23PH120 **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 classical and quantum mechanics, thermodynamics, electromagnetic waves, lasers and optical fibers, 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	Calculate the position, velocity and acceleration of an object using Cartesian, polar and cylindrical coordinates	TPS3	85	80
CO2	Apply Schrodinger wave equation to arrive at the energy values and wave function for a particle in a box	TPS3	85	80
CO3	Compute the theoretical efficiency of heat engines and change in entropy in a thermal cycle	TPS3	85	80
CO4	Demonstrate electromagnetic wave propagation using the Maxwell's equations	TPS3	85	80
CO5	Describe the physical principles, working and applications of Quantum Cascade laser and Nd:YAG laser	TPS2	85	80
CO6	Demonstrate the wave propagation in an optical fiber and its applications	TPS3	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	**S**	**M**	**L**	**-**	**-**	**-**	**-**	**-**	**L**	**L**	**-**	**-**
CO5	**M**	**L**	**-**	**-**	**-**	**-**	**-**	**-**	**L**	**L**	**-**	**-**
CO6	**S**	**M**	**L**	**-**	**-**	**-**	**-**	**-**	**L**	**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	4	10	20	100									4	-	10
CO2	8	10	15										4	-	10
CO3	8	10	15										2	10	10
CO4							4	10	25	50			4	-	10
CO5							12	10	-	-			4	10	-
CO6							4	10	25	50			2	10	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

Classical Mechanics: (6 Hours)

Scalars and vectors under rotation transformation – Cartesian coordinate system – Degrees of freedom – Constraints - Position, velocity, acceleration and force vector for Polar, Cylindrical coordinate system – Satellite manoeuvre - Problems

Quantum Mechanics: (6 Hours)

Failures of Classical Mechanics - Wave nature of particles - Uncertainty principle - wave function and its properties - expectation values – Classical wave equation (qualitative) - Schrodinger wave equation - Particle in a box – Quantum computation - Problems

Thermodynamics: (6 Hours)

Laws of thermodynamics – Thermodynamic Processes - Concept of entropy - Change in entropy in reversible and irreversible process - Entropy of a perfect gas - Temperature-Entropy diagram – Efficiency of Petrol engine – CNG engine - Problems

Electromagnetic waves: (7 Hours)

Electromagnetic waves – Maxwell's equation in Differential and Integral form – Propagation of EM Waves in free space - Energy of EM waves - Poynting Vector - Equation of continuity – Smart Phone – Problems

Lasers: (5 Hours)

Spontaneous and stimulated emission - Population inversion - Einstein's coefficients – Lasing action - Quantum Cascade laser - Nd: YAG Laser – Light Detection and Ranging, Bridge deflection and Laser Cutting

Fiber Optics: (6 Hours)

Principle and classification of optical fibers - Propagation of light in optical fibers - Numerical aperture and Acceptance angle – Losses in Optical Fibers - Attenuation and Dispersion (Qualitative) - Fiber Optical Communication system – Temperature Sensor – Endoscopy - Problems

Text Books

1. M.N. Avadhanulu, P.G. Kshirsagar and TVS Arun Murthy, A Text book of Engineering Physics, 11th Edition, S. Chand, 2018.

Reference Books

1. Manoj K. Harbola, Engineering Mechanics, 2nd Edition, Cengage, 2018.
2. Raymond A. Serway, John W. Jewett, Physics for Scientists and Engineers with Modern Physics, 10th Edition, Brooks and Cole, 2018.
3. Paul A. Tipler and G. Mosca, Physics for Scientists and Engineers, 6th Edition, Freeman, 2008.
4. David J. Griffiths, Darrell F. Schroeter, Introduction to quantum mechanics, 3rd Edition, Cambridge University Press, 2018.
5. Satya Prakash, Quantum Mechanics, Pragati Prakashan, 9th Edition, 2018.
6. Yunus Cengel & Boles, Thermodynamics – An Engineering Approach, 9th Edition, McGraw-Hill Education, 2019.
7. Heat Thermodynamics and Statistical Physics, Brij Lal, N Subrahmanyam, PS Hemne, 2nd Edition, S.Chand, 2018.
8. Halliday, Resnick and Jearl Walker, Principles of Physics, 11th Edition, Wiley, 2020 (Chapters - 23, 24, 32 & 33).
9. Raymond A. Serway, John W. Jewett, Physics for Scientists and Engineers with Modern Physics, 10th Edition, Brooks and Cole, 2018.
10. R. K. Gaur, S. L. Gupta, “Engineering Physics”, Dhanpat Rai Publications, 2017.
11. Ajoy Ghatak, Optics, 7th Edition, Tata McGraw Hill, 2020.

Course Contents and Lecture Schedule

Module No.	Topic	No. of Periods
1	**Classical Mechanics**	**(6 Hours)**
1.1	Scalars and vectors under rotation transformation - Cartesian Coordinate system – Degrees of freedom – Constraints	2
1.2	Position, velocity, acceleration and force vector for Polar, Cylindrical coordinate system	2
1.3	Satellite Manoeuvres	1
1.4	Problems	1
2	**Quantum Mechanics**	**(6 Hours)**
2.1	Failures of classical mechanics - Wave nature of particles – Uncertainty Principle - wave function and its properties - expectation values	2
2.2	Classical wave equation (qualitative) - Schrodinger wave equation	1
2.3	Particle in a box	1
2.4	Quantum computation	1
2.5	Problems	1
3	**Thermodynamics**	**(6 Hours)**

3.1	Laws of thermodynamics – Thermodynamic Processes	1
3.2	Concept of entropy - change in entropy in reversible and irreversible process	1
3.3	Entropy of a perfect gas - Temperature–Entropy diagram	1
3.4	Efficiency of Petrol engine – CNG engine	2
3.5	Problems	1
	CAT-I after 18 contact hours	
4	**Electromagnetic waves**	**(7 Hours)**
4.1	Electromagnetic waves	1
4.2	Maxwell's equation in Differential and Integral form	2
4.3	Propagation of EM Waves in free space	1
4.4	Energy of EM waves - Poynting Vector	1
4.5	Equation of continuity – Smart Phone	1
4.6	Problems	1
5	**Lasers**	**(5 Hours)**
5.1	Spontaneous and stimulated emission - Population inversion - Einstein's coefficients - Lasing action	2
5.2	Quantum Cascade laser - Nd: YAG Laser	2
5.3	Light Detection and Ranging, Bridge deflection and Laser Cutting	1
6	**Fiber Optics**	**(6 Hours)**
6.1	Principle and classification of optical fibers - Propagation of light in optical fibers – Numerical aperture and Acceptance angle	2
6.2	Losses in Optical Fibers – Attenuation and Dispersion (Qualitative)	1
6.3	Fiber Optical Communication system – Temperature Sensor – Endoscopy	2
6.4	Problems	1
	CAT-II after 18 contact hours	
	Total	**36**

Course Designers:

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