Core Courses of PHYSICS
Engineering Major

DEPARTMENT OF PHYSICS

Amaravati 522502, Andhra Pradesh

INDIA

CURRICULUM AND SYLLABI

(For students admitted from the academic year 2018)

CURRICULUM

Semester I

Course Category	Course Code	Course Name	L	T	P	L+T+P	C
C	PHY101	Physics E-I	2	0	0	2	2
C	PHY101-L	Laboratory: Physics- E-I	0	0	2	2	1
		TOTAL					

Semester II

Course Category	Course Code	Course Name	L	T	P	L+T+P	C
C	PHY102	Physics E-II	2	0	0	2	2
C	PHY102-L	Laboratory: Physics E-II	0	0	2	2	1
		TOTAL					

PHY 101	Physics E-I	L	T	P	C
		2	0	0	2
Co-requisite:	Single variable calculus (MAT 000)				
Prerequisite:	NIL				
Data Book / Codes/Standards	NIL				
Course Category	CORE				
Course designed by	Department of Physics				
Approval					

PUR-POSE	The course aims to cover the fundamental formalism and applications of Physics. It mainly includes basic Newtonian mechanics, Waves and oscillations, Introduction to thermodynamics, Electricity & magnetism with General properties of maters

LEARNING OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	apply the fundamental concepts of mechanics such as force, energy, momentum etc. more rigorously as needed for further studies in engineering and technology							
2.	students' physical intuition and thinking process through understanding the theory							
3.	model simple mechanical systems by correlating it to the real world practical problems							

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I - Review of Newtonian Mechanics	**6**			
1.	Introduction to Vector and Coordinate systems	1	C		1, 2
2.	Kinematics: Equations of motion for constant acceleration	1	C-D		1, 2
3.	Dynamics: Contact forces, Static friction, kinetic friction and worked examples.	1	C-D		1, 2
4.	Free body force diagram; Applications of Newton's law. Worked examples (i.e. pulley, inclined planes)	1	D-I		1, 2
5.	Momentum and Impulse, Impulse momentum theorem	1	C-D		1, 2
6.	Conservation of linear and angular momenta, worked example (Fly wheel)	1	D-I-O		1, 2

	UNIT II – Waves, oscillations, optics	**6**			
7.	Simple harmonic motion: simple pendulum, compound pendulum	1	C		1, 2
8.	Damped and driven harmonic oscillations, Quality factor; electrical equivalent (LCR circuit)	1	C-D		1, 2
9.	Longitudinal waves, transverse waves; standing waves	1	C-D		1, 2
10.	Optics: Interference, diffraction (qualitative)	1	C-D		1, 2
11.	Double slit interference and concept of coherence length	1	D-I		1, 2
12.	Polarization of light (qualitative)	1	D-I		1, 2
	UNIT III – Classical thermodynamics	**6**			
13.	Thermodynamic systems and equilibrium: example of ideal gas	1	C		1,2,3
14.	Zeroth law of thermodynamics and concept of temperature	1	C		1,2,3
15.	First law of thermodynamics, internal energy and specific heat	1	D		1,2,3
16.	Second law of thermodynamics, entropy, reversibility	1	C-D		1,2,3
17.	Concept of work and free energies	1	C-D		1,2,3
18.	Black body radiation – Stefan's law	1	I		1,2,3
	UNIT IV: MATERIAL PROPERTIES	**6**			
19.	States of Matter: Solid, Liquid, Gases and Plasma	1	C		1, 2
20.	Mechanical Properties of solids: linear elasticity (Hooke's Law). Elastic moduli.	1	C-D		1, 2
21.	Shear stress and strain. Rigidity modulus	1	C-D		1, 2
22.	Bulk and surface properties of liquid – Adhesion, Cohesion – Surface tension	1	C-D-I		1, 2
23.	Viscosity and Stoke's equation	1	C-D		1, 2
24.	Bernoulli's principle	1	C-D		1, 2
	UNIT V: REVIEW OF ELECTRO-MAGNETISM	**6**			
25.	Properties of charge and Coulomb's law, calculation of electric field and potential	1	C-D		1, 2
26.	Gauss's law and its applications (line, plane, sphere)	1	C-D		1, 2
27.	Parallel plate capacitor.	1	D-I-O		1, 2
28.	Biot-Savart Law for magnetic fields, Magnetic field (circular loop).	1	D-I		1, 2

29.	Ampere's circuital law, Examples – Infinite wire and Solenoid. Lenz's Law, Faraday's law.	1	C-D-I		1, 2
30.	Maxwell's equations and Electromagnetic wave motion from Maxwell's Equation.	1	C-D-I		1, 2
	Total contact hours	**30**			

LEARNING RESOURCES	
	TEXT BOOKS/REFERENCE BOOKS/OTHER READING MATERIAL
1	University Physics With Modern Physics with Mastering Physics - D Young, Roger A Freedman And Lewis Ford, XII Edition (2018), Publisher – PEARSON
2	Physics for Scientist and Engineers - Raymond A. Serway, John W. Jewett XIX Edition (2017), Publisher - Cengage India Private Limited
3	Concept of Modern Physics - Arthur Besier, Shobhit Mahajan, S Rai, 2017 Edition, Publisher - Tata McGraw Hill
4	Introduction to Electrodynamics – David J. Griffiths; 4th Edition (2012), Publisher - PHI Eastern Economy Editions
5	Electricity and Magnetism - A S Mahajan and A A Rangwala, Revised of 1 Edition (2001), Publisher - McGraw-Hill
6	Advanced Engineering Mathematics - Erwin Kreyszig, X Edition (2016), Publisher - Wiley

Course nature				**Theory**		
Assessment Method – Theory Component (Weightage 100%)						
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Assignment	Class Test	**Total**
	Weightage	**15%**	**15%**	**10%**	**10%**	**50%**
End semester examination Weightage :						**50%**

PHY 101L	Physics-I LABORATORY	L	T	P	C
		0	0	2	1
Co-requisite:	NIL				
Prerequisite:	NIL				
Data Book / Codes/Standards	NIL				
Course Category	CORE				
Course designed by	Department of Physics				
Approval					

PURPOSE	The course aims to cover the applications related to fundamental formalism of Physics. It mainly includes basic Newtonian mechanics, Waves and oscillations, Introduction to thermodynamics, Electricity & magnetism with General properties of maters

LEARNING OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	Understand basic equipment operation and analysis							
2.	Correlate fundamental concept of physics to laboratory experiments							
3.	Origin and analysis of error							

Sl. No	Description of Experiments	Contact hours	C-D-I-O	IOs	Reference
1a	Revisions of Vernier caliper and Screw Gauge measurement methods	1	C		1, 2
1b	Plotting experimental data in graphs and error analysis				
2	To determine the moment of inertia of a flywheel	1	I-O		1, 2
3	(a) Measurement of time period for a given compound pendulum with different lengths (b) To determine radius of gyration of a given pendulum	1	I-O		1, 2
4	Verification of Stefan`s Law	1	I-O		1, 2
5	Measurement of specific heat capacity of any given material	1	I-O		1, 2
6	Verify of Hooke's law and to determine spring contact for given spring combinations	1	I-O		1, 2
7	To determine the rigidity modulus of steel wire by torsional oscillations	1	I-O		1, 2
8	To calculate Young's modulus of a given material by deflection method	1	I-O		1, 2
9	(a) To measure the capacitance as a function of area and distance between the plates. b) To determine the dielectric constant of different	2	I-O		1, 2

	dielectric materials.				
10	(a) Measurement of the induced voltage impulse as a function of the velocity of the magnet. b) Calculation of the magnetic flux induced by a falling magnet as a function of the velocity of the magnet	1	I-O		1, 2
11	(a) To study the magnetic field along the axis of a current carrying circular loop. b) To study the dependency of magnetic field on the diameter of coil	1	I-O		1, 2
12	(a) To investigate the spatial distribution of magnetic field between coils and determine the spacing for uniform magnetic field. b) To demonstrate the superposition of the magnetic fields of the two individual coils.	2	I-O		1, 2
13	Study of B-H-Curve To study permeability curve of a given material	1	I-O		1, 2
	Total contact hours (Including demo and repeat labs)	**15**			

LEARNING RESOURCES	
	TEXT BOOKS/REFERENCE BOOKS/OTHER READING MATERIAL
1	Physics for Scientist and Engineers, Ninth edition (2017) - Raymond A. Serway, John W. Jewett (Publisher - Cengage India Private Limited))
2	Physics laboratory manuals

Course nature			**Practical**		
Assessment Method – Practical Component (Weightage 100%)					
In-semester	**Assessment tool**	Lab performance	Practical model exam	Viva	**Total**
	Weightage	**10%**	**30%**	**10%**	**50%**
End semester examination Weightage :					**50%**

PHY 102	Physics E-II	L	T	P	C
		2	0	0	2
Co-requisite:	NIL				
Prerequisite:	Physics – I				
Data Book / Codes/Standards	NIL				
Course Category	CORE				
Course designed by	Department of Physics				
Approval					

PURPOSE	The course aims to cover the fundamental formalism and applications of Physics. It mainly includes introduction to modern physics, fundamentals of quantum mechanics, solid state physics and devices

LEARNING OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	apply the fundamental concepts of modern physics and explain physics phenomenon							
2.	students' physical intuition and thinking process through understanding the theory							
3.	Understand basics of solid state physics and functioning of devices							

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I – Introduction to Quantum Mechanics	**6**			
1.	Light as particle: Photoelectric effect, idea of photon	1	C		1,2,3

2.	Wave particle duality Matter waves - De Broglie hypothesis	1	C		1,2,3
3.	Postulates of quantum mechanics, Wave function and its physical interpretation	1	C		1,2,3
4.	Heisenberg's uncertainty principle (from double slit experiment)	1	C		1,2,3
5.	Schrodinger's equation	1	C-D		1,2,3
6.	Probability current density, Equation of continuity, and its physical significance	1	C-D		1,2,3
	UNIT II – Application of Quantum Mechanics	**6**			
7.	Free particle, Particle in infinitely deep potential well (one - dimension)	1	D		1,2,3
8.	Particle in three dimensional rigid box	1	D		1,2,3
9.	Step potential, Potential barrier (Qualitative discussion).	1	D-I		1,2,3
10.	Barrier penetration and tunneling effect.	1	D-I		1,2,3
11.	Hydrogen atom, Qualitative discussion on the radial and angular parts of the bound state energy	1	D		1,2,3
12.	Electron in periodic potential; Kronig-Penney model	1	I-O		1,2,3
	UNIT III: LASER	**6**			
13.	Introduction to LASER	1	C		4
14.	Spontaneous Emission of Radiation	1	C-D		4
15.	Stimulated Emission of Radiation	1	C-D		4
16.	Population Inversion, Einstein's Coefficients	1	C-D		4
17.	Construction and Working of Ruby LASER	1	D-I		4
18.	He-Ne LASER, Applications of LASER	1	I-O		4
	UNIT-IV Fiber Optics	**6**			
19.	Fundamental ideas about optical fiber	1	C		4
20.	Types of fibers	1	C-D		4
21.	Acceptance angle and cone	1	C-D		4
22.	Numerical aperture	1	C-D		4
23.	Propagation mechanism and communication in optical fiber.	1	D		4
24.	Attenuation, Signal loss in optical fiber and dispersion	1	D-I		4
	UNIT V: Solid State Physics and Semiconductors	**6**			
25.	Classification of solids based on band theory	1	C		1,2,3
26.	Semiconductors - origin of band gap	1	C-D		1,2,3

27.	Intrinsic and extrinsic semiconductors, *p* and *n* type.	1	D-I		1,2,3
28.	Lorenz force, Hall effect	1	D		1,2,3
29.	Fundamentals of Energy storage devices, supercapacitors	1	I-O		1,2,3
30.	Light emitting diodes and solar cells	1	I-O		1,2,3
	Total contact hours	**30**			

LEARNING RESOURCES	
	TEXT BOOKS/REFERENCE BOOKS/OTHER READING MATERIAL
1	University Physics With Modern Physics with Mastering Physics - D Young, Roger A Freedman And Lewis Ford, XII Edition (2018), Publisher – PEARSON
2	Physics for Scientist and Engineers - Raymond A. Serway, John W. Jewett XIX Edition (2017), Publisher - Cengage India Private Limited
3	Concept of Modern Physics - Arthur Besier, Shobhit Mahajan, S Rai, 2017 Edition, Publisher - Tata McGraw Hill
4	Optics - Ajay Ghatak, Fifth Edition (2010), Publisher - Mcgraw Hill
5	Fiber optics and Lasers: The two revolutions - A. Ghatak, K. Tyagarajan (2006) Publisher -Macmillan

Course nature				**Theory**		
Assessment Method – Theory Component (Weightage 100%)						
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Assignment	Class Test	**Total**
	Weightage	**15%**	**15%**	**10%**	**10%**	**50%**
End semester examination Weightage :						**50%**

PHY 102L	Physics E-II LABORATORY	L	T	P	C
		0	0	2	1
Co-requisite:	NIL				
Prerequisite:	NIL				
Data Book / Codes/Standards	NIL				
Course Category	CORE				
Course designed by	Department of Physics				
Approval					

PURPOSE	The course aims to cover the application of fundamental formalism of Physics. It mainly includes modern physics, wave and optics, fiber optics, solid state physics.							
LEARNING OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
1.	Understand basic equipment operation and analysis							
2.	Correlate fundamental concept of physics to laboratory experiments							

Sl. No	Description of Experiments	Contact hours	C-D-I-O	IOs	Reference
1	Measurement of Planck's constant by Cs photocell	1	I-O		1, 2
2	To record the Franck-Hertz characteristic curve for neon emission	1	I-O		1, 2
3	Determination of Rydberg constant using neon emission spectra	1	I-O		1, 2
4	Determination of the beam quality factor (M-parameter) of a given laser	1	I-O		1, 2
5	To determine the wavelength of a given laser lights with the diffraction patterns by single slit and double slit	1	I-O		
6	a) To measure the grating constants with the diffraction patterns of laser light b) To observe the diffraction patter by metal mesh	1	I-O		
7	To determine the wavelength of a laser using the Michelson interferometer	1	I-O		1, 2
8	a) Determination the wavelength of He-Ne laser using diffraction grating b) Determination the particle size of a given powder	2	I-O		1, 2
9	To calculate the numerical aperture and study the losses that occur in optical fiber cable	1	I-O		1, 2
10	Determine charge carrier type and concentration of a given semiconductor using Hall Effect	1	I-O		1, 2
11	Determination of thermal conductivity of a given material	1	I-O		1, 2
12	Four-probe Resistivity Measurement	2	I-O		1, 2
13	a) To measure the photo-current as a function of the irradiance at constant voltage b) Current-voltage and current-load characteristics of a solar cell as a function of the irradiance	1	I-O		1, 2

	Total contact hours (Including demo and repeat labs)	**15**

LEARNING RESOURCES	
	TEXT BOOKS/REFERENCE BOOKS/OTHER READING MATERIAL
1	Physics for Scientist and Engineers, Ninth edition (2017) - Raymond A. Serway, John W. Jewett (Publisher - Cengage India Private Limited))
2	Physics laboratory manuals

Course nature				**Practical**	
Assessment Method – Practical Component (Weightage 100%)					
In-semester	**Assessment tool**	Lab performance	Practical model exam	Observation note	**Total**
	Weightage	**20%**	**20%**	**10%**	**50%**
End semester examination Weightage :					**50%**