INSTITUTE OF AERONAUTICAL ENGINEERING

(AUTONOMUS)
Dundigal, Hyderabad - 500 043

ELECTRONICS AND COMMUNICATION ENGINEERING

COURSE DESCRIPTION FORM

Course Title	**ELECTRONIC CIRCUIT ANALYSIS**			
Course Code	**A40412**			
Regulation	**R13 – JNTUH**			
Course Structure	Lectures	Tutorials	Practicals	Credits
	4	1	-	4
Course Coordinator	Mrs. C Deepthi, Associate Professor, ECE			
Team of Instructors	Mrs. C Deepthi, Assistant Professor, ECE Mrs .G Ajitha , Assistant Professor, ECE Mrs. L. Sruthi, Assistant Professor, ECE Mr . K. Ravi, Assistant Professor, ECE			

I. COURSE OVERVIEW:

This course starts by introducing some basic ideas of electronic amplifiers, oscillator and tuned circuits. Subsequently the course covers important concepts like analysis of a single stage, multistage amplifiers. Frequency response analysis of various amplifiers is also discussed. Next the course probes into brief introduction and emphasis of MOS Amplifier. Further, design concepts of large signal (power) amplifiers are explained. In later units study of feedback concepts (both positive and negative), Oscillators and Tuned amplifiers circuits are emphasized.

II. PREREQUISITE(S):

Level	Credits	Periods/ Week	Prerequisites
UG	4	5	Electronic Devices & Circuits

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	75	100

Sessional Marks	University End Exam Marks	Total Marks
every theory course. Assignments are usually issued at the time of commencement of the semester. These are of problem solving in nature with 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. Familiarize the student with the analysis and design of different amplifier circuits (single and multi stage) using BJTs.
II. Understand the concepts of MOS Characteristics and analyze MOS amplifier.
III. Understand the concepts of feed back in amplifiers and emphasis on feedback amplifiers (ckts of different implementing different topologies) and oscillators.
IV. Familiarize with different power amplifier circuits using BJT and designing the power amplifier
V. Learn about various tuned amplifiers and their frequency responses.

VI. COURSE OUTCOMES:

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

1. Analyze various transistor amplifier circuits and their freq. responses at low, mid and high frequencies.
2. Designing amplifier circuits using BJTs.
3. Analyze the concepts of both positive and negative feedback in electronic circuits.
4. Design, construct & analyze oscillator circuits to generate signals in various frequency ranges.
5. Design different types of power amplifiers for practical applications of desired specifications.
6. Understand the concepts MOS characteristics and amplifier
7. Analyze different tuned amplifiers circuits.
8. Acquire experience in building and troubleshooting simple electronic analog circuits.

VII. 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, Tutorials
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	Assignments
PO3	**Design/Development of Solutions** Design solutions for complex engineering problems and design system components or processes that	H	Mini Projects

Program Outcomes		Level	Proficiency assessed by
	meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations		
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	H	Projects
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	Projects
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	N	--
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	S	Assignments
PO8	**Ethics** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice	S	Oral Discussions
PO9	**Individual and Team Work** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings	N	--
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	Presentations
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	Seminars, Discussions
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	H	Development of Prototype, 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, Assignments
PSO2	**Problem-solving skills:** An ability to solve complex Electronics and communication Engineering problems, using latest hardware and software tools, along with analytical skills to arrive cost effective and appropriate solutions.	S	Tutorials
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	S	Seminars and Projects

Program Specific Outcomes		Level	Proficiency assessed by
	applications using optimal resources as an Entrepreneur.		

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

IX. SYLLABUS:

UNIT -I:

SINGLE STAGE AMPLIFIERS: Classification of Amplifiers – Distortion in amplifiers, Analysis of CE, CC and CB configurations with simplified hybrid model, Analysis of CE amplifier with emitter resistance and emitter follower, Miller's theorem and its dual, Design of single stage RC coupled Amplifier using BJT.

MULTISTAGE AMPLIFIERS: Analysis of Cascaded RC coupled BJT amplifiers, Cascode Amplifier, Darlington Pair, Different Coupling Schemes used in Amplifiers – RC coupled amplifiers, Transformer Coupled Amplifier, Direct Coupled Amplifier.

UNIT-II:

BJT AMPLIFIERS-FREQUENCY RESPONSE: Logarithms, Decibels, General frequency considerations, Frequency response of BJT Amplifier, Analysis at low and high frequencies, Effect of coupling and bypass capacitors. The Hybrid pi model –Common Emitter Transistor Model, CE Short Circuit current gain, current gain with resistive load, Single stage CE transistor Amplifier Response, Gain –Bandwidth Product, Emitter follower at high frequencies.

MOS AMPLIFIERS: Basic Concepts, MOS Small signal model, Common source amplifier with resistive load.

UNIT-III:

FEEDBACK AMPLIFIERS: Concepts of feedback, Classification of feedback amplifiers, General characteristics of negative feedback amplifiers, Effect of feedback on amplifier characteristics, Voltage Series, Voltage Shunt, Current Series and Current Shunt Feedback Configurations, Illustrative examples.

OSCILLATORS: Classification of oscillators, Condition for oscillations, RC Phase shift Oscillators, Generalized analysis of LC Oscillators-Hartley and Colpitts Oscillators, Wien Bridge and crystal Oscillators, Stability of Oscillators

UNIT-IV:

LARGE SIGNAL AMPLIFIERS: Classification, Class A Large signal amplifiers, Transformer Coupled Class A Audio Power amplifier, Efficiency of class A amplifier, Class B amplifier, Efficiency of class B Amplifier, class B Push pull Amplifier, Complementary Symmetry Class B Push Pull Amplifier, Distortion of Power Amplifiers, Thermal Stability and Heat sinks

UNIT-V:

TUNED AMPLIFIERS Introduction, Q Factor, Small signal Tuned Amplifiers, Effect of Cascading Single tuned Amplifiers on bandwidth, Effect of Cascading Double Tuned Amplifiers on Bandwidth, Stagger Tuned Amplifiers, Stability of tuned amplifiers.

TEXT BOOKS:

1. Integrated Electronics – by J. Millman and C.C. Halkias, -1991 ed 2008 TMH. **(T1)**
2. Electronic Devices and Circuits – by B.P. Singh, Rekha Singh, pearson,2013 **(T2)**
3. Design of Analog CMOS Integrated Circuits- Behzad Razavi,2008,TMH. **(T3)**

REFERENCE BOOKS:

1. Electronic Circuit Analysis-Rashid, Cengagelearning2013 **(R1)**
2. Electronic Devices and Circuits Theory-Robert L. Boylestad and Louis Nashelsky, PHI, 9th 2008 **(R2)**
3. Micro Electronic Circuits – by Sedra A.S. and K.C. Smith, Oxford University Press,5th Edition **(R3)**

4. Electronic Devices and Circuits – by K. Lal Kishore, 2004 BSP. **(R4)**
5. Electronic Devices and Circuits – by S.Salivahanan, N.Suresh Kumar,A.Vallavaraj,2009 ,TMH. **(R5)**
6. Electronic Circuit Analysis – A.P.Godse- Technical Publications **(R6)**
7. Electronic Devices and Circuits – by G K Mittal Kanna Publications **(R7)**
8. Electronic Circuit Analysis-– by K. Lal Kishore**(R8)**

IX. COURSE PLAN:

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

Lecture No.	CLO	Unit	Learning Objective	Topics to be covered	Reference
Course Content Delivery --- Lecture Wise Break-up of Topics I SPELL					
1-3	1.		**Identify** different biasing techniques and types of amplifiers, amplifier analysis using hybrid model	Introduction, Classification of amplifiers	**R6 1.1, 1.4**
4-5	2.		**Apply** the hybrid model for different types of Amplifiers.	Analysis of CE, CC and CB configurations with simplified hybrid model	**R6 1.5-14**
6	3.		**Identify** the concept of Miller's theorem and its dual	Miller's theorem and its dual	**R6 1.36**
7-10	4.		**Apply** the concept of Miller theorem for CE amplifier with emitter resistance and emitter follower with collector resistance	Analysis of CE amplifier with emitter resistance	**R6 1.17**
11	5.		**Define** various distortions in amplifier circuits	Distortion in amplifiers	**R7 6.3(II)**
12-15	6.	**I**	**Differentiate** various coupling schemes of BJT amplifier	Different Coupling Schemes used in Amplifiers – RC coupled amplifiers, Transformer Coupled Amplifier, Direct Coupled Amplifier.	**R6 2.36**
16-17	7.		**Apply** the hybrid model for different types of amplifiers.	Analysis of Cascaded RC coupled BJT amplifiers, cascade, Darlington pair, CE-CC	**R6 2.2.4,5,2.3, 2.4.1**
18	8.		**Explain** the Concepts of dB	Logarithms, Decibels, General frequency considerations	**R6 3.3.1**
19-20	9.		**Describe** the high frequency analysis of BJT CE amplifier using hybrid-π model	The Hybrid pi model – Common Emitter	**R6 3.5,6,7,8**
21-22	10.		**Evaluate** the current gain (short circuit and resistive load)	CE Short Circuit current gain, current gain with resistive load,	**R6 3.9**
23	11.	**II**	**Formulate & Relate** the concepts of f_α f_β f_γ	Single stage CE transistor Amplifier Response Gain –Bandwidth Product,	**R6 3.10**

24	12.		**Describe** the high frequency analysis of BJT CC amplifier using hybrid-π model	Emitter follower at high frequencies.	**R6 3.11**
25-26	13.		**Sketch** the response of BJT Amplifier	Frequency response of BJT Amplifier, Analysis at low and high frequencies, Effect of coupling and bypass capacitors.	**R6 3.4**
Lecture No.	**CLO**	**Unit**	**Learning Objective**	**Topics to be covered**	**Reference**
27-29	14.		**Summarize** concepts of MOS device and Second order effects and design a small signal model considering the second order effects	Basic Concepts of MOS, Small signal model	**T3 2.1,2,3,4**
30-32	15.		**Analyze** CS amplifier	Common source amplifier with resistive load	**T3 3.1,.2.1**
33	16.	**III**	**Describe** concepts of feedback	Concepts of feedback	**R6 5.1,.2**
34	7.		**Discriminate** various feedback amplifiers	Classification of feedback amplifiers,	**R6 5.4**
35-36	18.		**Examine** the characteristics of negative feedback amplifiers	General characteristics of negative feedback amplifiers, , Effect of feedback on amplifier characteristics,	**R6 5.5,.6**
37-40	19.		**Analyze** Voltage Series amplifier, Current Series amplifier, Current Shunt amplifier, Voltage shunt amplifier	Voltage Series, Current Series, Current Shunt, Voltage shunt with illustrative example	**R6 5.7,.8**
Course Content Delivery --- Lecture Wise Break-up of Topics II SPELL					
41	20.	**III**	**Distinguish** various types of oscillators and explain the condition of oscillation using positive feedback	Classification of oscillators, Condition for oscillations,	**R6 6.4,.2,.3**
42-45	21.		**Formulate & Analyze** general LC & RC oscillator	Generalized analysis of LC Oscillators-Hartley Oscillators RC Phase Shift, Wien Bridge	**R6 6.5,-6.10**
46-47	22.		**Extend** the concept of stability in oscillators and crystal oscillator	Stability of Oscillators, crystal Oscillators	**R6 6.12,13**
48	23.	**IV**	**Discriminate** power amplifiers based on the Q-point selection and angle of conduction	Classification of Power amplifiers	**R6 7.1-.4**
49-55	24.		**Analyze** various power amplifiers and formulate their efficiency	Class A Large signal amplifiers (series fed) Class A Large signal amplifiers(transformer coupled) Class A Audio Power amplifier, Efficiency of class A	**R6 7.5-.7,.11,.12, .13,**

				amplifier, Class B Push pull Amplifier & effic, Complementary Symmetry Class B Push Pull Amplifier	
56-58	25.		**Explain** the concept of distortion in Power Amplifiers, Thermal Stability and Heat sinks.	Distortion of Power Amplifiers, Thermal Stability and Heat sinks	**R6 7.9,.15,.16 7.20,.21**
Lecture No.	**CLO**	**Unit**	**Learning Objective**	**Topics to be covered**	**Reference**
59	26.	**V**	**Discuss** the need for tuned amplifier, basics of tuned amplifier, concept of Q-factor, classification of tuned amplifiers	Introduction, Q Factor,	**R8 5.1**
60-63	27		**Analyze** single tuned capacitive coupled amplifier (high freq analysis) of tapped single tuned , single tuned inductor or transformer coupled amplifier capacitive coupled amplifier	Single tuned capacitive coupled amplifier, Tapped single tuned capacitive coupled amplifier, Single tuned inductor or transformer coupled amplifier	**R8 5.2,.3,.4,.5**
64	28.		**Illustrate** the effect of cascading Single tuned Amplifiers on bandwidth	Cascading Single tuned Amplifiers on bandwidth	**R6 8.10,**
65-66	29.		**Analyze** the double tuned amplifier circuit, effect of cascading double tuning on BW, stagger Tuning	Double tuned amplifiers Effect of Cascading Double Tuned Amplifiers on Bandwidth, Stagger Tuned Amplifiers	**R6 8.9,.11,.14**
67-68	30.		**Define** term stability of tuned amplifiers and compensating circuits used to obtain the stability	Stability of tuned amplifiers.	**R6 8.15**

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				H		S	S
II		S					S			S			H	S	
III				H				S			S		H	S	
IV			H		S							H	H	S	
V	H			H			S							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	H		H					S			S	H		S	S
2	H				S		S				S		H	S	
3		S			S			S				H	H	S	
4	H			H			S	S		S	S			S	
5	H	S	H		S								H	S	
6	H		H	H			S			S			H	S	
7	H			H				S		S	S			S	
8	H	S	H		S		S						H	S	

S – Supportive **H - Highly Related**

Prepared by : Mr. K Ravi, Assistant Professor, ECE
Date : 13th DEC, 2016

HOD, ECE