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: Bachelor of Science

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 B.Sc - Physics, the learners should be enriched with knowledge and be able to-

PSO1: Knowledge: Understand fundamental theories and principles of Physics, which includes Nuclear Physics, Electrodynamics, thermodynamics, waves & optics, materials science, Atomic and Molecular Physics, Classical Mechanics, Quantum Mechanics, Statistical Mechanics, Mathematical Physics, Solid state Physics, Electronics, C++ programming language, AVR microcontroller and its applications in different areas of science and technology.

PSO2: Analytical abilities and practical skills: Develop analytical abilities towards complex problem solving and acquire laboratory practical skill required to transform Physics knowledge into real life applications for society.

PSO3: Skills and Life-long learning: Acquire skills like collaboration, communication, and independent learning and prepares for lifelong learning to overcome challenges ahead

PSO4: Competitive examinations: Clear entrance tests for higher studies and competitive examination for public sectors and Civil service

PSO5: Conduct investigations of complex problems in physical science: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions

PSO6: 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

This is an undergraduate program (Six Semesters) in Physics, to be taught in Semester III & IV from the academic year 2020-21 onwards. All the six theory courses are devoted to fundamentals of Physics including Advanced optics, Material Science, Thermodynamics, Electronics, Quantum Physics, Thermal and Statistical Physics. The laboratory practical component in course consists of combination of laboratory experiment related to theory topics, skill experiments and demonstration experiment.

This syllabus is planned to hone the learners for understanding of fundamental concepts of Physics along with practical skill required to achieve excellence in recent advances of Physics and its applications to society. This course shall motivate learners for higher studies in Physics and build-up successful career in various branches of science and technology.

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

SYLLABUS

SYBSC, PHYSICS, SEMESTER-III

Program: Bachelor of Science				**Semester : III**	
Course : Advanced Optics				**Course Code: USMAPH301**	
Teaching Scheme				**Evaluation Scheme**	
Lecture (per week) 48 min each	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Continuous Assessment and Evaluation (CAE) (Marks - 25)**	**Term End Examinations (TEE) (Marks - 75)**
3	-	-	2	25	75

Pre-requisite: Knowledge of waves and geometrical optics, integration.

Learning Objectives:

Learn fundamentals of Polarization, types of polarizers and their applications, Fresnel and Fraunhofer diffraction and their applications, Michelson and Fabry-Perot interferometers and their applications, Rayleigh's criterion for resolution and resolving power of optical instruments.

Course Outcomes:

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

CO1: state types of polarization, diffraction, interferometry.

CO2: explain various methods to produce plane polarized light, types of diffraction, working of interferometers.

CO3: solve problems on polarization, diffraction and interferometry, resolving power of optical instruments, demonstrate applications of polarization, diffraction and interferometry.

CO4: investigate the origin of circular and elliptically polarized light, intensity pattern due to diffraction at various types of obstacles, distinguish between types of diffraction, construction of retarders, interferometers.

CO5: estimate the resolving power of optical instruments, applications of retarders.

CO6: derive expressions for superposition of plane polarized light, light intensity due to Fresnel/ Fraunhofer diffraction for various types of obstacles, resolving power of optical instruments.

Outline of Syllabus: (per session plan)

Unit	**Description**	**Duration**
1	Polarization	**15**
2	Diffraction	**15**
3	Interferometry and Resolving Power of Instruments	**15**

	Total	**45**
DETAILED SYLLABUS		
Unit	**Description**	**Duration**
1.	**Polarization** Types of polarization, Plane polarized light, Circularly polarized light, Elliptically polarized light, Partially polarized light, Production of Plane polarized light using wire grid polarizer, Polarization by reflection from dielectric surface, Polarization by refraction – pile of plates, Polarization by scattering, Polarization by selective Absorption, Polarization by double refraction, Malus' Law, Anisotropic crystal, Calcite crystal, Optic Axis, Double refraction in calcite crystal, Double refraction in Nicol prism, Huygens' explanation of double refraction, Ordinary and Extra ordinary rays, Positive and Negative crystals, Superposition of waves linearly polarized at right angles (omit detailed derivation), Superposition of e-Ray and o-Ray, Retarders, Quarter wave plate, Half wave plate, Applications of polarized light.	**15**
2.	**Diffraction** **Fresnel's Diffraction**: Fresnel's assumptions, Rectilinear propagation (Half period zones) of light, Diffraction pattern due to straight edge, Positions of maxima and minima in intensity, Intensity at a point inside the geometrical shadow (straight edge), Diffraction due to a narrow slit, Diffraction due to a narrow wire. **Fraunhoffer Diffraction :** Introduction, Fraunhoffer diffraction at a single slit, Intensity distribution in diffraction pattern due to a single slit, Fraunhoffer diffraction at a double slit, Distinction between single slit and double slit diffraction pattern and missing orders, Plane diffraction Grating, Theory of plane transmission grating, Width of principal maxima.	**15**
3.	**Interferometry and Resolving Power of Instruments** **Michelson Interferometer**: principle, construction, working, circular fringes, localized fringes, Visibility of fringes. Applications of Michelson interferometer, a) Measurement of wavelength b) Determination of the difference in wavelengths of two waves c) Thickness of thin transparent sheet. d) Standardization of meter.	**15**

	Fabry-Perot interferometer and etalon: Formation of fringes, determination of wavelength, Measurement of difference in wavelength of two waves. **Resolving Power of Instruments: I**ntroduction, Rayleigh's criterion, resolving power of optical instruments, criterion for resolution according to Lord Rayleigh's; Resolving power of telescope, resolving power of a prism, resolving power of a plane transmission grating.	

Reference Books:

1. A text book of Optics – Subramanyam, BrijLal, Avadhanulu.
2. Optics – Ajoy Ghatak (3rd Ed) Mc. Graw Hill Co.
3. Optics- Jenkins and White.

Program: Bachelor of Science				**Semester : III**	
Course : Material Science				**Course Code: USMAPH302**	
Teaching Scheme				**Evaluation Scheme**	
Lecture (per week) 48 min each	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Continuous Assessment and Evaluation (CAE) (Marks)**	**Term End Examinations (TEE) (Marks)**
3	-	-	2	25	75

Pre-requisite: Basic knowledge of crystal structures and properties of materials.

Learning Objectives:

To know crystal geometry, classification of materials, synthesis and characterization of nanomaterials, properties and application of materials.

Course Outcomes:

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

CO1: describe and recognize different types of materials and crystal structures, magnetic materials, methods of material preparation
CO2: discuss and explain interplanar spacing, analysis and characterization techniques
CO3: solve problems on all units based on Miller indices, lattice constants. Solving an unknown crystal structure using given data.
CO4: investigate properties of materials and their applications, hysteresis.
CO5: evaluate Miller indices, lattice parameters, magnetic induction, permeability, density.
CO6: derive formulas, Arrange synthesis in physical, chemical methods, etc.

Outline of Syllabus: (per session plan)		
Unit	**Description**	**Duration**
1	**Material classification and crystal geometry**	**15**
2	**Synthesis and analysis of nanomaterials**	**15**
3	**Material Properties & Applications**	**15**
	Total	**45**
DETAILED SYLLABUS		
1	**UNIT I: Material classification and crystal geometry:** Classification and selection of materials: Classification of materials, organic, inorganic and biological materials, semiconductor materials, current trends and advances in materials. Material structure and examination, selection of materials. Crystal geometry and structure: Crystals, single crystal, Whiskers, lattice point and space lattice. Unit cell, primitive cell, Atomic radius, Density of crystal, Direction lattice planes, Miller indices, Inter planar spacing, Crystal planes in cubic unit cell, common planes in simple cubic structure, Coordination number, Introduction to bulk crystal growth methods.	**15**
2	**Unit-II: Synthesis and analysis of nanomaterials:** **Physical methods:** Introduction to vacuum techniques and measurements, Mechanical Methods, Methods based on evaporation, Molecular beam epitaxial, chemical vapour deposition. **Chemical methods**: Synthesis of metal nanoparticles by colloidal route, Sol-gel method, hydrothermal, microwave synthesis, **Analysis techniques**: Electron microscopes, scanning probe microscope, Diffraction techniques, and spectroscopy, Analysis of X-ray and Magnetization data.	**15**
3	**Unit-III: Material Properties & Applications** **Properties of materials**: Electrical Properties: Review of energy band diagram for materials, conductors, semiconductors and insulators, Electrical conductivity in metals,	**15**

	semiconductors and insulators (dielectrics), effect of temperature on conductivity. Optical Properties: Reflection, refraction, absorption and transmission of electromagnetic radiation in solids. Magnetic Properties: Origin of magnetism in solids (basic idea), Types of magnetic order (paramagnetism, diamagnetism, antiferro magnetism, ferromagnetism, ferrimagnetism), magnetic hysteresis **Applications:** Optical materials: LEDs, OLEDs, LCDs, Flat Panel Displays, optical fibers Dielectric materials: Piezoelectric, ferroelectric and pyroelectric materials Magnetic Materials: Soft magnets (Transformer steels), Hard magnets for permanent magnets, Magnetic Recording and Storage.	

Reference Books:

1. Materials Science and Engineering- An introduction, William D. Callister, Jr. David G. Rethwisch, Wiley Publication.
2. Nanotechnology: Principles and Practices, Sulabha K. Kulkarni, Capital Publishing Company.
3. Electronic Properties of Materials, Rolf E Hummel.

Program: Bachelor of Science				**Semester : III**	
Course :	**Thermodynamics**			**Course Code: USMAPH303**	
Teaching Scheme				**Evaluation Scheme**	
Lecture (per week) 48 min each	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Continuous Assessment and Evaluation (CAE) (Marks)**	**Term End Examinations (TEE) (Marks)**
3	-	-	2	25	75

Pre-requisite: Fundamental knowledge of kinetic theory of gases.

Learning Objectives:

1. To learn transport phenomenon of gases, heat engines, Entropy and laws of thermodynamics.
2. To develop analytical abilities towards real world problems of thermodynamics.
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 the basic concepts of thermodynamics & its applications in physical situation.

CO2: explain the science of low temperature production.
CO3: explain the principle and working of Carnot's cycle.
CO4: compare the various types of heat engines.
CO5: use the formulas to solve problems of thermodynamics in real life.
CO6: apply their knowledge to design some thermodynamical projects.

Outline of Syllabus: (per session plan)

Unit	Description	Duration
1	**Real Gases and Transport phenomenon.**	15
2	**Carnot's Theory of Heat Engine.**	15
3	**Third Law of Thermodynamics and Entropy.**	15
	Total	45

DETAILED SYLLABUS

1	Real gas: Van der Waal's gas, equation of state, nature of Van der Waal's forces, comparison of P-V curves, the critical gas constants, gas and vapour, Joule's expansion of ideal gas and Van der Waal's gas, Joule coefficient, estimates of JT cooling. Transport phenomena in gases: Molecular collision, Mean free path and collision cross-section, estimates of molecular diameter and mean free path, transport of masses, momentum and energy.	15
2	Review of zeroth and first law of thermodynamics. Conversion of heat into work, heat engine, Carnot's cycle: its efficiency. Second law of thermodynamics, Statements, Equivalence of Kelvin and Plank statement, Carnot's theorem, Reversible and irreversible process, Absolute scale of temperature. Steam engine, Rankine cycle, Otto engine, Efficiency of Otto cycle, Diesel cycle, Efficiency of Diesel cycle, Otto and diesel engine comparison.	15
3	Third law of thermodynamics: Nernst heat theorem, Consequences of the third law, Maxwell's thermodynamic relations, Maxwell's equations, Clausius – Clapeyron equation, Thermal Expansion. Entropy: Concept of Entropy, Clausius theorem, Entropy of a cyclic process, Reversible process, Entropy change, Reversible heat transfer, Principle of increase in entropy, generalized form of first and second law, entropy change of an ideal gas, entropy of steam, entropy and unavailable energy, entropy and disorder, absolute entropy.	15
	Total	45

Reference Books:

1. Heat thermodynamics and Statistical Physics, Brijlal, N.Subramanyam, P. S. Hemne, S. Chand, edition 2007.
2. Thermodynamics: An Engineering Approach, Yunus A. Çengel, Boles, Michael A. Boles, McGraw-Hill Education.
3. Heat and thermodynamics : M. Zemansky , Dittman, McGraw-Hill Education

Program: Bachelor of Science				**Semester : III**	
Course :	**Physics Practical**			**Course Code: USMAPHP3123**	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (per week) 48 min**	**Tutorial (Hours per week)**	**Credit**	**Continuous Assessment and Evaluation (CAE) (Marks - _____)**	**Term End Examinations (TEE) (Marks- _____)**
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Pre-requisite:

Measuring units, Conversion to SI and CGS. Familiarization with Vernier calliper, Screw gauge, Spectrometer, travelling microscope, thermometer, LCR meter, DMM and CRO. Instruments accuracy, precision, sensitivity, resolution range. Errors in measurements.

Learning Objectives:

5. To give exposure to students to experiments related to advanced optics, material properties and thermodynamics.
6. To develop analytical abilities towards real world problems related to experimental Physics
7. To familiarize with current and recent scientific and technological developments.

Course Outcomes:

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

1. Acquire skills in use of laboratory equipment, tools.
2. Demonstrate an ability to collect data through observation and interpreting data.
3. Demonstrate an understanding of laboratory procedures including safety, and scientific methods.
4. Demonstrate a deeper understanding of abstract concepts in optics, material properties and thermodynamics and visualizing them as authentic phenomena.

List of experients:		Duration
1.	**Skill Experiments:** 1. Error analysis of a given experiment	

	2. Use of electronic balance: radius of small ball bearing. 3. Dual trace CRO: Phase shift measurement. 4. Plotting of graph using computer software.	**Per week 3 sessions of 144 min each**
2.	**Demonstration experiments:** 1. Metallurgical Microscope with computer interfacing. 2. Vacuum evaporation system.	
3.	**Regular Experiments:** **Group A** 1. Resolving power of telescope. 2. R.P. of grating 3. Brewster's law: determination of μ 4. Study of Single and multiple slit diffraction pattern. 5. To determine the value of Cauchy's constant of a prism. 6. Determine the wavelength of (a) Sodium (b) Mercury using plane diffraction grating 7. Finding angle of rotation of sugar solution. 8. Double refraction. 9. Interference experiment using Lloyd's Mirror. **Group B** 1. B-H magnetization curve to find flux in core. 2. Ferroelectric hysteresis loop tracer. 3. Study of optical fibre. 4. Measurement of dielectric constant of a material. 5. Measurement of Electrical resistivity using Four Probe. 6. Plotting and analysis of X-ray diffraction data of an unknown material. 7. Study of LED spectrum using spectrometer. 8. Synthesis of nanoparticles by any one method. (Equivalent to two practical) 9. Malus's law. 10. Experiment on Study of Solar cell **Group C** **1.** Constant volume gas thermometer. **2.** Verification of Stefan's law (electrical method). **3.** Thermistor properties. **4.** To determine the temperature coefficient of resistance by Platinum resistance thermometer. **5.** To study the variation of thermo-emf across two junctions of a thermocouple with temperature. **6.** Study of variation of specific heat of graphite with temperature. **7.** Study of Thermoelectric effect.	

Reference Books:

1. Advanced course in Practical Physics D. Chattopadhya, PC. Rakshit & B. Saha. (6th Edition) Book & Allied Pvt. Ltd.
2. BSc Practical Physics – Harnam Singh S. Chand & Co. Ltd. – 2001
3. A Text book of advanced Practical Physics – Samir Kumar Ghosh, New Central Book Agency – (3^{rd} edition)
4. B Sc. Practical Physics – CL Arora (1^{st}Edition) – 2001 S. Chand & Co. Ltd.
5. Practical Physics – CL Squires – (3^{rd}Edition) Cambridge University Press.
6. University Practical Physics – D C Tayal. Himalaya Publication.
7. Advanced Practical Physics – Worsnop & Flint.

Any other information:

Minimum 4 regular experiments from each group and all skill/demonstration experiments should be completed in the first semester.

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SYLLABUS

SYBSC, PHYSICS, SEMESTER-IV

Program: Bachelor of Science				**Semester: IV**	
Course: Thermal and statistical Physics				**Course Code: USMAPH401**	
Teaching Scheme				**Evaluation Scheme**	
Lecture (per week) 48 min each	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Continuous Assessment and Evaluation (CAE) (Marks - _____)**	**Term End Examinations (TEE) (Marks- _____)**
3	-	-	2	25	75

Pre-requisite: Basic knowledge of Thermodynamics laws.

Learning Objectives:

1. To learn Physics of liquefaction of gases and Maxwell's equations, Thermal and statistical Physics and its applications.
2. To develop analytical abilities towards real world problems in thermodynamics.
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: understand the basic concepts of liquefaction of gases and Maxwell's equations.
CO2: understand or classify the Thermal and Statistical Physics.
CO3: appy the thermodynamics formulas to solve the problems.
CO4: compare the various types of cooling techniques.
CO5: judge why statistical approach over classical.
CO6: derive different thermodynamical potential like free energy, enthalpy, Gibb's free energy.

Outline of Syllabus: (per session plan)

Unit	**Description**	**Duration**
1	**Liquefaction of gases and Maxwell's equations**	**15**
2	**Thermal physics**	**15**
3	**Statistical Physics**	**15**
	Total	**45**

DETAILED SYLLABUS

Unit	**Description**	**Duration**

1	**Liquefaction of gases and Maxwell's equations:** Thermodynamic variables, extensive and intensive, Maxwell's general relationships, application of JT cooling and adiabatic cooling in general systems. Boyle temperature and inversion temperature, principle of regenerative cooling, cascade cooling, liquefication of nitrogen, oxygen, refrigeration cycle and meaning of efficiency.	**15**
2	**Thermal physics:** **Description of a system:** Why statistical approach, Particle-states, System-states, Microstates and Macro states of a system, equilibrium and Fluctuations, Irreversibility, The equiprobability postulate, Statistical ensemble, Number of states accessible to a system, Phase space, Reversible processes. **Thermal and Adiabatic Interactions:** Thermal interaction, Canonical distribution, Energy fluctuations, Entropy of system in a heat bath, Helmholtz free energy, Adiabatic interaction and enthalpy, General interaction and the first law of thermodynamics, Infinitesimal general interaction, Gibbs free energy, Phase transitions.	**15**
3	**Statistical Physics** **Statistical Mechanics:** Phase space, The probability of a distribution, The most probable distribution, Maxwell-Boltzmann statistics, Molecular speeds. **Quantum Statistics:** Bose-Einstein statistics, Black-body radiation, The Rayleigh-Jeans formula, The Planck radiation formula, Fermi-Dirac statistics, Comparison of results, Transition between states.	**15**

Reference Books:

1. Heat thermodynamics and Statistical Physics, Brijlal, N. Subramanian, P. S. Hemne, S. Chand, edition 2007.
2. Statistical and Thermal Physics: an introduction, S. Lokanathan and R. S. Gambhir.

Program: Bachelor of Science				**Semester : IV**	
Course : Quantum Physics				**Course Code: USMAPH402**	
Teaching Scheme				**Evaluation Scheme**	
Lecture (per week) 48 min each	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Continuous Assessment and Evaluation (CAE) (Marks - _____)**	**Term End Examinations (TEE) (Marks- _____)**

3	-	-	2	25	75

Pre-requisite:
Basic knowledge of modern physics and differential equation, probability.

Learning Objectives:

1. To learn the basic principles of quantum mechanics and mathematical concepts required to study it.
2. To learn the concept of wave function and its physical interpretation.
3. To learn basic steps involved in applications of Schrodinger equation to different potential problems..

Course Outcomes:

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

CO1: describe the various of concept of quantum mechanics like wave function, eigenvalue equation etc, list the different types of operators in quantum mechanics, describe the fundamentals of Schrodinger's equation.

CO2: understand and explain the differences between classical and quantum mechanics, understand the role of Heisenberg's uncertainty principle in quantum physics, explain the Postulates of Quantum Mechanics

CO3: apply operators on wave function to obtain information about a particle's physical properties such as position, momentum and energy, solve the problems based on the topics covered in the syllabus.

CO4: analyze the wave function to obtain dynamics of the particle.

CO5: evaluate the eigenvalues and eigen solution for basic quantum mechanical problems.

CO6: formulate Schrodinger's equation and its application to different types of potential problem

Outline of Syllabus: (per session plan)

Unit	Description	Duration
1	**The Schrodinger wave equation:**	15
2	**Applications of Schrodinger steady state equation-I:**	15
3	**Applications of Schrodinger steady state equation –II:**	15
	Total	45

DETAILED SYLLABUS

1	**The Schrodinger wave equation:** Concept of wave function, Born interpretation of wave function. Concepts of operator in quantum mechanics examples – position, momentum and energy operators, Eigenvalue equations, expectation values of operators, Schrodinger equation, Postulates of Quantum Mechanics, Analogy between Wave equation and Schrodinger equation, Time dependent and time independent (Steady State) Schrodinger equation, Stationary State,	15

	Superposition principle, Probability current density, Equation of continuity and its physical significance.	
2	**Applications of Schrodinger steady state equation-I:** Free particle, Particle in infinitely deep potential well (one - dimension), Particle in finitely deep potential well (one - dimension), Step potential, Particle in three dimension rigid box, degeneracy of energy state.	**15**
3	**Applications of Schrodinger steady state equation –II:** Potential barrier (Finite height and width) penetration and tunnelling effect (derivation of approximate transmission probability), Theory of alpha particle decay from radioactive nucleus, Harmonic oscillator (one-dimension), correspondence principle.	**15**
	Total	**45**

Reference Books:

1. Concepts of Modern Physics – A. Beiser (6th Ed.) Tata McGraw Hill.
2. Quantum Mechanics – S P Singh, M K Bagade, Kamal Singh, - S. Chand : 2004 Ed.
3. Quantum Mechanics by H.C. Verma 2nd edition.
4. Introduction to Quantum Mechanics. - By D. Griffiths Published by Prentice Hall.

Program: Bachelor of Science				**Semester : IV**	
Course :	**Electronics**			**Course Code: USMAPH403**	
Teaching Scheme				**Evaluation Scheme**	
Lecture (per week) 48 min each	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Continuous Assessment and Evaluation (CAE) (Marks)**	**Term End Examinations (TEE) (Marks)**
3	--	-	2	25	75

Pre-requisite: Basic understating of inductor capacitor and resistor. Characteristics of alternating and direct current.

Learning Objectives:

1. To learn basics of semiconductor devices and their applications and design its prototype in real life.
2. To learn basic electronic circuits for universal logic building blocks and basic concepts of digital communication.

Course Outcomes:

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

CO1: describe the basic structure, properties and working principles of P-N junction circuit, BJT, FET and OPAMP Circuits.

CO2: understand various types, characteristics operation of diodes and apply the DC circuit analysis principles to diode circuits, biasing of BJT and FET circuits and OPAMP application.
CO3: apply the properties and operations of Diode, BJTs (bipolar junction transistors), FET and OPAMP for analog circuits.
CO4: analyse circuits based on diode, transistors and OPAMP.
CO5: evaluate the various types of analog circuits.
CO6: construct circuits based on diode, transistor and OPAMP

Outline of Syllabus: (per session plan)

Unit	Description	Duration
1	Diodes application and power supplies.	**15**
2	Transistors and its applications.	**15**
3	Operational Amplifier.	**15**
	Total	**45**

DETAILED SYLLABUS

1	**Diodes application and power supplies.** Introduction to semiconductors, n-type, p-type, Diode, Basing of diode, Diode characteristics, The Half-Wave Rectifier, The Full-Wave Rectifier, clipper clamper circuits, The Basic DC Power Supply, Special purpose diodes, The Zener Diode, Varactor, The Light-Emitting Diode (LED), The Photodiode, Regulated DC power supply using Monolithic linear IC voltage Regulators. (LM 78XX, LM 79XX, LM 317).	**15**
2	**Transistors and its applications.** DC and AC Operation Of Bipolar Junction Transistors, Fixed transistor bias circuit, voltage divider bias circuits, stability, BJT Class A Amplifiers, BJT Class B Amplifiers, The BJT As A Switch, DC Operation Of Field-Effect Transistors (FETs), FET Amplifiers.	**15**
3	**Operational Amplifier** Operational Amplifiers: Introduction, Schematic symbol of OPAMP, Output voltage from OPAMP, AC analysis, Bandwidth of an OPAMP, Slew rate, Frequency Response of an OPAMP, OPAMP with Negative feedback, Inverting Amplifier, Non-Inverting Amplifier, Voltage Follower, Summing Amplifier, Applications of Summing amplifier, OPAMP Integrator and Differentiator, Critical frequency of Integrator, Comparator. Differential Amplifier using transistor.	**15**

Reference Books:

1. Electronics Fundamentals Circuits, Devices and Applications Thomas L. Floyd David L. Buchla Eight Edition
2. Electronic devices and circuits – An introduction Allan Mottershead (PHI Pvt. Ltd.– EEE – Reprint – 2013)
3. Electronic Devices And Circuit Theory, Boylestad, Prentice Hall.

Program: Bachelor of Science					**Semester : IV**
Course :	**Physics Practical**				**Course Code: USMAPHP4123**
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (per week) 48 min**	**Tutorial (Hours per week)**	**Credit**	**Continuous Assessment and Evaluation (CAE) (Marks - _____)**	**Term End Examinations (TEE) (Marks- _____)**
--	9	-	3	30	120

Pre-requisite:

Measuring units, Conversion to SI and CGS. Familiarization with Vernier calliper, Screw gauge, Spectrometer, travelling microscope, thermometer, LCR meter, DMM and CRO. Instruments accuracy, precision, sensitivity, resolution range. Errors in measurements.

Learning Objectives:

1. To give exposure to students to experiments related to quantum mechanics, Electronics, thermal Physics.
2. To develop analytical abilities towards real world problems related to experimental Physics
3. To familiarize with current and recent scientific and technological developments.

Course Outcomes:

1. On successful completion of this course students will be able to:
2. Acquire skills in use of laboratory equipment, tools.
3. Demonstrate an ability to collect data through observation and interpreting data.
4. Demonstrate an understanding of laboratory procedures including safety, and scientific methods.
5. Demonstrate a deeper understanding of abstract concepts in thermodynamics, basic electronics and quantum Physics through experimental verifications and visualizing them as authentic phenomena

List of experiments:		Duration
	Skill Experiments: 1. Study of data sheet of electronic component. 2. Soldering technique. 3. Wiring of a simple circuit using bread board. 4. Use of Digital storage oscilloscope.	**per week 3 sessions of 144 min each**
	Audio Visual Lab: 1. Documentary on Thermodynamics 2. Documentary on Quantum Mechanics.	
	Regular Experiments: **Group A** 1. Verification of Boltzmann equation. (Band gap of diode) 2. Thermal expansion of copper rod/brass rod. 3. Determination of temperature coefficient of resistance of given material. 4. LM 317 as voltage regulator. 5. Zener regulated power supply. 6. Study of thermocouple properties. 7. Thermal conductivity by Lee's method 8. Horizontal component of earth magnetic field **Group B** 1. Computer simulation of Schrödinger's equation- potential well problems. 2. To study the quantum tunnelling effect with solid state device, e.g. tunnelling current in backward diode or tunnel diode. 3. Photodiode characteristics 4. Photo transistor characteristics 5. Planck constant using LED. 6. Single Slit and Multiple Slit diffraction experiment **Group C** 1. CE amplifier: determination of bandwidth 2. CE amplifier: variation of gain with load 3. FET characteristics 4. Wien bridge oscillator. 5. Bridge rectifier (with and without capacitor) 6. FET Amplifiers –bandwidth study. 7. OpAmp: Integrator and Differentiator 8. OpAmp: Non-inverting amplifier, Inverting amplifier and voltage follower	

Reference Books:

8. Advanced course in Practical Physics D. Chattopadhya, PC. Rakshit & B. Saha. (6th Edition) Book & Allied Pvt. Ltd.
9. BSc Practical Physics – Harnam Singh S. Chand & Co. Ltd. – 2001
10. A Text book of advanced Practical Physics – Samir Kumar Ghosh, New Central Book Agency – (3rd edition)
11. B Sc. Practical Physics – CL Arora (1stEdition) – 2001 S. Chand & Co. Ltd.
12. Practical Physics – CL Squires – (3rdEdition) Cambridge University Press.
13. University Practical Physics – D C Tayal. Himalaya Publication.
14. Advanced Practical Physics – Worsnop & Flint.

Any other information:

Note:

1. Minimum 4 experiments from each group and all skill/demonstration experiments should be completed in the first semester. Certified journal is a must to be eligible to appear for the semester end practical.
2. Exemption of two experiments from section A and / or B and / or C may be given if student carries out any one of the following activity.
    - Execute a mini project to the satisfaction of teacher in-charge of practical.
    - Participate in a study tour or visit & submit a study tour report.

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

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 SYBSc, Semester-III and IV, to be implemented from academic year 2020-21.

Question No.		**Instruction/Question**	**Marks**
Q.1		**Attempt <u>any two</u>:** (Questions on unit- I : Theory and problem solving)	**(20)**
	a)		10
	b)		10
	c)		10
Q.2		**Attempt <u>any two</u>:** (Questions on unit- II : Theory and problem solving)	**(20)**
	a)		10
	b)		10
	c)		10
Q.3		**Attempt <u>any two</u>:** (Questions on unit- I : Theory and problem solving)	**(20)**
	a)		10
	b)		10
	c)		10
Q.4		**Attempt <u>any three</u>: (**minimum one Questions on unit I,II and III: Short answer theory question and problem solving**)**	**(15)**
	a)		5
	b)		5
	c)		5
	d)		5

c) Semester end Examination- 80 % of the total marks per practical course:

A candidate will be allowed to appear for the semester end practical examination only if the candidate submits a certified journal at the time of practical. The duration of the practical

examination will be two hours per experiment. There will be three experiments, each of 40 marks, one from each Group, through which the candidate will be examined in practical.

d) Continuous Evaluation – 20% of the total marks per practical course:

Practical Skill in performing experiments, data presentation, log book, analysis and interpretation of results.

Signature HOD	Signature Approved by Vice Principal	Signature Principal