A.V.V.M. SRI PUSHPAM COLLEGE (AUTONOMOUS), POONDI

Programme: M. Sc.
Department: Physics

Syllabus Revision 2017-2018

S.No.	Courses	Number of courses having changes
1.	Core Course	04
2.	Elective Course	02
	TOTAL	06

Total Number of Courses : 23

Total Number of Courses having changes : 06

Percentage of Revision : 26.1 %

Note:

The content of the syllabus which has been revised is highlighted.

M.Sc. PHYSICS (2017- 2018)

S. No	SEM	Category	Paper Code	Title of the Paper	Maximum Marks			Minimum Marks For Pass			Hours Week	Credits
					CIA	E.E	Total	CIA	E.E	Total		
1	I	Core	17P1PHC1	Classical Dynamics	25	75	100	10	30	50	6	5
2		Core	17P1PHC2	Mathematical Physics – I	25	75	100	10	30	50	6	4
3		Core	17P1PHC3	Statistical Mechanics	25	75	100	10	30	50	6	4
4		Core	17PIPHCP1	Major Practical – I	40	60	100	16	24	50	6	4
5		Major Elective	17P1PHEL1A 17P1PHEL1B	Nanophysics Laser and Fiber Optic Communication	25	75	100	10	30	50	6	4
6	II	Core	17P2PHC4	Electromagnetic Theory	25	75	100	10	30	50	5	5
7		Core	17P2PHC5	Mathematical Physics-II	25	75	100	10	30	50	5	4
8		Core	17P2PHC6	Electronics and Instrumentation	25	75	100	10	30	50	5	4
9		Core	17P2PHC7	Numerical Methods in Physics	25	75	100	10	30	50	5	4
10		Core	17P2PHCP2	Major Practical – II	40	60	100	16	24	50	6	4
11		Major Elective	17P2PHEL2A 17P2PHEL2B	Crystal growth & Thin Films Medical Physics	25	75	100	10	30	50	4	4
12	III	Core	17P3PHC8	Solid State Physics	25	75	100	10	30	50	5	4
13		Core	17P3PHC9	Quantum Mechanics	25	75	100	10	30	50	5	5
14		Core	17P3PHC10	Microcontroller- Programming and Applications	25	75	100	10	30	50	5	4
15		Core	17P3PHC11	Biomedical Instrumentation	25	75	100	10	30	50	4	4
16		Core	17P3PHCP3	Major Practical – III	40	60	100	16	24	50	6	4
17		EDC	17P3PHEDC	Extra Disciplinary Course	25	75	100	10	30	50	4	
			Communicative Skill and Personality development		-	-	-	-	-	-	1	-
18	IV	Core	17P4PHC12	Atomic and Molecular Spectroscopy	25	75	100	10	30	50	6	4
19		Core	17P4PHC13	Nuclear Physics	25	75	100	10	30	50	6	5
20		Core	17P4PHCP4	Major Practical – IV	40	60	100	16	24	50	6	4
21		Major Elective	17P4PHEL3A 17P4PHEL3B	Advanced Optics Radiation Physics	25	75	100	10	30	50	6	4
22		CN	17P4PHCN	Comprehension	-	100	100	-	50	50	5	2
23		PR	17P4PHPR	Project	40	60	100	16	24	50	-	4
			Communicative Skill and Personality Development		-	-	-	-	-		1	-
				Total			**2300**				**120**	**90**

Semester	Subject Code	Title of the Paper	Hours of Teaching/ week	No. of Credits
I	**17P1PHEL1A**	**Major Elective – I Nanophysics**	**6**	**4**

Objective:

- To gain the knowledge about Nanotechnology.

Unit I Background and emergence of Nanotechnology

Atomic structure – Periodic table – Molecules and phases – Energy – Emergence of nanotechnology – Nanomaterials – types – characteristics – surface to volume ratio – its effect on properties of nanomaterials – Nanoparticles, wires, composites and nanoclusters – Applications of nanomaterials.

Unit II Preparation of nanomaterials

Nanomaterials – Preparation – Top-down method – Ball milling – Nanolithography – Photolithography – Electron beam lithography – Molecular beam epitaxy – Bottom-up technique – Molecular self assembly – Sol-gel synthesis.

Unit III Carbon nanotubes

Carbon age – new carbon forms – carbon clusters – discovery of C_{60} – Carbon fullerences – Bucky balls – Nanotubes – synthesis of single walled nanotubes – multiwalled nanotubes – thermal and mechanical properties – Applications of CNTs.

Unit IV Characterization Techniques

Structural characterization – Principle of X-ray powder diffraction – Determination of structural parameters – Optical studies – UV-Vis-NIR – Raman & IR spectral analysis – Surface morphological analysis– SEM – AFM – TEM.

Unit V Photonics & Nanoelectronics

Interaction of light and nanomaterials – Properties of light and nanophotonics – Nano manipulation – Imaging – Photonic crystals – New low cost energy efficient windows – Nanoelectronics – birth of electronics – Molecular diodes, transistors – quantum electronic devices.

Books for Study

1. Essentials of Nanotechnology, Preedep.
2. Nanostructures and Nanomaterials, synthesis, properties and applications, Imperial college press, London.
3. NanoScience and nanotechnology K.P.Mathur, 1stEdition 2007, RajatPublications, NewDelhi

Books for Reference

1. M.Ratner.et al., Nanotechnology; A Gentle introduction, Prentice – Hall ISBN 0-13-101400-5, 2003.
2. Nanotechnology; Basic Science and Emergining Technologies, CRC Press
3. Charles P.Poole Jr and Frank J. Owens. "Introduction to Nanotechnology" Wiley, 2003.
4. A.S. Edelstein and R.C. Cornmarata, Nanomaterials; synthesis, Properties and Applications, 2 Ed, Iop (U.K), 1996.

Semester	Subject Code	Title of the Paper	Hours of Teaching/ week	No. of Credits
II	**17P2PHC6**	**Electronics and Instrumentation**	**5**	**4**

Objective:

- To gain the knowledge in Electronics and Instrumentation.

Unit - I Analog Electronics

Precision and accuracy–Introduction: Op-amp– op-amp based circuits: Integrator-Differentiator– Summing– Differential–Logarithmic amplifier – comparators and controls–Analog simulation–Wein Bridge oscillators using op-amp– Instrumentation Amplifier–Solid state switching circuits – 555 Timer– Discrete and integrated voltage regulators.

Unit – II Digital Electronics

Logic gates-Combinational logic circuits-Flip Flop: SR-JK-M/S-D-T Flip Flop-Register: Left shift and right shift register – Counter: Modulus of a counter – MOD X counter (Feedback only)–4 bit asynchronous Ripple counter– Ring counter - A/D Convertor: Simultaneous conversion – Dual slope method – D/A convertor: Variable resistor network–R2Rmethod–Computer and Microprocessor: Introduction– Architectures - Sample & Hold Circuits.

Unit – III Optoelectronics

Semiconductor lasers – optical fiber and characteristics – modes of propagation – losses in fibers – fiber optic communication, optoelectronic modulation and switching devices – Photo detectors – Optocoupler and isolators – Optical data storage techniques.

Unit – IV Instrumentation - I

Static characteristics–Error in measurement– Errors: Gross error – Systematic error–Random error– Dynamic characteristics – Statistical analysis – Permanent magnetic moving coil –Taut band instrument – Electrodynamometer – moving iron type instrument –LCD – Dot matrix display – Liquid vapour display.

Unit – V Instrumentation – II

Qualities of measurements–digital instruments: Digital multimeter – transducers, strain gauge, LVDT, Load cell, piezo electric transducers, temperature transducers, flow meters - recorders and transducers – signal conditioning – data acquisition, conversion and transmission– digital signal processing.

Books for Study:-

1. B.G. Stretman and S. Banerjee, 'Solid state electronic devices', (5th Edition), Pearson Education Inc., New Delhi, (2000).
2. A.P. Malvino, 'Electronic principles', (6th Edition), Tata McGraw Hill Publ. Co.Ltd., New Delhi (1999).
3. Robert T. Paynter, "Introductory electronic devices and circuits", Pearson Education Inc., New Delhi, (2009).
4. T.L.Floyd, Electronic Devices (6th Edition), Pearson Education Inc., New Delhi, (2003).

Books for Reference:-

1. P. Bhattacharya, Semiconductor Optoelectronic Devices, 2nd Edition, Pearson Education Inc., New Delhi, (2002).
2. H. S. Kalsi, Electronic Instrumentation, 2nd Edition, Tata McGraw Hill Publishing Co., New Delhi, (2004).
3. William David Cooper, Electronic Instrumentation and Measurement techniques – Prentice Hall of India Pvt. Ltd., (1991).
4. A. K. Sawhney, Electrical and Electronic Measurements and Instrumentation, Dhanpat Rai and Sons, New Delhi, (1990).

Semester	Subject Code	Title of the Paper	Hours of Teaching/ week	No. of Credits
II	**17P2PHC7**	**Numerical Methods in Physics**	**5**	**4**

Objective:

- To gain the knowledge in Numerical methods in physics.

Unit – I Errors and Curve fitting

Errors and their computations – General formula for errors – Errors of observation and measurement – Round of errors and Computer Arithmetic – Empirical formula – Graphical method – method of averages – Least square fitting – curve fitting – parabola, exponential – Algorithms and convergence.

Unit – II Numerical solution of Algebraic and Transcendental equations

The iteration method – the bisection method – The method of false position – Newton – Raphson method - C++ program for finding roots using Newton – Raphson method - Simultaneous Linear algebraic equations: Direct methods – Gauss elimination method – Gauss – Jordan method – Iterative method – Jacobi's method – Gauss Seidel iterative method – C++ Program for solution of linear equations.

Unit – III Interpolation

Finite differences – Interpolation – Gregory – Newton forward interpolation of Newton's formula – Backward differences – Newton's Backward interpolation formula – central differences – Gauss's forward and backward formula – Stirling's formula – Divided differences – Newton's divided difference formula – Lagrange's interpolation formula - C ++programming for Lagrange's interpolation.

Unit – IV Numerical differentiation and integration

Introduction – Numerical differentiation – Errors in numerical differentiation – The cubic spline method – Maximum and Minimum values of a tabulated function – Numerical integration – Trapezoidal rule – simpson's rule – Extended Simpson's rule – Use of cubic splines – Romberg integration – C++ Program to evaluate integrals using Simpson's and trapezoidal rules – Gaussian integration.

Unit – V Numerical solutions of ordinary differential equations

Solution by Taylor's series – Picard's method of successive approximation – Euler's method – Modified Euler's method – Runge Kutta method – second and fourth order – Predictor – Corrector method – Milne's method – C++ program for solving ordinary differential equations using RK method.

Books for Study

1. Unit I-IV – Numerical methods in Science and Engineering - G. Venkatraman, National Publishing Co., Chennai, 2001.
2. Unit V - Numerical methods - E. Balagurusamy, McGraw Hill Publishing Company.
3. Introductory methods of Numerical Analysis – S.S. Sastry, IV Ed, PHI learning pvt ltd, 2006.
4. Numerical methods – Maccormic, Prentice hall.

Books for Reference

1. Numerical Methods for Scientific and Engineering Computation – M. K. Jain, S. R. K. Iyengar, R. K. Jain, New age international, New Delhi, 1983.
2. Numerical Methods – P. Kandasamy, K. Thilagavathi and Gunavathy S. Chand & Co, New Delhi, 2010.

Semester	Subject Code	Title of the Paper	Hours of Teaching/ week	No. of Credits
II	**17P2PHEL2A**	**Major Elective – II** **Crystal Growth & Thin Films**	**4**	**4**

Objectives:

- To introduce the knowledge of crystal growth
- To know the basic ideas of thin films

Unit – I Nucleation and Growth

Nucleation – Different kinds of nucleation - Concept of formation of critical nucleus – Classical theory of nucleation - Spherical and cylindrical nucleus – Growth Kinetics of Thin Films - Thin Film Structure – Crystal System and Symmetry.

Unit – II Growth Techniques

Solution Growth Technique: Low temperature solution growth: Solution - Solubility and super solubility –Expression of super saturation – Miers T-C diagram - Constant temperature bath and crystallizer - Seed preparation and mounting - Slow cooling and solvent evaporation methods.

Gel Growth Technique: Principle – Various types – Structure of gel – Importance of gel – Experimental procedure – Chemical reaction method – Single and double diffusion method – Chemical reduction method – Complex and decomplexion method – Advantages of gel method.

Unit – III Melt and Vapour Growth Techniques

Melt technique: Bridgman technique - Basic process – Various crucibles design – Thermal consideration – Vertical Bridgman technique – Czochralski technique – Experimental arrangement – Growth process.

Vapour technique: Physical vapour deposition – Chemical vapour deposition (CVD) – Chemical Vapour Transport.

Unit – IV Thin Film Deposition Techniques

Thin Films – Introduction to Vacuum Technology - Deposition Techniques – Physical Methods – Resistive Heating, Electron Beam Gun, Laser Gun Evaporation and Flash Evaporations, Sputtering - Reactive Sputtering, Radio-Frequency Sputtering – Chemical Methods – Spray Pyrolysis – Preparation of Transparent Conducting Oxides.

Unit – V Characterization Techniques

X – Ray Diffraction (XRD) – Powder and single crystal - Fourier transform Infrared analysis (FT-IR) – Elemental analysis – Elemental dispersive X-ray analysis (EDAX) -Scanning Electron Microscopy (SEM) – UV-Vis-NIR Spectrometer – Etching (Chemical) – Vickers Micro hardness.

Books for Study

1. J.C. Brice, Crystal Growth Processes, John Wiley and Sons, New York (1986)
2. A. Goswami, Thin Film Fundamentals, New Age International (P) Limited, NewDelhi (1996)

Books for Reference

1. P. SanthanaRagavan and P. Ramasamy, Crystal Growth Processes and Methods, KRU Publications, Kumbakonam (2001)
2. H.H. Willard, L.L. Merritt, J.A. Dean, F.A. Settle, CBS, Publishers and Distributors, New Delhi

Semester	Subject Code	Title of the Paper	Hours of Teaching /week	No. of Credits
III	**17P3PHC8**	**Solid State Physics**	**5**	**4**

Objective:

- **This course deals with theoretical aspects of band theory, lattice vibration, dielectrics, ferroelectrics, superconductivity.**

Unit – I Crystal Structure and Imperfections

Crystal symmetry – Bravais lattices – reciprocal lattice – X-ray diffraction – Bragg's law – experimental methods of x-ray diffraction: Rotating crystal method and Debye – Scherrer powder method- Atomic scattering factor – geometrical structure factor - Classification of imperfections: point defects – line defects – surface defects – volume defects – colour centres – Burger's vector – Schottky defects and Frenkel defects – Derivation.

Unit – II Conductors and Semiconductors

Conductors: Free electron theory – Classical and Quantum theory – Band theory of solids – Density of states – K- space – Bloch theorem – Kronig – Penny model – Construction of Brillouin Zones – Semiconductors: Intrinsic and Extrinsic semiconductors – Band gap –Effective mass – Carrier concentration – Electrical conductivity – Hall effect – Determination of type of conductivity – carrier concentration – mobility resistivity.

Unit – III Magnetic and Dielectric properties

Langevin's classical theory of diamagnetism and paramagnetism – Quantum theory of paramagnetism – Weiss theory of ferromagnetism – origin of domains – Hystersis – explanation on the basis of domain theory – Curie temperature and Neel temperature – Dielectrics – Macroscopic electric field – local electric field – dielectric constant and polarizability – types of polarization – Clausius - Mosotti relation – determination of dielectric constant – parallel plate method.

Unit – IV Lattice Vibrations and optical properties

Wave motions of one dimensional atomic lattice – wave motion of linear diatomic lattice – optical and acoustical modes – infrared absorption – inelastic scattering of neutrons – inelastic scattering of x-rays – Photoconductivity – Simple model of photoconductor – traps - influence of traps – Luminescence and its types – Emission and absorption spectra – Thermoluminescence and glow curve.

Unit – V Super Conductivity

Zero resistance – behaviour in magnetic field – Meissner effect – Type I and Type II superconductors – entropy – Isotopic effect - Thermal conductivity – London equations - penetration depth – Josephson Effect – AC and DC – Quantum tunneling – BCS theory – high Tc super conductors – SQUID.

Books for Study:-

1. Introduction to Solid State Physics – Charles Kittel, John Wiley,2004.
2. Solid State Physics – Gupta & Kumar, K. Nath & Co, Meerut, 2000.
3. Solid State Physics – Singhal, Kedarnath Ramnath & Co, Meerut,2005.
4. Material Science – M.Arumugam.

Books for Reference:

1. Elementary solid state physics–Ali Omar, Addison Wesley Publishing Company, 1975.
2. Elements of Solid State Physics – J.P.Srivastava, Second Edition.
3. Solid State Physics and Electronics – A.B.Gupta & Nurul Islam.

Semester	Subject Code	Title of the Paper	Hours of Teaching/ week	No. of Credits
III	**17P3PHC11**	**Biomedical Instrumentation**	**4**	**4**

Objective:

- To introduce the knowledge in Biomedical Instrumentation.

Unit - I Human Physiological Systems

Cells and their structure – Nature of Cancer cells – Transport of ions through the cell membrane – Resting and action potentials – Bio-electric potentials – Nerve tissues and organs – Different systems of human body – Biopotential Electrodes and Transducers Design of Medical instruments – components of the biomedical instrument system – Electrodes – Transducers.

Unit - II Biosignal Acquisition

Physiological signal amplifiers – Isolation amplifiers – Medical preamplifier design – Bridge amplifiers – Line driving amplifier – Current amplifier – Chopper amplifier – Biosignal analysis – Signal recovery and data acquisition – Drift Compensation in operational amplifier – Pattern recognition – Physiological Assist Devices – Pacemakers – Pacemakers batteries – Artificial heart valves – Defibrillators – nerve and muscle stimulators Heart – Lung machine – Kidney machine.

Unit - III Biopotential Recorders

Characteristics of the recording system – Electrocardiography (ECG) – Electroencephalography (EEG) – Electromyography (EMG) – Electroretinogrphy (ERG) and Electroculography (EOG) – Recorders with high accuracy – recorders for OFF line analysis.

Unit – IV Operation Theatre Equipment

Surgical diathermy- shortwave diathermy – Microwave diathermy – Ultrasonic diathermy – Therapeutic effect of heat – Range and area of irritation of different techniques – Ventilators – Anesthesia machine – Blood flow meter – Cardiac Output measurements – Pulmonary function analyzers – Gas analyzers – Blood gas analyzers – Oxymeters – Elements of intensive care monitoring.

Unit - V Specialized Medical Equipments

Blood Cell counter – Electron microscope – Radiation detectors – Photometers and colorimeters – digital thermometer – audiometers – X-rays tube – X-ray machine – image intensifiers – Angiography – Application of X-ray examination – Safety instrumentation: Radiation safety instrumentation – Physiological effects due to 50Hz current passage – Micro shock and macro shock – electrical accident Hospitals – Devices to protect against electrical hazards – Hospitals architecture.

Books for study

1. Dr. M. Arumugan–Biomedical instrumentation, Anurada Agencies Publishers, 1992.
2. R.S Khandpur, "Handbook on Biomedical Instrumentation", Tata McGraw Hill Company, New Delhi, 1989
3. Ohn G Webster, Ed., "Medical Instrumentation Application and Design", Third edition, John Wiley & Sons, Singapore, 1999

Books for Reference

1. L. Cromwell, F. J. Weibell, E. A. Pfeiffer – Biomedical instrumentation and Measurements, PHI second edition, 1993.
2. Joseph J. Carr and John M. Brown, "Introduction to Biomedical Equipment Technology", Pearson Education Asia, New Delhi, 4th Edition, 2001.