

## 2/4 B.Tech - FOURTH SEMESTER

EC4T3

Analog Electronic Circuits

Credits: 3

Lecture: 3 periods/week

Internal assessment: 30 marks

Tutorial: 1 period /week

Semester end examination: 70 marks

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**Pre-requisites:** Electronic Devices & Circuits (EC2T5), Network & Electrical Technology (EC3T4)

### Course Objectives

- To introduce small signal and large signal behavior of transistors
- To analyze single and multistage amplifiers
- To familiarize the concepts of feedback amplifiers and oscillators

### Learning Outcomes

Student will be able to

- Solve the problems on small signal and large signal amplifiers
- Design the amplifiers, feedback amplifiers and oscillators
- Characterize the given amplifier

### UNIT- I

**BJT at low frequencies:** Transistor hybrid model, h-parameters, conversion formulas for the parameters of the three transistor configurations, analysis of a transistor amplifier circuit using h-parameters, emitter follower, comparison of transistor amplifier configurations, linear analysis of a transistor circuit, simplified CE hybrid model, simplified calculations for CC configuration, CE amplifier with an emitter resistance.

### UNIT-II

**BJT at high frequencies:** hybrid-pi CE model, hybrid-pi conductances, hybrid-pi capacitances, validity of hybrid-pi model, variation of hybrid-pi parameters, CE short-circuit current gain, current gain with resistive load, voltage gain with resistive load, gain-bandwidth product, emitter follower at high frequencies.

### UNIT- III

**FET Amplifiers:** FET small model, low frequency CS and CD amplifiers, CS amplifier at high frequencies, CD amplifier at high frequencies.

**Multistage Amplifiers:** cascading transistor amplifiers, cascode amplifier, Darlington emitter follower, bootstrapped Darlington circuit, frequency response of an amplifier, bandpass of cascaded stages, RC coupled amplifier- effect of coupling capacitor on low frequency response, effect of an emitter bypass capacitor on low frequency response; high frequency response of two cascaded CE transistor stages.

## UNIT-IV

**Feedback Amplifiers :** Classification of amplifiers, Concept of feedback, transfer gain with feedback, General characteristics of negative feedback amplifiers, effect of feedback on input and output resistances, method of analysis of a feedback amplifier, voltage-series feedback, current-series feedback, current-shunt feedback, voltage-shunt feedback.

## UNIT- V

**Sinusoidal oscillators:** principle of oscillations, condition for oscillations, RC-phase shift oscillator, Wien bridge oscillator, Hartley and Colpitts oscillators, Crystal oscillators, frequency stability.

**Power Amplifiers:** classification of amplifiers, class-A large signal amplifier, second-harmonic distortion, class-A transformer-coupled power amplifier, efficiency, push-pull amplifiers, class-B amplifiers, class-AB operation, class-C tuned power amplifier

### Learning Resources

#### Text Books:

1. Integrated Electronics – J. Millman and C.C. Halkias, McGraw-Hill, 1972.

#### References:

1. Electronic Devices and Circuits Theory – Robert L. Boylestad and Louis Nashelsky, Pearson/Prentice Hall, 9th Edition, 2006.
2. Micro Electronic Circuits – Sedra A.S. and K.C. Smith, Oxford University Press, 5th edition.
3. Electronic Circuit Analysis and Design – Donald A. Neaman, McGraw Hill.

#### Web Resources:

1. <http://aries.ucsd.edu/NAJMABADI/CLASS/ECE65/06-W/NOTES/>
2. <http://nptel.ac.in/courses/115102014/downloads/module3.pdf>
3. <https://coefs.uncc.edu/dlsharer/files/2012/04/I3.pdf>
4. [http://iweb.tntech.edu/snatarajan/ECE331/Classnotes/CHAP8\\_adobe.pdf](http://iweb.tntech.edu/snatarajan/ECE331/Classnotes/CHAP8_adobe.pdf)