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

S.NO.	Study Components		Ins. hrs /week	Credit	Title of the Paper	Maximum Marks		
	Course Title							
	SEMESTER I					**CIA**	**Uni. Exam**	**Total**
1	MAIN	Paper-1	6	5	Mathematical Physics -I	25	75	100
2	MAIN	Paper-2	6	5	Classical and Statistical Mechanics	25	75	100
3	MAIN	Paper-3	5	5	Quantum Mechanics - I	25	75	100
4	MAIN PRACTICAL	Paper-1	4	-	General Experiments	-	-	-
5	MAIN PRACTICAL	Paper-2	4	-	Electronics Experiments	-	-	-
6	ELECTIVE	Paper-1	5	3	**(to choose 1 out 3)** A. Electronic Devices and Applications B. Electronics Instrumentation C. Electronics communication systems	25	75	100
			30	**18**		**125**	**375**	**400**
	SEMESTER II					**CIA**	**Uni. Exam**	**Total**
7	MAIN	Paper-4	5	4	Mathematical Physics -II	25	75	100
8	MAIN	Paper-5	5	4	Electromagnetic Theory and Plasma Physics	25	75	100
9	MAIN	Paper-6	5	5	Quantum Mechanics II	25	75	100
10	MAIN PRACTICAL	Paper-1	4	4	General Experiments	40	60	100
11	MAIN PRACTICAL	Paper-2	4	4	Electronics Experiments	40	60	100
12	**Compulsory Paper**		2	2	**Human Rights**	25	75	100
13	ELECTIVE	Paper-2	5	3	**(to choose 1 out 3)** A. Nano Science B. Fibre Optics C. Non linear Optics	25	75	100
			30	**26**		**150**	**450**	**700**

SEMESTER III						CIA	Uni. Exam	Total
14	MAIN	Paper-7	5	5	Spectroscopy	25	75	100
15	MAIN	Paper-8	5	5	Nuclear and Particle Physics	25	75	100
16	MAIN	Paper-9	5	5	Microprocessor and Microcontroller	25	75	100
17	MAIN PRACTICAL	Paper-3	5	-	Advanced General Experiments	-	-	-
18	MAIN PRACTICAL	Paper-4	5	-	Microprocessor, Microcontroller and C Programming	-	-	-
19	ELECTIVE	Paper-3	5	3	**(to choose 1 out 3)** A. Crystal Growth and Thin Films B. Advanced Spectroscopy C. Advanced Nuclear Physics	25	75	100
			30	**18**		**125**	**375**	**400**
SEMESTER IV						**CIA**	**Uni. Exam**	**Total**
20	MAIN	Paper-10	5	5	Material Science and Laser Physics	25	75	100
21	MAIN	Paper-11	5	5	Condensed matter Physics	25	75	100
22	MAIN	Paper-12	5	5	Project with *viva voce*	100	0	100
23	MAIN PRACTICAL	Paper-3	5	5	Advanced General Experiments	40	60	100
24	MAIN PRACTICAL	Paper-4	5	5	Microprocessor, Microcontroller and C Programming	40	60	100
25	ELECTIVE	Paper-4	5	3	**(to choose 1 out 3)** A. Advanced Microprocessor B. C Programming and MATLAB C. Numerical Methods and programming in C	25	75	100
			30	**28**		**255**	**345**	**600**

Subject	**Papers**	**Credit**	**Total Credits**	**Marks**	**Total marks**
MAIN	12	4-5	58	100	1200
MAIN PRACTICAL	4	4-5	18	400	400
ELECTIVE	4	3	12	100	400
COMPULSORY PAPER	1	2	2	100	100
Total	**21**	**-**	**90**	**-**	**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

Coordinate transformation– summation convention - Contravariant, Covariant and mixed tensors – Rank of a tensor – symmetric and anti-symmetric tensors - Invariant tensors - Kronecker delta, Levi-civita tensor in three dimensions – contraction of tensors - product rule - Quotient rule - tensors of higher rank- Tensor forms of Operators

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:

1. P.K. Chattopadhyay, 1990, Mathematical Physics, Wiley Eastern, Madras.
2. G. Arfken and H.J. Weber, 2001, Mathematical Methods for Physicists, 5^{th} Edition, Harcourt (India), New Delhi.
3. M.D. Greenberg, 1998, Advanced Engineering Mathematics, 2nd Edition, International Ed., Prentice - Hall International, New Jersey.
4. E. Kreyszig., 1999, Advanced Engineering Mathematics, 8th Ed. Wiley, New York.
5. B.D. Gupta, 2006, Mathematical Physics, Vikas publishing house Third edition, New Delhi.
6. Satyaprakash, 2004, Mathematical Physics, Sultan Chand & sons, New Delhi.

Books for Reference:

1. Schaum's outline series, McGraw Hill 1964, (i) Vector and tensor analysis, (ii) Linear Algebra, (iii) Matrices, (iv) Differential Equations (v) Probability (vi) Statistics
2. P.R Halmos, 1965, Finite dimensional Vector Spaces, 2nd Edition. Affiliated East - West, New Delhi.
3. C.R. Wylie and LC. Barrett, 1995, Advanced Engineering Mathematics, 6th Edition., International Edition. McGraw Hill, New York.
4. P.K. Chakrabarti and S.N. Kundu, 1996, A Text Book of Mathematical Physics, New Central Book Agency, Kolkata.
5. A.K. Ghatak, I.C. Goyal and S.H. Chua, 2002, Mathematical Physics Macmillan India, New Delhi.

PAPER-2

CLASSICAL AND STATISTICAL MECHANICS

PART A: CLASSICAL MECHANICS

UNIT-I: Lagrangian and Hamiltonian formulation

Hamilton's Variational Principle and Lagrange's equation - Lagrange Problems - Double Pendulum, Spherical pendulum, Cylinder rolling down an inclined plane - Hamilton's equations - cyclic variables – Principle of least action – Hamiltonian Problems - motion of a particle in a central force field, charged particle moving in an electromagnetic field – Equations of motion and first integrals – Kepler's laws – Scattering by central potential – Transformation from centre of mass to laboratory frame.

UNIT-II: Rigid body dynamics and Canonical transformations

Rigid body motion – Kinematics - Euler's angles - Angular momentum and kinetic Energy – Moment of inertia tensor - Euler's equations of motion – Torque-free motion of a rigid body - Motion of a symmetrical top under the action of gravity - Canonical transformation and their generators – simple examples – Poisson brackets – Equations of motion in Poisson bracket form - Noether's theorem.

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

Hamilton-Jacobi equations – application to Linear Harmonic Oscillator problem - Action Angle variables - Application to Kepler's problem - Oscillatory motion - Theory of small oscillation – Two coupled pendulums - Linear triatomic molecule - Stability of Oscillatory motion - Forced Harmonic Oscillator - non- linear Oscillation in a symmetric potential.

PART B : STATISTICAL MACHANICS

UNIT-IV: Thermodynamics and Classical statistics

Entropy, Free energy – thermodynamic potentials – Gibbs phase rule – First and second order phase transitions – Ehrenfest's equations - Random walk - Brownian motion - Langevin theory and Einstein theory.

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

Quantum Statistics of ideal gas - Ideas of Bose-Einstein and Fermi-Dirac Particles - Degeneracy of gases - Bose-Einstein condensation of gases - Photon gas - Planck's law of radiation and its limitation - Thermionic emission - Pauli's theory of Paramagnetism - Ising model

Books for Study:

1. H. Goldstein, 2002, Classical Mechanics. 3rd Edition. Pearson Education, Asia, New Delhi.
2. S.N. Biswas, 1998, Classical Mechanics, Books and Allied Ltd., Kolkata.
3. Upadhyaya, 1999, Classical Mechanics, Himalaya Publishing Co., New Delhi.
4. Gupta Kumar Sharma, Classical Mechanics, 2004, Pragati Prakashan, Meerut.
5. K. Huang, 1975, Statistical Mechanics, Wiley Eastern Ltd., New Delhi.
6. B.K. Agarwal and M. Eisner, 1998, Statistical Mechanics, 2nd Edition, New Age International, New Delhi.
7. Sathya Prakash and J.P Agarwal, 1994, Statistical Mechanics, 7th Edition, Kedar Nath and Ram Nath & Co, Meerut.
8. J.K.Bhattacharjee, 1996, Statistical Mechanics: An Introductory Text, Allied Publication, New Delhi.

Books for Reference:

1. L.D. Landau and E.M. Lifshitz, 1969, Mechanics, Pergomon Press, Oxford.
2. K.R. Symon, 1971, Mechanics, Addison Wesley, London.
3. J.L. Synge and B.A Griffith, 1949, Principles of Classical Mechanics, Mc.Graw-Hill, NewYork.
4. C.R.Mondal, Classical Mechanics, Prentice - Hall of India, New Delhi.
5. L.P. Kadanoff, 2001, Statistical Physics - Statics, Dynamics and Renormalization, World Scientific, Singapore.
6. M. Glazer and J. Wark, 2001, Statistical Mechanics, Oxford University Press, Oxford.

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

Ladder Operators - Commutation rules for angular momentum operators - Eigen value spectrum from angular momentum algebra - Matrix representation - Spin angular momentum – Non-relativistic Hamiltonian including spin - Addition of two angular momenta - Clebsch-Gordan coefficients - Symmetry and anti symmetry of wave functions - Pauli's spin matrices.

Books for Study:

1. P.M. Mathews and K. Venkatesan, 1976, A Text book of Quantum Mechanics, Tata McGraw-Hill, New Delhi.
2. L.I. Schiff, 1968, Quantum Mechanics, 3rd Edition, International Student Edition,McGraw-Hill Kogakusha, Tokyo.
3. V. Devanathan, 2005, Quantum Mechanics, Narosa Publishing House, New Delhi.
4. V.K. Thankappan, 1985, Quantum Mechanics, 2nd Edition, Wiley Eastern Ltd, NewDelhi.

Books for Reference:

1. E. Merzbacher, 1970, Quantum Mechanics 2nd Edition, John Wiley and Sons, NewYork.
2. P.A.M. Dirac, 1973, The Principles of Quantum Mechanics, Oxford University Press, London.
3. L.D. Landau and E.M. Lifshitz, 1976, Quantum Mechanics, Pergomon Press, Oxford.
4. Ajoy Ghatak, Loganathan, 1999, Quantum Mechanics theory and applications, Fourth edition, Macmillan
5. Franz Schwabl, 1998, Quantum Mechanics, Narosa Publishing House.
6. B.S. Rajput, 2007, Advanced Quantum Mechanics, Seventh Edition, A Pragati Prakashan
7. J.J.Sakurai, 1985, Modern Quantum Mechanics, Benjamin Cummings
8. R.P. Feynman, R.B.Leighton and M.Sands, 1992, The Feynman Lectures on Physics, Vol.3, Narosa Publishing House.

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

Instrumentation amplifier - V to I and I to V converter - Op-amp circuits using diodes - Sample and Hold circuits - Log and Antilog amplifiers - Multiplier and Divider - Electronic analog Computation solving simultaneous and differential equation- Schmitt Trigger - Astable, Monostable Multivibrator – Triangular wave generator - Sine wave generator - Active filters – Low, High and Band pass first and second order Butterworth filters – wide and narrow band reject filters.

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:

1. S.M. Sze, 1985, Semiconductor Devices - Physics and Technology, Wiley, New York.
2. Millman and Halkias, Integrated Electronics, McGraw-Hill, New Delhi.
3. R.A. Gaekwad, 1994, Op-Amps and integrated circuits EEE.
4. Taub and Shilling, 1983, Digital Integrated Electronics, McGraw-Hill, New Delhi.
5. J. Millman, 1979, Digital and Analog Circuits and Systems, McGraw-Hill, London.
6. George Kennedy, 1987, Electronic communication systems 3rd Edition, McGraw-Hill, London.

Books for Reference:

1. R.F. Coughlin and F.F, Driscol, 1996, Op-Amp and linear integrated circuits, Prentice Hall of India, New Delhi.
2. M.S.Tyagi, Introduction to Semiconductor Devices, Wiley, New York.
3. P. Bhattacharya, 2002, Semiconductor Optoelectronic Devices, 2nd Edition, Prentice-Hall of India, New Delhi.
4. Deboo/ Burrous, 1985, Integrated circuits and semiconductor Devices – Theory and application, McGraw-Hill, New Delhi.
5. D. Roy Choudhury, 1991, Linear integrated circuits, Wiley Eastern, New Delhi.
6. Ramakant Gaekwad, 1981, Operational amplifiers, Wiley Eastern, New Delhi

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.
2. S.Ramabhadran, 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.

PAPER – 1

ELECTRONICS COMMUNICATION SYSTEMS

UNIT I- Signal Encoding Techniques

Antennas: types-Propagation modes – line of sight transmission- fading in the mobile environment – signal encoding techniques: criteria- ASK – FSK – BFSK – MFSK – PSK – BPSK – QPSK –multilevel PSK – AM modulation – Angle modulation – PCM – delta and adaptive delta modulation.

UNIT II – Coding and Error Control

Error detection – Parity check – cycle redundancy check – block error correction codes – hamming code – cyclic codes – BCH code – reed – Solomon codes – block interleaving – convolution codes – decoding – turbo coding – automatic repeat request – flow control – error control

UNIT III – Satellite Communication

Satellite parameters and configurations – Satellite orbits – GEO – MEO – LEO – frequency bands – transmission impairments – Satellite foot print – atmospheric attenuation – satellite network – configuration – capacity allocation – multiplexing : FDM and TDM.

UNIT IV – Cellular wireless networks

Principles of cellular networks : Organization – frequency reuse – operation – mobile radio propagation effects – hand-off – power control – traffic engineering – first generation analog – AMPS – second generation – TDMA – mobile wireless TDMA design consideration – CDMA – mobile wireless CDMA design considerations – Soft handoff –IS 95 – Third generation systems – wireless local loop.

UNIT V – Wireless LANS

Overview: Wireless LAN applications – wireless LAN requirements – wireless LAN technology – Infrared LANS – spread spectrum LANS – narrow band microwave LANS – IEEE 802 architecture – IEEE 802.11 architecture.

REFERENCES:

1. Wireless communications and Networks – William Stallings – Pearson education - Asia (2002)
2. Electronic communications, modulation and transmission – Robert J. Schoen beck, PHI, (1999).
3. Telecommunication switching and networks – P. Gnanasivam, PHI (2004).

SEMESTER II

PAPER-4

MATHEMATICAL PHYSICS II

UNIT-I: Complex Variables

Functions of a complex variable – Single and multi valued functions - Analytic functions - Cauchy Riemann conditions – Singular points - Cauchy's integral theorem and formula - Taylor and Laurent expansions – Zeros and poles - Residue theorem - applications to evaluation of definite integrals.

UNIT –II: Partial differential equations

Laplace's equations – solutions of Laplace's using cylindrical and spherical harmonics – Diffusion equation (Fourier equation of heat flow) – solutions of two and three dimensional heat flow - Wave equations – D' Alembert's solution - Interpretation - Vibrations of a rectangular membrane – Normal modes in three dimensions

UNIT – III Laplace and Fourier Transforms

Laplace transforms: solution of linear differential equations with constant Coefficients – Fourier integral. Fourier transforms: Fourier sine and cosine transforms – Convolution theorems – Applications.

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:

1. P.K. Chattopadhyay, 1990, Mathematical Physics Wiley Eastern, Madras.
2. G. Arfken and H.J. Weber, 2001, Mathematical Methods for Physicists, 5th Edition, Harcourt (India), New Delhi.
3. M.D. Greenberg, 1998, Advanced Engineering Mathematics, 2nd Edition, International Ed., Prentice - Hall International, New Jersey.
4. E. Kreyszig., 1999, Advanced Engineering Mathematics, 8th Ed. Wiley, New York.
5. B.D. Gupta, 2006, Mathematical Physics, Vikas publishing house Third edition, New Delhi.
6. Satyaprakash, 2004, Mathematical Physics, Sultan Chand & sons, New Delhi.
7. F.A. Cotton, Chemical Application of Group Theory 3rd Edition, John Wiley and Sons, New York.
8. A.W. Joshi, 1997, Elements of group Theory for Physicists, 4th Edition, New Age International, New Delhi.
9. R.Resnick, Introduction to special theory of Relativity
10. D.Rindler, 1982, Special Theory of Relativity, Oxford University Press.

Books for Reference:

1. Schaum's outline series, McGraw Hill 1964, (i) Complex Variables, (ii) Laplace Transforms, (iii) Group Theory, (iv) Differential equations
2. P.R Halmos, 1965, Finite dimensional Vector Spaces, 2nd Edition. Affiliated East - West, New Delhi.
3. M. Hamermesh, 1962, Group Theory and Its application to Physical Problems Addison Wesley, London.
4. C.R. Wylie and LC. Barrett, 1995, Advanced Engineering Mathematics, 6th Edition., International Edition. McGraw Hill, New York.
5. P.K. Chakrabarti and S.N. Kundu, 1996, A Text Book of Mathematical Physics, New Central Book Agency, Kolkata.
6. A.K. Ghatak, I.C. Goyal and S.H. Chua, 2002, Mathematical Physics Macmillan India, New Delhi.

PAPER-5

ELECTROMAGNETIC THEORY AND PLASMA PHYSICS

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

Faraday's laws of Induction - Maxwell's displacement current - Maxwell's equations – free space and linear isotropic media - Vector and scalar potentials - Gauge invariance - Wave equation and plane wave solution- Coulomb and Lorentz gauges - Energy and momentum of the field - Poynting's theorem - Lorentz force - Conservation laws for a system of charges and electromagnetic fields.

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

The Boltzmann Equation - Simplified magneto-hydrodynamic equations - Electron plasma oscillations - The Debye shielding problem - Plasma confinement in a magnetic field - Magneto-hydrodynamic waves - Alfven waves and magnetosonic waves.

Books for study:

1. D.J. Griffiths, 2002, Introduction to Electrodynamics, 3rd Edition, Prentice-Hall of India, New Delhi.
2. J.R. Reitz, F. J. Milford and R. W. Christy, 1986, Foundations of Electromagnetic Theory, 3rd edition, Narosa Publication, New Delhi.
3. J. D. Jackson, 1975, Classical Electrodynamics, Wiley Eastern Ltd. New Delhi.
4. J. A. Bittencourt, 1988, Fundamentals of Plasma Physics, Pergamon Press, Oxford.
5. P.Lorrain and D.Corson, 1986, Electromagnetic fields and waves, CBS Publishers and distributors.

Books for reference:

1. W. Panofsky and M. Phillips, 1962, Classical Electricity and Magnetism, Addison Wesley, Lodon.
2. J. D. Kraus and D. A. Fleisch, 1999, Electromagnetics with Applications, 5th Edition, WCB McGraw-Hill, New York.
3. B. Chakraborty, 2002, Principles of Electrodynamics, Books and Allied, Kolkata.
4. R. P. Feynman, R. B. Leighton and M. Sands, 1998, The Feynman Lectures on Physics, Vols. 2, Narosa, New Delhi..

PAPER-6

QUANTUM MECHANICS II

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

Time dependent perturbation theory - Constant and harmonic perturbations - Transition probabilities - Fermi's-Golden rule - Selection rules for dipole radiation - Adiabatic approximation - Sudden approximation - The density matrix - spin density matrix and magnetic resonance - Semi classical treatment of an atom with electromagnetic radiation.

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:

1. P.M. Mathews and K. Venkatesan, 1976, A Text book of Quantum Mechanics, Tata Mc Graw-Hill, New Delhi.
2. L.I. Schiff, 1968, Quantum Mechanics, 3rd Edition, International Student Edition, McGraw-Hill, Kogakusha, Tokyo.
3. E. Merzbacher, 1970, Quantum Mechanics, 2nd Edition, John Wiley and Sons, NewYork.
4. J.D. Bjorken and S.D. Drell, 1964, Relativistic Quantum Mechanics, McGraw-Hill, New York.
5. V. Devanathan, 2005, Quantum Mechanics, Narosa Publishing House, New Delhi.
6. P.A. M. Dirac, 1973, The Principles of Quantum Mechanics, Oxford University Press, London.
7. B.K. Agarwal, 1976, Quantum Mechanics and Field Theory, Lokbharti Publications, India.
8. Amitabha Lahiri and B.G. Pal, 2005, A First Book of Quantum Field Theory, Narosa Publications, New Delhi.

Books for Reference:

1. V.K. Thankappan, 1985, Quantum Mechanics, 2nd Edition, Wiley Eastern Ltd, New Delhi.
2. V. Devanathan, 1999, Angular Momentum Techniques in Quantum Mechanics, Kluwer Academic Publishers, Dordrecht.
3. L.D. Landau and E.M. Lifshitz, 1958 Quantum Mechanics, Pergomon Press, London.
4. J.S. Bell, Gottfried and M. Veltman, 2001, The Foundations of Quantum Mechanics, World Scientific.
5. G. Aruldhas, 2002, Quantum Mechanics, Prentice-Hall of India, New Delhi.
6. Claude Itzykson and Isau Bernard Zuber, 1987, Quantum Field Theory, McGraw-Hill International Edition.
7. Leslie E. Vallentine, 1998, Quantum Mechanics - A Modern Development, World Scientific Publications Pvt. Ltd, Singapore.

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.
6. Co-efficient of linear expansion - Air wedge method.
7. Permittivity of a liquid using RFO.
8. Viscosity of liquid - Meyer's disc.
9. Solar spectrum - Hartmann's Interpolation formula
10. F.P. Etalon using spectrometer.
11. Iron / Copper arc spectrum.
12. Brass / Alloy arc spectrum.
13. B-H loop using Anchor ring.
14. Specific charge of an electron -Thomson's method / Magnetron method.
15. Electrical resistance of a metal / alloy by four probe method- as a function of temperature.
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.
21. Lasers: Study of laser beam parameters.
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.
25. Biprism - Wavelength of monochromatic source - Refractive Index of a liquid.

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.
3. Op-amp - Inverting, Non-inverting amplifier - Voltage follower - summing, difference, average amplifier - differentiator and integrator.
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.
8. Op-amp - Design of Schmitt Trigger and construction of Monostable multivibrator.
9. Op-amp - Design of active filters - second order - low pass, high pass, band pass and band rejecter.
10. Op-amp – 4 bit D/A converter - Binary weighted method and R-2R ladder method.
11. Arithmetic operations (Adder/Subtractor) Using IC 7483.
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
14. Up-down counters - Design of modulus counters.
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.
21. Pulse width modulator using IC 741.
22. A/D converter using comparator LM 339.
23. Phase Locked Loop.
24. Study of arithmetic and logical operations using IC74181
25. Study of A/D converters – 4 bit simultaneous A/D converter and successive approximation A/D converter using ADC IC 0801/IC 0804.

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:

Nano SEM - Scanning Conducting microscopy (SCM) - High-resolution Transmission Electron Microscopy (HRTEM) - single nanoparticle characterization –Scanning capacitance microscopy. Principle and working of Atomic Force Microscopy (AFM) and Scanning tunneling microscopy (STM) – Principle of Transmission Electron Microscopy (TEM) – applications to nanostructures – nanomechanical characterization – nanoindentation

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:

1. Nanotechnology by S. Shanmugam, TBH Edition.
2. Nano- the essential, T. Praddetp, Mc graw hill education, Chennai.
3. Physics and Chemistry of Metal cluster components, De Jongh J, 1994, Kulwer academic publishers, Dordrecht.
4. Nanoscale Materials in Chemistry, Kenneth J. Klabunde, 2001 Wiley & Sons, Publcn.
5. Nanosystems, Dexler E, John Wiley, CNY, 1992.
6. Nanotechnology: Principles and Practices, Sulabha K.Kulkarni, Capital Publishing company
7. Principles of Nanoscience and Nanotechnology, M.A.Shah, Tokeer Ahmad

Books for references:

1. Nanotechnology, AIP Press, Springer-Verlag, Gregory Timp, editor, 1999, New York, (ISBN 0-387-98334-1),
2. Nanoscale characterization of surfaces & interfaces, N. JohnDinardo, Weinheim Cambridge: Wiley-VCH, 2000 2nd Ed.
3. Semiconductors for micro and nanotechnology-An introduction for engineers, Jan Korvink & Andreas Greiner, Weinheim Cambridge: Wiley-VCH, 2001.
4. Nanomaterials and mechanics,W. Kamliu et. Al John Wiley.
5. Hand Book of Nanosciene, Engineering and Technology – The Electrical Engineering handbook series.

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.

Sources: LED - Lasers – mode locked Lasers - modulation capability- transient response - semiconductor losses - diode structure and threshold conditions – modulation – temperature effects – source linearity and reliability – Photo detectors – PIN Photo detector – avalanche photodiode.

Unit III: Transmission characteristics of optical fibers

Attenuation – material absorption losses in silica fibers – linear and nonlinear scattering losses – fiber bend loss – mid-infrared and far-infrared transmission – intramodal and intermodal dispersion – overall fiber dispersion in multimode and single-mode fibers – modal birefringence.

Unit IV: Fabrication and connection of optical fibers

Glass fibers - Preparation of optical fibers – Liquid-phase (melting) and Vapour-phase deposition techniques – characteristics of single-mode, multimode, plastic-clad and all-plastic fibers - Stability of the Fiber Transmission Characteristics: Micro bending and hydrogen absorption – fiber alignment and joint loss – fiber splices – Fiber connectors: cylindrical ferrule expanded beam connectors - Fiber couplers: Three and four port couplers - star couplers.

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

Refractive index – frequency and intensity dependent refractive index – group velocity dispersion – self-phase modulation - Kerr effect – chirping - stimulated Raman scattering – stimulated Brillouin scattering – self-steepening – self-focusing – self-defocusing – concept of

solitons – formation of solitons – kdV equation - Nonlinear Schrödinger equation for solitons – soliton switching – soliton laser- advantages of soliton based communication.

Books for study:

1. Introduction to fiber optics, Ajoy Ghatak and K. Thyagarajan, Cambridge University press, 6th ed., 2006.
2. Optical fiber communications: Principles and practice, John M. Senior, PHI, 2nd edition.
3. Fiber-Optic communication systems, Govind P. Agrawal, John Wiley, 2003.
4. Waves called solitons: concepts and experiments, Springer Verlag, 1992.

Books for reference:

1. Optical fiber communications, Gerd Keiser, McGra-Hill, 2nd edition.
2. Lasers and Non-Linear optics, B.B. Laud, New Age International, New Delhi.
3. Solitons in optical communications, Akira Hasegawa and Yujiodama,, Oxford Press, 1995.
4. Nonlinear fiber optics – Robert W Boyd, Elsevier, 2nd ed., 2006.

PAPER-2

C. NON LINEAR OPTICS

Unit I: Lasers

Gas lasers – He-Ne, Az + ion lasers – Solid state lasers – Ruby – Nd: YAG, Ti Sapphire –Organic dye laser – Rhodamine – Semiconductor lasers – Diode laser, p-n-junction laser, GaAs Laser

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

Two photon process – Theory and experiment – Three photon process parametric generation of light – Oscillator – Amplifier – Stimulated Raman scattering – Intensity dependent refractive index optical Kerr effect – photorefractive, electron optic effects

Unit IV: Nonlinear Optical Materials

Basic requirements – Inorganics – Borates – Organics – Urea, Nitro aniline – Semi organics – Thiourea complex – X-ray diffraction, FTIR and FT-NMR qualitative study – Kurtz test – Laser induced surface damage threshold

Unit V: Fiber Optics

Step – Graded index fibers – wave propagation – Fiber modes – Single and multimode fibres – Numerical aperture – Dispersion – Fiber bandwidth – Fiber loss – Attenuation coefficient – Material absorption

Books for Reference

1. B.B. Laud, Lasers and Nonlinear Optics, 2nd Edn. New Age International (P) Ltd., New Delhi, 1991

2. Robert W. Boyd, Nonlinear Optics, 2nd Edn., Academic Press, New York, 2003
3. Govind P. Agarwal, Fiber-Optics Communication Systems, 3rd Edn. John Wiley & Sons, Singapore 2003
4. William T. Silvast, Laser Fundamentals, Cambridge University Press, Cambridge 2003
5. Nonlinear Optics – Basic Concepts D.L. Mills, Springer, Berlin 1998.

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 quadruple moment of linear molecules - Experimental techniques - Molecular structure determination - Stark effect - inversion spectrum of ammonia - Applications to chemical analysis.

UNIT-II: Infrared spectroscopy

Vibrational spectroscopy of diatomic and simple polyatomic molecules - Harmonic Oscillator - Anharmonic Oscillator - Rotational vibrators - Normal modes of vibration of Polyatomic molecules - Experimental techniques - Applications of infrared spectroscopy - H_2O and N_2O molecules - Reflectance 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 CO_2 molecules - Laser Raman Spectroscopy.

UNIT-IV: NMR and NQR Techniques

Theory of NMR - Bloch equations - Steady state solution of Bloch equations - Theory of chemical shifts - Experimental methods - Single Coil and double coil methods - Pulse Method - High resolution method - Applications of NMR to quantitative measurements. Quadruple Hamiltonian of NQR - Nuclear quadruple energy levels for axial and non-axial symmetry - Experimental techniques and applications.

UNIT-V: ESR and Mossbauer Spectroscopy

Quantum mechanical treatment of ESR - Nuclear interaction and hyperfine structure - Relaxation effects - Basic principles of spectrographs - Applications of ESR method - Mossbauer Effect - Recoillness emission and absorption - Mossbauer spectrum - Experimental methods - Mossbauer spectrometer - Hyperfine interactions - Chemical Isomer shift - Magnetic hyperfine interactions - Electric quadruple interactions - Simple biological applications.

Books for Study:

1. C.N. Banwell and E.M. Mc Cash, 1994, Fundamentals of Molecular Spectroscopy, 4th Edition, Tata McGraw-Hill Publications, New Delhi.
2. G. Aruldas, 2001, Molecular Structure and Spectroscopy, Prentice - Hall of India Pvt.Ltd., New Delhi.
3. D.N. Satyanarayana, 2004, Vibrational Spectroscopy and Applications, New Age International Publications, New Delhi.
4. Raymond Chang, 1980, Basic Principles of Spectroscopy, Mc Graw-Hill Kogakusha

Books for Reference:

1. Straughn and Walker, 1967, Spectroscopy, Vol I &II Chapman and Hall.
2. Atta Ur Rahman, 1986, Nuclear Magnetic Resonance, Spinger Verlag, New York.
3. Towne and Schawlow, 1995, Microwave Spectroscopy, McGraw-Hill,
4. Raymond Chang, 1980, Basic Principles of Spectroscopy, Mc Graw-Hill, Kogakusha, Tokyo.
5. D.A. Lang, Raman Spectroscopy, Mc Graw-Hill International, N.Y.
6. John Ferraro, 2008, Introductory Raman Spectroscopy, Academic Press.

PAPER-8

NUCLEAR AND PARTICLE PHYSICS

UNIT I: Nuclear Interactions

Nuclear forces – Exchange forces - Two body problem – ground state of duetron - Magnetic moment – quardrupole moment - Tensor forces –Nucleon-nucleon interaction –Meson theory of nuclear forces –Yukawa potential – Nucleon-Nucleon scattering – Effective range theory – Spin dependence of nuclear forces – Charge independence and charge symmetry of nuclear forces – Isospin formalism.

UNIT II: Nuclear Reactions

Types of reactions and conservation laws – Energetics of nuclear reactions –Dynamics of nuclear reactions – Q-value equation – Scattering and reaction cross sections – Compound nucleus reactions – Direct reactions – Resonance scattering – Breit-Wigner one level formula.

UNIT III: Nuclear Models

Liquid drop model – Bohr-Wheeler theory of fission – Experimental evidence for shell effects – Shell model – Spin-orbit coupling - Magic numbers – Angular momenta and parities of nuclear ground states – Qualitative discussion and estimate of transition rates – Magnetic moments and Schmidt lines – Collective model of Bohr and Mottelson.

UNIT IV: Nuclear Decay

Beta decay – Fermi theory of beta decay – Shape of the beta spectrum – Total decay rate - Mass of the neutrino – Angular momentum and parity selection rules – Allowed and forbidden decays – Comparative half-lives – Neutrino physics – Non-conservation of parity – Gamma decay – Multipole transitions in nuclei – Angular momentum and parity selection rules – Internal conversion – Nuclear isomerism.

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:

1. K. S. Krane, 1987, Introductory Nuclear Physics, Wiley, New York.
2. D. Griffiths, 1987, Introduction to Elementary Particle Physics, Harper & Row, New York.
3. R. R. Roy and B.P. Nigam, 1983, Nuclear Physics, New age Intl. New Delhi.
4. M.L. Pandya and R.P.S. Yadav, 1995, Elements of Nuclear Physics 7^{th} edition, Kedar Nath Ram Nath, Delhi.

Books for reference:

1. H. A. Enge, 1983, Introduction to Nuclear Physics, Addison-Wesley, Tokyo
2. Y. R. Waghmare, 1981, Introductory Nuclear, Physics, Oxford-IBH, New Delhi.
3. Ghoshal, Atomic and Nuclear Physics, Vol. 2
4. J. M. Longo, 1971, Elementary particles, McGraw-Hill, New York.
5. R. D. Evans, 1955, Atomic Nucleus, McGraw-Hill, New York.
6. I. Kaplan, 1989, Nuclear Physics, Narosa, New Delhi
7. B. L. Cohen, 1971, Concepts of Nuclear Physics, TMH, New Delhi
8. M. K. Pal, 1982, Theory of Nuclear Structure, Affl. East-West, Chennai.
9. W. E. Burcham and M. Jobes, 1995, Nuclear and Particle Physics, Addison-Wesley, Tokyo.

PAPER-9

MICROPROCESSOR AND MICROCONTROLLER

UNIT-I: 8085 Architecture and Programming

8085 Architecture - Programmer's model - ALU - Registers and Flags - Stacks - Complete instruction set of Intel 8085 - State transition and timing diagrams - T States - Machine cycles - Instruction cycles - Addressing modes - Assembly language programs – Timing diagram for memory read and memory write cycles - time delay subroutines and delay calculations – maskable and Non-maskable Interrupts.

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

Introduction – 8 and 16 bit Microcontroller families –Flash series – Embedded RISC Processor – 8051 Microcontroller Hardware – Internal registers – Addressing modes – Assembly Language Programming – Arithmetic, Logic and Sorting operations.

UNIT IV: Interfacing I/O and Memory With 8051

Interfacing I/O Ports, External memory, counters and Timers - Serial data input/output, Interrupts – Interfacing 8051 with ADC, DAC, LED display, Keyboard, Sensors and Stepper motor.

UNIT V: Embedded Microcontroller

Embedded microcontroller system – types of embedded operating system – Micro chip PIC 16C6X /7X family – features – Architecture – Memory Organization – Register file map – I/O ports – Data and flash program memory – asynchronous serial port – Applications in communication and industrial controls.

Books for Study

1. R.S. Gaonkar, 1997, Microprocessor Architecture, programming and Application with the 8085, 3rd Edition, Penram International Publishing, Mumbai.
2. V.Vijayendran, 2002, Fundamentals of Microprocessor 8085 - Architecture, programming and interfacing, Viswanathan Publication, Chennai.
3. Kenneth J. Ayala – The 8051 Micro Controller Architecture, Programming and Applications. 3rd Edition , Penram International
4. John B. Peatman, 2004, Design with PIC Microcontrollers, 7th Indian reprint, Pearson Education.

Books for Reference

1. B. Ram, Fundamentals of Microprocessors and Microcomputers, Dhanpat Rai publications, New Delhi.
2. R. Thiagarajan, S. Dhanasekaran and S.Dhanapal, Microprocessor and its applications, New Age International, New Delhi.
3. Muhammed Ali Mazidi and Janice Gillespie Mazidi, 2004, The 8051 Microcontroller and Embedded Systems, *Fourth Indian Reprint, Pearson Education.*
4. Raj Kamal, 2002, Introduction to Embedded Systems, TMS

ELECTIVE

PAPER-3

(to choose 1 out of 3)

A. CRYSTAL GROWTH AND 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 Growth Techniques

Melt technique: Bridgman technique - Basic process – Various crucibles design - Thermal consideration –Vertical Bridgman technique –Crystal Pulling technique - Czochralski technique – Experimental arrangement – Growth process –Zone melting technique –Skull melting process –Verneuil Process

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 - Chemical vapour deposition (CVD)– Preparation of Transparent Conducting Oxides.

UNIT V: Characterization Technique

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 – Dielectric studies – Second harmonic generation test.

Books for Study and Reference:

1. J.C. Brice, Crystal Growth Processes, John Wiley and Sons, New York (1986)
2. P. SanthanaRagavan and P. Ramasamy, Crystal Growth Processes and Methods, KRU Publications, Kumbakonam (2001)
3. A. Goswami, Thin Film Fundamentals, New Age International (P) Limited, New Delhi (1996)
4. H.H. Willard, L.L. Merritt, J.A. Dean, F.A. Settle, CBS, Publishers and Distributors, New Delhi

PAPER-3

B. ADVANCED SPECTROSCOPY

UNIT I: UV Spectroscopy

Energy levels, Molecular orbitals – Theory of UV spectra – Franck Condon Principle – transition Probability, measurement of spectrum – Types of transition in Organic molecules – Types of absorption bands – transition in metal complexes – Selection rules – Electronic spectra in poly atomic molecules – Chromophore concept – Application of UV Spectroscopy.

UNIT II: Atomic absorption and Emission Spectroscopy

Principle of AAS, measurement of atomic absorption – Instrumentation – single beam Spectrophotometer –Applications of AAS - Atomic emission Spectroscopy – Principle of AES, Advantages - Instrumentation- laser beam – applications of AES –Difference between AAS and AES.

UNIT III: Surface Enhanced Raman Scattering (SERS)

Surfaces for SERS study – Enhancement mechanism – Instrumentation and sampling techniques - Surface selection rules – SERS microprobe – SERS study of bio molecules – SERS in medicine –Use of Laser FT Raman spectrometer – measurement of depolarization ratio – sample handling methods

UNIT IV: Surface Spectroscopy

Electron energy loss spectroscopy (EELS) – Reflectance Absorbance – IR spectroscopy (RAIRS) – Inelastic helium scattering – Photo electron spectroscopy (PES) – X ray photo electron spectroscopy (XPES) – Ultraviolet PES – Auger electron spectroscopy (AES).

UNIT V: Nonlinear Spectroscopic Phenomena

Nonlinear Raman phenomena – Hyper Raman effect – Experimental Technique – Stimulated Raman scattering – Inverse Raman effect – Coherent antistokes Raman scattering(CARS) – Photo acoustic Raman scattering – Multiphoton spectroscopy.

BOOKS FOR STUDY

1. C. N. Banwell and E. M. McCash, 1994, Fundamentals of Molecular Spectroscopy, 4th Edition, Tata Mc Graw-Hill, New Delhi.
2. G. Aruldhas, 2001, Molecular structure and spectroscopy, Prentice Hall of India Pvt. Ltd., New Delhi
3. H.Kaur, 2009, Spectroscopy, 5th Edition, A Pragati Prakashan
4. P. S. Sindhu, 1990, Molecular Spectroscopy, Tata Mc Graw-Hill, New Delhi.
5. D.N. Sathyanarayana, Vibrational Spectroscopy, New age International Publishers.

BOOKS FOR REFERENCE:

1. G. W. King, 1964, Spectroscopy and molecular structure, Hoit Rinchart and Winsten Inc, London
2. T. A. Carlson, 1975, Photo electron and Auger spectroscopy, Plenum Press
3. J . Loder, 1970, Basic Laser Raman spectroscopy, Hezdan and Son Ltd.
4. T. P. Das and E. L. Hehn, 1958, NQR Spectroscopy, Academic Press
5. Raymond Chang, 1980, Basic Principles of Spectroscopy Mc Graw-Hill Kogakusha

PAPER-3

C. ADVANCED NUCLEAR PHYSICS

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.
2. Elements of nuclear Physics, M.L.Pandya, R.P.S Yadhav, Kedharnath, Ramnath, Meerut, 1995.
3. Nuclear Physics, Irving Kaplan, Narosha Publshers, New Delhi-1989.

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

Anelastic and visco elastic behaviour - Atomic model of elastic behaviour - rubber like elasticity - An elastic deformation - Relaxation process - Model for visco elastic behaviour - Polymers - Polymerization mechanism - Polymer structures - Deformation of polymers - Behaviour of polymers. Ceramics - Ceramic phases - Structure - classes - Effect of structure on the behaviour of ceramic phases - composites.

UNIT-IV: Nano Material and Its Applications

Classification of Nanomaterials – Synthesis – Ball milling, Solgel and CVD methods – metal and semiconductor nanoparticles by colloidal route – microorganism method – Analytical methods and properties, STM- TEM – Electrical, Magnetic and optical properties of nanoparticles – Applications Optoelectronic electronic devices – LED – applications – Colourants and pigments – Nano biotechnology – DNA chips – DNA array devices – Drug delivery systems.

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 co-efficient - 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:

1. G.K. Narula, K.S. Narula, and V.K. Gupta, 1995, Material Science, TMH, New Delhi.
2. A.J. Dekker, 1981, Solid State Physics, McMillan Co.
3. V.Ragavan, 2003, Material Science and Engineering, 4th Edition, Prentice Hall of India,New Delhi.
4. M. Arumugam, 2002, Materials Science, 3rd Edition, Anuradha Agencies.
5. Allen and Jones, 1967, Principles of Gas lasers, Butterworths, London.
6. K.R. Nambiar, 2004, Laser Principles, types and Application, New Age International.
7. K. Thyagarajan, and A.K. Ghatak, 1997, Laser Theory and Applications, Macmillan India Ltd.

Books for Reference:

1. Lawrence H. Vlack, 1998, Elements of Materials Science and Engineering, 6th Edition, Second ISE reprint, Addison-Wesley.
2. H. Iabch and H. Luth, 2001, Solid State Physics, An introduction to principles of Material Science, 2nd Edition, Springer.
3. B.B. Laud, 1991, Lasers and Non linear optics, Wiley Eastern Ltd.
4. Verdayan J.J. 1993, Laser Electronics, Prentice-Hall India, New Delhi.

PAPER-11

CONDENSED MATTER PHYSICS

UNIT-I: Crystal Physics

Types of lattices - Miller indices – symmetry elements and allowed rotations - simple crystal structures – Atomic packing factor - Crystal diffraction - Bragg's law –Scattered wave amplitude - Reciprocal lattice (sc, bcc, fcc) – Diffraction conditions - Laue equations – Brillouin Zone - Structure factor - Atomic form factor - Inert gas crystals - Cohesive energy of ionic crystals - Madelung constant - Types of crystal binding(general ideas) .

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

Free electron gas in three dimensions - Electronic heat capacity - Wiedmann-Franz law - Band theory of metals and semiconductors - Bloch theorem - Kronig-Penny model - Semiconductors - Intrinsic carrier concentration – Temperature dependence - Mobility - Impurity conductivity – Impurity states - Hall effect -Fermi surfaces and construction - Experimental methods in Fermi surface studies - de Haas Van Alphen effect.

UNIT-IV: Magnetism

Diamagnetism - quantum theory of Paramagnetism - Rare earth ion - Hund's rule - Quenching of orbital angular momentum - Adiabatic demagnetization - Quantum theory of ferromagnetism - Curie point - Exchange integral - Heisenberg's interpretation of Weiss field - ferromagnetic domains - Bloch Wall - Spin waves - Quantization - Magnons - thermal excitation of magnons - Curie temperature and susceptibility of ferrimagnets - Theory of anti ferromagnetism - Neel temperature.

UNIT-V: Super conductivity

Experimental facts: Occurrence - Effect of magnetic fields - Meissner effect – Critical field – Critical current - Entropy and heat capacity - Energy gap - Microwave and infrared properties - Type I and II superconductors. Theoretical explanation: Thermodynamics of super conducting transition - London equation - Coherence length – Isotope effect - Cooper pairs - BCS Theory - single particle Tunneling - Josephson tunneling - DC and AC Josephson effects - High temperature super conductors - SQUIDS.

Books for Study:

1. C. Kittel, 1996, Introduction to Solid State Physics, 7th Edition, Wiley, New York.
2. M. Ali Omar, 1974, Elementary Solid State Physics-Principles and Applications, Addison-Wesley, London.
3. H.P. Myers, 1998, Introductory Solid State Physics, 2nd Edition, Viva Book, New Delhi.
4. S.O. Pillai, 1997, Solid State Physics, New Age International, New Delhi.

Books for Reference:

1. N.W. Aschroft and N.D. Mermin, Solid State Physics, Rhinehart and Winton, New York.
2. J.S. Blakemore, 1974, Solid State Physics, 2nd Edition, W.B. Saunder, Philadelphia.
3. A.J. Dekker, Solid State Physics, Macmillan India, New Delhi.
4. H.M. Rosenburg, 1993, The Solid State, 3rd Edition, Oxford University Press, Oxford.
5. S.O. Pillai, 1994, Problems and Solutions in Solid State Physics, New Age International, New Delhi.
6. S.L. Altmann, Band Theory of Metals, Pergamon, Oxford.
7. M.A. Wahab, 1999, Solid State Physics, Structure and Properties of Materials, Narosa, New Delhi.
8. J.M. Ziman, 1971, Principles of the Theory of Solids, Cambridge University Press, London.

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.
4. Michelson Interferometer - Thickness of mica sheet.
5. F.P. Etalon - using Michelson set up.
6. Hall Effect.
7. Molecular Spectra - AlO Band.
8. Molecular Spectra - CN Band.
9. Susceptibility of a liquid by Quincke's method.
10. Susceptibility of a liquid by Guoy's method.
11. Ultrasonic Diffraction - Velocity and Compressibility of a liquid.
12. Ultrasonic Interferometer - Velocity and Compressibility of a liquid.
13. B-H curve using CRO.
14. Spectral analysis of a salt.
15. Absorption Spectra.
16. Laser beam - Interference Experiments
    (a) Using on optically plane glass plate.
    (b) Using Lloyd's single mirror method.
17. Laser beam – Diffraction Experiments.
    (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
26. Numerical integration by Simpson's rule with algorithm and flowchart with program and its output.
27. Numerical solution of ordinary first order differential equation -Euler's method with algorithm, flowchart and its output.
28. Numerical solution of ordinary first order differential equations by the Runge-kutta method, with algorithm, flow chart with program and its output
29. Curve fitting - Least square fitting with algorithm, flowchart and its output.
30. Matrix manipulation - Multiplication Transpose and Inverse with algorithm, Flow chart and its output.

ELECTIVE

PAPER-4

A. ADVANCED MICROPROCESSOR

UNIT-I 8086 Architecture and programming

Internal architecture of 8086 - Software model - Internal registers - Minimum mode and Maximum mode system - Instruction set - Addressing modes – Data transfer, Arithmetic, Logical, Shift and rotate instruction – Compare, Jump, Loop, String, Processor control, CALL - RET and stack instructions - Procedures - Assembler Macros - Assembler directives.

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

Centronix parallel interface of printers - Printer concepts - Interfacing ASCII keyboard - Concepts of secondary storage device like floppy disk and Hard disk – PCI bus architecture – AGP - USB - Data Communication methods and standard GPIB – IEEE-488, RS-232C, RS-422 and RS-423A - Temperature controller.

Books for Study:

1. Douglas V. Hall : - Microprocessors and Interfacing programming and Hardware (Tata Mc Graw Hill)
2. W.A. Triebel and Avatar Singh, The 8086 /8088 Microprocessors- Programming, Software, Hardware and application, Prentice Hall of India, New Delhi.
3. Badri Ram, 2006, Advanced Microprocessors and interfacing, Tata McGraw Hill

Books For Reference:

1. B. Brey, 1995, Intel Microprocessors 8086/8088, 80186,80286,80486,80486, Architecture, Programming and Interfacing
2. V. Vijayendran, 2002, Fundamentals of Microprocessor –8086- Architecture, Programming (MASM) and interfacing, Viswanathan, Chennai.
3. Yu – Cheng and Glenn A. Gibson, The 8086 / 8088 family Architecture, Programming and Design, Prentice-Hall of India.

PAPER-4

B. PROGRAMMING IN C AND MATLAB

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

Basic structure of C programs – Character set – C tokens- Constants– keywords and identifiers – variables – data types - declaration of variables – Assigning values to variables – defining symbolic constants – Reading and writing a character – formatted inputs and outputs.

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

Basic Computations, Array operations, Solving Algebraic equations in MATLAB-Differentiation, Integration, Limits, sums and products, Taylor's series – Simple x-y plots – Matrices – Determinant, multiplication, transpose – Loops – Branching – Script M-file – Function M-files.

Books for study:

1. Programming in ANSI C, E. Balagurusamy, TMH, New Delhi, 4th ed. (2009).
2. S.S. Sastry, Introductory methods of Numerical analysis – Prentice – Hall of India, New Delhi (2003) 3rd Edition.
3. E. Balagurusamy, Numerical methods, Tata MCGraw
4. Gilat, MATLAB: An introduction with Applications, John Wiley & Sons, Inc 2004.

Books for Reference:

1. MATLAB 7.0 Basics, P. Howard, spring, 2005.
2. http://www.maths.tamu.edu/~phoward/308/matbasics.pdf
3. S.S. Kuo, 1996, Numerical Methods, and Computer, Addison-Wesley.
4. W.H. Press, 1992, Numerical Recipes in C, 2nd Edition, Cambridge University Press.

PAPER-4

C. NUMERICAL METHODS AND PROGRAMMING in C

UNIT-I: Errors and the measurements

General formula for errors – Errors of observation and measurement – Empirical formula – Graphical method – Method of averages – Least square fitting – curve fitting –parabola, exponential.

UNIT-II: Numerical solution of algebraic and transcendental equations

The iteration method – The method of false position – Newton – Raphson method – Convergence and rate of convergence – C program for finding roots using Newton – Raphson method - Simultaneous linear algebraic equations - Gauss elimination method – Jordon's modification – Gauss–Seidel method of iteration – C program for solution of linear 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

Nth order ordinary differential equations – Power series approximation – Pointwise method – Solutions of Taylor series – Euler's method – Improved Euler's method – Runge-Kutta method – second and fourth order – Runge-Kutta method for solving first order differential equations – C program for solving ordinary differential equations using RK method.

Books for study and Reference:

1. Introductory Methods of Numerical analysis – S.S. Sastry, Prentice – Hall of India, New Delhi (2003) 3rd Edition.

2. Numerical Methods in Science and Engineering – M.K. Venkataraman – The National Publishing Co. Madras (2001).
3. Numerical methods – E. Balagurusamy – Tata Mc Graw Hill, New Delhi (2008).
4. Numerical Recipes in C, W.H. Press, B.P.Flannery, S.A.Teukolsky, W.T. Vetterling, Cambridge University (1996).
5. Monte Carlo : Basics, K.P.N. Murthy, ISRP, Kalpakkam, 2000.
6. Numerical Methods in C and C++, Veerarajan, S.Chand, New Delhi (2006).

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