MAHENDRA ARTS & SCIENCE COLLEGE (AUTONOMOUS)

(Accredited by NAAC & Recognized under u/s 2(f) and 12(B))

DEPARTMENT OF PHYSICS

COURSE STRUCTURE AND SYLLABUS for UG

(CBCS)

(2016-2017) ONWARDS

MAHENDRA ARTS & SCIENCE COLLEGE

(Autonomous)

Accredited by NAAC with "A" grade & Recognized by u/s 2(f) and 12(B) of the UGC Act 1956

Affiliated to Periyar University

DEPARTMENT OF PHYSICS (2016 Regulations)
UG – Syllabus (B.Sc)

1. Eligibility:

Candidates seeking admission to first year of the Bachelor of Science - Physics shall be required to have passed the Higher secondary examination with Mathematics, Physics and Chemistry conducted by the Government of Tamilnadu or an examination accepted as equivalent there to by the Syndicate subject to the conditions as may be prescribed thereto are permitted to appear and qualify for B.Sc., (Physics) degree examination of this University after a course of study of three academic years.

2. Duration of the Course:

The course for the degree of Bachelor of Science shall consist of three years divided into six semesters with internal assessment.

3. Course of Study:

The course of study shall comprise instruction in the following subjects according to the syllabus and books prescribed from time to time.

4. Examinations:

The theory examination shall be three hours duration to each paper at the end of each semester. The candidates failing in any subject(s) will be permitted to appear for each failed subject(s) in the subsequent examination.

5. Question Paper Pattern:

Time: 3 Hours   Max Marks-75

Part A: 10 x 2 = 20

(Answer all questions)

(Two questions from each unit)

Part B: 5 x 5 = 25

(Answer all questions)

(One question from each unit with internal choice)

Part C: 3 x 10 = 30

(Answer any three questions)

(In Part C out of total 5 questions 2 questions may be problem oriented)

6. Passing Minimum:

The candidate shall be declared to have passed the examination if the candidate secures not less than 30 (External) and 10 (Internal) marks in each theory paper. For the practical paper a minimum of 24 (External) and 10 (Internal) marks the record notebook taken together is required to pass the examination. There is no passing minimum for record notebook. However submission of record notebook is a must.

7. Classification of Successful candidates:

Candidates who secure not less than 60% of the aggregate marks in the whole examination in First Class. All other successful candidates shall be declared to have passed in Second Class.

Candidates who obtain 75% of the marks in the aggregate shall be deemed to have passed in First Class with Distinction provide they pass all the examinations prescribed for the course at first appearance. Candidates who pass all the examinations prescribed for the course in the first attempt and within a period of three academic years from the year of admission to the course alone are eligible for University Ranking.

8. Maximum duration for the completion of UG Program:

The maximum duration for the completion of UG Program shall not exceed six years.

9. Commencement of this Regulation:

These regulations shall take effect from the academic year 2016-17 and thereafter.

10. Pattern of Question Paper for Practical Examinations;

Each set of question paper should contain SEVEN questions and the candidate has to choose one by lot.

11. Awarding of marks for Practical examinations.

Total Marks: 100 (Internal 40 Marks + External 60 Marks)

DEPARTMENT OF PHYSICS (2016 Regulations)
UG – Syllabus (B.Sc)

COURSE STRUCTURE

SEM	SUBJECT CODE	PAPER TITITLE	HRS / WEEK	CREDIT	INT. MARK	EXT. MARK
I	M16UFTA01	TAMIL – I	5	3	25	75
	M16UFEN01	ENGLISH – I	5	3	25	75
	M16UPH01	CORE – I PROPERTIES OF MATTER AND SOUND	6	5	25	75
	M16UMAA01	ALLIED MATHS - I	6	4	25	75
	M16UPHP01	CORE PRACTICAL - I	3	-	40	60
	M16UMAAP01	ALLIED MATHS PRACTICAL - I	3	-	40	60
	M16UVE01	VALUE EDUCATION – MANALAKKALAI YOGA	2	2	25	75

SEM	SUBJECT CODE	PAPER TITITLE	HRS / WEEK	CREDIT	INT. MARK	EXT. MARK
II	M16UFTA02	TAMIL – II	5	3	25	75
	M16UFEN02	ENGLISH – II	5	3	25	75
	M16UPH02	Core II – MECHANICS	5	5	25	75
	M16UMAA02	ALLIED MATHS - II	5	4	25	75
	M16UPHP01	Core Practical – I	3	3	40	60
	M16UMAAP01	Allied Practical - I	3	3	40	60
	M16UPHS01	SBEC – I: ENERGY PHYSICS	2	2	25	75
	M16UES01	ENVIRONMENTAL STUDIES	2	2	25	75

Total Credit for I & II Semesters = 42 Credits

SEM	SUBJECT CODE	PAPER TITILE	HRS / WEEK	CREDIT	INT. MARK	EXT. MAR
III	M16UFTA03	TAMIL – III	5	3	25	75
	M16UFEN03	ENGLISH – III	5	3	25	75
	M16UPH03	Core III – HEAT AND THERMODYNAMICS	5	5	25	75
	M16UCHA01	ALLIED CHEMISTRY - I	5	4	25	75
	M16UPHP02	Core Practical – II	3	-	40	60
	M16UCHAP01	ALLIED CHEMISTRY PRACTICAL - I	3	-	40	60
	M16UPHS02	SBEC – II: SPACE SCIENCE	2	2	25	75
	M16UPHN01	NMEC – I: STATISTICS	2	2	25	75

SEM	SUBJECT CODE	PAPER TITILE	HRS / WEEK	CREDIT	INT. MARK	EXT. MAR
IV	M16UFTA04	TAMIL – IV	5	3	25	75
	M16UFEN04	ENGLISH – IV	5	3	25	75
	M16UPH04	Core IV – BASIC AND DIGITAL ELECTRONICS	5	5	25	75
	M16UCHA02	ALLIED CHEMISTRY - II	5	4	25	75
	M16UPHP02	Core Practical – II	3	3	40	60
	M16UCHAP01	Allied Practical - II	3	3	40	60
	M16UPHN02	NMEC II: C-PROGRAMMING	2	2	25	75
	M16UVE01	VALUE EDUCATION 1: CELL PHONE SERVICES	2	2	25	75

Total Credit for III & IV Semesters = 44 Credits

SEM	SUBJECT CODE	PAPER TITILE	HRS / WEEK	CREDIT	INT. MARK	EXT. MAR
V	M16UPH05	ATOMIC PHYSICS	5	5	25	75
	M16UPH06	MATHEMATICAL PHYSICS	5	5	25	75
	M16UPHE01	CORE ELECTIVE I: ADVANCED ELECTRONICS	5	5	25	75
	M16UPHE02	CORE ELECTIVE II: BIO PHYSICS	5	5	25	75
	M16UPHS03	SBEC III: OPTICAL COMMUNICATION	2	2	25	75
	M16UPHS04	SBEC IV: APPLIED PHYSICS	2	2	25	75
	M16UPHP03	CORE PRACTICAL: III	3	-	40	60
	M16UPHP04	CORE PRACTICAL: IV	3	-	40	60

SEM	SUBJECT CODE	PAPER TITILE	HRS / WEEK	CREDIT	INT. MARK	EXT. MAR
VI	M16UPH07	NUCLEAR PHYSICS	5	5	25	75
	M16UPH08	QUANTUM MECHANICS AND RELATIVITY	5	5	25	75
	M16UPH09	MATERIALS SCIENCE	5	5	25	75
	M16UPHE03	CORE ELECTIVE III: NANO SCIENCE & TECHNOLOGY	5	5	25	75
	M16USE05	SBEC V: ASTRO PHYSICS	2	2	25	75
	M16UPHP03	CORE PRACTICAL: III	3	3	40	60
	M16UPHP04	CORE PRACTICAL: IV	3	3	40	60
		MINI PROJECT	2	1	-	100
		EXTENSION ACTIVITIES		1		

Total Credit for V & VI Semesters = 59 Credits

Examination hours : 3 (For all the semesters)

Total Marks : 100 (For all the semesters)

Total Credits : 145 (For 6 semesters)

M16UPH01 - PROPERTIES OF MATTER AND SOUND

UNIT I :

Elasticity : Three types of elastic moduli - Poisson's ratio - Bending of beams - Expression for bending moment - Depression of the loaded end of a Cantilever - uniform - non uniform bending - theory - experiment pin and microscope method - work done in uniform bending - Koenig's method - non-uniform bending - theory - expression for couple per unit twist - determination of rigidity modulus - Static torsion method with scale and telescope - Rigidity modulus by torsion pendulum with mass.

UNIT II :

Viscosity : Coefficient of critical velocity - Poiseulli's formula for coefficient of viscosity and its correction - determination of coefficient of viscosity by capillary flow method - comparison of viscosities Oswald's viscometer - viscosity of a highly viscous liquid - Stoke's method for the Coefficient of a highly viscous liquid - variations of viscosity with temperature and pressure - viscosity of gases - Mayer's formula for the rate of flow of a gas through a capillary tube - Rankine's method for the determination of viscosity of a gas.

UNIT III :

Surface tension and Osmosis :   Surface energy - angle of contact and its determination - excess of pressure   inside curved   surface - formation of drops - Experimental study of variation of Surface tension with temperature - drop weight method of determining surface tension and interfacial surface tension - angle of contact of mercury - Quincke's method - surface tension and vapour pressure   osmosis - experimental determination of osmotic pressure - Laws of osmosis pressure - osmotic and vapour pressure of a solution.

UNIT IV

Sound : Definition of free, damped and forced vibrations - Theory of forced vibrations - Resonance - Sharpness of resonance - Fourier's theorem - application for Saw- tooth wave and square wave.   - Sonometer - determination   of A.C. frequency using sonometer   - Determination of frequency using Melde's apparatus.

UNIT V

Ultrasonics :   Ultrasonics - Production - Piezo electric method - magneto-striction method - detection - properties - applications.

Acoustics : Acoustics of buildings - reverberation time   - derivation of Sabine's formula - determination of absorption coefficient.

BOOKS FOR STUDY :

1. Elements of properties of matter by D. S. Mathur S. Chand & Co., (2005).

2. Properties of matter by R. Murugesan, S. Chand & Co., (2005).

3. Properties of matter by Brijlal and N. Subramaniam S. Chand & Co., (2005).

4. Properties of matter and Acoustics by R. Murugesan, S. Chand & Co., (2005).

5. A Text Book of Sound by N. Subramaniam and Brijlal, S. Chand & Co., (2005).

BOOKS FOR REFERENCE :

1. Fundamentals of General Properties of Matter, H. R. Gulati, S. Chand & Co., (2005).

2. Properties of Matter, Subramania Iyer and Ranga Rajan, Viswanathan Publication (2002).

3. A Text Book of Sound (2005), R. L. Saighal, S. Chand & Co.,

M16UPH02 - MECHANICS

UNIT I

Projectile: Definition of Range, time of flight and angle of projection - Range up and down an inclined plane maximum range - two directions of projections 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 - Loss of kinetic energy in direct impact - velocity change in oblique impact between two smooth spheres.

UNIT II

SHM: Composition of two SHM's of same period along a straight line and at the 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 fiction - equilibrium of a body on an inclined plane under the action of a force.

UNIT IV

Center of pressure: Definition - center of pressure of a rectangular lamina and triangular lamina.

Hydrodynamics: equation of continuity of flow - Bernoullie's theorem - venturimeter - Pitot's tube.

UNIT V

Classical Mechanics: Mechanics of system of particles - conservation theorem for angular momentum and energy - constraints and its classification - generalized coordinates - transformation between generalized coordinate and physical coordinates - principle of virtual work - D' Alembert's principle - derivation of Lagrangian equation of motion from D' Alembert's principle - Atwood's machine - conservation theorems using Lagrangian function - generalized momentum, energy, time and linear and angular momentum.

Books for Study:

1. Mechanics and Mathematical Methods by R. Murugesan. S.Chand and Co.

2. Dynamics by M. Narayanamurthi and M. Nagarathnam, The National Publishing Company.

3. Statics, Hydrostatics and Hydrodynamics By Narayanamurthi and M. Nagarathnam, The National Publishing Company.

Books for Reference:

1. Classical Mechanics by H. Goldstein Addition Wesley Publications

2. Mechanics by D.S. Mathur, S. Chand and Co.,

THERMAL PHYSICS – M16UPH03

UNIT I

Thermometry and Calorimery : Platinum resistance thermometer -correction determination of specific heat by Newton's law of cooling - two specific heat capacities of a gas - determination of Cv by Joly's differential steam calorimeter - determination of Cp by Regnault's method.

UNIT II

Low temperature physics : Joule - Thomson effect - porous plug - theory and experiment - liquification of gases by Linde's process -Helium by K. Onnes method - properties of Helium I and Helium II - adiabatic demagnetisation - practical applications of low temperature in cryogenic engines and air conditioning machines.

UNIT III

Thermodynamics: Zeroth, first and second laws of thermodynamics - reversible and irreversible processes - heat engines - Carnot's petrol and diesel engines - their efficiency - entropy - change in entropy in reversible and irreversible processes - Third law of thermodynamics-Temperature - entropy diagram.

UNIT IV
Conduction and Radiation   :   Thermal   Conductivity -   definition - thermal conductivity of a bad conductor - Lee's disc method - good conductor - Searle's method - radiation - Blackbody radiation - definition - Wien's Displacement law - Rayleigh Jean's law - Planck's law - Stepan's law and experimental verification of Stepan's law - Solar constant - temperature of the sun - by Angstrom's Pyrheliometer.

UNIT V
Maxwell's   Thermodynamic   relations: Derivation   of   Maxwell's thermodynamic relations- Helmholtz function- Gibb's function- Enthalpy- T-ds equation- Clausius-Clapeyron's Latent heat equation - specific heat relations.

TEXT BOOK :

1. Brijlal and Subramaniam, Heat and Thermodynamics, S. Chand & Co, New Delhi 2004.

2. D. S. Mathur, Heat and Thermodynamics, S. Chand & Co, New Delhi 2004.

BOOKS FOR REFERENCE :

1. J. B. Rajam and C. L. Arora, Heat and Thermodynamics, S. Chand & Co, New Delhi 2004.

2. A. B. Gupta and H. Roy, Thermal Physics, Allied Books, New Delhi 2002.

3. M.W. Zeemansky and R.H. Diffman, Heat and Thermodynamics, PHI,

M16UPH04- OPTICS

UNIT - I

Aberrations : Monochromatic aberrations - spherical aberration - methods of minimizing spherical aberration - Definition of coma, astigmatism and curvature of field, distortion - Method of minimizing spherical aberration ... - chromatic aberration - the achromatic doublet - removal of chromatic aberration of a separated doublet - Equivalent focal length of two thin lenses - in contact and out of contact method.

Eye pieces : Huygen's and Ramsden eyepiece - location of cardinal points.Velocity of light - determination of velocity of light - Kerr cell method.

UNIT - II

Interference and Interferometers : Coherence - temporal coherence and spatial coherence - Air wedge - testing the planeness of a surface - Michelson Interferometer - types of fringes - Difference in wavelength of Sodium D1, D2 lines and thickness of a thin transparent plate.

Multiple beam interference - Febry - Perot interferometer - formation of fringes.

Holography : Holography - recording and reconstruction.

UNIT - III DIFFRACTION AND OPTICAL INSTRUMENTS

Diffraction : Fresnel's and Fraunhoffer diffraction - Fresnel's half period zones - area of the half period zones - zone plate - Comparison of zone plate with convex lens - Phase revesal zone plate - Phase contrast microscope - Fraunhoffer diffraction pattern with N slits (diffraction grating) - normal incidence - absent and ovelapping spectra of diffraction grating.

Optical Instruments : Rayleigh's criterion - Resolving power of a telescope, microscope and grating.

UNIT IV

Polarization : Polarization - Nicol prism as polarizer and analyzer - Dichroic Polarizers - Huygen's theroy of double refraction in uniaxial crystals - Double image polarizing prisms - Quarter wave plate, Half wave plate - Babinet's compensator - Plane, elliptically and circularly polarized light - production and detection - Optical activity, analysis of light by Laurent's half shade polarimeter.

UNIT V

Fibre Optics : Introduction - fibre optic system - the fibre optic communication compared to metallic cable (electrical) communication - basic principle - total internal reflection - acceptance angle and numerical aperture - types of optical fibres based on material - propagation (transmission) of light through an optical fibre - index profile - fibre configurations - difference between singlemode fibre and multimode fibre - difference between step index fibre and graded index fibre - fibre optic communication link.

Books for Study:

1. A text book of Optics - N. Subramaniyam and Brij lal, Revised by M.N. Avadhanulu, S. Chand & Co, New Delhi., 2004.

2. Optics and Spectroscopy R. Murugesan and Kiruthiga Sivaprasath, S.Chand & Co, New Delhi., 2006

3. Geometrical and Physical Optics - P. K. Chakrabarti, New Central Book Agency (P) Ltd, Kolkata., 2005.

4. Optics - D.R. Khanna and H.R. Gulati, R. Chand & Co, New Delhi., 1979.

5. Engineering Physics - G. Vijayakumari, Vikas Publications.

Books for Reference:

1. Optics - Eugene Hecht, Fourth Edition, Pearson Education, New Delhi. 2007.

2. Fundamentals of Optics - Jerkins A Francis and White E Harvey, McGraw Hill Inc., New Delhi, 1976.

3. Optical Physics - S.G. Lipson, H. Lipson and D.S. Tannhauser, Cambridge University Press. 1995.

4. Fundamentals of Optics - M.G. Raj, Anmol Publications Pvt. Ltd., New Delhi, 1996.

ELECTRICITY AND MAGNETISM – M16UPH05

UNIT I

Principle of a capacitor - energy stored in a capacitor - energy density - change in energy due to dielectric slab - force of attraction between plates of a charged capacitor - capacitance of a spherical and cylindrical capacitors - types of capacitors - electrometers - Kelvin's attracted disc electrometer - quadrant electrometer - measurement of potential, ionization current and dielectric constant (solid).

UNIT II

Carey-Foster Bridge - theory - temperature coefficient of resistance - potentiometer- measurement of current, voltage and resistance thermoelectricity- laws of thermo e.m.f, intermediate metals, intermediate temperature - S. G. Starling method for Peltier effect and Thomson effect - Thermodynamics of thermocouple - determination of π and σ - thermoelectric diagrams and its uses.

UNIT III

Magnetic induction due to a straight conductor carrying current - magnetic induction on the axis of a solenoid - moving coil ballistic galvanometer- damping correction- determination of absolute capacity of a condenser- self- inductance by Anderson's Bridge method- experimental determination of mutual inductance coefficient of coupling - concept of displacement current - Maxwell's electromagnetic equations in differential and integral form (no derivation).

UNIT IV

Transient current - growth and decay of current in a circuit containing resistance and inductance - growth and decay of charge in a circuit containing resistance and capacitance - measurement of high resistance by leakage - growth and decay of charge in a *LCR* circuit - condition for the discharge to be oscillatory - frequency of oscillation - Importance in wireless telegraphy.

UNIT V

Alternating current - peak, average and *RMS* value of current and voltage - form factor - *j* operator - ac circuit containing resistance and inductance - choke coil - ac circuit containing resistance and capacitance - series and parallel resonance circuits - *Q* factor - power in an ac circuit containing *LCR* - Wattless current - Transformer - construction, theory and uses - energy loss - skin effect - Tesla coil

Books for Study:

1. Electricity and Magnetism - Brijlal and Subramaniam, S. Chand & Co., (2005).

2. Electricity and Magnetism - R. Murugesan, S. Chand & Co., (2005).

Books for Reference:

1. Electricity and Magnetism - D. N. Vasudeva, S. Chand & Co., (2005).

2. Electricity and Magnetism- K. K. Tewari, S. Chand & Co., (2005)

BASIC ELECTRONICS – M16UPH06

UNIT I

Special diodes : Light Emitting Diode (LED) and its advantages - multicolor LEDs and its applications - Photo diode - characteristics and applications - Tunnel diode and its characteristics - Tunnel diode as an Oscillator - Varactor diode - Theory and its applications - Shockley diode - PIN diode and its applications.

UNIT - II

Hybrid (h) parameters - determination of h-parameters - h-parameters equivalent circuit - performance of a linear circuit in h-parameter - the h-parameter of a transistor - Nomenclature for transistor h-parameters - input impedance, voltage gain and current gain in h-parameters - experimental determination of h-parameters - limitations of h-parameters.

UNIT - III

Common emitter transistor as an amplifier - DC and AC load line analysis - Transistor biasing - stabilization - base resistor method - feed back resistor method - Voltage divider bias method Construction of JFET - its characteristics and parameters - Common source JFET amplifier- MOSFET- Depletion MOSFET- Enhancement MOSFET - UJT, SCR - Construction, working, V-I characteristics and their application.

UNIT - IV

Multistage amplifier - definition of gain, frequency response, decibal gain and bandwidth - operation, frequency response, advantage, disadvantage and applications of RC coupled CE transistor amplifier (two stage) and transformer coupled amplifier. Principle of feedback in amplifiers-positive and negative feedback-effect of negative feedback - emitter follower - positive feedback amplifier as an oscillator - Hartley oscillator, Wien-bridge oscillator and Piezo electric crystal oscillator.

UNIT - V

Multivibrators - astable, monostable and bistable multivibrator using transistor.Operational Amplifier : Differential amplifier - basic circuit and its operation -CMRR - Op-amp - Block diaram and explanation – applications - differentiator , integrator and comparator - multistage op-amp - solving simultaneous equations.

Books for Study:

1. Basic Electronics   (Solid state), B.L. Theraja, S. Chand & Co., (2000).

2. Principles of Electronics, Metha, V.K. S. Chand & Co., (2001).

Books for Reference:

1. Foundations of electronics, D. Chattopadhyay and etal., New Age International Publishers (1999).

2. Hand book of Electronics - Gupta & Kumar, Pragati Prakhasan (2005).

ATOMIC PHYSICS – M16UPH07

UNIT - I

Photoelectric effect - Lenard's method to determine e/m for photoelectrons - Richardson and Compton experiment - relation between photoelectric current and retarding potential - relation between velocity of photoelectrons and frequency of light -failure of electromagnetic theory - Einstein's light quantum hypothesis and photoelectric equation - experimental verification of photoelectric equation - Millikan's experiment.

UNIT - II

Positive ray analysis - Thomson's parabola method- theory- determination of e/m and mass of positive ions- Astons mass spectrograph determination of masses of isotopes- uses of mass spectrographs - separation of isotopes- mass spectrograph method -diffusion method- thermal diffusion method- pressure diffusion method.

UNIT - III

Theory of alpha scattering - Rutherford scattering formula -experimental verification - nature of privileged quantum orbits - Bohr's correspondence principle - effect of motion of nucleus - evidences in favour of Bohr's theory - Determination of critical potential - Davis and Goucher's method - Sommerfield's relativistic atom model -application to fine structure of Hα line.

UNIT - IV

Description of vector atom model - quantum numbers associated with vector atom model - coupling schemes - J.J. coupling – LScoupling - application of spatial quantisation - Pauli's exclusion principle - the selection rule - intensity rule- Lande's g factor –Bohr magneton - applications of vector atom model - electron configuration - magnetic dipole due to spin - Stern - Gerlach experiment.

UNIT - V

Spectral terms and notations - fine structure of Sodium D lines - fine structure of Hα line - Zeeman effect - Larmor's theorem-Quantum mechanical explanation of normal Zeeman effect-anomalous Zeeman effect of D1 and D2 lines of Sodium-Paschen – Bach effect - Stark effect.

Books for study:

1. Modern Physics - by R. Murugesan, S. Chand & Co. (2004).

2. Atomic Physics - J.B. Rajam, S. Chand & Co. (2004).

3. Atomic and Nuclear Physics - by N. Subramanyam and Brijlal,S. Chand & co. (2004).

Books for Reference:

1.Atomic specra by White(2003), Mc Graw Hill Intl. Book Company.

2.Atomic and Nuclear Physics by H. Semat and J.R. Albright, Chapman and Hall (2003).

3.Atomic and Nuclear Physics by T.A. Littlefields and Thorley, ELBS (2003).

4.Atomic and Nuclear Physics by S.N. Ghoshal, S. Chand & Co (2004).

UNIT - I : RADIOACTIVITY

Laws of successive disintegration - transient - and secular equilibria-range of alpha particles - experimental measurement - Geiger-Nuttal Law - alpha ray spectra - Gamow's theory of alpha decay and its experimental verification - Beta ray spectra - origin of line and continuous spectrum - Fermi's theory of beta decay- K electron capture - Nuclear Isomerism.

UNIT - II : NUCLEAR DETECTORS

Principle and working - solid state detector - proportional counter - Wilson's cloud chamber - Scintillation counter.
Accelerators : Synchrocyclotron - Synchrotron - Electron synchrotron -proton synchrotron - Betatron.

UNIT - III : ARTIFICIAL TRANSMUTATION

Rutherford's experiment - Bohr's theory of Nuclear disintegration - Q value equation for a nuclear reaction - threshold energy - types of nuclear reaction - energy balance and the Q value - threshold energy of an endoergic reaction.

Neutron: Mass, charge, decay, spin and magnetic moment, Neutron diffration, absorption of neutron by matter - neutron sources -detectors - neutron collimator.

UNIT - IV : NUCLEAR STRUCTURE

General properties of nucleus - size , mass and charge.
Proton - electron theory - proton - neutron theory - Nuclear size - experimental measurement of nuclear radius - mirror nuclei method- meson theory of nuclear forces - nuclear models - liquid drop model - Weizacker's semi - empirical formula - nuclear shell model.

UNIT - V : Nuclear fission, fusion and elementary particles

Nuclear fission - Bohr Wheeler theory - chain reaction - critical size and critical mass - Nuclear fission reactor - Nuclear fusion – source of stellar energy - Carbon - Nitrogen cycle - Proton - Proton cycle -Thermo Nuclear reaction - plasma.

Elementary Particles- types of interactions- classification of elementary particles - particle quantum numbers - baryon number -lepton number- strangeness number - hyper charge - isospin quantum number.

Books for Study:

1. Modern Physics by R. Murugesan, S.Chand & Co., (2005)
2. Atomic Physics by J.B. Rajam, S.Chand & Co., (2005)
3. Nuclear Physics by D.C.Tayal, Himalaya Publishing House.

Books for Reference:

1. A Source book on Atomic energy by Samuel Glass Stone (2002)

2. Atomic and Nuclear Physics by Albrignt Semat (2003)

3. Atomic and Nuclear Physics by Little field and Thorley. ELBS (2002)

4. Basic Nuclear Physics and Cosmic rays, B.N. Srivatsava, Pragti Prakasham.

5. Concepts of Nuclear Physics, Bernald L. Cohen, TMH.

QUANTUM MECHANICS AND RELATIVITY - M16UPH09

UNIT I : WAVE NATURE OF MATTER

Inadequacy of classical mechanics - matter waves - Phase and group velocity - wave   packet - Heisenberg's uncertainity principle - its consequences (free electron cannot reside inside the nucleus and gamma ray microscope) - expressions for de-Broglie wavelength -Davisson and Germer's experiment - G.P. Thomson experiment.

UNIT II : POSTULATES

Basic postulates of wave mechanics - Schrodinger's equation properties of wave function - operator formalism - linear operators- self-adjoint operators - expectation values (position and momentum)- eigen value and eigen function - commutativity and compatibility.

UNIT   III :

Application   Of Wave Mechanics In One Dimension Particle in a box of length L - Barrier penetration problem - Linear harmonic oscillator.

UNIT IV: APPLICATION   OF WAVE MECHANICS IN THREE DIMENSION

Orbital   angular   momentum   (L)   -   operators   and   their commutation relations - separation of   three dimensional Schroedinger's   equation into radial and angular parts - rigid rotator - Hydrogen atom.

UNIT V : RELATIVITY

Frame of reference - Gallilean transformation - Michelson & Morley experiment   - postulates of special theory of relativity - Lorentz transformation   - length contraction - time   dilation -

relativity of simultaneity - addition of velocities - variation of mass with velocity - mass - energy relation - Minkowski's four dimensional space - time continuum - four vectors - elementary ideas of general theory of relativity.

Books for Study:

1. Modern Physics, R. Murugesan, S.Chand & Co., New Delhi.

2.Quantum mechanics, V.K. Thangappan, New Age International, New Delhi.

3. A text book of quantum mechanics, Mathews & Venkatesan, Tata McGraw Hill, New Delhi.

4. Relativity and quantum mechanics, P.K. Palanisamy, Sitech Pub., Kumbakonam.

5. Quantum Mechanics, G. Aruldass, PHI.

Books for Reference:

1. Quantum mechanics- Ghatak & Loganathan, Macmillan Publications.

2. Introduction to quantum mechanics - Pauling & Wilson, McGraw hill Co., New York.

3. Perspective of Modern Physics - Arthur Beiser, McGraw hill Co., New York.

4. Quantum mechanics - V. Devanathan.

5. Quantum Mechanics in Physics and Chemistry with applications to Biology - Rabi Majumdar, PHI.

NUMERICAL METHODS – M16UPHE01

UNIT I : MATRICES

Solution of linear equation - Cramer's rule - characteristics matrix and characteristics equation of a matrix - eigen values and eigen vectors - sub space and null space Diagonalisation of *3 x 3* symmetric matrices.

UNIT II : BETA AND GAMMA FUNCTIONS

Fundamental properties of gamma functions - the value and graph of gamma function - transformation of gamma function - different forms of beta function - relation between beta and gamma function - application.

UNIT III : CURVE FITTING

Principle of least square - fitting a straight line - linear regression - fitting a parabola - fitting an exponential curve.

UNIT IV : ITERATIVE METHODS

Solving non - linear equation - bisection method - Successive approximation - Newton Rapson method - modified Euler's method - Runge - Kutta method (second and third orders only)

UNIT V : NUMERICAL INTEGRATION

General formula - Trapezoidal rule - Simpson's -*1/3 rd* rule and *3/8th* rule - Gaussian quadrature formula.

Books for study:

1. Introductory methods of numerical analysis - S.S. Sastry, Prentice Hall of India, New Delhi 2000 Edition.

2. Numerical methods - A. Singaravelu, Meenakshi Agency, Chennai (2001).

3. Numerical   method   in Science   and   Engineering   - Venkataraman, PHI - New Delhi, 1997.

4. Mechanics and Mathematical methods, R. Murugesan, S. Chand & Co, New Delhi - 1999.

SOLID STATE PHYSICS – M16UPHE05

UNIT I : CRYSTAL STRUCTURE

Crystal lattice - primitive and unit cell - crystal systems - Bravais lattice - Miller indices - Structure of Crystal - Simple Cubic, Body Centered Cubic, Face Centered Cubic and Hexagonal Close Packed structure, Sodium chloride structure, Zinc blende structure and Diamond structure.

UNIT II : CRYSTALLOGRAPHY AND CRYSTAL IMPERFECTIONS
X ray Spectrum - Moseley's law - diffraction of X-rays by crystals - Bragg's law in one dimension - Experimental method in X-ray diffraction - Laue's method, rotating crystal method - powder photograph method - point defects - line, surface and volume defects - effects of crystal imperfections.

UNIT III : MAGNETIC PROPERTIES
Different types of magnetic materials (dia- , para- , ferro - and anti-ferro) - Langevin's theory of diamagnetism - Langevin's theory of paramagnetism - Weiss theory of paramagnetism - quantum theory of ferromagnetism - ferrites - general properties of superconductors - type I & type II superconductors.

UNIT IV : DIELECTRIC PROPERTIES

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

UNIT - V: MODERN ENGINEERING MATERIALS

Polymers- ceramics- super strong materials- cermets- high temperature materials - thermoelectric materials - electrets - nuclear engineering materials - plastics - metallic glasses - optical materials - fiber optic materials & uses.

Books for Study:

1. Introduction to Solid State Physics - C. Kittel, John Wiley (2004).

2. Material Science - M. Arumugam, Anuradha Agencies, (2004).

3. Engineering Physics - G. Vijayakumari, Vikas Publications.

Books for Reference:

1. Materials Science and Engineering - Raghavan (2004).

2. Introduction to Solids - Azaroff (2004).

3. Solid State Physics - A.J. Deckker (2004).

UNIT I : ATOMIC SPECTROCOPY

Constant deviation spectrometer - Hartmann's formula - fine structure and super fine structure - Solar Spectrum - high resolution Spectroscopy - L. G. plate - Fabry - Perot etalon application.

UNIT II : MOLECULAR SPECTROCOPY

Microwave spectroscopy - theory - pure rotational Spectra of diatomic molecules - rigid rotator - symmetric and asymmetric top molecule- microwave spectrometer - microwave oven.

UNIT III : LASER PHYSICS

Laser - spontaneous and stimulated emission - population inversion- laser pumping - Einstein's coefficient resonators - vibrational modes of resonators - control resonators - Q- factor -losses in the cavity - Ruby laser - Helium Neon Laser - $CO2$ laser - solid state laser - Application of lasers in industry, medicine and instrumentation, holography.

UNIT IV: INFRARED SPECTROSCOPY
The energy of diatomic molecules - the simple harmonic oscillator - the diatomic vibrating rotator - the vibration - rotation spectrum of Carbon   Monoxide - Breakdown   of   the Born   Oppenheimer - approximation - the interaction of rotation

and vibration - techniques and instrumentation - double and single - beam operation.

UNIT V : RAMAN SPECTRPSCOPY

Raman effect - classical and quantum theory - molecular polarizability - pure rotational Raman spectra of linear molecules - vibrational Raman spectra - structure determination -vibrational spectroscopy - techniques and instrumentation.

Books for study and reference :

1. Principles of Optics - D.S. Mathur.

2. Atomic Physics - J.B. Rajam, S. Chand & Co.,

3. Fundamentals of molecular spectroscopy - Banwell, Tata Mcgraw Hill, New Delhi.

4. An introduction to Laser theory and application- M.N. Aravamudhan, S.Chand & Co.

5. Basic principles of spectroscopy - Chang Raymond, Mc Graw Hill.

6. Spectroscopy (Atomic and Molecular) - Gurdeep R. Chatwal etal, Himalaya Publishing House.

7. Laser systems and applications - Nityanand Chowdry and Richa Verma, PHI.

8. Molecular Structure and Spectroscopy - G. Aruldass, PHI.

SPACE SCIENCE – M16UPHS02

UNIT I : Universe

Planets - interior planets - exterior planets - crust, mantle and core of the earth - different - region of earth's atmosphere - rotation of the earth - magnetosphere - Van Allen belts – Aurora.

UNIT II : Comets, Meteors, Asteroids

Composition and structure of comets- periodic comets- salient features of asteroids, meteors and its use.

UNIT III : Sun
Structure of photosphere, chromosphere, corona - sunspots - solar flares - solar prominences - solar piages -satellites of planets - structure, phases and their features of moon.

UNIT IV : Stars

Constellations - binary stars - their origin and types star clusters- globular clusters - types of variable stars - types of galaxies.

UNIT V : Origin of Universe

Big bang theory - pulsating theory - steady state theory - composition of universe expansion.

Reference :
1. K.D. Abyankar, Astrophysics of the solar system, University press, India.

2. Baidyanath Basu, An introduction to Astrophysics, Prentice Hall of India, New Delhi.

3. Prof. P. Devadas, The fascinating Astronomy, Published by Devadas Telescopies, 2, Charkrapani Road, Guindy, Chennai.

4. Elements of Space Physics - R.P. Singhal, PHI.

BIO - MEDICAL INSTRUMENTATION – M16UPHS03

UNIT I :

Electro - Cardiography (ECG) - Electromyography (EMG) - Electro - Encephelograph (EEG) - Phonocardiography.

UNIT II :

Pacemakers - introduction- external and internal pacemakers artificial heart valves - (principle - block diagram and operation).

UNIT III :

Anesthesia machine - recording fetal heart movements and blood circulation using doppler ultrasonic method - laser based Doppler blood flow meter - Blood cell counter - B.P. measurement - direct and indirect method - Haemocytometer - counting of RBCs and WBCs.

UNIT IV :

Radiation safety instrumentation- effects of radiation exposure radiation monitoring instruments - pocket dosimeter - pocket type radiation alarm.

UNIT V :

Area monitoring instruments - physiological effects due to current passage - micro shock and macro shock - electrical accidents in hospital - micro shock hazards - macro shock hazards.

Books for Study and Reference:

1. Bio-medical Instrumentation- Dr. M. Arumugam- Anuradha Agencies.

2. Bio instrumentation - John G. Webster, editor - John Wiley & Sons, Inc.

3. Biological Instrumentation and methodology, P.K. Bajpai.

DIGITAL ELECTRONICS – M16UPHS04

UNIT I

Binary, Octal, Hexadecimal - interconversion - Gray code - excess 3-code - ASCII code - basic gates - DeMorgan's theorem - universal gates.

UNIT II

Laws of Boolean algebra - solving Boolean expression - K-map-minterms - SOP - K-map simplification using minterm (*2, 3* and *4* variables) - POS - K-map simplification using max terms (*2, 3* and *4* variables) - incomplete specified functions.

UNIT III

Half adder - Full adder - Half subtractor - Full subtractor - Decoder - BCD to seven segment decoder - Encoder - decimal to BCD encoder - multiplexer - applications - de-multiplexer.

UNIT IV

RS Flip flop using NOR and NAND gates - clocked RS flip flop - D flip flop- JK flip flop - Master Slave JK flip flop- Registers- Shift Registers (right to left and left to right) - applications.

UNIT V

Counters - modulus of a counter - asynchronous counter (*4*-bits) - synchronous counter (*3*-bits) - BCD counter - D/A conversion - R-*2*R binary ladder method - A/D conversion - successive approximation.

Books for study :

1. Digital principles and applications - Malvino and Leach, TMH.

2. Digital fundamentals - Vijayendran, S. Viswanathan Printers and Publishers Pvt. Ltd.,

3. Digital electronics - Virendra Kumar, New Age International Publishers.

ELECTRICAL APPLIANCES - M16UPHS05

UNIT I

Electrical charge - current - potential - units - Ohm's law - electrical energy - power - watt - kWh - consumption of electrical power - resistance - capacitance - inductance and its units - measuring meter Galvanometer, ammeter, voltmeter and multimeter.

UNIT II

Principles of transformers - constructional details - Core type, Shell type - classification of transformers - EMF equation - voltage ratio - current ratio - transformer on no load - auto transformer - applications.

UNIT III

AC and DC - single phase and three phase connections - three phase transformer - house wiring star-star, star-delta, delta -star connections - overloading - earthing - short circuiting - fuses - cooling of transformers - protective devices and accessories - losses in transformer.

UNIT IV

Electrical bulbs - fluorescent lamps - inverter - UPS - Stabilizer - principle and operations of fan - wet grinder - mixer - water heater - electric iron box - microwave oven - refrigerator.

UNIT V

Electric heating - resistance heating - induction heating - high frequency eddy current heating - Dielectric heating - resistance welding - electric arc welding - occupational hazards due to chemical reactions.

Books for study and also for reference :

1. A text book in electric power - P. L. Soni, P.V. Gupta and V.S. Bhatnagar.

2. Utilization of electrical energy - E.O. Taylor, Orient Longman.

3. Arts and Science of utilization of electrical energy - H. Partas, M/s. Dhanpat Raji & Sons, New Delhi.

4. A course in electrical power - J.B. Gupta, M/S. Jaataris & Sons.

5. A text book in electrical technology - B.L. Teraja, S. Chand & Co. , New Delhi.

6. A text book in electrical technology - A.K. Teraja, S. Chand & Co., New Delhi.

7. Alternating current machines - Philip Kermp

8. Performance and design of A.C. Machines - M.G. Say, ELBS Edn.

9. Theory of alternating current machinery - Alexander Langsdort.

MICROPROCESSOR AND ITS APPLICATIONS - M16UPHS06

UNIT I :

Microcomputer - microprocessor development - terms related to microprocessor - *8085* microprocessor - architecture.

UNIT II :

8085- word length, address registers - block diagram of microprocessor - ALU - accumulator - instruction format - assembly language programming.

UNIT III :

Counter - stack pointer - internal data bus - addressing modes - instruction set - mneumonics - communication with microprocessor - polling and interrupt.

UNIT IV :

Programs for i) *8* bit addition ii) *8* bit subtraction iii) multiplication and division iv) Greatest and smallest number in an array of *8* bit unsigned numbers.

UNIT V :

v) Arranging numbers in ascending and decending order vi) *D/A* conversion vii) *A/D* conversion viii) Sum of *N* numbers ix) bubble sort method.

Books for Study:

1. Introduction to Microprocessor - P. Mathur, TMH.

2. Microprocessor principles and Application - Gilmore, TMH.

3. Fundamentals of Microprocessor *8085* - V. Vijayendran, SV Publication.

Books for Reference:

1. Microprocessor Architecture Programming and application Gaonkar.

2. Advanced Microprocessor and Peripherals - A.K. Roy and K.M. Bunchandi, TMH.

3. Ten days with *8085* MicroProcessor - K.A. Krishnamurthy, PHI.

Allied Physics – I – M16UPHA01

UNIT I- Mechanics

Projectile - range up and down an inclined plane - impulse and impact - laws of impact coefficient of restitution - direct impact between two spheres - compound pendulum - theory - determination of acceleration due to gravity. Newton's law of gravitation - determination of gravitational constant - Boy's method.

UNIT II : Properties of Matter:

Bending of beams - expressions for bending moment - expression for the depression of the free end of the cantilever - uniform and nonuniform bending - theory and experiment - torsion - expression for couple per unit twist - torsion pendulum - theory - rigidity modulus by static torsion. Surface tension and interfacial surface tension drop weight method.

UNIT III : Heat:

Specific heats: Determination of Cp and Cv - Van-der waal's equation - critical constants and their determination - expressions for critical constants - thermal conductivity of a bad conductor - Lee's disc method Joule - Thomson effect - porous plug experiment - theory - inversion temperature - Boyle temperature - liquefaction of Helium.

UNIT IV : Optics

Small angled prism - formation of two thin prisms to produce dispersion without deviation and deviation without dispersion - constant deviation spectroscope.
Interference - air wedge - thickness of a wire - Jamin's Interferometer - Polarisation - specific rotatory power and its determination.

UNIT V : Electricity

Carey Foster's bridge - Theory - Measurement of resistance. Potentiometer - Low range voltmeter and Ammeter calibration - Theory of moving coil Ballistic Galvanometer - Determination of current and voltage sensitivities.

Books for Study and Reference:

1. Mechanics and mathematical methods - R. Murugesan, S.Chand & Co.

2. Properties of matter - R. Murugesan, S. Chand & Co.

3. Heat and Thermodynamics - Brijlal and Subramaniam, S. Chand & Co.

4. Optics and Spectoscopy - R. Murugesan, S. Chand & Co.

5. Electricity and Magnetism - R. Murugesan, S. Chand & Co.

ALLIED PHYSICS PRACTICALS

List of experiments

01. Young's Modulus - non uniform bending - Scale and Telescope.

02. Young's Modulus - uniform bending - Scale and Telescope.

03. Torsion pendulum - rigidity modulus.

04. Static torsion - rigidity modulus.

05. Surface tension and interfacial surface tension - drop weight method.

06. Specific heat capacity of liquid - method of mixtures -half time radiation correction.

07. Lee's disc - coefficient of thermal conductivity of a bad conductor.

08. Sonometer - frequency of fork.

09. Air Wedge - thickness of wire.

10. Newton's rings - radius of curvature.

11. Spectrometer - wavelength of mercury lines - grating - minimum deviation method.

12. Potentiometer - Voltmeter calibration.

13. Potentiometer - Ammeter calibration.

14. Field along the axis of a coil - BH (Compass box).

15. Zener diode - characteristics.

16. Low range power pack - using two diodes.

M16UPHA02 - Allied Physics : II

UNIT I : Atomic Physics

Vector atom model - Spatial quantization - spinning electron - Quantum numbers associated with vector atom model - Coupling schemes - LS and jj coupling - Pauli's exclusion principle - periodic classifications of elements example of electron configuration - Stern and Gerlach experiment.

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UNIT II : Nuclear Physics and Solid state Physics

Nuclear models - liquid drop model - Semi empirical mass formula - merits and demerits - shell model - evidences. Nuclear radiation detectors - Ionisation chamber - Geiger Muller Counter - Wilson cloud chamber. Particle accelerator - Betatron.

Solid state physics - bonding in crystals - ionic bond - covalent band - metallic bond - molecular bond - hydrogen bond.

UNIT III : Spectroscopy

Basic theory of IR spectrum - single beam experiment - applications - Theory of Raman spectroscopy - vibrational spectrum - applications - electronic spectra - Basic theory of NMR and ESR.

UNIT IV : Basic Electronics

Semi conductor physics - construction and characteristics of FET, UJT - Multivibrator - Astable - Monostable - Bistable - basic circuits.

Operational amplifier - differentiator and integrator.

UNIT V : Digital Electronics

Binary, Hexadecimal numbers and their inter conversion - Laws of Boolean algebra - De Morgan's theorems - NAND and NOR as universal blocks - simplification of Boolean expression.

Books for Study:

1. Modern Physics, R. Murugesan, S.Chand & Co., Twelfth Edition.

2. Digital Principles and application, Malvino & Leach , TMH.

3. Principles of Electronics - V.K. Metha, S. Chand & Co.,

Books for Reference:

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

2. Hand book of Electronics, Gupta & Kamar, Pragathi Prakashan.