INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE DESCRIPTION FORM

Course Title	**ELECTRONIC CIRCUITS**			
Course Code	**A40413**			
Regulation	**R15**			
Course Structure	Lectures	Tutorials	Practicals	Credits
	4	--	--	4
Course Coordinator	**Ms ANUSHA .N , Assistant Professor**			
Team of Instructors	**Ms ANUSHA .N , Assistant Professor**			

I. COURSE OVERVIEW:

The course is an introduction to Electronic Circuits which are the applications such as amplifiers oscillators and multi vibrators. This course deals with single stage amplifiers, feedback amplifiers and design aspects of power amplifiers to drive loud speakers. The lectures introduce basic ideas of Non-linear wave shaping such as Clippers &Clampers and linear wave shaping, their responses to sine, step, pulse, square and ramp inputs. The lecturers also cover the design and analysis of different types of multi vibrators and switching characteristics of devices such as diode, transistor and their design, switching times.

PREREQUISITES:

Level	Credits	Periods	Prerequisite
UG	4	**4**	1.Knowledge of electronic circuits 2.Knowledge of Amplifiers 3. knowledge of pulse circuits

II. COURSE ASSESSMENT METHODS:

a) Marks distribution:

Session marks	University end exam marks	Total marks
There shall be two mid tem examinations. Each id term exam consists of subjective type and objective type test. The subjective test is for 10 marks, with duration of 1 hour. Subjective test of each semester shall contain four questions; the student has to answer two out of them. Each carrying 5 marks The objective test paper Is prepared by JNTUH, which consists of 20 questions each carrying 0.5 marks and total of 10 marks. The student is assessed by giving two assignments, one, after completion of 1to 4 units and the second, after the completion of 4 to 8 units each carrying 5 marks. On the total the internal marks are 25.	75	100

The average of two internal tests is the final internal marks. The external question paper is set by JNTUH consisting of 8 questions each carrying 15 marks out of which 5 questions are to be answered their by external examination is of total 75 mark		

III. EVALUATION SCHEME:

S. No	Component	Duration	Marks
1	I Mid Examination	90 minutes	20
2	I Assignment	--	05
3	II Mid Examination	90 minutes	20
4	II Assignment	--	05
5	External Examination	3 hours	75

IV. COURSE OBJECTIVE:

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

a) Understand the classification of amplifiers and Approximation model of transistor and also know the types of feedback amplifiers
b) To understand the concepts of frequency response of BJT&FET amplifiers and their design & construction of amplifier circuits to amplify signals at various frequencies.
c) Design and analysis of Multi-vibrators and Non-Linear wave shaping(Clippers & Clampers) circuit
d) To design, construct and analyze power amplifiers to achieve better efficiencies and also to analyze Linear wave shaping circuits for different inputs
e) To make the students to understand the switching times of diode and transistor.

V. COURSE OUTCOMES:

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

1. Understand working principles of electronic measuring instruments.
2. Understand advantages & applications of electronic measuring instruments.
3. Understand design and analysis of electronic voltmeters, ammeters and ohmmeters
4. To apply the operating knowledge of major electronic measuring instruments& advanced meters toselect and used for Engineering problems by making use of modern instruments.

VI. HOW PROGRAM OUTCOMES ARE ASSESSED:

Program outcomes		Level	Proficiency assessed by
PO1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	H	Assignments
PO2	**Problem Analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	S	Exercise

PO3	**Design/Development of Solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	H	Projects
PO4	**Conduct Investigations of Complex Problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	N	-------
PO5	**Modern Tool Usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.	S	Discussion, Seminars
PO6	**The Engineer and Society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.	S	Exercise
PO7	**Environment and Sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	H	Discussion, Seminars
PO8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.	S	Discussions
PO9	**Individual and Team Work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	S	Discussions
PO10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	S	Discussion, Seminars
PO11	**Project Management and Finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	S	Discussions, Seminars
PO12	**Life – Long Learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	S	Prototype, discussions

N= None **S=Supportive** **H=highly related**

VII. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes		Level	Proficiency assessed by
PSO1	**Professional Skills:** Able to utilize the knowledge of high voltage engineering in collaboration with power systems in innovative, dynamic and challenging environment, for the research based team work.	S	Lectures, Assignments
PSO2	**Problem-Solving Skills:** Can explore the scientific theories, ideas, methodologies and the new cutting edge technologies in renewable energy engineering, and use this erudition in their professional development and gain sufficient competence to solve the current and future energy problems	N	------

	universally.		
PSO3	**Successful Career and Entrepreneurship:** The understanding of technologies like PLC, PMC, process controllers, transducers and HMI one can analyze, design electrical and electronics principles to install, test , maintain power system and applications	S	Guest Lectures

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

VIII. SYLLABUS

UNIT - I

Single stage Amplifiers Design and Analysis:
Review of CE, CB, CC& CS amplifiers-Classification of Amplifiers, Distortion in amplifiers-Approximate analysis, CE, CB, CC amplifiers comparison.

Feedback Amplifiers:
Concept of feedback, classification of feedback amplifiers, General characteristics of feedback amplifiers, Effect of feedback on Amplifier characteristics- Voltage series- Voltage shunt, Current series and Current shunt feedback configurations- Simple problems.

UNIT - II

BJT & FET Frequency Response:
Logarithms Decibels, General frequency considerations, Low frequency Analysis, Low frequency response of BJT amplifiers, Low frequency response of FET amplifier, Miller effect capacitance, High frequency response of BJT amplifier, Square wave testing

UNIT - III

Multivibrators:
Analysis and Design of Bi-stable, Monostable, Astable - multivibrator and Schmitt trigger using Transistors

Clippers and Clampers:
Diode clippers, Transistor clippers, clipping at two independent levels, Transfer characters of clippers, Emitter coupled clipper, Comparators, applications of voltage comparators, Clamping operation, clamping circuits using diode with different inputs, clamping circuit theorem, practical clamping circuits, effect of diode characteristics on clamping voltage, Transfer characteristics of clampers.

UNIT - IV

Large signal Amplifiers:
s-A power Amplifier, Maximum value of efficiency of class-A Amplifier, Transformer coupled amplifier- Push-pull amplifier-Complimentary Symmetry circuits-Phase inverters, Transistor power Dissipation, Thermal runaway, Heat sinks.

Linear Wave shaping:
High pass, Low pass RC circuits, their response for sinusoidal, pulse, square and ramp inputs.

UNIT - V

Switching characteristics of devices:
Diode as a switch, piecewise linear diode characteristics, Transistor as a switch, Break down voltage considerations of transistor, saturation parameters of transistor and their variation with temperature, Design of transistor switch, transistor switching times.

TEXT BOOKS:

1. Electronic Devices and Circuit Theory, Robert L. Boylestad, Louis Nasheisky, 9th Edition 2007, Pearson Education.
2. Electronic Devices and Circuits by S. Salivahanan, N.Suresh Kumar and A.Vallavaraj, 2nd 2008, Tata McGraw Hill edition companies.
3. Solid state pulse circuits by David A. Bell, 4thedition, prentice Hall of India.

REFERENCES:

1. Introductory Electronic Devices and circuits-Robert T.Paynter, 7th edition 2009, PEI
2. Electronic Devices and circuits, Anil K.Mani, Varsha Agarwal, 1st edition WILEY.
3. Electronic Circuits by S. Salivahanan, N.Suresh Kumar and A.Vallavaraj, 2nd 2008, Tata McGraw Hill edition companies.
4. Pulse and Digital Circuits by A.Anand Kumar
5. Pulse, Digital and Switching Waveforms by Jacob Millman, Herbert Taub, Mothiki S. Prakash Rao (20083rd edition, Tata McGraw Hill edition companies.)

IX. COURSE PLAN:

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

Lecture . No.	CLO	Learning Outcomes	Unit No.	Topic to be covered	Reference
1-3	1	**Memorize** the characteristics of CE, CB , CC &CS amplifiers, classification and Distortions in amplifiers	I	Introduction, Transistor as an amplifier, Classification of amplifiers, Review of CE, CB, CC & CS amplifiers& Distortion in amplifiers	**R3 1.45,1.68**
4-10	2	**Analyze** the transistor models of CE, CB and CC amplifiers using h-parameters and distinguish among three amplifier circuits.		Approximate analysis, Analysis of a transistor using exact model, Approximate analysis of CE and CC amplifiers, Approximate analysis of CB amplifier and comparison of CE, BB, CE amplifiers	**R3 1.33,1.41**
10-14	3	**Classify** the feedback amplifiers and know the characteristics of negative feedback amplifiers.		Introduction to Feedback amplifiers and classification General characteristics of Negative feedback amplifiers	**R3 3.1,3.5**
16	4	**Apply** feedback on amplifier characteristics and know the effect.		Effect of feedback on amplifier characteristics.	**R3 3.7**
17-22	5	**Analyze** the feedback topologies of negative feedback amplifiers and problems		Voltage series, voltage shunt , current series and current shunt feedback configurations, Simple problems	**R3 3.12,3.15,3 .17**
23	6	**Recall** the frequency response of BJT & FET amplifiers.	II	Introduction to BJT & FET Frequency responses	**R3 2.1**
23	7	**Define** Logarithms-Decibels to solve transistor gain problems		Logarithms-Decibels	**R3 2.3**
24	8	**Analyze** the frequency response of different coupling schemes of amplifiers and low frequency BJT		General frequency considerations, Low frequency Analysis of BJT Low frequency response of BJT,	**R3 2.7,2.9**

		amplifier			
25	9	**Examine** the low frequency response of BJT and FET amplifiers.		Low frequency response of FET Miller effect capacitance	**R32.14,2.18, 2.30**
26-27	11	**Explain** the π-model (high frequency) model of transistor and understand the frequency response.		High frequency response of BJT	**R3 2.20**
28	12	**Estimate** different parameters of π-model. **Test** the frequency response for square wave input.		Problems on π-model of transistor Square wave testing	**R3 2.19,2.21,2 .43**
29	13	**Describe** about multivibrators	III	Introduction to Multivibrators	**R4, 223**
29-34	14	**Design** of multivibrators.**Analyze** bistable, monostable and astable multivibrators		Analysis & Design of Bi-stable, Analysis & Design of Mono-stable, Analysis & Design of Astable multivibrator	**R4,225,279, 299**
35	15	**Construct** Schmitt trigger circuit using transistors and calculate LTP and UTP.		Schmitt trigger using Transistors	**R4 261**
36	16	**Design** multivibrators from given parameters		Problems on Multivibrators	**R4, 269**
37	17	**Define** Non-linear wave shaping		Introduction to Non-linear wave shaping	**R4, 104**
38-40	18	**Explain** the operation of different types of clippers to understand the operation of clippers.		Diode clippers and Transistor clippers ,Emitter coupled clipper, Clipping at two independent levels, Transfer characteristics of clippers	**R4,111, 115,107**
41	19	**Write** the applications of comparators.		Comparators, applications of voltage comparators	**R4, 149**
42-44	20	**Discuss** about clamping circuits, clamping theorem and effect of diode characteristics on clamping voltage.		Clamping operation, clamping circuits using diode with different inputs, Clamping circuit theorem, Practical clamping circuits, Effect of diode characteristics on clamping voltage, Transfer characteristics of clampers	**R4,153,161,16 5**
45-46	21	**Classify** power amplifiers based on the location of operating point.	IV	Introduction to Large signal amplifiers, Classification of Power amplifiers, Class-A power amplifier	**R3, 5.2**
47-49	22	**Design** of different types of power amplifiers and calculate efficiency of each amplifier.		Transformer coupled amplifier Push-Pull Amplifier, Complimentary Symmetry Circuits	**R3,5.13, 5.19**
50-53	23	**Explain** the operation of phase inverter and power dissipation in transistor.		Phase inverters, Transistor power dissipation, Thermal runway, Heat sinks Problems on power amplifiers	**R3, 5.21,5.23**
54	24	**Define** Linear wave shaping to understand linear circuits.		Introduction to Linear wave shaping.	**R4, 1**
55-57	25	**Identify** the high pass and Low pass circuits and their responses to different inputs.		High pass and Low pass RC circuits and their response for sine, step, pulse, square and ramp inputs	**R4,5,10, 23**
58-59	26	**Compute** upper 3dB frequency of low pass circuit.		Problems on Linear wave shapingers	**R4,17**

60-63	27	**Describe** the switching characteristics of diode and transistor	V	Introduction to switching characteristics of devices, Piecewise linear diode characteristics Diode as a switch, Transistor as a switch	**R4 ,200,202**
64	28	**Explain** the breakdown phenomenon of a transistor.		Breakdown voltage considerations of transistor	**R4,205**
65	29	**Indicate** the saturation parameters of transistor and their variation with temperature.		Saturation parameters of transistor and their variation with temperature	**R4,208, 209**
66-69	30	**Design** of a transistor switch and switching times of diode and transistor.		Design of a transistor switch Diode switching times witching times of a Transistor Problems on switching characteristics of devices	**R4, 199,210, 203,**

X. MAPPING COURSE OBJECTIVES LEADING TO THE ACHIEVEMENT OFPROGRAM 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
a	S	S	S		S	H			S	S	S	S	S	S	S
b	S	S	H	S	S	H	S		S			S	S	S	S
c	S	H	H		S			S				S	S	H	S
d	S	H	H	S	H	S			S	S	S	S	S	S	S
e	H	H	S	S		H	S		S	S	S	S	S	H	S

S – Supportive **H - Highly Related**

XI. MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF THE PROGRAM OUTCOME

Course Objectives	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	H	S	H		S	H		S	S	S	S	S	S	S	S
2	S	S	H	S	S	H	S		S		S	S	S	H	S
3	S	S	H	S	S		S		S		S	S	S	H	S
4	S	H	H	S	S	S			S	S	S	S	S	S	S

S – Supportive **H - Highly Related**

Prepared by: Ms. Anusha. N, Assistant Professor

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