Shri Vile Parle Kelavani Mandal's

MITHIBAI COLLEGE OF ARTS, CHAUHAN INSTITUTE OF SCIENCE & AMRUTBEN JIVANLAL COLLEGE OF COMMERCE AND ECONOMICS (AUTONOMOUS)

NAAC Reaccredited 'A' grade, CGPA: 3.57 (February 2016),

Granted under RUSA, FIST-DST & -Star College Scheme of DBT, Government of Indi

Best College (2016-17), University of Mumbai

Affiliated to the

UNIVERSITY OF MUMBAI

Program: Master of Science (By paper)

Course: Physics

Semester: III and IV

Choice Based Credit System (CBCS) with effect from the Academic year 2020-21

PROGRAM SPECIFIC OUTCOMES (PSO'S)

On completion of the MSc Physics, the learners should be enriched with knowledge and be able to-

PSO1: Physics knowledge: Understand current development in various dolmens of modern Physics like Nuclear Physics, Electrodynamics, Atomic and Molecular Physics, Classical Mechanics, Quantum Mechanics, Statistical Mechanics, Mathematical Physics, Solid state Physics, Advanced Electronics, Solid state devices, Experimental techniques and electronic communication technology.

PSO2: Practical Skills and Analytical Abilities: Develop analytical abilities and acquire practical skill in handling measuring equipment required to carry out experiments in different areas of Physics, verify complex Physics problems through experimentation and use them to develop science and technology.

PSO3: Motivation and life-long learning: Acquire skills like collaborative work, communication and independent learning required for lifelong learning to overcome challenges ahead.

PSO4: Research: Clear competitive examination like SET, NET, JRF, PET and JEST required for pursue research at different research institutes and Universities. Get trained for a career in basic sciences and contribute in educational institutes, industries and emerging branches of science

PSO5: Ethics: Demonstrate professional behaviour such as (i) being objective, unbiased and truthful in all aspects of work and avoiding unethical, irrational behaviour such as fabricating, falsifying or misrepresenting data or committing plagiarism; (ii)the ability to identify the potential ethical issues in work-related situations; (iii) appreciation of intellectual property, environmental and sustainability issues; and (iv) promoting safe learning and working environment.

PREAMBLE

Physics is a scientific knowledge of natural phenomenon at macro as well as micro level and proved as key for development of modern science and technology. The courses offered in this M.Sc Physics program gives adequate knowledge of Physics and necessary practical skills to students who may go on to work in different areas like Nuclear Physics, Material science, advanced electronics, Astrophysics, Theoretical Physics and Instrumentations.

This M. Sc. in Physics Program to be taught from the academic year 2020-21 onwards consists of total 16 theory courses, total 6 practical lab courses and 2 projects spread over four semesters. 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.

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SYLLABUS

MSC, PHYSICS, SEMESTER-III

Program: Master of Science (Physics)				**Semester: III**	
Course:	Statistical Mechanics			**Course Code:** PSMAPH301	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Continuous Assessment and Evaluation (CAE) (Marks - _____)**	**Term End Examinations (TEE) (Marks- _____ in Question Paper)**
4	-	-	4	25	75

Pre-requisite:

Basic knowledge of Thermodynamics and statistical mechanics up to undergraduate level. The systematic and planned curricula from these courses shall motivate and encourage learners to understand basic concepts of Physics.

Learning Objectives:

To teach concept of ensemble, Liouville's theorem and its consequences, microcanonical ensemble and its applications, Grand canonical ensembles and its applications, Quantum mechanical ensemble theory, theory density matrix and its applications, Understand various applications of canonical, micro canonical and grand canonical ensemble theories to thermodynamics properties of matters.

Course Outcomes:

After completion of the course, learners would be able to:

- **CO1:** describe the statistical basis of thermodynamics, concept of ensemble, Liouville's theorem and its consequences, microcanonical ensemble and its applications, Grand canonical ensembles and its applications, Quantum mechanical ensemble theory, theory density matrix and its applications.
- **CO2:** understand various applications of canonical, micro canonical and grand canonical ensemble theories to thermodynamics properties of matters.
- **CO3:** classify various ensembles and apply them to solve statistical mechanics problems.
- **CO4:** compare different particle systems and choose proper method to evaluate different thermodynamical potential.
- **CO5:** evaluate density matrix for quantum statistical system to solve problems in statistical mechanics. And Estimate different thermodynamical potential using various ensemble.
- **CO6:** derive and formulate various theorems based on topic covered

Outline of Syllabus: (per session plan)

Unit	**Description**	**Duration**

1	**The Statistical Basis of Thermodynamics, and Microcanonical Ensemble**	**15**
2	**Canonical ensemble.**	**15**
3	**The Grand Canonical Ensemble**	**15**
4	**Formulation of Quantum Statistics.**	**15**
	Total	60

DETAILED SYLLABUS

Unit	Description	Duration
1	**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	**15**
2	**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.	**15**
3	**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.	**15**
4	**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.	**15**

Reference Books:

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

Additional Reference Book:

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

Program: Master of Science (Physics)				**Semester: III**	
Course: Nuclear Physics				**Course Code: PSMAPH302**	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Continuous Assessment and Evaluation (CAE) (Marks - _____)**	**Term End Examinations (TEE) (Marks- _____ in Question Paper)**
4	--	-	4	25	75

Pre-requisite: Basic Knowledge of Nuclear Physics and quantum mechanics

Learning Objectives:

1. To teach the students concept of radioactivity, nuclear reaction, nuclear model and theory of elementary particles
2. To familiarize with current and recent scientific and technological developments.

Course Outcomes:

After completion of the course, learners would be able to:

CO1: understand Basic nuclear properties, Q value equation, energy release in fusion and fission reactions, nucleon-nucleon scattering, Spin –orbit interaction, theories of alpha, beta and gamma particles, interaction of alpha, beta and gamma particles with matter, Nuclear models, compound and direction nuclear reaction, theory of elementary particles.

CO2: explain dipole, quadrupole momentum of nucleus. Explain Deuteron and its ground state properties.

CO3: application of fermi's Golden rule, apply nuclear reactions to find nuclear energy states.

CO4: distinguish Compound and direct nuclear reactions, distinguish Fermi and GT transitions.

CO5: evaluate energy and spin states for nuclei, evaluate type of radiation for a given nuclear transitions.

CO6: derive expression for energetics in beta decays, derive expression for nuclear moments.

Outline of Syllabus: (per session plan)

Unit	Description	Duration
1	Static properties of nuclei, Deuteron Problem.	15
2	Review of alpha decay, beta decay and its energetics and Gama decay.	15
3	Nuclear Models and Nuclear Reactions	15
4	Elementary particle Physics	15
	Total	60

DETAILED SYLLABUS

Unit	Description	Duration
1	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.	**15**
2	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.	**15**
3	Nuclear Models: Shell Model (extreme single particle): Introduction, Assumptions, Evidences, Spin-orbit interactions, Predictions including Schmidt lines, limitations, Collective model - Introduction to Nilsson Model. Nuclear Reactions: Kinematics, scattering and reaction cross sections, Compound nuclear reaction, direct nuclear reaction.	**15**

4	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 Electrodynamics, 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.	**15**

Reference Books:

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.

Additional Reference Books:

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

Program: Master of Science (Physics)				**Semester : III**	
Course : Signal Modulation and Transmission Techniques				**Course Code:** PSMAPH303	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Continuous Assessment and Evaluation (CAE) (Marks -)**	**Term End Examinations (TEE)**

					(Marks- in Question Paper)
4	-	-	4	25	75

Pre-requisite: Basic Knowledge of analog and digital signals.

Learning Objectives:

1. To teach the students concept of signal modulation smith chart and its application propagation of EM waves and theory of antenna and its application.
2. To familiarize with current and recent scientific and technological developments.

Course Outcomes:

After completion of the course, learners would be able to:

CO1: describe Electromagnetic spectra and different frequency bands, different types of modulation, receivers, concept of characteristic impedance, stubs.

CO2: classify the various strata of atmosphere and its effect on electromagnetic propagation of waves, explain frequency spectrum, draw conclusions, generation of FM.

CO3: calculate the various parameter associates with electromagnetic propagation of waves. Solve the numerical based on all concepts of modulation, noise, receivers, matching of transmission lines using Smith charts and matching of impedance using sub

CO4: compare the electromagnetic propagation of waves at different time and space, compare different modulation techniques.

CO5: evaluate the Evaluate modulation index, sideband power, deviation, etc. Evaluate electromagnetic propagation of waves

CO6: derive the various expression/equation associated with electromagnetic propagation of waves, derive the equation for carrier suppression, capacitive reactance etc and other formulas

Outline of Syllabus: (per session plan)

Unit	Description	Duration
1	**Single Sideband Techniques**	**15**
2	**Transmission Line Theory**	**15**
3	**Electromagnetic Radiation and Propagation of Waves**	**15**
4	**Antennas**	**15**
	Total	**60**

DETAILED SYLLABUS

Unit	Description	Duration
1	**Single Sideband Techniques***:* Evolution and description of SSB, Suppression of carrier, Suppression	**15**

	of unwanted sideband, Extensions of SSB, Frequency Modulation: Theory of frequency and phase modulation, Noise and frequency modulation, Generation of frequency modulation. Radio Receivers: Receiver types, AM receivers, Communication receivers, FM receivers, Single- sideband receivers, Independent-sideband receivers.	
2	**Transmission Line Theory*:*** Fundamental of transmission lines, Different types of transmission lines; Telephone lines and cables, Radio frequency lines, Micro strip transmission lines. Definition of characteristics impedance, Losses in transmission lines, Standing waves, Quarter and Half wavelength lines, Reactance properties of transmission lines, Fundamental of the Smith charts and its applications.	**15**
3	**Electromagnetic Radiation and Propagation of Waves*:*** Fundamental of electromagnetic waves, Effects of the environment, Propagation of waves; Ground waves, Sky wave propagation, Space waves, Tropospheric scatter propagation, Extraterrestrial communication	**15**
4	**Antennas:** Basic considerations, Wire radiators in space, Terms and definitions, Effects of ground on antennas, Antenna Coupling at medium frequencies, Directional high frequency antennas, UHF and Microwave antennas, Wideband and special purpose antennas	**15**

Reference Books:

1. Electronic Communication Systems by George Kennedy and Bernard Davis, 4th ed., Tata McGraw-Hill Publishing Company Ltd., New Delhi.
2. Electronic Communication Systems-*Fundamentals through Advanced* by Wayne Tomasi; 4th Edition, Pearson education Singapore.

Additional References:

3. Electronic Communications by Dennis Roddy & John Coolen, (4th ed., Pearson Ed.)
4. Electronic Communication by Gary M. Miller, (6th ed., Prentice Hall International Inc).

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Program: Master of Science (Physics)	**Semester : III**
Course : Microwave Electronics, Radar and Optical Fiber Communication.	**Course Code: PSMAPH304**

Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Continuous Assessment and Evaluation (CAE) (Marks - _____)**	**Term End Examinations (TEE) (Marks- _____ in Question Paper)**
4	-	-	4	25	75

Pre-requisite: Basic Knowledge of electronic and optical Fiber.

Learning Objectives:

To teach the students concept of wave guides optical fiber communication system, microwave electronics, Radar system and semiconductor devices.

Course Outcomes:

After completion of the course, learners would be able to:

CO1: describe the need for waveguides, microwave tubes, state limitations of vacuum tubes, various components use in optical fiber communication and various radar systems

CO2: explain working of different types of waveguides, microwave tubes, semiconductor devices and circuits, working of analog and digital fiber communication, concepts of various radar transmission techniques.

CO3: solve problems on waveguides, optical fiber communication Link, radar communications

CO4: distinguish between the various types of waveguides, microwave tubes, compare the properties of waveguides and microwave tubes. Investigate the working of optical fiber link based on system requirements. Compare different types of radar.

CO5: assess the applications of various types of waveguides. microwave tubes and semiconductor devices and circuits. Summarize the various components of optical communication. Evaluate the advantage and disadvantages of various types of radar

CO6: design and construct waveguides, microwave tubes for specific applications. Design and construct the optical fiber communication link depending upon the system requirement. Design radar system

Outline of Syllabus: (per session plan)

Unit	**Description**	**Duration**
1	**Waveguides, Resonators and Components**	**15**
2	**Microwave Tubes and Circuits**, **Microwave Semiconductor Devices and Circuits, Microwave Measurements**	**15**
3	**Radar Systems**:	**15**

4	**Optical Fiber Communication Systems:**	**15**
	Total	**60**

DETAILED SYLLABUS

Unit	Description	Unit
1	**Waveguides, Resonators and Components**: Rectangular waveguides, Circular and other waveguides, Waveguide coupling, matching and attenuation, Cavity resonators, Auxiliary components.	**15**
2	**Microwave Tubes and Circuits**: Microwave triodes, Multicavity Klystron, Reflex Klystron, Magnetron, Traveling wave tube. **Microwave Semiconductor Devices and Circuits:** Passive microwave circuits, Transistors and integrated circuits, parametric amplifiers, Tunnel Diodes and Negative Resistance Amplifier, Gunn effect and diodes, Avalanche effects and diodes. PIN Diode, Schottky barrier diode, backward diode. **Microwave Measurements:** Slotted line VSWR measurement-Impedance measurement, insertion loss and attenuation measurements	**15**
3	**Radar Systems**: Basic principles; Fundamentals, Radar performance factors Pulsed systems; Basic pulsed radar system, Antennas and scanning, Display methods, Pulsed radar systems, Moving radar systems. Moving target indication, Radar beacons, CW Doppler radar, Frequency modulated CW radar, Phased array radars, Planar array radars.	**15**
4	**Optical Fiber Communication Systems:** Introduction to optical fibers, signal degradation in optical fibers, Fiber optical sources and coupling, Fiber optical receivers, System parameters, Analog optical fiber communication links, Design procedure, Multichannel analog systems, FM/FDM video signal transmission, Digital optical fiber systems.	**15**

Reference Books:

1. Electronic communication systems by George Kennedy and Bernard Davis, 4th ed., Tata McGraw-Hill Publishing Company Ltd., New Delhi.
2. Optical Fiber Communication by Gerd Keiser; McGraw-Hill International, Singapore, 3rd Ed; 2000
3. Tomasi; 4th Edition, Pearson education
4. Electronic Communication Systems Fundamentals through Advanced by Wayne n Singapore.

Additional References:

1. Electronic Communications by Dennis Roddy and John Coolen, (4th ed., Pearson Education).
2. Modern Electronic Communication by Gary M. Miller, (6th ed., Prentice Hall International, Inc.).
3. Digital Communications Systems by Harold Kolimbiris, (Pearson Education Asia).

Program: Master of Science (Physics)				**Semester : III**	
Course : Physics Practical				**Course Code: PSMAPHP312**	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Continuous Assessment and Evaluation (CAE) (Marks)**	**Term End Examinations (TEE) (Marks)**
--	8	-	4	20	80

Pre-requisite:
Knowledge of LCR meter, CRO and DSO. Instruments accuracy, precision, sensitivity, resolution range. Errors in measurements.

Learning Objectives:

1 To teach standard methods of performing practicals based on advanced Optics, Laser, and Electronics.
2 To familiarize with current and recent scientific and technological developments.

Learning Outcomes:

On successful completion of this course students will be able to:

1. Design and perform standard experiments related to AM modulation and demodulation, characterization of PLL, FM modelation and demodulation using PLL, study of optical fiber communication link, data transmission using optical fiber link, Study of propagation characteristics in a waveguide, Simulation of radiation patterns of various antennas, computation using software for curve fitting and interpolation.
2. Acquire practical skill in handling measuring equipment, electronic circuit analysis and data interpretations required to practically verify theoretical knowledge of Physics and transform it to real life applications in different area of science and technology.
3. Demonstrate an understanding of laboratory procedures including safety, and scientific methods.

PRACTICALS		Duration
1.	**Regular Experiments:** **Group: A** 1. Generation of AM signal using OTA IC CA3080/op-amp and	**Per Week 8 Hours**

	demodulation using diode demodulator. 2. Balanced modulator and demodulator - study of suppressed carrier AM generation using IC 1496/1596. 3. Generation of FM signal using IC 566/XR 2206 4. Characteristics of PLL IC 565/4046. 5. Frequency multiplication using PLL IC 565/4046. 6. FM modulator and demodulator using PLL IC 565/4046. 7. Loss measurements and numerical aperture in optical fiber. 8. Linear control system using fiber optical communication method. 9. Telemetry using optical fiber system. 10. Study of reflex Klystron modes using X-band and oscilloscope. 11. Study of propagation characteristics in a waveguide. 12. Simulation of radiation patterns of various antennas. **Group: B** 1. Study of Nuclear Magnetic Resonance (NMR): determination of magnetic moment of proton and nuclear g factor. 2. Determination of range of alpha particle in air. 3. Determination of Physical parameters of transmission line. 4. Millikan's oil drop experiment.	

Reference Books:

1. Op-amp and linear ICs by Ramakant Gayakwad (3^{rd} ed. 1993, Prentice Hall of India).
2. Modern Electronic Communication by Gary M. Miller (6^{th} ed., 1999, Prentice Hall International, Inc.).
3. Op-amp and linear integrated circuits by Coughlin and Driscoll (4^{th} ed. 1992, Prentice Hall of India).
4. Integrate Circuits by K. R. Botkar (8^{th} ed., Khanna Publishers, Delhi).
5. Design with Operational Amplifiers and Analog Integrated Circuits by Sergio Franco (3^{rd} ed., Tata McGraw Hill).
6. Analog and Digital Communication Systems by Martin S. Roden (5^{th} ed., Shroff Publishers and Distributors Pvt. Ltd.).
7. Microwaves by K. C. Gupta (New Age International Ltd.).
8. Electronic Communications by Dennis Roddy and John Coolen (4^{th} ed., Pearson Education).
9. Basic microwave techniques and laboratory manual by M. L. Sisodia and G. Raghuvanshi (Wiley Eastern Ltd. 1987.).
10. Electronic communication systems by George Kennedy and Bernard Davis (4^{th} ed., Tata McGraw Hill Publishing Company Ltd., New Delhi).
11. Digital communication systems by Harold Kolimbiris (Pearson Education Asia).

12. Optical fiber communication by G. Keiser (3rd ed., McGraw Hill).
13. Digital signal processing demystified by James D. Broesch (Penram International Publications, India).
14. The indispensable PC hardware book - Hans-Peter Messmer, Addison Wesley (PEA).
15. Parallel port complete by Jan Axelson, (Penram International Publications, India).
16. Serial port complete by Jan Axelson, (Penram International Publications, India).
17. 8031/8051 Manuel Provided by the manufacturers
18. AVD: - Microcontrollers by Ajay V. Deshmukh, Tata-Mcgraw Hill Publication
19. The 8051 Microcontroller & Embedded Systems by M.A. Mazidi, J.G. Mazidi and R.D. Mckinlay, Second Edition, Pearson
20. Starting out with C++ from Control structures through objects, by Tony Gaddis, Sixth edition, Penram International Publications, India
21. Object Oriented Programming with C++, By E. Balagurusamy, 2nd ed. TMH

Note:
Minimum 8 experiments from group A and minimum 2 experiments from group B be performed and reported in the journal.

Program: Master of Science (Physics)				**Semester : III**	
Course : Physics Project Work- I				**Course Code: PSMAPHP334**	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Continuous Assessment and Evaluation (CAE) (Marks)**	**Term End Examinations (TEE) (Marks-_____)**
--	8	-	4	20	80

Pre-requisite:
Fundamental knowledge of physics and experimental skills.

Learning Objectives:
To guide the student to work on specific problems of her/his interest under a faculty member's guidance.

Learning outcomes:

Under the guidance of teacher, student will be able to :

1. Acquire the ability to make use of Physics knowledge to generate, develop and evaluate ideas to fulfill the assigned project task.
2. Acquire the skills to communicate effectively and to present ideas clearly.
3. Acquire collaborative skills through working in a team to achieve common goals.
4. Students will be able to learn on their own, reflect on their learning and take appropriate actions to improve it.
5. Develop habit of independent learning and prepares them for lifelong learning and overcome the challenges ahead.

Project work-I		Duration
	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 on Electronic Communication. 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 a sophisticated equipments etc. Maximum two 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.	**Per week 8 hours**

Guidelines for report submission:

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

Project evaluation by External/Internal examiner will be based on following criteria: (semester end examination)

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

Any other information :

Note:

1. At beginning of semester, student has to get approval for the chosen project topic in her / his area of interest from the guiding teacher and head of the department.
2. Student has to submit a copy of project work to the department.
3. All the rules of plagiarism are mandatory while writing the project report

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SYLLABUS
MSC, PHYSICS, SEMESTER-IV

Program: Master of Science (Physics)				**Semester : IV**	
Course : Experimental Physics				**Course Code: PSMAPH401**	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Continuous Assessment and Evaluation (CAE) (Marks -_____)**	**Term End Examinations (TEE) (Marks-_____)**
4	-	-	4	25	75

Pre-requisite:
Basic mathematics, instrumentation and physics behind material characterization.

Learning Objectives:
Understand the data Analysis in various fields of physics. Understand the method of production and utilization of vacuum. Design of accelerator physics and study about various instruments used for material characterization.

Course Outcomes:
After completion of the course, learners would be able to:

- **CO1:** Describe various techniques used in Data analysis. Define and describe the various terms and techniques associated with vacuum techniques. Describe different types of characterization techniques, detectors and accelerators.
- **CO2:** Discuss the data analysis. Understand vacuum theory. Summarize the properties of detectors and accelerators.
- **CO3:** Apply various numerical data analysis to experimental data. Examine the vacuum production techniques. Explain x ray diffraction, spectroscopy, Electron microscopy, Van de Graff generators etc.
- **CO4:** Analyze the experimental data based on the data analysis techniques. Categorize the various vacuum methods. Solve the numerical based on all concepts discussed in the unit. Solve a crystal structure.
- **CO5:** Judge the validity of the data. Evaluate the vacuum in a given system. Evaluate lattice constants, Miller indices, radius of particle revolution, etc.
- **CO6:** Formulate the various data analysis techniques Compose lab and industrial system based on vacuum techniques. Derive the equation for structure factor and other formulas.

Outline of Syllabus: (per session plan)

Unit	**Description**	**Duration**
1	**Data Analysis for Physical Sciences**	15

2	**Vacuum Techniques**	15
3	**Nuclear Detectors and Accelerators**	15
4	**Characterization techniques for materials analysis:**	15
	Total	60

DETAILED SYLLABUS

Unit	Description	Duration
1	**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.	15
2	**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	15
3	**Nuclear Detectors:** Gamma ray spectrometer using NaI scintillation detector, High Purity Germanium detector, Multi-wire Proportional counter **Accelerators:** Cockcroft Walton Generator, Van de Graff Generator, Sloan and Lawrence type Linear Accelerator, Proton Linear Accelerator, Cyclotron and Synchrotron.	15
4	**Characterization techniques for materials analysis:** **1.** Spectroscopy: XRD, XRF, XPS, EDAX , Raman, UV Visible spectroscopy, FTIR spectroscopy. **2.** Microscopy: SEM, TEM, AFM	15

Reference Books:

1. Data Analysis for Physical Sciences (Featuring Excel®) Les Kirkup, 2nd Edition, Cambridge University Press (2012)
2. Vacuum Technology, A. Roth, North Holland Amsterdam
3. Ultra High Vacuum Techniques, D. K. Avasthi, A. Tripathi, A. C. Gupta, Allied Publishers Pvt. Ltd (2002)
4. Vacuum Science and Technology, V. V. Rao, T. B. Ghosh, K. L. Chopra, Allied Publishers Pvt. Ltd (2001)
5. Nuclear Radiation Detection- William James Price , McGraw Hill
6. Techniques for Nuclear and Particle Physics Experiments, W.R. Leo, Springer-Verlag
7. Radiation Detection and Measurement, Glenn F. Knoll, John Wiley and sons, Inc.
8. An Introduction to Materials Characterization, Khangaonkar P. R., Penram International Publishing
9. Rutherford Backscattering Spectrometry, W. K. Chu, J. W. Mayer, M. A. Nicolet, Academic Press
10. A Guide to Materials Characterization and Chemical Analysis, John P. Sibilia, Wiley-VCH; 2 edition

Program: Master of Science (Physics)				**Semester : IV**	
Course : Atomic and molecular Physics				**Course Code: PSMAPH402**	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Continuous Assessment and Evaluation (CAE) (Marks - _____)**	**Term End Examinations (TEE) (Marks- _____)**
4	-	-	4	25	75

Learning Objectives:

Familiarizing students with the theoretical framework quantum theory of fine and hyperfine structure, spectroscopy, energy states of many electron atoms and molecular structures.

1.

Course Outcomes:

After completion of the course, learners would be able to:

CO1: Explain fine structure in Hydrogen atom, Lambe shift, The Hertry theory, L-S and J-J couplings, allowed terns in coupling schemes. interaction of electron with EM radiation, emission and absorption rates, vibrational and electronic energy levels of diatomic molecules, Principle of Electron spins resonance ESR, ESR spectrometer.

CO2: Explain spectral structure of one electron atoms, central field theory, Einstein coefficients, selection rules, spectral line shape and width, X –ray spectra, rotational
CO3: Applications of Nuclear Magnetic Resonance (NMR), NMR spectroscopy, applications of quantum theory of Raman effect.
CO4: Compare the atomic spectra of one and many electron atoms. Compare L-S and J-J couplings.
CO5: Derive energy expression for vibrational, rotational levels of molecules.
CO6: Derive expression for absorption and emission transition rates

Outline of Syllabus: (per session plan)

Unit	Description	Duration
1	**Review of one and two-electron atoms.**	**15**
2	**Basics of spectroscopy.**	15
3	**Many electron atoms.**	15
4	**Molecular structure**	15
	Total	60

DETAILED SYLLABUS

Unit	Description	Duration
1	Review of one-electron Eigen functions and energy levels of bound states, Probability density and Virial theorem. Fine structure of hydrogenic atoms, Lamb shift. Hyperfine structure and isotope shift. Linear and quadratic Stark effect in spherical polar coordinates. Zeeman effect in strong and weak fields, Paschen-Back effect. Schrodinger equation for two electron atoms: Identical particles, The Exclusion Principle. Exchange forces and the helium atom, independent particle model, ground and excited states of two electron atoms.	**15**
2	The central field, Thomas-Fermi potential, the gross structure of alkalis. The Hartree theory, ground state of multi-electron atoms and the periodic table, 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.	**15**
3	Interaction of one electron atoms with electromagnetic radiation: Electromagnetic radiation and its interaction with charged particles,	**15**

	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.	
4	Born-Oppenheimer approximation - rotational, vibrational and electronic energy levels of diatomic molecules, Linear combination of atomic orbitals and Valence bond approximations, comparison of valence bond and molecular orbital theories. **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. 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.	**15**

Reference Books:

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

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)

SVKM's Mithibai College of Arts, Chauhan Institute of Science & Amrutben Jivanlal College of Commerce & Economics (AUTONOMOUS)

Program: Master of Science (Physics)				**Semester: IV**	
Course:	Digital Communication Systems and Python Programming			**Course Code: PSMAPH403**	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Continuous Assessment and Evaluation (CAE) (Marks - _____)**	**Term End Examinations (TEE) (Marks- _____ in Question Paper)**
4	-	-	4	25	75

Pre-requisite:
Basics of Modulation and Assembly language program.

Learning Objectives:

1. To teach digital modulations techniques, digital transmission techniques and Python programming language.
2. To familiarize fundamental of telephone instruments and circuits.
3. To familiarize with current and recent scientific and technological developments.
4. To enrich knowledge through problem solving, hands on activities, study visits, projects etc.

Course Outcomes:
After completion of the course, learners would be able to:

CO1: Describe parameters of digital modulation, the subscriber Loop, standard telephone set, basic telephone call procedures, PC series ports, cellular phone and cellular phone system. State different types of operators, expressions, control flow and functions.

CO2: Explain parameters of digital modulation, digital transmission, various call progress tones and signals, PC serial ports, Cellular phone and its system. Translate algorithm into python program using correct syntax and execute it.

CO3: Examine various methods of digital modulation and digital transmission and the working of cordless telephones, caller ID, electronic telephones, PC serial port, Cellular phone. Demonstrate the use of operators, expression, control flow and functions.

CO4: Distinguish between different types of digital modulation, digital transmission, various call progress tones and signals. Analyze python program and troubleshoot it to find the errors.

CO5: Compare various types of line conditioning, assess application of various types of digital modulation and transmission techniques, transmission parameters and private line circuits, Asses different python program and evaluate it to find the output of the program.

CO6: Devise trans receiver circuits, Voice frequency circuit arrangement. Formulate algorithm for given problem and Develop small program using python language.

Outline of Syllabus: (per session plan)

Unit	**Description**	**Duration**

1	**Digital Modulation and Digital Transmission.**	**15**
2	**Telephone Instruments and signals and Telephone Circuits**	**15**
3	**Study of PC serial Ports, Cellular Phone Concepts and Cellular Phone System.**	**15**
4	**Python Programming Language.**	**15**
	Total	**60**

DETAILED SYLLABUS

Unit	Description	Duration
1	**Telephone Instruments and Signals:** Introduction, The subscriber Loop, Standard telephone set, Basic telephone call procedures, Call progress tones and signals, Cordless telephones, Caller ID, Electronic telephones. **Telephone Circuits**: Introduction, Local subscriber loop, Transmission parameters and private line circuits (concepts only), Voice frequency circuit arrangement.	**15**
2	**Telephone Instruments and Signals:** Introduction, The subscriber Loop, Standard telephone set, Basic telephone call procedures, Call progress tones and signals, Cordless telephones, Caller ID, Electronic telephones. **Telephone Circuits**: Introduction, Local subscriber loop, Transmission parameters and private line circuits (concepts only), Voice frequency circuit arrangement.	**15**
3	**Study of PC Serial Port:** Options and choices, Formats and protocols, The PCs serial port from the connector in, PC programming. **Cellular Phone Concepts :** Introduction , Mobile phone service , evolution of cellular phone , frequency reuse , interference , cell Splitting , sectoring , segmentation and dualization , cellular system topology , roaming and handoffs **Cellular Phone Systems**: Digital cellular phone, Interim standard 95, CDMA, GSM communication.	**15**
4	**Python Programming language:** Introduction, Installing Python, First steps, The basics, operators and expressions, control flow, Functions. More emphasis on writing small programs using Python language	**15**

Reference Books:

1. Advanced Electronic Communications Systems (Sixth edition) by Wayne Tomasi (PHI EE Ed)
2. Serial Port Complete by Jan Axelson; Penram International Publications.
3. A Byte of Python by C. H. Swaroop.

Additional Reference Book:

1. Electronic Communication Systems Fundamentals Through by Wayne Tomasi; 4th Edition, Pearson education Singapore.
2. Electronic Communications by Dennis Roddy and John Coolen, (4^{th} ed., Pearson Education).
3. Modern Electronic Communication by Gary M. Miller, (6^{th}ed., Prentice Hall International, Inc.).
4. Wireless Communication Technology by Roy Blake, (Delmar – Thomson Learning).
5. Digital Communications Systems by Harold Kolimbiris, (Pearson EducationAsia).

Program: MASTER OF SCIENCE (Physics)				**Semester: IV**	
Course: Computer Networking				**Course Code: PSMAPH404**	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Continuous Assessment and Evaluation (CAE) (Marks - _____)**	**Term End Examinations (TEE) (Marks- _____)**
4	-	-	4	25	75

Pre-requisite:

Fundamental knowledge of computer networks.

Learning Objectives:

1. To teach OSI model of data communication system, flow and error control in data link layers, Transport layer protocols, fundamental tasks of application layer, network security-cryptography, security protocols in internet, Transport level security, Application layer security, Firewalls and Virtual private network.
2. To familiarize industrial applications of computer networking.

Course Outcomes:

After completion of the course, learners would be able to:

CO1: Describe the working of Network layers in Wired and wireless LANs. Describe traditional and modern ciphers, understand the Multiple access, Random access, Controlled access, Channelization.

CO2: Explain the working of transport layer, application layer in data communication Explain symmetric and asymmetric cryptography, various encryption standards, topology of network connection, explain the error and flow control in data link layers.

CO3: Demonstrate applications of cryptography. Demonstrate the working of ethernet, various types of LANs, Connecting devices. Demonstrate the working of IPV4, IPV6, TCP, UDP

CO4: Analyze various security services for message and entity authentication. Analyse the working of DNS, DDNS, FTP, HTTP and WWW, Analyse different functions of layered structure OSI model of network system.

CO5: Assess key management system, IP Security, VPN, Firewalls.

CO6: Design ciphers for transmitting secret data and methods to transmit them securely.

Outline of Syllabus: (per session plan)

Unit	Description	Duration
1	**Overview of Data Communication and Networking**	15
2	**Local Area Networks: Ethernet**	15
3	**Network Layer**	15
4	**Network Security**	15
	Total	60

DETAILED SYLLABUS

Unit	Description	Duration
1	Introduction, Data communications, Networks, The internet, Protocols and standards; Network models, Layered tasks, Internet model, OSI model. Data Link layer: Error detection and correction, Types of errors, Detection, Error correction, Data link control and protocols, Flow and error control, Stop and wait ARQ, Go-back-N ARQ, Selective repeat ARQ, HDLC, Point to point access, Pont to point protocol, PPP stack, Multiple access, Random access, Controlled access, Channelization.	15
2	Traditional ethernet, Fast ethernet, Gigabit Ethernet, Wireless LANs, IEEE 802.11, Bluetooth. Connecting LANs, connecting devices (Repeaters, Hubs, Bridges, Two	15

	layer switch, Router and three layer switches), Backbone networks, Virtual LANs, Virtual circuit switching, Frame relay, ATM, ATM LANs	
3	Internetworks, Addressing, Routing, Network layer protocols, ARP, IP, ICMP, IPV6, Unicast and multicast routing protocols, Unicast routing, Unicast routing Protocols, Multicast routing, Multicast routing Protocols. Transport Layer: Process to process delivery, User datagram protocol (UDP), Transmission control protocol (TCP). Application Layer: Domain name system, Name space, Domain name space, Distribution of name space, DNS in the internet, Resolution, DNS messages, DDNS, Encapsulation, Electronic mail, File transfer (FTP), HTTP, World wide web (WWW).	**15**
4	Cryptography, Introduction, Symmetric cryptography, Public-key cryptography, Message security, Digital signature, User authentication, Key management, Kerberos, Security protocols in the internet, IP level security (IPSEC), Transport level security, Application layer security, Firewalls, Virtual private network.	**15**

Reference Books:

1. Data Communications and Networking by B. A. Forouzan (3rd ed., Tata McGraw Hill Publishing Company Ltd., New Delhi). Chapters
2. Advanced Electronic communications systems (Sixth edition) by Wayne Tomasi (PHI Ed)
3. Data Communications and Computer Networks by Prakash Gupta.

Program: Master of Science (Physics)	**Semester : IV**
Course : Physics Practical	**Course Code: PSMAPHP412**
Teaching Scheme	**Evaluation Scheme**

Lecture (Hours per week)	Practical (Hours per week)	Tutorial (Hours per week)	Credit	Continuous Assessment and Evaluation (CAE) (Marks)	Term End Examinations (TEE) (Marks)
--	8	-	4	20	80

Pre-requisite:
Knowledge of LCR meter, CRO and DSO. Instruments accuracy, precision, sensitivity, resolution range. Errors in measurements.

Learning Objectives:

1. To teach standard methods of performing practicals based on advanced experimental physics, vacuum system and Electronic communication.
2. To familiarize with current and recent scientific and technological developments.

Learning outcomes:

On successful completion of this course students will be able to:

1. Design and performing electronic communications related experiments like sample and hold ckt using IC, DAC-ADC systems using IC, PPM, PWM, TDM, FSK modulations and demodulation, analog multiplexing, PC to PC communication using TDM trainer kit, experiments using Phonex kit, classical experiment like Millikan's oil-drop method, Raman effect in liquids, e/m by Thomson's method, Rydberg's constant using constant deviation prism.
2. Acquire practical skill in handling measuring equipment, electronic circuit analysis and data interpretations required to practically verify theoretical knowledge of electronics and transform it to real life applications in different area of science and technology.

PRACTICALS		Duration
2.	**Regular Experiments:** **Group A:** 1. Sample and hold circuit using FETs or CMOS switch IC CA 4016/4066 or IC LF398. 2. Study of ADC-DAC system using ADC 0804/0808 and DAC 0800/0808. 3. Flat top pulse amp. Modulation (PAM) using CMOS switch IC CA 4016/4066 FET. 4. Pulse width modulation (PWM) & pulse position modulation (PPM) using IC565/ 555. 5. Time division multiplexing (TDM) using IC CA 4016/4066 or FET. 6. FSK modulator using IC 555 or PLL IC 565 and demodulation using PLL IC 4046. 7. Study of PCM – Transmission and reception using CODEC IC. 8. Two channel analog multiplexer using CMOS switch CA4016/CA4066/LF398 9. PC to PC communication through serial port 10. PC to PC communication through parallel port.	**Per week 8 hours**

	11. Study of Manchester coding and decoding using CODEC IC. 12. Experiments using Phoenix kit 13. Computation : Computer program for file handling **Group B:** 1. Study of Zeeman Effect 2. XRD data analysis using Rietveld analysis. 3. Analysis of FTIR spectra of materials. 4. Study of rotary vacuum pump and diffusion vacuum pump. 5. Deposition of thin film using vacuum evaporation techniques and measurement of its thickness using optical method.	

Reference Books:

1. Op-amp and linear ICs by Ramakant Gayakwad (3^{rd} ed. 1993, Prentice Hall of India).
2. Modern Electronic Communication by Gary M. Miller (6^{th} ed., 1999, Prentice Hall International, Inc.).
3. Op-amp and linear integrated circuits by Coughlin and Driscoll (4^{th} ed. 1992, Prentice Hall of India).
4. Integrate Circuits by K. R. Botkar (8^{th} ed., Khanna Publishers, Delhi).
5. Design with Operational Amplifiers and Analog Integrated Circuits by Sergio Franco (3^{rd} ed., Tata McGraw Hill).
6. Analog and Digital Communication Systems by Martin S. Roden (5^{th} ed., Shroff Publishers and Distributors Pvt. Ltd.).
7. Microwaves by K. C. Gupta (New Age International Ltd.).
8. Electronic Communications by Dennis Roddy and John Coolen (4^{th} ed., Pearson Education).
9. Basic microwave techniques and laboratory manual by M. L. Sisodia and G. S. Raghuvanshi (Wiley Eastern Ltd. 1987.).
10. Electronic communication systems by George Kennedy and Bernard Davis (4^{th} ed., Tata McGraw Hill Publishing Company Ltd., New Delhi).
11. Digital communication systems by Harold Kolimbiris (Pearson Education Asia).
12. Optical fiber communication by G. Keiser (3^{rd} ed., McGraw Hill).
13. Digital signal processing demystified by James D. Broesch (Penram International Publications, India).
14. Serial port complete by Jan Axelson, (Penram International Publications, India).
15. Innovative experiments using Phoenix by Ajit kumar IUACM New Delhi, India.

Any other information :

Minimum 8 experiments from group A and 2 from group B should be performed and reported in the journal.

Program: Master of Science				**Semester : IV**	
Course : Project Work- II				**Course Code: PSMAPHP434**	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Continuous Assessment and Evaluation (CAE) (Marks - _____)**	**Term End Examinations (TEE) (Marks- _____)**
--	4	-	4	20	80

Pre-requisite:
Fundamental knowledge of core, advance physics and experimental skills.

Learning Objectives:
To guide the student to work on specific problems of her/his interest under a faculty member's guidance.

Learning outcomes:
Under the guidance of teacher, student will be able to:

1. Acquire the ability to make use of Physics knowledge to generate, develop and explore ideas to fulfil the assigned project task.
2. Acquire the skills to communicate effectively and to present ideas.
3. Acquire collaborative skills through working in a team to achieve common goals.
4. Students will be able to learn on their own, reflect on their learning and take appropriate actions to improve it.
5. Develop habit of independent learning and prepares them for lifelong learning and overcome the challenges ahead.

Project work-II		Duration
3.	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 on Electronic Communication. However, for one long project students have to submit two separate project reports /	**Per week 8 hours**

	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 a sophisticated equipments etc. Maximum two 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. **Guidelines for report submission:** 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	

Note:

1. At the beginning of semester, student has to get approval for the chosen project topic in her / his area of interest from the guiding teacher and head of the department.
2. Student has to submit a certified copy of project work for departmental record.
3. All the rules of plagiarism are mandatory while writing the project report.

Evaluation Pattern

The performance of the learner will be evaluated in two components. The first component will be a Continuous Assessment with a weightage of 25% of total marks per course. The second component will be a Semester end Examination with a weightage of 75% of the total marks

per course. The allocation of marks for the Continuous Assessment and Semester end Examinations is as shown below:

a) Continuous Evaluation – 25% of the total marks per theory course:

Particulars	**Percentage**
Component I -Class test	15
Component II - Assignment / Project/ VIVA	10

b) Semester end Examination-75% of the total marks per theory course:

i) Duration – These examinations shall be of a duration of two and a half hours.

ii) Question paper pattern of semester end examination for M.Sc, Semester-I to IV, to be implemented from academic year 2020-21.

Q1.	**Attempt any Two.** (Questions on unit- I : Theory and problem solving)		**(Marks)**
	i)		09
	ii)		09
	iii)		09
Q2.	**Attempt any Two.** (Questions on unit- II : Theory and problem solving)		
	i)		09
	ii)		09
	iii)		09
Q3.	**Attempt any Two.** (Questions on unit- III: Theory and problem solving)		
	i)		09
	ii)		09
	iii)		09
Q4.	**Attempt any Two.** (Questions on unit- IV: Theory and problem solving)		
	i)		09
	ii)		09
	iii)		09
Q5	**Attempt any One.**		
	i)	(Questions on unit –I/unit- II : Short answer type question)	3
	ii)	(Questions on unit- III/unit- IV: Short answer type question)	3

c) Details of Semester-end examination for practical/project courses:

A candidate will be allowed to appear for the semester end practical examination only if the candidate submits a certified journal/project report at the time of practical examination. The duration of the practical examination will be four hours. There will be one experiment, through which the candidate will be examined in practical.
Project evaluation by External/Internal examiner will be based on following criteria:

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

d) Details of Continuous Assessment for practical courses:
Practical Skill in performing experiments, data presentation, analysis and interpretation of results: (Marks: 20)

Signature
HOD

Signature
Approved by Vice –Principal

Signature
Principal