

C. Abdul Hakeem College (Autonomous), Melvisharam.

Syllabus for B.Sc., Physics effective from the Batch 2015-2016

Year: III Year Subject Code : U15MPH501 Semester : V

Major-5 Title: **Optics**

Credits: 5 Max. Marks. 75

No. of hrs/wk : 6

Objectives:

- *To learn the principles which govern optics and fiber optics*
- *To learn and understand the various optical instruments and their usage*

UNIT – I : GEOMETRICAL OPTICS 18

Hours

Spherical aberration in lenses – Methods of minimizing spherical aberration – 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)– coma – astigmatism – Ramsden’s and Huygen’s eyepieces – Constant deviation spectrometer –Calculation of characteristic wave number of spectral lines.

UNIT – II : INTERFERENCE 18

Hours

Theory of thin films – Air wedge – Determination of diameter of a thin wire by air wedge – Michelson’s Interferometer – Theory – Applications – wave length, thickness of thin transparent material and resolution of spectral lines – Brewster’s fringes – Refractive index of gases – Jamin’s & Rayleigh’s Interferometers.

UNIT – III : DIFFRACTION 18

Hours

Fresnel’s diffraction – Diffraction at circular aperture, straight edge and single slit – Plane diffraction grating – Theory and experiment to determine wavelength – normal incidence – oblique incidence – Fraunhofer’s diffraction – Missing orders – Overlapping spectra - Rayleigh’s criteria – Resolving power of telescope, prism, microscope and grating.

UNIT – IV : POLARIZATION 18

Hours

Introduction to polarisation – Double refraction – Huygen’s explanation of double refraction in uniaxial crystal – Dichroism – Polaroids and their uses - Plane, elliptically and circularly polarized light – Production and detection – Optical Activity – Fresnel’s explanation of optical activity – Specific Rotatory Power – Determination using Laurent’s Half Shade Polarimeter – Kerr effect and Faraday effect.

UNIT – V : NONLINEAR OPTICS 18

Hours

Introduction – Harmonic generation – Optical Mixing – Self-Focussing – Momentum Mismatch – Second Harmonic Generation – Experimental Arrangement – Crystal Symmetry – Coherence Length – Index Matching Condition – Frequency Mixing (Sum and Difference frequency Generation – Parametric Amplification and Generation of Light.

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Books for study:

1. Optics by Subramaniam N & Brij Lal, S Chand & Co. Pvt. Ltd., New Delhi, 1990.
2. Optics by Khanna D R & Gulati H R, R Chand & Co. Pvt. Ltd., New Delhi, 1979.
3. Optics and Spectroscopy by Murugeshn, S Chand & Co. Pvt. Ltd., New Delhi.

Books for Reference:

1. Fundamentals of Optics by Jenkins Francis and White E Harvey, McGraw Hill Inc., New Delhi, 1976.
2. Optical Physics by Lipson. S G, Lipson H and Tannhauser D S, Cambridge University Press (1995).
3. Fundamental of Optics by Raj M G, Anmol Publications Pvt. Ltd., (1996), New Delhi.
4. Fundamentals of Physics, 6th Edition, by D Halliday, R Resnick and J Walker. Wiley NY 2001.
5. Physics, 4th Edition Vols I, II & II Extended by D Halliday, R Resnick and K S Krane, Wiley, Ny, 1994.
6. CRC Handbook of Physics & Chemistry, 80th Ed., CRS Press, Ny, 1999.
7. The Feynman Lectures on Physics, Vols. I, II and III by R P Feynman, R B Leighton and M Sands, Narosa, New Delhi 1998.
8. Fibre Optic Communication System, Govind P. Agarwal, John –Willey & Sons

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Syllabus for B.Sc., Physics effective from the Batch 2015-2016

Year: III Year Subject Code : U15MPH502 Semester : V

Major - 6 Title: **Atomic Physics and Spectroscopy**

Credits: 5 Max. Marks. 75

No. of hrs/wk : 6

Objectives:

- *To learn the principles of atomic physics and the instruments used to learn it.*
- *To learn and understand the various optical phenomena and the fundamental facts regarding the various spectroscopic methods*

UNIT I : ATOMIC STRUCTURE

18 Hours

Introduction – Rutherford's experiment on α -scattering – Bohr atom model – Correspondence principle – Critical Potential – Frank & Hertz experiment – Vector atom model – Associated quantum numbers - Pauli's Exclusion Principle – Total Angular Momentum - L-S and J-J couplings - Bohr magnetron - Stern and Gerlach experiment

UNIT II: OPTICAL SPECTRA AND SPLITTING OF ENERGY LEVELS

18 Hours

Spectral terms – Spectral notations – Selection rules – Hyperfine structure - Zeeman effect - Larmors theorem – Debye's explanation of normal Zeeman effect - Anomalous Zeeman effect - theoretical explanation. Lande's g factor and explanation of splitting of D₁ and D₂ lines of sodium - Paschen back effect - theory.

UNIT-III: MICROWAVE AND INFRARED SPECTROSCOPY

18 Hours

Classification of Molecules - Interaction of Radiation with Rotating Molecules – Theory of Rotational Spectrum of Rigid Diatomic Molecule – Theory of vibration-rotation spectrum of Diatomic molecules – Energy of Diatomic molecule – Vibrating Diatomic molecule as a harmonic oscillator.

UNIT-IV: RAMAN SPECTROSCOPY

18 Hours

Classical theory of Raman effects and its failure - Difference between IR and Raman spectra - Quantum theory of Raman effect - Molecular Polarizability - Pure rotational Raman spectra of linear molecules - Vibrational Raman spectra - Stokes and anti-Stokes lines and their intensity difference - rule of mutual exclusion.

UNIT V : ELECTRONIC SPECTROSCOPY OF MOLECULES & LASER PHYSICS 18 Hours

Electronic spectra of Diatomic molecules - The Franck Condon Principle - Disassociation energy and disassociation products - Lasers: Population inversion - Laser pumping - Resonators - Vibrational modes of resonators - number of modes/unit volume - Open resonators - Control resonators - Q Factor - Threshold condition - Quantum yield - Pumping power - Neodymium laser - Nd:YAG laser.

Books for study:

1. Modern physics by R Murugesan and Kiruthiga Sivaprasath, S Chand & Co., New Delhi - 2005.
2. Atomic and Nuclear physics by N Subramanian and Brij Lal, S Chand & Co. - 2000.
3. Molecular Structures & Spectroscopy by G Aruldhas
4. Atomic physics by J B Rajam.
5. Spectroscopy by Gupta & Kumar
6. Spectroscopy by Banwell

Books for Reference:

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1. Atomic physics by A B Gupta and Dipak Ghosh Books and Allied Publishers.
2. Modern physics by J H Hamilton and Yang, McGraw Hill Publication 1996.
3. Concepts of Modern physics by A Beiser, Tata McGraw Hill, New Delhi 1997.
4. Physics of Atoms and Molecules, Bransden and Joachein 2nd Edition (Pearson 2011)
5. Introduction to Atomic Spectroscopy by H.E. White (McGraw Hill).

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Year: III Year Subject Code : U15MPH503 Semester : V

Major- 7 Title: **Analog and Digital Electronics**

Credits: 5 Max. Marks. 75

No. of hrs/wk : 6

Objectives:

- To learn the characteristics of semiconductor devices and IC's.
- To learn the applications of analog and digital circuits

UNIT I – SEMICONDUCTOR PHYSICS AND DEVICES 18 Hours

Carrier concentration in intrinsic and extrinsic semiconductors – Variation of Fermi level with temperature in P&N type semiconductors – Bridge rectifier – Transistor characteristics (PNP - CE mode only) – Photodiode & Solar cell (Working) - LED (Working, characteristics and applications).

UNIT II – TRANSISTOR AMPLIFIERS (NPN – CE mode only) 18 Hours

Single stage Transistor amplifier – R-C coupled transistor amplifier – frequency response – Emitter follower – h-parameter – Analysis of transistor amplifier using h-parameters – Expression for current gain, input impedance, voltage gain and output impedance.

UNIT III – TRANSISTOR OSCILLATORS 18 Hours

Barkhausen criterion – Working of Hartley, Colpitts, phase shift and Wien bridge oscillators – Qualitative studies for frequency and condition for sustained oscillations in each case – Crystal oscillator.

UNIT IV – DIGITAL FUNDAMENTALS 18 Hours

Binary number system – 1's complement – 2's complement – 2's complement arithmetic – hexadecimal number system – De Morgan's theorems – NAND & NOR as universal gates – Karnaugh map simplification (upto 4-variables) – SOP and POS solutions – Half adder – Full adder – Half subtractor – Full subtractor – 4-bit adder-subtractor – 4-to-1 multiplexer – 1-to-4 demultiplexer.

UNIT V – SEQUENTIAL CIRCUITS 18 Hours

R-S Flip-Flop – Clocked R-S Flip-Flop – D Flip-Flop – J-K Flip-Flop – J-K Master-Slave Flip-Flop – 4-bit asynchronous counter – Modulus counters – 4-bit synchronous counter – MOD-3 and MOD-5 combination counters – BCD counter – cascaded counters.

Books for study and reference:

1. Principles of Electronics by V.K.Mehta and Rohit Mehta, S.Chand & Co., New Delhi.
2. A Text Book of Applied Electronics by R.S.Sedha, S.Chand & Co., New Delhi.
3. Elements of Electronics by Bagde and S.P.Singh.
4. Electronic Principles by A.P.Malvino, McGraw Hill Book Company.
5. Digital Fundamentals by V.Vijayendiran, S.Viswanathan Publishers, Chennai.
6. Digital Principles and Applications by A.P.Malvino and D.P.Leach, Tata McGraw Hill, New Delhi.

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Year: III Year Subject Code : U15EPH501 Semester : V

Elective - 1 Title: **Material Science (Elective - I)**

Credits: 3 Max. Marks. 75

No. of hrs/wk : 3

Objectives:

- To learn and the various field which involves the concept of materials.
- To learn the basic application of material science and nanoscience in different filed.

UNIT I: GROWTH TECHNIQUES OF MATERIALS 9 HOURS

Bulk growth – low temperature and high temperature solution growth. Thin film preparation- Physical vapour deposition (PVD) -Electron Beam evaporation – Spray Pyrolysis- Sol gel growth techniques.

UNIT II: CHARACTERIZATION OF MATERIALS 9 HOURS

Structural: Determination of NaCl Structure by x-ray diffraction (XRD) –Construction and working of scanning electron microscope (SEM).

Optical: Principle, construction and working of UVspectrometer – determination of absorption of light by NaCl crystal.

Electrical: Hall effect – construction and working – determination of charge carrier.

Unit III: NANOMATERIALS 9 HOURS

Definition of Nanoscale system – Electron confinement in 3D, 2D, 1D and 0D - Size effect - Surface to volume ratio - distinction between Nanomaterials and bulk materials in terms of energy band.

Properties of Nanomaterials: Physical, electrical, optical and magnetic properties.

Unit V: SYNTHESIS AND APPLICATION 9 HOURS

Synthesis of Nanomaterials: plasma arcing – chemical vapour deposition of semiconductor nanomaterial – electro-deposition – ball milling.

Applications of Nanomaterials: material technology – information technology – biomedical.

UNIT V – NEW MATERIALS 9 HOURS

Metallic glasses – Fiber reinforced plastics - Fiber reinforced metals – Bio materials – Ceramics – Cermets – High temperatures materials - SMART materials.

Space programme structural materials and their properties - pressure vessels materials – lubrication materials.

Book for study

1. Materials science and engineering- V Edn- V Raghavan(PHI)
2. Introduction to Materials science and engineering – Ralls Cartney and Wolf (Wiley)
3. Introduction to Nanoscience & Nanotechnology by K. K. Chattopadhyay and A. N. Banerjee, Publisher: PHI Learning and Private Limited
4. Nanotechnology, Rakesh Rathi, S Chand & Company, New Delhi.
5. Nanoparticle Technology Handbook – M. Hosokawa, K. Nogi, M. Naita, T. Yokoyama (Eds.), Elsevier 2007
6. Encyclopaedia of Materials Characterization, Surfaces, Interfaces, Thin Films, Eds. Brundle, Evans and Wilson, Butterworth – Heinmann, 1992
7. Springer Handbook of nanotechnology, Bharat Bhushan (Ed.), Springer-Verlag, Berlin, 2004
8. Nano Science and Technology, VS Muraleedharan and A Subramania, Ane Books Pvt. Ltd, New delhi.
9. M.A Wahab, Solid state physics- Narosa publications – 2006
10. M.Arumugam - Material Science – Anuradha publications – 2008
11. S.K. Hayra Choudhury, Materials Science and Processes – 1991.
12. CM Sri Vastava, C & C.Srinivasan, Science of Engineering materials

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Year: III Year Subject Code : U15SPH501 Semester : V

Skill Based -3 Title: **Applied Electronics (SBS -III)**

Credits: 3 Max. Marks. 60

No. of hrs/wk :3

Objectives :

- *To learn and understand the various field of electronic, which involves the physics concepts*
- *To learn the basics applications of physics in different special electronic devices and instruments*

UNIT I: SPECIAL SEMICONDUCTOR DEVICES 9 Hours

FET – working, characteristics & parameters – FET as amplifier – Construction of Depletion and enhancement MOSFETs – UJT & SCR – working & characteristics – SCR as full wave rectifier.

UNIT II: OPERATIONAL AMPLIFIERS 9 Hours

Op-amp – characteristics of ideal OP-AMP – expression for voltage gain of inverting and non-inverting amplifiers – voltage follower – summing amplifier – differentiator and integrator – astable multivibrator – Wien bridge oscillator.

UNIT III: 555 TIMER AND D/A, A/D CONVERTERS 9 Hours

555 timer block diagram – monostable and astable operations – weighted resistor D/A converter – R-2R ladder D/A converter – parallel A/D converter – successive approximation A/D converter.

UNIT IV: TRANSDUCERS 9 Hours

Classification of transducers – Thermistor - Piezoelectric, Photoelectric, Hall Effect, Magnetostrictive Transducers - Semiconductor Transducers - Electro-Optic Transducers - Shaft angle Encoder - Digital Transducers – Biosensors: components, types and features of biosensors.

UNIT V: ELECTRONICS INSTRUMENTATION 9 Hours

Principle, block diagram and working of Digital Multimeter - Physiological transducers to measure blood pressure, body temperature – sources of bio-electric potentials – resting potential, action potential, bio potential electrodes – principle, block diagram and operation of ECG recorder.

TEXT BOOKS:-

1. Garland, G.D., Introduction to Geophysics 11 Ed., WB Saunder Company, London, 1979
2. Cook, A. H., Physics of the Earth and Planets I Ed. , McMillan Press, London, 1973.
3. Sawhney A K / A course in Electrical and Electronics Measurements and Instrumentation / Dhanpat Rai & Co., Delhi / 2003.
4. Transducers and Instrumentation by D. V. S. Murthy, Prentice Hall of India Pvt. Ltd.
5. Bioinstrumentation / L Veerakumari / MJP Publishers
6. Dr. Rajendra Prasad, Electronic Measurements and Instrumentation, Khanna Publications.
7. S. Ramabhadran, Electronic Measurements and Instrumentation, Khanna Publications.

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Year: III Year Subject Code : U15MPH601 Semester : VI

Major-8 Title: **Nuclear Physics and Radiation Physics**

Credits: 4 Max. Marks. 75

No. of hrs/wk : 5

Objectives:

- *To learn about radio activity and its has got industrial, medical, research applications etc.*
- *To learn about Elementary particle and hence the basis of High Energy Particle Physics.*

UNIT – I : NUCLEAR STRUCTURE

General properties of nucleus- binding energy- packing fraction - Theories of nuclear composition - proton and electron hypothesis - proton – neutron hypothesis - nuclear forces – meson theory of nuclear forces. Liquid drop model – Bethe – Weizsacker’s mass formula – application to alpha decay – Shell model – evidences – theory of energy level diagram – spin orbit interaction – magic numbers – nuclear stability – the Collective model.

UNIT – II : NUCLEAR DECAY

Alpha, Beta and Gamma Rays - properties – range of alpha particles – Geiger – Nuttal experiment– Gamow’s theory of alpha decay - Beta ray spectra – origin – neutrino theory of beta decay – K-electron capture – origin of gamma rays - nuclear isomerism - Radioactive disintegration- Soddy-Fajan’s displacement law – law of successive disintegration – transient and secular equilibrium - units of radioactivity.

UNIT – III : NEUTRON, PARTICLE ACCELERATORS AND DETECTORS

Neutrons - discovery- properties – classification – radioactive sources - slow neutron sources- Types of accelerators - Linear accelerator - Cyclotron - Synchrocyclotron - Betatron - Electron synchrotron - Proton synchrotron (Bevatron) - Detection Methods - GM counter - Ionization chamber - Scintillation counter- Bubble chamber.

UNIT – IV : NUCLEAR FISSION AND FUSION

Characteristics of nuclear fission - Fission cross section - Energy in fission - Bohr-Wheeler’s theory of nuclear fission - Fission reactors - pressurized heavy water reactor - fast breeder reactor – Nuclear fusion - proton –proton cycle – carbon - nitrogen cycle - Thermo nuclear reactions – Controlled fusion reactions – Lawson criterion - Radiation hazards - control of radiation hazards - biological effects of radiation – Applications of radioactive radiations.

UNIT – V : ELEMENTARY PARTICLES

Classification of fundamental forces - Elementary particles: Baryons, Mesons, Leptons - Strange particles – Anti-nucleons - Conservation laws : Baryonic, leptonic, strangeness and isospin charges - quantum numbers - Invariance under time reversal (T), charge conjugation (C) and parity (P) – TCP theorem - Parity non-conservation – Basic ideas about quarks and their types.

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Books for study:

1. Modern physics by R Murugesan & Kiruthiga, Sivaprasath S Chand & Co. (2006).
2. Nuclear Physics S N Ghoshal – S Chand & Co. Edition 2003.
3. Nuclear Physics D G Tayal – Himalayan Publishing House.
4. Nuclear Physics – J B Rajam, S Chand Publishing Co.

Books for reference:

1. Introduction to Modern Physics by Rich Meyer, Kennard, Coop Tata McGraw Hill Publishing Co.
2. Atomic and nuclear physics by Littlefeld & Thorley.
3. Nuclear Physics – Irving Keplan
4. Elements of Nucler Physics – M L Pandya & R P S Yadav Kedar Nath Ram Nath (2000).

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Year: III Year Subject Code : U15MPH602 Semester : VI

Major - 9 Title: **Relativity, Quantum Mechanics and Mathematical Physics**

Credits: 4 Max. Marks. 75

No. of hrs/wk : 5

Objectives:

- To learn the basics of relativity, quantum mechanics & mathematical physics
- To learn the basics application of mathematics in physics

UNIT – I : RELATIVITY

15 Hours

Frames of reference – Michelson – Morley experiment – Significance of negative result – postulates of special theory of relativity – Lorentz transformation equations – Length contraction – Time dilation – Relativity of simultaneity – Law of addition of velocities – variation of mass with velocity – relativistic kinetic energy equations – postulates of general theory of relativity – gravitational red shift.

UNIT – II : WAVE MECHANICS

15 Hours

Matter waves – de Broglie wavelength – wave velocity and group velocity – Heisenberg's Uncertainty principle – proof of Uncertainty principle for one dimensional wave packet – Postulates of wave mechanics – properties of wave functions – operator formalism – eigen functions – eigen values – expectation values.

UNIT – III : SCHRODINGER EQUATIONS AND ITS APPLICATIONS

15 Hours

Schrodinger equation – time dependent and time independent – application of Schrodinger equations – linear harmonic oscillator – zero point energy – particle in a one dimensional box – barrier penetration and tunnelling effect – rigid rotator – hydrogen atom.

UNIT – IV : MATHEMATICAL PHYSICS

15 Hours

Gauss divergence theorem – Stokes theorem – Greens theorem – applications of vectors to hydrodynamics. Orthogonal curvilinear coordinates – spherical polar coordinates – differential operators in terms of orthogonal curvilinear coordinates – expressions for gradient, div, curl and ∇^2 in Cartesian coordinate.

UNIT – V : SPECIAL FUNCTIONS

15 Hours

Beta and gamma functions – problems – relation between beta and gamma functions – Bessel's differential equations – Legendre's differential equations – Hermite's differential equations – Laguerre's differential equations – series solutions – Dirac delta functions - properties.

Books for study:

1. Quantum Mechanics by V. Devanathan, Narosa, Chennai, 2005.
2. Modern Physics by R Murugesan, Kiruthiga, Sivaprasath S Chand & Co. (2007).
3. Quantum Mechanics by V K Thangappan, Wiley Eastern.
4. A Text Book of Quantum Mechanics by P M Mathews and Venkatesan, McGraw Hill.
5. Mathematical Physical by Sathya Prakash.
6. Mechanics and Mathematical Methods by Murugesan, S Chand Publishing & Co.

Books for reference:

1. Mathematical Physics by B D Gupta.
2. Quantum Mechanics by Ghatak and Loganathan, McMillan.
3. Basic Quantum Mechanics by A Ghatak, McMillan India (2002).

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Syllabus for B.Sc., Physics effective from the Batch 2015-2016

Year: III Year Subject Code : U15MPH603 Semester : VI

Major- 10 Title: **Solid State Physics**

Credits: 5 Max. Marks. 75

No. of hrs/wk : 5

Objectives:

- *To learn the basic principles of Physics applied to study of solids, the relationship between the structure and property.*

UNIT I: CRYSTALLOGRAPHY

12 Hours

Lattice Point and Space Lattice - Basis and crystal structure, unit cells and lattice Parameters, Atomic Packing - Crystal systems, Bravais space lattices-metallic crystal structure , sodium chloride, diamond, zinc sulphide, hexagonal and closed packed structure, directions, planes and Miller indices

UNIT II: FREE ELECTRON THEORY AND BAND THEORY OF SOLIDS 12 Hours

Free Electron theory in one dimension - Formation of Energy Bands - Bloch Theorem (Statement) - Kronig Penney Model – Brillouin Zones (qualitative) – Effective Mass - Carriers in Solids - Metals, Insulators and Semiconductors (Intrinsic) - Band Structure - Intrinsic and Extrinsic Semiconductors

UNIT III: BONDING AND CRYSTAL PROPERTIES

12 Hours

Types of Bonding in Crystals - Ionic, Valence, Metallic, van der Waal's and Hydrogen Bonding Optical properties of solids - Specific heat capacity of solids - Dulong and Pettit's law - Einstein's and Debye's theory - Explanation for the Occurrence of Superconductivity - General Properties of Superconductors - Types of Superconductors - Meissner effect.

UNIT IV: X-RAY DIFFRACTION AND CRYSTAL DEFECTS

12 Hours

Diffraction of X-Rays by Crystals - Bragg's Law in one Dimension - Experimental methods in X-Ray Diffraction - Laue Method, Rotating Crystal Method, Powder Photograph Method - von Laue's equations - Point Defects - Line Defects - Surface Defects - Volume Defects - Effects of crystal imperfections.

UNIT V: DIELECTRICS AND MAGNETIC PROPERTIES

12 Hours

Review of Basic Equations - Dielectric Constant - Dipole Moment - Polarizability-Clausius-Mosotti Relation- Ferroelectricity - Classification of Magnetic Materials - Different types of Magnetic materials - Classical Theory of Diamagnetism (Langevin's Theory) - Langevin's Theory of Paramagnetism - Weiss Theory of Paramagnetism.

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Books for Study:

1. Solid State Physics by Gupta and Kumar
2. Modern Physics by R Murugesan and Kiruthiga Sivaprasath, S. Chand & company Ltd Edition 2007
3. Material Science by M. Arumguarn, Anuradha Publishers.
4. Material Science and Engineering by V.Raghavan, PHI
5. Solid State Physics by S.O. Pillai
6. Introduction to Solids by Azaroff, TMH.
7. Concepts of Modern Physics by Beiser, Tata Mc.Graw Hill, 5th Edition, 1997.

Books for Reference:

1. Introduction to Solid State Physics by Kittel, Wiley and Sons
2. Solid State Physics A J Dekker
3. Solid State Physics, P.K. Palanisamy, Scitech publications
4. Solid State Physics, P.K. Puri, V.K. Babber, S. Chand and company, Delhi

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Syllabus for B.Sc., Physics effective from the Batch 2015-2016

Year: III Year Subject Code : U15EPH601 Semester : VI

Elective - 2 Title: **Microprocessor and Microcontroller Applications
(Elective - II)**

Credits: 3 Max. Marks. 75

No. of hrs/wk : 3

Objectives :

- *To learn and understand the architecture, programming, interfacing and applications of MSP430 microcontroller*

UNIT I: – ARCHITECTURE

9 Hours

Introduction to Microprocessors and Microcontrollers – RISC & CISC CPU Architectures – Harvard & Von-Neumann CPU architectures.

16-bit Microcontrollers – MSP430 RISC CPU architecture – Compiler friendly features – Instruction set – Clock system, Memory subsystem, bus-architecture – Different families in MSP430 (2xx, 4xx, 5xx, 6xx) – Key differentiating factors between families – Pin-out diagram & I/O port pins and their functions.

UNIT II: – PROGRAMMING

9 Hours

Data transfer, arithmetic, logical and branching instructions – The Assembly language and 'C' programming for MSP430 microcontrollers – Routines using Assembly – Embedded 'C' essentials.

Simple assembly language programs for hexadecimal addition, subtraction, multiplication, division and picking largest/smallest data in an array.

Introduction to Code Composer Studio – Using CCS for Assembly, C, Assembly+C projects.

UNIT III: I/O PORTS, INTERFACING AND LOW-POWER FEATURES

9 Hours

Digital I/O – I/O ports programming using C and assembly – Multiplexing scheme of the MSP430 pins.

Concepts of stack and subroutines – Instructions related to stack and subroutines – Interrupts – Hardware and software interrupts – Maskable and Non-maskable interrupts – Interrupt programming in Assembly and 'C'.

Low-power features of MSP430 – Clock system – Low-power modes – Clock request feature – Low-power programming and Interrupts.

UNIT IV: ON-CHIP PERIPHERALS AND COMMUNICATION

9 Hours

On-chip peripherals – Watchdog Timer – Comparator – Op-Amp – Basic Timer – Real Time Clock (RTC)– ADC & DAC – DMA – LCD – USCI – Low-power RF capabilities.

Communication using MSP430 – USCI features and modes – Simple communication programming using C and Assembly – Interfacing to PC.

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UNIT V: INTERFACING AND EMBEDDED SYSTEMS

9 Hours

Interfacing LED, external LCD using SPI, External memory – Seven segment LED modules interfacing – Watch (RTC).

Applications of MSP430 – Data acquisition system – Wired Sensor network.

Introduction to embedded systems – Architecture of embedded system – Classifications and Applications of embedded systems.

BOOK FOR REFERENCE

1. John Davies , "MSP430 Microcontroller Basics", Elsevier, 2008.
2. MSP430 Teaching CD-ROM, Texas Instruments, 2008 (can be requested <http://www.uniti.in>)
3. Raj Kamal, "Microcontrollers: Architecture, Programming, Interfacing and System Design", Pearson Education, 2005.
4. Microprocessor and Microcontrollers, N. Senthil Kumar, 2010, Oxford University Press
5. Embedded Systems: Architecture, Programming & Design, Raj Kamal, 2008, Tata McGraw Hill
6. Embedded Systems: Design & applications, S.F. Barrett, 2008, Pearson Education India
7. Introduction to embedded system, K.V. Shibu, 1st edition, 2009, McGraw Hill

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Year: III Year Subject Code : U15EPH602 Semester : VI

Elective - 3 Title: **Applied Physics (Elective - III)**

Credits: 3 Max. Marks. 75

No. of hrs/wk : 3

Objectives:

- To learn and understand the various field, which involves the basics physics concepts
- To learn the application of physics in different fields and their important

UNIT I – NON-DESTRUCTIVE TESTING (NDT) **9 HOURS**

Introduction - Defects in materials - NDT Methods - Visual Inspection - Liquid Penetration Testing - Magnetic Particle Testing (MPT) - Eddy Current Testing (ECT) - Radiographic Testing Methods – Applications, advantages and limitations.

UNIT II – ASTROPHYSICS **9 HOURS**

Origin of the universe - the big bang theory - the steady state theory - Hubble's law - major constituents of the universe - Solar System - Planets - laws of motion of planets - inner planets - outer planets - Stars - Birth of a star - Death of a star - Chandrasekhar limit - white dwarfs - Neutron stars

UNIT III – FIBER OPTICS **9 HOURS**

Principles and propagation of light through optical fiber - basic characteristics of optical fiber - acceptance angle - numerical aperture - classification of fibers - step index and graded index fibers - single mode and multi mode fibers - losses in fibers – absorption, scattering and bending losses. Fiber optic communication system (Block diagram only).

UNIT IV – GEOPHYSICS **9 HOURS**

Introduction - Seismology: P waves, S waves, their velocities - Time distance curves and the location of epicentres - Effect of boundaries - Major discontinuities and resulting phase of seismic waves

UNIT V – ENERGY PHYSICS **9 HOURS**

Conventional and Non-conventional energy sources- solar energy -The Characteristics of sun - Solar constant - Physical principles of the conversion of solar radiation into Heat - Flat-Plate collectors – Collector Energy losses- Solar air heaters – Concentrating collectors – focusing and non- focusing concentrators -Advantages and disadvantages of concentrating collectors over flat-plate collectors

Book for study

1. Mani P. Engineering Physics I, Dhanam Publications, 2011.
2. Optics and Spectroscopy by R Murugashan, Kiruthiga Sivaprasad, S. Chand 2014.
3. Introduction to Fiber optics by K. Thyagarajan and Ajoy Ghatak, Cambridge University Press, 1999.
4. Practical Non-Destructive Testing by Baldevraj, T. Jayakumar, M. Thanvasimuthu, Narosa Publishing House, Chennai, 2002.
5. Garland, G.D., Introduction to Geophysics 11 Ed., WB Saunder Company, London, 1979
6. Solar Energy Utilisation, G .D. Rai, Khanna Publications, New Delhi, 1982.
7. Non – Conventional Energy sources, G.D. Rai, Khanna Publishers, New Delhi,1994.