GOVERNMENT COLLEGE FOR WOMEN(AUTONOMOUS), MANDYA
DEPARTMENT OF PHYSICS

Academic Year-2020-21
(Revised CBCS Scheme 2018-19 Onwards)

Criterion –II - Teaching - Learning and Evaluation

2.6 **Teaching – Learning Process**

2.6. Student Performance and Learning Outcomes

2.6.1 Programme outcomes, programme Specific outcomes and Course outcomes for all programs offered by the institution are stated and displayed in website of the institution (to provide web link)

Programme Outcomes(POs): PCM

The B.Sc. PCM Programme enables students to:

1. Demonstrate an understanding of core theories and principles of Physics, Chemistry, Mathematics.
2. Understand the interrelations between the different subjects and develop the ability to identify the links.
3. Develop skills necessary to plan, design and conduct experiments to test, demonstrate, verify, and extend theoretical knowledge reliably and safely.
4. Develop ability to logically analyse data and solve problems systematically and objectively analyse open ended problems.
5. Acquire ability to face competitive exams for higher study in a chosen subject and procedural knowledge required for professional engagement in industry, teaching, research, or other service.
6. Contribute to the knowledge base of Science by being innovative having been exposed to the recent developments in the field of science. Exhibit a scientific temperament.

Programme Outcomes(POs): PMCs

The B.Sc. PMCs programme enables students to:

1. Demonstrate an understanding of core theories and principles of Physics, Mathematics, and Computer Science.
2. Understand the interrelations between the different subjects and develop the ability to identify the links.
3. Develop skills necessary to plan, design and conduct experiments to test, demonstrate, verify, and extend theoretical knowledge reliably and safely.
4. Be acquainted with the contemporary issues, latest trends in technological development and thereby innovate new ideas and solutions to existing problems.
5. Acquire ability to face competitive exams for higher study in a chosen subject and procedural knowledge required for professional engagement in industry, teaching, research, or other service.
6. Contribute to the knowledge base of Science by being innovative having been exposed to the recent developments in the field of science. Exhibit a scientific temperament.
7. Engage in current discussions of advanced topics in Physical and Applied Sciences. Apply standard Software Engineering practices and strategies in software project development using open-source programming environment to deliver a quality product for the society.

PROGRAMME SPECIFIC OUTCOMES (PSOs): Physics (Common for both PCM & PMCs)

The undergraduate course in Physics would provide the opportunity to the students:

1. To consolidate the knowledge acquired at +2 level and to motivate and inspire the students to create deep interest in Physics, to develop broad and balanced knowledge and understanding of physical concepts, principles, and theories of Physics.

2. To learn, design and perform experiments in the labs to demonstrate the concepts, principles and theories learned in the classrooms.
3. To develop the ability to apply the knowledge acquired in the classroom and laboratories to specific problems in theoretical and experimental Physics (to solve real time problems).
4. To enhance their academic abilities, personal qualities and transferable skills to develop as responsible citizens.
5. To excel in the competencies and develop values required for leadership to serve a rapidly evolving global community.
6. To emphasize the discipline of Physics to be the important branch of science for pursuing the interdisciplinary and multidisciplinary higher education and/or research in interdisciplinary and multidisciplinary areas.
7. To emphasize the importance of Physics as one of the most important discipline for sustaining the existing industries and establishing new ones to create job opportunities at all levels of employment.

Course Outcomes (Cos): Physics (Common for both PCM & PMCs)

Class	Semester	Course	Title of the Course	Course Outcomes(COs)
I BSc	I Semester	DSC - 1 (Theory)	Mechanics, Properties of Matter and Radiation	• This course introduces the basic concepts of Mechanics, Properties of matter, and Radiation. • The students would learn about the behaviour of physical bodies - it provides the basic concepts related to the motion of all the objects around us in our daily life. • Learn the concept of the moment of inertia about the given axis of symmetry for different uniform mass distributions. • Understand the phenomena of collisions and idea about centre of mass and laboratory frames and their correlation. • Understand the principles of elasticity through the study of Young Modulus and modulus of rigidity. • Understand simple principles of fluid flow and the equations governing fluid dynamics. • The course builds a foundation of various applied field in science and

				technology. • Develops problem solving skills with both theoretical and practical problems.
		DSC - 1 (Practical)	Practical – 1	Students would perform basic experiments related to mechanics, properties of matter and radiation and get familiar with various measuring instruments and would learn the importance of accuracy of measurements.
	II Semester	DSC - 2 (Theory)	Heat, Thermodynamics and Waves	• The course gives an idea of the laws of thermodynamics, thermodynamic description of systems, thermodynamic potentials, kinetic theory of gases, and progressive and harmonic waves. • The students also learn how laws of thermodynamics are used in a heat engine to transform heat into work. • Learn about entropy of the system. • Gain knowledge about Maxwell's Thermodynamic relations, low temperature Physics and Applications. • Understand the theory of Progressive Waves and Harmonic Waves and analysis of complex waves in terms of simple harmonic waves using Fourier Analysis.
		DSC - 2 (Practical)	Practical – 2	Students would perform basic experiments related to heat, thermodynamics and waves and get familiar with various measuring instruments and would learn the importance of accuracy of measurements.
II BSc	III Semester	DSC - 3 (Theory)	Electricity and Electromagnetism	• This course introduces the basic concepts of Electrostatics, Electricity and Magnetism. • Understand the concept of Gauss law, Coulomb's law for the electric field, and apply it to systems of point charges as well as line, surface, and volume distributions of charges. • Explain and differentiate the vector (electric fields, Coulomb's law) and scalar (electric potential, electric potential energy) formalisms of electrostatics. • Learn to apply Kirchhoff's rules to analyse AC circuits consisting of parallel and/or series combinations of voltage sources and resistors and to describe the graphical relationship of resistance, capacitor, and inductor.

				• Learn to apply various network theorems such as Superposition, Thevenin, Norton, Maximum Power Transfer, etc. and their applications in electronics, electrical circuit analysis, and electrical machines. • Achieve an understanding of the Maxwell's equations, role of displacement current, scalar, and vector potentials. • Apply Maxwell's equations to deduce wave equation, electromagnetic field energy, momentum, and angular momentum density.
		DSC - 3 (Practical)	Practical – 3	Students would perform basic experiments related to Electricity and magnetism and network theorems and get familiar with construction of electrical circuits, various measuring instruments and would learn the importance of accuracy of measurements.
	IV Semester	DSC - 4 (Theory)	Optics and Spectroscopy	• This course introduces the basic concepts of interference, diffraction, polarisation, and spectroscopy. • Students will have a deep knowledge of various physical processes around us based on interference, diffraction, and polarisation. • Thorough understanding of single and multielectron systems, their angular momenta, spin – orbit interaction and their effects. • Understand the Molecular bonds and Raman spectroscopy. • Students would have an idea of various optical instruments.
		DSC - 4 (Practical)	Practical – 4	Students would perform basic experiments related to Optics and Spectroscopy and get familiar with various optical instruments and would learn the importance of accuracy of measurements.
		DSE – 1.1 (Theory)	Nuclear and Theoretical Physics	• Learn various concepts of Special theory of relativity. • Learn the ground state properties of a nucleus – the constituents and their properties, mass number and atomic number, relation between the mass number and the radius and the mass number, average density, range of force, saturation property, stability curve, the concepts of packing fraction and binding energy, binding energy per nucleon vs. mass number graph, explanation of fusion and fission from the nature of the binding energy graph. • Know about the nuclear models and their roles in explaining the ground

	V Semester			state properties of the nucleus. • Learn about the process of radioactivity, the radioactive decay law, the emission of alpha, beta and gamma rays, the properties of the constituents of these rays and the mechanisms of the emissions of these rays. • Learn the basic aspects of nuclear reactions, the Q-value of such reaction and its derivation from conservation laws. • Learn about the detectors of nuclear radiations- the Geiger-Mueller counter, the scintillation counter, the photo-multiplier tube, the solid state, and semiconductor detectors. • The students are expected to learn about the principles and basic constructions of particle accelerators such as the Van-de-Graff generator, cyclotron, Betatron and synchrotron. • Gain knowledge on the basic aspects of particle Physics – the fundamental interactions, elementary and composite particles. • Students gain knowledge about wave particle duality, Heisenberg's uncertainty principle and applications. • Gain knowledge about the quantum wave equation and their applications, energy eigen values.
		DSE – 1.1 (Practical)	Practical – 5.1	Students would perform basic experiments related to Nuclear Physics and get familiar with the use of GM Counter and would learn the importance of accuracy of measurements.
		DSE – 1.2 (Theory)	Elements of Modern Physics -1	After the successful completion of the course the student is expected to learn • Learn the ground state properties of a nucleus, explanation of fusion and fission from the nature of the binding energy graph. • Know about the nuclear models and their roles in explaining the ground state properties of the nucleus. • Learn about the process of radioactivity, the radioactive decay law, the emission of alpha, beta and gamma rays, the properties of the constituents of these rays and the mechanisms of the emissions of these rays. • Learn the basic aspects of nuclear reactions, the Q-value of such reaction and its derivation from conservation laws.

III BSc				• Learn about the detectors of nuclear radiations. • Various statistical distribution functions. • The knowledge of lattice vibrations, phonons and in depth of knowledge of Einstein and Debye theory of specific heat of solids. • About different types of magnetism from diamagnetism to ferromagnetism and hysteresis loops and energy loss. • About the dielectric and ferroelectric properties of materials. • The band theory of solids and must be able to differentiate insulators, conductors, and semiconductors. • The basic idea about superconductors and their classifications.
		DSE – 1.2 (Practical)	Practical 5.2	Students would perform basic experiments related to Modern Physics and get familiar with the use of GM Counter and would learn the importance of accuracy of measurements.
		SEC - 1	Optoelectronic Devices	• Students will become familiar with optical phenomena and technology. • Understand the theory of various of optoelectronic devices such as LED and Photodetectors. • Study various types and properties of photodetectors. • Understand the fabrication and working of photovoltaic cells. • Experiments in this course will allow the students to discuss in peer groups to develop their cooperative skills and reinforce their understanding of concepts.
		SEC - 2	Lasers and Fiber Optics	• Qualitative understanding of basic lasing mechanism, characteristics of Laser Light, types of Lasers, and its applications • The idea of propagation of electromagnetic wave in a nonlinear media – Fibre optics as an example will enable the student to practice thinking in a logical process, which is essential in science.
		DSE – 2.1 (Theory)	Solid State Physics and Electronics	After the successful completion of the course the student is expected to learn • Various statistical distribution functions. • The knowledge of lattice vibrations, phonons and in depth of knowledge of Einstein and Debye theory of specific heat of solids. • About different types of magnetism from diamagnetism to ferromagnetism

	VI Semester			and hysteresis loops and energy loss. • About the dielectric and ferroelectric properties of materials. • The band theory of solids and must be able to differentiate insulators, conductors, and semiconductors. • The basic idea about superconductors and their classifications. • A brief idea about crystalline and amorphous substances, about lattice, unit cell, miller indices, reciprocal lattice, concept of Brillouin zones and diffraction of X-rays by crystalline materials. • Working of P and N type semiconductors, P-N junctions, Forward and Reverse biased junctions, p-n-p, n-p-n transistors, different characteristics of CB,CE and CC configurations, load line, gain and biasing for CE amplifiers and classification of amplifiers. Operational amplifiers and its characterization, circuits using Op-Amp for making Summing and subtracting circuits, differentiators, and integrators. Criterion for Oscillations, Oscillators, and evaluation of frequency of oscillators. • Basic logic gates and combinational circuits to construct half adders, full adder. • The idea of radiocommunication system • The idea of propagation of electromagnetic wave in a nonlinear media – Fibre optics as an example will enable the student to practice thinking in a logical process, which is essential in science.
		DSE – 2.1 (Practical)	Practical – 6.1	Students would perform basic experiments related to Solid State Physics and Electronics and get familiar with various instruments and would learn the importance of accuracy of measurements.
		DSE – 2.2 (Theory)	Elements of Modern Physics - 2	After the successful completion of the course the student is expected to learn • Concepts of Special Theory of Relativity • Working of P and N type semiconductors, P-N junctions, Forward and Reverse biased junctions, p-n-p, n-p-n transistors, different characteristics of CB,CE and CC configurations, load line, gain and biasing for CE amplifiers and classification of amplifiers. Operational amplifiers and its characterization, circuits using Op-Amp for making Summing and

				subtracting circuits, differentiators, and integrators. Criterion for Oscillations, Oscillators, and evaluation of frequency of oscillators. • The idea of radiocommunication system.
		DSE – 2.2 (Practical)	Practical Physics 6.2	Students would perform basic experiments related to Optics and Spectroscopy Modern Physics (Electronics)and get familiar with various instruments and would learn the importance of accuracy of measurements.
		SEC - 3	Solving Problems in Physics	At the end of the course the student must be able to solve the numerical problems on • Mechanics • Properties of matter • Heat and Thermodynamics • Electricity and Electromagnetism • Waves and Optics • Atomic and Molecular Spectroscopy • Wave Mechanics • Electronics and Solid-state Physics • Should learn the importance of computers in solving problems in Physics.
		SEC - 4	Nanomaterials	At the end of the course the student is expected to possess the concept the following. • Nano systems and its implications in modifying the properties of materials at the nanoscale. • Concept of Quantum confinement, 3D,2D,1D and 0D nanostructure with examples. • Different synthesis techniques including top down and bottom-up approaches. • Characterization of nanostructured materials using X-ray diffraction, electron microscopy, Atomic Force Microscopy and Scanning Tunnelling Microscopy. • Optical properties of nanostructured materials, modification of band gap, excitonic confinement