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

University of Kerala

Discipline	**PHYSICS**				
Course Code	**UK3DSCPHY200**				
Course Title	**BASIC ELECTRONICS**				
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 provides an introduction to the fundamentals of electronics with a focus on semiconductor devices, transistor operations, amplifier circuits, oscillators, Op-Amp and digital logic systems. It emphasizes the practical implementation of theoretical concepts through hands-on experiments with diodes, rectifiers, transistors, amplifiers, and logic gates.				

BOOKS FOR STUDY:

1. Principles of Electronics: V. K. Mehta and Rohit Mehta, S. Chand Ltd.,2020 Edition
2. Basic Electronics-Solid State: B. L. Theraja, S. Chand Ltd. 2005

BOOKS FOR REFERENCE:

1. Electronic Devices and Circuit theory: Robert Boylestad & Louis Nashelski, PHI,5th Edn.
2. Electronic Fundamentals & Applications: John D Ryder, PHI, 4th Edn.
3. Electronic circuits; Analysis and Design, Donald Neamen, Mc Graw Hill Education India (Third Edition)
4. Digital Principles and Applications, Donald P Leach and Albert Paul Malvino, The Mc Graw Hill Company, Sixth Edition.
5. Operational Amplifiers and Linear integrated circuits, R. A Gayakwad, Prentice Hall India (Fourth Edition 2015)
6. Digital Principles and Applications, Donald P Leach and Albert Paul Malvino, The Mc Graw Hill Company, Sixth Edition

DETAILED SYLLABUS: THEORY

Module	Unit	Content	Hrs	CO No
I	**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	**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	**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	**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**
Sl 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

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	✓	-	✓	-

University of Kerala

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	✓	-	-	✓

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.Aruldhas, 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
IV		**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**	
	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	**UK3DSCPHY203**				
Course Title	**HEAT, MAGNETISM AND GEOPHYSICS**				
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	Basic knowledge about physics of the earth, physics of atmosphere, magnetism of earth, transmission of heat and properties of magnetic materials.				

BOOKS FOR STUDY:

1. Fundamentals of Geophysics: William Lowrie, Cambridge University Press.
2. Modern Physics – R.Murugeshan, S.Chand & Co. Ltd

DETAILED SYLLABUS: THEORY

Module	Unit	Content	Hrs	CO No
I		**Terrestrial physics (Book 1)**	**9**	
	1	The solar system	1	1
	2	Earth's structure-earth's size and shape, gravitation, gravitational field and gravitational potential	3	1
	3	Gravitational field and potential due to solid sphere	2	1
	4	The tides-tidal effect of sun. (Elementary ideas only)	1	1
	5	Earth quakes and seismographs. (Elementary ideas only)	2	1

II	**Atmospheric Physics (Book 1)**		**9**	
	6	Atmospheric structure and composition	2	2
	7	Atmospheric pressure, density and temperature	2	2
	8	Measurement of air temperature	2	2
	9	Ionosphere and magnetosphere	3	2
III	**Earth's Magnetism (Book 1)**		**9**	
	10	Earth's magnetism	1	3
	11	Elements of earths magnetism	2	3
	12	Cause of earth's magnetism	2	3
	13	Magnetic maps and their uses	2	3
	14	Magnetographs	2	3
IV	**Transmission of Heat : (Book 2)**			
	15	Thermal conductivity and thermometric conductivity	2	4
	16	Weidmann and Franz law	1	4
	17	Energy distribution in the spectrum of black body and results	2	4
	18	Wien's displacement law, Rayleigh-Jeans law, their failure and Planck's hypothesis, Planck's law	2	4
	19	solar constant, its determination, temperature of sun	2	4
V*	**Magnetism : (Book 2)**		**9**	
	20	Magnetic properties of matter, Magnetic vectors B.M and H	1	5
	21	Magnetic susceptibility and permeability	1	5
	22	Diamagnetism, Paramagnetism and ferromagnetism	3	5
	23	Electron theory of magnetism	3	5
	24	Domain theory of ferromagnetism	1	5

DETAILED SYLLABUS: PRACTICALS

Part A – At least 5 Experiments to be performed		CO No
Sl No	**Name of Experiment**	
1	Specific heat-method of mixtures applying Barton's correction	6
2	Lee's disc- Thermal conductivity of cardboard	6
3	Deflection and vibration magnetometer- M and Bh	6
4	Circular coil- magnetization of a magnet	6
5	Thermo-emf-measurement of emf using digital multimeter.	6
6	Carey Foster's Bridge-Temperature coefficient of resistance	6
7	Circular coil-Study of earth's magnetic field using compass box.	6
8	Phase transition-determination of M.P of wax.	6
9	Determination of thermal conductivity of rubber	6
Part B* – At least One Experiment to be performed		
10	Circular coil-Calibration of ammeter.	6
11	Potentiometer –Reduction factor of T.G	6
12	Searle's vibration magnetometer-comparison of magnetic moments.	6

COURSE OUTCOMES

CO No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Hypothesising about solar system in general and earth in particular	E	PSO 1,2,3,4
CO-2	Explain about earth's atmosphere	An	PSO 1,2,3,4
CO-3	Accessing properties and causes of terrestrial magnetism	E	PSO 1,2,4
CO-4	Formulate the energy distribution in the spectrum of a black body and solve problems relating to it.	C	PSO 1,2

CO-5	Classify paramagnetic, diamagnetic and ferromagnetic materials	An	PSO 1,2
CO-6	Demonstrating simple experiments	Ap	PSO 7

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

Name of the Course: HEAT, MAGNETISM AND GEOPHYSICS

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

CO No.	CO	PO / PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO-1	Hypothesising about solar system in general and earth in particular	PO 1,2,3,4,6, 8/ PSO 1,2,3,4	E	F,C	L	-
CO-2	Explain about earth's atmosphere	PO 1,2,3,4,6, 8/ PSO 1,2,3,4	An	F,C	L	-
CO-3	Accessing properties and causes of terrestrial magnetism	PO 1,3,4,6,8/ PSO 1,2,4	E	F,C	L	-
CO-4	Formulate the energy distribution in the spectrum of a black body and solve problems relating to it.	PO 1,3,4,6,8/ PSO 1,2	C	F,C	L	-
CO-5	Classify paramagnetic, diamagnetic and ferromagnetic materials	PO 1,3,4,6,8/ PSO 1,2	An	F,C	L	-
CO-6	Demonstrating simple experiments	PO 1,2,4,8 / 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	3	2	-	-	-	2	2	3	2	-	2	-	2
CO-2	2	2	2	2	-	-	-	2	2	2	2	-	3	-	2
CO-3	2	1	-	2	-	-	-	2	-	2	2	-	2	-	2
CO-4	2	1	-	-	-	-	-	2	-	2	2	-	2	-	2
CO-5	2	2	-	-	-	-	-	2	-	2	2	-	2	-	2
CO-6	-	-	-	-	-	-	3	2	3	-	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	**UK3DSCPHY204**				
Course Title	**LIGHT, ELECTRICITY AND EMERGING ENERGY SOURCES**				
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. Light and its properties: frequency, wavelength, intensity 2. Basics of current electricity – Potential difference, electric current, Ohm's law, dc & ac 3. Energy levels of atoms and molecules, chemical energy, semiconductor diode				
Course Summary	Introduce different types of basic sources and detectors of light and their working principle. Give a detailed idea of the working of LASER. Give introductory knowledge about optical instruments such as laser diodes, camera, telescope and compound microscope. The course also aims the understanding of the generation of dc and ac. In a comprehensive level, the trouble shooting in electric circuits is introduced. As an energy source of the future, solar energy and its successful use in various fields such as cooking, heating, cooling, distillation, pumping etc are introduced. The impact of solar energy and solar cells on the future of humankind is analysed. Different thermo-electric effects and their applications are discussed. Introductory ideas of fuel cells such as working principle, classification etc are discussed.				

BOOKS FOR STUDY:

1. Light_ Introduction to Optics and Photonics, Judith Donnelly & Nicholas Massa, Photonics Media Press (2018) Second Edition
2. DC/AC Electrical Fundamentals, Dale R. Patrick, Stephen W. Fardo, Ray E. Richardson & Vigyan (Vigs) Chandra, River Publishers
3. Non-Conventional Energy Sources and Utilisation, R.K. Rajput, S. Chand & CO

BOOKS FOR REFERENCE:

1. A Text Book of Optics, Brijlal & N Subramanyam, S Chand & CO
2. Physics for Scientists and Engineers with Modern Physics (extended version) 2008, Paul A. Tipler & Gene Mosca, W. H. Freeman and Company
3. Non-Conventional Energy Resources, B H Khan, Mc Graw Hill India, 2016

DETAILED SYLLABUS: THEORY

Module	Unit	Content	Hrs	CO No
I		**Sources and detectors of light (Book 1: Chapter 2)**	**9**	
	1	Natural Light Sources, Incandescent Light Sources, Fluorescent lamps, High Intensity Discharge (HID) Lamps, Low-Pressure Sodium Lamps, Flash Lamps and Arc Lamps, Light Emitting Diodes (LEDs)	4	1
	2	Detectors- Thermal Detectors, Quantum Detectors, Photo-emissive Detectors, Photoconductive Detectors	3	1
	3	Photodiodes, Photodiode Parameters	2	1
II		**Optical Instruments & Lasers (Book 1: Chapter 8, 9 & 10)**	**9**	
	4	Simple Magnifier, The SLR Camera	2	2
	5	Optical Telescopes, The Compound Microscope	2	2
	6	Laser - Emission and absorption of photons	1	3
	7	Basic laser components, energy transitions in laser action	2	3
	8	Semiconductor lasers (laser diodes)- Homo Junction, Hetero Junction Laser, Distributed Feedback Lasers	2	2,3
III		**Sources of DC & AC Electrical Energy (Book 2: Chapter 8 & 10)**	**9**	
	9	Chemical Sources – Primary and Secondary Cells	2	4

	10	Battery Connections – Series, Parallel, Combination	1	4
	11	Light Sources, Heat Sources, Pressure Sources, Electro-Magnetic Sources	2	4
	12	AC Generator Basics	1	4
	13	Single Phase and Three Phase AC generators , Analysis and Trouble shooting	3	4
IV	**Solar Energy Applications (Book 3: Chapter 4)**		**9**	
	14	Solar water heating, space heating, space cooling	2	5
	15	Solar distillation, solar pumping, solar air heaters and drying	2	5
	16	Solar cooking, solar furnace	2	5
	17	Solar green-houses and global warming, solar power plants	2	5
	18	Solar Photo Voltaic Cells (qualitative idea only)	1	5
V*	**Emerging Technologies (Book 3: Chapter 9)**		**9**	
	19	Thermoelectric effect – Seebeck effect, Peltier effect, Thomson effect, Joule effect	1	5
	20	Thermoelectric generator – Construction and working, Thermoelectric materials and their selection, Advantages and disadvantages of thermoelectric power generator	2	5
	21	Thermionic generator/converter – Introduction, Thermionic generator, Desirable of Properties of Thermionic Converter Materials, Advantages, disadvantages/limitations and applications of thermionic converter	2	5
	22	Fuel cell: Advantages, disadvantages and applications of fuel cells	1	5
	23	Components and working theory of a fuel cell, Classification fuel cells, Requirements of electrolyte and electrode, Desirable characteristics of a fuel cell	2	5
	24	Hydrogen-oxygen fuel cell (hydroxy cell)	1	5

DETAILED SYLLABUS: PRACTICALS

Part A – At least 5 Experiments to be performed		**CO No**
Sl No	**Name of Experiment**	
1	Experiment to determine the Wavelength of Sodium Light Using a Diffraction Grating/prism and Spectrometer	6
2	Determine and plot the characteristics of the light emitting diode in the forward-bias region, and to compare between different coloured diodes.	6
3	To study the VI Characteristics of Photodiode	6
4	Study the operating characteristics for a diode laser, including threshold current, output power versus current, and slope efficiency	6
5	Study diffraction by single slit	6
6	Study diffraction by double slit	6
7	Determine the voltage and current by connecting 3 dry cells (a) Series (b) Parallel	6
8	Study the Characteristics of Thermistor	6
9	Study the Characteristics of Solar cell	6
10	To verify the relationship between the voltage, the electric field and the spacing of a parallel plate capacitor.	6
11	To verify superposition theorem/Thevenin's theorem/Norton's theorem/ Maximum power transfer theorem in a circuit	6
12	Set up simple circuits with resistors, capacitors, and/or inductors and use a Multimeter to measure voltages, currents, and resistances at different points in the circuit.	6
Part B* – At least One Experiment to be performed		
11	To Calibrate the given thermistor with standard thermistor, hence to find the temperature of the unknown liquid.	6
12	Demonstration of Seebeck Effect and determination of Seebeck Coefficient and Figure of Merit	6
13	To verify Ohm's law in a resistive circuit	6
14	To demonstrate Kirchhoff's laws in a circuit	6

COURSE OUTCOMES

CO No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Explaining different types of sources of light and light detectors	Ap	PSO-1,5
CO-2	Analyze the working principle of basic optical instruments such as camera, telescope and microscope.	An	PSO-1,5
CO-3	Accessing the working principle of LASER and laser action in semiconductor diodes	E	PSO-1,2
CO-4	Formulating dc & ac electric circuits and practice troubleshooting of electric circuits.	C	PSO-1,5
CO-5	Illustrating the usage, storage and importance of solar energy, Thermo-electric energy, thermionic energy, fuel cells	An	PSO-1,3
CO-6	Demonstrating simple experiments	Ap	PSO-1,6,7

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

Name of the Course: LIGHT, ELECTRICITY AND EMERGING lENERGY SOURCES
Credits: 3:0:1 (Lecture: Tutorial: Practical)

CO No.	CO	PO / PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO-1	Explaining different types of sources of light and light detectors	PO1,2,3, 4,6,7 / PSO-1,5	Ap	F, C	L	-
CO-2	Analyze the working principle of basic optical instruments such as camera, telescope and microscope.	PO1,2,3, 4,6,7/ PSO-1,5	An	F, C	L	-
CO-3	Accessing the working principle of LASER	PO1,3,4, 6,8/	E	F, C	L	-

	and laser action in semiconductor diodes	PSO-1,2				
CO-4	Formulating dc & ac electric circuits and practice troubleshooting of electric circuits.	PO1,2,3, 4,6,7/ PSO-1,5	C	F, C, P	L	-
CO-5	Illustrating the usage, storage and importance of solar energy, Thermo-electric energy, thermionic energy, fuel cells	PO1,2,3, 4,6/ PSO-1,3	An	F, C	L	-
CO-6	Demonstrating simple experiments	PO1,2,3, 4,6,7,8/PSO-1,6,7	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	3	-	-	-	2	-	-	2	3	2	2	-	2	3	-
CO-2	3	-	-	-	3	-	-	2	2	3	2	-	2	3	-
CO-3	3	2	-	-		-	-	2	-	2	2	-	2	-	2
CO-4	3	-	-	-	3	-	-	2	2	3	2	-	2	2	-
CO-5	3	-	3	-	-	-	-	2	3	2	3	-	2	-	-
CO-6	3	-	-	-	-	2	3	2	2	2	2	-	3	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	✓	-	✓	-
CO-6	✓	-	-	✓

University of Kerala

Discipline	**PHYSICS**				
Course Code	**UK3DSEPHY200**				
Course Title	**FUNDAMENTALS OF EARTH-ATMOSPHERE SYSTEM**				
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 Hr	-	-	4 Hr
Pre-requisites	1. The student should have a general idea about Sun and planets, Elliptical orbits of planets, Tilt of axis of rotation. 2. The student should have a basic knowledge about evaporation and condensation. 3. The students must have observed the changes in daily weather conditions and the optical phenomena like rainbow, mirages.				
Course Summary	The course introduces the basics of Earth's atmosphere which is an exact mixture of gases and heat/moisture conditions necessary to sustain life. It starts from the Sun-earth system and gives an understanding about the vertical structure of the atmosphere in terms of temperature, pressure, composition and ionisation. The second module deals with various phenomena associated with clouds and their formation. Different scales of winds and the cause of their generation are given in the third module. The fourth module details the causes of hazardous weather and climate change. Fifth module describes the physics behind the interesting natural phenomena in the atmosphere such as rainbows, mirages, halos etc.				

BOOKS FOR STUDY:

1. The Atmosphere : An Introduction to Meteorology, Frederick K. Lutgens, Edward J Tarbuck, Dennis Tasa, Pearson., 2018

BOOKS FOR REFERENCE:

1. Basis of Atmospheric Science, A Chandrasekhar, PHI., 2010
2. Atmospheric Science: An Introductory Survey : John M Wallace and Peter V. Hobbs, Academic Press, 2nd Edition, 2006,
3. Essentials of Meteorology: An Invitation to the Atmosphere, C. Donald Ahrens, Cengage, 8th Edition, 2017.

DETAILED SYLLABUS:

Module	Unit	Content	Hrs	CO No
I	**Earth as a System – Atmosphere of the Earth (Book:1 – Chapter: 1)**		**12**	
	1	Introduction to Sun - Earth System	2	1
	2	Earth's motions – Rotation and Revolution, Seasons on the Earth	3	1
	3	Earth System – Geosphere, Atmosphere, Hydrosphere, Biosphere – Interactions between various spheres	2	1
	4	Composition of the Atmosphere- Major components, trace gases, variable components	2	1
	5	Vertical structure of the Atmosphere – Pressure and Temperature changes	3	2
II	**Forms of Condensation and Precipitation (Book:1 – Chapter: 5)**		**12**	
	6	Cloud formation	3	3
	7	Cloud Classification (Cirrus, Stratus, Cumulous, Nimbus and combinations)	3	3
	8	Types of fog	3	3
	9	Formation of precipitation - Rain, snow, glaze, hail	3	3
III	**Circulations and Winds (Book:1 – Chapter: 7)**		**12**	
	10	Wind and Air pressure	2	3
	11	Temporal and spatial scales of atmospheric motion	2	3
	12	Local winds- Land and sea breezes, Mountain and Valley breezes	3	3

	13	Monsoons – Asian Monsoon	3	4
	14	Cyclones, Tornados, Hurricanes	2	4
IV	**Hazardous Weather and Climate Change (Book:1 – Chapter: 9,10,11)**		**12**	
	15	Distinction between Weather and Climate	2	4
	16	Air Pollution, Sources of air pollution – anthropogenic and natural	2	4
	17	Natural causes of Climate Change- Plate tectonics, Volcanic Activity, Variation of Earth's Orbit, Solar Variability	2	4
	18	Human Impact on Climate Change- Rising CO_2 levels, Role of trace gases, Role of aerosols	2	4
	19	Ozone Depletion	2	4
	20	Greenhouse effect, Enhanced Greenhouse effect, Global Warming, Consequences of Global Warming	2	4
V*	**Optical Phenomena of the Atmosphere (Book:1 – Chapter: 16)**		**12**	
	21	Interaction of Light and matter – Scattering, Reflection, Refraction, Diffraction, Absorption	3	5
	22	Mirages, Rainbows, Glories	2	5
	23	Halos, Sundogs, Solar Pillars, Sub Sun	2	5
	24	Coronas, Iridescent Clouds	2	5
	25	Auroras, Airglow, Alpenglow, Afterglow	2	5

COURSE OUTCOMES

CO No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Describe the basics of the Sun Earth System	U	PSO-1,3
CO-2	Demonstrate the vertical structure of the atmosphere and formulate the changes	C	PSO-1,3
CO-3	Examine the phenomenon of cloud formation and Catagorise different types of clouds	An	PSO-1,3

CO-4	Recognize various weather phenomenon and Evaluate the changing climate its causes and impacts	E	PSO-1,3
CO-5	Examine the interaction of light and matter and identify various optical phenomenon in the atmosphere	Ap	PSO-1,3

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

Name of the Course: FUNDAMENTALS OF EARTH-ATMOSPHERE SYSTEM
Credits: 4:0:0 (Lecture: Tutorial: Practical)

CO No.	CO	PO / PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO-1	Describe the basics of the Sun Earth System	PO1/PSO-1,3	U	F	L	-
CO-2	Demonstrate the vertical structure of the atmosphere and formulate the changes	PO1/PSO-1,3	C	F, C	L	-
CO-3	Examine the phenomenon of cloud formation and Catagorise different types of clouds	PO1/PSO-1,3	An	F	L	-
CO-4	Recognize various weather phenomenon and Evaluate the changing climate its causes and impacts	PO1/PSO-1,3	E	C	L	-
CO-5	Examine the interaction of light and matter and identify various optical phenomenon in the atmosphere	PO1/PSO-1,3	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	1	-	1	-	-	-	-	1	-	-	-	-	-	-	-
CO-2	1	-	2	-	-	-	-	2	-	-	-	-	-	-	-
CO-3	1	-	1	-	-	-	-	2	-	-	-	-	-	-	-
CO-4	2	-	2	-	-	-	-	2	-	-	-	-	-	-	-
CO-5	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

Discipline	**PHYSICS**				
Course Code	**UK3DSEPHY201**				
Course Title	**CIRCUIT ELEMENTS AND NETWORK THEOREMS**				
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	This course discusses the basic electrical technology, network theorems, circuit analysis. It also helps to understand the ac circuit analysis and an idea regarding optoelectronic devices.				

BOOKS FOR STUDY:

1. Basic Electronics Solid State: B. L. Theraja, S Chand & Company LTD.

BOOKS FOR REFERENCE

1. Principles of Electronics, V K Mehta and Rohith Mehta, S Chand & Company LTD.
2. Basic Electronics: Devices, circuits and IT fundamentals: Santiram Kal, PHI, 2010

DETAILED SYLLABUS: THEORY

Module	Unit	Content	Hrs	CO No
I		**Ohm's Law (Book 1: Chapter 1,2&3)**	**12**	
	1	Linear and non-linear Resistors, Resistor Colour code	2	1
	2	Resistor Types-Wire wound Resistors, Carbon composition Resistors, Carbon film Resistors, Metal film Resistors	2	1

	3	Resistive circuits, Series and Parallel Resistor circuits, Series aiding and Series opposing Voltages	2	2
	4	Proportional Voltage formula, Proportional Current formula, Series Voltage Dividers	2	2
	5	'Open' and 'Short' in Series, Parallel and Series – Parallel Circuits.	2	1,2
	6	Cells in series and parallel	2	1,2
II	**Inductors and Capacitors (Book 1: Chapter 5)**		**12**	
	7	Inductance, Inductor Types: Air core inductor, Iron-core Inductor, Ferrite-core Inductor	2	1
	8	Self-Induction, Mutual Induction, relation connecting self-inductance and mutual inductance	2	1
	9	Coefficient of Coupling, Inductors in Series or Parallel without M, series combination with M,	2	2
	10	Stray Inductance, Reactance offered by a Coil.	1	1
	11	Capacitance, Capacitors in Series and Parallel, Reactance offered by the Capacitor	2	2
	12	Type of Capacitors- Fixed Capacitors, Variable Capacitors	1	1
	13	Charging and discharging of a capacitor	2	1,2
III	**Network Theorems (Book 1: Chapter 4)**		**12**	
	14	Ideal constant Voltage Source, Ideal constant Current Source	2	1
	15	Kirchhoff's Law	2	2
	16	Super position theorem	2	3
	17	Thevenin's and Norton's Theorem	4	3
	18	Maximum Power Transfer Theorem	2	3
IV	**Alternating Current (Book 1: Chapter 5)**		**12**	
	19	Type of alternating waveforms, Different values of sinusoidal voltage and current, Phase and Phase difference of A.C	2	1
	20	Non-sinusoidal waveform, Harmonics	1	1

	21	A.C through Resistor, Inductor, Capacitor	2	2
	22	L-R, R-C and LCR circuits	3	2
	23	Sharpness of resonance, Q-factor, Bandwidth	2	5
	24	Tuning of radio, Parallel LCR	2	5
V*	**Optoelectronic devices (Book 1: Chapter 16)**		**12**	
	25	Light Emitting Diode (LED) – theory, construction and applications	3	4,5
	26	Photo Emissive Devices	2	4
	27	Photomultiplier Tube	2	4
	28	Photovoltaic Devices – bulk type photoconductive cells	2	4,5
	29	Photodiodes – P-N junction photodiode – PIN photodiode – avalanche photodiode.	3	4,5

COURSE OUTCOMES

CO No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Describe basic electronic components	U	PSO-1
CO-2	Design electrical circuits in series and parallel combinations using different circuit elements	C	PSO-1, 2
CO-3	Create equivalent circuits using network theorems	C	PSO-1,2
CO-4	Familiarize the different semiconductor devices	U	PSO-1
CO-5	Analyze the V-I characteristics of the circuits	An	PSO-1

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

Name of the Course: CIRCUIT ELEMENTS AND NETWORK THEOREMS

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

CO No.	CO	PO / PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO-1	Describe basic electronic components	PO 1/ PSO 1	U	C	L	-
CO-2	Design electrical circuits in series and parallel combinations using different circuit elements	PO 1,2/ PSO 1,2	C	C	L	-
CO-3	Create equivalent circuits using network theorems	PO 1/ PSO 1,2	C	C	L	-
CO-4	Familiarize the different semiconductor devices	PO 1/ PSO 1	U	F	L	-
CO-5	Analyze the V-I characteristics of the circuits	PO 1,2/ PSO 1	An	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	1	-	-	-	-	-	-	1		-	-	-	-	-	-
CO-2	2	2	-	-	-	-	-	1	1	-	-	-	-	-	-
CO-3	2	2	-	-	-	-	-	1	-	-	-	-	-	-	-
CO-4	2	-	-	-	-	-	-	1	-	-	-	-	-	-	-
CO-5	1	-	-	-	-	-	-	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	✓	✓	-	✓

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	-

	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	✓	-	-	-

University of Kerala

Discipline	**PHYSICS**				
Course Code	**UK3DSEPHY203**				
Course Title	**FUNDAMENTALS OF ASTROPHYSICS**				
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	1. Laws of motion, Familiarity with optics and light propagation 2. Knowledge of trigonometric functions and identities				
Course Summary	The course aims to give a fundamental concept of astronomy and astrophysics. This includes formation and evolution of stars and galaxies, basics of observational astronomy. On completion of the course, the student will get a comprehensive understanding of the fundamental principles and latest developments in astronomy and astrophysics.				

BOOKS FOR STUDY:

1. An Introduction to Astrophysics, Baidyanath Basu, PHI Learning Private Limited (2010)
2. Fundamentals of Astrophysics. Stan Owocki, Cambridge University Press, 2021
3. Astronomy 2e, Andrew Fraknoi, David Morrison, and Sidney C. Wolff, XanEdu Publishing Inc; Second edition (2022)
4. Introduction to Space Science – Robert C Hymes (1971), John Wiley & Sons Inc.
5. Introduction to Cosmology- J. V. Narlikar (1993), Cambridge University Press
6. Observational Astronomy, Birney, Gonzalez, and Oesper, Cambridge University Press, 2006
7. Modern Physics- R. Murugeshan, Kiruthika Sivaprasath (2007), S.Chand & Company Ltd

BOOKS FOR REFERENCE:

1. Astrophysics: Stars and Galaxies, K.D. Abhyankar, Universities Press (India) Limited (2001)
2. An Introduction to Modern Astrophysics, Bradley Carroll & Dale Ostlie Pearson Addison-Wesley, 2007

RELATED ONLINE CONTENTS [MOOC, SWAYAM, NPTEL, Websites etc.]:

1. A Beginner's Guideto Workingwith Astronomical Data, Markus Possel (1905.13189v2.pdf (arxiv.org))
2. https://www.secretsofuniverse.in/basics-of-astrophysics-sou/

DETAILED SYLLABUS: THEORY

Module	Unit	Content	Hrs	CO No
I	**Introduction to Astronomy & Astrophysics (Book 3: Chapter 2 & 3)**		**12**	
	1	Ptolemy's model of Universe – Copernican and Galilean contributions, Branches of Astronomy	3	1
	2	Laws of planetary motion: Tycho Brahe's observations, Kepler's laws	5	1
	3	Cosmology: Expansion of the Universe - redshifts , The Big Bang and the expanding universe; dark matter and dark energy, Hubble's law	4	1
II	**Stellar Astrophysics (Book 2: Chapter 3; Book 6: Chapter 1,5, Book 7)**		**12**	
	4	Celestial coordinates, Astronomical distances- Parallaxes and Parsec, Electro-magnetic spectrum, Magnitude & Types, Color, Luminosity, Color-Magnitude Diagram (Basic idea)	3	2
	5	Formation of stars, Estimation of Star Formation Rate	3	2
	6	Stellar evolution, White dwarfs, Supernova explosion, Neutron stars,Chandrasekhar limit, Black holes	3	2
	7	Spectral classification of stars: The Harvard classification, Yerkes Classification, M-K classification, Hertzsprung Russel diagram	3	2
III	**Galaxies (Book 2: Chapter 4)**		**12**	
	8	Galaxy types: Spiral, Elliptical, Dwarf, Galaxy formation	4	3
	9	Our Galaxy- Galactic structure	4	3
	10	Cepheid variables as standard candle for distances to external Galaxies, Galactic redshift and Hubble's law	4	3
IV	**Solar system (Book 1: Chapter 5)**		**12**	
	11	Formation of solar system: Nebular hypothesis, Evolution of protoplanetary disks	4	4
	12	Growth of solid bodies, Formation of Terrestrial and Giant planets	3	4

	13	Physical characteristics of planets in solar system	2	4
	14	Familiarization of solar system objects: Satellites, Asteroid belt, Kuiper belt, Comets and Meteorites, Search for extrasolar planets	3	4
V*	**Observational Techniques in Astronomy (Book 1: Chapter 1, E-content - 1)**		**12**	
	15	Imaging techniques: photography, CCD imaging	3	5
	16	Telescopes :Chandra X- ray observatory, Hubble space telescope, James web Telescope, Ultra-violet Imaging telescope	4	5
	17	Familiarisation of software for data analysis - DS9, Topcat, Laxpc, Astropy, IRAF	5	5

COURSE OUTCOMES

CO No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Recall the historical development of astronomy and astrophysics	U	PSO 3
CO-2	Discuss the key concepts in astronomy and astrophysics and integrating these ideas to develop observational skills to identify celestial objects	Ap	PSO 3
CO-3	Differentiate between different types of galaxies and categorise them based on the structure of galaxies and assess the nature of universe	E	PSO 3
CO-4	Differentiate the structure and composition of the solar system and design the model of the solar system	C	PSO 3
CO-5	Explain use of telescopes and observational tools to collect and analyse and assess the astronomical data	E	PSO 3

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

Name of the Course: FUNDAMENTALS OF ASTROPHYSICS
Credits: 4:0:0 (Lecture: Tutorial: Practical)

CO No.	CO	PO / PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO-1	Recall the historical development of astronomy and astrophysics	PO 1/ PSO 3	U	F, C	L	-
CO-2	Discuss the key concepts in astronomy and astrophysics and integrating these ideas to develop observational skills to identify celestial objects	PO 1/ PSO 3	Ap	F,C,P	L	-
CO-3	Differentiate between different types of galaxies and categorise them based on the structure of galaxies	PO 1/ PSO 3	E	F,C,P	L	-
CO-4	Differentiate the structure and composition of the solar system and design the model of the solar system	PO 1/ PSO 3	C	F,C, P	L	-
CO-5	Explain use of telescopes and observational tools to collect and analyse and assess the astronomical data	PO 2/ PSO 3	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	-	-	-	-	1	-	-	-	-	-	-	-
CO-2	-	-	2	-	-	-	-	1	-	-	-	-	-	-	-
CO-3	-	-	2	-	-	-	-	1	-	-	-	-	-	-	-
CO-4	-	-	2	-	-	-	-	1	-	-	-	-	-	-	-
CO-5	-	-	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

Discipline	**PHYSICS**				
Course Code	**UK3DSEPHY204**				
Course Title	**INTRODUCTION TO MEDICAL PHYSICS**				
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	1. Concept of rotation, torque, rigid body 2. Definition of gas pressure, equation of state, velocity of fluid and equation of continuity. 3. Electromagnetic spectrum, properties of light: frequency, wavelength, polarization				
Course Summary	The course gives an understanding of biomechanical and fluid mechanical aspects of the human body, in terms of motion of bones, joints etc and the blood flow along various body parts. The thermodynamical and mechanical aspects of respiration, metabolism etc are discussed. Different bio-membranes and their functionality including sound is discussed. The optical aspects of eyesight are discussed. The interaction of electro-magnetic radiation with human body and different diagnostic methods using sound and radiation are introduced.				

BOOKS FOR STUDY:

1. Introduction to Medical Physics-Zanichelli Alessandro Bacchettam & Domenico Scannicchio - CEA (2023)
2. Basic radiological Physics – Kuppusamy Thayalan,
3. Bio-medical Physics for Nurses – K Thayalan

BOOKS FOR REFERENCE:

1. An Introduction to Medical Physics-Springer International Publishing (2017) Muhammed Maqbool (eds.)
2. Encyclopaedia of Medical Physics_ Two Volume Set-CRC Press (2021) Slavik Tabakov, Franco Milano, Magdalena S. Stoeva, Perry Sprawls, Sameer Tipnis, Tracy Underwood

DETAILED SYLLABUS: THEORY

Module	Unit	Content	Hrs	CO No
I		**Biomechanics & Fluid mechanics (Book1, Chapter 2& 3)**	**12**	
	1	Introduction: muscles and bones, Torque, Rigid body equilibrium, Center of mass and center of gravity	2	1
	2	Constraints and levers, Mechanical equilibrium applied to body joints- Levers in human body, Hip joint equilibrium	2	1
	3	Rotational dynamics, Deformations, Deformations of bones	2	1
	4	Introduction: the cardiovascular system, Hydrostatic pressure and buoyancy, Liquid flow and continuity equation (No derivation)	2	1
	5	Vascular flow- Blood flow rate and velocity, Aneurysm and stenosis	2	1
	6	Blood viscosity, Blood pressure and resistance of vessels (No derivation), Effects of hydrostatic pressure	2	1
II		**Pulsation, respiration and metabolism (Book1, Chapter 4 & 5)**	**12**	
	7	Heart, Cardiac Work & Laplace formula	2	1
	8	Equilibrium radius of vessels, Hydrodynamic effects of vessel dispensability	2	1
	9	Blood pressure measurements, Pulsatile motion and mechanical impedance (No derivation)	2	1
	10	Ideal Gas & Real Gas	1	1
	11	Air Composition and Respiration	1	1
	12	Basics only -Laws of Thermodynamics, Enthalpy, Entropy	2	1
	13	Metabolism and Spirometry	2	1
III		**Physics of Ultrasound (Book 2, Chapter 19)**	**12**	
	14	Physical characteristics of sound and its propagation in	1	2

		different media		
	15	Basics of ultrasound	1	2
	16	Interaction of ultrasound with medium	2	2
	17	Ultrasound transducer, Transducer array	2	2
	18	Ultrasound image display	2	2
	19	Dopller ultrasound	2	2
	20	Ultrasound image quality and bioeffects	2	2
IV	**Tissue Optics (Book 3, Chapter 6, Book 1, Chapter 10)**		**12**	
	21	The Human Eye and Visual defects	2	3
	22	Biological Effcets of light, Laser in Medicine	2	3
	23	Optical instruments in medicine	3	3
	24	The eye: sight	2	3
	25	The eye: vision	3	3
V*	**Electromagnetic ionizing radiations in medicine (Book 2, Chapter 28, Book 1 chapter 9 & 11)**		**12**	
	26	Electromagnetic waves: spectrum, emission and absorption	2	4
	27	Ionizing radiations in medicine	2	4
	28	X-ray imaging, CT Scan	2	4
	29	Sources of radiation	2	4
	30	Biological effects of radiation	2	4
	31	Radiation Hazards, evaluation and control	2	4

COURSE OUTCOMES

CO No.	**Upon completion of the course the graduate will be able to**	**Cognitive Level**	**PSO addressed**
CO-1	Evaluate human body functions from a physics perspective by analyzing the application of core concepts such as mechanics, fluid dynamics, and thermodynamics to enhance understanding and advancement in medical physics.	E	PSO-1,3

CO-2	Develop imaging approaches based on the physics of sound propagation, reflection, and attenuation in biological tissues to optimize ultrasound imaging modalities	C	PSO-1,3
CO-3	Develop optical diagnostic approaches by integrating knowledge of light-tissue interactions, including scattering, absorption, and fluorescence, for innovative applications in medical diagnostics.	C	PSO-1,3
CO-4	Apply knowledge of the physical and biological effects of ionizing radiation to analyze its impact on matter and living tissues	Ap	PSO-1,3

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

Name of the Course: INTRODUCTION TO MEDICAL PHYSICS

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

CO No.	CO	PO / PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO-1	Evaluate human body functions from a physics perspective by analyzing the application of core concepts such as mechanics, fluid dynamics, and thermodynamics to enhance understanding and advancement in medical physics.	PO1,4,6 / PSO 1,3	E	C	L	-
CO-2	Develop imaging approaches based on the physics of sound propagation, reflection, and attenuation in	PO1,3,4 ,6/ PSO 1,3	C	C	L	-

	biological tissues to optimize ultrasound imaging modalities					
CO-3	Develop optical diagnostic approaches by integrating knowledge of light-tissue interactions, including scattering, absorption, and fluorescence, for innovative applications in medical diagnostics.	PO1,2,3 ,4,6/ PSO 1,3	C	F,C	L	-
CO-4	Apply knowledge of the physical and biological effects of ionizing radiation to analyze its impact on matter and living tissues	PO1,2,4 ,6/ PSO 1,3	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	3	-	3	-	-	-	-	2	-	-	2	-	2	-	-
CO-2	3	-	3	-	-	-	-	2	-	3	2	-	2	-	-
CO-3	3	-	3	-	-	-	-	2	2	2	2	-	2	-	-
CO-4	3	-	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	✓	✓	✓	-

University of Kerala

Discipline	**PHYSICS**				
Course Code	**UK3DSEPHY205**				
Course Title	**MATHEMATICAL TOOLS FOR PHYSICS**				
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	Mathematical tools serve as the backbone for solving complex physics problems. They encompass concepts such as curvilinear coordinate systems for describing non-linear geometries, differential equations for modeling dynamic systems, complex functions for analyzing oscillatory behavior, infinite and Fourier series for understanding periodic phenomena, matrices and linear vector spaces for handling transformations, and operators for representing physical observables and their interactions within a structured mathematical framework. These tools provide physicists with powerful techniques to describe, analyze, and predict various physical phenomena across diverse fields.				

BOOKS FOR STUDY:

1. Introduction to Electrodynamics by David J Griffith; 4th edition
2. Introduction to mathematical physics by Charlie Harper
3. Mathematical Methods in The Physical Sciences by Mary L Bose; 3rd edition
4. Calculus by Anton, Bivens and Davis; 10th edition
5. Matrices and tensors in physics by A W Joshi; 3rd edition
6. Quantum mechanics by V K Thankappan; 3rd edition

BOOKS FOR REFERENCE:

1. Mathematical Methods for Physicists by Arfken, Weber and Harris; 7th edition.
2. Calculus by Thomas; 13th edition
3. Differential equations with applications with Historical notes by George F Simmons; 3rd edition

DETAILED SYLLABUS: THEORY

Module	Unit	Content	Hrs	CO No
I	**Vector algebra and Orthogonal curvilinear coordinate system (Books 1 & 2)**		**12**	
	1	Orthogonal curvilinear coordinate systems: plane polar, Spherical polar and cylindrical coordinate systems- unit vectors, coordinate transformations.	3	1
	2	Infinitesimal line segment, scale factors, area elements, volume elements, line-surface-volume integrals with examples	3	1
	3	Gradient, divergence, curl and Laplacian in spherical polar and cylindrical coordinate systems (derivation excluded).	3	1
	4	Integral theorems- Stoke's theorem and Gauss divergence theorem (verification with examples only).	3	1
II	**Infinite series (Books 3 & 4)**		**10**	
	5	Infinite series – convergence test (Book 4)	2	2
	6	Maclaurin and Taylor series (Book 4)	3	2
	7	Convergence of Taylor series (Book 4)	2	2
	8	Fourier series – examples (Book 3)	3	2
III	**Complex functions (Books 2 & 3)**		**12**	
	9	Complex numbers, graphical representation (Book 3)	2	3
	10	Complex functions, arithmetic operation-conjugates, modulus (Book 3)	2	3
	11	Polar form, powers and roots (Book 3)	2	3
	12	Euler's formula, Demovre's theorem (Book 3)	2	3
	13	Analytical functions and Cauchy-Riemann Conditions, examples of analytic functions (Book 3)	4	3

IV	**Differential equations and Matrices (Book 2 & 3)**		**14**	
	14	First order equations and linear second order differential equations with constant coefficients, homogeneous and inhomogeneous equations. (Book 2)	4	4
	15	Partial differential equation- variable separable solution (elementary ideas). (Book 2)	3	4
	16	Matrices: symmetric matrices, skew symmetric matrices, Hermitian-orthogonal-unitary matrices, rank, trace. (Book 2)	5	5
	17	Eigenvalue problems, eigen vectors. (Book 2)	2	5
V*	**Linear vector space and operators (Book 5 & 6)**		**12**	
	18	Group, field, linear vector space, linear independence of vectors, vector space of n-tuplets.	4	6
	19	Inner product, orthonormality and linear independence, bases and dimensions, norm.	4	6
	20	Operators-linear operators, eigenvalue and eigenfunctions of an operator.	3	6
	21	Hermitian operator, unitary operator.	1	6

COURSE OUTCOMES

CO No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Apply vector algebra in orthogonal curvilinear coordinate systems, and evaluate gradient, divergence, curl, and Laplacian in different coordinate systems.	Ap	PSO-1, 2
CO-2	Apply the convergence of infinite series to form Maclaurin, Taylor, and Fourier series representations for physical functions.	Ap	PSO-1, 2
CO-3	Analyse the concept of complex numbers and functions, and apply analytical techniques such as Euler's formula and Cauchy-Riemann conditions to solve problems.	An	PSO-1, 2

CO-4	Investigate ordinary and partial differential equations relevant to physical systems, and apply these methods to model real-world physics problems.	An	PSO-1, 2
CO-5	Formulate matrix operations and matrix properties such as symmetry, rank, trace, and eigenvalue problems in the context of physical applications.	C	PSO-1, 2
CO-6	Analyse the structure of linear vector spaces and operators, and apply concepts like orthonormality, Hermitian and unitary operators to formulate physical theories.	An	PSO-1, 2

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

Name of the Course: MATHEMATICAL TOOLS FOR PHYSICS

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

CO No.	CO	PO / PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO-1	Apply vector algebra in orthogonal curvilinear coordinate systems, and evaluate gradient, divergence, curl, and Laplacian in different coordinate systems.	PO-1,2,3 PSO-1, 2	Ap	F, C	L	-
CO-2	Apply the convergence of infinite series to form Maclaurin, Taylor, and Fourier series representations for physical functions.	PO-1,2,3 PSO-1, 2	Ap	F, C	L	-
CO-3	Analyse the concept of complex numbers and functions, and apply analytical techniques such as Euler's formula and Cauchy-Riemann	PO-1,2,3 PSO-1, 2	An	F, C	L	-

	conditions to solve problems.					
CO-4	Investigate ordinary and partial differential equations relevant to physical systems, and apply these methods to model real-world physics problems.	PO-1,2,3 PSO-1, 2	An	F, C	L	-
CO-5	Formulate matrix operations and matrix properties such as symmetry, rank, trace, and eigenvalue problems in the context of physical applications.	PO-1,2,3 PSO-1, 2	C	F, C	L	-
CO-6	Analyse the structure of linear vector spaces and operators, and apply concepts like orthonormality, Hermitian and unitary operators to formulate physical theories.	PO-1,2,3 PSO-1, 2	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	3	-	-	-	-	-	3	2	1	-	-	-	-	-
CO-2	2	3	-	-	-	-	-	3	2	1	-	-	-	-	-
CO-3	2	3	-	-	-	-	-	3	2	1	-	-	-	-	-
CO-4	2	3	-	-	-	-	-	3	2	1	-	-	-	-	-
CO-5	2	3	-	-	-	-	-	3	2	1	-	-	-	-	-
CO-6	2	3	-	-	-	-	-	3	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	**UK3DSEPHY206**				
Course Title	**COMPUTER HARDWARE AND OPERATING SYSTEM**				
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	This course gives an overview of different hardware components used in a personal computer. It also discusses how to assemble or disassemble components of a computer for better performance. General idea of operating system is discussed and procedure to configure a computer with a new operating system (Linux and Windows) is discussed in detail. This course will helps one to assemble a new PC and configure it with a new OS.				

BOOKS FOR STUDY:

1. PC Hardware A Beginner's Guide: Ron Gilster, McGraw-Hill Education (India) Pvt Ltd.
2. The architecture of computer hardware, system software and networking-An information technology approach: Irv Englander, Wiley Publications
3. PC Assembly and Installation: Dr. Tariq Hussain Sheikh, Naresh Kumar, Books clinic Publications
4. Operating Systems: Achyut S Godbole, Atul Kahate, Tata Mc Graw-Hill Education
5. The official Ubuntu Book: Benjamin Mako Hill, Matthew Helmke, Corey Burger, Pearson Education Inc.

BOOKS FOR REFERENCE:

1. Computing Fundamentals, Introduction to Computers: Faithe Wempen, Wiley publications
2. Guide to Operating Systems: Greg Tomsho, Cengage Learning.

3. Operating Systems made easy: C. Madana Kumar Reddy, Lexmi Publications.
4. Operating Systems Internals and Design principles: William Stallings, Prentice Hall publication 7th Edn

DETAILED SYLLABUS: THEORY

Module	Unit	Content	Hrs	CO No
I	**Evolution of computers (Book 1, 2)**		**12**	
	1	Overview of Systems and components, Electronics of the PC – Conductors, Insulators, and Semiconductors – Electronic building blocks of PC (Book1: Chapter1 &2)	3	1
	2	Components of the computer, the concept of virtualization, Architectural history of the computer - hardware, operating system, communication network and internet (Book 2: Chapter1)	5	1
	3	Evolution of PC microprocessor (Book1: Chapter 3)	2	1
	4	The general concepts of systems, IT System architecture (Book2: Chapter 2)	2	1
II	**Overview of Computer Hardware (Book 1, 3)**		12	
	5	Computer hardware-CPU, Motherboard, HDD, ODD, the power supply (SMPS), Mouse, Monitor.	2	1
	6	Motherboard-Definition, Architecture, Chipset, Bus, CPU Sockets, Interface Ports used to connect different Peripherals I/O Ports (PS/2, Serial, Parallel, USB, VGA, HDMI, Audio, Ethernet).	5	1
	7	Memory-Introduction to RAM, ROM, Cache Memory, Buffer Memory, Virtual Memory, DDR, DDR2, DDR3, DDR4, Hybrid Memory.	5	1
III	**Computer Assembly (Book 3)**		**12**	
	8	Assembling and Disassembling a PC, Precautions to be taken while assembling the PC.	4	2
	9	Introduction to BIOS/CMOS Setup, POST (Power on Self-Test). BIOS/CMOS Configuration (Date, Time, Enable/Disable Devices).	4	2
	10	Dual BIOS Feature BIOS/CMOS Setup, Booting Sequence/Boot Order	4	2

IV	**Operating Systems (Book 4, 5)**		**12**	
	11	Operating Systems objectives and functions	2	3
	12	Evolution of operating systems, Types of operating systems, Different services of the operating system	4	3
	13	GUI, Kernel, Booting, Virtual Machine, OS design consideration for Multiprocessor and Multicore	4	3
	14	Overview on Operating Systems- WINDOWS, UNIX, LINUX	2	4
V*	**Configuring a computer with Linux OS (Book 4, 5)**		**12**	
	15	Choosing Ubuntu version, Getting Ubuntu, Installing Ubuntu	8	5
	16	Performing Dual Boot / Multi Boot	4	5

COURSE OUTCOMES

CO No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Discuss the main features of computer hardware, peripherals and various memory systems used in it.	U	PSO 5
CO-2	Develop operational procedure for assembling a PC	C	PSO 5,7
CO-3	Demonstrate the evolution, objectives and functions of various operating systems	Ap	PSO 5
CO-4	Evaluate the functions of various operating Systems and their applications	E	PSO 5
CO-5	Illustrate the methods to configure a computer with Linux and Windows OS	Ap	PSO 5,7

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

Name of the Course: COMPUTER HARDWARE AND OPERATING SYSTEM

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

CO No.	CO	PO / PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO-1	Discuss the main features of computer hardware, peripherals and various memory systems used in it.	PO 1/ PSO 5	U	C	L	-
CO-2	Develop operational procedure for assembling a PC	PO 1,6/ PSO 5,7	C	C, P	L	-
CO-3	Demonstrate the evolution, objectives and functions of various operating systems	PO 1/ PSO 5	Ap	C	L	-
CO-4	Evaluate the functions of various operating Systems and their applications	PO 1/ PSO 5	E	C	L	-
CO-5	Illustrate the methods to configure a computer with Linux and Windows OS	PO 1,6/ PSO 5,7	Ap	C, P	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	-	-	-	-	-	-	-
CO-2	-	-	-	-	1	-	2	1	-	-	-	-	2	-	-
CO-3	-	-	-	-	2	-	-	1	-	-	-	-	-	-	-
CO-4	-	-	-	-	1	-	-	1	-	-	-	-	-	-	-
CO-5	-	-	-	-	2	-	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	**UK3VACPHY200**				
Course Title	**ENERGY CRISIS, SUSTAINABILITY AND MANAGEMENT**				
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 understanding of the historical context, current challenges, and future prospects of global energy consumption and production. Upon completion of the course, graduates will be equipped with the knowledge and skills to analyze energy systems, evaluate sustainability measures, and contribute to informed decision-making in the energy sector				

BOOKS FOR STUDY

1. World Issues - Energy Crisis, S Chand Publishing, ISBN: 9788121933391
2. Understanding the Global energy crisis, Edited by Eugene D. Coyle and Richard A. Simmons, ISBIN: 978-1-55753-661-7, Purdue University Press, USA

Books for reference

3. Non-conventional energy sources, G D Rai, Khanna publishers, ISBN; 9788174090738 (sixth Edition)
4. Energy technology (nonconventional, renewable and conventional), S Rao and B B Parulekar, Khanna publishers, ISBN; 9788174090401 (third revised and updated edition)

DETAILED SYLLABUS: THEORY

Module	Unit	Content	Hrs	CO No
I	**Global energy demand (book1,book2)**		**7**	**1**
	1	Energy demand before industrial revolution	1	1
	2	Energy sources in 19th century	2	1
	3	Growth of energy demand and sources in 20th century	2	1
	4	Energy demand and gross national product	2	1
II	**Fuel crisis - coal and oil (book1)**		**7**	
	5	Oil crisis; Oil extraction, reserves, Oil types- Shale, Heavy and Tar Sands, Environmental Issues	2	2
	6	Coal: Production, reserves, mining, Environmental Issues	3	2
	7	Disinvestment from fossil fuels and rise in oil prices	2	2
III	**Renewable Energy sources (book2)**		**11**	
	8	Solar Energy	2	3
	9	Wind Energy	2	3
	10	OCEAN and WAVE ENERGY; Tidal Power, Wave, Ocean Thermal Energy Conversions, Future and Scope	3	3
	11	Scope of Geothermal energy	2	3
	12	Hydroelectric energy, hydroelectric generation, future of hydroelectric energy (Environmental and economic viability)	2	3
IV	**Policies and planning (book2,book1)**		**11**	
	13	Energy supply and investment planning	3	4
	14	Future GDP/Energy consumption ratio	3	4
	15	Future energy options for developing nations	3	4
	16	Global energy politics and policies	1	4
	17	India: Energy and Climate Change Policies	1	4
V*	**Energy Options for the Future (book1)**		**9**	
	18	Hydrogen and Fuel Cells (Brief description of its Design, working, advantages and disadvantages)	4	5
	19	Future Energy storage options: An introduction on Thermal energy storage systems Mechanical energy storage systems Chemical energy storage systems	5	5

		Electrochemical energy storage systems Solar energy storage systems		

COURSE OUTCOMES

CO No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Analyse the historical context of energy consumption prior to the Industrial Revolution, identifying the primary sources of energy utilized before the Industrial Revolution and their limitations.	An	PSO-1
CO-2	Explain the historical context, causes, and consequences of oil crises on global economies and energy policies, analyzing techniques, challenges, and geopolitical implications of oil extraction and reserve estimation.	Ap	PSO-1,3
CO-3	Evaluate the principles and applications of solar energy, wind energy, various forms of ocean energy (including tidal power, wave energy, and ocean thermal energy conversion (OTEC), geothermal energy) and hydroelectric power generation.	E	PSO-1,3
CO-4	Formulate principles and methodologies involved in strategic energy supply planning and investment decision-making.	C	PSO-1,3
CO-5	Evaluate the design, working principles, advantages, and disadvantages of hydrogen-based fuel cell technologies and the concepts and applications of various energy storage systems.	E	PSO-1,3

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

Name of the Course: ENERGY CRISIS, SUSTAINABILITY AND MANAGEMENT

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

CO No.	CO	PO / PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO-1	Analyse the historical context of energy consumption prior to the Industrial Revolution, identifying the primary sources of energy utilized	PO1,3,4,7/ PSO-1	An	F	L/T	-

	before the Industrial Revolution and their limitations.					
CO-2	Explain the historical context, causes, and consequences of oil crises on global economies and energy policies, analyzing techniques, challenges, and geopolitical implications of oil extraction and reserve estimation.	PO1,3,4,5,7,8/ PSO-1,3	Ap	F	L	-
CO-3	Evaluate the principles and applications of solar energy, wind energy, various forms of ocean energy (including tidal power, wave energy, and ocean thermal energy conversion (OTEC), geothermal energy) and hydroelectric power generation.	PO1,3,4,5,7,8/ PSO-1,3	E	F, C,P	L	-
CO-4	Formulate principles and methodologies involved in strategic energy supply planning and investment decision-making.	PO1,3,4,7,8/ PSO-1,3	C	F, C,P	L/T	-
CO-5	Evaluate the design, working principles, advantages, and disadvantages of hydrogen-based fuel cell technologies and the concepts and applications of various energy storage systems.	PO1,3,4,7/ PSO-1,3	E	F, C,P	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	-	-	-	-	-	-	2	-	2	2	-	-	3	-
CO-2	1	-	1	-	-	-	-	2	-	3	2	1	-	1	2
CO-3	1	-	1	-	-	-	-	2	-	1	2	3	-	2	2
CO-4	1	-	1	-	-	-	-	2	-	1	2	-	-	2	3
CO-5	1	-	1	-	-	-	-	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

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 Book 1 (Chapter 1 & 2), Book 3 (Chapter 2), Book 4 (Chapter 1)**		**9**	
	1	Introduction to General Safety Principles and labels	4	1
	2	Basic lab safety equipments- Safety Goggles, Lab Coats, Gloves, Fume Hood, Fire Extinguisher, Safe Laboratory Practices	5	1
II	**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
	6	Safety clothing, Safety tags, Safety grounding, circuit breaker, safety measuring instruments	3	1
III	**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
	11	Safe disposal of Chemical substances	1	1, 3
IV	**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), Schielding, 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

Discipline	**PHYSICS**				
Course Code	**UK3VACPHY202**				
Course Title	**THE HISTORY OF PHYSICS AND ITS INFLUENCE ON SOCIETY**				
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 explores the interconnected narratives of physics and human society. Trace the evolution of scientific thought from ancient civilizations to contemporary breakthroughs. Analyse key discoveries, from Babylonian astronomy to Newton's laws and quantum mechanics. Uncover Indian physicist's contributions to modern science and nation-building. Gain insights into technological milestones such as transistors, satellites, and space exploration. Enlighten the mind with a world vision through this course on the history of physics.				

BOOKS FOR STUDY:

1. History of Physics, Florian Cajori, Dover Publications/Maven Books, ISBN-13: 978-9387488472
2. Biographical dictionary of Indian scientists, Anjana Chattopadhyay, Rupa & Company
3. Heat and Thermodynamics, M W Zemansky, McGraw Hill
4. Article: Steps of Power: Note on the history of electrification in India (1883 - 1930), Proceedings of the Indian History Congress, 2017, Vol 78(2107), pp 498-506
5. Nuclear Physics, D C Tayal, Himalaya Publishing House
6. Website of Atomic Energy Regulatory Board, Govt. of India
7. Quantum Mechanics, G Aruldas, PHI Learning Pvt Ltd
8. Article: It's time to go quantum in medicine, J Clin Med, 2023 Jul; 12(13): 4506.

9. A history of the world - Semiconductor Industry, P R Morris, Peter Peregrinus LTD, ISBN: 0863412270
10. Satellite technology: Principles and applications, Anil K. Maini & Varsha Agrawal, John Wiley & Sons

DETAILED SYLLABUS: THEORY

Module	Unit	Content	Hrs	CO No
I		**Birth of physics and early human society (Book 1: Chapters 1-4)**	**5**	
	1	Early civilizations (a) Babylonian & Egyptian (b) Greeks: Aristotle, Archimedes and Heron. Light, Sound, and atomic theory. Greek physical inquiry and its failure. (c) Romans & Arabs	2	1
	2	Europe during the Middle Ages: Invention of gunpowder, Mariner's Compass, An early concept of Light.	1	2
	3	Contributions of Indians: (a) Aryabhata (b) Brahmagupta (c) Varahamihira (d) Bhaskara (Book 2)	2	1
II		**Renaissance and Newtonian Era (Book 1: Chapter 5)**	**6**	
	4	Copernican system: Greek Anticipations of Copernicus, Greek theory of epicycles and eccentrics, Studies of Copernicus, Kepler's Inductive Researches	2	1
	5	Galileo: (a) Experiments at leaning tower (b) The book - Discourses on two new sciences (c) Telescope and studies on the Sun, Moon and Jupiter’s satellite	2	1
	6	Mechanics: Laws of Motion, Law of Gravitation, Motion of projectiles	1	3
	7	Light: Velocity of light, Newton's experiments with prism, Huygen’s wave theory of light, Reflection telescope.	1	3

III	**Physics in 18th, 19th and early 20th centuries (Book 1: Chapter 7,8)**		**14**	
	8	(a) Laws of thermodynamics (results only) and their implications (qualitative): zeroth law & concept of temperature, first law and conservation of energy, second law & disorder and entropy, third law and idea of absolute zero temperature. (b) Thermometers, Early development of steam engine	3	4
	9	(a) Concept of atoms & molecules (b) Light: Concepts of wave theory of light, solar spectrum, color photography, human eye	2	2
	10	(a) Electricity: Contributions of Benjamin Franklin's experiment, Cavendish, Volta and Coulomb (b) Beginning of electrolysis, voltage cell and storage batteries, Ohm's law	2	4
	11	Evolution of dynamo and alternating current, Transmission of electricity, Invention of telegraph and telephones (Book 1,4)	2	5
	12	History of Electrification in India (Book 1,4)	1	5
	13	(a) Contributions of Becquerel and Curie. Radio activity: alpha, beta and gamma rays (b) Nuclear fission and fusion, Einstein's Mass energy equivalence (Book 1,5)	2	5
	14	Destructive and Peaceful use of nuclear energy Nuclear power plants in India: Their location, capacity, fuel etc (Book 6)	2	5
IV	**Physics in 20th and 21st centuries (Book 7, 8, 9 & 10)**		**11**	
	15	Emergence of quantum mechanics: (a) Max Plank: Light as photons and a new constant - h (b) de Broglie: The idea of matter wave (c) Schrodinger: Wave equation of matter wave (d) Heisenberg: The uncertainty relation and its implications	2	6
	16	Medical application of quantum theory: Mind, diagnosis & DNA (based on Article: It's time to go quantum in medicine, book 8)	2	6
	17	Brief discussion on the Invention of transistor & IC chips: Germanium and silicon transistors, monolithic IC's, Full	2	7

		custom & semi-custom circuits, microprocessors (Chapter 4: Book 9)		
	18	Definition of Satellite. Orbit of satellite, Basic Principles of orbiting satellite - Newton's Law of Gravitation & Newton second law of motion.	2	3
	19	(a) History of the Evolution of Satellites: Early Communications, Meteorology & Scientific Exploration, Non-geosynchronous Communication Satellites, Emergence of Geosynchronous Communication Satellites, International Communication Satellite Systems, Domestic Communication Satellite Systems (Book 10) (b) Indian Space programmes: Cartosat, Astrosat, Chandrayan I & II, Aditya L1 (refer any relevant source)	3	7
V*	**Indian contributions in the modern era (Book 2 and any other resource)**		**9**	
	20	Three major discoveries (results only) by Indian scientists in modern physics & their implications: (a) Bose-Einstein statistics & Bosons (b) Raman effect & Raman spectroscopy (c) Chandrasekhar limit & death of stars	3	8
	21	Brief discussion on the contribution of Indian scientists & their role in nation building: (a) Homi J Baba & Indian atomic energy research (b) Vikram Sarabhai & his contribution to the development of ISRO (c) J V Narlikar and IUCAA	3	8
	22	Eminent scientists from Kerala and their contribution: (a) R S Krishnan (b) E C G Sudarshan (c) T Padmanabhan	3	8

COURSE OUTCOMES

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Explain the key milestones in the history of physics, including significant discoveries made by ancient civilizations, such as the Babylonians, Egyptians Greeks and Indians	U	PSO-4
CO-2	Describe important figures and their contributions to physics during pivotal periods, such as the Renaissance and Newtonian Era, highlighting the work of Copernicus, Galileo, and Newton.	U	PSO-4
CO-3	Demonstrate the principles of classical physics, such as Newton's Laws and Kepler's laws, shaping our understanding of the physical world and application of Newton's laws of gravitation in orbiting satellites	Ap	POS-1,4
CO-4	Analyse the importance of the two fundamental branches which fills the gap between Newton's mechanics and physics of the modern era - namely thermodynamics and electricity.	An	POS-1,4
CO-5	Evaluate how, for the first time in history, physics started directly influencing the day-to-day life via steam engine, electrification, fission, fusion, etc	E	POS-1,4
CO-6	Assess a glimpse of the most revolutionary discovery in the history of modern physics - quantum mechanics and how profoundly it is influencing human evolution through say medical research.	E	POS-1,4
CO-7	Design a timeline highlighting key milestones in the development of transistors, ICs, microprocessors and satellites	C	POS-1,4,6
CO-8	Illustrate the contributions of Indian scientists to physics and their influence on the general public.	Ap	PSO-1,4

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

Name of the Course: THE HISTORY OF PHYSICS AND ITS INFLUENCE ON SOCIETY

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

CO No.	CO	PO / PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO-1	Explain the key milestones in the history of physics, including significant discoveries made by ancient civilizations, such as the Babylonians, Egyptians Greeks and Indians	PO 2,6,8 / PSO 4	U	F, C	L	-
CO-2	Describe important figures and their contributions to physics during pivotal periods, such as the Renaissance and Newtonian Era, highlighting the work of Copernicus, Galileo, and Newton.	PO 6, 8 / PSO 4	U	F, C	L	-
CO-3	Demonstrate the principles of classical physics, such as Newton's Laws and Kepler's laws, shaping our understanding of the physical world and application of Newton's laws of gravitation in orbiting satellites	PO 6, 8 / PSO 1,4	Ap	F, C	L	-
CO-4	Analyse the importance of the two fundamental branches which fill the gap between Newton's	PO 6, 8 / PSO 1,4	An	F, C	L	-

	mechanics and physics of the modern era - namely thermodynamics and electricity.					
CO-5	Evaluate how, for the first time in history, physics started directly influencing the day-to-day life via steam engine, electrification, fission, fusion, etc	PO 2,6,8 / PSO 1,4	E	F, C	L	-
CO-6	Assess a glimpse of the most revolutionary discovery in the history of modern physics - quantum mechanics and how profoundly it is influencing human evolution through say medical research.	PO 6, 8 / PSO 1,4	E	F, C, M	L	-
CO-7	Design a timeline highlighting key milestones in the development of transistors, ICs, microprocessors and satellites	PO 6, 8 / PSO 1,4,6	C	F, C	L	-
CO-8	Illustrate the contributions of Indian scientists to physics and their influence on the general public.	PO 2,5,6,8 / PSO 1,4	Ap	F, 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	-	-	-	3	-	-	-	-	3	-	-	-	1	-	3
CO-2	-	-	-	3	-	-	-	-	-	-	-	-	1	-	3
CO-3	2	-	-	3	-	-	-	-	-	-	-	-	1	-	3
CO-4	2	-	-	3	-	-	-	-	-	-	-	-	1	-	3
CO-5	2	-	-	3	-	-	-	-	1	-	-	-	1	-	3
CO-6	3	-	-	3	-	-	-	-	-	-	-	-	1	-	3
CO-7	3	-	-	3	-	2	-	-	-	-	-	-	1	-	3
CO-8	2	-	-	3	-	-	-	-	2	-	-	2	1	-	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	✓	-	✓	✓
CO-7	✓	-	-	✓
CO-8	✓	✓	-	-

ADDITIONAL ELECTIVE COURSES-

RECOMMENDED EXCLUSIVELY FOR INTER

DISCIPLINARY MAJOR PATHWAY

University of Kerala

Discipline	**PHYSICS**				
Course Code	**UK3DSEPHY207**				
Course Title	**ELECTRODYNAMICS**				
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	3 Hrs	-	2 Hrs	5 Hrs
Pre-requisites	Basics of electrostatics				
Course Summary	This course is recommended for students pursuing the **interdisciplinary major pathway**. This course aims to provide a strong foundation to the principles of electrostatics and magnetostatics and equip the students to be familiar with the theoretical basis of electrodynamics. The course also provides hands on experience in handling different electrical circuits.				

BOOKS FOR STUDY:

1. Electrodynamics: David J Griffith, PHI, 3rd Edn.
2. Electricity and Magnetism: K.K. Tewari, S. Chand & Co.

BOOKS FOR REFERENCE:

1. Electricity and Magnetism: Murugesan, S. Chand & Co.
2. Electricity and Magnetism: E.M. Purcell, Berkley Physics course, Vol.2, MGH
3. Electricity and Magnetism: J.H. Fewkes & John Yarwood, University Tutorial Press
4. Electromagnetics: B.B. Laud, Wiley Eastern Ltd., 2ndEdn.
5. Electricity and Magnetism: D.C. Tayal, Himalaya Publishing Co.

DETAILED SYLLABUS: THEORY

Module	Unit	Content	Hrs	CO No
I	**ELECTROSTATIC FIELD (Book 1, Chapter : 2)**		**9**	
	1	Coulomb's law, Electric field due to continuous charge distribution	2	1
	2	Divergence and Curl of electrostatic fields, Field lines, flux, Gauss's law, Uniformly charged Solid Sphere	3	1
	3	Electric potential, Poisson's and Laplace's equations, Potential of a localized charge distribution, Uniformly charged Spherical shell.	3	1
	4	Electrostatic boundary conditions – E and V (Derivations not needed)	1	1
II	**ELECTROSTATIC FIELD IN MATTER (Book 1, Chapter : 4)**		**9**	
	5	Polar and Nonpolar molecules, Induced dipole and polarizability. Alignment of polar molecules in uniform and nonuniform electric field.	2	2
	6	Polarization in a Dielectric Material, The field of a polarized object: Bound and Free Charges, Bound Charge Density, Physical interpretation of bound charges	3	2
	7	Electric displacement, Gauss's law in presence of dielectric.	2	1, 2
	8	Boundary conditions (Derivations not needed)	2	2
III	**MAGNETOSTATICS (Book 1, Chapter : 5)**		**9**	
	09	Lorentz Force, Electric Current- surface current density, volume current density, Equation of continuity.	2	3
	10	The Biot- Savarts law, Applications-Magnetic field due to long wire and circular loop	2	3
	11	Magnetic flux, Gauss's law in magnetism, Divergence of B (Physical interpretation only)	1	3

	12	Ampere's law, Curl of B (Physical interpretation only), Applications- Magnetic field due to Solenoid and Toroid	2	3
	13	Boundary conditions (Derivations not needed)	1	3
IV	**ELECTROMAGNETIC INDUCTION AND WAVES (Book 1, Chapter : 7, 9)**		**9**	
	14	Electromagnetic Induction, Faraday's law, Lenz's law, Motional e m f, Induced electric field	2	4
	15	Self - inductance and Mutual inductance, back emf	1	4
	16	Maxwell's equation, correction of Ampere's circuital theorem,	2	4
	17	Waves in one dimension: Wave equation of electromagnetic waves in vacuum, propagation of electromagnetic waves through vacuum and linear dielectric media	3	4
	18	Monochromatic planes waves, Energy and Momentum in EM waves	1	4
V*	**ALTERNATING CURRENT (Book 2, Chapter : 16)**		**9**	
	19	Description of A.C, mean and rms value of A.C, complex representation of A.C Circuits-Phasor diagram	2	5
	20	A.C circuit containing -Resistance only, Inductor only, capacitance only	2	5
	21	Circuit containing resistance and inductance in series, circuit containing resistance and capacitance in series, circuit containing inductor and capacitance in series	2	5
	22	LCR in series. Resonance, Sharpness of resonance, Quality factor	2	5
	23	Power in A.C circuit, Choke coil	1	5

DETAILED SYLLABUS: PRACTICALS

Part A – At least 5 Experiments to be performed		**CO No**
Sl No	**Name of Experiment**	
1	Potentiometer- Resistivity	6
2	Potentiometer –Calibration of ammeter	6
3	Carey Foster's Bridge-Resistivity	6
4	Carey Foster's Bridge-Temperature coefficient of resistance.	6
5	Mirror galvanometer-figure of merit.	6
6	BG- Absolute capacity of a condenser	6
7	Conversion of galvanometer into ammeter and calibration using digital Multimeter	6
8	Circular coil-Calibration of ammeter.	6
9	Absolute determination of m and B_h using box type and Searle's type vibration magnetometers	6
10	Searle's vibration magnetometer-comparison of magnetic moments.	6
11	Potentiometer – Calibration of high range voltmeter	6
12	Potentiometer - Reduction factor of TG	6
Part B* – At least One Experiment to be performed		
13	. Potentiometer –Calibration of low range voltmeter	6
14	Study of network theorems-Thevenin's & Norton's theorems and maximum power transfer theorem	6
15	Thermo emf- Measurement of thermo emf of thermocouple (Seebeck effect)	6
16	Circular coil-Study of earth's magnetic field using compass box.	6
17	Conversion of galvanometer into voltmeter and calibration using digital Multimeter.	6

COURSE OUTCOMES

CO No	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Identify the principles of electrostatics and apply it to the solutions of problems relating to electric field and boundary conditions	C	PSO-1,2
CO-2	Identify the mechanism of polarization and its various effects in dielectric, by applying the principles of electrostatics.	An	PSO-1,2
CO-3	Identify the principles of magnetostatics and apply it to the solutions of problems relating to magnetic field and boundary conditions.	C	PSO-1,2
CO-4	Recognize the concepts related to Faraday ‘s law, induced emf, Maxwell ‘s equations and compare the properties of electromagnetic waves in vacuum, and matter	An	PSO-1,2
CO-5	Summarize the basic concepts of Alternating Current, its complex representation and analyse the behaviour of current and voltage through different A.C circuits.	An	PSO-1,2,6
CO-6	Analyse the principle of Electromagnetism through hands-on experimentation	An	PSO-1,2,7

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

Name of the Course: ELECTRODYNAMICS

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 principles of electrostatics and	PO-1,2/ PSO-1,2	C	F, C	L	-

	apply it to the solutions of problems relating to electric field and boundary conditions					
CO-2	Identify the mechanism of polarization and its various effects in dielectric, by applying the principles of electrostatics.	PO-1,2/ PSO-1,2	An	C	L	-
CO-3	Identify the principles of magnetostatics and apply it to the solutions of problems relating to magnetic field and boundary conditions.	PO-1,2/ PSO-1,2	C	C	L	-
CO-4	Recognize the concepts related to Faraday ‘s law, induced emf, Maxwell ‘s equations and compare the properties of electromagnetic waves in vacuum, and matter	PO-1,2/ PSO-1,2,6	An	F, C, P	L	-
CO-5	Summarize the basic concepts of Alternating Current,	PO-1,2/ PSO-1,2,6	An	F, C, P	L	-

	its complex representation and analyse the behaviour of current and voltage through different A.C circuits.					
CO-6	Analyse the principles of Electromagnetism through hands-on experimentation	PO-1,2,4,6/ PSO-1,2,7	An	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	3	-	-	-	-	-	2	2	-	-	-	-	-	-
CO-2	3	3	-	-	-	-	-	2	2	-	-	-	-	-	-
CO-3	3	3	-	-	-	-	-	1	2	-	-	-	-	-	-
CO-4	3	3	-	-	-	-	-	2	2	-	-	-	-	-	-
CO-5	3	3	-	-	-	2	-	2	1	-	-	-	-	-	-
CO-6	2	2	-	-	-	-	3	2	1	-	1	-	1	-	-

Correlation Levels:

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

Assessment Rubrics:

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CO-2	✓	✓	-	✓
CO-3	✓	✓	-	✓
CO-4	✓	✓	-	✓
CO-5	✓	✓	-	-