – pointer expressions – pointers and arrays – array of pointers - pointers to functions – pointers and structures – preprocessor derivatives. Simple programs in arrays, functions, pointers, structures and union.

Unit III Introduction to C++: Data types, Operators and Statements - Basic concepts – character set – identifiers and key words – Constants – operators – variables – expressions – statements Switching, Loop and Breaking statements. Simple programs.

Unit IV Functions and Arrays: Functions – Types of functions – local and global variables – arguments – multifunction program- Recursive function – standard functions – preprocessors. Arrays – Array declaration – Array Initialization – arrays and functions – multidimensional arrays and character array – Simple programs.

Unit V: Pointers, Structures, Classes and Objects: Pointer – Pointer declaration - Pointer arithmetic – Pointers and functions – Pointers and arrays – Pointers and strings – Pointers to Pointers. Structures – declaration and initialization of structures – functions and structures. Declaration of class - structures and classes – array of class objects – pointers and classes – classes within classes – simple programs. Inheritance and overloading - file operations.

Text Books:

1. Fundamentals of computing and Programming by E. Balagurusamy , TMH Private Ltd. New Delhi, Second Edition (2012).
2. Programming in C++ by E. Balagurusamy, TMH Private Ltd. New Delhi, Second Edition (2012).

Reference Books:

1. Programming with C by Schaum Series
2. Object Oriented Programming with C++ by E.Balagurusamy TMH Private Ltd. New Delhi, Fourth Edition (2008)
3. Programming with C++ by D.Ravichandran TMH Private Ltd. Second Edition.

Paper – VIII - Analog and Digital Electronics

Unit I Semiconductor Diodes and Transistors: Constant current and voltage sources – Thevenin's theorem – Norton's theorem – semiconductor -- N-type and P-type - semiconductor diodes – Half and full-wave rectifiers – filter circuits – low, high, band pass and band elimination filters. Special purpose diodes – LED and Photo diodes. Transistor – transistor configurations – relation between α, β and γ - transistor biasing – biasing methods – stability factor – Filed Effect transistor – FET characteristics – JFET and MOSFET – Applications of MOSFET.

Unit II Amplifiers, Oscillators, Multivibrators and Modulatons: Single stage amplifier – A.C & D.C equivalent circuits – load line analysis – voltage, current, power gains – input and output impedance using h-parameter – frequency response – two stage amplifier. Feedback principle – positive and negative feedbacks – Barkhausen's criterion – transistor oscillators – Hartely, Colpitt, Phase shift oscillators with mathematical analysis. Astable and monostable multivibrators using transistors. Operational amplifier – characteristics – application as adder, subtractor, integrator and differentiator. Modulation – types of modulation - modulation index – amplitude, frequency and digital modulations – AM and FM transmitters.

Unit III Digital Electronics: Number Systems – Conversion from one another – Binary Arithmetics – one's and two's complements – BCD code – Boolean algebra – De Morgan's theorems – Karnaugh Map – 2,3, and 4 variable – simplification. Logic gates – Or, AND, NOT, NOR, NAND and X-OR gates – Logic families - Diode Resistor Logic (OR, AND gates), RTL(NOT gate), DTL and TTL(NOR and NAND).

Unit IV Adders, Registers and Counters: Half and full adders – Half and full subtractor – Encoders and Decoders. IC 555 Timer – mono and astable multivibrators – Flip-Flops – R-S, J-K, JK master Slave FF – D flip-flop – T flip-flop. Registers – Shift Register – Classification. Counters – Ring counter – 4-bit counter – Decade counter – A/D and D/A converters.

Unit V 8085 Microprocessor: Microprocessor fundamentals – microprocessor architecture – memory maps – The 8085 CPU – Instructions –Classification – Data transfer operations – Arithmetic operations – logic operations – Branch operations – writing assembly language programs – Debugging a program – Looping, Counting and Indexing programming techniques – simple programs. 16 bit Instructions- counters and time delays – Stack and Subroutines – simple Programs.

Text Books:

1. Principles of Electronics by V.K. Metha and Rohit Matha, S. Chand &Co. Edition 2009.
2. Basic Electronics by B.L.Theraja, S. Chand &Co.
3. Digital Principles and Applications by Leech, Malvino and Saha 6th Edition. Mcgraw Hill International Edition.
4. Microprocessor Architecture, Programming and Applications(8085) by Goyankar, Wiley Easten.

Reference Books:

1. Principles of Electronics by Albert Paul Malvino, Mcgraw Hill International Edition.

Electronics Devices and Circuits By Salivaganan, sureshkumar and Vallvaraj, TMH Private Ltd. New Delhi, Second Edition (2004).

Paper – IX - Materials and Nano Science

Unit I Crystal Structure and Diffraction of X-Rays: Basic concepts of crystal - unit cell - Bravais Lattice – crystal planes and Miller indices – SC, BCC, FCC, HCP crystal structures – important crystal structures(NaCl, CsCl, ZnS and Diamond) – Bragg's Law – Laue and Powder methods of X-ray diffraction . Thermal properties of solids – mono and diatomic lattice vibrations – Phonons – classical, Einstein's and Debye's theories of specific heat.

Unit II Bonding and Defects in Solids: Bonding in solids-primary bonds – Ionic, covalent and metallic bonds – secondary bonds – Van-der-Waals' bond and hydrogen bond. Defects in solids – point defects – line defects – colour centers.

Unit III Conductors and Semiconductors: Classical free electron theory of metals – electrical and thermal conductivity – Wiedmann-Frantz law. Quantum free electron theory – Schrodinger wave equation – density of states. Band theory of solids – Bloch theorem – Kronig Penney model – Brillouin zones. Semiconductors – Intrinsic and extrinsic semiconductors – carrier concentration of P type and N type – Hall effect.

Unit IV Dielectric, Magnetic and Superconducting Materials: Dielectrics – polarization – types of polarization - dielectric constant – Clausius-Mosotti equation – properties of dielectric materials – dielectric loss and breakdown. Magnetism – dia,para,ferro,antiferro and ferrimagnetisms – Langevin's theory of dia and para magnetism – Wies's theory of ferromagnetism – Antiferromagnetic materials – Ferrimagnetic materials – hard and soft magnetic materials. Superconductors – properties of superconductors – critical temperature – Isotopic effect – Meissner effect – Types of superconductors – BCS theory – Cooper pair - London equations – AC and DC Josephson effects – High temperature superconductors.

Unit V Nano Meterials: Nano particles – properties and applications – scanning and transnmission electron microscopes – X-ray diffraction. Nano powders and nano

materials – preparation methods – plasma arcing, chemical vapour deposition, electro deposition and ball milling methods – nano electronics – micro and nano fabrication – quantum electronic devices. Nanotechnology – micro electro mechanical systems.

Text books

1. Solid State Physics by Dr K. ILANGOVAN, S.Viswanathan Printers and Publishers Pvt. Ltd. Edition 2007.
2. Solid State Physics by R.K.Puri and V.K.Babber S.Chand & Co. First Edition 1997.
3. Nanotechnology by M.Willson, K.K.M Smith and B.Raguse, Overseas Press Edition 2005.

Reference books

1. Materials Science by M.Arumugam, Anuratha Agencies Revised Edition 1997.
2. Solid State Physics by S.O.Pillai, New Age Publications, Edition 1997.
3. Fundamentals of Solid State Physics by Saexena,Gupta Saexena, Pragati Prakashan,tenth revised edition 2003.

Nano the essentials by T.Pradeep, Mcgraw Hill Company, Edition 2007.

I B.Sc. Physics
Practical-I
(Any Twelve**)**

1. Young's Modulus Uniform bending-Pin and Microscope Method.
2. Young's Modulus Non uniform bending-Optic lever Method (Telescope).
3. Compound Pendulum-Determination of 'g'.
4. Torsional Pendulum-Determination of Rigidity Modulus.
5. Spectrometer-Dispersive power of prism (Mercury lamp).
6. Potentiometer-Low range voltmeter calibration.
7. Melde's String.
8. Young's Modulus Uniform bending-Optic lever method (Telescope).
9. Young's Modulus Non uniform bending-Pin and Microscope method.
10. Potentiometer Resistivity & Comparison of Resistance.
11. Spectrometer Normal Incidence using Grating.
12. Potentiometer-Calibration of Ammeter
13. Lee's Disc method-Thermal conductivity of card board.
14. Spectrometer-μ of the small angle prism.
15. Viscosity – Stoke's method.
16. Estimation of Errors.

II B.Sc. Physics

Practical-II

(Any Twelve)

1. Sonometer-Frequency of AC.
2. Newton's Ring-Sodium lamp (Microscope).
3. spectrometer-i-d curve
4. Carey Foster Bridge.
5. B.G Comparison of Capacitance.
6. B.G Charge Sensitiveness.
7. Copper Voltameter.
8. Comparison of Capacitance –De Sauty's Bridge
9. Airwedge
10. Spectrometer-i i' curve using prism.
11. Bi-Prism.
12. B.G- Comparison of E.m.f s.
13. M.G-Current and Voltage Sensitivity.
14. Spectrometer-Grating by minimum Deviation
15. Magnetic field along the axis of a coil carrying a current.
16. Carey Foster Bridge-Temperature Coefficient of Resistance.

III – B.Sc. (Physics)

Practical-III

(Any Twelve)

1. Hartmann's constant
2. LCR Series Resonance Circuit
3. Cauchy's Constants.
4. Comparison of Mutual Inductance
5. LCR Parallel Resonance Circuit
6. Determination of Mutual Inductance.
7. Owen's Bridge.
8. B.G High Resistance by Leakage.
9. Anderson's Bridge.
10. μp – 8 bit Addition and Subtraction.
11. μp-Multiply two 8-bit numbers using repeated addition.
12. μp-Find the largest of given N- Number.
13. μP-To arrange the data array in Ascending order.
14. B.G-Absolute Capacity of a condenser.
15. Maxwell's Bridge.
16. EMF of a thermocouple using Potentiometer

III – B.Sc. (Physics)

Practical- IV

(Any Twelve)

1. Transistor Characteristics – CE mode.
2. Colpitt's Oscillator.
3. Construction of Dual Power Supply.
4. Astable multivibrator using transistor.
5. Hartley Oscillator.
6. Zener diode characteristics.
7. Integrator and Differentiator using IC-741.
8. Logic gates using IC-(AND,OR,NOT).
9. Single stage amplifier.
10. Operation amplifier characteristics.
11. Double stage amplifier without Feedback.
12. Universal building block-NAND and NOR gates.
13. Logic gates using discrete components(AND,OR,NOT).
14. Bridge Rectifier.
15. Operational amplifier-Addition, Subtraction.
16. Tunnel diode-Characteristics.

ANCILLARY ANALOG ELECTRONICS – I

Unit I Semiconductors: Junction diodes – diode characteristics – types of diodes – Zener diode – zener diode characteristics – LED – bridge rectifier using zener diode – filter circuits – types of filters. Transistors – transistor biasing, action and symbols – transistor connections – relation between α, β and γ - transistor biasing - common emitter characteristics - transistor amplifier (CE) – frequency response.

Unit II Field Effect Transistors and SCR : Junction field effect transistor(JFET) – principle and working of JFET – Parameters of JFET – Advantages of JFET – Metal Oxide Semiconductor FET (MOSFET) – MOSFET biasing – Silicon Controlled Rectifier(SCR) – working of SCR – Applications of SCR.

Unit III Oscillators and Multivibrators: Feedback principle – positive and negative feedbacks – Advantages of negative feedback – emitter follower – application of emitter follower - transistor oscillators – Hartely, Colpitt oscillators – Phase shift oscillators - Astable and monostable multivibrators using transistor.

Unit IV Power Electronics: The triac – triac construction and operation – phase control circuit – applications of triac – The diac – applications of diac. Unijunction transistor (UJT) – equivalent circuit – characteristics of UJT – applications of UJT.

Unit V Operational amplifier and Modulation: Op-Amp characteristics and applications - adder, subtractor, integrator and differentiator. Modulation – types of modulation - amplitude modulation- modulation index –frequency and digital modulations – AM diode detector – AM and FM receivers – Demodulation.

Reference Books :

1. A text book of Electronics – J.B.Rajam
2. A text book of Electronics – Theraja
3. Analog and Digital Electronics – Ubald raj, Jose Robin.

Ancillary Digital Electronics – II

Unit I Number systems: Number systems – Binary number system – Decimal to binary and Binary to decimal conversion - Binary addition, subtraction, multiplication – Octal and Hexadecimal number systems.

Unit II Logic Circuits: - AND, OR, NOT gates – one's and two's complements – BCD code – Boolean algebra – De Morgan's theorems. NAND and NOR gates – NAND and NOR as universal building block. Logic families - Diode Resistor Logic (OR, AND gates), RTL(NOT gate), DTL and TTL(NOR and NAND).

Unit III Multivibrators: Operational Amplifier – Op-Amp characteristics - Monostable and Astable multivibrators using Op-Amp. IC 555 Timer – monostable and Astable multivibrators using IC- 555 timer.

Unit IV Adders, Registers and Counters: Half and full adders – Half subtractor - full subtractor – Encoders and Decoders. Flip-Flops – R-S, J-K, JK master Slave FF – D flip-flop – T flip-flop. Registers – Shift Register – Classification of shift registor. Counters – Ring counter – 4-bit counter – Decade counter – A/D and D/A converters.

Unit V 8085 Microprocessor: Microprocessor fundamentals – microprocessor architecture – The 8085 CPU – 8085 Instructions –Instruction Classification – Data transfer operations – Arithmetic operations – logic operations – Branch operations – writing assembly language programs – Looping, Counting and Indexing programming techniques – simple programs. 16 bit Instructions - counters and time delays – Stacks and Subroutines – simple programs.

Text Books:

1. Digital Principles and Applications by Leech, Malvino and Saha 6th Edition. Mcgraw Hill International Edition.
2. Microprocessor Architecture, Programming and Applications(8085) by Goyankar, Wiley Easten.

Reference Books:

1. Modern Digital Electronics by R P Jain TMH Publishing Company Ltd.
   Digital Electronics and Microprocessors by R P Jain TMH Publishing Company Ltd

II – B.Sc. (Physics)

Practical- I Ancillary Electronics

(Any Twelve)

1. Halfwave Rectifier.
2. Fullwave Rectifier.
3. Logic Gates using discrete components-(NAND,NOR).
4. Wave form analysis using CRO.
5. AC/DC current analyzing using CRO.
6. Flip-Flops-RS and JK.
7. De-Morgan's theorem verification.
8. Op-Amp as low pass filter.
9. Clipping Circuits.
10. FET-Charecteristic.
11. Transistor Characteristic CB mode.
12. Positive voltage Regulator using IC.
13. Negative voltage Regulator using IC.
14. Low voltage Regulator using IC-273.
15. High voltage Regulator using IC-273.
16. Inverting AC amplifier.

III – B.Sc. (Physics)

Practical- II Ancillary Electronics

(Any Twelve)

1. Non-Inverting AC amplifier.
2. Single stage amplifier with Feedback.
3. A/D convertor using Op-Amp.
4. D/A convertor using Op-Amp.
5.1-16 De-Multiplexer.
6.16-1 De-Multiplexer.
7. Monostable Multivibtrator using Transistor.
8. Bistable Multivibtrator using Transistor.
9. Monostable Multivibtrator using 555 timer.
10. Squre wave generator using 555 timer.
11. Shift Register.
12. Dual Power supply.
13. Ring Counter.
14. Frequency measuring-waveform method.
15. Frequency measuring- Lissajou's figure method.
16. AC/DC voltage measurement using CRO.

B.Sc. ANCILLARY PHYSICS (Non – Semester) SYLLABUS

1. Subjects of Study and Scheme of Examination:
   The subjects offered in Ancillary Physics for two years (four semesters) and the scheme of examination are given.
2. Question Paper Pattern:
   Total Mark in each paper is 100.

Section A: (10 x 3 = 30 Marks)

Short Answers:

1. At least one question from each Unit.
2. Maximum 12 questions in this section.
3. Answer any 10 out of 12 questions.

Section B: (5 x 6 =30 Marks)

1. Answer any 5 questions choosing out of 8 questions.
2. Answer not exceeding two pages.
3. At least one problem from any one unit.

Section C: (4 x 10 = 40 Marks)

1. Answers not exceeding four pages.
2. Answer any four out of six .
3. At least one problem from any one unit.

There must be at least one problem in Section B and Section C.

Blue Print of the Question Paper:

Section	Type of Questions	No. of Questions	No. of Questions to be Answered	Marks for each Question	Total Marks
A	Short answers at least one problem from any one unit.	12	10	3	30
B	Not exceeding 2 pages one from each unit*	8	5	6	30
C	Not exceeding 4 pages	6	4	10	40

- There must be at least one problem each in Part B and Part C

DETAILS OF B.Sc. ANCILLARY PHYSICS PAPERS – YEAR WISE:

Section	Title of the Paper	Subject Code	Year of Study	Exam Hour	Max. Marks	Min Marks for Pass
1.	Mechanics Properties of Matter, Sound and Thermal Physics		I / II	3 hrs	100	35
2.	Anc. Physics Practical I		I / II	3 hrs	100	35

3.	Electricity, Electronics, Optics and spectroscopy		II / III	3 hrs	100	35
4.	Anc. Physics Practical II		II / III	3 hrs	100	35

- **Environmental Science is a Compulsory Paper for all Third Year Students.**

Practical:

Every student should submit the practical record book at the time of practical examination. The maximum marks of 100 for the practical will be allotted as follows:

Practical record Note - 25
Practical Examination - 75

100

B.Sc. ANCILLARY PHYSICS (NON SEMESTER) SYLLABUS

I / II YEAR

MECHANICS, PROPERTIES OF MATTER, SOUND AND THERMAL PHYSICS

UNIT I

Forces in nature – Central forces – Gravitational and electromagnetic – Conservative and Non-Conservative forces – Examples – Nuclear force – Friction- Angle of friction - Motion of bodies along an inclined plane – Work done by a force – Work done by a varying force – Expression for Kinetic energy – Expression for potential energy – Power.

UNIT II

Angular velocity – Normal acceleration (no derivation) – Centrifugal and Centripetal forces – Torque and angular acceleration – Work and power in rotational motion – Angular momentum – K.E. of rotation – Moment of Inertia – Laws of parallel and Perpendicular axes theorems- M.I. of circular ring, Solid sphere, hollow sphere and cylinder.

UNIT III

Kepler's laws of planetary motion – Laws of Gravitation – Boy' method for G – Compound pendulum – Expression for period – Experiment to find g – Variation of g with latitude , altitude and depth – Artificial Satellites.

UNIT IV

Elastic moduli – Poisson's ratio – beams – Expression for bending moment – Determination of Young's modulus by uniform and non-uniform bending – I section of girders. Torsion – Expression for couple per unit twist – Work done in twisting – Torsional pendulum – Derivation Poiseuille's formula (analytical method) – Bernoulli's theorem – Proof Application – Venturimeter – Pitot tube.

UNIT V

Simple harmonic motions – Progressive Waves properties – Composition of Two S.H.M. and beats Stationary Waves – Properties – Melde's experiments for the frequency of electrically maintained tuning fork – Transverse and longitudinal modes – Acoustics – Ulrasonics – Properties and Applicationsl.

UNIT VI

Expansion of Crystals – Determination of α by air wedge method – Expansion of antiotropic solids – solids of low expansivity and their uses – anomalous expansion of water – thermostats. Isolated and adiabatic changes – Derivation of equation for both C_v, and C_p of a gas – relation between them – experimental determination of C_v, by Joly's method- Determination of C_p by Regnault's method.

UNIT VII

Lee's disc method for conductivity of bad conductor – air and cardboard/ ebonite – analogy between heat flow and electric current Wiedmann –Franz law – Convection in atmosphere – laps rate – stability of atmosphere – green house effect – atmospheric pollution.

UNIT VIII

Radiation – Stefan's law – determination of Stefan's constant by filament heating method – solar constant measurement water flow Pyrheliometer – temperature of the Sun – Solar spectrum – energy distribution in black body spectrum – Planck's law (no derivation) – derivation of Wien's and Rayleigh Jeans laws from Planck's law.

UNIT IX

Kinetic theory of gases – Mean free Path – transport phonomena – diffusion , viscosity and thermal conductivity – Maxwell's law of distribution of molecular speed- experimental verification –degree of freedom – Boltzman's law of equipartition of energy – calculation of Cp for monoatomic and diataic gases.

UNIT X

Thermodynamics – Carnot's theorem – Derivation of Efficiency – Second law of thermodynamics – entropy – changes of entropy in Carnot's cycle – Change of entropy in conversion of ice into steam – Joule – Kelvin effect – simple theory of Porous – Plug experiment adiabatic – diamagnetism – Curie's law Giauque's Method Superconductivity.

Reference Books:

1. B.Sc., Ancillary Physics – R. Murugeasan, Retd. Prof. Vivekananda College, Thiruvendagam West.

B.Sc. ANCILLARY PHYSICS (NON SEMESTER) SYLLABUS

II / III YEAR

ELECTRICITY, ELECTRONICS, OPTICS, SPECTROSCOPY AND MODERN PHYSICS

UNIT I

Gaus's law – proof – Applications – Field due to a charged sphere and an infinite plane sheet – Field near a charged conducting cylinder – Coloumb's theorem – Electronic potential – Relation between potential and field – Capacitors – Expression for C of parallel plate spherical (outer sphere earthed) and cylindrical capacitors – Energy of charged capacitor – Loss of energy due to sharing of charges.

UNIT II

Kirchoff's laws – application of wheatstone's network – sensitiveness of bridge – Crey Foster Bridge – Measurement of resistance and temperature Coefficient of resistance – principle of potentiometer – Calibration of ammeter and voltmeter – low and high range measurement of resistance using potentiometer.

UNIT III

Torque on a current loop – mirror galvanometer, dead beat and ballistic – current sensitiveness I B.G theory – damping correction – experiments for charge sensitiveness – comparison of emf's and comparison of capacitors.

Electro motive force generated in a coil rotating in a coil rotating in a uniform magnetic field – R.M.S and mean values – L.C.R circuit –impedances – Series and Parallel resonant circuits – Power factor – Wattless current – Choke.

UNITIV

Junction diodes – Froward and Reverse bias – Diode characteristics – Types of diodes – (LED and Zener) Bridge rectifier using junction – II filter – Transistors – Characteristics (CE modes only) – Biasing and action of a single transistor (CE) amplifier – Frequency response Hartley oscillator – Modulation (qualitative study) – OPAMP and its characteristics - virtual earth – voltage amplifier in inverting mode – OpAmp as adder and Subtractor.

UNIT V

Binary number system – reason for using binary numbers – binary to decimal and decimal to binary conversions – addition and subtraction of binary numbers. Logic circuits – Boolean algebra – De Morgan's theorem – OR.AND ,NOT,NOR and NAND Gates – NOR and NAND gates as universal building blocks – Ex-Or gates.

UNIT VI

Deviation produced by thin lens – Focal length of two thin lenses in and out of contact – Cardinal points – Refraction through a thin prism – Dispersion – Dispersive power – Combination of thin prisms to produce (a) deviation without dispersion and (b) dispersion without deviation – Direct vision spectroscope – Chromatic aberration in lenses and its removal – Spherical aberration and its removal – Aplanatic surfaces – Oil immersion objective – Theory of primary and secondary rainbows.

UNIT VII

Interference in thin films – Air wedge – Newton's rings (Reflected beam only) – Determination of wavelength – Jamin's Interferometer, principle and use. Diffraction; Theory of plane transmission grating (Normal incidence only) – Experiment to determine wavelengths.

UNIT VIII

Double refraction – Nicol prisms, construction, action and uses – QWP and HWP – Optical activity (No theory) – Biot's laws –Secific rotatory power – Half shade polarimeter – Determination of specific rotatory power – Fiber optics – Light propagation in fibres – Fiber optic communication system.

UNIT IX

Infra red radiations, production, properties and uses – Ultraviolet radiations, sources, properties and uses. **Quantum Theory** – plank's quantum theory – Raman effect – Simple theory Experimental study (Wood's apparatus) Applications. **Photo electricity** – Laws of photo electricity – Einstein's equation Photocells and their uses, photo emissive, photoconductive and photovoltaic cells.

UNIT X

DeBrogle's theory – Electron diffraction – G.P. Thomson's experiment. Michelson – Morely experiment – Significance of the negative results – Postulates of special theory of relativity – Lorentz transformation equations (No derivation) – Length contraction – Time dilation – Variation of mass with velocity and Mass – Energy relation (simple derivation).

Reference Books:

1. 1. B.Sc., Ancillary Physics – R. Murugeasan, Retd. Prof. Vivekananda College, Thiruvendagam West.

ANCILLARY PHYSICS PRACTICALS – I

(ANY TWELVE)

1. Non Uniform Bending – Optic Lever.
2. Uniform bending – Pin and microscope.
3. Compound Pendulum – Determination of "g"
4. Torsion Pendulum – determination of M.I. and G.
5. Thermal conductivity of Card Board – Lee's Disc method.
6. Melde's String – Frequency of fork.
7. Sonometer – Verification of Laws.
8. Calibration of Voltmeter (low range) – Potentiometer
9. Calibration of Ammeter – Potentiometer
10. Resistance and resistivity – Potentiometer
11. Comparison of Capacitances – B.G./ Spot Galvanometer method.
12. Comparison of emf's – B.G. / Spot Galvanometer method.
13. Carey Foster Bridge – resistance & resistivity of a wire.
14. Spectrometer - □ of Prism.
15. Comparison of Coefficient of Viscosities by Ostwald's Viscometer.
16. Coefficient of Viscosity – Stoke's Method.

ANCILLARY PHYSICS PRACTICALS – II

(ANY TWELVE)

1. Miror Galvanometer – voltage and current sensitiveness.
2. LCR – Series resonance – determination of L & Q factor.
3. Air – wedge – Thickness of a wire.
4. Dispersive power of prism – spectrometer.
5. Grating N and □ □ Normal incidence – Spectrometer.
6. Newton's rings – Determination of radius of curvature.
7. Bridge rectifier with filter circuit.
8. Transistor Static characteristics – C.E. mode
9. Single stage transistor amplifier.
10. Hartley Oscillator.
11. Logic Gates – AND, OR, NOT – truth table verification – discrete components..
12. Logic Gates – NAND, NOR, truth table verification – discrete components..
13. Zener diode characteristics & Break down Voltage.
14. OP AMP as an adder and Subtractor.
15. Comparison of Capacitances – Desauty's Method using headphone.
16. LCR – Parallel resonance.