22EE260 ELECTRONIC DEVICES AND CIRCUITS

Category	L	T	P	Credit
PCC	3	0	0	3

Preamble

Signals contain information about a variety of things and activities in our physical world. An observer, be it a human or a machine, invariably needs to condition and process the signals in some predetermined manner to extract the required information from the signal. This signal conditioning/processing is usually most conveniently performed by electronic systems. The signal conversion/conditioning/processing is done by using different semiconductor/signal conditioning devices like diodes, transistors and voltage regulator ICs, etc. These could involve rectification, filtering, regulation, amplification, modulation, demodulation, mixing, frequency synthesizing etc.

Course Outcomes

On the successful completion of the course, students will be able to

CO No.	COURSE OUTCOMES	TCE Proficiency Scale	Expected Proficiency in %	Expected Attainment Level %
CO1	Explain the characteristics and applications of diode, special diodes, BJTs and MOSFETs	TPS2	80	85
CO2	Design rectifier, clipper and clamper circuits for the given specifications	TPS3	80	85
CO3	Design BJT and MOSFET based amplifier for the given specifications	TPS3	80	85
CO4	Explain the operation of Class A,B,C and D power amplifiers	TPS2	80	85
CO5	Design feedback amplifiers and oscillators for the given specifications	TPS3	80	85
CO6	Explain the operation of Opto-electronic devices	TPS2	80	85

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L						M		M				M	
CO2	S	M	L	L				M		M				S	
CO3	S	M	L	L				M		M				S	
CO4	M	L						M		M				M	
CO5	S	M	L	L				M		M				S	
CO6	M	L						M		M				S	

S- Strong; M-Medium; L-Low

Assessment Pattern: Cognitive Domain

CO	CAT1						CAT2						Assignment 1				Assignment 2				Terminal					
TPS Scale	1	2	3	4	5	6	1	2	3	4	5	6	3	4	5	6	3	4	5	6	1	2	3	4	5	6
CO1	10	10											20								5	10				
CO2	10	10	30										40										25			
CO3		10	20										40										20			
CO4							10	10									20				5	5				
CO5							5	15	40								60				5		15			
CO6							5	15									20				5	5				

Syllabus

Diode: Semiconductor – Types, Drift and Diffusion currents, Diode-Operation, V-I Characteristics, Current equation, Parameters and equivalent circuit, Load line analysis, Transition and Diffusion capacitance, Reverse recovery Characteristics, Application of Diodes – Wave shaping circuits: Rectifiers, Clippers and Clampers.

Special Diodes: Zener diode, Varactor diode, Schottky Diode and their application - Selection of diode using data sheets for the given application.

BJTs and UJT: Operation of NPN and PNP transistor, Characteristics of BJT in CB, CE and CC configurations, DC and AC load line, Fixed, Emitter feedback and Voltage divider bias, Stability factor, Application of BJT as amplifier, BJT as switch, Switching characteristics of BJT, Low frequency and high frequency hybrid model, AC analysis of BJT CE amplifier - Selection of BJT using data sheets for the given application - Working principle, operation and applications of UJT.

MOSFETs: Introduction to JFET, Construction, Operation, Characteristics and Parameters of MOSFET, MOSFET as a voltage controlled resistor, Voltage divider bias in MOSFET CS

amplifier, Small signal model of MOSFET- AC analysis of MOSFET CS amplifier, Selection of MOSFET using data sheets for the given application-Introduction to FinFET.

Power Amplifiers: Construction and operation of Class A, B, C and D amplifiers.

Feedback amplifiers & Oscillators: Positive and negative feedback- Feedback amplifiers-Gain and frequency response - Oscillators – Colpitts, Hartley and Crystal oscillator

Opto-electronic Devices: Photo diode, Photo transistor, LED**,** LCD, Laser diode, Opto-couplers, IR Emitter and Detector.

Text Book

1. Robert Boylestad and Louis Nashelsky, “Electronic Devices and Circuit Theory”, 11th Edition, Pearson Education, 2013.

Reference Books & web resources

1. Floyd T.L,” Electronic Devices”, 10th Edition, Pearson Education, 2017.
2. David A. Bell, “Electronic Devices and Circuits”, 5th Edition, Prentice Hall India, 2010.
3. Albert Malvino and David J.Bates, “Electronic Principles”, 7th Edition, Tata Mc-Graw Hill, 2017.
4. Jacob Millman, Halkias C.C and Satyabrata Jit, “Electronic Devices and Circuits”, 4th Edition, Tata Mc-Graw Hill, 2012.
5. Sedra A.S. and Smith K.C, “Microelectronic Circuits”, 7th Edition, Oxford press, 2014.
6. Donald A.Neamen, “Electronic circuit analysis and design”, Second edition, Tata Mc-Graw Hill, 2003.
7. VK.Mehta and Rohit Mehta, “Principles of Electronics”, S.Chand and Company, 11th Edition, 2008.

Course Contents and Lecture Schedule

S.No.	Topics	No. of Lectures	CO
1.	**Diode**		
1.1	Semiconductor–Types, Drift and Diffusion currents	1	CO1
1.2	Operation, V-I Characteristics, Current equation, Parameters and equivalent circuit	1	CO1
1.2	Load line analysis, Transition and Diffusion capacitance, Reverse recovery Characteristics	1	CO1
1.3	Application of Diodes – Rectifiers	2	CO2
1.4	Clippers and Clampers	2	CO2
2.	**Special Diodes**		
2.1	Zener diode, Varactor diode, Schottky Diode and their application	1	CO1
2.2	Selection of diode using data sheets for the given application.	1	CO2
3.	**BJTs**		
3.1	Operation of NPN and PNP transistor, Characteristics of BJT in CB, CE and CC configurations	1	CO1
3.2	DC & AC load line, Fixed and Emitter feedback bias	2	CO3
3.3	Voltage divider bias, Stability factor	1	CO3
3.4	Application of BJT as amplifier and switch	1	CO2
3.5	Switching characteristics of BJT	1	CO1

3.6	Low frequency and high frequency hybrid model, AC analysis of BJT CE amplifier – Selection of BJT using data sheets for the given application	1	CO3
3.7	Characteristics and applications of UJT	2	CO1
4.	**MOSFETs**		
4.1	Introduction to JFET, Construction, Operation, Characteristics and Parameters of MOSFET	2	CO1
4.2	MOSFET as a voltage controlled resistor, Voltage divider bias in MOSFET CS amplifier	2	CO3
4.3	Small signal model of MOSFET- AC analysis of MOSFET CS amplifier	2	CO3
4.4	Selection of MOSFET using data sheets for the given application	1	CO1
4.5	Introduction to FinFET	1	CO1
5.	**Power Amplifiers**		
5.1	Construction and operation of Class A, B, C and D amplifiers	2	CO4
6.	**Feedback amplifiers & Oscillators**		
6.1	Positive and negative feedback	1	CO5
6.2	Feedback amplifiers- Gain and frequency response	1	CO5
6.3	Oscillators – Colpitts, Hartley and Crystal oscillator	1	CO5
6.4	Design of Oscillators	2	CO5
7.	**Opto-electronic Devices**		
7.1	LED, LCD	1	CO6
7.2	Laser diode, Photo-diode Photo-transistor	1	CO6
7.3	Opto-couplers, IR Emitter and Detector	1	CO6
	Total	36	

Course Designers

1. Dr. M.Saravanan, Professor, EEE mseee@tce.edu
2. Dr. V.Suresh Kumar, Professor, EEE vskeee@tce.edu

		Category	L	T	P	Credit
22EE270	**ELECTRICAL WORKSHOP**	ESC	0	0	2	1

Preamble

The course is designed to provide students a widespread knowledge and understanding of the basic Electrical Systems Components and Laws. The indispensable and pervasive knowledge of electrical wiring and the electronic circuits will give the students an insight to their practical approach in our daily life.

Prerequisite

NIL

Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	TCE Proficiency Scale	Expected Proficiency in %	Expected Attainment Level %
CO1	Analyze the resistance, inductance and capacitance of various dimensions/shapes of materials experimentally	TPS2	25	30
CO2	Analyze Electric field lines and equi-potential lines of different electrode configurations experimentally.	TPS2	25	30
CO3	Practice assembling, soldering and testing of the given simple electronic circuit using PCB	TPS3	25	30
CO4	Verify Electrical circuit laws, and theorems for the electric circuit using hardware and simulation software	TPS3	25	30
CO5	Verify series resonance phenomena in a RLC circuit experimentally	TPS4	40	50
CO6	Analyze the transient behavior of the given RL, RC, RLC circuits experimentally	TPS2	25	30

*** Weightage depends on Bloom's Level, number of contact hours,

Mapping with Programme Outcomes and Programme Specific Outcomes

Cos	PO 1	PO 2	PO 3	PO 4	PO5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	S	S	M	M	S			M	M	M				S	S
CO2	S	S	M	M	S			M	M	M				S	S
CO3	S	S	M	M	S			M	M	M				S	S
CO4	S	S	M	M	S			M	M	M				S	S
CO5	S	S	M	M	S			M	M	M				S	S
CO6	S	S	M	M	S			M	M	M				S	S

S- Strong; M-Medium; L-Low