Allied Courses of PHYSICS
Non-Engineering Major

DEPARTMENT OF PHYSICS

Amaravati 522502, Andhra Pradesh

INDIA

CURRICULUM AND SYLLABI

(For students admitted from the academic year 2018)

CURRICULUM

Semester II

Course Category	Course Code	Course Name	L	T	P	L+T+P	C
Core/Allied	**PHY 204**	**Physics A1**	**3**	**0**	**0**	**3**	**3**
Core/Allied	**PHY 204L**	**Laboratory: Physics- A1**	**0**	**0**	**2**	**2**	**1**
		TOTAL					

Semester IV

Course Category	Course Code	Course Name	L	T	P	L+T+P	C
Core/Allied	**PHY 214**	**Physics A2**	**3**	**0**	**0**	**3**	**3**
Core/Allied	**PHY 214L**	**Laboratory: Physics- A2**	**0**	**0**	**2**	**2**	**1**
		TOTAL					

PHY 204	Physics A1	L	T	P	C
		3	0	0	3
Co-requisite:	NIL				
Prerequisite:	NIL				
Data Book / Codes/Standards	NIL				
Course Category	CORE				
Course designed by	Department of Physics				
Approval	Academic Council Meeting, 2019 (**Regulation - 2018**)				

PURPOSE	The course aims to cover the fundamental formalism and applications of Physics. It mainly includes basic Newtonian Mechanics, Heat & Thermodynamics, Electricity & Magnetism

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 basic science							
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	**9**			
1.	Review of Scalars, Vectors, Kinematics: Equations of motion for constant acceleration and non-constant acceleration	1	C		1,2,3
2.	Dynamics: Contact forces, Static friction, kinetic friction and worked examples, Free body force diagram; Applications of Newton's law. Worked examples	1	C-D-I		1,2,3
3.	Tension, Pulley systems, worked examples, Solving various pulley systems using free body force diagram and Newton's law	1	C-D		1,2,3

4.	Momentum and Impulse, Impulse momentum theorem, Average force, Worked examples	1	C-D-I		
5.	Conservation of Momentum, Momentum Diagrams, Worked examples	1	C-D		
6.	Center of Mass of point objects and continuous systems e.g., rod, rectangular sheet	1	C-D		
7.	Center of Mass of a Uniform and different objects	1	C-D		
8.	Motion of the Center of Mass; Velocity and Acceleration of the Center of Mass,	1	C-D		
9.	Reduction of a System to a Point Particle, Center of Mass Trajectory, projectile blast problem	1	C-D		
	UNIT II – Work and Energy				
10.	Kinetic Energy and Work in 1D, 2D and 3D; Work by a Constant and a non- Constant Force	1	C-D		1,2,3
11.	Work-Kinetic Energy Theorem and worked examples	1	C-D		1,2,3
12.	Conservative and Non-conservative Forces with examples, Potential Energy due to gravity and Potential Energy of a spring	1	C-D		1,2,3
13.	Principle of energy conservation; worked examples	1	C-D		1,2,3

14.	Collision and its type. Collision in 1D and 2D;	1	C-D		1,2,3
15.	Rigid body, Rotational Motion, moment of inertia	1	C-D		
16.	Moment of inertia of various objects, worked examples, Parallel and perpendicular axis theorem	1	C-D		
17.	Torque and Angular momentum, conservation of angular momentum, worked examples	1	D-I		
18.	Rolling motion, worked examples, Conservation of energy in rotational motion	1	D-I		
	UNIT III – HEAT & HERMODYNAMICS	**9**			
19.	Basic Thermodynamics – Concept of Temperature	1	C		1,2,3
20.	First and Second Law(s) applicable to Heat Engines and Refrigerators;	1	C		
21.	Thermodynamic Process-Isothermal, Adiabatic, Isobaric, Isochoric, Adiabatic relations of system for perfect gas	1	C-D		
22.	Pressure-Volume and Temperature-Entropy Diagrams for engines	1	C-D		1,2,3
23.	Conversion of Heat into Work and its converse, Carnot's Cycle and Carnot's Heat Engine and its efficiency	1	C-D		1,2,3
24.	Otto cycle, Diesel cycle and its comparison, efficiencies, The Carnot Refrigerator	1	C-D		
25.	Maxwell–Boltzmann Distribution, Equipartition theorem	1	C-D		1,2,3

26.	Seebeck, Peltier and Thomson effect,	1	C		
27.	Thermoelectric generators and its applications, Thermocouples, Temperature measurement, Thermoelectric materials	1	C		
	UNIT IV: ELECTROSTATICS	**9**			1,2,3
28.	Coordinate system, Cartesian, Cylindrical and Spherical polar	1	C		
29.	Gradient, divergence and curl	1	C		
30.	Properties of charge and Coulomb's law	1	C		1,2,3
31.	Gauss's law and its applications	1	C-D-I		1,2,3
32.	Electric potential and potential energy, examples	1	D-I		1,2,3
33.	Capacitors, parallel plate, cylindrical and spherical	1	D-I		1,2,3
34.	Introduction to Electric Dipole and dipole Moment	1	C		
35.	Torque and potential energy of a dipole	1	D		1,2,3
36.	Potential and field due to electric dipole	1	C		1,2,3
	UNIT V: MAGNETISM	**9**			1,2,3
37.	Magnetic force and cyclotron	1	C		1,2,3
38.	Biot-Savart Law for magnetic fields	1	C		1,2,3
39.	Magnetic field due to various current loops	1	C-D		
40.	Motion of a current carrying coil in magnetic field and torque	1	D		
41.	Ampere's circutal law	1	C		

42.	Introduction to time-varying fields	1	C		
43.	Faraday's law of induction	1	C-D		
44.	Lenz law and electro-motive force	1	C-D		
45.	Maxwell's equations in free space	1	C-D		
	Total contact hours	45			

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	Introduction to Electrodynamics –David J. Griffiths; 4th Edition, 2012, PHI Eastern Economy Editions

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 204L	Physics A1 LABORATORY	L	T	P	C
		0	0	2	1
Co-requisite:	NIL				
Prerequisite:	NIL				
Data Book / Codes/Standards	NIL				
Course Category	Allied				
Course designed by	Department of Physics				
Approval	Academic Council Meeting, 2019 (**Regulation - 2018**)				

PURPOSE	The course aims to cover the fundamental formalism and applications of Physics. It mainly includes basic Newtonian mechanics, heat & thermodynamics, electricity & magnetism

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

Sl. No	Description of Experiments	Contact hours	C-D-I-O	IOs	Reference
1	Revisions of Vernier caliper and Screw Gauge	1	I-O		1, 2
2	Plotting graphs and Error analysis	1	I-O		1, 2
3	Determine moment of inertia of a flywheel	2	I-O		1, 2
4	Determination of spring constant	1	I-O		1, 2
5	Determination of thermal conductivity of a given material	2	I-O		1, 2
6	Measurement of specific heat capacity of any given material	2	I-O		1, 2
7	To find the dielectric constant of the medium using parallel plate capacitor	2	I-O		1, 2
8	Use Faraday's law for finding the total magnetic flux through the coil	1	I-O		1, 2
9	Verify the Biot-Savart law for a given circular coil	2	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	**20%**	**20%**	**10%**	**50%**
End semester examination Weightage :					**50%**

PHY 214	Physics A2	L	T	P	C
		3	0	0	3
Co-requisite:	NIL				
Prerequisite:	NIL				
Data Book / Codes/Standards	NIL				
Course Category	CORE				
Course designed by	Department of Physics				
Approval	Academic Council Meeting, 2019 (**Regulation - 2018**)				

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								
7.	Apply the fundamental concepts of modern physics and explain physics phenomenon							
8.	Students' physical intuition and thinking process through understanding the theory							
9.	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 Modern Physics	**9**			
1.	Electromagnetic waves; coupled magnetic and electric oscillations	1	C		1,2,3
2.	Introduction to special theory of relativity	1	C		1,2,3
3.	Inertial and non-inertial frames of reference	1	C		1,2,3
4.	Length contraction and time dilation	1	C-D		1,2,3
5.	Mass energy relation	1	C-D		1,2,3
6.	Quantum states of an electron in an atom, Introduction Atomic Spectra	1	C		1,2,3

7.	Early models of H-atoms	1	D		1,2,3
8.	Spectrum of Hydrogen	1	I		1,2,3
9.	Photoelectric effect and Compton scattering	1	I		1,2,3
	UNIT II – Origin of Quantum Mechanics				
10.	Limitation of classical mechanics	1	C		1,2,3
11.	Review of Black body radiation, examples	1	C		1,2,3
12.	Wave particle duality Matter waves - De Broglie hypothesis, Photoelectric effect	1	C-D		1,2,3
13.	Linear Vector Space, Hilbert Space	1	C-D		1,2,3
14.	Heisenberg's uncertainty principle	1	C-D		1,2,3
15.	Postulates of quantum mechanics - Schrödinger	1	C		1,2,3
16.	Wave function and its physical interpretation, Position, Momentum operator, angular momentum operator, and total energy operator	1	C		1,2,3
17.	Orthogonality, Orthonormality, Operator Schrödinger time dependent and independent equation	1	C-D		1,2,3
18.	Schrödinger Representation, Heisenberg Representation, Interaction Representation	1	C-D		1,2,3
	UNIT III – Application of Quantum Mechanics	**9**			
19.	Equation of continuity, and its physical significance	1	C		1,2,3
20.	Bound State, Free particle, Particle in infinitely deep potential well (one - dimension)	1	C_D		1,2,3
21.	Particle in three dimension rigid box	1	C-D		1,2,3

22.	Scattering State	1	C-D		1,2,3
23.	Step potential, Potential barrier. (Qualitative discussion),	1	C-D		1,2,3
24.	Angular Momentum	1	C-D		1,2,3
25.	Generalized Angular Momentum	1	C-D		1,2,3
26.	Spin Momentum	1	C-D		1,2,3
27.	Qualitative discussion on the radial and angular parts of the bound state energy	1	D-I		1,2,3
	UNIT IV: Introduction to Solid State Physics	**9**			
28.	Crystalline and amorphous solids, Lattice, Basis,	1	C		1,2,3
29.	Translational vectors, Primitive and non-primitive unit cell	1	C		1,2,3
30.	Symmetry operations, Different types of lattices-2D and 3D (Bravais lattices), Miller indices	1	C		1,2,3
31.	SC, BCC and FCC structures, Packing fraction	1	C		1,2,3
32.	Various types of crystal structures Crystal structures- NaCl, diamond, CsCl, ZnS, HCP	1	C		1,2,3
33.	Concept of reciprocal lattice and its properties	1	C		1,2,3
34.	Ionic, covalent, molecular and metallic binding in crystalline solids	1	D		1,2,3
35.	Bragg's law and Bragg's Diffraction condition in direct and reciprocal lattice,	1	C-D		1,2,3
36.	Ewald's construction, Debye Schrrerer method	1	C-D		1,2,3
	UNIT V: Solid State Devices	**9**			
37.	Classification of solids based on band theory	1	C-I		1,2,3

38.	Semiconductors - origin of band gap	1	C-I		1,2,3
39.	Intrinsic and extrinsic semiconductors, *p* and *n* type, and p-n junction diodes	1	C-I		1,2,3
40.	Transistors and its characteristics	1	I		1,2,3
41.	Different types of transistors and their uses	1	I		1,2,3
42.	Examples of various transistors and applications	1	I-O		1,2,3
43.	Energy storage devices, Supercapacitors, fuel cells.	1	I-O		1,2,3
44.	Photodetectors, transducers and sensors; applications	1	I-O		1,2,3
45.	Solar Cells	1	I-O		1,2,3
	Total contact hours	45			

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	Introduction to Solid State Physics – C Kittel; Eighth Edition, Wiley publishers
3	Concepts of Modern Physics (2017)- Arthur Besier, Shobhit Mahajan, S. Rai Choudhury (Tata McGraw Hill)

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 214 L	Physics A2 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	Academic Council Meeting, 201 (**Regulation - 2018**)				

PURPOSE	The course aims to cover the fundamental formalism and applications of Physics. It mainly includes basic Newtonian mechanics, heat & thermodynamics, electricity & magnetism

LEARNING OBJECTIVES		**STUDENT OUTCOMES**						
At the end of the course, student will be able to								
10	Understand basic equipment operation and analysis							
11	Correlate fundamental concept of physics to laboratory experiments							

Sl. No	Description of Experiments	Contact hours	C-D-I-O	IOs	Reference
1	Determine velocity of sound	2	I-O		1, 2
2	Verification of Stefan`s Law	1	I-O		1, 2
3	Characteristics of a p-n junction	2	I-O		1, 2
4	Study the various Transistor Biasing configurations and CE Characteristics, load line and Q-factor	2	I-O		1, 2
5	Characteristics of a Solar cell	2	I-O		1, 2
6	Determine charge carrier type and concentration of a given semiconductor using Hall Effect	2	I-O		1, 2
7	Study spectral lines from Neon using a Neon discharge lamp and determine the Rydberg constant using the Bohr model formulation	2	I-O		1, 2
8	Determine lattice parameter of a given crystalline powder using X-ray diffractometer	2	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	**20%**	**20%**	**10%**	**50%**
End semester examination Weightage :					**50%**