Course Name: Modern Physics (MG2DSCPHY100)

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	To acquire in depth knowledge on Special theory of relativity and its applications	U, A	1, 2
2	To illustrate the dual nature of matter and radiation and to apply the uncertainity principle to microscopic systems.	U, A	1, 2
3	To understand the concept of energy levels ,spectra of atoms and atomic excitations.	U	1, 2
4	To understand the basic theory of LASERS	U	1, 2
5	To understand the basic concepts leading to quantum physics.	U,A	1, 2
6	To gain hands on expertise in experiments related to modern physics	S, A, An	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	**Theory of Relativity**		**10**	
	1.1	Frames of Reference, Postulates of Special Relativity	2	1
	1.2	Length Contraction, Time Dilation and Twin Paradox	6	1
	1.3	Mass Energy Relation	2	1
2	**2.1 Particle properties of waves**		**10**	
	2.1.1	Electromagnetic waves, Blackbody Radiation, Planck's quantum theory of radiation	**6**	2
	2.1.2	Photoelectric effect, Quantum Theory of Light	**4**	2

	2.2 Wave Properties of Particles		**7**	
	2.2.1	De Broglie's Waves, Waves of probability,Electron microscope.	**3**	2
	2.2.2	Heisenberg Uncertainty Principle(only verbal and mathematical statements required), Applying Uncertainty principle.	**4**	2
3	**3.1 Atomic Structure**		**10**	
	3.1.1	Energy Levels and Spectra, origin of line spectra,Hydrogen spectrum,Atomic excitation :absorption and emission of energy by atoms.	**6**	3
	3.1.2	LASER: basic properties, stimulated absorption, spontaneous and stimulated emissions, population inversion, (exclude practical lasers)	**4**	4
	3.2 Introduction to Quantum Mechanics		**8**	
	3.2.1	Wave functions and wave equations.	**2**	5
	3.2.2	Schrodinger Equation – Time dependent form	**2**	5
	3.2.3	Schrodinger equation - Steady state form	**2**	5
	3.2.4	Particle in a box(upto energy eigen values and eigen functions)	**2**	5
4	**Practical**		**30**	**6**
	1	Refractive index of water using laser (by forming circular ring).		
	2	Plotting of waveforms using GeoGebra (Sine wave, Cosine Wave etc) and understanding of phase relationships.		
	3	Determine the angle of the given prism using a spectrometer.		
	4	Measure the thickness of a thin wire using a travelling microscope.		
	5	Solar cell- understanding of power generation- measure the output current and voltage for a fixed load for two different intensities and plot the V-I graph		
	6	Study the climate parameters (temperature, pressure, humidity) at a location from satellite data (MOSDAC) and		

		graphically represent the same over a period of time.		
	7	Verification of Stefan's law using low power (dc) incandescent lamp.		
	8	Determination of least count of a ruler using laser – Reflection grating.		
	9	Plot the black body spectrum using a Python program for different temperatures.		
	10	Plot superposition of two sine waves of different frequencies using Python.		
5	Teacher specific content		To be evaluated internally	

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Lectures, Demonstrations, Presentations, Discussions
Assessment Types	**MODE OF ASSESSMENT** **A.Continuous Comprehensive Assessment (CCA)** **Theory:25 marks** **Formative assessment** ● Quiz ● Assignment ● Seminar **Summative assessment** ● Written test **Practical:15 marks** ● Lab involvement ● Viva
	B.Semester End Examination **Theory: 50 marks** ● Short answer type questions: Answer any 10 questions out of 14(10x2=20) ● Short essay-type questions: Answer any 6 questions out of 8(6x5=30)

	Practical:35 marks ● Lab Exam:30 marks ● Record: 5 marks

Textbook

1. Beiser, Arthur, Mahajan. Shobhit, Choudhury, S. Rai. Concepts of modern physics. McGraw Hill Education, 2017 7th Edition

References

1. Tipler, Paul A., and Llewellyn, Ralph A., Modern Physics, W. H. Freeman and Company, 2008. https://web.pdx.edu/~pmoeck/books/Tipler_Llewellyn.pdf
2. Young, Hugh D., Roger A. Freedman, and Ragbir Bhathal. University physics: Australian edition. Pearson Higher Education AU, 2010.Krane,
3. Kenneth S. Modern physics. John Wiley & Sons, 2019.
4. Shankar R. Fundamentals of Physics II – Electromagnetism, Optics, and Quantum Mechanics: The Open Yale Courses Series) Yale University Press 2019.