INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad - 500 043

ELECTRONICS AND COMMUNICATION AND ENGINEERING

COURSE DESCRIPTION FORM

Course Title	**ELECTRONIC DEVICES AND CIRCUITS**			
Course Code	**R15 – A30404**			
Course Structure	Lectures	Tutorials	Practicals	Credits
	4	1	3	4
Course Coordinator	Mr V.R.Seshagiri Rao, Professor,HOD Department of ECE			
Team of Instructors	Mr. M. Ramesh Babu, Professor,HOD Department of ECE Mr. D. Khalandar Basha, Associate Professor, Department of ECE Ms. C. Deepthi, Associate Professor, Department of ECE			

I. COURSE OVERVIEW:

This course provides the basic knowledge over the construction and functionality of the basic electronic devices such as diodes and transistors. It also provides the information about the uncontrollable and controllable electronic switches and the flow of current through these switches in different biasing conditions. This course is intended to describe the different configurations and modes of controllable switches and how these electronic devices can be configured to work as rectifiers, clippers, clampers, oscillators and amplifiers.

II. PREREQUISITE(S):

Level	Credits	Periods/ Week	Prerequisites
UG	4	4	Engineering Physics, Engineering Mathematics-I

III. MARKS DISTRIBUTION:

Sessional Marks	University End Exam Marks	Total Marks
Midterm Test There shall be two midterm examinations. Each midterm examination consists of essay paper, objective paper and assignment. The essay paper is for 10 marks of 60 minutes duration and shall contain 4 questions. The student has to answer 2 questions, each carrying 5 marks. The objective paper is for 10 marks of 20 minutes duration. It consists of 10 multiple choice and 10 fill-in-the blank questions, the student has to answer all the questions and each carries half mark. First midterm examination shall be conducted for the first two and half units of syllabus and second midterm examination shall be conducted for the remaining portion. Five marks are earmarked for assignments. There shall be two assignments in every theory course. Assignments are usually issued at the time of commencement of the semester. These are of problem solving in nature with	75	100

Sessional Marks	University End Exam Marks	Total Marks
critical thinking. Marks shall be awarded considering the average of two midterm tests in each course.		

IV. EVALUATION SCHEME:

S. No	Component	Duration	Marks
1	I Mid Examination	80 minutes	20
2	I Assignment	-	5
3	II Mid Examination	80 minutes	20
4	II Assignment	-	5
5	External Examination	3 hours	75

V. COURSE OBJECTIVES:

At the end of the course, the students will be able to:

I. Be familiar with the basic P-N junction diode, few special purpose diodes and their functioning.
II. Understand the diode as rectifier and regulator.
III. Be familiar with the construction, current flow, different configurations and modes of the three terminal electronic devices such as BJT and UJT.
IV. Be familiar with the different biasing techniques.
V. Be familiar with the field effect transistors and functioning as amplifier.

VI. COURSE OUTCOMES:

After completing this course the student must demonstrate the knowledge and ability to:

1. **Understand** the operation of various semiconductor diodes
2. **Analyze** characteristics of different types of diodes.
3. **Understand** the function of diode as rectifier.
4. **Analyze** and design various rectifier circuits.
5. **Understand** the operation of transistors in different configurations.
6. **Analyze** and characteristics of BJT and UJT in different modes.
7. **Understand** the biasing techniques of transistors.
8. **Design** and analyze the DC bias circuitry of BJT and FET.
9. **Design** biasing circuits using diodes and transistors.
10. **Analyze** and design amplifier circuits and oscillators employing BJT, FET devices.

VII. HOW PROGRAM OUTCOMES ARE ASSESSED:

Program Outcomes		Level	Proficiency assessed by
PO1	**Engineering knowledge**: An ability to apply knowledge of basic sciences, mathematical skills, engineering and technology to solve complex electronics and communication engineering problems (**Fundamental Engineering Analysis Skills**).	S	Assignments, Exercises
PO2	**Problem analysis**: An ability to identify, formulate and analyze engineering problems using knowledge of Basic Mathematics and Engineering Sciences. (**Engineering Problem Solving Skills**).	H	Design Exercises
PO3	**Design/development of solutions**: An ability to provide solution and to design Electronics and Communication Systems as per social needs **(Social Awareness)**	S	--
PO4	**Conduct investigations of complex problems**: An ability to investigate the problems in Electronics and Communication field and develop suitable solutions (**Creative Skills**).	S	Lab Sessions
PO5	**Modern tool usage** An ability to use latest hardware and software tools to solve complex engineering problems (**Software and Hardware Interface**).	S	Lab Exercises
PO6	**The engineer and society**: An ability to apply knowledge of contemporary issues like health, Safety and legal which influences engineering design (**Social Awareness**).	N	--
PO7	**Environment and sustainability** An ability to have awareness on society and environment for sustainable solutions to Electronics & Communication Engineering problems(**Social awareness**).	N	--
PO8	**Ethics**: An ability to demonstrate understanding of professional and ethical responsibilities(**Engineering impact assessment skills**).	N	--
PO9	**Individual and team work**: An ability to work efficiently as an individual and in multidisciplinary teams(**Team Work**).	N	Seminars Discussions
PO10	**Communication**: An ability to communicate effectively and efficiently both in verbal and written form(**Communication Skills**).	N	--
PO11	**Project management and finance**: An ability to develop confidence to pursue higher education and for life-long learning(**Continuing education awareness**).	S	Design Exercises, Seminars, Paper Presentations
PO12	**Life-long learning**: An ability to design, implement and manage the electronic projects for real world applications with optimum financial resources**(Practical engineering analysis skills**).	H	Design Exercises, Development of Prototypes, Mini Projects

N - None **S - Supportive** **H - Highly Related**

VIII. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes		Level	Proficiency assessed by
PSO1	**Professional Skills:** An ability to understand the basic concepts in Electronics & Communication Engineering and to apply them to various areas, like Electronics, Communications, Signal processing, VLSI, Embedded systems etc., in the design and implementation of complex systems.	H	Lectures and Assignments
PSO2	**Problem-solving skills:** An ability to solve complex Electronics and communication Engineering problems, using latest hardware and	S	Tutorials

Program Specific Outcomes		Level	Proficiency assessed by
	software tools, along with analytical skills to arrive cost effective and appropriate solutions.		
PSO3	**Successful career and Entrepreneurship:** An understanding of social-awareness & environmental-wisdom along with ethical responsibility to have a successful career and to sustain passion and zeal for real-world applications using optimal resources as an Entrepreneur.	S	Seminars and Projects

N - None **S - Supportive** **H - Highly Related**

IX. SYLLABUS:

UNIT -I:

P-N Junction Diode: Qualitative Theory of P-N Junction, P-N Junction as a Diode, Diode Equation, Volt-Ampere Characteristics, Temperature dependence of VI characteristic, Ideal versus Practical – Resistance levels (Static and Dynamic), Transition and Diffusion Capacitances, Diode Equivalent Circuits, Load Line Analysis, Breakdown Mechanisms in Semiconductor Diodes, Zener Diode Characteristics.

Special Purpose Electronic Devices: Principle of Operation and Characteristics of Tunnel Diode (with the help of Energy Band Diagram), Varactor Diode, SCR and Semiconductor Photo Diode.

UNIT-II:

Rectifiers and Filters : The P-N junction as a Rectifier, Half wave Rectifier, Full wave Rectifier, Bridge Rectifier, Harmonic components in a Rectifier Circuit, Inductor Filters, Capacitor Filters, L-Section Filters, π- Section Filters, Comparison of Filters, Voltage Regulation using Zener Diode.

UNIT-III:

Bipolar Junction Transistor and UJT: The Junction Transistor, Transistor Current Components, Transistor as an Amplifier, Transistor Construction, BJT Operation, BJT Symbol, Common Base, Common Emitter and Common Collector Configurations, Limits of Operation , BJT Specifications, BJT Hybrid Model, Determination of h-parameters from Transistor Characteristics, Comparison of CB, CE, and CC Amplifier Configurations, UJT and Characteristics.

UNIT-IV:

Transistor Biasing and Stabilization: Operating Point, The DC and AC Load lines, Need for Biasing, Fixed Bias, Collector Feedback Bias, Emitter Feedback Bias, Collector - Emitter Feedback Bias, Voltage Divider Bias, Bias Stability, Stabilization Factors, Stabilization against variations in VBE and β, Bias Compensation using Diodes and Transistors, Thermal Runaway, Thermal Stability, Analysis of a Transistor Amplifier Circuit using h-Parameters.

UNIT-V:

Field Effect Transistor and FET Amplifiers

Field Effect Transistor: The Junction Field Effect Transistor (Construction, principle of operation, symbol) – Pinch-off Voltage - Volt-Ampere characteristics, The JFET Small Signal Model, MOSFET (Construction, principle of operation, symbol), MOSFET Characteristics in Enhancement and Depletion modes.

FET Amplifiers: FET Common Source Amplifier, Common Drain Amplifier, Generalized FET Amplifier, Biasing FET, FET as Voltage Variable Resistor, Comparison of BJT and FET.

TEXT BOOKS:

1. J. Millman, C.C.Halkias and Satyabrata Jit, “Millman’s Electronic Devices and Circuits”, 2e, 1998, TMH.
2. Mohammad Rashid, “Electronic Devices and Circuits”, 2013, Cengage learning.
3. David A. Bell, “Electronic Devices and Circuits”, 5e, Oxford University Press.

REFERENCE BOOKS:

1. J. Millman and Christos C. Halkias, "Integrated Electronics", 1e, 2008, TMH.
2. R.L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuits", 9e, 2006, PEI/PHI.
3. B. P. Singh, Rekha Singh, "Electronic Devices and Circuits", 2e, 2013, Pearson.
4. K. Lal Kishore, "Electronic Devices and Circuits", 2e, 2005, BSP.
5. Anil K. Maini and Varsha Agarwal, "Electronic Devices and Circuits", 1e, 2009, Wiley India Pvt. Ltd.
6. S. Salivahanan, N. Suresh Kumar and A. Vallavaraj, "Electronic Devices and Circuits", 2e, 2011, TMH.

IX. COURSE PLAN:

At the end of the course, the students are able to achieve the following course learning outcomes:

Lecture No.	Topics to be covered	Course Learning Objectives	Reference
1-2	**P-N Junction Diode:** Qualitative theory of P-N Junction diode, junction as a diode	**Understand** the functioning of diode	T1: 5.1
3	Formation of PN Junction, operation PN Junction under forward and reverse direction.		T1: 5.2
4	Derivation of diode current equation.		T1: 5.3
5	V-I Characteristics, Effect of temp on V-I Characteristics of a diode.	**Examine** the P-N junction diode under different biasing conditions.	T1: 5.6-5.7
6	Comparison of ideal versus practical diode, Equivalent circuits of diode, load line analysis		T1: 5.6 – 5.7 R6: 1.7
7-8	Static & dynamic resistances, Transition and diffusion capacitance.		T1: 5.8 - 5.10
9	Avalanche break down.		T1: 5.12 R6: 1.15
10	Operation of Zener diode and V-I Characteristics, Zener break down	**Understand** the operation of Zener diode.	T1: 5.12
11	Operation of Tunnel diode, Varactor diode and V-I Characteristics	**Understand** the operation of tunnel diode.	T1:5.13-5.14 R6: 8.2
12-13	SCR and semiconductor photo diode.	**Understand** the operation of SCR and semiconductor photo diode.	R6: 8.5-8.6
14-15	**Rectifiers and Filters:** PN junction as a rectifier, Operation of half wave rectifier and its corresponding harmonic components.	**Understand** and analyze P-N diode as rectifier	T1: 6.1-6.2
16-17	Operation of full wave rectifier and its corresponding harmonic components.		T1: 6.3
18-19	Operation of bridge wave rectifier its corresponding harmonic components.		T1: 6.4-6.6
20	Types of filters, operation of Inductor and capacitor filters		T1: 6.7-6.8
21-22	L-section and Pi-Section filters, comparison of all filters		T1: 6.10-6.13
23	Zener diode as voltage regulator.	**Model** Zener diode as voltage regulator.	T1: 6.15
24	**Bipolar Junction Transistors and UJT:** Introduction to BJT, Construction, symbol	**Understand** the operation of bipolar transistor	T1: 7.1, 7.4
25	Operation of PNP and NPN transistors.		T1: 7.1

26	Transistor current components,		T1: 7.2-7.3
27	Input & output characteristics of a transistor in CB configuration.	**Examine** the BJT	T1:7.7
28	Input & output characteristics of a transistor in CE and configuration.		T1: 7.8-7.10
29	Input & output characteristics of a transistor in CC configurations, limits of operation		T1: 7.12
30	BJT specifications, BJT Hybrid model	**Understand** the Hybrid model of BJT	T1:9.6-9.7
31	Determination of h-parameters from transistor characteristics		T1:9.7
32-33	Transistor as an Amplifier, Comparison of CB, CE and CC amplifiers configuration.	**Model** the transistor as an amplifier	R6: 3.5
34	UJT and its characteristics	**Understand** the operation of UJT.	T1: 12.12 R6: 7.12-7.13
35	**Transistor biasing and stabilization:** Operating point.	**Analyze** and design proper BJT circuits	T1: 8.1
36	DC and AC load lines.		R6: 4.2
37	Need for biasing, fixed bias.		T1: 8.4
38-40	Collector feedback bias., Emitter feedback bias, Collector-Emitter feedback bias and voltage divider bias		T1:8.5-8.6
41-42	Bias stability, stabilization factor.		T1: 8.2 R6: 4.4
43	Bias compensation using diodes and transistor.		T1: 8.9 R6: 4.5
44	Thermal runaway and stability		T1: 8.12-8.13
45	h-parameter model for CB amplifier and their comparison.	**Distinguish** Hybrid model of BJT	T1: 10.6
46	h-parameter model for CE amplifier and their comparison.		T1: 10.4
47-48	h-parameter model for CC amplifier and their comparison.		T1: 10.5
49-50	**Field Effect Transistor and FET Amplifiers:** Junction field effect transistor (construction, principle, and symbol)	**Understand** the operation of JFET	T1: 12.1
51	Junction field effect transistor operation, pinch-off voltage		T1: 12.2
52	V-I characteristics of JFET		T1: 12.3
53-54	Small signal model of JFET		R6: 7.8
55-56	MOSFET (construction, principle of operation, symbol), characteristics in enhancement and depletion modes	**Understand** and analyze the operation of IGFETs	T1:12.5
57	MOSFET (principle of operation)		T1: 12.5
58	MOSFET characteristics in enhancement and depletion modes		R6: 7.7
59	FET Amplifiers: CS, CD Amplifier	**Model** the FET circuits	R6: 7.1-7.5
60-62	Biasing FET, Voltage variable resistor and comparison between BJT and FET.		T1: 12.11

X. MAPPING COURSE OBJECTIVES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Objectives	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
I	H	S	S		S							S	H	S	
II	S	S	H		S							S	H	S	
III	H	S	S		S							S	H	S	
IV	S	H	S		S							S	H	S	
V	S	S	S									S	H	S	

S – Supportive **H - Highly Related**

XI. MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	S	S	H									S	H	S	
2	S	S	S		S							S	S	S	
3	S	H	H		S							S	S	S	
4	S	H	S		H							S	H	S	
5	H	S	S	S								S	S	S	
6	S	H	H		H							S	H	S	
7	S											S	S	S	
8	H		H		H							S	H	S	
9	S	S		S								S	S	S	
10	S		H		S							S	S	S	

S – Supportive **H - Highly Related**

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