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 Amplifier, Op-Amp with negative feedback, Inverting and Non Inverting Amplifier.	5	4
	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	Ap	1

	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.	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	PO 1/ PSO1	C	F, C	L	-

	operational amplifiers and construct digital logic circuits using digital logic principles and boolean algebra.					
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.	PO 1/ PSO 1	Ap	F, C	L	-
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 :

	PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO-1	2	-	-	-	-	-	-	2	-	-	-	-	-	-	-

CO-2	2	-	-	-	-	-	-	2	-	-	-	-	-	-	-
CO-3	2	-	-	-	-	-	-	1	-	-	-	-	-	-	-
CO-4	1	-	-	-	-	-	-	2	-	-	-	-	-	-	-
CO-5	2	-	-	-	-	-	-	2	-	-	-	-	-	-	-
CO-6	-	-	2	-	-	-	-	1	-	-	-	-	-	-	-

Correlation Levels:

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

Assessment Rubrics:

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

Mapping of COs to Assessment Rubrics :

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

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