College of Arts, Science & Commerce

SIES

RISE WITH EDUCATION

SIES COLLEGE OF ARTS, SCIENCE AND COMMERCE
(Autonomous)

Affiliated to

UNIVERSITY OF MUMBAI

Syllabus for

SEM I, II, III and IV

Program: M.Sc.

Course: Physics

(Credit Based Semester and Grading System With effect from the academic year 2018-19)

Course Structure & Distribution of Credits

M. Sc. in Physics Program consists of total 16 theory courses, total 6 practical lab courses and 2 projects spread over four semesters. Twelve theory courses and four practical lab course are common and compulsory for all the students. Remaining four theory courses can be chosen from the list of elective courses offered by the institute. Two Lab courses can be chosen from the elective lab courses offered by the institute. Each theory course will be of 4 (four) credits, each practical lab course will be of 4 (four) credits and each project will be of 4 (four) credits. A project can be on theoretical physics, experimental physics, applied physics, development physics, computational physics or industrial product development. A student earns 24 (twenty four) credits per semester and total 96 (ninety six) credits in four semesters. The course structure is as follows,

Theory Courses

	Paper-1	**Paper-2**	**Paper-3**	**Paper-4**
Semester-I	Mathematical Methods	Classical Mechanics	Quantum Mechanics I	Solid State Physics
Semester-II	Advanced Electronics	Electrodynamics	Quantum Mechanics – II	Solid State Devices
Semester-III	Statistical Mechanics	Nuclear Physics	Elective Course - 1	Elective Course - 2
Semester-IV	Experimental Physics	Atomic and Molecular Physics	Elective Course -3	Elective Course 4

Practical Lab Courses

Semester-I	Lab Course -1	Lab Course -2
Semester-II	Lab Course -3	Lab Course -4
Semester-III	Project -1	Elective Lab Course-1
Semester-IV	Project -2	Elective Lab Course-2

The elective theory courses offered by SIES College of Arts, Science and Commerce will be from the following list:

1. Microcontrollers and Interfacing
2. Embedded systems and RTOS
3. Advanced Microprocessor and ARM 7
4. VHDL and communication Interface

As of now these are the only electives offered by SIES College. Hopefully more will be added as in the future

Semester I

M.Sc. in Physics Program for Semester I consists of four theory courses and two Practical Lab courses. The details are as follows:

Theory Courses (4): 16 hours per week (One lecture of one hour duration)

Theory Paper	Subject	Lectures(Hrs.)	Credits
SIPSPHY11	Mathematical Methods	60	04
SIPSPHY12	Classical Mechanics	60	04
SIPSPHY13	Quantum Mechanics-I	60	04
SIPSPHY14	Solid State Physics	60	04
	TOTAL	**240**	**16**

Practical lab courses (2): 16 hours per week

Practical Lab Course	Practical Lab Sessions (Hrs)	Credits
SIPSPHYP11	**120**	**04**
SIPSPHYP12	**120**	**04**

Semester II

M.Sc. in Physics Program for Semester-II consists of four theory courses and two Practical Lab courses. The details are as follows:

Theory Courses (4): 16 hours per week (One lecture of one hour duration)

Theory Paper	Subject	Lectures(Hrs.)	Credits
SIPSPHY21	Advanced Electronics	60	04
SIPSPHY22	Electrodynamics	60	04
SIPSPHY23	Quantum Mechanics-II	60	04
SIPSPHY24	Solid State Devices	60	04
	TOTAL	**240**	**16**

Practical lab courses (2): 16 hours per week

Practical Lab Course	Practical Lab Sessions (Hrs)	Credits
SIPSPHYP21	**120**	**04**
SIPSPHYP22	**120**	**04**

Semester III

M.Sc. in Physics Program for Semester III consists of four theory courses, one Practical Lab course and one Project course. The details are as follows:

Theory Courses (4): 16 hours per week (One lecture of one hour duration)

Theory Paper	Subject	Lectures(Hrs.)	Credits
SIPSPHY31	Statistical Mechanics	60	04
SIPSPHY32	Nuclear Physics	60	04
*	Elective Course	60	04
*	Elective Course	60	04
	TOTAL	**240**	**16**

*: To be chosen from the list below with odd-even number combination. Odd numbered course will be paper 3 and even numbered course will be paper 4.

Theory Paper	**Subjects**	**Lectures(Hrs.)**	Credits
SIPSPHYE135	Microcontrollers and Interfacing	60	04
SIPSPHYE136	Embedded Systems and RTOS	60	04

Project (1): 8 hours per week

Project	Course	Total Project Period (Hrs)	Credits
SIPSPHYP31	Project -3	**120**	**04**

Practical lab course (1): 8 hours per week

Practical Lab	Course	Practical Lab Sessions	Credits

Course		(Hrs)	
SIPSPHYP32	**Advanced Physics Lab-1**	**120**	**04**

Semester IV

M.Sc. in Physics Program for Semester IV consists of four theory courses, one Practical Lab course and one Project course. The details are as follows:

Theory Courses (4): 16 hours per week (One lecture of one hour duration)

Theory Paper	Subject	Lectures(Hrs.)	Credits
SIPSPHY41	Experimental Physics	60	04
SIPSPHY42	Atomic and Molecular Physics	60	04
*	Elective Course	60	04
*	Elective Course	60	04
	TOTAL	**240**	**16**

*: To be chosen from the list below with odd-even number combination. Odd numbered course will be paper-3 and even numbered course will be paper-4.

Theory Paper	**Subjects**	**Lectures(Hrs.)**	Credits
SIPSPHYE145	Advanced Microprocessor and ARM 7	60	04
SIPSPHYE146	VHDL and Communication Interface	60	04

Project (1): 8 hours per week

Project	Course	Total Project Period (Hrs)	Credits
SIPSPHYP41	Project -4	**120**	**04**

Practical lab course (1): 8 hours per week

Practical Lab Course	Course	Practical Lab Sessions (Hrs)	Credits
SIPSPHYP42	**Advanced Physics Lab-2**	**120**	**04**

The candidate shall be awarded the degree of *Master of Science in Physics* **(M. Sc. in Physics),** after completing the course and meeting all the evaluation criteria. The Elective Course titles will appear in the statement of marks. When the elective courses are chosen from a particular specialization, the statement of marks shall also carry the name of the specializations as stated below. Courses selected in third semester for a particular specialization are prerequisites for courses in fourth semester for that specialization.

2. Scheme of Examination and Passing:

1. This course will have 40% Term Work (TW) / Internal Assessment (IA) and 60% Semester End Examination (written examination of 2.5 Hours duration for each course paper and practical examination of 4 Hours duration for each practical).

2. To pass, a student has to obtain minimum grade point E or above separately in the IA and the external examination.
3. The examination for all Theory and Practical courses shall be conducted at the end of each Semester and the evaluation of Project course and Project Dissertation will be conducted at the end of the each Semester.
4. The candidates shall appear for Semester End examination of 4 theory courses each carrying 60 marks of 2.5 hours duration and 2 practical courses(1 Practical Course and 1 Project Course in M.Sc. Part II) each carrying 100 marks at the end of each semester.
5. The candidate shall prepare and submit for practical examination a certified Journal based on the practical course carried out under the guidance of a faculty member with minimum number of experiments as specified in the syllabus for each group.
6. The candidate shall submit a Project Report / Dissertation for the Project Course at the end of each semester as per the guidelines given on page 32.

M.Sc. (Physics) Theory Courses
Semester –I

Semester-I: Paper-I:
Course no.: SIPSPHY11: Mathematical Methods (60 lectures, 4 credits)

Unit-I
Complex Variables, Limits, Continuity, Derivatives, Cauchy-Riemann Equations, Analytic functions, Harmonic functions, Elementary functions: Exponential and Trigonometric, Taylor and Laurent series, Residues, Residue theorem, Principal part of the functions, Residues at poles, zeroes and poles of order m, Contour Integrals, Evaluation of improper real integrals, improper integral involving Sines and Cosines, Definite integrals involving sine and cosine functions.
Unit-II
Matrices, Eigenvalues and Eigen vectors, orthogonal, unitary and hermitian matrices, Diagonalization of Matrices, Applications to Physics problems. Introduction to Tensor Analysis, Addition and Subtraction of Tensors, summation convention, Contraction, Direct Product, Levi-Civita Symbol
Unit-III
General treatment of second order linear differential equations with non-constant coefficients, Power series solutions, Frobenius method, Legendre, Hermite and Laguerre polynomials, Bessel equations, Nonhomogeneous equation – Green's function, Sturm-Liouville theory.
Unit-IV
Integral transforms: three dimensional fourier transforms and its applications to PDEs (Green function of Poisson's PDE), convolution theorem, Parseval's relation, Laplace transforms, Laplace transform of derivatives, Inverse Laplace transform and Convolution theorem, use of Laplace's transform in solving differential equations.

Main references:

1. S. D. Joglekar, Mathematical Physics: The Basics, Universities Press 2005
2. S. D. Joglekar, Mathematical Physics: Advanced Topics, CRC Press 2007
3. M.L. Boas, Mathematical methods in the Physical Sciences, Wiley India 2006
4. G. Arfken and H. J. Weber: Mathematical Methods for Physicists, Academic Press 2005

Additional references:

1. A.K. Ghatak, I.C. Goyal and S.J. Chua, Mathematical Physics, McMillan
2. A.C. Bajpai, L.R. Mustoe and D. Walker, Advanced Engineering Mathematics, John Wiley
3. E. Butkov, Mathematical Methods, Addison-Wesley
4. J. Mathews and R.L. Walker, Mathematical Methods of physics
5. P. Dennery and A. Krzywicki , Mathematics for physicists
6. T. Das and S.K. Sharma, Mathematical methods in Classical and Quantum Mechanics
7. R. V. Churchill and J.W. Brown, Complex variables and applications, V Ed. Mc Graw. Hill
8. A. W. Joshi, Matrices and Tensors in Physics, Wiley India

Semester-I: Paper-II:

Course no.: SIPSPHY12: Classical Mechanics (60 lectures, 4 credits)

Unit-I
Review of Newton's laws, Mechanics of a particle, Mechanics of a system of particles, Frames of references, rotating frames, Centrifugal and Coriolis force, Constraints, D'Alembert's principle and Lagrange's equations, Velocity-dependent potentials and the dissipation function, Simple applications of the Lagrangian formulation. Hamilton's principle, Calculus of variations, Derivation of Lagrange's equations from Hamilton's principle, Lagrange Multipliers and constraint extremization problems, Extension of Hamilton's principle to non-holonomic systems, Advantages of a variational principle formulation

Unit-II
Conservation theorems and symmetry properties, Energy Function and the conservation of energy. The Two-Body Central Force Problem**:** Reduction to the equivalent one body problem, The equations of motion and first integrals, The equivalent one-dimensional problem and classification of orbits, The virial theorem, The differential equation for the orbit and integrable power-law potentials, The Kepler problem: Inverse square law of force, The motion in time in the Kepler problem, Scattering in a central force field, Transformation of the scattering problem to laboratory coordinates.

Unit-III
Small Oscillations: Formulation of the problem, The eigenvalue equation and the principal axis transformation, Frequencies of free vibration and normal coordinates, Forced and damped oscillations, Resonance and beats.
Legendre transformations and the Hamilton equations of motion, Cyclic coordinates and conservation theorems, Derivation of Hamilton's equations from a variational principle.

Unit-IV
Canonical Transformations, Examples of canonical transformations, The symplectic approach to canonical transformations, Poisson brackets and other canonical invariants, Equations of motion, infinitesimal canonical transformations and conservation theorems in the Poisson bracket formulation, The angular momentum Poisson bracket relations.

Main Reference: Classical Mechanics, H. Goldstein, Poole and Safko, 3rd Edition, Narosa Publication (2001)

Additional References:

1. Classical Mechanics, N. C. Rana and P. S. Joag. Tata McGraw Hill Publication.
2. Classical Mechanics, S. N. Biswas, Allied Publishers (Calcutta).
3. Classical Mechanics, V. B. Bhatia, Narosa Publishing (1997).
4. Mechanics, Landau and Lifshitz, Butterworth, Heinemann.
5. The Action Principle in Physics, R. V. Kamat, New Age Intnl. (1995).
6. Classical Mechanics, Vol I and II, E. A. Deslougue, John Wiley (1982).
7. Theory and Problems of Lagrangian Dynamics, Schaum Series, McGraw (1967).
8. Classical Mechanics of Particles and Rigid Bodies, K. C. Gupta, Wiley Eastern 2001)

Semester-I: Paper-III:

Course No: SIPSPHY13: Quantum Mechanics-I (60 lectures, 4 Credits)

Unit I

1. Review of concepts:
Postulates of quantum mechanics, observables and operators, measurements, state function and expectation values, the time-dependent Schrodinger equation, time development of state functions, solution to the initial value problem. The Superposition principle, commutator relations, their connection to the uncertainty principle, complete set of commuting observables. Time development of expectation values, conservation theorems and parity.

2. Formalism:
Linear Vector Spaces and operators, Dirac notation, Hilbert space, Hermitian operators and their properties, Matrix mechanics: Basis and representations, unitary transformations, the energy representation. Schrodinger, Heisenberg and interaction picture.

Unit II

1. **Wave packet:** Gaussian wave packet, Fourier transform.
2. **Schrodinger equation solutions: one dimensional problems:**
General properties of one dimensional Schrodinger equation, Particle in a box, Harmonic oscillator by raising and lowering operators and Frobenius method, unbound states, one dimensional barrier problems, finite potential well.

Unit III

Schrodinger equation solutions: Three dimensional problems:
Orbital angular momentum operators in cartesian and spherical polar coordinates, commutation and uncertainty relations, spherical harmonics, two particle problem-coordinates relative to centre of mass, radial equation for a spherically symmetric central potential, hydrogen atom, eigenvalues and radial eigenfunctions, degeneracy, probability distribution.

Unit IV

Angular Momentum:

1. Ladder operators, eigenvalues and eigenfunctions of L^2 and L_z using spherical harmonics, angular momentum and rotations.
2. Total angular momentum J; LS coupling; eigenvalues of J^2 and Jz.
3. Addition of angular momentum, coupled and uncoupled representation of eigenfunctions, Clebsch Gordan coefficient for and and .
4. Angular momentum matrices, Pauli spin matrices, spin eigenfunctions, free particle wave function including spin, addition of two spins.

Main references:

1. Richard Liboff, Introductory Quantum Mechanics, 4th edition, Pearson.
2. D J Griffiths, Introduction to Quantum Mechanics 4th edition
3. A Ghatak and S Lokanathan, Quantum Mechanics: Theory and Applications, 5th edition.
4. N Zettili, Quantum Mechanics: Concepts and Applications, 2nd edition, Wiley.

Additional References

1. W Greiner, Quantum Mechanics: An introduction, Springer, 2004
2. R Shankar, Principles of Quantum Mechanics, Springer, 1994
3. P.M. Mathews and K. Venkatesan, A Textbook of Quantum Mechanics, Tata McGraw Hill (1977).
4. J. J. Sakurai Modern Quantum Mechanics, Addison-Wesley (1994).

Semester-I : Paper-IV:

Course no.: SIPSPHY14: Solid State Physics (60 lectures, 4 credits)

Unit – I*: Diffraction of Waves by Crystals and Reciprocal Lattice*

Bragg law, Scattered Wave Amplitude – Fourier analysis, Reciprocal Lattice Vectors, Diffraction Conditions, Brillouin Zones, Reciprocal Lattice to SC, BCC and FCC lattice. Interference of Waves, Atomic Form Factor, Elastic Scattering by crystal, Ewald Construction, Structure Factor, Temperature Dependence of the Reflection Lines, Experimental Techniques (Laue Method, Rotating Crystal Method, Powder Method) Scattering from Surfaces, Elastic Scattering by amorphous solids.

Unit-II: *Lattice Vibrations and thermal properties:*

Vibrations of Monoatomic Lattice, normal mode frequencies, dispersion relation. Lattice with two atoms per unit cell, normal mode frequencies, dispersion relation, Quantization of lattice vibrations, phonon momentum, Inelastic scattering of neutrons by phonons, Surface vibrations, Inelastic Neutron scattering. Anharmonic Crystal Interaction. Thermal conductivity – Lattice Thermal Resistivity, Umklapp Process, Imperfections

Unit-III: *Diamagnetism and Paramagnetism:*

Langevin diamagnetic equation, diamagnetic response, Quantum mechanical formulation, core diamagnetism. Quantum Theory of Paramagnetism, Rare Earth Ions, Hund’s Rule, Iron Group ions, Crystal Field Splitting and Quenching of orbital angular momentum; Adiabatic Demagnetization of a paramagnetic Salt, Paramagnetic susceptibility of conduction electrons;

Unit-IV*: Magnetic Ordering:*

Ferromagnetic order- Exchange Integral, Saturation magnetization, Magnons, neutron magnetic scattering; Ferrimagnetic order, spinels, Yttrium Iron Garnets, Anti Ferromagnetic order. Ferromagnetic Domains – Anisotropy energy, origin of domains, transition region between domains, Bloch wall, Coercive force and hysteresis.

Main References:-

1. Charles Kittel “Introduction to Solid State Physics”, 7th edition John Wiley & sons.
2. J.Richard Christman “Fundamentals of Solid State Physics” John Wiley & sons
3. M.A.Wahab “Solid State Physics –Structure and properties of Materials” Narosa Publications 1999.
4. M. Ali Omar “Elementary Solid State Physics” Addison Wesley (LPE)
5. H.Ibach and H.Luth 3rd edition “Solid State Physics – An Introduction to Principles of Materials Science” Springer International Edition (2004)

M.Sc. (Physics) Practical Lab Course
Semester –I

Semester – I Lab-1

Course number: SIPSPHYP11 (120 hours, 4 credits)

Group A

Sr. No	**Experiment**	**Reference Books**
1	Michelson Interferometer	Advanced Practical Physics -Worsnop and Flint
2	Analysis of sodium spectrum	a. Atomic spectra- H.E. White b. Experiments in modern physics – Mellissinos
3	h/e by vacuum photocell	a. Advanced Practical Physics -Worsnop and Flint b. Experiments in modern physics – Mellissinos
4	Study of He-Ne laser- Measurement of divergence and wavelength	a. A course of experiments with Laser - Sirohi b. Elementary experiments with Laser - G. White
5	Susceptibility measurement by Quincke's method /Guoy's balance method	Advanced Practical Physics -Worsnop and Flint
6	Absorption spectrum of specific Liquids	Advanced Practical Physics -Worsnop and Flint
7	Coupled Oscillations	HBCSE Selection camp 2007 Manual

Group B:

Sr. No	**Experiment**	**References**
1.	Diac - Triac phase control circuit	a. Solid state devices- W.D. Cooper b. Electronic text lab manual - P.B. Zbar
2.	Delayed linear sweep using 1C 555	Electronic Principles - A. P. Malvino
3.	Regulated power supply using 1C LM 317 voltage regulator IC	a. Operational amplifiers and linear Integrated circuits - Coughlin & Driscoll b. Practical analysis of electronic circuits through experimentation – L. Macdonald
4.	Regulated dual power supply using IC LM317 & 1C LM 337 voltage regulator ICs	c. Operational amplifiers and linear Integrated circuits - Coughlin & Driscoll d. Practical analysis of electronic circuits through experimentation – L. Macdonald
5.	Constant current supply using IC 741 and LM317	Integrated Circuits - K. R. Botkar
6.	Active filter circuits (second order)	a. Op-amps and linear integrated circuit technology- R. Gayakwad b. Operational amplifiers and linear integrated circuits - Coughlin &. Driscoll

7.	Study of 4 digit multiplex display system	Digital Electronics - Roger Tokheim

Note: Minimum number of experiments to be performed and reported in the journal = 06 with minimum 3 experiments from each Group. i.e. Group A: 03 and Group B: 03

Semester –I Lab-2

Course number: SIPSPHYP12 (120 hours, 4 credits)

Group A

Experiment		References	
1.	Carrier lifetime by pulsed reverse method		Semiconductor electronics by Gibson
2.	Resistivity by four probe method		Semiconductor measurements by Runyan
3.	Temperature dependence of avalanche and Zener breakdown diodes	a)	Solid state devices - W.D. Cooper
		b)	Electronic text lab manual - PB Zbar
		c)	Electronic devices & circuits - Millman and Halkias
4.	DC Hall effect	a)	Manual of experimental physics - E.V.Smith
		b)	Semiconductor Measurements - Runyan
		c)	Semiconductors and solid state physics - Mackelvy
		d)	Handbook of semiconductors – Hunter
5.	Determination of particle size of lycopodium particles by laser diffraction method	a)	A course of experiments with Laser - Sirohi
		b)	Elementary experiments with Laser- G. White
6.	Magneto resistance of Bi specimen		Semiconductor measurements by Runyan
7.	Microwave oscillator characteristics	a)	Physics of Semiconductor Devices by S.M.Sze

Group B:

Experiment		References	
1.	Temperature on-off controller using IC		Op-amps and linear integrated circuit technology by Gayakwad
2.	Waveform Generator using ICs	a)	Operational amplifiers and linear integrated circuits- Coughlin & Driscoll
		b)	Op-amps and linear integrated circuit technology :R. Gayakwad
		c)	Operational amplifiers : experimental manual C.B. Clayton
3.	Instrumentation amplifier and its applications	a)	Operational amplifiers and linear integrated circuits - Coughlin &. Driscoll
		b)	Integrated Circuits - K. R. Botkar

4.	Study of 8 bit DAC	a)	Op-amps and linear integrated circuit technology — R. Gayakwad
		b)	Digital principles and applications by Malvino and Leach
5.	16 channel digital multiplexer	a)	Digital principles and applications by Malvino and Leach
		b)	Digital circuit practice by RP Jain
6.	Study of elementary digital Voltmeter		Digital Electronics by Roger Tokheim (5 Ed, page 371)

Note: Minimum number of experiments to be performed and reported in the journal = 06 with minimum 3 experiments from each Group, i.e. Group A: 03 and Group B: 03

Additional references:

1. Digital theory and experimentation using integrated circuits - Morris E. Levine (Prentice Hall)
2. Practical analysis of electronic circuits through experimentation - Lome Macronaid (Technical Education Press)
3. Logic design projects using standard integrated circuits - John F. Waker (John Wiley & sons)
4. Practical applications circuits handbook - Anne Fischer Lent & Stan Miastkowski (Academic Press)
5. Digital logic design, a text lab manual - Anala Pandit (Nandu printers and publishers Pvt. Ltd.)

Note:

1. Journal should be certified by the laboratory in-charge only if the student performs satisfactorily the minimum number of experiments as stipulated above. Such students, who do not have certified journals, will not be allowed to appear for the practical examinations.
2. Total marks for the practical examinations = 200

M.Sc. (Physics) Theory Courses
Semester –II

Semester-II: Paper-I:
Course no.: SIPSPHY21: Advanced Electronics (60 lectures, 4 credits)

Unit-I Microprocessors and Microcontrollers:

1. Microprocessors: Counters and Time Delays, Stack and Sub-routines

RSG: Microprocessor Architecture, Programming and Applications with the 8085 : R. S. Gaonkar , 5^{th} Edition, Penram International

2. Introduction to Microcontrollers: Introduction, Microcontrollers and Microprocessors, History of Microcontrollers and Microprocessors, Embedded versus External Memory Devices, 8–bit and 16–bit Microcontrollers, CISC and RISC Processors, Harvard and Von Neumann Architectures, Commercial Microcontroller Devices.

AVD: Ch.1

3. 8051 Microcontrollers: Introduction, MCS–51 Architecture, Registers in MCS-51, 8051 Pin Description, Connections,8051 Parallel I/O Ports and Memory Organization.

AVD: Ch. 2, 3

4. 8051 Instruction set and Programming: MCS-51 Addressing Modes and Instruction set. 8051 Instructions and Simple programs using Stack Pointer.
AVD: Ch.4
Reference: AVD: Microcontrollers (Theory and Applications) by Ajay V. Deshmukh, TMH

Unit-II Analog and Data Acquisition Systems:

1. Power Supplies: Linear Power supply, Switch Mode Power supply, Uninterrupted Power Supply, Step up and Step down Switching Voltage Regulators.

2. Inverters: Principle of voltage driven inversion, Principle of current driven inversion, sine wave inverter, Square wave inverter.

3. Signal Conditioning: Operational Amplifier, Instrumentation Amplifier using IC, Precision Rectifier, Voltage to Current Converter, Current to Voltage Converter, Op-Amp Based Butterworth Higher Order Active Filters and Multiple Feedback Filters, Voltage Controlled Oscillator , Analog Multiplexer, Sample and Hold circuits, Analog to Digital Converters, Digital to Analog Converters.

Unit-III Data Transmissions, Instrumentations Circuits& Designs:

1. Data Transmission Systems: Analog and Digital Transmissions, Pulse Amplitude Modulation, Pulse Width Modulation, Time Division Multiplexing, Pulse Modulation, Digital Modulation, Pulse Code Format, Modems.

2. Optical Fiber: Introduction to optical fibers, wave propagation and total internal reflection in optical fiber, structure of optical fiber, Types of optical fiber, numerical aperture, acceptance angle, single and multimode optical fibers, optical fiber materials and fabrication, attenuation, dispersion, splicing and fiber connectors, fiber optic communication system, fiber sensor, optical sources and optical detectors for optical fiber.

Unit-IV Instrumentation Circuits and Designs:

Microprocessors/ Microcontrollers based D C motor speed controller. Microprocessors /Microcontrollers based temperature controller. Electronic weighing single pan balance using strain gauge/ load cell. Optical analog communication system using fiber link. Electronic intensity meter using optical sensor. IR remote controlled ON/OFF switch.

Reference Books:

1. Microprocessor Architecture, Programming and Applications with the 8085 R. S. Gaonkar, 4th Edition. Penram International.
2. The 8051 Microcontroller and Embedded Systems, Dr. Rajiv Kapadia, Jaico Publishing House.
3. The 8051 Microcontroller & Embedded Systems by M.A. Mazidi, J.G. Mazidiand R.D. Mckinlay
4. The 8051 Microcontroller: K.J. Ayala: Penram International
5. Programming & customizing the 8051 Microcontroller : Myke Predko, TMH
6. Power Electronics and its applications, Alok Jain, 2nd Edition, Penram International India.
7. Op-Amps and Linear Integrated Circuits - R. A. Gayakwad , 3rd Edition Prentice Hall India.
8. Operational Amplifiers and Linear Integrated Circuits, Robert F. Coughlin and Frederic F. Driscoll, 6th Edition, Pearson Education Asia.
9. Optical Fiber Communications, Keiser, G. Mcgraw Hill, Int. Student Ed.

10. Electronic Communication Systems; 4th. Ed. Kennedy and Davis, (Tata- McGraw. Hill, 2004.
11. Electronic Instrumentation, H.S. Kalsi, Tata-McGraw. Hill, 1999

Semester-II: Paper-II:
Course no.: SIPSPHY22: Electrodynamics (60 lectures, 4 credits)

Unit-I:
Maxwell's equations, The Pointing vector, The Maxwellian stress tensor, Lorentz Transformations, Four Vectors and Four Tensors, The field equations and the field tensor, Maxwell equations in covariant notation.
Unit-II:
Electromagnetic waves in vacuum, Polarization of plane waves. Electromagnetic waves in matter, frequency dependence of conductivity, frequency dependence of polarizability, frequency dependence of refractive index. Wave guides, boundary conditions, classification of fields in wave guides, phase velocity and group velocity, resonant cavities.
Unit-III:
Moving charges in vacuum, gauge transformation, The time dependent Green function, The Lienard- Wiechert potentials, Leinard- Wiechert fields, application to fields-radiation from a charged particle, Antennas, Radiation by multipole moments, Electric dipole radiation, Complete fields of a time dependent electric dipole, Magnetic dipole radiation
Unit-IV:
Relativistic covariant Lagrangian formalism: Covariant Lagrangian formalism for relativistic point charges. The energy-momentum tensor, Conservation laws.

Main Reference:

1. W.Greiner, Classical Electrodynamics (Springer- Verlag, 2000) (WG).
2. M.A. Heald and J.B. Marion, Classical Electromagnetic Radiation, 3rd edition (Saunders, 1983) (HM)

Additional references:

1. J.D. Jackson, Classical Electrodynamics, 4Th edition, (John Wiley & sons) 2005 (JDJ)
2. W.K.H. Panofsky and M. Phillips, Classical Electricity and Magnetism,2nd edition, (Addison - Wesley) 1962.
3. D.J. Griffiths, Introduction to Electrodynamics,2nd Ed., Prentice Hall, India,1989.
4. J.R. Reitz ,E.J. Milford and R.W. Christy, Foundation of Electromagnetic Theory, 4th ed., Addison -Wesley, 1993

Semester-II: Paper-III:
Course no.: SIPSPHY23: Quantum Mechanics-II (60 lectures, 4 credits)
Unit I: Perturbation Theory:
Time independent perturbation theory: First order and second order corrections to the energy eigenvalues and eigenfunctions. Degenerate perturbation Theory: first order correction to energy.
Time dependent perturbation theory: Harmonic perturbation, Fermi's Golden Rule, sudden and adiabatic approximations, applications.
Unit II: Approximation Methods
1. Variation Method: Basic principle, applications to simple potential problems, He-atom.

2. WKB Approximation: WKB approximation, turning points, connection formulas, Quantization conditions, applications.

Unit III: scattering Theory

Laboratory and centre of mass frames, differential and total scattering cross-sections, scattering amplitude, Partial wave analysis and phase shifts, optical theorem, S-wave scattering from finite spherical attractive and repulsive potential wells, Born approximation.

Unit IV

1. Identical Particles: Symmetric and antisymmetric wave functions, Bosons and Fermions, Pauli Exclusion Principle, slater determinant.
2. Relativistic Quantum Mechanics
3. The Klein Gordon and Dirac equations. Dirac matrices, spinors, positive and negative energy solutions physical interpretation. Nonrelativistic limit of the Dirac equation.

Main references:

1. Richard Liboff, Introductory Quantum Mechanics, 4th edition, Pearson.
2. D J Griffiths, Introduction to Quantum Mechanics 4th edition
3. A Ghatak and S Lokanathan, Quantum Mechanics: Theory and Applications, 5th edition.
4. N Zettili, Quantum Mechanics: Concepts and Applications, 2nd edition, Wiley.
5. J. Bjorken and S. Drell, Relativistic Quantum Mechanics, McGraw-Hill (1965).

Additional References

1. W Greiner, Quantum Mechanics: An introduction, Springer, 2004
2. R Shankar, Principles of Quantum Mechanics, Springer, 1994
3. P.M. Mathews and K. Venkatesan, A Textbook of Quantum Mechanics, Tata McGraw Hill (1977).
4. J.J. Sakurai Modern Quantum Mechanics, Addison-Wessley (1994).

Semester-II : Paper-III:

Course no.: SIPSPHY24: Solid State Devices (60 lectures, 4 credits)

Note: Problems form an integral part of the course.

Unit-I: Semiconductor Physics:

Classification of Semiconductors; Crystal structure with examples of Si, Ge & GaAs semiconductors; Energy band structure of Si, Ge & GaAs; Extrinsic and compensated Semiconductors; Temperature dependence of Fermi-energy and carrier concentration. Drift, diffusion and injection of carriers; Carrier generation and recombination processes- Direct recombination, Indirect recombination, Surface recombination, Auger recombination; Applications of continuity equation-Steady state injection from one side, Minority carriers at surface, Haynes Shockley experiment, High field effects. Hall Effect; Four – point probe resistivity measurement; Carrier life time measurement by light pulse technique.

Unit-II: Semiconductor Devices I:

p-n junction : Fabrication of p-n junction by diffusion and ion-implantation; Abrupt and linearly graded junctions; Thermal equilibrium conditions; Depletion regions; Depletion capacitance, Capacitance – voltage (C-V) characteristics, Evaluation of impurity distribution, Varactor; Ideal and Practical Current-voltage (I-V) characteristics; Tunneling and avalanche reverse junction break down mechanisms; Minority carrier storage, diffusion capacitance, transient behavior; Ideality factor and carrier concentration measurements; Carrier life time measurement by reverse recovery of junction diode;; p- i-n diode; Tunnel diode, Introduction to p-n junction solar cell and semiconductor laser diode.

Unit-III: Semiconductor Devices II:

Metal – Semiconductor Contacts: Schottky barrier – Energy band relation, Capacitance-voltage (C-V) characteristics, Current-voltage (I-V) characteristics; Ideality factor, Barrier height and carrier concentration measurements; Ohmic contacts. Bipolar Junction Transistor (BJT): Static Characteristics; Frequency Response and Switching. Semiconductor heterojunctions, Heterojunction bipolar transistors, Quantum well structures.

Unit-IV: Semiconductor Devices III:

Metal-semiconductor field effect transistor (MESFET)- Device structure, Principles of operation, Current voltage (I-V) characteristics, High frequency performance. Modulation doped field effect transistor (MODFET); Introduction to ideal MOS device; MOSFET fundamentals, Measurement of mobility, channel conductance etc. from I_{ds} vs, V_{ds} and I_{ds} vs V_g characteristics. Introduction to Integrated circuits.

Main References:

1. S.M. Sze; Semiconductor Devices: Physics and Technology, 2nd edition, John Wiley, New York, 2002.
2. B.G. Streetman and S. Benerjee; Solid State Electronic Devices, 5th edition, Prentice Hall of India, NJ, 2000.
3. W.R. Runyan; Semiconductor Measurements and Instrumentation, McGraw Hill, Tokyo, 1975.
4. Adir Bar-Lev: Semiconductors and Electronic devices, 2nd edition, Prentice Hall, Englewood Cliffs, N.J., 1984.

Additional References:

1. Jasprit Singh; Semiconductor Devices: Basic Principles, John Wiley, New York, 2001.
2. Donald A. Neamen; Semiconductor Physics and Devices: Basic Principles, 3rd edition, Tata McGraw-Hill, New Delhi, 2002.
3. M. Shur; Physics of Semiconductor Devices, Prentice Hall of India, New Delhi, 1995.
4. Pallab Bhattacharya; Semiconductor Optoelectronic Devices, Prentice Hall of India, New Delhi, 1995.
5. S.M. Sze; Physics of Semiconductor Devices, 2nd edition, Wiley Eastern Ltd., New Delhi, 1985.

M.Sc. (Physics) Practical Lab Course
Semester –II

Semester –II Lab-1
Course number: SIPSPHYP21 (120 hours, 4 credits)
Group A

Experiment	References
1. Zeeman Effect using Fabry-Perot etalon /Lummer — Gehrecke plate	a. Advance practical physics - Worsnop and Flint b. Experiments in modern physics - Mellissinos
2. Characteristics of a Geiger Muller counter and measurement of dead time	a. Experiments in modern physics: Mellissions b. Manual of experimental physics --EV-Smith c. Experimental physics for students - Whittle & Yarwood
3. Ultrasonic Interferometry-Velocity measurements in different Fluids	Medical Electronics- Khandpur
4. Measurement of Refractive Index of Liquids using Laser	Sirohi-A course of experiments with He-Ne Laser; Wiley Eastern Ltd
5. I-V/ C-V measurement on semiconductor specimen	Semiconductor measurements - Runyan

6. Double slit- Fraunhofer diffraction (missing order etc.)	Advance practical physics - Worsnop and Flint
7. Determination of Young's modulus of metal rod by interference method	Advance practical physics - Worsnop and Flint (page 338)

Group B

Experiment	**Reference**
1. Adder-subtractor circuits using ICs	a. Digital Principles and applications-Malvino and Leach b. Digital circuit practice-R.P.Jain
2. Study of Presettable counters- 74190 and 74193	a. Digital circuit practice-Jain & Anand b. Digital Principles and applications-Malvino and Leach c. Experiments in digital practice-Jain & Anand
3. TTL characteristics of Totempole, Open collector and tristate devices	a. Digital circuit practice-Jain & Anand b. Digital Principles and applications-Malvino and Leach
4. Pulse width modulation for speed control of dc toy motor	Electronic Instrumentation - H. S. Kalsi
5. Study of sample and hold circuit	Integrated Circuits - K. R. Botkar
6. Switching Voltage Regulator	

Note: Minimum number of experiments to be performed and reported in the journal = 06 with minimum 3 experiments from each Group. i.e. Group A: 03 and Goup B: 03

Semester –II Lab-2

Course number: SIPSPHYP22 (120 hours, 4 credits)
Group A

Experiment	**References**
1. Carrier mobility by conductivity	Semiconductor electronics - Gibson
2. Measurement of dielectric constant, Curie temperature and verification of Curie— Weiss law for ferroelectric material	a. Electronic instrumentation & measurement : b. W. D. Cooper c. Introduction to solid state physics - C. Kittel d. Solid state physics — A. J. Dekkar
3. Barrier capacitance of a junction diode	Electronic engineering - Millman Halkias
4. Linear Voltage Differential Transformer	Electronic Instrumentation - W.D. Cooper
5. Faraday Effect-Magneto Optic Effect: a) To Calibrate Electromagnet b) To determine Verdet's constant for KCI & KI solutions.	a. b. Manual of experimental physics: E.V. Smith Experimental physics for students: Whittle & Yarwood
6. Energy Band gap by four probe method	Semiconductor measurements — Runyan
7. Measurement of dielectric constant(Capacitance)	

Group B

Experiment	References
1. Shift registers	a. Experiments in digital principles-D.P. Leach b. Digital principles and applications - Malvino and Leach
2. Study of 8085 microprocessor Kit and 3. execution of simple Programmes	a. Microprocessor Architecture, Programming and Applications with the 8085 - R. S. Gaonkar b. Microprocessor fundamentals- Schaum Series- Tokheim c. 8085 Kit User manual
4. Waveform generation using 8085	a. Microprocessor Architecture, Programming and Applications with the 8085 - R. S. Gaonkar b. Microprocessor fundamentals- Schaum Series- Tokheim
5. SID& SOD using 8085	a. Microprocessor Architecture, Programming and Applications with the 8085 - R. S. Gaonkar b. Microprocessor fundamentals- Schaum Series- Tokheim c. 8085 Kit User manual
6. Ambient Light control power Switch	a. Electronic Instrumentation H. S. Kalsi b. Helfrick & Cooper, PHI
7. Interfacing TTL with buzzers, relays, motors and solenoids	Digital Electronics by Roger Tokheim

Note: Minimum number of experiments to be performed and reported in the journal = 06 with minimum 3 experiments from each Group. i.e. Group A: 03 and Goup B: 03

Additional references:

1. Digital theory and experimentation using integrated circuits - Morris E. Levine (Prentice Hall)
2. Practical analysis of electronic circuits through experimentation - Lome Macronaid (Technical Education Press)
3. Logic design projects using standard integrated circuits - John F. Waker (John Wiley & sons)
4. Practical applications circuits handbook - Anne Fischer Lent & Stan Miastkowski (Academic Press)
5. Digital logic design, a text lab manual - Anala Pandit (Nandu printers and publishers Pvt. Ltd.)

Note:

1. Journal should be certified by the laboratory in-charge only if the student performs satisfactorily the minimum number of experiments as stipulated above. Such students, who do not have certified journals, will not be allowed to appear for the practical examinations.
2. Total marks for the practical examinations = 200

M.Sc. (Physics) Theory Courses

Semester –III

Semester-III: Paper-I:

Course no.: SIPSPHY31: Statistical Mechanics (60 lectures, 4 credits)

Unit – I

The Statistical Basis of Thermodynamics - The macroscopic and the microscopic states, contact between statistics and thermodynamics, the classical ideal gas, The entropy of mixing and the Gibbs paradox, the enumeration of the microstates

Elements of Ensemble Theory - Phase space of a classical system, Liouville's theorem and its consequences.

The microcanonical ensemble - Examples

Quantum states and the phase space

Unit – II

The Canonical Ensemble - Equilibrium between a system and a heat reservoir, a system in the canonical ensemble, physical significance of the various statistical quantities in the canonical ensemble, expressions of the partition function, the classical systems, energy fluctuations in the canonical ensemble, correspondence with the microcanonical ensemble, the equipartition theorem and the virial theorem, system of harmonic oscillators, statistics of paramagnetism, thermodynamics of magnetic systems.

Unit – III

The Grand Canonical Ensemble - Equilibrium between a system and a particle-energy reservoir, a system in the grand canonical ensemble, physical significance of the various statistical quantities, Examples, Density and energy fluctuations in the grand canonical ensemble, correspondence with other ensembles.

Unit – IV

Formulation of Quantum Statistics - Quantum-mechanical ensemble theory: the density matrix, Statistics of the various ensembles, Examples, systems composed of indistinguishable particles, the density matrix and the partition function of a system of free particles.

Note: 50% of time allotted for lectures to be spent in solving problems.

Textbook/Main Reference:

Statistical Mechanics - R. K. Pathria & Paul D. Beale (Third Edition), Elsevier 2011 – Chap. 1 to 5

Additional References:

1. Thermodynamics and Statistical Mechanics, Greiner, Neise and Stocker, Springer 1995.
2. Introduction to Statistical Physics, Kerson Huang , Taylor and Francis 2001.
3. Thermal and Statistical Physics, F Reif.
4. Statistical Physics, D Amit and Walecka.
5. Statistical Mechanics, Kerson Huang.
6. Statistical Mechanics, J.K. Bhattacharjee.
7. Non-equilibrium Statistical Mechanics, J.K. Bhattacharjee.
8. Statistical Mechanics, Richard Feynman.
9. Statistical Mechanics, Landau and Lifshitz.
10. Thermodynamics, H.B. Callen

Semester-III: Paper-II:
Course no.: SIPSPHY32: Nuclear Physics (60 lectures, 4 credits)

Unit I. (12 Lectures + 3 Tutorials)

All static properties of nuclei (charge, mass, binding energy, size, shape, angular momentum, magnetic dipole momentum, electric quadrupole momentum, statistics, parity, isospin), Measurement of Nuclear size and estimation of R_0 (mirror nuclei and mesonic atom method) Q-value equation, energy release in fusion and fission reaction.

Deuteron Problem and its ground state properties, Estimate the depth and size of (assume) square well potential, Tensor force as an example of non-central force, nucleon-nucleon scattering-qualitative discussion on results, Spin-orbit strong interaction between nucleon, double scattering experiment.

*Tutorials should include 3 problem solving session based on above mentioned topics

Unit II. (11 Lectures + 4 Tutorials)

Review of alpha decay, Introduction to Beta decay and its energetic, Fermi theory: derivation of Fermi's Golden rule, Information from Fermi–curie plots, Comparative half-lives, selection rules for Fermi and G-T transitions.

Gamma decay: Multipole radiation, Selection rules for gamma ray transitions, Gamma ray interaction with matter, and Charge-particle interaction with matter.

*Tutorials should include 4 problem solving session based on above mentioned topics

Unit III. (11 Lectures + 4 Tutorials)

1. Nuclear Models: Shell Model (extreme single particle): Introduction, Assumptions, Evidences, Spin-orbit interactions, Predictions including Schmidt lines, limitations, Collective model - Introduction to Nilsson Model.
2. Nuclear Reactions: Kinematics, scattering and reaction cross sections, Compound nuclear reaction, direct nuclear reaction.

*Tutorials should include 4 problem solving session based on above mentioned topics

Unit IV. (11 Lectures + 4 Tutorials)

Introduction to the elementary particle Physics, The Eight fold way, the Quark Model, the November revolution and aftermath, The standard Model, Revision of the four forces, cross sections, decays and resonances, Introduction to Quantum Eletrodynamics, Introduction to Quantum Chromodynamics. Weak interactions and Unification Schemes (qualitative description), Revision of Lorentz transformations, Four-vectors, Energy and Momentum. Properties of Neutrino, helicity of Neutrino, Parity, Qualitative discussion on Parity violation in beta decay and Wu's Experiment, Charge conjugation, Time reversal, Qualitative introduction to CP violation and TCP theorem.

*Tutorials should include 4 problem solving session based on above mentioned topics

Main References:

1. Introductory Nuclear Physics, Kenneth Krane, Wiley India Pvt. Ltd.
2. Quantum Physics of Atoms, Molecules, Solids, Nuclei, and Particles, Robert Eisberg and Robert Resnick, Wiley (2006)
3. Introduction to Elementary Particles, David Griffith, John Wiley and sons.

Other References:

1. Introduction to Nuclear Physics, H. A. Enge, Eddison Wesley
2. Nuclei and Particles, E. Segre, W. A. Benjamin
3. Concepts of Nuclear Physics, B. L. Cohen
4. Subatomic Particles, H. Fraunfelder and E. Henley, Prentice Hall
5. Nuclear Physics : Experimental and Theoretical, H. S. Hans, New Age International
6. Introduction to Nuclear and Particle Physics, A. Das & T. Ferbel, World Scientific
7. Introduction to high energy physics, D. H. Perkins, Addison Wesley
8. Nuclear and Particle Physics, W. E. Burcham and M. Jones, Addison Wesley
9. Introductory Nuclear Physics, S. M. Wong, Prentice Hall.
10. Nuclear Physics: An Introduction, S. B. Patel, New Age International.
11. Nuclear Physics : S. N. Ghoshal
12. Nuclear Physics: Roy and Nigam

Semester-III: Elective Paper-III (Electronics I)

Course no.: SIPSPHYE135: Microcontrollers and Interfacing (60 lectures, 4 credits)

Unit-I:

8085 Interrupts**: The 8085 Interrupt, 8085 Vectored Interrupts, Restart as Software Instructions, Additional I/O Concepts and Processes.**

RSG - Ch 12: 12.1, 12.2, 12.3, 12.4

Programmable Peripheral and Interface Devices: The 8255A Programmable Peripheral Interface, Interfacing Keyboard and Seven Segment Display**, t**he 8259A Programmable Interrupt Controller, Direct Memory Access (DMA) and 8237 DMA Controller, the 8279 Programmable Keyboard/Display Interface

RSG - Ch 15: 15.1, 15.2, 15.5, 15.6 & Ch 14: only 14.3

Serial I/O and Data Communication: Basic Concepts in Serial I/O, Software Controlled Asynchronous Serial I/O, The 8085 Serial I/O lines: SOD and SID

RSG - Ch 16: 16.1, 16.2, 16.3,

Ref. RSG: - Microprocessor Architecture, Programming and Applications with the 8085 by Ramesh S. Gaonkar, Fifth Edition Penram International Publication (India) Pvt Ltd

Unit-II

8086 microprocessor:

Register organization of 8086, Architecture, Signal Descriptions of 8086, Physical Memory Organization, General Bus operation, I/O Addressing Capability, Special Processor Activities, Minimum mode 8086 system and timings, Maximum mode of 8086 system and timings.

AB - Ch 1: 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 1.8, 1.9.

8086 Instruction set and assembler directives:

Machine Language Instructions Formats, Addressing modes of 8086, Instruction set of 8086.

AB - Ch 2: 2.1, 2.2, 2.3.

The Art of Assembly Language Programming with 8086:

A few machine level programs, Machine coding the programs, Programming with an assembler (only using Debug), Assembly language example programs.

AB - Ch 3: 3.1, 3.2, 3.3.4 & 3.4

Special architectural features and related programming:

Introduction to Stack, Stack structure of 8086, Interrupts and Interrupt Service Routines, Interrupt cycle of 8086, Non-maskable interrupt, Maskable interrupt (INTR).

AB - Ch 4: 4.1, 4.2, 4.3, 4.4, 4.5, 4.6

Ref. AB: - Advanced Microprocessors and Peripherals by a K Ray and K M Bhurchandi Second Edition Tata McGraw–Hill Publishing Company Ltd.

(Note: Also refer Intel’s 8086 Data Sheet)

Unit-III:

8051 microcontroller: (Review of 8051), Timer/Counters, Interrupts, Serial communication

Programming 8051 Timers, Counter Programming

Basics of Serial Communication, 8051 Connection to RS232, 8051 Serial Port Programming in assembly. 8051 Interrupts, Programming Timer Interrupts,

Programming External hardware Interrupts, Programming the Serial Communication Interrupt, Interrupt Priority in 8051/52.

Ref. MMM: - The 8051 Microcontroller & Embedded Systems by M.A. Mazidi, J.G. Mazidi and R.D. Mckinlay, Second Edition, Pearson

Ref. AVD: -The 8051 Microcontroller

Unit-IV

16C61/71 PIC Microcontrollers: Overview and Features, PIC 16C6X/7X, PIC Reset Actions, PIC Oscillator Connections, PIC Memory Organization, PIC 16C6X/7X Instructions, Addressing Modes, I/O Ports, Interrupts in PIC 16C61/71, PIC 16C61/71Timers, PIC 16C71 Analog-to-Digital Converter.

Ref. AVD: - Microcontrollers by Ajay V. Deshmukh, Tata-Mcgraw Hill Publication

Additional Reference books:

1. The 8051 Microcontroller & Embedded Systems-Dr. Rajiv Kapadia (Jaico Pub.House)
2. 8051 Micro-controller, K.J.Ayala., Penram International.
3. Design with PIC microcontrollers by John B. Peatman, Pearson Education Asia.
4. Programming & customizing the 8051 microcontroller By Myke Predko, TMH.

Semester-III : Elective Paper-IV (Electronics I)

Course no.: SIPSPHYE136: Embedded Systems and RTOS (60 lectures, 4 credits)

Unit-I:

Programming Using C++: Introduction to Computers and programming , Introduction to C++, Expressions and interactivity , Making decisions, Looping , Functions , Arrays , Sorting arrays , Pointers

TG – Ch 1: 1.3 to 1.7 , Ch 2: 2.1 to 2.14, Ch 3: 3.1 to 3.11, Ch 4: 41 to 4.15, Ch 5: 5.1 to 5.13, Ch 6: 6.1 to 6.14, Ch 7: 7.1 to 7.9 , Ch 8: 8.3 , Ch 9: 9.1 to 9.7

Ref. TG: - Starting out with C++ from Control structures through objects, by Tony Gaddis, Sixth edition, Penram International Publications, India

Unit-II:

Introduction to classes: More about classes, Inheritance, polymorphism, virtual functions. TG – Ch 13: 13.1 to 13.11, Ch 14: 14.1 to 14.5, Ch 15: 15.1 to 15.6

Introduction to VC++: YK – Ch 1, 2, 3

Reference:

TG: - Starting out with C++ from Control structures through objects, by Tony Gaddis, Sixth edition Penram International Publications, India

YK: - Introduction to Visual C++ by Yashwant Kanetkar

Unit-III: Embedded systems

Introduction to Embedded Systems: What is an embedded system, Embedded System v/s General Computing System, Classification of Embedded Systems, Major Application Areas of Embedded Systems, Purpose of Embedded Systems, Smart Running Shoes.

SKV – Ch 1: 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7

A Typical Embedded system: Core of the embedded system

SKV – Ch 2: 2.1

Characteristics and quality Attributed of Embedded Systems: Characteristics of an Embedded System, Quality Attributes of Embedded Systems

SKV – Ch 3: 3.1, 3.2

Embedded Systems-Application and Domain–Specific: Washing Machine, Automatic-Domain, Specific examples of embedded system

SKV – Ch 4: 4.1, 4.2

Design Process and design Examples: Automatic Chocolate Vending machine (ACVM), Smart Card, Digital Camera, Mobile Phone, A Set of Robots

RK - Ch 1: 1.10.2, 1.10.3, 1.10.4, 1.10.5, 1.10.6, 1.10.7

Ref. SKV:- Introduction to embedded systems, by Shibu K. V. ,Sixth Reprint 2012, Tata McGraw Hill

Ref. RK: - "Embedded Systems" Architecture, Programming and Design, by Raj Kamal, Second Edition, The McGraw-Hill Companies

Unit-IV: - Real –Time Operating System based Embedded System Design:

Operating system Basics, Types of Operating Systems, Tasks, Process and Threads, Multi-processing and Multitasking, Task Scheduling, Threads, Processes and Scheduling: Putting them altogether, task Communication, task Synchronizations, Device Drivers, How to choose an RTOS.

SKV: Ch – 10: 10.1, 10.2, 10.3, 10.4, 10.5, 10.6, 10.7, 10.8, 10.9. 10.10

Ref: SKV :- Introduction to embedded systems, by Shibu K. V. ,Sixth Reprint 2012, Tata Mcgraw Hill

Additional references:

1. Object Oriented Programming with C++, By E. Balagurusamy, 2^{nd} ed. TMH.
2. OOPS with C++ from the Foundation, By N. R. Parsa, Dream Tech Press India Ltd.

M.Sc. (Physics) Practical Lab Course

Semester –III

Semester III Elective Lab Course-1

Course no.: SIPSPHYP32

The Students have to perform at least 10 experiments from the following:

I Microprocessor 8085 and 8086 based experiments

1. Study of 8085 interrupts (Vector Interrupt 7.5).
2. Study of PPI 8255 as Handshake I/O (mode 1): interfacing switches and LED's.
3. 8086 assembly language programming:
4. Simple data manipulation programs.(8/16-bit addition, subtraction, multiplication, division, 8/16 bit data transfer, finding greatest/smallest number, finding positive/negative numbers, finding odd/even numbers, ascending/descending of numbers, converting BCD nos. into Binary using INT 20, displaying a string of characters using INT 20)

Please note: Assembly language programming of 8086 may be done by operating PC in real mode by using 'Debug' program. Separate 8086 study kit not needed.

II Microcontroller 8031/8051 based experiments:

1. 8031/51 assembly language programming:

Simple data manipulation programs.(8/16-bit addition, subtraction, multiplication, division, 8/16 bit data transfer, cubes of nos., to rotate a 32- bit number, finding greatest/smallest number from a block of data, decimal / hexadecimal counter)

2. Study of IN and OUT port of 8031/51 by Interfacing switches, LEDs and Relays: to display bit pattern on LED's, to count the number of "ON" switches and display on LED's, to trip a relay depending on the logic condition of switches, event counter(using LDR and light source)

3. Study of external interrupts (INT0/INT1) of 8031/51.
4. Study of internal timer and counter in 8031/51.

III 16F84 or 16FXXX) PIC Micro-controller based experiments (Using assembly language only):

1. Interfacing LED's: flashing LED's, to display bit pattern, 8-bit counter.
2. Interfacing Push Buttons: to increment and decrement the count value at the output by recognizing of push buttons, etc
3. Interfacing Relay: to drive an ac bulb through a relay; the relay should be tripped on recognizing of a push button.
4. Interfacing buzzer: the buzzer should be activated for two different frequencies, depending on recognizing of corresponding push buttons.

IV C++ and Visual C++ experiments:

1. C++ Program (Conversion from decimal system to binary, octal, hexadecimal system).
2. C++ Program (Program on mean, variance, standard deviation for a set of numbers.
3. C++ Program (Sorting of data in ascending or descending order).
4. C++ experiment (Programs on class, traffic lights)
5. C++ experiment (Programs on inheritance, over loading)
6. Visual C++ experiment

V Computation

1. Least squares fit / curve-fitting
2. Interpolation

References:

(i) Op-amp and linear ICs by Ramakant Gayakwad (3rd ed. 1993, Prentice Hall of India).
(ii) Modern Electronic Communication by Gary M. Miller (6th ed., 1999, Prentice Hall International, Inc.).
(iii) Op-amp and linear integrated circuits by Coughlin and Driscoll (4th ed. 1992, Prentice Hall of India).
(iv) Integrate Circuits by K. R. Botkar (8th ed., Khanna Publishers, Delhi).
(v) Design with Operational Amplifiers and Analog Integrated Circuits by Sergio Franco (3rd ed., Tata McGraw Hill).
(vi) Analog and Digital Communication Systems by Martin S. Roden (5th ed., Shroff Publishers and Distributors Pvt. Ltd.).
(viii) Microwaves by K. C. Gupta (New Age International Ltd.).
(ix) Electronic Communications by Dennis Roddy and John Coolen (4th ed., Pearson Education).
(x) Basic microwave techniques and laboratory manual by M. L. Sisodia and G. S. Raghuvanshi (Wiley Eastern Ltd. 1987.).
(xi) Electronic communication systems by George Kennedy and Bernard Davis (4th ed., Tata McGraw Hill Publishing Company Ltd., New Delhi).
(xii) Digital communication systems by Harold Kolimbiris (Pearson Education Asia).
(xiii) Optical fiber communication by G. Keiser (3rd ed., McGraw Hill).
(xiv) Digital signal processing demystified by James D. Broesch (Penram International Publications, India).
(xv) The indispensable PC hardware book - Hans-Peter Messmer, Addison Wesley (PEA).
(xvi) Parallel port complete by Jan Axelson, (Penram International Publications, India).
(xvii) Serial port complete by Jan Axelson, (Penram International Publications, India).
(xviii) 8031/8051 Manuel Provided by the manufacturers
(xix) AVD: - Microcontrollers by Ajay V. Deshmukh, Tata-Mcgraw Hill Publication
(xx) The 8051 Microcontroller & Embedded Systems by M.A. Mazidi, J.G. Mazidi and R.D. Mckinlay, Second Edition, Pearson

(xxi) Starting out with C++ from Control structures through objects, by Tony Gaddis, Sixth edition, Penram International Publications, India
(xxii) Object Oriented Programming with C++, By E. Balagurusamy, 2^{nd} ed. TMH.

Note:

1. Journal should be certified by the laboratory in-charge only if the student performs satisfactorily the minimum number of experiments as stipulated above. Such students, who do not have certified journals, will not be allowed to appear for the practical examinations.

M.Sc. (Physics) Theory Courses
Semester –IV

Semester-IV: Paper-I:

Course no: SIPSPHY41 Experimental Physics (60 hours 4 Credits)

Unit-I

Data Analysis for Physical Sciences: Population and Sample, Data distributions Probability, Probability Distribution, Distribution of Real Data, The normal distribution, The normal distribution, From area under a normal curve to an interval, Distribution of sample means, The central limit theorem, The t distribution, The log- normal distribution, Assessing the normality of data, Population mean and continuous distributions, Population mean and expectation value, The binomial distribution The Poisson distribution, Experimental Error, Measurement, error and uncertainty, The process of measurement, True value and error, Precision and accuracy, Random and systematic errors, Random errors, Uncertainty in measurement.

Main Reference: Data Analysis for Physical Sciences (Featuring Excel®) Les Kirkup, 2nd Edition, Cambridge University Press (2012), Chapters 1-6 and 9

Additional Reference: Statistical Methods in Practice for scientists ad Technologists, Richard Boddy and Gordon Smith, John Wiley & Sons (2009)

Internal tests will be of solving problems using Excel.

Unit II

Vacuum Techniques: Fundamental processes at low pressures, Mean Free Path, Time to form monolayer, Number density, Materials used at low pressurs, vapour pressure Impingement rate, Flow of gases, Laminar and turbulent flow, Production of low pressures; High Vacuum Pumps and systems, Ultra High Vacuum Pumps and System, Measurement of pressure, Leak detections

References:

I. Vacuum Technology, A. Roth, North Holland Amsterdam

II. Ultra High Vacuum Techniques, D. K. Avasthi, A. Tripathi, A. C. Gupta, Allied Publishers Pvt. Ltd (2002)

III. acuum Science and Technology, V. V. Rao, T. B. Ghosh, K. L. Chopra, Allied Publishers Pvt. Ltd (2001)

Unit III

Nuclear Detectors: Gamma ray spectrometer using NaI scintillation detector, High Purity Germanium detector, Multi-wire Proportional counter

Acclerators: Cockroft Walten Generator, Van de Graaf Generator, Sloan and Lawrence type Linear Accelerator, Proton Linear Accelerator, Cyclotron and Synchrotron.

References

1. Nuclear Radiation Detection- William James Price , McGraw Hill
2. Techniques for Nuclear and Particle Physics Experiments, W.R. Leo, Springer- Verlag
3. Radiation Detection and Measurement, Glenn F. Knoll, John Wiley and sons, Inc.
4. Particle Accelerators, Livingston, M. S.; Blewett, J.
5. Introduction to Nuclear Physics, HA Enge, pp 345-353
6. Electricity & Magnetism and Atomic Physics Vol. II, J. Yarwood
7. Principles of Particle Accelerators, E. Persico, E. Ferrari, S.E. Segre

8. Fundamentals of Molecular Spectroscopy, C. N. Banwell, Tata-McGraw Hill
9. Radiation detection & Measurement-Glenn F. Knoll
10. Techniques for Nuclear & Particle Physics Experiment- William Leo

Unit IV

Characterization techniques for materials analysis:

1. Spectroscopy: XRD,XRF, XPS, EDAX , Raman, UV Visible spectroscopy, FTIR spectroscopy.

2. Microscopy: SEM, TEM, AFM

References:

i. An Introduction to Materials Characterization, Khangaonkar P. R., Penram International Publishing

ii. Rutherford Backscattering Spectrometry, W. K. Chu, J. W. Mayer, M. A. Nicolet, Academic Press

iii. A Guide to Materials Characterization and Chemical Analysis, John P. Sibilia, Wiley-VCH; 2 edition

iv. Fundamentals of Surface and Thin Film Analysis, L.C. Feldman and J.W. Mayer North Holland amsterdam

v. Elements of X-ray diffraction, Cullity, B. D Addison-Wesley Publishing Company, Inc.

vi. Nano: The Essentials: T.Pradeep, TMH Publications

<u>**Semester-IV: Paper-II:**</u>

<u>**Course no: SIPSPHY42 Atomic and Molecular Physics (60 hours 4 Credits)**</u>

Unit I: Review* of one-electron eigenfunctions and energy levels of bound states, Probability density, Virial theorem. Fine structure of hydrogenic atoms, Lamb shift. Hyperfine structure and isotope shift. (ER 8-6)

Linear and quadratic Stark effect in spherical polar coordinates. Zeeman effect in strong and weak fields, Paschen-Back effect. (BJ, GW)

Schrodinger equation for two electron atoms: Identical particles, The Exclusion Principle. Exchange forces and the helium atom (ER), independent particle model, ground and excited states of two electron atoms. (BJ)

Unit II

The central field, Thomas-Fermi potential, the gross structure of alkalis (GW). The Hartree theory, ground state of multi-electron atoms and the periodic table (ER), The L-S coupling approximation, allowed terms in LS coupling, fine structure in LS coupling, relative intensities in LS coupling, j-j coupling approximation and other types of coupling (GW)

Unit III:

Interaction of one electron atoms with electromagnetic radiation: Electromagnetic radiation and its interaction with charged particles, absorption and emission transition rates, dipole approximation. Einstein coefficients, selection rules. Line intensities and life times of excited state, line shapes and line widths. X-ray spectra. (BJ)

Unit IV:

Born-Oppenheimer approximation - rotational, vibrational and electronic energy levels of diatomic molecules, Linear combination of atomic orbitals (LCAO)and Valence bond (VB) approximations, comparison of valence bond and molecular orbital theories (GA, IL)

A) Rotation of molecules: rotational energy levels of rigid and non-rigid diatomic molecules, classification of molecules, linear, spherical, symmetric and asymmetric tops. **B)** Vibration of molecules: vibrational energy levels of diatomic molecules, simple harmonic and anharmonic oscillators, diatomic vibrating rotator and vibrational-rotational spectra. **c)** Electronic spectra of diatomic molecules: vibrational and rotational structure of electronic spectra. (GA, IL)
Quantum theory of Raman effect, Pure rotational Raman spectra, Vibrational Raman spectra, Polarization of light and the Raman effect, Applications
General theory of Nuclear Magnetic Resonance (NMR). NMR spectrometer, Principle of Electron spin resonance ESR. ESR spectrometer. (GA, IL)
(*Mathematical details can be found in BJ. The students are expected to be acquainted with them but not examined in these.)

Reference:

1. Robert Eisberg and Robert Resnick, Quantum physics of Atoms, Molecules, Solids, Nuclei and Particles, John Wiley & Sons, 2nd ed, (ER)
2. B.H. Bransden and G. J. Joachain, Physics of atoms and molecules, Pearson Education 2nd ed, 2004 (BJ)
3. G. K. Woodgate, Elementary Atomic Structure, Oxford university press, 2nd ed, (GW).
4. G. Aruldhas, Molecular structure and spectroscopy, Prentice Hall of India 2nd ed, 2002 (GA)
5. Ira N. Levine, Quantum Chemistry, Pearson Education, 5th edition, 2003 (IL)

Additional reference:

1. Leighton, Principals of Modern Physics, McGraw hill
2. Igor I. Sobelman, Theory of Atomic Spectra, Alpha Science International Ltd. 2006
3. C. N. Banwell, Fundamentals of molecular spectroscopy, Tata McGraw-Hill, 3rd ed
4. Wolfgang Demtröder, Atoms, molecules & photons, Springer-Verlag 2006
5. Sune Svanberg, Atomic and Molecular Spectroscopy Springer, 3rd ed 2004
6. C.J. Foot, Atomic Physics, Oxford University Press, 2005 (CF)

Semester-IV : Elective Paper-III (Electronics I)

Course no.: SIPSPHYE145: Microprocessors and ARM 7 (60 lectures, 4 credits)

Unit-I: PIC 16F8XX Flash Microcontrollers:
Introduction, Pin Diagram, STATUS Register, Power Control Register (PCON), OPTION_REG Register, Program memory, Data memory, I/O Ports
AVD – Ch 10: 10.1, 10.2, 10.3, 10.4, 10.5, 10.6, 10.7, 10.10 Capture/Compare/PWM (CCP) Modules in PIC 16F877, Analog-to-Digital Converter AVD – Ch 11: 11.1, 11.2, 11.5
Ref. AVD: - Microcontrollers by Ajay V. Deshmukh, Tata-Mcgraw Hill Publication

Unit-II: Interfacing microcontroller/PIC microcontroller and Industrial Applications of microcontrollers:
Light Emitting Diodes (LEDs); Push Buttons, Relays and Latch Connections; Keyboard Interfacing; Interfacing 7-Segment Displays; LCD Interfacing; ADC and DAC Interfacing with 89C51 Microcontrollers.
Introduction and Measurement Applications (For DC motor interfacing and PWM refer Sec 17.3 of MMM)
AVD: ch.12,ch.13.
MMM: Sec 17.3
Ref: AVD: -Microcontrollers by Ajay V. Deshmukh, Tata-Mcgraw Hill Publication

Ref. MMM:- The 8051 Microcontroller & Embedded Systems by M.A. Mazidi, J.G. Mazidi and R.D. Mckinlay, Second Edition, Pearson

Unit-III: ARM 7:

The ARM Architecture: The Acorn RISC Machine, Architectural inheritance, The ARM Programmer's model, ARM development tools.

SF - Ch 2: 2.1, 2.2, 2.3, 2.4

ARM Organization and Implementation: 3 – stage Pipeline ARM organization, ARM instruction execution, ARM implementation.

SF - Ch 4: 4.1, 4.3, 4.4

ARM Processor Cores: ARM7TDMI

SF – Ch 9: 9.1 only

Ref. SF: - ARM System-on-Chip Architecture, by Steve Furber, Second Edition, Pearson

Unit-IV: ARM 7

ARM Assembly language Programming: Data processing instructions, Data transfer instructions, Control flow instructions, Writing simple assembly language programs.

SF – Ch 3: 3.1, 3.2, 3.3, 3.4

The ARM Instruction Set: Introduction, Exceptions, Condition execution, Branch and Branch with Link (B, BL), Branch, Branch with Link and eXchange (BX,BLX), Software Interrupt (SWI), Data processing instructions , Multiply instructions, Count leading zeros (CLZ), Single word and unsigned byte data transfer instructions, Half-word and signed byte data transfer instructions, Multiple register transfer instructions, Swap memory and register instructions (SWP), Status register to general register transfer instructions, General register to Status register transfer instructions

SF – Ch 5: 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.7, 5.8, 5.9, 5.10, 5.11, 5.12, 5.13, 5.14, 5.15

The Thumb Instruction Set: the Thumb bit in the CPSR, The Thumb programmer's model, Thumb branch instructions, Thumb software interrupt instruction, Thumb data processing instructions, Thumb single register data transfer instructions, Thumb multiple register data transfer instructions, Thumb breakpoint instruction, Thumb implementation, Thumb applications, Example and exercises.

SF – Ch 7: 7.1, 7.2, 7.3, 7.4, 7.5, 7.6, 7.7, 7.8, 7.9, 7.10, 7.11

Ref. SF: - ARM System-on-Chip Architecture, by Steve Furber, Second Edition, Pearson

Additional Ref:

1 Microprocessors and interfacing, programming and hardware, By Douglas V. Hall (TMH)

2 8086 Microprocessor: Programming and Interfacing K.J.Ayala, Penram International

Semester-IV: Elective Paper-IV (Electronics I)

Course no.: SIPSPHYE146: VHDL and Communication Interface (60 lectures, 4 credits)

Unit – I: VHDL-I:

Introduction to VHDL: VHDL Terms, Describing Hardware in VHDL, Entity, Architectures , Concurrent Signal Assignment , Event Scheduling, Statement concurrency, Structural Designs, Sequential Behavior, Process Statements, Process Declarative Region, Process Statement Part, Process Execution, Sequential Statements, Architecture Selection, Configuration Statements, Power of Configurations.

DLP - Ch 1

Behavioral Modeling: Introduction to Behavioral Modeling, Transport Versus Inertial Delay, Inertial Delay, Transport Delay, Inertial Delay Model, Transport Delay Model, Simulation Deltas, Drivers, Driver Creation, Bad Multiple Driver Model, Generics, Block Statements, Guarded Blocks.

DLP - Ch 2

Sequential Processing: Process Statement, Sensitivity List, Process Example, Signal Assignment Versus Variable Assignment, Incorrect Mux Example, Correct Mux Example, Sequential Statements, IF Statements, CASE Statements, LOOP statements, NEXT Statement, EXIT Statement, ASSERT Statement, Assertion BNF, WAIT statements, WAIT ON Signal, WAIT UNTIL Expression, WAIT FOR time_expression, Multiple WAIT Conditions, WAIT Time-Out, Sensitivity List Versus WAIT Statement, Concurrent Assignment Problem, Passive Processes.

DLP - Ch 3

Ref. DLP: - VHDL programming by example by Douglas L. Perry, Fourth edition, Tata McGraw- Hill

Unit-II: VHDL-II:

Data Types: Object Types, Signal, Variables, Constants, Data Types, Scalar Types, Composite Types, Incomplete Types, File Types, File Type Caveats, Subtypes.

DLP - Ch 4

Subprograms and Packages: Subprograms Function, Conversion Functions, Resolution Functions, Procedures, Packages, Package Declaration, Deferred Constants, Subprogram Declaration, Package Body.

DLP - Ch 5

Predefined Attributes: Value Kind Attributes, Value Type Attributes, Value Array Attributes, Value Block Attributes, Function Kind Attributes, Function Type Attributes, Function Array Attributes, Function Signal Attributes, Attributes ‘EVENT and ,LAST-VALUE Attribute ‘LAST- EVENT Attribute, ‘ACTIVE and ‘LAST-ACTIVE Signal Kind Attributes, Attribute ‘DELAYED, Attribute ‘STABLE, Attribute ‘QUIET, Attribute TRANSACTION, Type Kind Attributes, Range Kind Attributes.

DLP - Ch 6

Configurations: Default Configurations, Component Configurations, Lower-Level Configurations, Entity-Architecture Pair Configuration, Port Maps, Mapping Library Entities, Generics in Configurations, Generic Value Specification in Architecture, Generic Specifications in Configurations, Board-Socket-Chip Analogy, Block Configurations, Architecture configurations. DLP - Ch 7

Ref. DLP: - VHDL programming by example by Douglas L. Perry, Fourth edition, Tata McGraw- Hill

Unit-III: Understanding USB and USB Protocols

USB Basics: Uses and limits, Evolution of an interface, Bus components, Division of Labor, Developing a Device.

JA – Ch 1

Inside USB Transfers: Transfer Basics, Elements of a Transfer, USB 2.0 Transactions, Ensuring Successful Transfers, SuperSpeed Transactions.

JA – Ch 2

A Transfer Type for Every Purpose: Control transfers, Bulk Transfers, Interrupt Transfers, Isochronous Transfers, More about time-critical transfers.

JA – Ch 3

Enumeration: How the Host learns about devices: The Process,

Descriptors. JA – Ch 4

Control Transfers: Structured Requests for Critical Data: Elements of a Control Transfer, Standard Requests, Other Requests.

JA – Ch 5

Chip Choices: Components of USB device.

JA – Ch 6: Pages 137 - 141

How the Host Communicates: Device Drivers, Inside the Layers, Writing Drivers, Using GUIDs. JA – Ch 8

Ref. JA: - The Developers Guide "USB Complete", by Jan Axelson, Fourth Edition, Penram International Publishing (India) Pvt Ltd

Unit-IV: Communication Interface

On board Communication Interface: Inter Integrated Circuit (I2C), Serial Peripheral Interface (SPI), Universal Asynchronous Receiver Transmitter (UART), Wire Interface, Parallel Interface, External Communication Interfaces: RS-232 & RS-485, USB, IEEE 1394 (Firewire), Infrared (IrDA), Bluetooth, Wi-Fi, ZigBee, GPRS.

SKV: Ch – 2: 2.4

Detailed studies of I2C Bus refer:

I2C Bus Specification Version 2.1 by Philips (Pages 4-18 and 27-30) (Download from www.nxp.com)

- The I2C-Bus Benefits designers and manufacturers (Art 2: 2.1, 2.2)
- Introduction to the I2C-Bus Specification (Art 3)
- The I2C-Bus Concept (Art 4)
- General Characteristics (Art 5)
- Bit Transfer (Art 6)

Data validity (6.1), START and STOP conditions (6.2)

- Transferring Data (Art 7) Byte format 7.1, Acknowledge 7.2
- Arbitration and Clock Generation (Art 8)

Synchronization (8.1), Arbitration (8.2), Use of the clock synchronizing mechanism as a handshake (8.3)

- Formats with 7-Bit Addresses (Art 9)
- 7-Bit Addressing (Art 10)

Definition of bits in the first byte (10.1)

- 10-Bit Addressing (Art 14)

Definition of bits in the first two bytes (14.1), Formats with 10-bit addresses (14.2) Detailed study of Bluetooth: Overview, Radio Specifications, FHSS WS: Ch- 15: 15.1, 15.2 upto Page 512

Ref: SKV :- Introduction to embedded systems, by Shibu K. V. ,Sixth Reprint 2012, Tata Mcgraw Hill

WS:-Wireless Communications and Networks, by William Stallings, 2nd edition Pearson

M.Sc. (Physics) Practical Lab Course

Semester –IV

Course no.: SIPSPHYP42

B. Students have to perform at least 10 experiments out of following:

I. Interfacing 8031/8051 based experiments:

1. Interfacing 8 bit DAC with 8031/51 to generate waveforms: square, sawtooth, triangular.
2. Interfacing stepper motor with 8031/51: to control direction, speed and number of steps.
3. Interface 8-bit ADC (0804) with 8031/51: to convert an analog signal into its binary equivalent.

II. ARM7 based experiments:

1. Simple data manipulation programs (addition, subtraction, multiplication, division etc).
2. Study of IN and OUT port of ARM7 by Interfacing switches, LEDs etc.
3. Study of Timer.
4. Interfacing DAC/ADC using I2C Protocols.

III. Basic VHDL experiments:

a. Write VHDL programs to realize: logic gates, half adder and full adder
b. Write VHDL programs to realize the following combinational designs: 2 to 4 decoder, 8 to 3 encoder without priority, 4 to 1 multiplexer, 1 to 4 de- multiplexer
c. Write VHDL programs to realize the following: SR – Flip Flop, JK – Flip Flop, T – Flip Flop
d. Write a VHDL program to realize a 2/3/4 - bit ALU (2- arithmetic,2-logical operations)

IV VHDL interfacing based experiments

1. Interfacing stepper motor: write VHDL code to control direction, speed and number of steps.
2. Interfacing dc motor: write VHDL code to control direction and speed using PWM.
3. Interfacing relays: write VHDL code to control ac bulbs (at least two) using relays.

V. Computation
   a. Computer program for file handling.

VI.
e.g.
Any one classical Experiment (available in department or affiliated institutions)

1. Millikan's oil-drop method,
2. Raman effect in liquids,
3. e/m by Thomson's method
4. Rydberg's constant using constant deviation prism.

References:

1. Advanced Microprocessors and Peripherals by a K Ray and K M Bhurchandi Second Edition Tata McGraw–Hill Publishing Company Ltd.
2. ARM System-on-Chip Architecture, by Steve Furber, Second Edition, Pearson
3. VHDL programming by example by Douglas L. Perry, Fourth edition, Tata McGraw-Hill
4. Manual of VHDL kit.

1. Journal should be certified by the laboratory in-charge only if the student performs satisfactorily the minimum number of experiments as stipulated above. Such students, who do not have certified journals, will not be allowed to appear for the practical examinations.

M.Sc. (Physics) Projects

Semesters III and IV

Project evaluation guidelines

Every student will have to complete one project each in Semester III and Semester IV with four credits (100 marks) each. Students can take one long project (especially for SSP/SSE/Material Science/Nanotechnology/Nuclear Physics etc) or two short project (especially for EI /EII). However, for one long project students have to submit two separate project reports / dissertation consisting of the problem definition, literature survey and current status, objectives, methodology and some preliminary experimental work in Semester III and actual experimental work, results and analysis in semester IV with four credits each. Those who have opted for two separate projects will also have to submit two separate project reports at each examination. The project can be a theoretical or experimental project, related to advanced topic, electronic circuits, models, industrial project, training in a research institute, training of handling sophisticated equipment etc.

Maximum three students can do a joint project. Each one of them will submit a separate project report with details/part only he/she has done. However he/she can in brief (in a page one or two) mention in Introduction section what other group members have done. In case of electronic projects, use of readymade electronic kits available in the market should be avoided. The electronics project / models should be demonstrated during presentation of the project. In case a student takes training in a research institute/training of handling sophisticate equipment, he/she should mention in a report what training he/she has got, which instruments he/she handled and their principle and operation etc.

Each project will be of 100 marks with 50% by internal and 50% by external evaluation.

The project report should be file bound/spiral bound/hard bound and should have following format

- Title Page/Cover page
- Certificate endorsed by Project Supervisor and Head of Department
- Declaration
- Abstract of the project
- Table of Contents
- List of Figures
- List of Tables
- Chapters of Content –
- Introduction and Objectives of the project
- Experimental/Theoretical Methodology/Circuit/Model etc. details
- Results and Discussion if any
- Conclusions
- References

Evaluation by External/Internal examiner will be based on following criteria:
(each semester)

Criteria	**Maximum Marks**
Literature Survey	05
Objectives/Plan of the project	05
Experimental/Theoretical methodology/Working condition of project or model	10
Significance and originality of the study/Society application and Inclusion of recent References	05
Depth of knowledge in the subject / Results and Discussions	10
Presentation	15
Maximum marks by External examiner	50
Maximum marks by internal examiner/guide	50
Total marks	100