Academic Course Description

BHARATH UNIVERSITY
Faculty of Engineering and Technology
Department of Electronics and Communication Engineering

BEC402 Electronic Circuits

Fourth Semester, 2016-17 (Even Semester)

Course (catalog) description

This is the first course in Electronics and Communication Engineering, to educate and explain the methods used for biasing circuits in a graphical analysis of non-linear electronic circuits and also includes small signal transistor models, parameters and their frequency responses. Following this, analyzing different types of feedback amplifiers, power amplifiers, tuned amplifiers, sinusoidal and non-sinusoidal oscillators using transistor and designing of different electronic circuits are included in the course.

Compulsory/Elective course : Compulsory for ECE students

Credit & contact hours : 3 & 45

Course Coordinator : Ms K.Subbulakshmi, Assoc. Professor, Department of ECE

Instructor(s) :

Name of the instructor	Class	Office location	Office phone	Email@bharathuniv.ac.in)	Consultation
K.Subbulakshmi	III YEAR	SA BLOCK		subbulakshmi.ece@bharathuniv.ac.in	12.30-1.30 PM

Relationship to other courses

Pre-requisites	:	Circuit theory, Basic Electrical & Electronics Engineering
Assumed knowledge	:	The students will have a physics and mathematics background obtained at a high school (or equivalent) level. In particular, working knowledge of basic mathematics including differentiation, integration and probability theories are assumed.
Following courses	:	-

Syllabus Contents

UNIT I BASIC DEVICE STABILIZATION AND LOW FREQUENCY DESIGN ANALYSIS 9 HOURS

circuits for BJT, DC and AC Load lines, Stability factor analysis, Temperature compensation methods, biasing circuits for FET's and MOSFET's. Transistor, FET and MOSFET Amplifiers, Equivalent circuit, input and output characteristics, calculation of midband gain, input and output impedance of various amplifiers, cascode amplifier, Darlington Bootstrapping, Differential amplifier, CMRR measurement, Use of current source in Emitter.

UNIT II LARGE SIGNAL AMPLIFIERS 9 HOURS

Class A, AB, B, C and D type of operation, efficiency of Class A amplifier with resistive and transformer coupled load, efficiency of Class B, Complementry Symmetry amplifiers, MOSFET Power amplifiers, Thermal stability of Power amplifiers, heat sink design.

UNIT III FEEDBACK AMPLIFIERS 9 HOURS

Types of feedback, Effect of feedback on noise, distortion, gain, input and output impedance of the amplifiers, Analysis of Voltage and Current feedback amplifiers, Negative Resistance Oscillator, Barhausen Criterion for oscillation in feedback oscillator, Mechanism for start of oscillation and stabilization of amplitude, Analysis of RC Oscillators using Cascade connection of Lowpass and Highpass filters, Wein Phase shift and twin-T network, Analysis of LC Oscillators, Colpitts, Hartley, Clapp, Franklin, Armstrong and Miller Oscillator, Quartz Crystal Oscillator circuits.

UNIT IV TUNED AMPLIFIERS & MULTIVIBRATOR CIRCUITS 9 HOURS

Tank circuits, Analysis of single tuned amplifier, Double tuned, stagger tuned amplifiers, instability of tuned amplifiers, stabilization techniques, Narrow band neutralization using coil, Broad banding using Hazeltine neutralization, Class C tuned amplifiers and their applications. Efficiency of Class C tuned Amplifier. Astable multivibrators, monostable and bistable multivibrator using similar and complementary transistors, speed up capacitors, Schmitt trigger circuits.

UNIT V RECTIFIERS, BLOCK OSCILLATORS AND TIMEBASE GENERATORS 9 HOURS

Half Wave Rectifier - Full Wave Rectifier – Bridge Rectifier – Performance of Rectifiers – Filters – Types of Filters – L, C, LC, π Filters – Ripple Factor Calculation for C, L, LC and π Filter – Regulators – Shunt and SeriesVoltage Regulator – IC Regulator – SMPS – Power Control using SCR. RC and RL wave shaping circuits, UJT sawtooth generators, Linearization using constant current circuit, Bootstrap and Miller saw tooth generators, current time base generators, Time base circuits - Voltage-Time base circuit, Current-Time base circuit.

TextBook:

1.RobertL. Boylestad and Louis Nasheresky, “ElectronicDevices and Circuit Theory”, 10thEdition,Pearson Education/ PHI ,2008

2.David A.Bell,“Electronic Devices and Circuits”, FifthEdition, Oxford University Press,2000

3. Donald .A. Neamen, Electronic Circuit Analysis and Design –2nd Edition,Tata Mc Graw Hill, 2009.

4. Millman.J. and Halkias C.C, “Integrated Electronics”, Mc Graw Hill, 2001.

References:

1 .MillmanJ.andTaub H., “Pulse Digital and SwitchingWaveforms”, TMH,2000.

2. Adel .S. Sedra, Kenneth C. Smith, “Micro Electronic Circuits”, 6th Edition, Oxford University.

3 .David A., “Bell Electronic Devices and Circuits”, Oxford Higher Education Press,5th Editon,

4. Behzad Razavi, “Design of Analog CMOS Integrated Circuits”, Tata Mc Graw Hill,2007.

5. Paul Gray, Hurst, Lewis, Meyer “Analysis and Design of Analog Integrated Circuits”

Computer usage: Nil

Professional component

General	-	0%
Basic Sciences	-	0%
Engineering sciences & Technical arts	-	0%
Professional subject	-	100%

Broad area : Communication | Signal Processing | **Electronics** | **VLSI** | Embedded

Test Schedule

S. No.	Test	Tentative Date	Portions	Duration
1	Cycle Test-1	February 2nd week	Session 1 to 14	2 Periods
2	Cycle Test-2	march 2nd week	Session 15 to 28	2 Periods
3	Model Test	April 3rd week	Session 1 to 45	3 Hrs
4	University Examination	TBA	All sessions / Units	3 Hrs.

Mapping of instructional objective with program outcome

This is to educate and explain the methods used for biasing circuits in a graphical analysis of non-linear electronic circuits and also includes small signal transistor models, parameters and their frequency responses. Following this, analyzing different types of feedback amplifiers, power amplifiers, tuned amplifiers, sinusoidal and non-sinusoidal oscillators using transistor and designing of different electronic circuits are included in the course:	**Correlates to program outcome**		
	H	**M**	**L**
1. Discuss the concepts of various biasing methods for BJT. Analyze the BJT configurations and BJT amplifiers using small signal model.	a, c, d, h	e, f	g, i
2. To learn about the large signal amplifiers	a, c, d, h	e, f	g, i
3. To learn about the various feedback amplifier.	a, c, d, h	e, f	g, i
4. Understand the basic principles of different types of tuned amplifiers and learn the neutralization techniques	a, c, d, h	e, f	g, i
5. Describe the operation of multivibrator circuits, time base generators, and their applications	a, c, d, h	e, f	g, i
6. Discuss the working and characteristics of regulated power supply and SMPS.	a, c, d, h	e, f	g, i

H: high correlation, M: medium correlation, L: low correlation

Draft Lecture Schedule

Session	Topics	Problem Solving (Yes/No)	Text / Chapter
UNIT I BASIC DEVICE STABILIZATION AND LOW FREQUENCY DESIGN ANALYSIS			
1	Circuits for BJT, DC and AC Load lines	**Yes**	T1/C3,C4
2	Stability factor analysis, Temperature compensation methods	**Yes**	T1/C3,C4
3	biasing circuits for FET's and MOSFET's Transistor	**Yes**	T1/C5,C6
4	FET and MOSFET Amplifiers, Equivalent circuit, input and output characteristics	**Yes**	T1/C9
5	calculation of midband gain, input and output impedance of various amplifiers	**Yes**	T1/C14,C15,C16
6	cascode amplifier, Darlington Bootstrapping	**Yes**	T1/C16
7	Differential amplifier	**Yes**	T1/C14
8	CMRR measurement	**Yes**	T1/C14
9	Use of current source in Emitter	**Yes**	T3/C10
UNIT II LARGE SIGNAL AMPLIFIERS			
10	Class A, Class AB type of operation	**No**	T3/C8
11	Class B, Class C type of operation	**No**	T3/C8
12	Class D type of operation	**No**	T3/C8
13	efficiency of Class A amplifier with resistive and Transformer coupled load	**No**	T3/C8
14	efficiency of Class B	**No**	T3/C8
15	Complementry Symmetry amplifiers	**No**	T1/C14
16	MOSFET Power amplifiers	**No**	T1/C16
17	Thermal stability of Power amplifiers	**No**	T1/C16
18	heat sink design	**No**	T1/C3
UNIT III- FEEDBACK AMPLIFIERS			
19	Types of feedback	**No**	T3/C12
20	Effect of feedback on noise, distortion, gain, input and output impedance of the amplifiers	**No**	T3/C12
21	Analysis of Voltage and current feedback amplifiers	**Yes**	T3/C12
22	Negative Resistance Oscillator, Barhausen Criterion for oscillation in feedback oscillator	**Yes**	T3/C12
23	Mechanism for start of oscillation and stabilization of amplitude	**No**	T3/C12
24	Analysis of RC Oscillators using Cascade connection of Lowpass and Highpass filters	**No**	T3/C12
25	Wein Bridge Oscillator, Phase shift Oscillator, Twin-T	**No**	T3/C12

	Oscillator, Analysis of LC Oscillators		
26	Colpitts, Hartley, Clapp, Quartz Crystal Oscillator circuits	**No**	T3/C12
27	Franklin, Armstrong and Miller Oscillator	**No**	T3/C12
UNIT IV	**TUNED AMPLIFIERS & MULTIVIBRATOR CIRCUITS**		
28	Tank circuits	**No**	T2/C12
29	Analysis of single tuned amplifier, Double tuned	**No**	T2/C12
30	Analysis of stagger tuned amplifiers	**No**	T2/C12
31	instability of tuned amplifiers, stabilization techniques	**No**	T2/C12
32	Narrow band neutralization using coil, Broad banding using Hazeltine neutralization	**No**	T2/C12
33	Class C tuned amplifiers and their applications. Efficiency of Class C tuned Amplifier	**No**	T3/C8
34	Astable multivibrators, monostable multivibrators using similar and complementary transistors	**No**	T2/C12
35	bistable multivibrator using similar and complementary transistors	**No**	T2/C12
36	speed up capacitors, Schmitt trigger circuits	**No**	T2/C12
UNIT V RECTIFIERS, BLOCK OSCILLATORS AND TIMEBASE GENERATORS			
37	Half Wave Rectifier - Full Wave Rectifier	**No**	T1/C2
38	Bridge Rectifier – Performance of Rectifiers	**No**	T1/C2
39	Filters – Types of Filters – L, C, LC, π Filters	**Yes**	T3/C15
40	Ripple Factor Calculation for C, L, LC and π Filter	**Yes**	T3/C15
41	Regulators – Shunt and Series Voltage Regulator – IC Regulator – SMPS	**No**	T3/C15
42	Power Control using SCR. RC and RL wave shaping circuits, UJT sawtooth generators	**No**	T3/C15
43	Linearization using constant current circuit, Bootstrap and Miller saw tooth generators	**No**	T3/C15
44	current time base generators, Time base circuits	**No**	T3/C15
45	Voltage-Time base circuit, Current-Time base circuit	**No**	T3/C15

Teaching Strategies

The teaching in this course aims at establishing a good fundamental understanding of the areas covered using:

- Formal face-to-face lectures
- Laboratory sessions, which support the formal lecture material and also provide the student with practical construction, measurement and debugging skills.
- Small periodic quizzes, to enable you to assess your understanding of the concepts.

Evaluation Strategies

Cycle Test – I	-	5%
Cycle Test – II	-	5%
Model Test	-	10%
Assignments/Seminar/online test/quiz	-	5%
Attendance	-	5%
Final exam	-	70%

Prepared by: Ms.K.Subbulakshmi, Assoc.Professor, Department of ECE **Dated :**

Addendum

ABET Outcomes expected of graduates of B.Tech / ECE / program by the time that they graduate:

a) An ability to apply knowledge of mathematics, science, and engineering

b) An ability to design and conduct experiments, as well as to analyze and interpret data

c) An ability to design a hardware and software system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

d) An ability to function on multidisciplinary teams

e) An ability to identify, formulate, and solve engineering problems

f) An understanding of professional and ethical responsibility

g) An ability to communicate effectively

h) The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context

i) A recognition of the need for, and an ability to engage in life-long learning

j) A knowledge of contemporary issues

k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Program Educational Objectives

PEO1: PREPARATION

Electronics Engineering graduates are provided with a strong foundation to passionately apply the fundamental principles of mathematics, science, and engineering knowledge to solve technical problems and also to combine fundamental knowledge of engineering principles with modern techniques to solve realistic, unstructured problems that arise in the field of Engineering and non-engineering efficiently and cost effectively.

PEO2: CORE COMPETENCE

Electronics engineering graduates have proficiency to enhance the skills and experience to apply their engineering knowledge, critical thinking and problem solving abilities in professional engineering practice for a wide variety of technical applications, including the design and usage of modern tools for improvement in the field of Electronics and Communication Engineering.

PEO3: PROFESSIONALISM Electronics Engineering Graduates will be expected to pursue life-long learning by successfully participating in post graduate or any other professional program for continuous improvement which is a requisite for a successful engineer to become a leader in the work force or educational sector.

PEO4: SKILL

Electronics Engineering Graduates will become skilled in soft skills such as proficiency in many languages, technical communication, verbal, logical, analytical, comprehension, team building, interpersonal relationship, group discussion and leadership ability to become a better professional.

PEO5: ETHICS

Electronics Engineering Graduates are morally boosted to make decisions that are ethical, safe and environmentally-responsible and also to innovate continuously for societal improvement.

Course Teacher	Signature
Ms. K.Subbulakshmi	

Course Coordinator **HOD/ECE**