# M.Sc. Physics: Syllabus (CBCS)

## Thiruvalluvar University

**Master of Science Degree Course**

**M.Sc. Physics**

**Under CBCS**

(with effect from 2012-2013)

The Course of Study and the Scheme of Examinations

<table>
<thead>
<tr>
<th>S.NO.</th>
<th>Study Components</th>
<th>Ins. hrs/week</th>
<th>Credit</th>
<th>Title of the Paper</th>
<th>Maximum Marks</th>
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<td>Classical and Statistical Mechanics</td>
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<td>ELECTIVE Paper-1</td>
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<td>(to choose 1 out 3) A. Electronic Devices and Applications B. Electronics Instrumentation C. Electronics communication systems</td>
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<td>Electromagnetic Theory and Plasma Physics</td>
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<td>(to choose 1 out 3) A. Nano Science B. Fibre Optics C. Non linear Optics</td>
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### SEMESTER III

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<td>(to choose 1 out 3) A. Crystal Growth and Thin Films B. Advanced Spectroscopy C. Advanced Nuclear Physics</td>
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#### Total Credits: 30, Total Marks: 180

### SEMESTER IV

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<td>25</td>
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<td>(to choose 1 out 3) A. Advanced Microprocessor B. C Programming and MATLAB C. Numerical Methods and programming in C</td>
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#### Total Credits: 30, Total Marks: 300

### Subject wise Total Calculation

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<th>Subject</th>
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#### Total: 21 Papers, Total Credits: 90, Total Marks: 2100
Project

There will be a Project work at the end of the Semester IV. The guidelines for the Project work with viva-voce as follows.

a) The Project should be valued for 75 marks by an external examiner and viva voce should be conducted by the external examiner and the internal guide/teacher concerned.
b) The Project Report may consist of 40 to 50 pages.
c) The candidate has to submit the project report 15 days before the commencement of the IV semester examinations.
d) A candidate who fails in the Project/Dissertation may resubmit the report (on the same topic) with necessary modification/correction/ improvements in the subsequent semester examination for evaluation.
e) Each candidate shall be required to appear for viva-voce Examination (in defense of the Project only)
THIRUVALLUVAR UNIVERSITY
M.Sc. PHYSICS
SYLLABUS
UNDER CBCS
(with effect from 2012-2013)

SEMESTER I
PAPER-1
MATHEMATICAL PHYSICS I

UNIT-I : Linear Vector Spaces and Matrices

Linear Vector Spaces: Linear independence, basis and dimension - inner products. Orthonormality and completeness - Schwartz Inequality - Orthonormal basis - Gram-Schmidt orthogonalization process - Linear operators - Vectors in n dimensions - Matrix algebra, similarity transforms, matrix diagonalization - Orthogonal, Hermitian and Unitary matrices-Properties

UNIT –II: Tensors


UNIT-III: Ordinary Differential Equations

Second order linear differential equations: Wronskian, Ordinary and singular points- series solutions - Generating functions – Rodrigue's formula - Orthogonality relations - Important recurrence relations for Bessel, Legendre, Hermite and Laguerre functions - Spherical harmonics

UNIT – IV: Green’s functions

Dirac-delta function - Green’s function - One dimensional Green function - boundary conditions – Eigen function - expansion of the Green’s function- Reciprocity theorem – Sturm-Liouville type equations in one dimension and their Green’s functions
UNIT V: Probability theory and Random variables

Probability distributions and probability densities - Binomial, Poisson’s and Normal - standard discrete and continuous probability distributions - moments and generating functions - Central limit theorem (statement and applications).

Books for Study:

Books for Reference:
PAPER-2

CLASSICAL AND STATISTICAL MECHANICS

PART A: CLASSICAL MECHANICS

UNIT-I: Lagrangian and Hamiltonian formulation


UNIT-II: Rigid body dynamics and Canonical transformations


UNIT-III: Hamilton - Jacobi Theory and Theory of Small Oscillations


PART B: STATISTICAL MACHANICS

UNIT-IV: Thermodynamics and Classical statistics

Classical Statistics: Microstates and Macrostates - Phase space - Liouville theorem and it’s significance - ensembles - Definition of Micro Canonical, Canonical and Grand Canonical ensembles - Partition function - Translational partition functions - Gibb’s Paradox - Sackur-Tetrode equation.
UNIT-V: Quantum Statistics


Books for Study:


Books for Reference:

PAPER-3

QUANTUM MECHANICS I

UNIT-I: Basic formalism

Wave functions for a free particle - Interpretation and conditions on the wave function - Postulates of quantum Mechanics and the Schrödinger equation - Ehrenfest’s theorem - Expectation Value - Stationary States - Hermitian Operators for dynamical variables - Eigen values and Eigen functions - Uncertainty Principle.

UNIT-II: One Dimensional and Three Dimensional Problems

One Dimensional: Particle in a box – simple harmonic oscillator - Square well potential – Barrier penetration – Three Dimensional: Orbital angular momentum and spherical harmonics - Central forces and reduction of two body problem - Particle in a Spherical well - Hydrogen atom.

UNIT-III: General formalism

Hilbert’s space - Dirac notation - Representation theory - Co-ordinate and momentum representations - Time evolution - Schrödinger, Heisenberg and Interaction pictures - Symmetries and conservation laws - Unitary transformations associated with translations and rotations.

UNIT-IV: Approximation methods

Time-independent perturbation theory for non- degenerate and degenerate levels - Application to ground state of an harmonic oscillator and Stark effect in Hydrogen - Variation method -Application to ground state of Helium atom - WKB approximation - WKB quantization rule - Application to simple Harmonic Oscillator.

UNIT-V: Angular momentum and identical particles

Books for Study:


Books for Reference:

7. J.J. Sakurai, 1985, Modern Quantum Mechanics, Benjamin Cummings
M.Sc. Physics : Syllabus (CBCS)

ELECTIVE

PAPER - 1

(to choose 1 out of 3)

A. ELECTRONIC DEVICES AND APPLICATIONS

UNIT-I: Fabrication of IC and logic families

Fabrication of IC - Monolithic integrated circuit fabrication - IC pressure transducers - Monolithic RMS - Voltage measuring device - Monolithic voltage regulators - Integrated circuit multipliers - Integrated circuit logic - Schottky TTL - ECL - I^2L - P and N-MOS Logic - CMOS Logic - Tristate logic circuits – PLA, PLC and PLD.

UNIT-II: Opto electronic devices

Light sources and Displays - Light emitting diodes - Surface emitting LED - Edge Emitting LED - Seven segment display - LDR - Diode lasers - Photo detectors - Basic parameters - Photo diodes - p-i-n Photo diode - Solar cells - Photo transistors - IR and UV detectors.

UNIT-III: 555 Timer and applications

555 Timer - Description - Monostable operation - Frequency divider - Astable operation - Schmitt trigger - Phase Locked Loops - Basic principles - Analog phase detector - Voltage Controlled Oscillator - Voltage to Frequency conversion - PLL IC 565 - Description - Lock-in range - Capture range - Application - Frequency multiplication.

UNIT-IV: Op-amp applications


UNIT-V: Pulse and digital Communication

Pulse communications - Introduction - Types - Pulse-Amplitude Modulation (PAM) - Pulse Time Modulation - Pulse Width Modulation (PWM) - Pulse Position Modulation (PPM) - Pulse Code Modulation (PCM) - Principles of PCM - Quantizing noise - Generation and Demodulation of PCM - Effects of Noise - Advantages and applications of PCM - Pulse systems - Frequency-
Shift keying - Digital communication - Modem classification - Modes of modem operation - Modem interconnection - Modem interfacing.

Books for Study:

3. R.A. Gaekwad, 1994, Op-Amps and integrated circuits EEE.

Books for Reference:

PAPER – 1

B. ELECTRONIC INSTRUMENTATION

UNIT-I: Transducers

Classification of Transducers - Principle, construction and working of Thermistor - LVDT, Electrical strain gauges and capacitive transducers, Photoelectric transducer, Piezoelectric transducer - Measurement of non-electrical quantities - Strain, Displacement, temperature, Pressure, Magnetic fields, vibration, optical and particle detectors.

UNIT-II: Digital Instrumentation

Principle, block diagram and working of Digital frequency counter, digital multimeter, digital pH meter, digital conductivity meter and digital storage oscilloscope.

UNIT-III: Analytical Instrumentation

Principle, block diagram, description, working and applications of UV-VIS spectrometer, IR spectrometer, Flame emission spectrometer and ICP - AES spectrometer - Basic concepts of Gas and Liquid Chromatography.

UNIT-IV: Bio-Medical Instrumentation

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 and EEG - recorders.

UNIT-V: Computer Peripherals

Printers - Printer mechanism – Classification - Dot matrix, Ink jet and laser printers - Basic concepts of key board and mouse. Mass data storage - floppy disk - Hard Disk - Optical disk (CD).

Books for Study:

1. Dr.Rajendra Prasad, Electronic Measurements and Instrumentation, Khanna Publications.
Books for Reference:

1. S.M. Dhir, Electronics and Instrumentation, Khanna Publishers, Khandpur,
2. Albert D. Heltrick, William D. Cooper, Modern Electronics Instrumentation and measurement Techniques, PHI.
M.Sc. Physics: Syllabus (CBCS)

PAPER – 1

ELECTRONICS COMMUNICATION SYSTEMS

UNIT I – Signal Encoding Techniques


UNIT II – Coding and Error Control


UNIT III – Satellite Communication


UNIT IV – Cellular wireless networks


UNIT V – Wireless LANS

REFERENCES:

SEMESTER II

PAPER-4

MATHEMATICAL PHYSICS II

UNIT-I: Complex Variables


UNIT –II: Partial differential equations


UNIT – III Laplace and Fourier Transforms


UNIT-IV: Group Theory

Definition of groups, subgroups and conjugate classes - Symmetry elements, Transformation, Matrix representation - Point groups - representation of a group - Reducible and irreducible representations - Orthogonality theorem - character of a representation - character Table C_{2v} and C_{3v} – Application to IR and Raman active vibrations of XY_3 molecules - Symmetry rotations SO(2) and SO(3) groups - Symmetry Unitary SU(2) and SU(3) groups.

UNIT –V Relativity

Relativistic mass-energy and momentum-energy relation – Relativistic Doppler effect – Velocity addition formula and its criticism - Relativistic Lagrangian and Hamiltonian for a particle – Minkowski’s Space – four vectors – space-time and energy-momentum four vectors – centre of mass system for two relativistic particles – Invariance of Maxwell’s field equations
Books for Study:

9. R.Resnick, Introduction to special theory of Relativity

Books for Reference:

UNIT I: Electrostatics

Laplace and Poisson equation – Boundary value problems - boundary conditions and uniqueness theorem – Laplace equation in three dimensions– Solution in Cartesian and spherical polar co ordinates – Examples of solutions for boundary value problems - Polarization and displacement vectors - Boundary conditions - Dielectric sphere in a uniform field – Molecular polarisability and electrical susceptibility – Electrostatic energy in the presence of dielectric – Multipole expansion.

UNIT II: Magnetostatics

Biot-Savart Law - Ampere's law - Magnetic vector potential and magnetic field of a localised current distribution - Magnetic moment, force and torque on a current distribution in an external field - Magnetostatic energy - Magnetic induction and magnetic field in macroscopic media - Boundary conditions - Uniformly magnetised sphere.

UNIT III: Maxwell Equations


UNIT IV: Electromagnetic Waves

Plane waves in non-conducting media - Linear and circular polarization, reflection and refraction at a plane interface- Fresnel’s law, interference, coherence and diffraction - Waves in a conducting medium - Propagation of waves in a rectangular wave guide - Inhomogeneous wave equation and retarded potentials - Radiation from a localized source - Oscillating electric dipole.

UNIT V: Elementary Plasma Physics

Books for study:


Books for reference:

UNIT-I: Scattering Theory

The scattering problem - formulation –cross sections - Scattering amplitude – Greens function approach - Born approximation and its validity - Partial wave analysis - optical theorem - Phase shifts - Scattering length and effective range - Low energy scattering - Transformation from centre of mass to laboratory frame.

UNIT-II: Perturbation Theory


UNIT-III: Relativistic Quantum Mechanism

Klein-Gordon equation - Failures - Dirac equation - Plane - wave solutions - Interpretation of negative energy states - Antiparticles - Spin of electron - Magnetic moment of an electron due to spin - Energy values in a coulomb potential.

UNIT-IV: Dirac equation

Covariant form of Dirac equation - properties of gamma matrices - Traces -Separation of the equation and the Hydrogen atom problem - Invariance of Dirac equation under Lorentz transformation - T-Transformation for the Dirac equation in presence of electromagnetic field.

UNIT-V: Quantisation of Fields

Relativistic Lagrangian and Hamiltonian of a charged particle in an electromagnetic field - The Lagrangian and Hamiltonian formulations of field – Quantum equation for the field - Second quantization of Klein-Gordon field - creation and annihilation operators - Commutation relations - Quantization of electromagnetic field - Quantization of Schroedinger's field - Quantization of Dirac field.
Books for Study:


Books for Reference:

MAIN PRACTICAL PAPER-1

GENERAL EXPERIMENTS

(Any 15 out of the given 25)

1. Cornu’s method - Young’s modulus by elliptical fringes.
2. Cornu’s method - Young’s modulus by hyperbolic fringes.
3. Determination of Stefan’s constant.
4. Band gap energy - Thermistor.
5. Hydrogen spectrum - Rydberg’s constant.
7. Permittivity of a liquid using RFO.
9. Solar spectrum - Hartmann’s Interpolation formula
10. F.P. Etalon using spectrometer.
11. Iron / Copper arc spectrum.
16. Edser and Butler fringes - Thickness of air film.
17. Spectrometer - Polarisability of liquids.
18. Spectrometer - Charge of an electron.
19. Determination of strain hardening co-efficient.
20. Thickness of the enamel coating on a wire - by diffraction.
22. Measurement of Numerical aperture (NA) of a telecommunication graded index optic fiber.
23. Fiber attenuation of a given optical fiber.
24. Determination of solar constant.
MAIN PRACTICAL

PAPER-2

ELECTRONICS EXPERIMENTS

(Any 20 out of the given 25)

1. FET as amplifier – frequency response, input impedance and output impedance.
2. Switching and power control using SCR and Triac.
4. Op-amp - Study of the attenuation characteristics and design of the phase-shift Oscillator.
5. Op-amp - Study of the attenuation characteristics and design of the Wien Bridge Oscillator.
6. Op-amp - Solving simultaneous equations
7. Op-amp - Design of square wave, saw tooth wave, and Triangular wave generators.
12. Study of (i) Multiplexer using IC 74150 for the generation of Boolean functions and (ii) Demultiplexer using IC 74154
13. IC 7490 -as modulus counters and display using IC-7447
15. IC 7476 - 4 bit Shift Register - Ring counter and Johnson counters.
16. IC 555 - Astable multivibrator and Voltage Controlled Oscillator.
17. IC 555 - Monostable multivibrator, Frequency Divider.
18. IC 555 - Schmitt Trigger and Hysteresis.
19. Temperature co-efficient using 555 timer.
20. Instrumentation Amplifier - using IC 741.
23. Phase Locked Loop.
24. Study of arithmetic and logical operations using IC74181
ELECTIVE

PAPER-2

(to choose 1 out of 3)

A. NANO SCIENCE

UNIT I: NANOSCALE SYSTEMS

Introduction to Nanoscale – Size-Dependent properties - Size effect - surface tension, wettability - specific surface area and surface area to volume ratio – Reason for change in optical properties, electrical properties and mechanical properties – nanoscale catalysis - Principles of Top-Down and Bottom-Up approaches.

UNIT II: SYNTHESIS OF NANOSTRUCTURE MATERIALS

Gas phase condensation – Vacuum deposition -Physical vapor deposition (PVD) - chemical vapor deposition (CVD) - Sol-Gel- Ball milling – spray pyrolysis – plasma based synthesis process (PSP) - hydrothermal synthesis - Etching technologies: wet and dry etching - photolithography – Drawbacks of optical lithography for nanofabrication - electron beam lithography – ion beam lithography - dip-pen nanolithography.

UNIT III: QUANTUM DOTS

Quantum confinement - Excitons and excitonic Bohr radius – difference between nanoparticles and quantum dots - Preparation through colloidal methods - Epitaxial methods- MOCVD and MBE growth of quantum dots - current-voltage characteristics - magneto tunneling measurements - Absorption and emission spectra of quantum dots - photo luminescence spectrum.

UNIT IV: CHARACTERIZATION:


UNIT V: APPLICATIONS OF NANOTECHNOLOGY:

Nanodiodes, Nanoswitches, molecular switches, Nano-logic elements - Single electron transistors - small metallic tunnel junctions - nanoparticles based solar cells and quantum dots based white LEDs – CNT based transistors –Surface acoustic wave (SAW) devices, microwave
MEMS, field emission display devices, - Super hard nanocomposite coatings and applications in tooling - Biochemistry and medical applications: lab-on-a-chip systems. Nanoboat – nanosubmarines - DNA engineering.

Books for study:

7. Principles of Nanoscience and Nanotechnology, M.A.Shah, Tokeer Ahmad

Books for references:

PAPER-2

B. FIBRE OPTICS

Unit I: Linear, nonlinear waves and Maxwell’s equations

Simple pendulum – small and large oscillations – Duffing oscillator – Linear and nonlinear medium - Maxwell’s equations – Electromagnetic waves phase and group velocity, modes in a planar and cylindrical wave guides – polarization - dielectric susceptibility – first and higher order susceptibilities.

Unit II: Optical fiber waveguides and sources

Ray theory transmission: Total internal reflection, acceptance angle, numerical aperture and skew rays – evanescent field and Goos-Haechen shift – step index and graded index fibers – single and multi-mode fibers.


Unit III: Transmission characteristics of optical fibers


Unit IV: Fabrication and connection of optical fibers


Unit V: Nonlinear effects in fiber and solitons in optical fiber communication


Books for study:


Books for reference:

PAPER-2

C. NON LINEAR OPTICS

Unit I: Lasers


Unit II: Introduction to Nonlinear Optics

Refractive index – frequency dependent and intensity dependent refractive index - Wave propagation in an anisotropic crystal – Polarization response of materials to light – Second harmonic generation – Sum and difference frequency generation – Phase matching -four wave mixing - Third harmonic generation – self focusing – Parametric amplification - bistability

Unit III: Multiphoton Processes


Unit IV: Nonlinear Optical Materials


Unit V: Fiber Optics


Books for Reference

SEMESTER III
PAPER-7
SPECTROSCOPY

UNIT-I: Microwave spectroscopy

Pure rotational spectra of diatomic molecules - Polyatomic molecules - Study of linear molecules and symmetric top molecules - Hyperfine structure and quadrupole moment of linear molecules - Experimental techniques - Molecular structure determination - Stark effect - inversion spectrum of ammonia - Applications to chemical analysis.

UNIT-II: Infrared spectroscopy


UNIT-III: Raman Spectroscopy

Classical theory of Raman Scattering - Raman effect and molecular structure - Raman effect and crystal structure - Raman effect in relation to inorganic, organic and physical chemistry - Experimental techniques - Coherent anti-Stokes Raman Spectroscopy - Applications of infrared and Raman spectroscopy in molecular structural confirmation of water and CO₂ molecules - Laser Raman Spectroscopy.

UNIT-IV: NMR and NQR Techniques


UNIT-V: ESR and Mossbauer Spectroscopy

Books for Study:


Books for Reference:

3. Towne and Schawlow, 1995, Microwave Spectroscopy, McGraw-Hill,
PAPER-8

NUCLEAR AND PARTICLE PHYSICS

UNIT I: Nuclear Interactions


UNIT II: Nuclear Reactions


UNIT III: Nuclear Models


UNIT IV: Nuclear Decay


UNIT V: Elementary Particle Physics

Types of interaction between elementary particles – Hadrons and leptons – Symmetries and conservation laws – Elementary ideas of CP and CPT invariance – Classification of hadrons – SU(2) and SU(3) multiplets – Quark model - Gell-Mann-Okubo mass formula for octet and decuplet hadrons – Charm, bottom and top quarks
Books for study:


Books for reference:

1. H. A. Enge, 1983, Introduction to Nuclear Physics, Addison-Wesley, Tokyo
3. Ghoshal, Atomic and Nuclear Physics, Vol. 2
6. I. Kaplan, 1989, Nuclear Physics, Narosa, New Delhi
7. B. L. Cohen, 1971, Concepts of Nuclear Physics, TMH, New Delhi
PAPER-9

MICROPROCESSOR AND MICROCONTROLLER

UNIT-I: 8085 Architecture and Programming


UNIT-II: Interfacing Memory and I/O devices

Interfacing memory and devices – I/O and Memory mapped I/O – Simple polled I/O and Handshaking operations - Programmable keyboard / display interface 8279 - Programmable peripheral device 8255A - 8253 Timer Interface - Wave form generation (Square, triangular and ramp wave) - Programmable communication interface 8251 (USART).

UNIT-III: Microcontroller 8051


UNIT IV: Interfacing I/O and Memory With 8051


UNIT V: Embedded Microcontroller

Books for Study


Books for Reference

ELECTIVE

PAPER-3

(to choose 1 out of 3)

A. CRYSTAL GROWTH AND THIN FILMS

UNIT I: Nucleation and Growth


UNIT II: Growth Techniques


UNIT III: Melt Growth Techniques


UNIT IV: Thin Film Deposition Techniques


UNIT V: Characterization Technique

Books for Study and Reference:

PAPER-3

B. ADVANCED SPECTROSCOPY

UNIT I: UV Spectroscopy


UNIT II: Atomic absorption and Emission Spectroscopy


UNIT III: Surface Enhanced Raman Scattering (SERS)


UNIT IV: Surface Spectroscopy


UNIT V: Nonlinear Spectroscopic Phenomena

BOOKS FOR STUDY


BOOKS FOR REFERENCE:

2. T. A. Carlson, 1975, Photo electron and Auger spectroscopy, Plenum Press.
UNIT-I: Methods of investigating nuclear size
Classification of nuclei, nuclear size - methods to investigate nuclear size - Mesonic X-rays, Electron scattering, Coulomb energies of mirror nuclei, neutron scattering methods

UNIT-II: Discovery and Properties of neutron
Discovery of neutron, neutron sources, - radioactive sources, Photo-neutron sources, accelerated particle sources – Detection of neutrons – General principles, slow neutron detectors by foil activation method, detection of fast neutrons by scintillation counter, fundamental properties of neutron.

UNIT-III: Classification and interaction of neutron
Classification of neutrons according to energy, Neutron –electron interactions, slowing down of fast neutrons, slowing down time, slowing down density, resonance escape probability, neutron diffusion-solution to diffusion equation, diffusion of fast neutrons-Fermi-age equation

UNIT-IV: Reactor Physics
Condition of criticality of nuclear reactor, the critical equation and buckling, critical reactor dimensions, criticality of large thermal reactors- migration length, the reflector reactor, continuum theory of nuclear reactions, optical model theory of nuclear reactions, photo-nuclear reactions.

UNIT-V: Nuclear fusion: Thermonuclear energy
Nuclear fusion, the fusion reaction, thermonuclear reactions, sources of stellar energy, controlled thermonuclear reactions, the possibility of fusion reactor, cold fusion and transuranic elements.
References:

1. The atomic nucleus, Robley D. Evans, TMH, New Delhi, 1982.


SEMESTER IV

PAPER-10

MATERIALS SCIENCE AND LASER PHYSICS

UNIT-I: Defects

Point defects - Schottky and Frenkel defects - number of defects as a function of temperature - Diffusion in metals - Diffusion and ionic conductivity in ionic crystals - Dislocations - Edge and screw dislocations - Burgers vector - Plastic deformation - Slip - Motion of dislocations under uniform shear stress - Stress fields around dislocations - Density - Work hardening - Effect of grain size on dislocation motion - Effect of solute atoms on dislocation motion.

UNIT-II: Optical Properties, Dielectric Properties and Ferro Electrics

Color centers - Photo conductivity - electronic transitions in photo conductors - Trap, Capture, recombination centers - General mechanism - Luminescence - Excitation and emission - Internal electric field in a dielectric - Clausius-Mossotti and Lorentz - Lorenz equations - Dielectric dispersion and loss - Ferroelectrics - Ferro electricity - General properties - Dipole theory - Ionic displacements and the behaviors of BaTiO$_3$.

UNIT-III: Elastic Behaviour, Polymer and Ceramics


UNIT-IV: Nano Material and Its Applications


UNIT-V: Laser Physics

Introduction - Interaction of radiation - with matter - Spontaneous and stimulated emission - Conditions for oscillation to occur - Frequency of oscillation of the system - Einstein coefficient - Possibility of amplification - Population inversion - Laser pumping Rate equations - Three level and four level system - Optical resonator - Types and modes of resonator -
Oscillation - Threshold condition. The confocal resonant cavity - theory - Spot size and beam divergence - quality factor (Q) of an optical cavity.

Books for Study:


Books for Reference:

PAPER-11

CONDENSED MATTER PHYSICS

UNIT-I: Crystal Physics


UNIT-II: Lattice dynamics

Monoatomic lattices - Lattice with two atoms per primitive cell - First Brillouin zone - Group and phase velocities - Quantization of lattice vibrations - Phonon momentum - Inelastic scattering by phonons - Debye’s theory of lattice heat capacity - Einstein’s model and Debye’s model of specific heat - thermal expansion - Thermal conductivity - Umklapp processes.

UNIT-III: Theory of metals and semiconductors


UNIT-IV: Magnetism


UNIT-V: Super conductivity

Books for Study:


Books for Reference:

PAPER-12

PROJECT WITH VIVA VOCE

Preamble

The concept of introducing the project will help the student community to learn and apply the principles of Physics and explore the new research avenues.

In the course of the project the student will refer books, Journals or collect literature / data by the way of visiting research institutes/ industries. He/she may even do experimental /theoretical work in his/her college and submit a dissertation report with a minimum of 40 pages not exceeding 50 pages.

Format for Preparation of Dissertation

The sequence in which the dissertation should be arranged and bound should be as follows

1. Cover Page and title Page
2. Declaration
3. Certificate
4. Abstract (not exceeding one page)
5. Acknowledgement (not exceeding one page)
6. Contents (12 Font size, Times new Roman with double line spacing)
7. List of Figures/ Exhibits/Charts
8. List of tables
9. Symbols and notations
10. Chapters
11. References

Distribution of marks for Dissertation (100 Marks)

(a) For Organization and presentation of Thesis – 60 marks
(b) For the novelty /Social relevance – 10 marks
(c) Presentation of work /Participation in state/ national level Seminar/publication – 5 marks
(d) Viva voce (Preparation, Presentation of work and Response to questions) - 25 marks
MAIN PRACTICAL

PAPER-3

ADVANCED GENERAL EXPERIMENTS

(Any 15 out of the given 20)

1. G.M. Counter - characteristics, Inverse square law.
2. G.M. Counter - Absorption co-efficient.
3. Michelson Interferometer - Wavelength and separation of wavelengths.
5. F.P. Etalon - using Michelson set up.
9. Susceptibility of a liquid by Quincke’s method.
10. Susceptibility of a liquid by Guoy’s method.
13. B-H curve using CRO.
15. Absorption Spectra.
16. Laser beam - Interference Experiments
   (a) Using on optically plane glass plate.
   (b) Using Lloyd’s single mirror method.
   (a) Diffraction at straight edge.
   (b) Diffraction at a straight wire.
   (c) Diffraction at a circular aperture.
18. Microwave experiment.
19. Determination of Planck’s constant.
20. Spectrophotometer - Beer’s law verification and absorption co-efficient.
MAIN PRACTICAL

PAPER-4

Microprocessor, Microcontroller and C Programming

(Any 20 out of the given 30)

Microprocessor 8085 programs

1. Number conversion - 8 bit and 16 bit: BCD to Binary, Binary to BCD, Hex to ASCII.
2. Square and square root of BCD and HEX numbers (both 8 and 16 bit).
3. Time delay subroutine and a clock programme.
4. Sum of simple series and arithmetic progression.
5. Interfacing (i) Op-amp 8 bit DAC R-2R network (ii) Switching an array of LEDs.
6. ADC and interfacing IC 0809 with MPU
7. Interfacing and programming IC 0800 with MPU – Unipolar and Bipolar.
8. Wave form generation – sine wave, square wave, triangular and ramp wave.
9. Analog to digital conversion using a DAC Comparator and MPU system.
10. Interfacing a DC stepper motor to the MPU system - clockwise and anticlockwise - full Stepping and half stepping.
11. Parallel and Serial communication between two microprocessor systems.
12. Interfacing a HEX keyboard to the MPU system through I/O ports.

Microprocessor 8086 programs using MASM

13. Addition, subtraction
14. Multiplication and division.
15. Multibyte addition/ Subtraction
16. Computation of LCM
17. Sorting in ascending/ descending order.
18. Factorial of a number

Microcontroller 8051 experiments

19. Addition, Subtraction
20. Multiplication and Division.
21. Block transfer
22. BCD to Binary conversion and binary to BCD
23. Sorting in ascending and descending order.
24. LED interface and Stepper motor interface.
Computation methods – C programming

25. Lagrange interpolation with algorithm, flow chart with program and its output
ELECTIVE
PAPER-4

A. ADVANCED MICROPROCESSOR

UNIT-I 8086 Architecture and programming


UNIT-II Software Programs of 8086

Assembly language Programming – Addition, subtraction and multiplication and division of two 16 bit numbers - Multibyte addition/subtraction – Ascending order – Sum of a series - Computation of LCM - Block transfer – Factorial of a number

UNIT-III: Memory and Interrupt interface of 8086 Microprocessor

Memory interface - block diagram - Hardware organization of the memory address space - Memory control signals - The stack - Stack segment register and stack pointer - RAM interface - Dynamic RAM interfacing and refreshing - Types of interrupts - Interrupt and address pointer table - Interrupt instructions - Masking of interrupts - External hardware interrupt interface - Interrupt sequence - 8259 Programmable interrupt controller (PIC)

UNIT-IV: 80286, 386 and 486 Microprocessor

Introduction to Intel Processor and its architecture 80286/ 80386 and 80486 microprocessors – block diagram of 386 and 486 - comparison - Pentium Processor –block diagram (Pentium II, III and IV) and its salient features – Multitasking concepts - Operating system concepts and terms - DISK operating system (DOS) - Multitasking and multiprogramming operating system (UNIX)
UNIT-V: Data communication and applications


Books for Study:

1. Douglas V. Hall : - Microprocessors and Interfacing programming and Hardware (Tata McGraw Hill)

Books For Reference:

1. B. Brey, 1995, Intel Microprocessors 8086/8088, 80186,80286,80486,80486, Architecture, Programming and Interfacing
PAPER-4

B. PROGRAMMING IN C AND MATLAB

UNIT-I: Data types, managing input and output operations


UNIT-II: Operators, Expressions and Arrays

Arithmetic, relational, logical, assignment, increment, decrement, conditional, bitwise special operators –Arithmetic expressions- evaluation of expressions, precedence of arithmetic operators-one dimensional arrays, two dimensional arrays, multi dimensional arrays-declaration and initialization of arrays.

UNIT-III Decision making, Branching and Looping

Simple if, If-else, If-else ladder, switch, go-to statements- While, DO, FOR statements, simple programs using these statements.

UNIT-IV: Functions and Application programs

Programs for finding square root of second degree algebraic equations-matrix addition, multiplication, diagonalisation and inversion-Solution of simultaneous equations- Gauss elimination method, Solution of first order differential equations- Euler’s method, runge Kutta IV order method, numerical integration-Simpson’s 1/3 rule.

UNIT-V: MATLAB


Books for study:

3. E. Balagurusamy, Numerical methods, Tata McGraw
Books for Reference:

1. MATLAB 7.0 Basics, P. Howard, spring, 2005.
PAPER-4

C. NUMERICAL METHODS AND PROGRAMMING in C

UNIT-I: Errors and the measurements


UNIT-II: Numerical solution of algebraic and transcendental equations


UNIT-III: Interpolation

Linear interpolation – Lagrange interpolation Gregory – Newton forward and backward Interpolation formula – Central difference interpolation formula – Gauss forward and backward interpolation formula – Divided differences – Properties – Newton’s interpolation formula for unequal intervals – C programming for Lagrange’s interpolation

UNIT-IV: Numerical differentiation and integration

Newton’s forward and backward difference formula to compute derivatives – Numerical Integration: the trapezoidal rule, Simpson’s rule – Extended Simpson’s rule – C program to evaluate integrals using Simpson’s and trapezoidal rules.

UNIT-V: Numerical Solutions of ordinary differential equations


Books for study and Reference:


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