SEMESTER 1

Mahatma Gandhi University

Kottayam

Programme	**BSc (Hons) Physics**					
Course Name	**Foundations of Physics**					
Type of Course	**DSC A**					
Course Code	**MG1DSCPHY100**					
Course Level	**100**					
Course Summary	This course aims to provide a strong foundation of Physics and equip the students to be familiar with the methodology of Physics. It also throws light to basic laws of mechanics and its application. This course also provides a hands on experience in programming using Python.					
Semester	1	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	0	1	0	75
Pre-requisites if any	Nil					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	To apply vector algebra to physical problems.	U, A	1, 2
2	To apply the concepts of distance, time, mass, and accelerated motion.	A	1, 2
3	To illustrate the basic ideas of Newtonian Mechanics	U, A, An	1, 2
3	To apply the concepts of work, energy and power in practical problem solving	U, An	1, 2
4	To familiarise the concept of programming using Python	U, A, S	1, 2

5	To acquire the basic knowledge of error analysis and to get hands on expertise in using basic components and equipment in Physics lab	U, A, An, S	1, 2
Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom Transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	**How Physics Describe Things**		**14**	
	1.1	The Nature of Physics, Solving Physics Problems, Standards and Units, Consistency and Conversions, Uncertainty and Significant Figures, Estimates and Orders of Magnitude	2	1
	1.2	Vectors and Vector Addition, Components of Vectors, Unit Vectors, Products of Vectors	2	2
	1.3	Displacement, Time, Average and Instantaneous Velocity, Average and Instantaneous Acceleration	2	3
	1.4	Motion with constant acceleration, Freely Falling Bodies, Velocity and Position by Integration	3	3
	1.5	Position and velocity vectors, The acceleration vector	2	3
	1.6	Projectile motion, Motion in a Circle, Relative Velocity	3	3
2	**2.1 Newton's Laws of Motion and its Applications**		**13**	
	2.1.1	Force and Interactions, Newton's First Law, Newton's Second Law	2	3
	2.1.2	Mass and Weight, Newton's Third Law, Free-Body Diagrams	2	3
	2.1.3	Newton's Laws- Applications	7	3

	2.1.4	Frictional force	2	3
	2.2 Energy and Energy Conservation		**10**	
	2.2.1	Work, Kinetic Energy and the Work-Energy Theorem	3	4
	2.2.2	Work and Energy with Varying Forces, Power	2	4
	2.2.3	Gravitational Potential Energy, Elastic Potential Energy	2	4
	2.2.4	Conservative and Nonconservative Forces, Force and Potential Energy, Energy Diagrams	3	4
3	**Python as Calculator**		**8**	
	3.1	Introduction to Python, Writing and executing simple Python scripts, Declaring and using variables,	2	5
	3.2	Basic mathematical operations in Python (+, -, *, /, %), Using parentheses for precedence, String Operations, User Input, Conditional Statements	3	5
	3.3	Introduction to for and while loops, Loop control statements (break, continue), Basic list operations (appending, indexing, slicing), Parameters and return statements.	3	5
4	**Practical (Error analysis should be done for experiments 1 to 8)**		**30**	6
	1	Conceptualization of random error and propagation of error by measuring the dimensions of a thin metallic rod (using Screw gauge and Vernier calliper) and hence calculating its volume and surface area.		
	2	Comparison of Screw gauge and Vernier calliper readings by measuring the dimensions of a small object and comparison of Vernier calliper and meter scale readings by measuring the dimensions of a larger object.		
	3	Comparison of microscope and Screw gauge readings by measuring the thickness of a wire.		
	4	Parallelogram law of vector addition and determination of unknown mass/density of a liquid using loss of weight concept.		

	5	Verification of vector addition using force table.		
	6	Laser triangulation- determination of the height of an object using a laser.		
	7	Conceptualization of significant digits and rounding of numbers by measuring the time period of a simple harmonic motion using analogue and digital time keeping devices.		
	8	Identify resistances using colour code and verify using a multimeter. Compare the given tolerance with the measured value. Study the series and parallel resistance of two resistors.		
	9	Building a basic calculator program using Python.		
	10	Simple Programs using Python.		
5	Teacher Specific Content			

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Lectures, Demonstrations, Animations, Presentations, Discussions, Programming sessions.
Assessment Types	**MODE OF ASSESSMENT** **A.Continuous Comprehensive Assessment (CCA)** **Theory: 25 marks** **1. Formative assessment** ● Quiz ● Assignment ● Seminar **2. Summative assessment** ● Written test **Practical: 15 marks** ● Lab involvement

	• Viva
	B. End Semester Examination(ESE) **Theory: 50 marks** • Short answer type questions: Answer any 7 questions out of 10(7*2=14) • Short essay-type questions: Answer any 4 questions out of 6(4*6=24) • Essay type questions: Answer any 1 question out of 2(1*12=12) **Practical: 35 marks** • Lab Exam: 30 marks • Record: 5 marks

Textbooks

1. Young, Hugh D., Freedman, Roger A. *University Physics With Modern Physics*. Ed. 14 London: Pearson Education, Inc.2016
2. Olenick, Richard P., et al. *The Mechanical Universe: Introduction to Mechanics and Heat and Beyond the Mechanical Universe: From Electricity to Modern Physics and The Mechanical Universe: Mechanics and Heat* (Advanced Edition) (1987): 98-100.
3. Downey, Allen B. *How to think like a computer scientist: Learning with Python,* Green Tea Press 2003.

References

1. Shankar R. *Fundamentals of Physics I – Mechanics, Relativity, and Thermodynamics* (Open Yale Courses) Yale University Press, 2019.
2. Beiser, Arthur, Mahajan. Shobhit, Choudhury, S. Rai. *Concepts of Modern* Physics. McGraw Hill Education, 2017 7th Edition
3. Krane, Kenneth S. *Modern* Physics. John Wiley & Sons, 2019
4. Frautschi, Steven C. *The mechanical universe: Mechanics and heat*. Cambridge University Press, 1986.
5. Mahendra K Verma *Practical numerical computing using Python* 2021

Mahatma Gandhi University

Kottayam

Programme	**BSc (Hons) Physics**					
Course Name	**Physics around you**					
Type of Course	**MDC**					
Course Code	**MG1MDCPHY100**					
Course Level	**100**					
Course Summary	This course, "Physics Around You," provides an engaging exploration of fundamental physics principles manifested in everyday life, trying to connect theoretical concepts and the real-world phenomena that shape our daily experiences. From mastering concepts like units, dimensions, and motion laws to developing expertise in optical phenomena, including reflection and refraction, learners will gain a solid foundation in physics					
Semester	**1**	**Credits**			**3**	**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	
		2	**0**	**1**	**0**	**60**
Pre-requisites, if any	**Nil**					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains	PO No
1	Students will be able to understand the concepts of elementary mechanics	U	1, 2
2	Students will be able to explain the fundamentals of Electricity	U	1, 2
3	Students will be able to apply optical phenomena in analysing real life situations	A, An	1, 2
4	Students will be able to understand the basic principle, properties and its applications	U	1, 2
5	Students will be able to acquire hands on expertise in the basic electrical and electronic equipment and to demonstrate the basic light phenomena	A, An, S	1, 2

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C),

Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom Transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	**Elementary mechanics**		**15**	
	1.1	Units and Dimensions, conversions of units, Order of magnitude	2	1
	1.2	Motion in a straight line, velocity, acceleration, laws of motion	4	1
	1.3	Work, power, efficiency, kinetic energy, potential energy, conservation of energy.	4	1
	1.4	Waves, properties of waves, sound, speed of sound, doppler effect	5	1
2	**Electricity and Light**		15	
	2.1	Electric current, voltage, Ohm's law, resistivity, electric power	5	2
	2.2	Electromagnetic waves, reflection, refraction (twinkling of stars), total internal reflection (sparkling of diamonds, Optical fiber), scattering (blue colour of the sky).	8	3
	2.3	Laser–principle, properties and applications	2	4
3	**Practical**		30	
	1	Demonstration of Ohm's law		5
	2	Screw gauge to measure the radius of the wire, the volume of the sphere and the glass piece		5
	3	Vernier calliper to measure the volume of cylinder, sphere		5
	4	Familiarization of digital multimeter to, test the diodes, measuring electrical properties like current, voltage, resistance, capacitance		5
	5	Familiarization of CRO by studying waveforms from a function generator (amplitude, frequency time period of		5

		sine square and triangular waves)		
	6	Modelling and review report on advance in space research in India – Chandrayan mission, Adithya L1		5
	7	Demonstration of standing waves using Melde's string experiment.		5
	8	Demonstration of total internal reflection using Laser.		5
	9	Laser triangulation- determination of the height of an object using a laser.		5
	10	Demonstration of refraction of light through a prism		5
4	**Teacher specific content**			

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Lecture, Demonstration, Observation, Interactive, E-learning Group discussion
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** **Theory:15 marks** **Formative assessment** ● Assignment ● Seminar ● Tutorial work **Summative assessment** ● MCQ exams **Practical:15 marks** ● Lab involvement ● Viva
	B. End Semester Examination(ESE) **Theory: 35 marks**

	• MCQ exams **Practical: 35 marks** • Lab Exam:30 marks • Record: 5 marks

Textbooks

1. Beiser, Arthur. Schaum's Easy Outline of Applied Physics, Revised Edition McGraw-Hill Education, 2011
2. Hewitt, Paul G. Conceptual Physics. Pearson Education, 2002.
3. Chattopadhyay, D., and Rakshit, P. C.. An Advanced Course In Practical Physics. India, New Central Book Agency, 1990.

References

1. Lewin, Walter, and Warren Goldstein. *For the Love of Physics: From the End of the Rainbow to the Edge of Time-A Journey through the Wonders of Physics*. Simon and Schuster, 2011.
2. Shukla, R K. Practical Physics. India, New Age International (P) Limited, Publishers, 2007.