

| <b>Analog Electronics and Linear Integrated Circuits</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                  |             |                   |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|-------------|-------------------|
| Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>1BEC304</b>   | Scheme      | 2025              |
| Type of Course                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>PCC</b>       | Semester    | III               |
| Teaching Hours/Week (L:T:P)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>3:0:0</b>     | CIE Marks   | 50                |
| Total Hours of Pedagogy (L :T:P:SL&TW)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>42:0:0:48</b> | SEE Marks   | 50                |
| Credits                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>3</b>         | Total Marks | 100               |
| Examination type (SEE)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Theory           | Exam Hours  | 3                 |
| <b>Course outcome (Course Skill Set)</b><br>At the end of the course, the student will be able to: <ol style="list-style-type: none"> <li>1. Describe the working principle, fundamental characteristics of various semiconductor devices such as transistors, MOSFETs, and operational amplifiers in basic electronic circuits.</li> <li>2. Analyze basic amplifier circuits using the principles BJTs, MOSFETS, and operational amplifiers.</li> <li>3. Illustrate the fundamental concepts of oscillators and timers.</li> <li>4. Design basic filters and power amplifiers.</li> <li>5. Analyze the fundamental concepts of linear Op-Amps, linear Op-Amps and their applications.</li> <li>6. Analyze the electronic circuit schematic and its working.</li> </ol> |                  |             |                   |
| <b>Module-1</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                  |             |                   |
| <b>BJT AC Models:</b> Base Biased Amplifier, Emitter Biased Amplifier, Small Signal Operation, AC Beta, AC Resistance of The Emitter Diode, Two Transistor Models, Analyzing Amplifier.<br><b>Voltage Amplifiers:</b> Voltage Gain, Multistage Amplifiers.<br><b>CC And CB Amplifiers:</b> CC Amplifier, Output Impedance, Cascading CE And CC, Darlington Connections, Voltage Regulation, The Common Base Amplifier.<br>Text book 1: 8.1-8.7, 8.9, 9.1, 9.3-9.8                                                                                                                                                                                                                                                                                                       |                  |             |                   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                  |             | Number of Hours:9 |
| <b>Module-2</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                  |             |                   |
| <b>MOSFET Biasing in MOS Amplifier Circuits:</b> Fixing VGS, Fixing VG, Drain to Gate Feedback Resistor.<br><b>Small Signal Operation and Modelling:</b> The DC Bias Point, Signal Current in Drain, Voltage Gain, Small Signal Equivalent Circuit Models, Transconductance, The T Equivalent Circuit Model.<br><b>MOSFET Amplifier Configuration:</b> Basic Configurations, Characterizing Amplifiers, CS Amplifier with And Without Source Resistance, The Common Gate Amplifier, Source Follower.<br>Text book 2: 7.2, 7.2.1, 7.3, 7.3.1 - 7.3.6, 7.4, 7.4.1                                                                                                                                                                                                         |                  |             |                   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                  |             | Number of Hours:9 |
| <b>Module-3</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                  |             |                   |
| <b>Negative Feedback:</b> Four Types of Negative Feedback, VCVS Voltage Gain, Other VCVS Equations, ICVS Amplifier, VCIS Amplifier, ICIS Amplifier (No Mathematical Derivation).<br><b>Oscillator:</b> Theory of Sinusoidal Oscillation, The Wein-Bridge Oscillator, RC Phase Shift Oscillator, The Colpitts Oscillator, Hartley Oscillator, Crystal Oscillator.<br><b>The 555 Timer:</b> Monostable Operation, Astable Operation.<br>Text book 1: 17.1-17.6, 21.1-21.8                                                                                                                                                                                                                                                                                                 |                  |             |                   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                  |             | Number of Hours:8 |
| <b>Module-4</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                  |             |                   |
| <b>Power Amplifiers:</b> Amplifier Terms, Two Load Lines, Class A Operation, Class B Operation, Class B Push Pull Emitter Follower, Class C Operation.<br><b>Active Filters:</b> Ideal Responses, First Order Stages, VCVS Unity Gain Second Order Low Pass Filters, VCVS Equal Component Low Pass Filters, VCVS High Pass Filters, MFB Bandpass Filters, Bandstop Filters.<br>Text book 1: 10.1-10.5, 10.8, 19.1, 19.4, 19.5, 19.7-19.10                                                                                                                                                                                                                                                                                                                               |                  |             |                   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                  |             | Number of Hours:8 |

| <b>Module-5</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                   |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|
| <p><b>Linear Op-amp Circuits:</b> Digital to Analog Conversion: Weighted Resistor DAC, R-2R DAC, Analog to Digital Conversion: Digital RAMP ADC, Successive Approximation ADC. Signal Processing Circuits: Saturating and Non Saturating Precision HWR, Precision FWR Using HWR and Summing Circuit.</p> <p><b>Nonlinear Op-Amp Circuits:</b> Zero Crossing Detector, Inverting Schmitt Trigger Circuit, Non-Inverting Schmitt Trigger Circuit.</p> <p><b>DC Voltage Regulators:</b> Introduction, Voltage Regulator Basics.</p> <p>Text book 3: 15.2, 15.4, 9.1, 9.2, 8.2-8.4, 13.1</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Number of Hours:8 |
| <p><b>Suggested Learning Resources: (Text Book/ Reference Book/ Manuals):</b></p> <p><b>Text books:</b></p> <ol style="list-style-type: none"> <li>1. Albert Malvino, David J Bates, Patrick E. Hoppe, Electronic Principles, 9<sup>th</sup> Edition, Mc Graw Hill Education, 2021.</li> <li>2. Adel S Sedra, Kenneth C Smith, Microelectronic Circuits, 7<sup>th</sup> Edition, Oxford University Press, 2015.</li> <li>3. David A. Bell, Operational Amplifiers and Linear ICs, 3<sup>rd</sup> Edition, Oxford University Press, 2011.</li> </ol> <p><b>Reference books / Manuals:</b></p> <ol style="list-style-type: none"> <li>1. Jacob Millman, Christos C. Halkias, Integrated Electronics: Analog and Digital Circuits and Systems, McGraw-Hill, 2015.</li> <li>2. Boylestad &amp; Nashelsky , Electronic Devices and Circuit, Eleventh Edition, Pearson, January 2015.</li> </ol>                                                                                                                                                                                                                                                                                                                                      |                   |
| <p><b>Web links and Video Lectures (e-Resources):</b></p> <ul style="list-style-type: none"> <li>• <a href="https://nptel.ac.in/courses/108102112">https://nptel.ac.in/courses/108102112</a></li> <li>• <a href="https://onlinecourses.nptel.ac.in/noc25_ee157/preview">https://onlinecourses.nptel.ac.in/noc25_ee157/preview</a></li> <li>• <a href="https://nptel.ac.in/courses/108106188">https://nptel.ac.in/courses/108106188</a></li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                   |
| <p><b>Teaching-Learning Process (Innovative Delivery Methods):</b></p> <p>The following are sample strategies that educators may adopt to enhance the effectiveness of the teaching-learning process and facilitate the achievement of course outcomes.</p> <ol style="list-style-type: none"> <li>1. Lecture method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.</li> <li>2. Show Video/animation films to explain the functioning of various analog and digital circuits.</li> <li>3. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it.</li> <li>4. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.</li> <li>5. Arrange visits to nearby industries to give brief information about the electronics manufacturing industry.</li> <li>6. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.</li> </ol> |                   |