KU1DSCPHY115:Semiconductor Physics and Electronics

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
1	DSC	100	KU1DSCPHY115	4	75

Learning Approach (Hours/ Week)		Marks Distribution			Duration of ESE (Hours)
Lecture+ Tutorial	Practical	CE	ESE	Total	
3	2	35	65	100	2

Course Description:

This course offers an introduction to semiconductor physics, including the properties and behaviour of semiconductors, diodes, and transistors. Students will learn about pn junctions, diode rectifiers, transistor biasing, and various types of transistor amplifiers and oscillators. Practical laboratory sessions will reinforce theoretical concepts, focusing on diode characteristics, rectifier circuits, voltage regulation, and amplifier and oscillator designs.

Course Prerequisite: Higher secondary level Physics

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Understand the concept of energy bands in solids .	*R, U*
2	Understand the principle and applications of PN junction diode , Zener diode and LEDs	*U, A, An*
3	Understand the structure, operations, characteristics of transistor	*R, U*
4	Analyse the characteristics of various transistor configurations and application of BJT as amplifier	*A, An*

Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	3	2	1	2	3	2	1
CO 2	3	2	2	2	3	2	1
CO 3	3	2	2	3	3	2	1
CO 4	3	2	3	3	3	2	1

Correlation level 0-None, 1-Slight, 2-Medium, 3-High

COURSE CONTENTS

Contents for Classroom Transaction:

MODULE	UNIT	DESCRIPTION	HOURS
1	**Introduction to Electronics and Energy bands**		**10**
	1	Electronics, Atomic structure, Structure of elements, The Electron, energy of an electron , valence electrons, free electron	**2**
	2	Voltage source, constant voltage source, constant current source	**2**
	3	Bohr atom model, energy levels and energy bands	**3**
	4	Important energy bands in solids, classification of solids and energy bands, silicon	**3**

	Section 1.1-1.10, 4.1-4.6 of Book 1		
2	**Semiconductor Physics**		**12**
	1	Semiconductor, Bonds in semiconductor, commonly used semiconductors, Energy band description of semiconductors, Effect of temperature on semiconductors, Hole current,	3
	2	Intrinsic semiconductor, n-type semiconductor, p-type semiconductor, charge on n-type and p-type semiconductor, majority, and minority carriers	3
	3	pn junction, Properties of pn junction, Biasing a pn junction, Current flow in a forward biased pn junction	3
	4	Voltage – Ampere characteristics of pn junction and important terms and limitation in the operating condition of pn junction.	3
		Book 1, Sections 5.1 to 5.20	
3	**Semiconductor Diode**		**12**
	1	Semiconductor diode, Crystal diode rectifier, resistance of crystal diode, important terms	2
	2	Half wave rectifier, Output frequency of Half –wave rectifier, efficiency of half wave rectifier	2
	3	Full wave rectifier, Centre - tap full wave rectifier, Full wave bridge rectifier, output frequency of full wave rectifier and efficiency of full wave rectifier, Ripple factor, Comparison of rectifiers	5
	4	Zener diode, Zener diode as voltage stabilizer, LED-LED voltage and current, advantages of LED, multi coloured LED, applications of LED	3
		Book 1, Sections 6.1-6.3, 6.6, 6.7 – 6.15, 6.18 - 6.19, 6.25 – 6.27,7.2-7.4	
4	**Transistors and transistor biasing**		**11**
	1	Transistor, naming the transistor terminals, some facts about transistor, transistor action, transistor symbols	2

	2	Transistor connection, Common base connection, Characteristics of common base connection, Common emitter connection, Characteristics of common emitter connection, Common collector connection	4
	3	Comparison of Transistor connections , commonly used transistor connection, Transistor as an amplifier in CE arrangement	5
	Book 1, Sections 8.1 – 8.10, 8.12 –8.16		
5	**Practical Module**		**30**
	Directions: Any 4 experiments from the list plus 2 experiments designed by course faculty		
	1. Familiarization of electronic components-resistors, diodes, capacitors, transistors, colour code of resistors 2. Determine resistance and resistivity of a wire using potentiometer 3. Find the radius of a capillary tube using travelling microscope 4. Determine angle of the prism using spectrometer 5. Forward and reverse characteristics of pn junction diode. 6. Half wave rectifier using a diode. Study ripple factor with and without filter. 7. Reverse characteristics of Zener diode 8. Experiments using LEDs		

Essential Readings:

1. Principle of Electronics, V K Metha and Rohith Mehtha, 11th Edn, S Chand & Company, 2019.

Suggested Readings:

1. Electronic Devices, 9th Edition ,Thomas L Floyd (Pearson), 2012.
2. Electronic Devices and Circuits, David A Bell, 5th Edn. 2009.
3. Electronic Devices and circuit theory, 11th Edn Robert L Boylestad & Louis Nashelsky Pearson Education, 2015.
4. Electronic Principles - A P Malvino (TMH), 2006.
5. Basic Electronics and Linear Circuits NN Bhargava, DC Kulshreshtha and SC Gupta (Mc Graw Hill)

Assessment Rubrics:

Evaluation Type			**Marks**	**Evaluation Type**			**Marks**	**Total**
Lecture			**75**	**Practical**			**25**	**100**
a)	**ESE**		**50**	a)	**ESE**		**15**	
b)	**CCA**		**25**	b)	**CCA**		**10**	
	i	*Test Paper	10		i	Punctuality	3	
	ii	**Assignment/ Book-Article review	10		ii	Skill	4	
	iii	Seminar/ Viva-Voce	5		iii	Record	3	

*Best out of two test papers

** or any other activities like quiz, open book exam, group activity