

Academic Course Description

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

BEC402 Electronic Circuits
Fifth 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 hours : 3 credits

Course Coordinator : Ms.S.Philomina, Asst. Professor, Department of ECE

Instructor(s) :

Name of the instructor	Class handling	Office location	Office phone	Email (domain: @bharathuniv.ac.in)	Consultation
S.philomina	III YEAR			philomina.ece	12.30-1.30 PM
K.Subbulakshmi	III YEAR			subbulakshmi.ece	12.30-1.30 PM
Rajipandurangan	III YEAR			rajipandurangan.ece	12.30-1.30 PM

Relationship to other courses

Pre-requisites : Nil

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 : EC1023 Digital communication

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, Complementary 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, Barkhausen 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 Series Voltage 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. Robert L. Boylestad and Louis Nashersky, "Electronic Devices and Circuit Theory", 10th Edition, Pearson Education/ PHI, 2008
2. David A. Bell, "Electronic Devices and Circuits", Fifth Edition, 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. Millman J. and Taub H., "Pulse Digital and Switching Waveforms", 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 Edition,
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 2 nd week	Session 1 to 14	2 Periods
2	Cycle Test-2	march 2 nd week	Session 15 to 28	2 Periods
3	Model Test	April 3 rd week	Session 1 to 45	3 Hrs
4	University Examination	TBA	All sessions / Units	3 Hrs.

Mapping of instructional objective with program outcome

The scope of this course is to provide the complete analysis of Microprocessor and Microcontroller. This knowledge helps them to acquire better application of these in Embedded system. The overall objective is to introduce the student to the basics of Microprocessor and Microcontroller . This course emphasizes:	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	Complementary 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, Barkhausen 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	-	10%
Cycle Test – II	-	10%
Model Test	-	25%
Attendance	-	5%
Final exam	-	50%

Prepared by: S.PHILOMINA, Assistant 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 fundamentals.
- b) an ability to identify, formulate, and solve engineering problems
- c) an ability to design a 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 design and conduct experiments, as well as to analyze and interpret data
- e) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
- f) an ability to apply reasoning informed by a knowledge of contemporary issues
- g) an ability to broaden the education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
- h) an ability in understanding of professional and ethical responsibility and apply them in engineering practices
- i) an ability to function on multidisciplinary teams
- j) an ability to communicate effectively with the engineering community and with society at large
- k) an ability in understanding of the engineering and management principles and apply them in Project and finance management as a leader and a member in a team.

Program Educational Objectives

PEO1: PREPARATION: To provide strong foundation in mathematical, scientific and engineering fundamentals necessary to analyze, formulate and solve engineering problems in the field of Electronics And Communication Engineering.

PEO2: CORE COMPETENCE: To enhance the skills and experience in defining problems in Electronics And Communication Engineering design and implement, analyzing the experimental evaluations, and finally making appropriate decisions.

PEO3: PROFESSIONALISM: To enhance their skills and embrace new Electronics And Communication Engineering Technologies through self-directed professional development and post-graduate training or education

PEO4: SKILL: To provide training for developing soft skills such as proficiency in many languages, technical communication, verbal, logical, analytical, comprehension, team building, inter personal relationship, group discussion and leadership skill to become a better professional.

PEO5: ETHICS: Apply the ethical and social aspects of modern communication technologies to the design, development, and usage of electronics engineering.

Course Teacher	Signature
S.Philomina	
K.Subbulakshmi	
RajiPandurangan	

Course Coordinator
(Ms.T.Ramya)

Academic Coordinator
(Mrs.R. Manohari)

Professor In-Charge
(Dr. Shanthi Prince)

HOD/ECE
(Dr.T.Rama Rao)