



UNIVERSITY OF KERALA

Four Year Under Graduate Programme (UoK FYUGP)

Third Semester – Modified Syllabus

Major Discipline: PHYSICS

University of Kerala
Senate House Campus, Palayam, Thiruvananthapuram- 34, Kerala, India
June 2025

DETAILED SYLLABUS: THEORY

Module	Unit	Content	Hrs	CO No
I JC	Diodes (Book 1: Chapter 5 & 6)		10	
	1	P-N Junction Diode – Applying D.C. Voltage across pn Junction, Current Flow in a Forward Biased pn Junction, V-I Characteristics, Forward current, Peak inverse voltage, Reverse current or leakage current, Resistance of Crystal Diode	4	1
	2	Zener diode - V-I Characteristics- break down voltage, Zener Diode as Voltage Stabiliser.	2	1
	3	Rectification: Halfwave, Full wave-Centre tap, Bridge rectifiers, RC Filter circuit, Ripple factor	4	1
II JC	Transistors (Book 1: Chapter 8)		9	
	4	Transistor- Types, naming the transistor terminal, working of transistor, Transistor symbols.	2	2
	5	Transistor Connections - Common base, Common emitter, Common Collector, Current amplification factors, Relation connecting current amplification factors, Comparison of Transistor Connections	3	2
	6	Transistor input and output Characteristics : CB, CE, CC Configurations	2	2
	7	Transistor as an Amplifier in CE Arrangement	2	2
III JC	Load lines and DC Biasing Circuits (Book 1: Chapter 8 & 9)		6	
	8	Transistor load line analysis- DC Load line, Operating point, Active region, Cut off region and Saturation Region	3	3
	9	Faithful amplification, Need for transistor biasing, stability factor (Derivations not required), Voltage divider bias method.	3	3
IV JJ	Operational Amplifiers and Digital Logic Fundamentals (Book 1: Chapter: 25, Book 2: Chapter 33 & 34)		11	
	10	Introduction, Block diagram of Op-Amp, Differential amplifier, Common mode and Differential mode signals, CMRR, Virtual ground, Important Characteristics of an ideal Op-Amp, Schematic Symbol of Operational	5	4

		Amplifier, Op-Amp with negative feedback, Inverting and Non Inverting Amplifier.		
	11	Basic Logic gates (OR, AND and NOT)	1	4
	12	De Morgan's theorem, Bubbled gates, Universal gates and XOR gates	2	4
	13	Laws of Boolean Algebra-Equivalent circuits	3	4
V*	Single Stage Transistor Amplifiers and Sinusoidal Oscillators (Book 1: Chapter 8, 10 & Book 2: Chapter 25 & 28)		9	
	14	Transistor Circuit as an Amplifier, Graphical Demonstration of Transistor Amplifier, Practical Circuit of Transistor CE Amplifier, Input/Output Phase Relationships (Voltage and Current)	3	5
	15	Feedback principles – Negative feedback - advantages of negative feedback	2	5
	16	Positive feedback - Barkhausen criterion for oscillations	2	5
	17	Principle of Sinusoidal oscillations, RC phase shift oscillator (derivations not required)	2	5

DETAILED SYLLABUS: PRACTICALS

Part A – At least 5 Experiments to be performed			CO No
SI No	Name of Experiment		
1	PN junction Diode (Ge or Si) characteristics-To draw the characteristic curves of a PN junction diode and to determine its ac and dc forward resistances.		6
2	Full wave (centre tapped) rectifier-To construct a full wave rectifier using junction diode and to calculate the ripple factor with and without shunt filter		6
3	Bridge rectifier-To construct a bridge rectifier using junction diodes and to calculate the ripple factor with and without shunt filter		6
4	Zener diode as a voltage regulator-To construct a voltage regulator using Zener diode and to study its line regulation and load regulation.		6
5	Transistor CE characteristics-To draw the characteristic curves of a transistor in the CE configuration and determine the current gain, input impedance and output impedance		6
6	RC Phase shift oscillator - To construct RC phase shift oscillator using transistor		6

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7	Logic Gates (AND, OR) - To verify the truth table of AND and OR gates using diodes	6
8	Logic Gates NOT - To verify the truth table of NOT gate using Transistor	6
Part B* – At least One Experiment to be performed		
9	Inverting /Non-Inverting Amplifier -To construct a inverting/non inverting amplifier using Op-Amp	6
10	Single stage CE amplifier- To construct a single stage CE transistor amplifier and study its frequency response (designing not required).	6
11	Zener diode - To study the V-I Characteristics and find the break down voltage.	6

COURSE OUTCOMES

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Design and develop rectifier circuits and voltage regulation systems by applying the working principles and characteristics of semiconductor diodes	C	1
CO-2	Illustrate the use of a transistor as an amplifier using the knowledge of construction, operation and configuration of transistors.	Ap	1
CO-3	Analyze amplifier circuits through load line analysis and biasing techniques to ensure faithful amplification.	An	1
CO-4	Develop analog circuits using operational amplifiers and construct digital logic circuits using digital logic principles and boolean algebra.	C	1
CO-5	Apply the concept of feedback in electronic circuits to interpret the principle and working of sinusoidal oscillators, particularly RC phase shift oscillators using transistors.	Ap	1
CO-6	Apply the principles of digital electronics and transistor-based circuits through hands-on experiments involving logic gates, amplifiers, and regulators.	Ap	3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: BASIC ELECTRONICS
Credits: 3:0:1 (Lecture: Tutorial: Practical)

CO No.	CO	PO / PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO-1	Design and develop rectifier circuits and voltage regulation systems by applying the working principles and characteristics of semiconductor diodes	PO1/ PSO1	C	F, C	L	-
CO-2	Illustrate the use of a transistor as an amplifier using the knowledge of construction, operation and configuration of transistors.	PO1/ PSO1	Ap	C	L	-
CO-3	Analyze amplifier circuits through load line analysis and biasing techniques to ensure faithful amplification.	PO1/ PSO1	An	C	L	-
CO-4	Develop analog circuits using operational amplifiers and construct digital logic circuits using digital logic principles and boolean algebra.	PO 1/ PSO1	C	F, C	L	-
CO-5	Apply the concept of feedback in electronic circuits to interpret the principle and working of sinusoidal	PO 1/ PSO 1	Ap	F, C	L	-

	oscillators, particularly RC phase shift oscillators using transistors.					
CO-6	Apply the principles of digital electronics and transistor-based circuits through hands-on experiments involving logic gates, amplifiers, and regulators.	PO 1/ PSO 3	Ap	P	-	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO-1	2	-	-	-	-	-	-	2	-	-	-	-	-	-	-
CO-2	2	-	-	-	-	-	-	2	-	-	-	-	-	-	-
CO-3	2	-	-	-	-	-	-	1	-	-	-	-	-	-	-
CO-4	1	-	-	-	-	-	-	2	-	-	-	-	-	-	-
CO-5	2	-	-	-	-	-	-	2	-	-	-	-	-	-	-
CO-6	-	-	2	-	-	-	-	1	-	-	-	-	-	-	-

Correlation Levels:

Level	-	1	2	3
Correlation	Nil	Slightly / Low	Moderate / Medium	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics :

CO No	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO-1	✓	✓	✓	✓
CO-2	✓	✓	✓	✓
CO-3	✓	✓	✓	✓
CO-4	✓	✓	✓	✓
CO-5	✓	✓	✓	✓
CO-6	✓	✓	✓	✓



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Discipline	PHYSICS				
Course Code	UK3DSCPHY201				
Course Title	DIGITAL ELECTRONICS AND DATASCIENCE				
Type of Course	DSC				
Semester	III				
Academic Level	200 - 299				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 Hrs	-	2 Hrs	5 Hrs
Pre-requisites	-				
Course Summary	This course introduces the fundamental concepts of Digital and Computational Methods in Physics. The first module comprises of the introduction to various number systems and codes. The idea of digital logic gates are introduced in the second module. The third module incorporates Boolean Laws and Theorems along with the concept Karnaugh Maps. The basics of data science which includes the types, collection pre-processing etc are discussed in fourth module. Fifth module explains the various data analysis and analytic techniques				

BOOKS FOR STUDY:

1. DIGITAL PRINCIPLES AND APPLICATION Albert Paul Malvino , Donald P Leach 7th Edition , Tata McGraw Hill Education Private limited
2. Digital Electronics_ Principles and Applications, Roger L. Tokheim, Patrick E. (2021, McGraw-Hill Education)
3. A Hands-On Introduction to Data Science- Chirag Shah - Cambridge University Press (2020)

BOOKS FOR REFERENCE:

1. Albert P. Malvino, Jerald A. Brown - Digital Computer Electronics (1993, McGraw-Hill)
2. Anil K. Maini - Digital Electronics. Principles, Devices and Applications [messy] (2007, Wiley)
3. Basics of Digital Electronics , Banani Ghosh, CRC Press, 2024

4. Electronics. Analog and Digital , Barun Raychaudhuri, Cambridge University Press, 2024
5. Ozdemir, Sinan - Principles of Data Science_ Learn the techniques and math you need to start making sense of your data (2016, Packt Publishing)
6. Sinan Ozdemir - Principles of Data Science_ A beginner's guide to essential math and coding skills for data fluency and machine learning-Packt Publishing Pvt Ltd (2024)

DETAILED SYLLABUS: THEORY

Module	Unit	Content	Hrs	CO No
I	Number Systems and Codes (Book 1: Chapter 5)		9	
	1	Binary Number System	1	1
	2	Binary-to-decimal Conversion, Decimal-to-binary Conversion, BCD	2	1
	3	Octal Numbers-Conversions , Hexadecimal Numbers-Conversions	3	1
	4	The ASCII Code, The Excess-3 Code, The Gray Code	1	1
	5	Error Detection and Correction	2	1
II	Digital Logic Gates (Book 2: Chapter 3)		9	
	6	The AND Gate, The OR Gate ,The Inverter and Buffer	2	2
	7	The NAND Gate, The NOR Gate	2	2
	8	The Exclusive OR Gate, The Exclusive NOR Gate	2	2
	9	The NAND Gate as a Universal Gate ,The NOR Gate as a Universal Gate	2	2
	10	Gates with More Than Two Inputs	1	2
III	Combinational Logic Circuits (Book 1: Chapter 3)			
	11	Boolean Laws and Theorems	2	3
	12	Sum-of-Products Method	1	3
	13	Truth Table to Karnaugh Map, Karnaugh Simplifications	3	3
	14	Don't-care Conditions	1	3
	15	Product-of-sums Method, Product-of-sums Simplification	2	3

IV	Introduction to Data Science (Book 3: Chapter 1 & 2)		9	
	16	Introduction- Data Science, Relation to other fields	1	4
	17	Data Types	2	4
	18	Data Collections	3	4
	19	Data Pre-processing	3	4
V*	Data Analysis and Data Analytics (Book 3: Chapter 3)		9	
	20	Descriptive Analysis- Variables, Frequency Distribution, Measures of Centrality, Dispersion of a Distribution	4	5
	21	Diagnostic Analytics- Correlations	3	5
	22	Predictive Analytics, Prescriptive Analytics	2	5

DETAILED SYLLABUS: PRACTICALS

Part A – At least 5 Experiments to be performed		CO No
Sl No	Name of Experiment	
1	To verify the truth table of any one logic gate using IC 74XX series	6
2	To verify the truth tables of AND gate using diodes	6
3	To verify the truth tables of OR gate using diodes	6
4	To verify the truth tables of NOT gates using transistors	6
5	To verify the truth tables of AND gate using IC's	6
6	To verify the truth tables of OR gate using IC's	6
7	To Calculate standard deviation and variance from a set of given ungrouped data	6
8	To verify Demorgan's theorem for 2 variables	6
9	To design a logical circuit and simplify it using Boolean algebra rules	6
10	To calculate the mean from a set of ungrouped and grouped data	6
Part B* – At least One Experiment to be performed		
11	To calculate the median and mode from a set of given ungrouped data	6

12	To verify the truth tables of NOT gate using IC's	6
13	To verify the truth tables of NAND gate using IC's	6
14	To verify the truth tables of NOR gate using IC's	6

COURSE OUTCOMES

CO No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Illustrate the conversion of different types of number system and codes	Ap	PSO 1,3,6
CO-2	Examine the concepts of digital logic gates and its applications	An	PSO 1,3,6
CO-3	Create equivalent circuits and solve complex logic circuits, using Boolean algebra and Karnaugh maps	C	PSO 1,3,6
CO-4	Investigate different Data types and processing techniques	An	PSO 1,2
CO-5	Employ and validate various analysis techniques and correlation	E	PSO 1,2
CO-6	Verify the working of various digital logic gates using diode/transistors and IC's and develop basic data processing skills	Ap	PSO 7

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: **DIGITAL ELECTRONICS AND DATA SCIENCE**

Credits: 3:0:1 (Lecture: Tutorial: Practical)

CO No.	CO	PO / PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO-1	Illustrate the conversion of different types of number system and codes	PO 1/ PSO 1,3,6	Ap	F, C	L	-
CO-2	Examine the concepts of digital logic gates and its applications	PO 1/ PSO 1,3,6	An	C	L	-
CO-3	Create equivalent circuits and solve complex logic circuits, using Boolean algebra and Karnaugh maps	PO 1/ PSO 1,3,6	C	C	L	-
CO-4	Investigate different Data types and processing techniques	PO 1/ PSO 1,2	An	C	L	-
CO-5	Employ and validate various analysis techniques and correlation	PO 1/ PSO 1,2	E	C	L	-
CO-6	Verify the working of various digital logic gates using diode/transistors and IC's and develop basic data processing skills	PO 6,7/ PSO 7	Ap	C,P	-	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO-1	1	-	1	-		1	-	1	-	-	-	-	-	-	-
CO-2	2	-	2	-		2	-	2	-	-	-	-	-	-	-
CO-3	2	-	1	-		1	-	2	-	-	-	-	-	-	-
CO-4	2	1	-	-	-	-	-	2	-	-	-	-	-	-	-
CO-5	2	2	-	-	-	-	-	2	-	-	-	-	-	-	-
CO-6	-	-	-	-	-	-	2	-	-	-	-	-	2	2	-

Correlation Levels:

Level	-	1	2	3
Correlation	Nil	Slightly / Low	Moderate / Medium	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics :

CO No	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO-1	✓	-	-	✓
CO-2	✓	-	-	✓
CO-3	✓	-	-	✓
CO-4	✓	-	-	✓
CO-5	-	✓	-	-
CO-6	✓	-	-	✓

CO No	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO-1	✓	-	-	✓
CO-2	✓	-	✓	✓
CO-3	✓	-	-	✓
CO-4	✓	-	-	✓
CO-5	✓	✓	-	-
CO-6	✓	-	✓	-



University of Kerala

Discipline	PHYSICS				
Course Code	UK3DSCPHY202				
Course Title	SOLID STATE PHYSICS & SPECTROSCOPY				
Type of Course	DSC				
Semester	III				
Academic Level	200 - 299				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 Hrs	-	2 Hrs	5 Hrs
Pre-requisites	1. Students should know the atom model 2. Students should be aware of different types of materials				
Course Summary	This course aims to provide the basic concepts of solid state physics and spectroscopy and make the students aware of some of the applications of spectroscopy.				

BOOKS FOR STUDY:

1. Modern Physics: R.Murugesan, S.Chand & Co.
2. University Physics Vol.3, OpenStax

BOOKS FOR REFERENCE:

1. Fundamentals of Molecular Spectroscopy: Banwell, TMH
2. Molecular Spectroscopy: G.Aruldas, PHI, 2004

DETAILED SYLLABUS: THEORY

Module	Unit	Content	Hrs	CO No
I	Solid State Physics (Book 1 : Sections 7.15, 7.16, 7.17, 7.18)		7	
	1	Types of crystals, crystal lattice and translation vectors, basis, unit cell, primitive lattice cell	2	1
	2	Elements of symmetry, two dimensional lattice types	2	1
	3	Bravais lattices, miller indices	3	1
II	Band Theory of Solids (Book 2 : Section. 9.5)		7	
	4	Energy bands- Valence band, Conduction band, Energy Gap	2	1
	5	Classification of solids as conductors, semiconductors and insulators based on band theory	1	1
	6	Semiconductors and doping	1	1
	7	Semiconductor devices- diodes, Transistors.	3	1
III	Spectroscopy (Book 1 : 6.4, 6.12, 6.22, 7.11, 7.12, 7.13, 19.7, 23.2, 23.3, 23.8, 23.10, 23.11)		13	
	8	Bohr atom model, bohr formulae, calculation of total energy, Bohr's interpretation of the Hydrogen spectrum. Spectral series of hydrogen atom, energy level diagram (Sections 6. 4)	4	2
	9	The vector atom model (Section 6.12)	2	2
	10	Optical spectra- spectral terms and notations, selection rules (Section -6.22)	1	2
	11	X-ray spectrum, Characteristic X-ray Spectrum, Moseley's law (Sections- 7.11, 7.12, 7.13)	2	2
	12	Molecular spectra- Nature, Different modes, Theory of the Origin of Pure Rotational Spectrum of a Molecule (Sections 19.7, 23.2, 23.3, 23.8)	2	2
	13	Energy of a diatomic molecule, Vibrating Diatomic Molecule as a Harmonic Oscillator (Sections 23.10, 23.11)	2	2
	Spectroscopic Techniques (Book 1 : 24.2, 24.3, 24.4, 24.5, 24.6, 24.9, 24.10, 24.11, 24.12, 24.13)		9	
IV	14	EM Spectrum- UV, Visible, IR, Radio and microwave regions	1	2

	15	Spectroscopy of the visible region- Constant Deviation Spectrograph, Recording the spectrum, Enhancement of Spectra: Computer Averaging	2	2
	16	Ultraviolet spectroscopy - Introduction, Quartz Spectrograph for Near U.V.Region	2	2
	17	IR Spectroscopy- prism - mirror, grating spectrometer	2	2
	18	Absorption spectroscopy, Block diagram of absorption spectrometer	2	2
V*	Laser (19.1,19.2, 19.3, 19.4, 19.5- Book 1)		9	
	20	Induced Absorption, Spontaneous Emission and Stimulated Emission, principle of laser, population inversion, pumping	3	3
	21	Types of Laser- Ruby laser, He-Ne laser, Semiconductor laser	4	3
	22	Application- Holography	2	3

DETAILED SYLLABUS: PRACTICALS

Part A – At least 5 Experiments to be performed		CO No
Sl No	Name of Experiment	
1	Study the forward characteristics of a PN junction diode.	4
2	Photo diode characteristics: To study the output characteristics of a photo diode	4
3	Half wave rectifier-Measurement of ripple factor with and without filter capacitor	4
4	Full wave rectifier- Measurement of ripple factor with and without filter capacitor	4
5	Study the V-I characteristics of Light Emitting Diode	4
6	Zener diode as a voltage regulator-To construct a voltage regulator using Zener diode and to study the output voltage variation (i) for different RL and (ii) for different input voltage with same RL.	4
7	Bridge rectifier-To construct a bridge rectifier using junction diodes and to calculate the ripple factor with and without shunt filter (10 readings for RL 100 to 5000).	4
Part B* – At least One Experiment to be performed		
8	To determine the Planck's constant using LEDs of at least 4 different colours	4

9	Bridge rectifier- Dual power supply-To construct a dual power supply using bridge rectifier and measure the output voltages for different pair of identical load resistors,	4
10	Transistor characteristics-CE-To draw the input and output characteristic curves of a transistor in the CE configuration	4

COURSE OUTCOMES

CO No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Analyse the types of crystals, elements of symmetry, Bravais lattices, and Miller indices of crystalline materials, and examine the band structure of solids to interpret the properties and operation of semiconductors and semiconductor devices	An	PSO – 1, 2
CO-2	Develop practical solutions by utilising the fundamental principles of atomic models, optical spectra, X-ray spectra, molecular spectra, and different spectroscopic techniques.	C	PSO – 1, 7
CO-3	Apply the basic principles of lasers to demonstrate their use in various practical applications.	Ap	PSO – 1, 2
CO-4	Inculcate experimental skills and to interpret experimental data through laboratory experiments	Ap	PSO - 1,7

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: **SOLID STATE PHYSICS & SPECTROSCOPY**
Credits: 3:0:1 (Lecture: Tutorial: Practical)

CO No.	CO	PO / PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO-1	Analyse the types of crystals, elements of symmetry, Bravais lattices, and Miller indices of crystalline materials, and	PO-1,6 PSO-1, 2	An	F, C	L	-

	examine the band structure of solids to interpret the properties and operation of semiconductors and semiconductor devices					
CO-2	Develop practical solutions by utilising the fundamental principles of atomic models, optical spectra, X-ray spectra, molecular spectra, and different spectroscopic techniques.	PO-1,6 PSO-1	C	F, C	L	-
CO-3	Apply the basic principles of lasers to demonstrate their use in various practical applications.	PO-1,2,6 PSO-1, 2	Ap	F, C	L	-
CO-4	Inculcate experimental skills and to interpret experimental data through laboratory experiments	PO-1,2, PSO-1,7	Ap	F, C	L	-

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO-1	2	2	-	-	-	-	-	1	-	-	-	-	2	-	-
CO-2	2	-	-	-	-	-	2	1	-	-	-	-	2	-	-
CO-3	2	1	-	-	-	-	1	1	2	-	-	-	2	-	-
CO-4	2	-	-	-	-	-	2	1	2	-	-	-	2	-	-

Correlation Levels:

Level	-	1	2	3
Correlation	Nil	Slightly / Low	Moderate / Medium	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics :

CO No	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO-1	✓	✓	-	✓
CO-2	✓	✓	-	✓
CO-3	✓	-	-	-
CO-4	✓	-	-	✓



University of Kerala

Discipline	PHYSICS				
Course Code	UK3DSEPHY202				
Course Title	BASICS OF NANOSCIENCE AND NANOTECHNOLOGY				
Type of Course	DSE				
Semester	III				
Academic Level	200 - 299				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	4 Hrs	-	-	4 Hrs
Pre-requisites	-				
Course Summary	Materials Structure and Bonding. Crystals and Imperfections in Solids, Electrical and Optical Properties of Materials, Generation of Nanoscience and Nanotechnology, Applications of Nanoscience and Nanotechnology for a Sustainable Future: Addressing Global Challenges				

BOOKS FOR STUDY:

1. Materials Science and Engineering: An Introduction, 10th Edition by William D. Callister Jr, David G. Rethwisc, Wiley (2018)
2. Textbook of Nanoscience And Nanotechnology, B.S Murthy, P. Shankar. Baldev Raj, B.B.Rath, James Murday, Orient Blackswan, (2021)
3. Nanotechnology: Principles and Practices, Third Edition, by Sulabha K. Kulkarn (2014)
4. Introduction To Nanoscience And Nanotechnology By Chattopadhyay, PHI, India
5. Introduction to Nanotechnology, Charles P. Poole Jr., Frank J. Owens, Wiley-Interscience

BOOKS FOR REFERENCE:

1. Fundamentals of Nanotechnology, CRC press, by G.L. Hornyak, J.J. Moone, H.F. Tihhale, J. Dutta
2. Nano Essentials- T.Pradeep, TMH
3. Nanomaterials by A.K. Bandyopadhyay; New Age International Publishers.
4. Nanotechnology by Mark Ratner and Daniel Ratner, Pearson Education.

WEB REFERENCE

1. <https://nptel.ac.in/courses/113/104/113104076/>

DETAILED SYLLABUS: THEORY

Module	Unit	Content	Hrs	CO No
I	Materials Structure and Bonding		12	
	1	Why Study Materials Science and Engineering? (Book1: Chapter 1)	1	1
	2	Crystal Structure- Fundamental Concepts, Unit Cell, *Elementary ideas and examples of Metallic Crystal structures (Book1: Chapter 3)	2	1
	3	Elementary ideas and examples of Three-Dimensional Crystal systems, Planes in the Crystals, Crystallographic Directions, (Book1: Chapter 3)	4	1
	4	Crystalline and non-crystalline materials Single crystals, Polycrystals (Book1: Chapter 3)	2	2,3
	5	Atomic packing factors of FCC, BCC, Hexagonal close packed crystal structure (Book1: Chapter 3)	3	2,3
II	Inter-atomic bonding		8	
	6	Atomic bonding in solids - bonding forces and energies (Book1: Chapter 2)	3	1
	7	Primary Interatomic bonds - Ionic bonding, Covalent bonding (Book1: Chapter 2)	3	1
	8	Metallic bonding, Secondary bonding (van der Waals bonding) (Book1: Chapter 2)	2	1
III	Electrical and Optical Properties of Materials		16	
	9	Electrical Conductivity, Electronic and Ionic Conduction (Book1: Chapter 18)	3	4
	10	Energy Band Structures in Solids, Conduction in Terms of Band and Atomic Bonding Models, Electron Mobility (Book1: Chapter 18)	4	4
	11	Semiconductivity- Intrinsic Semiconduction, Extrinsic Semiconduction (n-Type Extrinsic Semiconduction & p-Type Extrinsic Semiconduction) (Book1: Chapter 18)	4	4

	12	Electromagnetic Radiation, Light Interactions with Solids, Atomic and Electronic Interactions (Book1: Chapter 21)	2	4
	13	Optical properties of Non metals: Refraction, Reflection, Absorption, Transmission, Colour (Book1: Chapter 21)	3	4
IV	Generation of Nanoscience and Nanotechnology		12	
	14	Nano – History and Scope, Cluster and Magic Numbers, Early applications of nanotechnology -Nano-gold (Book 2: Chapter 1)	2	4
	15	Applications of Nanomaterials, Nature: The Best Nanotechnologist - web-spinning spider, lotus-leaf effect, Water striders (Book 2: Chapter 1)	2	4
	16	Effect of nano-dimensions on materials behaviour: Elastic properties & Melting point (Book 2: Chapter 2)	2	4,5
	17	Clusters- Types of Clusters, Semiconductor nanoparticles, Excitons (Book 3: Chapter 8)	3	4,5
	18	The Era of new nanostructures of Carbon – Buckminsterfullerene, Carbon Nanotubes (CNTs), Multi walled CNTs (Book 4: Chapter 8, Book 5: Chapter 5 Section 5.1 & 5.2 ONLY)	3	5
V*	Applications of Nanoscience and Nanotechnology for a Sustainable Future		12	
	19	Can small things make a big difference? Nanoscience and Properties, Classification of nanostructured materials (Book 2: Chapter 1, Book 5: Chapter 4)	4	4
	20	Fascinating nanostructures (Book 2: Chapter 1)	4	5
	21	Nanotechnology and Environment (Book 3, Chapter 11)	4	6

COURSE OUTCOMES

CO No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Explain the fundamentals of nanoscale systems and its physical, chemical and electrical properties	U	PSO-1,2
CO-2	List and classify the fundamental crystal structure of materials	Ap	PSO-2,3
CO-3	Outline the various bonds occurs in materials	U	PSO-1,3
CO-4	Formulate the concepts of electrical and optical properties of materials and compare it with that of nanomaterials	C	PSO-3,4
CO-5	Design models to demonstrate the influence of surface effects on the mechanical, physical, and chemical properties of materials such as CNTs and MWCNTs	C	PSO-5
CO-6	Analyse the fundamental applications of nanotechnology and point out how it supports for a sustainable future in modern era	An	PSO-6,7

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: BASICS OF NANOSCIENCE AND NANOTECHNOLOGY

Credits: 4:0:0 (Lecture: Tutorial: Practical)

CO No.	CO	PO / PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO-1	Explain the fundamentals of nanoscale systems and its physical, chemical and electrical properties	PO 1,3,4,5,6, 8/ PSO-1,2	U	F, C	L	-
CO-2	List and classify the fundamental crystal structure of materials	PO 1,2,3,4,5, 8/ PSO-2,3	Ap	F, C	L	-
CO-3	Outline the various bonds occurs in	PO 1,2,3,4,6/	U	F, C	L	-

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	materials	PSO-1,3				
CO-4	Formulate the concepts of electrical and optical properties of materials and compare it with that of nanomaterials	PO 1,2,3,4,6/ PSO-3,4	C	F, C	L	-
CO-5	Design models to demonstrate the influence of surface effects on the mechanical, physical, and chemical properties of materials such as CNTs and MWCNTs	PO 1,2,3,7/ PSO-5	C	F, C	L	-
CO-6	Analyse the fundamental applications of nanotechnology and point out how it supports for a sustainable future in modern era	PO 1,3,4,5,7, 8/ PSO- 6,7	An	F, C	L	-

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO-1	2	2	-	-	-	-	-	2	-	1	1	-	2	-	1
CO-2	-	2	1	-	-	-	-	1	2	2	1	-	-	-	2
CO-3	2	-	1	-	-	-	-	1	2	2	1	-	1	-	-
CO-4	-	-	3	2	-	-	-	2	2	1	1	-	1	-	-
CO-5	-	-	-	-	3	-	-	1	2	2	-	-	-	2	-
CO-6	-	-	-	-	-	2	2	1	-	2	2	-	-	1	1

Correlation Levels:

Level	-	1	2	3
Correlation	Nil	Slightly / Low	Moderate / Medium	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics :

CO No	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO-1	✓	-	-	✓
CO-2	✓	-	-	✓
CO-3	✓	✓	-	✓
CO-4	✓	✓	-	✓
CO-5	✓	✓	-	✓
CO-6	✓	-	-	-



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Discipline	PHYSICS				
Course Code	UK3VACPHY201				
Course Title	INTRODUCTION TO LABORATORY SAFETY MEASUREMENTS				
Type of Course	VAC				
Semester	III				
Academic Level	200 - 299				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	3	3 Hrs	-	-	3 Hrs
Pre-requisites					
Course Summary	This course provides a comprehensive overview of laboratory safety, covering general safety principles, operational rules, and safety equipment. It also includes an introduction to electrical and chemical safety measures, focusing on inspection, testing, protective clothing, and safe handling of hazardous substances. Additionally, the course explores radiation effects, monitoring, and safety protocols in nuclear physics labs and also a few activities to help students learn lab safety measures.				

BOOKS FOR REFERENCE:

1. CSIR-CECRI Lab Safety Manual Version 1.0
2. Introduction to Electrical Safety and Safety Management, Khanna Publishers, Chapter 1 pdf
3. Safety measurements, CSIR-Central Glass & Ceramic Research Institute Version 2.0
4. Laboratory Safety Manual, National Centre for Biological Sciences
5. Electrical Safety Hand book, John Cadick, Mary-Capelli-Schellpfeffer, Dennis, Neitzal (3rd Edition), McGraw-Hill (Chapter 2)
6. Techniques for Nuclear and Particle Physics experiments, W. R. Leo (Chapter 3)
7. Safety measurements for Indian Laboratories, Ajay Kumar Gupta & Prithanshu, ISBN: 1312254084, Lulu.
8. Hand book of Chemicals and Safety, TSS, Dikshith, ISBN No: 13-978-1-4398-2 (E-book), CRC Press, Taylor & Francis. (Chapter 2 & Chapter 3)

DETAILED SYLLABUS: THEORY

Module	Unit	Content	Hrs	CO No
I	Introduction		9	
	Book 1 (Chapter 1 & 2), Book 3 (Chapter 2), Book 4 (Chapter 1)			
	1	Introduction to General Safety Principles and labels	4	1
II	2	Basic lab safety equipments- Safety Goggles, Lab Coats, Gloves, Fume Hood, Fire Extinguisher, Safe Laboratory Practices	5	1
	Electrical safety measures (Book 2-Chapter 1, Book 5-Chapter 2)		9	
	3	Introduction to electrical safety measures	2	1
	4	Approaches to prevent accidents - Use of Warning Labels	2	1
	5	Strategies for Protection from the Electrical Hazards- Shock	2	1
III	6	Safety clothing, Safety tags, Safety grounding, circuit breaker, safety measuring instruments	3	1
	Chemical safety measures (Book-1 Chapter 3, Book-4 Chapter 2)		9	
	7	Introduction to use of chemical substances.	1	1
	8	Precautions for Hazardous Chemical Usage & Safety measures (Chemical Hood), Storage of Chemicals	3	2, 3
	9	Chemical Spills-Precautions against Acid spill & Mercury spill	2	2, 3
	10	Precautions against fire in the lab-Operation of Fire Extinguishers	2	1, 3
IV	11	Safe disposal of Chemical substances	1	1, 3
	Radiation effects (Book 4: Chapters 3)		9	
	12	Physical effects of radiation. Chemical effects of radiation	3	4
	13	Laser safety Terminology- Maximum Permissible Exposure(MPE) and safe work practices in a lab	3	4
	14	Permissible Dose (MPD), Shielding, Radiation safety in nuclear physics lab (Book 6, Chapter 3)	3	4

V*	Lab Safety measures in practice (Complete 2-3 activities of this Module)		9	
	15	Visit and prepare a report of the Electrical, Chemical and Radiation related safety measures adopted in any of the labs in your college or nearby labs.	3	5
	16	Conduct a mock drill in a lab or Conduct a demonstration of awareness in lab safety measures to students, Organize a talk or Interaction with an expert in lab safety.	4	5
	17	Study about the lab safety methods implemented in your college and give recommendations to upgrade it if necessary.	2	5

COURSE OUTCOMES

CO No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Describe fundamental laboratory safety guidelines, operational rules, and the appropriate use of safety equipment, fostering a safe lab environment and minimizing the likelihood of accidents or injuries during experiments.	U	PSO-1,3
CO-2	Analyse essential electrical safety measures, including inspection, safety clothing, insulated tools, arc protection, and safety devices like tags, locks, grounding, and circuit breakers, ensuring safe practices in electrical work environments.	An	PSO-1,3
CO-3	Summarize the knowledge of chemical substances, disposal methods, regulatory agencies, and occupational hazards to effectively manage and mitigate risks in practical scenarios.	E	PSO-1,3
CO-4	Develop proficiency in radiation monitoring and the use of dose meters, comprehend the physical and chemical effects of radiation, including Laser safety, understand concepts such as maximum permissible dose (MPD), and apply principles of shielding for radiation safety in nuclear physics laboratories.	C	PSO-1,3
CO-5	Summarize various different lab safety methods and develop standard operating procedures for their safe handling and usage.	C	PSO-1,3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

**Name of the Course: INTRODUCTION TO LABORATORY SAFETY
MEASUREMENTS**

Credits: 3:0:0 (Lecture: Tutorial: Practical)

CO No.	CO	PO / PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO-1	Describe fundamental laboratory safety guidelines, operational rules, and the appropriate use of safety equipment, fostering a safe lab environment and minimizing the likelihood of accidents or injuries during experiments.	PO1,3,4, 6,8/ PSO-1,3	U	F	L	-
CO-2	Analyse essential electrical safety measures, including inspection, safety clothing, insulated tools, arc protection, and safety devices like tags, locks, grounding, and circuit breakers, ensuring safe practices in electrical work environments.	PO1,3,4, 6,8/ PSO-1,3	An	F, C	L	-
CO-3	Summarize the knowledge of chemical substances, disposal methods, regulatory agencies, and occupational hazards to effectively manage and mitigate risks in practical scenarios.	PO1,3,4, 6,8/ PSO-1,3	E	P	L	-
CO-4	Develop proficiency in radiation monitoring and the use of dose meters,	PO1,3,4, 6,8/ PSO-1,3	C	P, M	L	-

	comprehend the physical and chemical effects of radiation, including Laser safety, understand concepts such as maximum permissible dose (MPD), and apply principles of shielding for radiation safety in nuclear physics laboratories.					
CO-5	Summarize various different lab safety methods and develop standard operating procedures for their safe handling and usage.	PO1,3,4, 6,8/ PSO-1,3	C	M	L	-

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO-1	2	-	2	-	-	-	-	2	-	3	2	2	2	-	2
CO-2	2	-	3	-	-	-	-	2	-	2	2	2	2	-	2
CO-3	3	-	2	-	-	-	-	3	-	3	2	2	2	-	2
CO-4	2	-	2	-	-	-	-	3	-	2	2	2	2	-	3
CO-5	2	-	2	-	-	-	-	2	-	3	2	2	2	-	2

Correlation Levels:

Level	-	1	2	3
Correlation	Nil	Slightly / Low	Moderate / Medium	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics :

CO No	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO-1	✓	-	-	✓
CO-2	✓	-	-	✓
CO-3	✓	-	-	✓
CO-4	✓	✓	-	✓
CO-5	✓	✓	-	-



UNIVERSITY OF KERALA

Four Year Under Graduate Programme

(UoK FYUGP)

Second Semester - Revised Syllabus

Major Discipline: PHYSICS

University of Kerala

Senate House Campus, Palayam, Thiruvananthapuram- 34, Kerala, India

December 2024



University of Kerala

Discipline	PHYSICS				
Course Code	UK2DSCPHY100				
Course Title	FOUNDATION COURSE IN PHYSICS-II				
Type of Course	DSC				
Semester	II				
Academic Level	100 - 199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 Hrs	-	2 Hrs	5 Hrs
Pre-requisites					
Course Summary	This course discusses the basic concepts required to learn advanced physics courses. The concept of error and precision emphasises the importance of numbers when expressing the magnitude of a quantity. Discussion on waves basic features of waves and its expression. Basic concepts of fluids helps us to understand application level problems like venturi meter and aeroplane wings. The discussion on elasticity gives an idea about different elastic moduli.				

BOOKS FOR STUDY:

1. Principles Of Physics 10th Edition, Robert Resnick Jearl Walker, David Halliday, Wiley, 2014.
2. Sear and Zemansky's University Physics With Modern Physics, Hugh D Young, Roger A Freedman, Addison -Wesley, 13TH EDITION, 2012.
3. College Physics 2e, PAUL PETER URONE, ROGER HINRICHS, Openstax, 2022
4. Elements of Properties of Matter: D.S. Mathur, S. Chand Publications, 2014

BOOKS FOR REFERENCE:

1. Mechanics: J. C. Upadhyaya and Ram Prasad, S. Chand Publications, 2017
2. Mechanics: H. S. Hans and S. P. Puri, TMH, 2ndEdn.
3. Properties of matter: Brijlal and Subramaniam, S. Chand & Co.,2004
4. Principles of Physics: P.V. Naik, PHI, 2010
5. Principles Of Physics 10th Edition, Robert Resnick Jearl Walker, David Halliday, Wiley, 2014.

WEB REFERENCE

1. https://www.owlnet.rice.edu/~labgroup/pdf/Error_analysis.htm
2. <https://faraday.physics.utoronto.ca/PVB/Harrison/ErrorAnalysis/>

DETAILED SYLLABUS: THEORY

Module	Unit	Content	Hrs	CO No
I	PRECISION IN PRACTICE (Web 1, Web 2)		9	
	1	Significant figures (Web 1)	1	1
	2	Absolute and relative error (Web 1)	1	1
	3	Systematic error (Web 1)	1	1
	4	Random error, estimating random errors (Web 1)	1	1
	5	Propagation of errors (Web 1)	2	1
	6	Precision and accuracy (Web 2)	2	1
	7	Error bars and graphical representation (Web 2)	1	1
II	PHYSICAL WORLD OF WAVES (Book1: Chapter 16)		9	
	8	Types of waves – Mechanical, Electromagnetic and matter waves, Transverse and longitudinal waves	1	2
	9	Amplitude, phase, wavelength, wave number, period, frequency, angular frequency, phase constant, Speed of a travelling wave	2	2
	10	Wave Speed on a stretched string, energy and power of a wave travelling along a string	2	2
	11	Wave equation	1	2
	12	The principle of Superposition of waves	1	2

	13	Standing waves and resonance(qualitative idea)	2	2
III	FLUID STATICS (Book 3: Chapter 11)		6	
	14	Cohesion and adhesion of liquids, surface tension - pressure inside a bubble, capillary action	4	3
	15	Pressure in the body: Blood pressure, pressure in eye, Pressure Associated with the Lungs, Other Pressures in the Body: Spinal Column and Skull- Bladder Pressure- Pressures in the Skeletal System	2	3
IV	FLUID DYNAMICS (Book 2: Chapter 12 and Book 3: Chapter 12)		12	
	16	Fluid flow-streamline and turbulent flow, continuity equation (Book 2: Chapter 12)	2	4
	17	Bernoulli's equation -derivation, venturi meter, lift on an aeroplane wing (Book 2: Chapter 12)	4	4
	18	Viscosity and Laminar Flow; Poiseuille's Law, Motion of an Object in a Viscous Fluid (Book 3: Chapter 12)	4	4
	19	Molecular Transport Phenomena: Diffusion, rate and direction of diffusion, Osmosis and Dialysis - Diffusion across Membranes (Book 3: Chapter 12)	2	4
V*	BEAUTY OF DEFORMATION AND RESTORATION (Book1, Book4)		9	
	20	Condition for equilibrium, Centre of Gravity (Book1: Chapter 12)	1	5
	21	Stress, Strain, and Elastic Moduli- Hook's law, Tensile stress and strain, Bulk Stress and Strain, Shear Stress and Strain (Book1: Chapter 12)	2	5
	22	bending of beams, bending moment, cantilever, Beams supported at its ends and loaded in the middle (Book 4: Chapter 12)	3	5
	23	Twisting couple on a cylindrical rod or wire, work done in twisting a wire, torsion pendulum (Book 4: Chapter 12)	3	5

DETAILED SYLLABUS: PRACTICALS

Part A – At least 5 Experiments to be performed		CO No
Sl No	Name of Experiment	
1	Uniform bending—Y- optic lever method	5
2	Uniform Bending- determination of Y using pin and Microscope	5
3	Rigidity modulus –Static torsion	5
4	Torsion pendulum I- By Torsional oscillations.	5
5	Torsion pendulum I- By Equal masses.	5
6	Viscosity-Continuous flow method using constant pressure head.	4
7	Viscosity-Variable pressure head arrangement	4
8	Surface tension - Capillary rise.	3
9	Sonometer - frequency of AC using sonometer.	2
10	Melde’s string - frequency of tuning fork	2
Part B* – At least One Experiment to be performed		
11	Evaluation of errors in simple experiments.	1
12	Experiment to demonstrate random error, by taking dimensions of a small rectangular object using Vernier calliper and evaluate the volume of the object	1
13	Comparison of least counts of measuring instruments.	1
14	Non-uniform bending-Y-Optic lever & telescope	5
15	Determination of the viscosity of fluid using Stoke’s method.	4
16	Kundt’s tube – determination of velocity of sound	2

COURSE OUTCOMES

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Discuss the basics of error analysis and design suitable methods for expressing errors in physical quantities.	C	1, 2, 7
CO-2	Evaluate the basic concepts of waves and its mathematical expression to understand periodic wave motion	E	1, 2

CO-3	Observe physical concepts of mechanics of fluids to understand several functioning of human body.	U	1, 2, 7
CO-4	Apply the concepts of fluid mechanics and molecular transport phenomena to some practical applications.	Ap	1, 2, 7
CO-5	Cite Hook's law and apply it to calculate the elastic moduli of beams and rods.	Ap	1, 2, 7

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: FOUNDATION COURSE IN PHYSICS-II

Credits: 3:0:1 (Lecture:Tutorial:Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO-1	Discuss the basics of error analysis and design suitable methods for expressing errors in physical quantities.	PSO 1, 2, 7/ PO 1, 2	C	F, C, P	L	P
CO-2	Evaluate the basic concepts of waves and its mathematical expression to understand periodic wave motion	PSO 1, 2, 7/ PO 1, 2	E	F, C	L	
CO-3	Observe physical concepts of fluids in rest, to understand some practical applications.	PSO 1, 2, 7/ PO 1, 2	U	F, C, P	L	P
CO-4	Apply the concepts of fluid mechanics and molecular transport phenomena to understand several physiological processes inside human body.	PSO 1, 2, 7/ PO 1, 2	Ap	F, C, P	L	P

CO-5	Cite Hook's law and apply it to calculate the elastic moduli of beams and rods.	PSO 1, 2, 7/ PO 1, 2	Ap	F, C, P	L	P
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F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO-1	2	2	-	-	-	-	2	1	1	-	-	-	-	-	-
CO-2	3	1	-	-	-	-	-	2	2	-	-	-	-	-	-
CO-3	3	2	-	-	-	-	3	2	2	-	-	-	-	-	-
CO-4	3	2	-	-	-	-	3	2	2	-	-	-	-	-	-
CO-5	3	2	-	-	-	-	3	3	3	-	-	-	-	-	-

Correlation Levels:

Level	-	1	2	3
Correlation	Nil	Slightly / Low	Moderate / Medium	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics :

CO No	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO-1	✓	-	-	✓
CO-2	✓	-	-	✓
CO-3	✓	-	-	✓
CO-4	✓	-	-	✓
CO-5	✓	✓	-	-



University of Kerala

Discipline	PHYSICS				
Course Code	UK2DSCPHY101				
Course Title	ELECTRICITY, MAGNETISM AND ACOUSTICS				
Type of Course	DSC				
Semester	II				
Academic Level	100 - 199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 Hrs	-	2 Hrs	5 Hrs
Pre-requisites					
Course Summary	This course provides a comprehensive understanding of fundamental principles and Phenomenon of electricity, magnetism, and acoustics. This course enables to identify and explain chemical, thermal and magnetic effect of electric current, analyses and solves electrical circuits with dc and ac source.				

BOOKS FOR STUDY:

1. Brijlal and Subramaniam, Electricity and Magnetism, S. Chand & Co, New Delhi (2016)
2. R. Murugesan, Electricity and Magnetism, S. Chand & Co, New Delhi (2016)
3. Textbook of Sound, D.R.Khanna and R.S. Bedi, Atmaram and sons, 1969.
4. A Text Book of Sound, N.Subrahmanyam and BrijLal, Vikas Publishing House - Second revised edition,1995.
5. Yarwood and Wittle; Experimental Physics for Students, Chapman & Hall Publishers.
6. A text book of practical physics, S. Viswanathan & Co., Chennai. Press.

BOOKS FOR REFERENCE:

1. David J Griffith, 1997, Introduction to electrodynamics, 2ND EDITION, New Delhi, Prentice Hall of India Pvt. Ltd.
2. Electricity and Magnetism - E. M. Purcell, Berkeley Physics Course, Vol. 2 (Mc Graw-Hill)
3. Hugh D. Young and Roger A. Freedman, Sears & Zemansky's University Physics with Modern Physics, 14th Edition (2015)
4. Fundamentals of Acoustics" by Lawrence E. Kinsler, Austin R. Frey, Alan B. Coppens

DETAILED SYLLABUS: THEORY

Module	Unit	Content	Hrs	CO No
I	Electric field and circuits (Book : 1 - Chapter: 2, 3, 4; Book : 2- Chapter: 2, 3, 4; Book : 3; Chapter: 1-5)		12	
	1	Electric charge and its properties	1	1
	2	Coulomb's Law - Electric intensity	1	1
	3	Electric field and electric field lines	1	1
	4	Gauss law- Electric field intensity due to a Uniformly charged sphere.	1	1
	5	Electrical potential – Equipotential surfaces	1	1
	6	Ohm's law- Current density, Electric resistivity and Conductivity	1	1
	7	Kirchoff law of circuit analysis – Maxwell Bridge	3	1
	8	Carey–Foster Bridge – theory – temperature coefficient of resistance, Potentiometer – theory	3	1
II	Magnetic Effect of Electric Current (Book: 1, 2)		10	
	9	Magnetic flux and magnetic induction, Relation connecting B.M and H, Magnetic susceptibility and permeability	2	1
	10	Biot Savart law- magnetic induction at a point due to a straight conductor carrying current	2	2
	11	magnetic induction at a point on the axis of a circular coil carrying current	2	2

	12	Amperes circuital law-magnetic field inside a long solenoid	2	1
	13	Lorentz force on a moving charge- direction of force	1	1
	14	Torque on a current loop in a uniform magnetic field.	1	2
III	Thermal and Chemical Effects of Electric Current (Book: 1,2)		06	
	15	Thermoelectricity – Seebeck effect- laws of thermo e.m.f	2	3
	16	measurement of thermo e.m.f. using potentiometer	1	3
	17	Peltier effect and Peltier coefficient	1	3
	18	Thomson effect and Thomson coefficient	1	3
	19	Faraday’s laws of electrolysis	1	3
IV	AC circuits (Book: 1,2)		08	
	20	EMF induced in a coil rotating in a magnetic field	1	1
	21	Peak, average and RMS values of AC voltage and current	1	1
	22	j operator method –use of j operator in the study of AC circuits	2	1
	23	Resistance in an AC Circuit-Inductance in an AC circuit. Capacitance in an AC circuit-	2	4
	24	AC through an inductance and capacitance in series	1	4
	25	AC through an capacitance and resistance in series	1	4
V*	Ultrasonics and Acoustics (Book: 3,4)		09	
	26	Ultrasonics	1.5	5
	27	Properties and Applications of Ultrasonics	2	5
	28	Acoustics of building – Reverberation- Sabine’s Reverberation formula	2.5	5
	29	Factors affecting acoustics of building- Sound distribution in an auditorium-	2	5
	30	Requisites for good acoustics.	1	5

DETAILED SYLLABUS: PRACTICALS

Part A – At least 5 Experiments to be performed		CO No
Sl No	Name of Experiment	
1	Deflection and vibration magnetometer- M and Bh	2,6
2	Circular coil- magnetization of a magnet	2,6
3	Searle's vibration magnetometer-comparison of magnetic moments	2,6
4	Potentiometer-Resistivity	1,6
5	Thermo-emf-measurement of emf using Potentiometer	5,6
6	Carey Foster's bridge – Measurement of unknown resistance of wire	1,6
7	Carey Foster's Bridge-Temperature coefficient of resistance	1,6
8	To study the frequency response of a series RC circuit	4,6
9	Sonometer-frequency of A.C	4,6
10	Melde's string-Frequency of fork	6
Part B* – At least One Experiment to be performed		
11	Verification of Ohms Law	1,6
12	Circular coil-dipole moment	2,6
13	Potentiometer – EMF of a thermocouple	3,6
14	To study the frequency response of a series LC circuit	4,6
15	Kundt's tube-determination of velocity of sound.	6

COURSE OUTCOMES

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Discover the fundamental concepts of electric field, magnetic field and AC circuits.	Ap	PSO-1,2
CO-2	Evaluate different scenarios of Biot-Savart's law and torque on a current loop in a uniform magnetic field.	E	PSO-1,2

CO-3	Identify the basics Thermocouple effects	U	PSO-1,2
CO-4	Design AC circuits using different resistors, inductors and capacitors in series.	C	PSO-1,2
CO-5	Compare the different methods of producing ultrasonic waves and associate the theories used in building acoustics.	U	PSO-1,2
CO-6	Develop practical skills and understanding experimental setups in the context of the relevant physical principles of Electricity, Magnetism and Acoustics.	Ap	PSO - 1,3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course:

Credits: 3:0:1 (Lecture: Tutorial: Practical)

CO No.	CO	PO / PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO-1	Discover the fundamental concepts of electric field, magnetic field and AC circuits.	PO-1/ PSO-1,2	Ap	C	L	-
CO-2	Evaluate different scenarios of Biot-Savart's law and torque on a current loop in a uniform magnetic field.	PO-1/ PSO-1,2	E	C	L	-
CO-3	Identify the basics Thermocouple effects	PO-1/ PSO-1,2	U	F, C	L	-
CO-4	Design AC circuits using different resistors, inductors and capacitors in	PO-1/ PSO-1,2	C	C	L	-

	series.					
CO-5	Compare the different methods of producing ultrasonic waves and associate the theories used in building acoustics.	PO-1/ PSO-1,2	U	F, C	L	-
CO-6	Develop practical skills and understanding experimental setups in the context of the relevant physical principles of Electricity, Magnetism and Acoustics.	PO-1,6/ PSO - 1,3	Ap	C, P		P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO-1	2	2	-	-	-	-	-	2	-	-	-	-	-	-	-
CO-2	2	2	-	-	-	-	-	2	-	-	-	-	-	-	-
CO-3	2	2	-	-	-	-	-	2	-	-	-	-	-	-	-
CO-4	2	2	-	-	-	-	-	2	-	-	-	-	-	-	-
CO-5	2	2	-	-	-	-	-	2	-	-	-	-	-	-	-
CO-6	2	-	2	-	-	-	-	2	-	-	-	-	-	-	-

Correlation Levels:

Level	-	1	2	3
Correlation	Nil	Slightly / Low	Moderate / Medium	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics :

CO No	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO-1	✓	-	-	✓
CO-2	✓	-	-	✓
CO-3	✓	-	-	✓
CO-4	✓	-	-	✓
CO-5	✓	✓	-	-
CO-6	✓	✓	-	-



University of Kerala

Discipline	PHYSICS				
Course Code	UK2DSCPHY103				
Course Title	MODERN PHYSICS				
Type of Course	DSC				
Semester	II				
Academic Level	100 - 199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 Hrs	-	2 Hrs	5 Hrs
Pre-requisites	-				
Course Summary	Knowledge about basic ideas of quantum mechanics, number systems, logic gates, atom models nuclear properties, radioactivity and crystallography.				

BOOKS FOR STUDY:

1. Modern Physics – R.Murugesan, S.Chand & Co. Ltd.
2. Principles of Electronics – V.K.Mehta

DETAILED SYLLABUS: THEORY

Module	Unit	Content	Hrs	CO No
I	Quantum Mechanics (Book 1)		9	
	1	Inadequacies of classical physics, experimental evidences	2	1
	2	Quantum theory Planck's hypothesis, foundation of quantum mechanics	3	1
	3	Wave function and probability density	2	1
	4	Schrödinger equation-time dependent and time independent	2	1

II	Digital electronics (Book 2)		9	
	5	Number systems – binary, octal and hexadecimal and their interconversions	3	2
	6	Binary arithmetic, 1's compliment and 2's compliment arithmetic	3	2
	7	Basic logic gates	2	2
	8	Universal logic gates	1	2
III	Atom models (Book 1)		9	
	9	Bohr atom model	3	3
	10	Space quantization and spin of electrons	2	3
	11	Vector atom model	3	3
	12	Pauli's exclusion principle	1	3
IV	Atomic nucleus (Book 1)		9	
	13	Basic properties of nuclei	1	4
	14	Nuclear force	1	4
	15	Mass defect and binding energy	2	4
	16	Radioactivity and law of radioactive decay	2	4
	17	Half-life and mean life	1	4
	18	Measurement of radioactivity, radiocarbon dating	2	4
V*	Crystallography (Book 1)		9	
	19	Crystalline and amorphous solids, Crystal structure-crystal lattice and translation vectors	2	5
	20	Unit cell, symmetry operations	2	5
	21	Types of lattices, lattice directions and planes	2	5
	22	X-ray crystallography-diffraction of x -rays, Bragg's law, x-ray crystallography, powder diffraction method.	3	5

DETAILED SYLLABUS: PRACTICALS

Part A – At least 5 Experiments to be performed		CO No
Sl No	Name of Experiment	
1	Carey Foster's bridge - Resistivity	6
2	Potentiometer- Resistivity	6
3	Diode Characteristics (for Ge and Si diodes)	6
4	Half wave rectifier-Measurement of ripple factor with and without filter capacitor	6
5	Full wave rectifier- Measurement of ripple factor with and without filter capacitor	6
6	Logic gates- OR and AND-To verify the truth tables of OR and AND gates using diodes.	6
7	Logic gate- NOT-To verify the truth tables of NOT gate using a transistor	6
8	Conversion of galvanometer into ammeter and calibration using digital Multimeter	6
9	Conversion of galvanometer into voltmeter and calibration using digital Voltmeter.	6
10	Potentiometer-Calibration of ammeter	6
Part B* – At least One Experiment to be performed		
11	Program to convert hexadecimal to decimal number, decimal to hexadecimal number, binary to hexadecimal numbers and hexadecimal to binary numbers	6
12	Program to find the result of binary addition and subtraction.	6

COURSE OUTCOMES

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Outline the evolution of quantum mechanics and explain the basic concepts of quantum mechanics	Ap	PSO-1,2
CO-2	Practice number system conversions and design digital circuits using logic gates & Boolean algebra.	C	PSO-1,2
CO-3	Describe and summarize vector atom model	Ap	PSO-1,2
CO-4	Identify the properties of a nucleus and evaluate the effects of radioactivity	E	PSO-1,2
CO-5	Identify types of crystal lattices and explain principle and applications of X-ray diffraction	U	PSO-1,2
CO-6	Describe and demonstrate simple experiments	Ap	PSO-7

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create**Name of the Course:****Credits: 3:0:1 (Lecture: Tutorial: Practical)**

CO No.	CO	PO / PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO-1	Outline the evolution of quantum mechanics and explain the basic concepts of quantum mechanics	PO-1 PSO-1,2	Ap	F,C	L	-
CO-2	Practice number system conversions and design digital circuits using logic gates & Boolean	PO-1, 2, 3 PSO-1,2	C	F,C	L	-



University of Kerala

Discipline	PHYSICS				
Course Code	UK2MDCPHY103				
Course Title	FOUNDATIONS IN FORENSIC SCIENCE				
Type of Course	MDC				
Semester	II				
Academic Level	100 – 199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	3	3 Hrs	-	-	3
Pre-requisites					
Course Summary	The "Foundations in Forensic Science" course is a comprehensive and interdisciplinary exploration of key areas in forensic investigation. Through this course, students can delve into the fundamental principles and techniques essential to modern forensic science. Beginning with an overview of forensic science's role in crime investigation, students progress to mastering crime scene management, evidence collection, and preservation. They then explore the analysis of various types of physical evidence and their forensic significance. The course culminates into practical experiences through some activity-oriented learning.				

BOOKS FOR STUDY

1. Criminalistics: An Introduction to Forensic Science, Richard Saferstein, (12/e), Pearson Education Inc.
2. Forensic Science in Criminal Investigation and trials, Dr. BR.Sharma, (4/e), Universal Law Publishing Co. Pvt. Ltd.

BOOKS FOR REFERENCE:

1. Crime Investigation, Paul L Kirk, Wiley
2. Solving Crimes with Physics, Carla Miller Nozigia, Mason Crest Publishers
3. Beginners Forensic Science, Dr. C. Hegde & Dr. R. Shekhar, Himalaya Publishing House.
4. Crime Scene Forensics: A Scientific Method Approach, Robert C Shaler, CRC Press
5. Fundamentals of Forensic Science, Max M. Houck & Jay A. Siegel, Elsevier Science.

DETAILED SYLLABUS: THEORY

Module	Unit	Content	Hrs	CO No
I	SCIENCE IN CRIMINAL JUSTICE SYSTEM [Sec 1,2,4,5 Book 1 Chapter 1; sec 3 Book 2, Chapter 1]		9	
	1	Definition and Scope of Forensic Science	1	1
	2	History and Development of Forensic Science	1	1
	3	Basic principles of Forensic Science	2	1
	4	Services of Criminal Laboratories - Basic Services Provided by Full-Service Crime laboratories	2	1
	5	Functions of Forensic Scientist - Analysis of Physical Evidence, The Importance of Physical Evidence, Determining Admissibility of Evidence, Providing Expert Testimony.	3	1
II	THE CRIME SCENE [Book 1, Chapter 2]		9	
	6	Processing the Crime Scene - Securing and Isolating the Crime Scene, Recording the Crime Scene, Conducting a Systematic Search for Evidence.	5	2
	7	Collecting and Packaging of Physical Evidence - Collecting Physical Evidence, Handling Evidence, Packaging Evidence.	2	2
	8	Maintaining the Chain of Custody - Obtaining Standard/Reference Samples, Submitting Evidence to the Laboratory.	1	2
	9	Ensuring the Crime Scene Safety	1	2
III	PHYSICAL EVIDENCE		9	

	[Book 1, Chapter 3 (sec 10 & 11), Chapter 4 (sec 12)]			
	10	Common Types of Physical Evidence	1	3
	11	The Significance of Physical Evidence -Identification, Comparison, Individual Characteristics, Class Characteristics, Assessing the Value of Physical Evidence, Cautions and Limitations in Dealing with Physical Evidence.	5	3
	12	Crime Scene Reconstruction - Principles of Crime- Scene Reconstruction, Personnel Involved in Reconstruction.	3	3
IV	MICRO-TRACES [Book 2, Chapter 17]		9	4
	13	Importance	1	4
	14	Nature -Plant Materials, Dust, Fibres, Polymers, Minerals, Glass, Paint, Soil	1	4
	15	Location - The Culprit, Victim, Crime Scene, Weapon, Vehicle, Location, Techniques.	1	4
	16	Collection - Handpicking, Taping, Tacuuming, Dissolving and Washing, Scraping.	1	4
	17	Forensic Problems	1	4
	18	Evaluation -Tools and Techniques, Microscopy	2	4
	19	Example of a Specific Trace Evidence - Glass - Importance, Nature, Location, Evaluation.	2	4
V	FORENSIC SCIENCE IN PRACTICE		9	
	20	Demonstration of a mock crime scene with at least three micro traces	1	5
	21	Visit to State/Regional/District Forensic Science Laboratories, Interaction with Forensic Scientist with a questionnaire OR Review of a movie	5	5
	22	Mini project based on an intriguing criminal case: Any one from the following three 1. Case presentation: Create a multimedia presentation 2. Investigative report: Write a detailed investigative report including evidence collection. 3. Reflective essay: Write a reflective essay, discussing what was learned and potential improvement for future improvements.	3	5

COURSE OUTCOMES

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Describe the services of a typical comprehensive crime laboratory and forensic scientist in a criminal justice system	U	2, 3
CO-2	Describe the various measures taken while securing, recording and searching the crime scene as well as describe the proper techniques for packaging common types of physical evidence.	Ap	2, 3
CO-3	Summarize the common types and significance of physical evidence encountered at crime scenes as well as the principles of crime scene reconstruction.	C	2, 3, 6
CO-4	Judge the physical evidence related to crimes involving microtraces.	E	2,3, 7
CO-5	Demonstrate the ability to apply forensic science concepts through practical engagement with mock crime scenes, develop professional insights through visits to forensic science labs and effectively communicate findings.	An	2,3, 7

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: FOUNDATIONS IN FORENSIC SCIENCE

Credits: 3:0:0 (Lecture:Tutorial)

CO No.	CO	PO / PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
1	Describe the services of a typical comprehensive crime laboratory and	PO- 1 / PSO - 2, 3	U	F, C	L/T	-

	forensic scientist in a criminal justice system					
2	Describe the various measures taken while securing, recording and searching the crime scene as well as describe the proper techniques for packaging common types of physical evidence.	PO- 1, 3, 6 / PSO - 2, 3	Ap	F, C	L/T	-
3	Summarize the common types and significance of physical evidence encountered at crime scenes as well as the principles of crime scene reconstruction.	PO- 1, 2, 3, 6/ PSO - 2, 3	C	F, C, P	L/T	-
4	Judge the physical evidence related to crimes involving microtraces.	PO- 1, 2,3, 6/ PSO - 2, 3, 7	E	F, C, P	L/T	-
5	Demonstrate the ability to apply forensic science concepts through practical engagement with mock crime scenes, develop professional insights through visits to forensic science labs and effectively communicate findings.	PO- 1, 2, 6/ PSO - 2, 3, 7	An	F, C	L/T	-

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO-1	-	1	1	-	-	-	-	1	-	-	-	-	-	-	-
CO-2	-	2	1	-	-	-	-	2	-	1	-	-	2	-	-
CO-3	-	3	1	-	-	-	-	3	2	2	-	-	2	-	-
CO-4	-	3	3	-	-	-	2	1	3	1	-	-	2	-	-
CO-5	-	3	3	-	-	-	2	1	3	-	-	-	2	-	-

Correlation Levels:

Level	-	1	2	3
Correlation	Nil	Slightly / Low	Moderate / Medium	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics:

CO No	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO-1	-	✓	-	✓
CO-2	-	✓	-	✓
CO-3	✓	-	-	✓
CO-4	✓	-	-	✓
CO-5	-	✓	✓	-



UNIVERSITY OF KERALA

Four Year Under Graduate Programme (UoK FYUGP)

First Semester – Modified Syllabus

Major Discipline: PHYSICS

University of Kerala
Senate House Campus, Palayam, Thiruvananthapuram- 34, Kerala, India

June 2025



University of Kerala

Discipline	PHYSICS				
Course Code	UK1DSCPHY100				
Course Title	FOUNDATION COURSE IN PHYSICS-I				
Type of Course	DSC				
Semester	I				
Academic Level	100 - 199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 Hrs	-	2 Hrs	5 Hrs
Pre-requisites	-				
Course Summary	This course discusses basic foundation concepts in Physics. Simple mathematical tools required for understanding Physical concepts are discussed in the first module. Motion of objects is explained on the basis of Newton's laws followed by the discussion on work and energy. Study on rotational dynamics reveals the concept of angular momentum and its significance in rigid bodies. The discussion on oscillations will help to understand simple harmonic motion and its applications in pendulum.				

BOOKS FOR STUDY:

1. Introduction to Electrodynamics, David J Griffiths, Prentice Hall
2. Sear and Zemansky's University Physics With Modern Physics, Hugh D Young, Roger A Freedman, Addison -Wesley, 13TH EDITION, 2012.
3. Mechanics, J C Upadhyaya, Ramprasad Publications

BOOKS FOR REFERENCE:

1. Introduction to Mechanics, Daniel Kleppner and Robert Kolenkow Second Edition, Mc Graw Hill Education, 2017.
2. Principles Of Physics 10th Edition, Robert Resnick Jearl Walker, David Halliday, Wiley, 2014.
3. Mechanics: H. S. Hans and S. P. Puri, TMH, 2ndEdn.
4. Properties of matter: Brijlal and Subramaniam, S. Chand & Co.,2004
5. Principles of Physics: P.V. Naik, PHI,

DETAILED SYLLABUS: THEORY

Module	Unit	Content	Hrs	CO No
I	LANGUAGE OF PHYSICS (Book 1: Chapter 1)		9	
	1	Vector algebra - vector operations, component form, triple products,	3	1
	2	Gradient, the operator ∇ , the divergence, the curl, product rules	3	1
	3	Integral calculus: line, surface and volume integrals	1	1
	4	Gauss's divergence theorem and Stokes's theorem	2	1
II	DYNAMICS OF MOTION- WORK AND ENERGY (Book 2: Chapter 6 & 7)		8	
	5	Work, Kinetic energy and work - energy theorem	1	2
	6	Work and energy with varying forces- Straight line motion, Motion along a curve, Power	2	2
	7	Gravitational Potential energy, elastic Potential energy	2	2
	8	Conservative and non-conservative forces, Law of Conservation of energy	2	2
	9	Force and potential energy	1	2
III	DYNAMICS OF ROTATION AND ANGULAR MOMENTUM (Book 2 and Book 3)		10	
	10	Torque, Angular acceleration, Rigid body rotation about a moving axis (Book 2:Chapter 10)	3	4
	11	Combined translation and rotation-energy relations, rolling without slipping. Rolling friction, work and power in rotational motion (Book 2: Chapter 10)	3	4
	12	Equation of motion of a rotating rigid body: Angular momentum and moment of inertia, Parallel axes theorem, perpendicular axes theorem, Calculation of moment of inertia of uniform rod, thin circular ring, circular disc, sphere. (Book 3 : Chapter 8)	4	4
IV	UNDERSTANDING OSCILLATIONS (Book 2, Book 3)		9	
	13	Simple Harmonic motion, Energy in Simple Harmonic motion (Book 2: Chapter 14)	3	5

	14	mass on a spring - oscillation of two particles connected by a spring (Book 3 : Chapter 9)	2	5
	15	compound pendulum - interchange ability of suspension and oscillation points-collinear points-conditions for maximum and minimum periods (Book 3 : Chapter 9)	4	5
V*	LAWS OF MOTION (Book 2: Chapter 4 & 8)		9	
	16	Newton's first law, law of inertia - Inertial frame of reference	2	3
	17	Newton's second law- Mass and Force	1	3
	18	Mass and weight- Variation of g with location, measuring mass and weight	2	3
	19	Newton's third law	1	3
	20	Momentum and impulse - Newton's second law in terms of Momentum, The impulse-momentum theorem	3	3

DETAILED SYLLABUS: PRACTICALS

Part A – At least 5 Experiments to be performed		CO No
Sl No	Name of Experiment	
1	Compound Bar Pendulum – Symmetric	5
2	Compound Bar Pendulum – Asymmetric.	5
3	Determination of moment of inertia of fly wheel	4
4	Helical spring- Spring constant	2, 5
5	Show that the period of oscillation of a simple pendulum is independent of the mass of the bob used.	5
6	Kater's Pendulum - Determine the value of g	5
Part B* – At least One Experiment to be performed		
7	Inclined plane - determine the downward force, along an inclined plane	1
8	Concurrent forces - determination of unknown mass	1
9	Concurrent forces - parallelogram law verification	1
10	Establish the relationship between length and period of a simple pendulum.	5

COURSE OUTCOMES

CO No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Use basic mathematical tools to solve problems involving vectors and their applications.	Ap	1, 2, 4
CO-2	Evaluate the concepts of work, energy and power in different physical situations.	E	1, 2
CO-3	Apply the basic ideas of Newtonian mechanics to evaluate dynamics of objects in detail.	Ap	1, 2
CO-4	Develop the concepts of torque, angular momentum and moment of inertia to study rigid bodies.	C	1, 2, 7
CO-5	Analyse the periodic movement of objects in relation to the simple harmonic motion.	An	1, 2, 7

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: FOUNDATION COURSE IN PHYSICS-I

Credits: 3:0:1 (Lecture:Tutorial:Practical)

CO No.	CO	PSO / PO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO-1	Use basic mathematical tools to solve problems involving vectors and their applications.	PSO 1, 2, 4/ PO 1, 2	Ap	F, C	L	P
CO-2	Evaluate the concepts of work, energy and power in different physical situations.	PSO 1, 2/ PO 1, 2	E	F, C	L	-
CO-3	Apply the basic ideas of Newtonian mechanics to evaluate dynamics of objects in detail.	PSO 1, 2/ PO 1, 2	Ap	F, C	L	-
CO-4	Develop the concepts of torque, angular momentum	PSO 1, 2/ PO 1, 2	C	F, C, P	L	P

	and moment of inertia to study rigid bodies.	PO 1, 2				
CO-5	Analyse the periodic movement of objects in relation to the simple harmonic motion.	PSO 1, 2, 7/ PO 1, 2, 3, 6	An	F, C, P	L	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO-1	3	2	-	1	-	-	-	1	3	-	-	-	-	-	-
CO-2	3	1	-	-	-	-	-	2	2	-	-	-	-	-	-
CO-3	3	2	-	-	-	-	-	2	3	-	-	-	-	-	-
CO-4	2	1	-	-	-	-	-	1	2	-	-	-	-	-	-
CO-5	2	2	-	-	-	-	2	3	2	1	-	-	2	-	-

Correlation Levels:

Level	-	1	2	3
Correlation	Nil	Slightly / Low	Moderate / Medium	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics :

CO No	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO-1	✓	-	-	✓
CO-2	✓	-	-	✓
CO-3	✓	-	-	✓
CO-4	✓	✓	-	✓
CO-5	✓	-	-	✓



University of Kerala

Discipline	PHYSICS				
Course Code	UK1DSCPHY101				
Course Title	PRINCIPLES OF DYNAMICS				
Type of Course	DSC				
Semester	I				
Academic Level	100 - 199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 Hrs	-	2 Hrs	5 Hrs
Pre-requisites	1. The students should have undergone a course in physics during their higher secondary curriculum 2. The students should have a basics understanding of motion 3. The students should have basic ideas physical quantities and units				
Course Summary	This course aims to present the basics of mechanics in an easily understandable way. The course begins with an introduction to kinematics which includes the properties of vectors, motions and Newton's laws. The second module comprises the basic ideas of momentum and collisions and discusses the concept of conservation. The basic ideas of circular motion is explained with a few examples in the third module. The work, energy, force and the concept of angular momentum are introduced in the fourth module. The last module includes the elementary ideas of equilibrium and stability.				

BOOKS FOR STUDY:

1. Physics for scientists and engineers with Modern Physics, 7th Edition, Serway & Jewett,
2. College Physics 2e, OpenStax
3. Sear and Zemansky's University Physics With Modern Physics, Hugh D Young, Roger A Freedman, Addison -Wesley, 13TH EDITION, 2012.
4. Mechanics, J C Upadhyaya, Ramprasad Publications

BOOKS FOR REFERENCE:

1. Principles of Physics, 10/e, Walker, Halliday & Resnick, International Student Version, Wiley

2. Basic Physics, Kenneth W Ford, World Scientific Publishing Co. Pvt. Ltd., 2016
3. An Introduction to Mechanics, D. Kleppner & R. Kolenkow, 2/e, Cambridge University Press.
4. University Physics, 13 th Edition, Hugh D. Young, Roger A. Freedmann, A. Lewis Ford, Pearson 2012.
5. Basic Physics: Principles and Concepts, Avijit Lahiri

DETAILED SYLLABUS: THEORY

Module	Unit	Content	Hrs	CO No
I	INTRODUCTION TO KINEMATICS (Book: 1 - Chapter 2, 3,4,5, 7,11)		9	
	1	Vectors, Properties of vectors - scalar product and Vector product	2	1
	2	Motion in One Dimension - Position, Velocity and speed, acceleration, freely falling objects	2	1
	3	Motion in two Dimension - position, velocity and acceleration vectors, projectile motion, particle in uniform circular motion	2	1
	4	Newton's First law and inertial Frames, Mass, Newton's Second Law, Newton's Third Law	3	1
II	Circular Motion (Book: 2 - Chapter 6)		8	
	5	Rotation angle and angular velocity	1	2
	6	Centripetal acceleration (discuss centrifuge as an example)	2	2
	7	Centripetal force: Coefficient of friction on a car tyre, ideal speed and angle of a car on a turn	3	2
	9	Fictitious Forces and Non-inertial Frames, The Coriolis Force	2	2
III	Linear Momentum, Impulse and Collisions (Book: 1, Book: 2)		9	
	10	Linear momentum, Conservation of linear momentum (Book: 1 - Chapter 9)	2	3

	11	Impulse - momentum theorem (Book: 1 - Chapter 9)	2	3
	12	Collisions, Collisions in one dimension and two dimensions (Book: 1 - Chapter 9)	2	3
	13	Elastic collisions in one dimension, inelastic collisions in one dimension (Book: 2 - Chapter 8)	3	3
IV	Angular Momentum (Book: 3, Book: 4)		10	
	14	Torque, Angular acceleration, Rigid body rotation about a moving axis (Book 3: Chapter 10)	4	4
	15	Equation of motion of a rotating rigid body: Angular momentum and moment of inertia, Parallel axes theorem, perpendicular axes theorem, Calculation of moment of inertia of uniform rod, thin circular ring, circular disc, sphere, solid cylinder. (Book 4 : Chapter 8)	6	4
V*	Equilibrium and stability (Book: 2 - Chapter 9)		9	
	18	Definition for equilibrium, first and second conditions for equilibrium	2	5
	19	Ideas of stability of a system	1	5
	20	Mechanical advantage and its determination	2	5
	21	Simple Machines: Nail puller and Wheel barrow	2	5
	22	Forces and torque in muscles and joints	2	5

DETAILED SYLLABUS: PRACTICALS

Part A – At least 5 Experiments to be performed		CO No
Sl No	Name of Experiment	
1	Least Count of instruments - Screw Gauge, Vernier Callipers, Spectrometer, traveling microscope	6
2	Screw Gauge - To find the thickness of a scale and radius of wire	6
3	Vernier Callipers - To find the breadth of a scale and the diameter of a small spherical/cylindrical body	6
4	The moment bar - To determine the weight of a bar/scale	6
5	Concurrent Forces - To find the weight of a body using parallelogram law of vectors	6

6	Viscosity - To find the Coefficient of viscosity- Continuous flow method using constant pressure head.	6
7	Viscosity- To find the Coefficient of viscosity- using Variable pressure head arrangement	6
8	To locate the points to given coordinates in space, measure the distance between two points in space and then to verify the distance using distance formula	
9	To find the distance of given point (in space) from a plane (passing through three non-collinear points) by actual measurement and also analytically	6
10	To study the third law of motion using two spring balances	6
Part B* – At least One Experiment to be performed		
11	Surface Tension - To find the surface tension of water by capillary rise method	6
12	The force of Friction - To determine the relationship between force of limiting friction and normal reaction and to find the coefficient of friction between a block and a horizontal surface	6
13	The inclined plane - To determine the downward force along the inclined plane acting on a trolley/roller	6
14	Fly Wheel - To determine the moment of inertia about its axle	6

COURSE OUTCOMES

CO No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Apply mathematical and physical principles of vectors and motion to solve problems involving objects moving in one, two, and three dimensions, and analyze the forces acting on these objects using Newton's laws of motion.	Ap	PSO-1
CO-2	Analyze the relationships between centripetal acceleration, centripetal force, friction, and motion in circular paths, and apply these concepts to determine ideal speeds, angles of turn, and forces involved, as well as examine the effects of frames of reference, fictitious forces, and Coriolis force on physical phenomena.	An	PSO-1
CO-3	Evaluate the principles of linear momentum, impulse-momentum theory, and collisions in one and two dimensions, and apply these concepts to analyze and solve problems	E	PSO-1

	involving elastic and inelastic collisions, demonstrating an understanding of the relationships between momentum, impulse, and energy transfer.		
CO-4	Develop the concepts of torque, angular momentum and moment of inertia to study rigid bodies.	C	PSO-1
CO-5	Apply the principles of equilibrium, stability, and mechanical advantage to analyze and solve problems involving simple machines, and extend these concepts to understand the forces and torques involved in human movement, muscles, and joints.	Ap	PSO-1
CO-6	Apply measurement techniques and fundamental principles to accurately measure physical quantities, analyze the behavior of concurrent forces, and determine the properties of liquids, including surface tension and viscosity.	Ap	PSO-2

Name of the Course: PRINCIPLES OF DYNAMICS

Credits: 3:0:1 (Lecture: Tutorial: Practical)

CO No.	CO	PO / PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO-1	Apply mathematical and physical principles of vectors and motion to solve problems involving objects moving in one, two, and three dimensions, and analyze the forces acting on these objects using Newton's laws of motion.	PSO-1 PO-1,2	Ap	F	L	-
CO-2	Analyze the relationships between centripetal acceleration, centripetal force, friction, and motion in circular paths, and apply these concepts to determine ideal speeds, angles of turn, and forces involved, as well as	PSO-1,2 PO-1, 2,3	An	F, C	L	-

	examine the effects of frames of reference, fictitious forces, and Coriolis force on physical phenomena.					
CO-3	Evaluate the principles of linear momentum, impulse-momentum theory, and collisions in one and two dimensions, and apply these concepts to analyze and solve problems involving elastic and inelastic collisions, demonstrating an understanding of the relationships between momentum, impulse, and energy transfer.	PSO-1,2 PO-1, 2,4	E	F, C	L	-
CO-4	Develop the concepts of torque, angular momentum and moment of inertia to study rigid bodies.	PSO-1,2 PO-1, 2,3	C	F, C	L	-
CO-5	Apply the principles of equilibrium, stability, and mechanical advantage to analyze and solve problems involving simple machines, and extend these concepts to understand the forces and torques involved in human movement, muscles, and joints	PSO-1 PO-1,2	Ap	F, C	L	-
CO-6	Apply measurement techniques and fundamental principles to accurately measure physical quantities,	PSO-7 PO-1,2	Ap	C, P	-	P

	analyze the behavior of concurrent forces, and determine the properties of liquids, including surface tension and viscosity.					
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F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO-1	1	-	-	-	-	-	-	2	-	-	-	-	-	-	-
CO-2	2	-	-	-	-	-	-	2	1	-	-	-	-	-	-
CO-3	1	-	-	-	-	-	-	2	2	-	-	-	-	-	-
CO-4	2	-	-	-	-	-	-	2	1	-	-	-	-	-	-
CO-5	2	-	-	-	-	-	-	1	-	-	-	-	-	-	-
CO-6	-	2	-	-	-	-	-	2	-	-	-	-	-	-	-

Correlation Levels:

Level	-	1	2	3
Correlation	Nil	Slightly / Low	Moderate / Medium	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics :

CO No	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO-1	✓	-	-	✓
CO-2	✓	-	-	✓
CO-3	✓	-	-	✓
CO-4	✓	✓	-	✓
CO-5	✓	✓	-	-
CO-6	✓	-	-	-



University of Kerala

Discipline	PHYSICS				
Course Code	UK1DSCPHY102				
Course Title	PROPERTIES OF SOLIDS				
Type of Course	DSC				
Semester	I				
Academic Level	100 - 199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 Hrs	-	2 Hrs	5 Hrs
Pre-requisites	1. Students should have a basic understanding of classification of materials based on the electrical properties. 2. Students should be aware of basics of diamagnetic, paramagnetic, and ferro magnetic substances. 3. Students should know the fundamentals of heat, temperature, thermal expansion and heat transfer by conduction, convection and radiation.				
Course Summary	This course explores the fundamental properties of solids and their applications. Topics covered include magnetic properties, superconductivity, thermal properties and dielectric properties. Emphasis is placed on understanding the underlying concepts of physics governing these properties and their technological significance.				

BOOKS FOR STUDY:

1. A textbook of Engineering Physics, Dr. M.N. Avadhanulu and Dr. P.G. Kshirsagar
2. Engineering Physics, G Aruldas, PHI Learning Private Limited, New Delhi(2012).
3. Heat and Thermodynamics: Brijlal and Subramaniam, S. Chand &Co.

BOOKS FOR REFERENCE:

1. Concepts of Modern Physics, Arthur Beiser, Shobhit Mahajan, S Rai Choudhury, McGraw Hill Education (India) Private Limited (2017).
2. Solid State physics and Electronics, R K Puri, V K Babbar, S Chand & Company Ltd, (2008).

3. Solid State Physics, Dr R Asokamani, Eswar Press, Chennai, (2015).
4. Applied Solid State Physics, Rajnikant, Wiely India Pvt. Ltd. 92011)
5. Heat and Thermodynamics: M. Zeemansky, McGraw Hill, New Delhi (2007).
6. Heat and Thermodynamics: Rose C. McCarthy, The Rosen Publishing Group, Inc. NY, (2005)
7. Thermodynamics Kinetic Theory and Statistical Thermodynamics: F. W. Sears and G.
8. L. Salinger, Addison-Wesley Publishing Company, 3rd Edn. (1975).

DETAILED SYLLABUS: THEORY

Module	Unit	Content	Hrs	CO No
I	SOLIDS Book 1 (28.2,28.3, 28.5, 28.6, 28.7, 28.8,28.9, 28.14)		8	
	1	Electrical conduction, Classification of materials	2	1
	2	Classical Free electron model of solids	2	1
	3	Drift velocity, Electrical conductivity, Mobility, Relaxation time	3	1
	4	Drawbacks of classical free electron theory	1	1
II	MAGNETIC PROPERTIES Book 2 (14.1, 14.2, 14.3, 14.6, 14.7, 14.8)		8	
	5	Permeability and Susceptibility	1	1
	6	Origin of Magnetic Moment	1	1
	7	Classification of magnetic materials	2	1
	8	Curie Temperature, Weiss theory of Ferromagnetism	2	1
	9	Hysteresis loop	2	1
III	SUPERCONDUCTIVITY Book 2 (7.1, 7.2, 7.3, 7.4, 7.5, 7.6, 7.9, 7.10)		8	
	10	Introduction, Magnetic Properties, Meissner Effect	2	1
	11	Type I and type II superconductors – London Penetration depth	2	1
	12	Isotope Effect, BCS Theory, Cooper Pairs	2	1
	13	High temperature superconductivity, Applications	2	1
IV	THERMAL PROPERTIES Book 3 (15.1, 15.13, 15.14, 15.19, 16.2, 16.3, 16.4, 16.5, 16.6, 13.17, 13.18, 13.19, 13.20, 13.21)		12	
	14	Coefficient of Thermal Conductivity, Thermal Diffusivity	1	2

	15	Thermal conductivity – Radial flow of heat, cylindrical flow	2	2
	16	Wiedemann – Franz Law	1	2
	17	Latent Heat of Fusion	1	2
	18	Laws of Fusion - Practical Applications	1	2
	19	Effect of Pressure and impurities on Freezing point,	1	2
	20	Thermoelectric effects – Seebeck, Peltier, Peltier Coefficient, Thomson effect and Thomson Coefficient	5	2
V*	DIELECTRIC PROPERTIES Book 2 (13.1, 13.2, 13.7, 13.8, 13.9)		9	
	21	Electric Dipole, Polarizability, Polarisation vector, Dielectric constant, Dielectric Susceptibility	2	3
	22	Dielectric polarisation- Electronic Polarisation, Ionic Polarisation, Orientation Polarisation, Space Charge Polarization, Total Polarisation	4	3
	23	Ferroelectric Crystals, Piezoelectric Crystals- Applications	2	3
	24	Applications of dielectric materials	1	3

DETAILED SYLLABUS: PRACTICALS

Part A – At least 5 Experiments to be performed		CO No
Sl No	Name of Experiment	
1	Diode Characteristics (for Ge and Si diodes)	4
2	Zener diode characteristics: To (i) trace and construct the circuit (ii) to plot the V-I characteristic under reverse biased condition and (iii) to calculate the dynamic resistance of the diode under reverse bias when conducting	4
3	Phase transition-determination of M.P of wax	4
4	Determination of thermal conductivity of rubber	4
5	Lee’s disc-determination of thermal conductivity of a bad conductor	4
6	Circular coil- magnetization of a magnet	4
7	Absolute determination of m and Bh using box type and Searle’s type vibration magnetometers	4
8	Searle’s vibration magnetometer-comparison of magnetic moments	4
9	Potentiometer – Resistivity	4
Part B* – At least One Experiment to be performed		
10	Thermo emf-measurement of emf using digital multimeter	4

11	Determination of dielectric constant of a given material	4
12	Carey Foster's Bridge-Resistivity	4

COURSE OUTCOMES

CO No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Assess the conducting properties of solids using the free electron model, evaluate the impact of mobility and relaxation time, interpret the magnetic behavior of materials, and critically examine the principles, properties, and diverse applications of superconductivity.	An	PSO-1,2
CO-2	Design experiments to explore the thermal conductivity of solids, utilizing latent heat of fusion, and create practical applications based on the thermoelectric properties of solids.	C	PSO-1,2
CO-3	Apply the concepts of electric dipole, polarizability, polarization vector, dielectric constant, and susceptibility to explain various types of polarization, and utilize the properties of dielectric, ferroelectric, and piezoelectric crystals in practical applications.	Ap	PSO-1,2
CO-4	Experiment and infer conductivity and magnetic property measurements as well as semiconductor device characterization.	Ap	PSO-1,2, 7

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: PROPERTIES OF SOLIDS

Credits: 3:0:1 (Lecture: Tutorial: Practical)

CO No.	CO	PO / PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO-1	Assess the conducting properties of solids using the free electron model, evaluate the impact of mobility and relaxation time,	PO 1, 2, 3, 4, 5, 8/ PSO – 1,2	An	C	L	-

	interpret the magnetic behavior of materials, and critically examine the principles, properties, and diverse applications of superconductivity.					
CO-2	Design experiments to explore the thermal conductivity of solids, utilizing latent heat of fusion, and create practical applications based on the thermoelectric properties of solids.	PO 1, 2, 3, 4, 6, 8/ PSO – 1,2	C	C	L	-
CO-3	Apply the concepts of electric dipole, polarizability, polarization vector, dielectric constant, and susceptibility to explain various types of polarization, and utilize the properties of dielectric, ferroelectric, and piezoelectric crystals in practical applications.	PO 1, 2, 3, 4, 8/ PSO – 1,2	Ap	C	L	-
CO-4	Experiment and infer conductivity and magnetic property measurements as well as semiconductor device characterization.	PO 1, 2, 3, 4, 5, 6, 8/ PSO – 1,2,7	Ap	P	-	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO-1	3	2	-	-	-	-	-	3	3	2	1	1	-	-	1
CO-2	3	3	-	-	-	-	-	3	3	2	1	-	1	-	1
CO-3	3	3	-	-	-	-	-	3	3	3	2	-	-	-	1
CO-4	3	3	-	-	-	-	3	3	3	3	3	3	3	-	3

Correlation Levels:

Level	-	1	2	3
Correlation	Nil	Slightly / Low	Moderate / Medium	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics:

CO No	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO-1	✓	-	-	✓
CO-2	✓	✓	-	✓
CO-3	✓	✓	✓	-
CO-4	✓	-	-	✓



University of Kerala

Discipline	PHYSICS				
Course Code	UK1MDCPHY104				
Course Title	PHYSICS OF EVERYDAY APPLIANCES				
Type of Course	MDC				
Semester	I				
Academic Level	100 - 199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	3	3 Hrs	-	-	3 Hrs
Pre-requisites					
Course Summary	“This course provides a basic exploration of the physical principles underlying everyday appliances and technologies. From the basics of electronics and electricity to modern communication technology, students will gain a comprehensive understanding of how various devices work, their impact on energy consumption and efficiency.”				

BOOKS FOR STUDY:

1. Louis A Bloomfield – “How things works – The physics of everyday life” - 5-th Edition - Willy Publications (2013)
2. Eric Kleinert - “Trouble shooting and repairing major appliances” Third Edition - McGraw Hills companies (2013)
3. Disseminating Star Labelling in Household Appliance (DISHA) Operational Manual, Bureau of Energy Efficiency

BOOKS FOR REFERENCE:

1. Edison's Electric Light: The Art of Invention (Johns Hopkins Introductory Studies in the History of Technology)
2. LED Lighting: A Primer to Lighting the Future, Sal Cangeloso
3. "The Physics of Everyday Things: The Extraordinary Science Behind an Ordinary Day" by James Kakalios
4. "Optics" by Eugene Hecht

WEB REFERENCES

1. <https://www.energy.gov/articles/history-light-bulb>
2. Energy_efficient_Ceiling_fans_using_BLDC_motors-A_practical_implementation - Dr Mahesh Rao (https://www.researchgate.net/profile/Mahesh-Rao-8/publication/325922681_Energy_efficient_Ceiling_fans_using_BLDC_motors-A_practical_implementation/links/5b2c7dcfa6fdcc8506bc8680/Energy-efficient-Ceiling-fans-using-BLDC-motors-A-practical-implementation.pdf)
3. Induction stoves: An option for clean and efficient cooking in Indonesia – Tiandho, Yuant etal 2020 (doi:10.1088/1757-899X/1034/1/012068)
4. Prospects for LED lighting <https://doi.org/10.1038/nphoton.2009.32>
5. Evaluating the Impacts of Mandatory Policies and Labeling program for Appliances in India <https://energy-evaluation.org/wp-content/uploads/2019/11/eeap2019-kishorekumar-paper.pdf>

DETAILED SYLLABUS: THEORY

Module	Unit	Content	Hrs	CO No
I	Lighting Devices (Ref Web Link -1,4,5 Book-1 section 13.2-13.3, Book 3)		9	
	1	History of light bulbs	1	1
	2	Discharge lamps-Gas Discharges, fluorescent lamps - mercury, metal-halide, and sodium lamps	3	1
	3	Light-emitting diodes- working of led	2	1
	4	LED performance parameter- luminous efficacy- Comparison of luminous efficacy-Advantages of LED	1	1,5
	5	Need for saving energy - bee standards & labelling - Impact of labelling programme on energy savings and emission programme	2	1,5
II	Mirrors, Lenses, and Camera (Book-1, section 14.1)		7	
	6	Introduction to mirrors and lenses, real images - focusing and lens diameter	2	2
	7	Focal lengths and f-numbers	1	2
	8	Improving the quality of a camera lens - the viewfinder and virtual images Image sensors - limit of resolution	3	2,5
	9	Eyes and eye glasses	1	2

III	Heat Transfer and Cooling Systems (Book-1, section 7.1, 8.2, 8.1, Web Link-3)		11	
	10	Woodstoves -thermal conductivity, conduction, convection, radiation, heat capacity	2	3
	11	Microwave ovens – speed, frequency, and wavelength in electromagnetic waves - polar and nonpolar molecules - working of ovens	2	3
	12	Induction stoves - basic principles	2	3
	13	Automobiles - using thermal energy: heat engines – the internal combustion engine, efficiency, Improving Engine Efficiency	3	3,5
	14	Air conditioners - pumping heat against its natural flow (qualitative only- how an air conditioner cools the indoor air- how an air conditioner warms the outdoor air)	2	3
IV	Other Domestic Appliances (Book-1, section 9.1, 9.2, Web Link-2)		9	
	15	Clocks- Time , natural resonance, Pendulums and Harmonic Oscillators , Electronic Clocks	3	1
	16	Musical Instruments: sound and music; vibrations in strings, air, surfaces, fundamental and higher-order modes; harmonic and nonharmonic overtones; sympathetic vibration; standing and traveling waves; transverse and longitudinal waves.	4	1
	17	BLDC Motors - features, applications (Fan, Pump)- BLDC and conventional fans comparison	2	1,5
V*	Hands on Training (Book-2, Chapter 6 & 7)		9	
	18	(Any five experiments to be done) 1. Soldering technique 2. Electric tester 3. Checking the continuity of electrical components in simple circuits using multimeter 4. Assembling/replacing of fuse wire in household devices 5. Familiarization of resistor, capacitor, diode, transformer 6. One lamp controlled by one switch - soldering 7. One lamp controlled by two switch - soldering 8. Led bulb/tube light making, and troubleshooting	9	4

		9. Finding the focal length of lens 10. Making of simple electrical extension boards 11. Electric earthing system 12. Energy auditing of devices		
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COURSE OUTCOMES

CO No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Summarize the basics of lighting technology, domestic appliances including proficiency in energy efficiency standards and labelling programs established by the Bureau of Energy Efficiency (BEE)	U	PSO-1, 4,6
CO-2	Formulate customized solutions to imaging problems through creative adjustments of optical components and sensor configurations.	C	PSO-1, 2,3,4
CO-3	Apply principles of heat transfer to explain the functioning of everyday appliances.	Ap	PSO-1, 4
CO-4	Construct electrical and optical systems using soldering, circuit testing, and component integration for practical applications.	C	PSO-3,6,7
CO-5	Evaluate and compare the performance, efficiency, and sustainability of modern technologies in lighting, imaging, thermal systems, and electromechanical applications.	E	PSO-1,2,3,4,6

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: PHYSICS OF EVERYDAY APPLIANCES**Credits: 3:0:0 (Lecture: Tutorial: Practical)**

CO No.	CO	PO / PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO-1	Summarize the basics of lighting technology, domestic appliances including proficiency in energy efficiency standards and labelling programs established by the Bureau of Energy Efficiency (BEE)	PO 4,7/ PSO-1, 4,6	U	F, C	L	P
CO-2	Formulate customized solutions to imaging problems through creative adjustments of optical components and sensor configurations.	PO 4,7/ PSO-1, 2,3,4	C	F, C, P	L/T	P
CO-3	Apply principles of heat transfer to explain the functioning of everyday appliances.	PO 4,7/ PSO-1,4	Ap	F, C, P	L	-
CO-4	Construct electrical and optical systems using soldering, circuit testing, and component integration for practical applications.	PO 3,4,7/ PSO-3,6,7	C	F,C,P	L	P
CO-5	Evaluate and compare the performance, efficiency, and sustainability of modern technologies in lighting, imaging, thermal systems, and electromechanical applications.	PO 1,6,7 PSO-1,2,3,4, 6	E	F, C, P	L	

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO-1	2	-	-	3	-	3	-	-	-	-	1	-	-	1	-
CO-2	2	3	3	3	-	-	-	-	-	-	1	-	-	1	-
CO-3	2	-	-	3	-	-	-	-	-	-	1	-	-	1	-
CO-4	-	-	3	-	-	3	3	-	-	1	1	-	-	3	-
CO-5	3	3	3	1	2	3	1	3	1	1	1	-	2	3	1

Correlation Levels:

Level	-	1	2	3
Correlation	Nil	Slightly / Low	Moderate / Medium	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics:

CO No	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO-1	✓	-	-	✓
CO-2	✓	-	-	✓
CO-3	✓	✓	-	✓
CO-4	✓	✓	-	-



14. DETAILED SYLLABUS



University of Kerala

Discipline	PHYSICS				
Course Code	UK1DSCPHY100				
Course Title	FOUNDATION COURSE IN PHYSICS-I				
Type of Course	DSC				
Semester	I				
Academic Level	100 - 199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 Hrs	-	2 Hrs	5 Hrs
Pre-requisites	-				
Course Summary	This course discusses basic foundation concepts in Physics. Simple mathematical tools required for understanding Physical concepts are discussed in the first module. Motion of objects is explained on the basis of Newton's laws followed by the discussion on work and energy. Study on rotational dynamics reveals the concept of angular momentum and its significance in rigid bodies. The discussion on oscillations will help to understand simple harmonic motion and its applications in pendulum.				

BOOKS FOR STUDY:

1. Introduction to Electrodynamics, David J Griffiths, Prentice Hall
2. Sear and Zemansky's University Physics With Modern Physics, Hugh D Young, Roger A Freedman, Addison -Wesley, 13TH EDITION, 2012.
3. Introduction to Mechanics, Daniel Kleppner and Robert Kolenkow Second Edition, Mc Graw Hill Education, 2017.
4. Mechanics, J C Upadhyaya, Ramprasad Publications
5. Principles of Physics 10th Edition, Robert Resnick, Jearl Walker, David Halliday, Wiley, 2014.

BOOKS FOR REFERENCE:

1. Mechanics: H. S. Hans and S. P. Puri, TMH, 2ndEdn.
2. Properties of matter: Brijlal and Subramaniam, S. Chand & Co., 2004
3. Principles of Physics: P.V. Naik, PHI,

DETAILED SYLLABUS: THEORY

Module	Unit	Content	Hrs	CO No
I	LANGUAGE OF PHYSICS (Book 1: Chapter 1)		9	
	1	Vector algebra - vector operations, component form, triple products,	3	1
	2	Gradient, the operator ∇ , the divergence, the curl, product rules	4	1
	3	Integral calculus: line, surface and volume integrals	1	1
	4	Gauss's divergence theorem and Stokes's theorem (statements only)	1	1
II	LAWS OF MOTION (Book 2: Chapter 4 & 8)		9	
	5	Newton's first law, law of inertia - Inertial frame of reference	2	2
	6	Newton's second law- Mass and Force	1	2
	7	Mass and weight- Variation of g with location, measuring mass and weight	2	3,5
	8	Newton's third law	1	2
	9	Momentum and impulse - Newton's second law in terms of Momentum, The impulse-momentum theorem	2	2
III	DYNAMICS OF MOTION- WORK AND ENERGY (Book 2: Chapter 6 & 7)		9	
	10	Work, Kinetic energy and work - energy theorem	1	2,5
	11	Work and energy with varying forces- Straight line motion, Motion along a curve, Power	2	2,5
	12	Gravitational Potential energy, elastic Potential energy	3	2

	13	Conservative and non-conservative forces, Law of Conservation of energy	2	3,5
	14	Force and potential energy	1	2,5
IV	DYNAMICS OF ROTATION AND ANGULAR MOMENTUM (Book 2, Book 3 and Book 4)		9	
	15	Torque, Angular acceleration, Rigid body rotation about a moving axis	4	2
	16	Combined translation and rotation-energy relations, rolling without slipping. Rolling friction, $\text{work and } \tau$ power in rotational motion (Book2: Chapter 10)	4	4,5
	17	Angular momentum of a particle, fixed axis rotation- Moment of Inertia (ring, Disc, Stick), The Parallel axis theorem, dynamics of fixed axis rotation) JV	3	4,5
V*	UNDERSTANDING OSCILLATIONS (Book 6, Book 2)		9	
	18	Simple Harmonic motion, Energy in Simple Harmonic motion (Book6, Chapter 15)	3	6
	19	mass on a spring - oscillation of two particles connected by a spring (Book 2, Chapter 9)	2	6
	20	compound pendulum - interchange ability of suspension and oscillation points-collinear points-conditions for maximum and minimum periods (Book 2, Chapter 9)	4	6

DETAILED SYLLABUS: PRACTICALS

Part A – At least 5 Experiments to be performed		CO No
Sl No	Name of Experiment	
1	Compound Bar Pendulum – Symmetric	6
2	Compound Bar Pendulum – Asymmetric.	6
3	Determination of moment of inertia of fly wheel	4, 6
4	Helical spring- Spring constant	2, 6

5	Show that the period of oscillation of a simple pendulum is independent of the mass of the bob used.	6
6	Establish the relationship between length and period of a simple pendulum.	6
Part B* – At least One Experiment to be performed		
7	Inclined plane - determine the downward force, along an inclined plane	1, 2
8	Concurrent forces - determination of unknown mass	1, 2
9	Concurrent forces - parallelogram law verification	1, 2

COURSE OUTCOMES

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Discuss the basic mathematical tools used to manipulate vectors and associated problems	U, Ap	1, 2, 4
CO-2	Recall Newton's laws of motion and describe basic concepts related to objects in motion like momentum, inertia, work, energy and simple harmonic motion.	R, U	1, 2
CO-3	Use the basic ideas of Newtonian mechanics to evaluate dynamics of objects in detail.	R, U	1, 2
CO-4	Describe the concept of moment of inertia and use it to objects having different shapes	R, U, Ap	1, 2, 7
CO-5	Solve numerical problems related to motion of objects	U, Ap	1, 2
CO-6	Relate the concept of simple harmonic motion with periodic movement of objects	U, Ap	1, 2, 7

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: FOUNDATION COURSE IN PHYSICS-I

Credits: 3:0:1 (Lecture:Tutorial:Practical)

CO No.	CO	PSO / PO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO-1	Discuss the basic mathematical tools used to manipulate vectors and associated problems	PSO 1, 2, 4/ PO 1, 2	U, Ap	F, C	L	P
CO-2	Recall Newton's laws of motion and describe basic concepts related to objects in motion like momentum, inertia, work, energy and simple harmonic motion.	PSO 1, 2/ PO 1, 2	R, U	F, C	L	-
CO-3	Use the basic ideas of Newtonian mechanics to evaluate dynamics of objects in detail.	PSO 1, 2/ PO 1, 2	R, U	F, C	L	-
CO-4	Describe the concept of moment of inertia and use it to objects having different shapes	PSO 1, 2/ PO 1, 2	R, U, Ap	F, C, P	L	P
CO-5	Solve numerical problems related to motion of objects	PSO 1, 2, 7/ PO 1, 2	U, Ap	F, C	L	-

CO-6	Relate the concept of simple harmonic motion with periodic movement of objects	PSO 1, 2, 7/ PO 1, 2, 3, 6	U, Ap	F, C, P	L	P
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F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO-1	3	2	-	1	-	-	-	1	3	-	-	-	-	-	-
CO-2	3	1	-	-	-	-	-	2	2	-	-	-	-	-	-
CO-3	3	2	-	-	-	-	-	2	3	-	-	-	-	-	-
CO-4	2	1	-	-	-	-	-	1	2	-	-	-	-	-	-
CO-5	2	3	-	-	-	-	1	2	3	-	-	-	-	-	-
CO-6	2	2	-	-	-	-	2	3	2	1	-	-	2	-	-

Correlation Levels:

Level	-	1	2	3
Correlation	Nil	Slightly / Low	Moderate / Medium	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics :

CO No	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO-1	✓	-	-	✓
CO-2	✓	-	-	✓
CO-3	✓	-	-	✓
CO-4	✓	✓	-	✓
CO-5	✓	-	-	✓
CO-6	✓	✓	-	-



University of Kerala

Discipline	PHYSICS				
Course Code	UK1DSCPHY101				
Course Title	PRINCIPLES OF DYNAMICS				
Type of Course	DSC				
Semester	I				
Academic Level	100 - 199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 Hrs	-	2 Hrs	5 Hrs
Pre-requisites	1. The students should have undergone a course in physics during their higher secondary curriculum 2. The students should have a basics understanding of motion 3. The students should have basic ideas physical quantities and units				
Course Summary	This course aims to present the basics of mechanics in an easily understandable way. The course begins with an introduction to kinematics which includes the properties of vectors, motions and Newton's laws. The second module comprises the basic ideas of momentum and collisions and discusses the concept of conservation. The basic ideas of circular motion is explained with a few examples in the third module. The work, energy, force and the concept of angular momentum are introduced in the fourth module. The last module includes the elementary ideas of central force.				

BOOKS FOR STUDY:

1. Physics for scientists and engineers with Modern Physics, 7th Edition, Serway & Jewett,
2. College Physics 2e, OpenStax
3. University Physics, 13 th Edition, Hugh D. Young, Roger A. Freedmann, A. Lewis Ford, Pearson 2012.
4. An Introduction to Mechanics, D. Kleppner & R. Kolenkow, 2/e, Cambridge University Press.

BOOKS FOR REFERENCE:

1. Principles of Physics, 10/e, Walker, Halliday & Resnick, International Student Version, Wiley
2. Basic Physics, Kenneth W Ford, World Scientific Publishing Co. Pvt. Ltd., 2016

WEB RESOURCES:

1. https://archive.org/details/basicph_current/mode/2up (Basic Physics: Principles and Concepts, Avijit Lahiri)

DETAILED SYLLABUS: THEORY

Module	Unit	Content	Hrs	CO No
I	INTRODUCTION TO KINEMATICS (Book :1 - Chapter: 2, 3,4; Book : 2- Chapter: 2,3,4; Book : 3; Chapter: 1-5)		9	
	1	Vectors, Properties of vectors - cross product and dot product, scalar product and Vector product, Divergence and Curl	3	1
	2	Motion in One Dimension - Position, Velocity and speed, acceleration, freely falling objects	2	2
	3	Motion in two Dimension - position, velocity and acceleration vectors, projectile motion, circular motion	2	2
	4	Newton's laws of motion, Application of Newton's laws - Particles in equilibrium, Dynamics of particles, Frictional Force	2	2
II	Linear Momentum, Impulse and Collisions (Book :1 - Chapter: 9; Book : 2- Chapter: 8)		9	
	5	Linear momentum, Conservation of linear momentum	2	3
	6	Impulse - momentum theorem	2	3
	7	Collisions, Collisions in one dimension and two dimensions,	2	3
	8	Elastic and inelastic collisions, concept of centre of mass, rocket propulsion	3	3
III	Circular Motion (Book 1, Chapter 4, Chapter 6)		9	
	9	The Particle in Uniform Circular Motion	2	4

	10	Tangential and Radial Acceleration	1	4
	11	Newton's Second Law for Particle in Uniform Circular Motion	3	4
	12	Non Uniform Circular Motion	3	4
IV	Angular Momentum (Book :1 - Chapter: 8, 11; Book : 2- Chapter: 10, Book:3 - Chapter 9,10)		9	
	13	Work done by a constant force and varying force, work-kinetic energy theorem, potential energy	2	4
	14	Conservative and non-conservative forces, conservative forces and potential energy	2	4
	15	Angular Momentum, Conservation of Angular Momentum, Torque	2	4
	16	Angular momentum of rotating rigid object	1	4
	17	Gyroscopic Effects: Vector Aspects of Angular Momentum	2	4
V*	Central Force (Book 4, Chapter 10)		9	
	18	Central Force Motion as a One- body Problem	2	5
	19	Consequences of Conservation of Angular Momentum	2	5
	20	Consequences of Conservation of Energy	1	5
	21	The Effective Potential	1	5
	22	The Formal Solution for Central Force Motion	3	5

DETAILED SYLLABUS: PRACTICALS

Part A – At least 5 Experiments to be performed		CO No
Sl No	Name of Experiment	
1	Least Count of instruments - Screw Gauge, Vernier Callipers, Spectrometer, traveling microscope	6
2	Screw Gauge - To find the thickness of a scale and radius of wire	6
3	Vernier Callipers - To find the breadth of a scale and the diameter of a small spherical/cylindrical body	6

4	The moment bar - To determine the weight of a bar/scale	6
5	Concurrent Forces - To find the weight of a body using parallelogram law of vectors	6
6	Viscosity - To find the Coefficient of viscosity- Continuous flow method using constant pressure head.	6
7	Viscosity- To find the Coefficient of viscosity- using Variable pressure head arrangement	6
8	To locate the points to given coordinates in space, measure the distance between two points in space and then to verify the distance using distance formula.	6
9	To find the distance of given point (in space) from a plane (passing through three non-collinear points) by actual measurement and also analytically	6
10	To study the third law of motion using two spring balances	6
Part B* – At least One Experiment to be performed		
11	Surface Tension - To find the surface tension of water by capillary rise method	6
12	The force of Friction - To determine the relationship between force of limiting friction and normal reaction and to find the coefficient of friction between a block and a horizontal surface	6
13	The inclined plane - To determine the downward force along the inclined plane acting on a trolley/roller	6
14	Surface Tension - To find the surface tension of water by capillary rise method	6

COURSE OUTCOMES

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Identify the basics of vectors and their properties	R	PSO-1
CO-2	Compare the motions in one and two dimensions and explain the newton's laws of motion and its applications	R, U	PSO-1
CO-3	Learn the physical and mathematical concepts of linear momentum, Impulse and Collisions	R, U	PSO-1
CO-4	Review the fundamental idea of work energy and force and recognize the concept of angular momentum	R, U	PSO-1

CO-5	Discuss the elementary ideas of central force	R, U	PSO-1
CO-6	Identify the methods to measure the radius of various objects and interpret the nature of various forces	U, Ap	PSO-2

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: PRINCIPLES OF DYNAMICS

Credits: 3:0:1 (Lecture: Tutorial: Practical)

CO No.	CO	PO / PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO-1	Identify the basics of vectors and their properties	PSO-1 PO-1	R	F	L	-
CO-2	Compare the motions in one and two dimensions and explain the newton's laws of motion and its applications	PSO-1 PO-1, 2	R, U	F, C	L	-
CO-3	Learn the physical and mathematical concepts of linear momentum, Impulse and Collisions	PSO-1 PO-1, 2	R, U	F, C	L	-
CO-4	Review the fundamental idea of work energy and force and recognize the concept of angular momentum	PSO-1 PO-1, 2	R, U	F, C	L	-
CO-5	Discuss the elementary ideas of central force	PSO-1 PO-1	R, U	F, C	L	-
CO-6	Identify the methods to measure the radius of	PSO-2 PO-1	U, Ap	C, P		P

various objects and interpret the nature of various forces						
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F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO-1	1	-	-	-	-	-	-	2	-	-	-	-	-	-	-
CO-2	2	-	-	-	-	-	-	2	1	-	-	-	-	-	-
CO-3	1	-	-	-	-	-	-	2	2	-	-	-	-	-	-
CO-4	2	-	-	-	-	-	-	2	1	-	-	-	-	-	-
CO-5	2	-	-	-	-	-	-	1	-	-	-	-	-	-	-
CO-6	-	2	-	-	-	-	-	2	-	-	-	-	-	-	-

Correlation Levels:

Level	-	1	2	3
Correlation	Nil	Slightly / Low	Moderate / Medium	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics :

CO No	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO-1	✓	-	-	✓
CO-2	✓	-	-	✓
CO-3	✓	-	-	✓
CO-4	✓	✓	-	✓
CO-5	✓	✓	-	-
CO-6	✓	-	-	-



University of Kerala

Discipline	PHYSICS				
Course Code	UK1DSCPHY102				
Course Title	PROPERTIES OF SOLIDS				
Type of Course	DSC				
Semester	I				
Academic Level	100 - 199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 Hrs	-	2 Hrs	5 Hrs
Pre-requisites	1. Students should have a basic understanding of states of matter and chemical bonding. 2. Students should be aware of basics of diamagnetic, paramagnetic, and ferro magnetic substances. 3. Students should know the fundamentals of heat, temperature, thermal expansion and heat transfer by conduction, convection and radiation. 4. Students should be familiar with foundation of semiconductor electronics.				
Course Summary	This course explores the fundamental properties of solids and their applications in semiconductor devices. Topics covered include magnetic properties, superconductivity, thermal properties, dielectric properties and semiconductor devices. Emphasis is placed on understanding the underlying concepts of physics governing these properties and their technological significance.				

BOOKS FOR STUDY:

1. Physics, Principles with Applications, Douglas C. Giancoli, Pearson Education Limited, 7th Edition (2016).
2. Engineering Physics, G Aruldas, PHI Learning Private Limited, New Delhi(2012).

3. Heat and Thermodynamics: Brijlal and Subramaniam, S. Chand & Co.

BOOKS FOR REFERENCE:

1. Concepts of Modern Physics, Arthur Beiser, Shobhit Mahajan, S Rai Choudhury, McGraw Hill Education (India) Private Limited (2017).
2. Solid State physics and Electronics, R K Puri, V K Babbar, S Chand & Company Ltd, (2008).
3. Solid State Physics, Dr R Asokamani, Eswar Press, Chennai, (2015).
4. Applied Solid State Physics, Rajnikant, Wiley India Pvt. Ltd. 92011)
5. Heat and Thermodynamics: M. Zeemansky, McGraw Hill, New Delhi (2007).
6. Heat and Thermodynamics: Rose C. McCarthy, The Rosen Publishing Group, Inc. NY, (2005)
7. Thermodynamics Kinetic Theory and Statistical Thermodynamics: F. W. Sears and G.
8. L. Salinger, Addison-Wesley Publishing Company, 3rd Edn. (1975).

DETAILED SYLLABUS: THEORY

Module	Unit	Content	Hrs	CO No
I 30	MOLECULES AND SOLIDS (Book 1)		8	
	1	Bonding in molecules, Potential Energy diagrams for molecules, Weak (Van der Waals) bonds – Protein synthesis,	2	1
	2	Bonding in solids	1	1
	3	Free electron theory of metals	2	1
	4	Band theory of solids, Semiconductors and doping, Semiconductor Diodes, LEDs, OLEDs, Transistors: Bipolar and MOSFETs, Integrated Circuits, 22-nm Technology	3	1,6
II 30	MAGNETIC PROPERTIES (Book 2)		10	
	5	Permeability and Susceptibility	1	2
	6	Origin of Magnetic Moment	1	1,6
	7	Classification of magnetic materials	2	2

	8	Curie Temperature, Weiss theory of Ferromagnetism	1	2
	9	Hysteresis loop	2	2
	10	Antiferromagnetism, Ferrimagnetism, Ferrites, Magnetic materials for information storage	3	2
III JJ	SUPERCONDUCTIVITY (Book 2)		8	
	11	Introduction, Magnetic Properties, Meissner Effect	2	3
	12	Type I and type II superconductors – London Penetration depth	2	3
	13	Isotope Effect, BCS Theory, Cooper Pairs	2	3
	14	High temperature superconductivity, Applications	2	3
IV JJ	THERMAL PROPERTIES (Book 3)		10	
	15	Coefficient of Thermal Conductivity, Thermometric Conductivity	1	4
	16	Thermal conductivity – Radial flow of heat, cylindrical flow	2	4,6
	17	Wiedemann – Franz Law	1	4
	18	Latent Heat of Fusion	1	4
	19	Laws of Fusion - Practical Applications	1	4
	20	Effect of Pressure and impurities on Freezing point,	1	4
	21	Thermoelectric effects – Seebeck, Peltier, Thomson effect and Thermo electric power	3	4
V* GL	DIELECTRIC PROPERTIES (Book 2)		9	
	22	Electric Dipole, Polarizability, Polarisation vector, Dielectric constant, Dielectric Susceptibility	2	5
	23	Dielectric polarisation- Electronic Polarisation, Ionic Polarisation, Orientation Polarisation, Space Charge Polarization, Total Polarisation	3	5

	24	Frequency dependence of Polarisation, Dielectric loss	2	5
	25	Ferroelectric Crystals, Piezoelectric Crystals- Applications	1	5
	26	Applications of dielectric materials	1	5

DETAILED SYLLABUS: PRACTICALS

Part A – At least 5 Experiments to be performed		CO No
Sl No	Name of Experiment	
1	Diode Characteristics (for Ge and Si diodes)	6
2	Zener diode characteristics: To (i) trace and construct the circuit (ii) to plot the V-I characteristic under reverse biased condition and (iii) to calculate the dynamic resistance of the diode under reverse bias when conducting	6
3	Phase transition-determination of M.P of wax	6
4	Determination of thermal conductivity of rubber	6
5	Lee's disc-determination of thermal conductivity of a bad conductor	6
6	Circular coil- magnetization of a magnet	6
7	Absolute determination of m and Bh using box type and Searle's type vibration magnetometers	6
8	Searle's vibration magnetometer-comparison of magnetic moments	6
9	Potentiometer – Resistivity	6
Part B* – At least One Experiment to be performed		
10	Thermo emf-measurement of emf using digital multimeter	6
11	Determination of dielectric constant of a given material	6
12	Carey Foster's Bridge-Resistivity	6

COURSE OUTCOMES

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Differentiate various types of bonding in solids, describe the relationship between band structure and electrical properties and apply the principles of doping in the fabrication of semiconductor devices	U, Ap	PSO-1,2
CO-2	Illustrate and interpret the magnetic properties of materials and their theoretical underpinnings crucial for different applications	U, Ap	PSO-1,2
CO-3	Explain the principles of superconductivity, describe the properties of superconducting materials, and evaluate the wide range of applications of superconductivity	U, Ap	PSO-1,2
CO-4	Describe and apply the thermal conductivity principles of solids, analyse the latent heat of fusion and evaluate its applications and analyse the thermoelectric properties of solids	U, Ap, An	PSO-1,2
CO-5	Describe the principles governing dielectric materials and categorise different types of dielectric crystals and appraise their application.	U, Ap	PSO-1,2
CO-6	Experiment and infer conductivity and magnetic property measurements as well as semiconductor device characterization.	Ap, An	PSO-1,2, 7

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: **PROPERTIES OF SOLIDS**

Credits: 3:0:1 (Lecture: Tutorial: Practical)

CO No.	CO	PO / PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO-1	Differentiate various types of bonding in solids, describe the relationship between band structure and electrical properties and apply the principles of doping in the fabrication of semiconductor devices	PO 1, 2, 3, 4, 5, 8/ PSO – 1,2	U, Ap	C	L	-
CO-2	Illustrate and interpret the magnetic properties of materials and their theoretical underpinnings crucial for different applications	PO 1, 2, 3, 4, 6, 8/ PSO – 1,2	U, Ap	C	L	-
CO-3	Explain the principles of superconductivity, describe the properties of superconducting materials, and evaluate the wide	PO 1, 2, 3, 4, 8/ PSO – 1,2	U, Ap	C	L	-

	range of applications of superconductivity					
CO-4	Describe and apply the thermal conductivity principles of solids, analyse the latent heat of fusion and evaluate its applications and analyse the thermoelectric properties of solids	PO 1, 2, 3, 4, 5, 8/ PSO – 1,2	U, Ap, An	C	L	-
CO-5	Describe the principles governing dielectric materials and categorise different types of dielectric crystals and appraise their application.	PO 1, 2, 3, 4, 8/ PSO – 1,2	U, Ap	C	-	-
CO-6	Experiment and infer conductivity and magnetic property measurements as well as semiconductor device characterization.	PO 1, 2, 3, 4, 5, 6, 8/ PSO – 1,2,7	Ap, An	P	-	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO-1	3	2	-	-	-	-	-	3	3	2	1	1	-	-	1
CO-2	3	3	-	-	-	-	-	3	3	2	1	-	1	-	1
CO-3	3	3	-	-	-	-	-	3	3	3	1	-	-	-	1
CO-4	3	3	-	-	-	-	-	3	3	3	1	1	-	-	1
CO-5	3	3	-	-	-	-	-	3	3	3	2	-	-	-	1
CO-6	3	3	-	-	-	-	3	3	3	3	3	3	3	-	3

Correlation Levels:

Level	-	1	2	3
Correlation	Nil	Slightly / Low	Moderate / Medium	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics :

CO No	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO-1	✓	-	-	✓
CO-2	✓	✓	-	✓
CO-3	✓		-	✓
CO-4	-	✓	-	✓
CO-5	✓	-	-	-
CO-6	✓	-	✓	-



University of Kerala

Discipline	PHYSICS				
Course Code	UK1MDCPHY103				
Course Title	PHYSICS IN ARTS AND SPORTS				
Type of Course	MDC				
Semester	I				
Academic Level	100- 199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	3	3 Hrs	-	-	3 Hrs
Pre-requisites					
Course Summary	Focusses on the physical principles behind arts and sports, with the purpose of enabling the student to develop and optimize ideas on arts/music/photography and sports				

BOOKS FOR STUDY:

1. Physics in the Arts P. U. P. A. Gilbert and W. Haeberli (Elsevier) Revised Edition
2. The Physics of Sports A Textbook by David R. Heskett
3. Concepts in physics by H C Verma

BOOKS FOR REFERENCE:

1. Phyllotaxis, anthotaxis and semataxis Acta Biotheoretica Vol 14, 1961, pages 1-28.
(Fibonacci series)
2. <https://www.mathnasium.com/blog/14-interesting-examples-of-the-golden-ratio-in-nature>
(Fibonacci series)
3. <https://science.howstuffworks.com/engineering/architecture/brunelleschis-dome.htm>

DETAILED SYLLABUS: THEORY

Module	Unit	Content	Hrs	CO No
I	INTRODUCTION (Book 1 Chapter 1, 2, 4) (Ref 1 & 2)		9	
	1	Electromagnetic Spectrum, Refraction and Total Internal Reflection in Diamonds, Polarization	2	1
	2	Geometry in Architecture, Developments from Brunelleschi to Leonardo	2	2
	3	Light and Shadow in Nature, Fibonacci Series, Golden Ratio and Symmetry in Nature.	4	
	4	Human Visual System	1	2
II	PHYSICS OF PAINTING & PHOTOGRAPHY (Book 1 Chapter 6, 7, 8 & 9)		9	
	5	Primary Colours, Colour Triangle, Colour Sensitivity of the Eye	3	1
	6	Colour: Saturation, Brightness in Painting and Photography. Additive Color Mixing in Painting, Subtractive Primary Colors	3	1
	7	Camera - Focusing the Camera	1	3
	8	Parameters Affecting Quality of Photos: Exposure Time, Aperture, Depth of Field, f Number, Rule of Third	2	3
III	PHYSICS OF MUSIC (Book 1 Chapter 10, 11 & 13)		9	
	9	Periodic Oscillations, Simple Harmonic Motion, Damped Oscillations (qualitative) and Resonance.	3	1
	10	Build-up and Decay of Musical Tones, Resonators in Musical Instruments	2	2
	11	Beats and Harmony, Principle of Superposition, Sound Perception: Pitch, Loudness and Timbre, Loudness and Amplitude, Loudness and Frequency	4	3

IV	PHYSICS IN SPORTS – I (Book 2 Chapter 1, 2 & 3)		9	
	12	Newton's Laws of Motion, Concept of Velocity, Momentum, Force, Action and Reaction, Conservation of Momentum and Energy, Torque	4	1
	13	Damping, Friction, Rotation, Circular Motion, Gravitation, Projectile, Range of Projectile	3	2
	14	Catches, Throws, Thrust, Pressure	2	2
V*	PHYSICS IN SPORTS - II (Book 2 Chapter 8, 9 & 10)		9	
	15	Science Behind Various Sports -Basketball, Football, Javelin, Discus, Cricket Batting, Kicking of Football, Badminton, Swimming	2	4
	16	Science Behind the Design of Bats - Table Tennis, Cricket, Tennis	1	4
	17	Cricket Bowling- Magnus Effect, Spin Motion, Reverse Swing	2	4
	18	Throw- Shot Put Throw, Discus Throw and Javelin Throw	1	4
	19	Athletics - Physics of Running, Long jump, High Jump & Gymnastics	3	4

COURSE OUTCOMES

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Discuss beauty and interconnectedness of the natural world and human understanding.	U, R	PSO-2,4
CO-2	Administer a solid foundation in the principles of light, color, for creative expression through photography and painting.	A, U, R	PSO-1, 2,4
CO-3	Explain the oscillatory phenomena and their relevance to	U, R	PSO-1, 2,4

	the production, transmission, and perception of sound.		
CO-4	Describe the application of physics principles to sports and athletics, enabling them to understand and enhance performance, design better equipment, and make informed decisions in coaching, training, and sports medicine.	U, R	PSO-1, 2,4

R-Remember, U-Understand, Ap-Apply, An-Analyze, E-Evaluate, C-Create

Name of the Course: PHYSICS IN ARTS AND SPORTS

Credits: 3:0:0 (Lecture: Tutorial: Practical)

CO No.	CO	PO / PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO-1	Discuss beauty and interconnectedness of the natural world and human understanding.	PO-3,6/ PSO-2,4	U	F, C	L	-
CO-2	Administer a solid foundation in the principles of light, color, for creative expression through photography and painting.	PO-3,6/ PSO-1, 2,4	U	F, C	L	-
CO-3	Explain the oscillatory phenomena and their relevance to the production, transmission, and perception of sound.	PO-3,6/ PSO-1, 2,4	U, R	F, C	L	-
CO-4	Describe the application of physics	PO-3,6/ PSO-1,	U, R	F, C	L, T	-

	principles to sports and athletics, enabling them to understand and enhance performance, design better equipment, and make informed decisions in coaching, training, and sports medicine.	2,4				
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F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO-1	-	1	-	3	-	-	-	-	-	1	-	-	1	-	-
CO-2	3	1	-	3	-	-	-	-	-	1	-	-	1	-	-
CO-3	3	1	-	3	-	-	-	-	-	2	-	-	1	-	-
CO-4	3	1	-	3	-	-	-	-	-	1	-	-	2	-	-

Correlation Levels:

Level	-	1	2	3
Correlation	Nil	Slightly / Low	Moderate / Medium	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics:

CO No	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO-1	-	-	-	✓
CO-2	-	-	-	✓
CO-3	✓	✓	-	✓
CO-4	✓	✓	-	-



UNIVERSITY OF KERALA

Four Year Under Graduate Programme

(UoK FYUGP)

Second Semester - Revised Syllabus

Major Discipline: PHYSICS

University of Kerala

Senate House Campus, Palayam, Thiruvananthapuram- 34, Kerala, India

December 2024



University of Kerala

Discipline	PHYSICS				
Course Code	UK2DSCPHY100				
Course Title	FOUNDATION COURSE IN PHYSICS-II				
Type of Course	DSC				
Semester	II				
Academic Level	100 - 199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 Hrs	-	2 Hrs	5 Hrs
Pre-requisites					
Course Summary	This course discusses the basic concepts required to learn advanced physics courses. The concept of error and precision emphasises the importance of numbers when expressing the magnitude of a quantity. Discussion on waves basic features of waves and its expression. Basic concepts of fluids helps us to understand application level problems like venturi meter and aeroplane wings. The discussion on elasticity gives an idea about different elastic moduli.				

BOOKS FOR STUDY:

1. Principles Of Physics 10th Edition, Robert Resnick Jearl Walker, David Halliday, Wiley, 2014.
2. Sear and Zemansky's University Physics With Modern Physics, Hugh D Young, Roger A Freedman, Addison -Wesley, 13TH EDITION, 2012.
3. College Physics 2e, PAUL PETER URONE, ROGER HINRICHS, Openstax, 2022
4. Elements of Properties of Matter: D.S. Mathur, S. Chand Publications, 2014

BOOKS FOR REFERENCE:

1. Mechanics: J. C. Upadhyaya and Ram Prasad, S. Chand Publications, 2017
2. Mechanics: H. S. Hans and S. P. Puri, TMH, 2ndEdn.
3. Properties of matter: Brijlal and Subramaniam, S. Chand & Co.,2004
4. Principles of Physics: P.V. Naik, PHI, 2010
5. Principles Of Physics 10th Edition, Robert Resnick Jearl Walker, David Halliday, Wiley, 2014.

WEB REFERENCE

1. https://www.owlnet.rice.edu/~labgroup/pdf/Error_analysis.htm
2. <https://faraday.physics.utoronto.ca/PVB/Harrison/ErrorAnalysis/>

DETAILED SYLLABUS: THEORY

Module	Unit	Content	Hrs	CO No
I	PRECISION IN PRACTICE (Web 1, Web 2)		9	
	1	Significant figures (Web 1)	1	1
	2	Absolute and relative error (Web 1)	1	1
	3	Systematic error (Web 1)	1	1
	4	Random error, estimating random errors (Web 1)	1	1
	5	Propagation of errors (Web 1)	2	1
	6	Precision and accuracy (Web 2)	2	1
	7	Error bars and graphical representation (Web 2)	1	1
II	PHYSICAL WORLD OF WAVES (Book1: Chapter 16)		9	
	8	Types of waves – Mechanical, Electromagnetic and matter waves, Transverse and longitudinal waves	1	2
	9	Amplitude, phase, wavelength, wave number, period, frequency, angular frequency, phase constant, Speed of a travelling wave	2	2
	10	Wave Speed on a stretched string, energy and power of a wave travelling along a string	2	2
	11	Wave equation	1	2
	12	The principle of Superposition of waves	1	2

	13	Standing waves and resonance(qualitative idea)	2	2
III	FLUID STATICS (Book 3: Chapter 11)		6	
	14	Cohesion and adhesion of liquids, surface tension - pressure inside a bubble, capillary action	4	3
	15	Pressure in the body: Blood pressure, pressure in eye, Pressure Associated with the Lungs, Other Pressures in the Body: Spinal Column and Skull- Bladder Pressure- Pressures in the Skeletal System	2	3
IV	FLUID DYNAMICS (Book 2: Chapter 12 and Book 3: Chapter 12)		12	
	16	Fluid flow-streamline and turbulent flow, continuity equation (Book 2: Chapter 12)	2	4
	17	Bernoulli's equation -derivation, venturi meter, lift on an aeroplane wing (Book 2: Chapter 12)	4	4
	18	Viscosity and Laminar Flow; Poiseuille's Law, Motion of an Object in a Viscous Fluid (Book 3: Chapter 12)	4	4
	19	Molecular Transport Phenomena: Diffusion, rate and direction of diffusion, Osmosis and Dialysis - Diffusion across Membranes (Book 3: Chapter 12)	2	4
V*	BEAUTY OF DEFORMATION AND RESTORATION (Book1, Book4)		9	
	20	Condition for equilibrium, Centre of Gravity (Book1: Chapter 12)	1	5
	21	Stress, Strain, and Elastic Moduli- Hook's law, Tensile stress and strain, Bulk Stress and Strain, Shear Stress and Strain (Book1: Chapter 12)	2	5
	22	bending of beams, bending moment, cantilever, Beams supported at its ends and loaded in the middle (Book 4: Chapter 12)	3	5
	23	Twisting couple on a cylindrical rod or wire, work done in twisting a wire, torsion pendulum (Book 4: Chapter 12)	3	5

DETAILED SYLLABUS: PRACTICALS

Part A – At least 5 Experiments to be performed		CO No
Sl No	Name of Experiment	
1	Uniform bending—Y- optic lever method	5
2	Uniform Bending- determination of Y using pin and Microscope	5
3	Rigidity modulus –Static torsion	5
4	Torsion pendulum I- By Torsional oscillations.	5
5	Torsion pendulum I- By Equal masses.	5
6	Viscosity-Continuous flow method using constant pressure head.	4
7	Viscosity-Variable pressure head arrangement	4
8	Surface tension - Capillary rise.	3
9	Sonometer - frequency of AC using sonometer.	2
10	Melde's string - frequency of tuning fork	2
Part B* – At least One Experiment to be performed		
11	Evaluation of errors in simple experiments.	1
12	Experiment to demonstrate random error, by taking dimensions of a small rectangular object using Vernier calliper and evaluate the volume of the object	1
13	Comparison of least counts of measuring instruments.	1
14	Non-uniform bending-Y-Optic lever & telescope	5
15	Determination of the viscosity of fluid using Stoke's method.	4
16	Kundt's tube – determination of velocity of sound	2

COURSE OUTCOMES

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Discuss the basics of error analysis and design suitable methods for expressing errors in physical quantities.	C	1, 2, 7
CO-2	Evaluate the basic concepts of waves and its mathematical expression to understand periodic wave motion	E	1, 2

CO-3	Observe physical concepts of mechanics of fluids to understand several functioning of human body.	U	1, 2, 7
CO-4	Apply the concepts of fluid mechanics and molecular transport phenomena to some practical applications.	Ap	1, 2, 7
CO-5	Cite Hook's law and apply it to calculate the elastic moduli of beams and rods.	Ap	1, 2, 7

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: FOUNDATION COURSE IN PHYSICS-II

Credits: 3:0:1 (Lecture:Tutorial:Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO-1	Discuss the basics of error analysis and design suitable methods for expressing errors in physical quantities.	PSO 1, 2, 7/ PO 1, 2	C	F, C, P	L	P
CO-2	Evaluate the basic concepts of waves and its mathematical expression to understand periodic wave motion	PSO 1, 2, 7/ PO 1, 2	E	F, C	L	
CO-3	Observe physical concepts of fluids in rest, to understand some practical applications.	PSO 1, 2, 7/ PO 1, 2	U	F, C, P	L	P
CO-4	Apply the concepts of fluid mechanics and molecular transport phenomena to understand several physiological processes inside human body.	PSO 1, 2, 7/ PO 1, 2	Ap	F, C, P	L	P

CO-5	Cite Hook's law and apply it to calculate the elastic moduli of beams and rods.	PSO 1, 2, 7/ PO 1, 2	Ap	F, C, P	L	P
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F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO-1	2	2	-	-	-	-	2	1	1	-	-	-	-	-	-
CO-2	3	1	-	-	-	-	-	2	2	-	-	-	-	-	-
CO-3	3	2	-	-	-	-	3	2	2	-	-	-	-	-	-
CO-4	3	2	-	-	-	-	3	2	2	-	-	-	-	-	-
CO-5	3	2	-	-	-	-	3	3	3	-	-	-	-	-	-

Correlation Levels:

Level	-	1	2	3
Correlation	Nil	Slightly / Low	Moderate / Medium	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics :

CO No	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO-1	✓	-	-	✓
CO-2	✓	-	-	✓
CO-3	✓	-	-	✓
CO-4	✓	-	-	✓
CO-5	✓	✓	-	-



University of Kerala

Discipline	PHYSICS				
Course Code	UK2DSCPHY101				
Course Title	ELECTRICITY, MAGNETISM AND ACOUSTICS				
Type of Course	DSC				
Semester	II				
Academic Level	100 - 199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 Hrs	-	2 Hrs	5 Hrs
Pre-requisites					
Course Summary	This course provides a comprehensive understanding of fundamental principles and Phenomenon of electricity, magnetism, and acoustics. This course enables to identify and explain chemical, thermal and magnetic effect of electric current, analyses and solves electrical circuits with dc and ac source.				

BOOKS FOR STUDY:

1. Brijlal and Subramaniam, Electricity and Magnetism, S. Chand & Co, New Delhi (2016)
2. R. Murugesan, Electricity and Magnetism, S. Chand & Co, New Delhi (2016)
3. Textbook of Sound, D.R.Khanna and R.S. Bedi, Atmaram and sons, 1969.
4. A Text Book of Sound, N.Subrahmanyam and BrijLal, Vikas Publishing House - Second revised edition,1995.
5. Yarwood and Wittle; Experimental Physics for Students, Chapman & Hall Publishers.
6. A text book of practical physics, S. Viswanathan & Co., Chennai. Press.

BOOKS FOR REFERENCE:

1. David J Griffith, 1997, Introduction to electrodynamics, 2ND EDITION, New Delhi, Prentice Hall of India Pvt. Ltd.
2. Electricity and Magnetism - E. M. Purcell, Berkeley Physics Course, Vol. 2 (Mc Graw-Hill)
3. Hugh D. Young and Roger A. Freedman, Sears & Zemansky's University Physics with Modern Physics, 14th Edition (2015)
4. Fundamentals of Acoustics" by Lawrence E. Kinsler, Austin R. Frey, Alan B. Coppens

DETAILED SYLLABUS: THEORY

Module	Unit	Content	Hrs	CO No
I	Electric field and circuits (Book : 1 - Chapter: 2, 3, 4; Book : 2- Chapter: 2, 3, 4; Book : 3; Chapter: 1-5)		12	
	1	Electric charge and its properties	1	1
	2	Coulomb's Law - Electric intensity	1	1
	3	Electric field and electric field lines	1	1
	4	Gauss law- Electric field intensity due to a Uniformly charged sphere.	1	1
	5	Electrical potential – Equipotential surfaces	1	1
	6	Ohm's law- Current density, Electric resistivity and Conductivity	1	1
	7	Kirchoff law of circuit analysis – Maxwell Bridge	3	1
	8	Carey–Foster Bridge – theory – temperature coefficient of resistance, Potentiometer – theory	3	1
II	Magnetic Effect of Electric Current (Book: 1, 2)		10	
	9	Magnetic flux and magnetic induction, Relation connecting B.M and H, Magnetic susceptibility and permeability	2	1
	10	Biot Savart law- magnetic induction at a point due to a straight conductor carrying current	2	2
	11	magnetic induction at a point on the axis of a circular coil carrying current	2	2

	12	Amperes circuital law-magnetic field inside a long solenoid	2	1
	13	Lorentz force on a moving charge- direction of force	1	1
	14	Torque on a current loop in a uniform magnetic field.	1	2
III	Thermal and Chemical Effects of Electric Current (Book: 1,2)		06	
	15	Thermoelectricity – Seebeck effect- laws of thermo e.m.f	2	3
	16	measurement of thermo e.m.f. using potentiometer	1	3
	17	Peltier effect and Peltier coefficient	1	3
	18	Thomson effect and Thomson coefficient	1	3
	19	Faraday’s laws of electrolysis	1	3
IV	AC circuits (Book: 1,2)		08	
	20	EMF induced in a coil rotating in a magnetic field	1	1
	21	Peak, average and RMS values of AC voltage and current	1	1
	22	j operator method –use of j operator in the study of AC circuits	2	1
	23	Resistance in an AC Circuit-Inductance in an AC circuit. Capacitance in an AC circuit-	2	4
	24	AC through an inductance and capacitance in series	1	4
	25	AC through an capacitance and resistance in series	1	4
V*	Ultrasonics and Acoustics (Book: 3,4)		09	
	26	Ultrasonics	1.5	5
	27	Properties and Applications of Ultrasonics	2	5
	28	Acoustics of building – Reverberation- Sabine’s Reverberation formula	2.5	5
	29	Factors affecting acoustics of building- Sound distribution in an auditorium-	2	5
	30	Requisites for good acoustics.	1	5

DETAILED SYLLABUS: PRACTICALS

Part A – At least 5 Experiments to be performed		CO No
Sl No	Name of Experiment	
1	Deflection and vibration magnetometer- M and Bh	2,6
2	Circular coil- magnetization of a magnet	2,6
3	Searle's vibration magnetometer-comparison of magnetic moments	2,6
4	Potentiometer-Resistivity	1,6
5	Thermo-emf-measurement of emf using Potentiometer	5,6
6	Carey Foster's bridge – Measurement of unknown resistance of wire	1,6
7	Carey Foster's Bridge-Temperature coefficient of resistance	1,6
8	To study the frequency response of a series RC circuit	4,6
9	Sonometer-frequency of A.C	4,6
10	Melde's string-Frequency of fork	6
Part B* – At least One Experiment to be performed		
11	Verification of Ohms Law	1,6
12	Circular coil-dipole moment	2,6
13	Potentiometer – EMF of a thermocouple	3,6
14	To study the frequency response of a series LC circuit	4,6
15	Kundt's tube-determination of velocity of sound.	6

COURSE OUTCOMES

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Discover the fundamental concepts of electric field, magnetic field and AC circuits.	Ap	PSO-1,2
CO-2	Evaluate different scenarios of Biot-Savart's law and torque on a current loop in a uniform magnetic field.	E	PSO-1,2

CO-3	Identify the basics Thermocouple effects	U	PSO-1,2
CO-4	Design AC circuits using different resistors, inductors and capacitors in series.	C	PSO-1,2
CO-5	Compare the different methods of producing ultrasonic waves and associate the theories used in building acoustics.	U	PSO-1,2
CO-6	Develop practical skills and understanding experimental setups in the context of the relevant physical principles of Electricity, Magnetism and Acoustics.	Ap	PSO - 1,3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course:

Credits: 3:0:1 (Lecture: Tutorial: Practical)

CO No.	CO	PO / PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO-1	Discover the fundamental concepts of electric field, magnetic field and AC circuits.	PO-1/ PSO-1,2	Ap	C	L	-
CO-2	Evaluate different scenarios of Biot-Savart's law and torque on a current loop in a uniform magnetic field.	PO-1/ PSO-1,2	E	C	L	-
CO-3	Identify the basics Thermocouple effects	PO-1/ PSO-1,2	U	F, C	L	-
CO-4	Design AC circuits using different resistors, inductors and capacitors in	PO-1/ PSO-1,2	C	C	L	-

	series.					
CO-5	Compare the different methods of producing ultrasonic waves and associate the theories used in building acoustics.	PO-1/ PSO-1,2	U	F, C	L	-
CO-6	Develop practical skills and understanding experimental setups in the context of the relevant physical principles of Electricity, Magnetism and Acoustics.	PO-1,6/ PSO - 1,3	Ap	C, P		P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO-1	2	2	-	-	-	-	-	2	-	-	-	-	-	-	-
CO-2	2	2	-	-	-	-	-	2	-	-	-	-	-	-	-
CO-3	2	2	-	-	-	-	-	2	-	-	-	-	-	-	-
CO-4	2	2	-	-	-	-	-	2	-	-	-	-	-	-	-
CO-5	2	2	-	-	-	-	-	2	-	-	-	-	-	-	-
CO-6	2	-	2	-	-	-	-	2	-	-	-	-	-	-	-

Correlation Levels:

Level	-	1	2	3
Correlation	Nil	Slightly / Low	Moderate / Medium	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics :

CO No	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO-1	✓	-	-	✓
CO-2	✓	-	-	✓
CO-3	✓	-	-	✓
CO-4	✓	-	-	✓
CO-5	✓	✓	-	-
CO-6	✓	✓	-	-



University of Kerala

Discipline	PHYSICS				
Course Code	UK2DSCPHY103				
Course Title	MODERN PHYSICS				
Type of Course	DSC				
Semester	II				
Academic Level	100 - 199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 Hrs	-	2 Hrs	5 Hrs
Pre-requisites	-				
Course Summary	Knowledge about basic ideas of quantum mechanics, number systems, logic gates, atom models nuclear properties, radioactivity and crystallography.				

BOOKS FOR STUDY:

1. Modern Physics – R.Murugesan, S.Chand & Co. Ltd.
2. Principles of Electronics – V.K.Mehta

DETAILED SYLLABUS: THEORY

Module	Unit	Content	Hrs	CO No
I	Quantum Mechanics (Book 1)		9	
	1	Inadequacies of classical physics, experimental evidences	2	1
	2	Quantum theory Planck's hypothesis, foundation of quantum mechanics	3	1
	3	Wave function and probability density	2	1
	4	Schrödinger equation-time dependent and time independent	2	1

II	Digital electronics (Book 2)		9	
	5	Number systems – binary, octal and hexadecimal and their interconversions	3	2
	6	Binary arithmetic, 1's compliment and 2's compliment arithmetic	3	2
	7	Basic logic gates	2	2
	8	Universal logic gates	1	2
III	Atom models (Book 1)		9	
	9	Bohr atom model	3	3
	10	Space quantization and spin of electrons	2	3
	11	Vector atom model	3	3
	12	Pauli's exclusion principle	1	3
IV	Atomic nucleus (Book 1)		9	
	13	Basic properties of nuclei	1	4
	14	Nuclear force	1	4
	15	Mass defect and binding energy	2	4
	16	Radioactivity and law of radioactive decay	2	4
	17	Half-life and mean life	1	4
	18	Measurement of radioactivity, radiocarbon dating	2	4
V*	Crystallography (Book 1)		9	
	19	Crystalline and amorphous solids, Crystal structure-crystal lattice and translation vectors	2	5
	20	Unit cell, symmetry operations	2	5
	21	Types of lattices, lattice directions and planes	2	5
	22	X-ray crystallography-diffraction of x -rays, Bragg's law, x-ray crystallography, powder diffraction method.	3	5

DETAILED SYLLABUS: PRACTICALS

Part A – At least 5 Experiments to be performed		CO No
Sl No	Name of Experiment	
1	Carey Foster's bridge - Resistivity	6
2	Potentiometer- Resistivity	6
3	Diode Characteristics (for Ge and Si diodes)	6
4	Half wave rectifier-Measurement of ripple factor with and without filter capacitor	6
5	Full wave rectifier- Measurement of ripple factor with and without filter capacitor	6
6	Logic gates- OR and AND-To verify the truth tables of OR and AND gates using diodes.	6
7	Logic gate- NOT-To verify the truth tables of NOT gate using a transistor	6
8	Conversion of galvanometer into ammeter and calibration using digital Multimeter	6
9	Conversion of galvanometer into voltmeter and calibration using digital Voltmeter.	6
10	Potentiometer-Calibration of ammeter	6
Part B* – At least One Experiment to be performed		
11	Program to convert hexadecimal to decimal number, decimal to hexadecimal number, binary to hexadecimal numbers and hexadecimal to binary numbers	6
12	Program to find the result of binary addition and subtraction.	6

COURSE OUTCOMES

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Outline the evolution of quantum mechanics and explain the basic concepts of quantum mechanics	Ap	PSO-1,2
CO-2	Practice number system conversions and design digital circuits using logic gates & Boolean algebra.	C	PSO-1,2
CO-3	Describe and summarize vector atom model	Ap	PSO-1,2
CO-4	Identify the properties of a nucleus and evaluate the effects of radioactivity	E	PSO-1,2
CO-5	Identify types of crystal lattices and explain principle and applications of X-ray diffraction	U	PSO-1,2
CO-6	Describe and demonstrate simple experiments	Ap	PSO-7

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create**Name of the Course:****Credits: 3:0:1 (Lecture: Tutorial: Practical)**

CO No.	CO	PO / PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO-1	Outline the evolution of quantum mechanics and explain the basic concepts of quantum mechanics	PO-1 PSO-1,2	Ap	F,C	L	-
CO-2	Practice number system conversions and design digital circuits using logic gates & Boolean	PO-1, 2, 3 PSO-1,2	C	F,C	L	-

	algebra.					
CO-3	Describe and summarize vector atom model	PO-1 PSO-1,2	Ap	F,C	L	-
CO-4	Identify the properties of a nucleus and evaluate the effects of radioactivity	PO-1, 2 PSO-1,2	E	F,C	L	-
CO-5	Identify types of crystal lattices and explain principle and applications of X-ray diffraction	PO-1, 2 PSO-1,2	U	F,C	L	-
CO-6	Describe and demonstrate simple experiments	PO-1, 2, 3 PSO-7	Ap	F,C		P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO-1	2	1	-	-	-	-	-	1	-	-	-	-	-	-	-
CO-2	2	2	-	-	-	-	-	2	3	2	-	-	-	-	-
CO-3	2	1	-	-	-	-	-	1	-	-	-	-	-	-	-
CO-4	2	1	-	-	-	-	-	2	2	-	-	-	-	-	-
CO-5	2	2	-	-	-	-	-	2	1	-	-	-	-	-	-
CO-6	-	-	-	-	-	-	3	2	2	1	-	-	-	-	-

Correlation Levels:

Level	-	1	2	3
Correlation	Nil	Slightly / Low	Moderate / Medium	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics :

CO No	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO-1	-	-	-	✓
CO-2	-	✓	-	✓
CO-3	-	✓	-	✓
CO-4	-	✓	-	✓
CO-5	✓	✓	-	-
CO-6	✓	-	-	✓



University of Kerala

Discipline	PHYSICS				
Course Code	UK2MDCPHY102				
Course Title	BEYOND THE SKY				
Type of Course	MDC				
Semester	II				
Academic Level	100 - 199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	3	3 Hrs	-	-	3 Hrs
Pre-requisites					
Course Summary	This course provides a comprehensive overview of astronomy, covering foundational concepts such as the scientific method and observational techniques. Students explore topics ranging from the formation of the solar system to the evolution of stars and galaxies. By the end of the course, students will have a deeper understanding of the cosmos and its wonders, from the smallest planets to the largest galaxies.				

BOOKS FOR STUDY:

1. Astrophysics: Stars and Galaxies, K. D. Abhayankar - University Press 2001
2. An Introduction to Astrophysics, Baidyanadh Basu – PHI Learning Private Limited 2010
3. Introduction to Astronomy and Cosmology – Ian Morison, Wiley 2008
4. Modern Physics, R Murugesan and Kiruthiga Sivaprasath, S. Chand & Company Pvt. Ltd. 2014
5. From Dust to Life: The Origin and Evolution of our Solar System, John Chambers and Jacqueline Mitton, Princeton University Press 2017\

BOOKS FOR REFERENCE:

1. An Introduction to Modern Astrophysics – Carroll & Ostlie, Latest Edition
2. Weinberg, S. The First Three Minutes: A Modern View of The Origin Of The Universe (Basic Books, 1993)
3. Minding the Heavens by Leila Belkora
4. The Amateur Astronomer by Sir Patrick Moore

Web References

1. <https://science.nasa.gov/solar-system/>
2. <https://spaceplace.nasa.gov/>
3. A brief history of the big bang theory
(https://www.worldscientific.com/doi/pdf/10.1142/9789811229442_0001)

DETAILED SYLLABUS: THEORY

Module	Unit	Content	Hrs	CO No
I	Introduction to Astronomy (Book 1 - Chapter 1,3 & 4)		9	
	1	Introduction –Importance of Astronomy	1	1
	2	Methods of Astronomy and Astrophysics –The Scientific Method - Scope of Astronomy	2	1
	3	Brightness Measurement 1. Magnitude Scale 2. Measurement of Apparent Luminosity 3. Corrections for Observed Magnitudes	3	1
	4	Distance Measurement 1. Measurement of Distances Within Solar System 2. Method of Parallax 3. The Method of Luminosity Distance	3	1
II	Observational Astronomy (Book 1 - Chapter 19, Web Link -1,2)		10	
	5	Optical Photometry and Spectroscopy, Astronomical Instruments - Optical Telescopes, Radio Telescopes, Space Telescopes - Hubble Space Telescope	6	2
	6	Night Sky	4	2

		1. Stars and Planets in Night Sky 2. Comets and Meteors 3. Familiarization with Common Constellations 4. Eclipses 5. Phases of the Moon		
III	Solar System (Book-3, Chapter 2 & 3, Book-2, Chapter-5, Web Link-1,3)		9	
	7	Formation of the Solar System	2	3
	8	The Sun –Photosphere - Chromosphere - Solar Corona – Prominences – Sunspots and Solar Cycle- Solar Flares	4	3
	9	The planets of the Solar System - Kuiper Belt – Oort Cloud	3	3
IV	Stellar Evolution (Book-3, Chapter 7, Book-4, Chapter -78)		8	
	10	Classification of Stars 1. Spectral Types of Stars - The Harvard Classification System 2. Hertzsprung—Russell Diagram	1	4
	11	Stellar Evolution - Low Mass Stars: 0.05–0.5 Solar Masses, Mid Mass Stars: 0.5–~8 Solar Masses, High Mass Stars in the Range 8 Solar Masses	5	4
	12	White Dwarfs - Chandrasekhar Limit, Neutron Stars, Black Holes, Supernova Explosion	2	4
V*	Galaxies and Beyond (Book-2 Chapter 21, 22, Book-3 Chapter 8 & 9)		9	
	13	Milky Way Galaxy - Size, Shape and Structure of the Milky Way	1	5
	14	Hubble Classification of Galaxies, Expanding Universe	2	5
	15	Big Bang Models of the Universe, The Cosmic Microwave Background	3	5
	16	Extrasolar Planetary Systems, Habitable Planets	3	5

COURSE OUTCOMES

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Understanding the Foundations of Astronomy	U	PSO-1,2,3
CO-2	Study the use of optical instruments and predict its suitability for night sky observation.	C	PSO-1,2,3
CO-3	Understand the constituents and formation of the solar system	U	PSO-1,2,3
CO-4	Assess the concepts of Stellar Evolution	E	PSO-1,2,3
CO-5	Exploring Galaxies and Cosmology	U	PSO-1,2,3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: BEYOND THE SKY

Credits: 3:0:0 (Lecture: Tutorial: Practical)

CO No.	CO	PO / PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO-1	Understanding the Foundations of Astronomy	PO 1,4,8/ PSO 1,2,3	U	F, C	L	-
CO-2	Study the use of optical instruments and predict its suitability for night sky observation.	PO 1,2,4,6/ PSO 1,2,3	C	F, C, P	L	-
CO-3	Understand the constituent and formation of the solar system	PO 2,4/ PSO 1,2,3	U	F,C	L	-
CO-4	Assess the concepts of Stellar Evolution	PO 4/ PSO 1,2,3	E	F,C	L	-
CO-5	Exploring Galaxies and Cosmology	PO 4,8/ PSO 1,2,3	U	F,C	L	-

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO-1	3	3	3	-	-	-	-	1	-	-	1	-	-	-	3
CO-2	3	3	3	-	-	-	-	1	1	-	1	-	2	-	-
CO-3	3	3	3	-	-	-	-	-	1	-	1	-	-	-	-
CO-4	3	3	3	-	-	-	-	-	-	-	1	-	-	-	-
CO-5	3	3	3	-	-	-	-	-	-	-	2	-	-	-	3

Correlation Levels:

Level	-	1	2	3
Correlation	Nil	Slightly / Low	Moderate / Medium	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics:

CO No	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO-1	-	✓	-	✓
CO-2	✓	-	-	✓
CO-3	✓	-	-	✓
CO-4	-	-	-	✓
CO-5	✓	✓	-	-