

ANALOG ELECTRONICS

III Semester: EEE																										
Course Code	Category	Hours / Week			Credits	Maximum Marks																				
AECC07	Core	L	T	P	C	CIA	SEE	Total																		
		3	0	0	3	30	70	100																		
Contact Classes: 45		Tutorial Classes: Nil		Practical Classes: Nil			Total Classes: 45																			
Prerequisite: : Electrical Circuits , Linear Algebra and Calculus																										
<p>I. COURSE OVERVIEW: This course provides the knowledge over the principles and construction of analog electronics. It covers the characteristics of electronic devices such as diodes, transistors, operational amplifiers and analysing amplifier circuits using small signal model and hybrid pi model, linear and nonlinear wave shaping. It focuses on applications in the area of power electronics, digital electronics and VLSI design.</p> <p>II. COURSE OBJECTIVES: The students will try to learn:</p> <p>I. The operational principles of analog electronic circuits such as feedback amplifiers and operational amplifiers II. The analog circuits fundamental theory to build signal conversion circuits, filter circuits, Data converters and Automatic Gain Control. III. The analog circuits applications in the advanced fields power electronics such as power factor monitoring circuits, power quality measurement, SMPS and battery controls.</p> <p>III. COURSE OUTCOMES: After successful completion of the course, students should be able to:</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 10%;">CO 1</td> <td style="width: 70%;">Recall the principles and operation of pn diode for the applications such as rectifiers, clippers, and clampers.</td> <td style="width: 20%;">Remember</td> </tr> <tr> <td>CO 2</td> <td>Illustrate the characteristics of bipolar and uni polar transistor for operating in different regions of operation.</td> <td>Understand</td> </tr> <tr> <td>CO 3</td> <td>Demonstrate differential amplifiers and power amplifiers using transistor high frequency model.</td> <td>Understand</td> </tr> <tr> <td>CO 4</td> <td>Estimate feedback amplifiers parameters based on sampling and mixer circuits.</td> <td>Apply</td> </tr> <tr> <td>CO 5</td> <td>Determine frequency of oscillations for the RC, LC, Hartley and Colpitts oscillators.</td> <td>Apply</td> </tr> <tr> <td>CO 6</td> <td>Utilize inverting and non inverting amplifiers as waveform generators and in IC related real time applications.</td> <td>Understand</td> </tr> </table> <p>IV. COURSE SYLLABUS:</p> <p>MODULE-I: DIODE CIRCUITS (10) P-N junction diode, I-V characteristics of a diode; review of half-wave and full-wave rectifiers, clamping and clipping circuits. Input output characteristics of BJT in CB, CE, CC configurations, biasing circuits, Load line analysis, common emitter, common base and common collector amplifiers; Small signal equivalent circuits.</p> <p>MODULE-II: MOSFET CIRCUITS (08) MOSFET structure and I-V characteristics. MOSFET as a switch. small signal equivalent circuits - gain, input and output impedances, small-signal model and common-source, common-gate and common-drain amplifiers, trans conductance, high frequency equivalent circuit.</p> <p>MODULE-III: MULTI-STAGE AND POWER AMPLIFIERS (10) Classification of Amplifiers, Distortion in amplifiers, Different coupling schemes used in amplifiers, Frequency response and Analysis of multistage amplifiers, Cascade amplifier, Darlington pair.</p> <p>Transistor at High Frequency: Hybrid - model of Common Emitter transistor model, f_{ω}, β and unity gain bandwidth, Gain band width product. Differential Amplifiers, Power amplifiers - Class A, Class B, Class C, Class AB.</p> <p>MODULE-IV: FEEDBACK AMPLIFIERS (10) 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</p>									CO 1	Recall the principles and operation of pn diode for the applications such as rectifiers, clippers, and clampers.	Remember	CO 2	Illustrate the characteristics of bipolar and uni polar transistor for operating in different regions of operation.	Understand	CO 3	Demonstrate differential amplifiers and power amplifiers using transistor high frequency model.	Understand	CO 4	Estimate feedback amplifiers parameters based on sampling and mixer circuits.	Apply	CO 5	Determine frequency of oscillations for the RC, LC, Hartley and Colpitts oscillators.	Apply	CO 6	Utilize inverting and non inverting amplifiers as waveform generators and in IC related real time applications.	Understand
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configurations, simple problems; Oscillators: Condition for Oscillations, RC type Oscillators RC phase shift and Wien-bridge Oscillators, LC type Oscillators, generalized analysis of LC Oscillators, Hartley and Colpitts oscillators;

MODULE-V: OPERATIONAL AMPLIFIERS (07)

Ideal op-amp, Output offset voltage, input bias current, input offset current, slew rate, gain bandwidth product, Inverting and non-inverting amplifier, Differentiator, integrator, Square-wave and triangular-wave generators.

V. TEXT BOOKS:

1. Jacob Millman, Christos C Halkias, "Integrated Electronics", McGraw Hill Education, 2nd Edition 2010.
2. Ramakanth A, Gayakwad, "Op-Amps & Linear Ics", PHI, 2003.

VI. REFERENCE BOOKS:

1. Thomas L. Floyd, "Electronic Devices Conventional and Current Version", Pearson, 2013.
2. J. Millman and A. Grabel, "Microelectronics", McGraw Hill Education, 1988.
3. P. Horowitz and W. Hill, "The Art of Electronics", Cambridge University Press, 1989.
4. P. R. Gray, R. G. Meyer and S. Lewis, "Analysis and Design of Analog Integrated Circuits", John Wiley & Sons, 2001

VII. WEB REFERENCES:

1. <http://www-mdp.eng.cam.ac.uk/web/library/enginfo/electrical/hong1.pdf>
2. <https://archive.org/details/ElectronicDevicesCircuits>
3. http://nptel.ac.in/courses/Webcourse-contents/IIT-ROORKEE/BASIC ELECTRONICS/home_page.htm
4. www.nptel.ac.in
5. notes.specworld.in/pdc-pulse-and-digital-circuits

VIII. E-TEXT BOOKS:

1. <http://services.eng.uts.edu.au/pmcl/ec/Downloads/LectureNotes.pdf>
2. <http://nptel.ac.in/courses/122106025/>
3. [http://www.freebookcentre.net/electronics-ebooks-download/Electronic-Devices-and-Circuits-\(PDF-313p\).html](http://www.freebookcentre.net/electronics-ebooks-download/Electronic-Devices-and-Circuits-(PDF-313p).html)
4. [http://www.introni.it/pdf/Millman-Taub- Pulse and Digital Switching Waveforms 1965.pdf](http://www.introni.it/pdf/Millman-Taub-Pulse%20and%20Digital%20Switching%20Waveforms%201965.pdf)
5. <https://www.jntubook.com/pulse-digital-circuits-textbook-free-download/>