INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad -500 043

COMPUTER SCIENCE AND ENGINEERING

COURSE DESCRIPTION FORM

Course Title	**ELECTRONIC DEVICES AND CIRCUITS**			
Course Code	**A30404**			
Regulation	**R15 – JNTUH**			
Course Structure	Lectures	Tutorials	Practicals	Credits
	4	-	-	4
Course Coordinator	Mr.B.Naresh ,Assistant professor ,Department of ECE			
Team of Instructors	Mr.B.Naresh ,Mr.K.Arun Sai ,Mr. M.Lakshmi Ravi Teja ,Mr.G.Vijay kumar Assistant 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. PREREQUISITES:

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

III. COURSE ASSESSMENT METHODS:

a) Marks Distribution:

Session Marks	University End Exam Marks	Total Marks
There shall be 2 midterm examinations. Each midterm Examination consists of subjective type and Objective type tests. The subjective test is for 10 marks, with duration of 1 hour. Subjective test of each semester shall contain 4 questions, the student has to answer 2 questions, each carrying 5 marks. The objective type test is for 10 marks with duration of 20 minutes. It consists of 10 Multiple choice and 10 objective type questions, the student has to answer all the questions and each carries half mark. First midterm examination shall be conducted for the first four units of syllabus and second midterm examination shall be conducted for the remaining portion. Five marks are marked for assignments. There shall be two assignments in every theory course. Marks shall be awarded considering the average of two assignments in each course.	75	100

IV. EVALUATION SCHEME:

S. No	Component	Duration	Marks
1	I Mid Examination	80 minutes	20
2	I Assignment	-	05
3	II Mid Examination	80 minutes	20
4	II Assignment	-	05
5	External Examination	3hours	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 erminal 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	Ability to apply acquired knowledge of science and engineering fundamentals in problem solving.	H	Assignments and Tutorials
PO2	Ability to undertake problem identification, formulation and providing optimum solution in software applications.	S	Experiments
PO3	Ability to utilize systems approach in designing and to evaluate operational performance of developed software.	N	------
PO4	Graduates will demonstrate an ability to identify, formulate and solve complex information technology related problems.	S	Experiments
PO5	Graduate will be capable to use modern tools and packages available for their professional arena.	H	Assignments, Exams
PO6	Understanding of the social, cultural responsibilities as a professional engineer in a global context.	H	Assigning Mini Projects
PO7	Understanding the impact of environment on engineering designs based on the principles of inter-disciplinary domains for sustainable development.	H	Assignments

PO8	Ability to understand the role of ethics in professional environment and implementing them.	N	------
PO9	Competency in software development to function as an individual and in a team of multidisciplinary groups.	H	Assignments, Tutorials and Exams
PO10	Ability to have verbal and written communication skills to use effectively not only with engineers but also with community at large.	N	-----
PO11	Ought to have strong fundamentals in Information Technology and be able to have lifelong learning required for professional and individual developments.	H	Lab and Exams
PO12	Be able to design, implement and manage projects in Information Technology with optimum financial resources with, environmental awareness and safety aspects.	N	------

N= None S= Supportive H = Highly Related

VIII. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes		Level	Proficiency assessed
PSO1	**Professional Skills:** The ability to research, understand and implement computer programs in the areas related to algorithms, system software, multimedia, web design, big data analytics, and networking for efficient analysis and design of computer-based systems of varying complexity.	H	Lectures, Assignments
PSO2	**Software Engineering practices:** The ability to apply standard practices and strategies in software service management using open-ended programming environments with agility to deliver a quality service for business success.	S	Projects
PSO3	**Successful Career and Entrepreneurship:** The ability to employ modern computer languages, environments, and platforms in creating innovative career paths, to be an entrepreneur, and a zest for higher studies.	H	Guest Lectures

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.

X. COURSE PLAN:

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.		T1:7.7

28	Input & output characteristics of a transistor in CE and configuration.	**Examine** the BJT	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

XI. MAPPING COURSE OBJECTIVES LEADING TO THE ACHIEVEMENT OF PROGRAM 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	H	S		S							S		S	S
II	S	S	H		S							S	S	S	S
III	H	S	S		S							S			S
IV	S	H	S		S							S		S	S
V	H	S	S									S	S		S

S – Supportive **H - Highly Related**

XII. MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM 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	S		S
2	H	S	S		H							S		S	S
3	S	H	H		S							S	S		S
4	S	H	S		H							S		S	S

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