PH6151 ENGINEERING PHYSICS	L	T	P	EL	CREDITS
	3	0	2	3	5

Prerequisites for the course: None

OBJECTIVES:

- To introduce the basic concepts of physics.
- To develop critical thinking through problem solving related to physics
- To identify, analyze and implement possible applications with the goal of achieving the most efficient and effective usage of conceptual physics.

MODULE I :	L	T	P	EL
	3	0	2	3

Elasticity – Stress-strain diagram – cantilever – bending moment – Young's modulus determination – twisting couple.

SUGGESTED ACTIVITIES :

- In Class activity: Simple harmonic motion
- Practical - Nonuniform bending: Determination of Young's modulus.
- EL: Cantilever, Torsional pendulum, Simple harmonic oscillations

SUGGESTED EVALUATION METHODS:

- Tutorial problems
- Assignment problems
- Quizzes

MODULE II :	L	T	P	EL
	3	0	2	3

Torsional pendulum - rigidity modulus - moment of inertia - simple harmonic motion - Wave equation – waves on a string – wave power & intensity – sound waves – decibels.

SUGGESTED ACTIVITIES :

- Flipped classroom and activity
- In class activity: Derivation and Simplification
- EL – Practical Problems - Waves – Resonance – Doppler effect of sound – standing waves in a string
- **Practical – Torsional Pendulum: Determination of rigidity modulus of wire and moment of inertia of disc.**

SUGGESTED EVALUATION METHODS:

- Tutorial problems
- Assignment problems
- Quizzes

MODULE III :	L	T	P	EL
	3	0	2	3

Noise in physical systems – noise mechanisms – ultrasonics: production – magnetostriction and piezoelectric methods – detection of ultrasonic waves– acoustic grating – ultrasonic interferometer.

SUGGESTED ACTIVITIES :

- EL: Piezoelectric effect, acoustic grating
- In class activity: Ultrasonic oscillator construction
- Practical - Ultrasonic interferometer: Determination of velocity of sound and compressibility of liquids.

SUGGESTED EVALUATION METHODS:

- Tutorial problems
- Assignment problems
- Quizzes

MODULE IV :	L	T	P	EL
	3	0	2	3

Thermal expansion – thermal stress – bimetals – heat transfer in solids & thermal conductivity - compound media – Forbe's and Lee's disc method: theory and experiment.

SUGGESTED ACTIVITIES :

- Flipped Class room
- EL: Thermal expansion, bimetals, Compound media, Thermal conductivity
- Practical – Lee's disc: Determination of thermal conductivity of a bad conductor.

SUGGESTED EVALUATION METHODS:

- Tutorial problems
- Assignment problems
- Quizzes

MODULE V :	L	T	P	EL
	3	0	2	3

Double and multiple slits interference – diffraction gratings – thin films – antireflection coating – Newton's rings, air-wedge and their applications – Michelson interferometer – The diffraction limit.

SUGGESTED ACTIVITIES :

- Applications in class discussion
- EL – Thin films, antireflection coating, Air-wedge, Interferometry
- Practical – Air-wedge: Determination of thickness of thin sheet/wire.

SUGGESTED EVALUATION METHODS:

- Tutorial problems
- Assignment problems
- Quizzes

MODULE VI:	L	T	P	EL
	3	0	2	3
Lasers – Principles and applications – Einstein's coefficients – laser resonator - semiconductor laser				
SUGGESTED ACTIVITIES : • Introduction in class • EL: Laser theory, principles, industrial applications, fiber optics • Flipped Classroom for further study • Practical – Compact disc: Determination of width of groove using laser				
SUGGESTED EVALUATION METHODS: • Tutorial problems • Assignment problems • Quizzes				

MODULE VII:	L	T	P	EL
	3	0	2	3
Optical fibers – propagation of light in optical fibers – acceptance angle – numerical aperture – fiber optical communication system – fiber optic sensors.				
SUGGESTED ACTIVITIES : • Combinations of in Class & Flipped class rooms • Practical: Optical fiber: Determination of numerical aperture and acceptance angle. • EL: Fiber optics & sensors				
SUGGESTED EVALUATION METHODS: • Tutorial problems • Assignment problems • Quizzes				

MODULE VIII:	L	T	P	EL
	3	0	0	3
Wave - particle duality - The Schrodinger equation - time dependent and independent equations - expectation values - particle in a box.				
SUGGESTED ACTIVITIES : • Illustration of potential wells and tunneling phenomena in class • Flipped classroom • EL – Wave - particle duality, Schrodinger equation, Particle in a box problem (1D, 2D, 3D)				
SUGGESTED EVALUATION METHODS: • Tutorial problems • Assignment problems • Quizzes				

MODULE IX:	L	T	P	EL
	3	0	2	3
Crystal structures and packing factor (SC, BCC, FCC, Diamond) – Bragg's law – determination of crystal structures.				
SUGGESTED ACTIVITIES : • Mostly in Class • EL - Mini project for constructing crystal structures using softballs, Crystal structure parameters • Practical: Crystal structures: Classification and packing factor, Modelling of Diamond crystal structure				
SUGGESTED EVALUATION METHODS: • Assignment problems • Project demonstration and presentation (crystal structures)				
MODULE X:	**L**	**T**	**P**	**EL**
	3	**0**	**4**	**3**
Density of states – Fermi-Dirac statistics – Population of the conduction and valence bands - Fermi level – single crystal growth – epitaxy - process of integrated circuit production.				
SUGGESTED ACTIVITIES : • Combination of in class & Flipped • EL – Crystal growth techniques and IC process • Practical: Post office box: Determination of band gap of a semiconductor • Practical: Solution growth of crystal				
SUGGESTED EVALUATION METHODS: • Tutorial problems • Assignment problems • Quizzes				

REFERENCE BOOKS:

1. Richard Wolfson, "Essential University Physics", Second Edition, Addision-Wesley, 2012.
2. Narciso Garcia and Arthur Damask, "Physics for Computer Science Students", Springer-Verlag, 1991.
3. Neil Gershenfeld, "The Physics of Information Technology", Cambridge University Press, 2000.
4. Harris Benson, "University Physics", Wiley India, 2004.
5. P.A. Tipler and G.P. Mosca, "Physics for Scientists and Engineers with Modern Physics, W.H. Freeman, 2007.

OUTCOMES:

Upon completion of the course, the students will be able to:

- Apply appropriate concepts of physics to solve problems.
- Acquire knowledge on the basics of properties of matter, optics, lasers, crystals.

- Appreciate the importance of physics of materials for various engineering applications.

EVALUATION METHOD TO BE USED:

Sl. no	Category of Courses	Continuous Assessment	Mid – Semester Assessment	End Semester
1.	**Theory Integrated with Practical**	**15(T) + 25 (P)**	**20**	**40**

MA6151 MATHEMATICS –I	**L**	**T**	**P**	**EL**	**CREDITS**
	3	**1**	**0**	**3**	**5**

OBJECTIVES:

- To gain proficiency in calculus computations.
- To make the student acquire sound knowledge of techniques in solving ordinary differential equations that model engineering problems.
- To familiarize the student with functions of several variables.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.

MODULE I SINGLE VARIABLE FUNCTIONS	**L**	**T**	**P**	**EL**
	3	**1**	**0**	**3**

Representation of functions - New functions from old functions - Limit of a function - Limits at infinity -Continuity.

SUGGESTED ACTIVITIES :

- Problem solving sessions

SUGGESTED EVALUATION METHODS:

- Tutorial problems
- Assignment problems
- Quizzes

MODULE II DIFFERENTIALCALCULUS	**L**	**T**	**P**	**EL**
	3	**1**	**0**	**3**

Derivatives - Differentiation rules – intermediate theorem - Rolle's theorem- Maxima and Minima of functions of one variable.

SUGGESTED ACTIVITIES :

- Problem solving sessions
- Applications in real life problems

SUGGESTED EVALUATION METHODS:

- Tutorial problems