22PH120	PHYSICS (Common to all branches)	Category	L	T	P	Credit
		BS	3	0	0	3
		Terminal Exam Type			Theory	

Preamble

The course work aims in imparting fundamental knowledge of mechanics, oscillations and waves and optics, electromagnetism and quantum mechanics which are essential in understanding and explaining engineering devices.

Prerequisite

None

Course Outcomes

On the successful completion of the course, students will be able to

	Course Outcome	TCE Proficiency Scale	Expected Proficiency (%)	Expected Attainment Level (%)
CO1	Apply the vector calculus approach and Newton's law in polar coordinates to solve problems in mechanics	TPS3	85	80
CO2	Solve for the solutions and describe the behaviour of a damped harmonic oscillator and waves.	TPS3	85	80
CO3	Introduce Schrodinger equation to arrive at the energy values of particle in a box and linear harmonic oscillator	TPS3	85	80
CO4	Use the principle of quantum mechanics for quantum mechanical tunnelling, quantum confinement and quantum computation	TPS2	85	80
CO5	Use the laws of electrostatics and magnetostatics to explain electromagnetic wave propagation	TPS3	85	80
CO6	Explain the fundamentals of optical phenomena and its applications	TPS2	85	80

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1.	**S**	**M**	**L**	**-**	**-**	**-**	**-**	**-**	**L**	**L**	**-**	**-**
CO2.	**S**	**M**	**L**	**-**	**-**	**-**	**-**	**-**	**L**	**L**	**-**	**-**
CO3	**S**	**M**	**L**	**-**	**-**	**-**	**-**	**-**	**L**	**L**	**-**	**-**
CO4	**M**	**L**		**-**	**-**	**-**	**-**	**-**	**L**	**L**	**-**	**-**
CO5	**S**	**M**	**L**	**-**	**-**	**-**	**-**	**-**	**L**	**L**	**-**	**-**
CO6	**M**	**L**										

S- Strong; M-Medium; L-Low

Assessment Pattern

	Assessment - I						Assessment - II						Terminal Exam (%)		
	CAT – I (%)			Assg. I * (%)			CAT – II (%)			Assg. II * (%)					
TPS Scale / CO	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
CO1	8	15	22	100									6	6	10
CO2	8	10	15										4	3	10
CO3	4	5	13				-	-	15	100			-	2	15
CO4							4	15	-				4	6	-
CO5							-	-	35				-	3	15
CO6							16	15	-				6	10	-
Total	**20**	**30**	**50**	**100**			**20**	**30**	**50**	**100**			**20**	**30**	**50**

*Assignment I, II – Quiz/ Puzzle/ Case analysis/ Problem-solving/ Presentation/ Writing tasks

Syllabus

Mechanics of Particles:
Scalars and vectors under rotation transformation - Coordinate system - Cartesian, Polar, Spherical, Cylindrical - Newton's second law of motion - Forces in nature - Central forces - Conservative and non-conservative forces - Work - Energy theorem - Conservation of angular momentum - Satellite manoeuvres

Oscillations and Waves:
Simple harmonic oscillators - Energy decay in a Damped harmonic oscillator - Q factor- Impedance matching- Wave groups and group velocity - Non dispersive Transverse and Longitudinal waves - Waves with dispersion - Water waves - Acoustic waves - Earthquake and Tsunami waves

Quantum Mechanics:
Wave nature of particles - wave function - probability current density and expectation values - Schrodinger wave equation - Uncertainty principle - Particle in a box in 1D - Linear harmonic oscillator - Quantum tunnelling – Quantum confinement in 0D, 1D, 2D systems - Scanning tunnelling microscope - Quantum Cascade lasers - Quantum computation (qubit) - Entanglement - Teleportation

Electromagnetic Fields and Waves:
Electric potential and Electric field of a charged disc - Magnetic Vector potential - Maxwell's equation - Equation of continuity – Poynting Vector - Energy and momentum of EM waves - CT/MRI scan

Optics:
Ray paths in inhomogeneous medium and its solutions – Applications - Fibre optics - Numerical Aperture & Acceptance angle - Fibre optic sensors - Liquid Level & Medical Applications - Interference in non-reflecting films - Fabry-Perot interferometer - Diffraction - Fraunhofer diffraction due to double slit

Text Books

1. Principles of Physics, Halliday, Resnick and Jearl Walker, 9th Edition, Wiley, 2011.
2. Paul A. Tipler and G. Mosca, Physics for Scientists and Engineers, 6th Edition, Freeman, 2008.

Reference Books

MECHANICS OF PARTICLES

1. Paul A. Tipler and Gene Mosca, Physics for Scientists and Engineers, 6th Edition, Freeman, 2008 (Chapters – 4, 9 & 10).
2. Manoj K. Harbola, Engineering Mechanics, 2nd Edition, Cengage, 2018.

OSCILLATIONS AND WAVES

1. Paul A Tipler, Gene Mosca, Physics for Scientists and Engineers, 6th Edition, Freeman, 2008 (Chapters – 14 & 15).
2. H J Pain, The Physics of Vibrations & Waves, 6th Ed., John Wiley 2005 (Ch. 2, 5, 6).

ELECTROMAGNETIC FIELDS AND WAVES

1. Principles of Physics, Halliday, Resnick and Jearl Walker, 9th Edition, Wiley, 2011 (Chapters - 23, 24, 32 & 33)

2. P M Fishbane, Stephen G. Gasiorowicz, Stephen T Thornton, Physics for Scientists & Engineers with Modern Physics, 3rd Edition, Pearson, 2005 (Chapters - 26, 28, 31, 34).

OPTICS

1. Paul A. Tipler and Gene Mosca, Physics for Scientists and Engineers, 6th Edition, Freeman, 2008 (Chapters – 31 & 33).
2. Ajoy Ghatak, Optics, 5th Edition, Tata McGraw Hill, 2012 (Chapters – 3, 18, 20)

QUANTUM MECHANICS

1. Paul A. Tipler and Gene Mosca, Physics for Scientists and Engineers, 6th Edition, Freeman, 2008 (Chapters – 34 & 35).
2. Stephen T. Thornton and Andrew Rex, Modern Physics for Scientists and Engineers, 4th Edition, Cengage, 2013. (Chapters - 5 & 6).
3. R. Shankar, Fundamentals of Physics – I, II, Yale University Press, 2014, 2016.

Course Contents and Lecture Schedule

Module No.	Topic	No. of Periods
1	**Mechanics of Particles**	**8**
1.1	Scalars and vectors under rotation transformation	2
1.2	Coordinate system - Cartesian, Polar, Spherical, Cylindrical	2
1.3	Newton's second law of motion - Forces in nature - Central forces	2
1.4	Conservative and non-conservative forces - Work - Energy theorem - Conservation of angular momentum - Satellite manoeuvres	2
2	**Oscillations and Waves**	**6**
2.1	Simple harmonic oscillators - Energy decay in a Damped harmonic oscillator	2
2.2	Q factor- Impedance matching – Wave groups and group velocity	2
2.3	Non-dispersive transverse and Longitudinal waves	1
2.4	Waves with dispersion - Water waves - Acoustic waves – Earthquake and Tsunami waves	1

3	**Quantum Mechanics**	**10**
3.1	Wave nature of particles - wave function -probability current density and expectation values - Uncertainty principle - Schrodinger wave equation	4
	CAT-I after 18 contact hours	
3.2	Applications - Particle in a box in 1D – Linear harmonic oscillator	2
3.3	Quantum tunnelling – Quantum confinement in 0D, 1D, 2D systems - Scanning tunnelling microscope – Quantum Cascade lasers – Quantum computation (qubit) – Entanglement - Teleportation	4
4	**Electromagnetic Fields and Waves**	**6**
4.1	Electric potential and Electric field of a charged disc	1
4.2	Magnetic Vector potential – Maxwell's Equations	2
4.3	Equation of continuity- Poynting vector - Energy and momentum of EM waves	2
4.4	CT/MRI scan	1
5	**Optics**	**6**
5.1	Ray paths in inhomogeneous medium & its solutions – Applications – Fiber optics	2
5.2	Numerical Aperture& Acceptance angle - Fiber optic sensors - Liquid Level & Medical Applications	2
5.3	Interference in non-reflecting films - Fabry- Perot interferometer - Diffraction - Two slit Fraunhoffer diffraction	2
	CAT-II after 18 contact hours	
	Total	**36**

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