Subject Code: 03EC0301
Subject Name: Linear Electronics
B. Tech. – Year – II (Semester III)

Objective: After completion of this course, student will be able to:

1. Understand basics of bipolar junction transistor (BJT) and operational amplifier (OP-AMP) circuits.
2. Understand the transistor and operational amplifier parameter for circuit design.
3. Apply the BJT and OP-AMP knowledge for electronics circuit design.
4. Understand the requirement of feedback electronics circuit.
5. Design various types of small project based on voltage regulators and timer IC.

Credits Earned: 4 Credits

Course Outcomes: After completion of this course, student will be able to:

1. Understand working fundamentals of BJT and OP-AMP.
2. Understand design parameters of BJT and OP-AMP.
3. Understand requirement of transistor feedback and oscillator circuit in circuit design.
4. Create small electronics project based on voltage regulators and timer IC.

Pre-requisite of course: - Basics Electronics

Teaching and Examination Scheme

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<th>Teaching Scheme (Hours)</th>
<th>Credits</th>
<th>Theory Marks</th>
<th>Tutorial/Practical Marks</th>
<th>Total Marks</th>
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<tbody>
<tr>
<td>Theory</td>
<td>Tutorial</td>
<td>Practical</td>
<td>ESE</td>
<td>IA</td>
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<tr>
<td>3</td>
<td>0</td>
<td>2</td>
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## Marwadi University
Draft Syllabus for Bachelor of Technology
Electronics and Communication

### Contents:

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<th>Lecture Hours</th>
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<td><strong>Module 2: Feedback and Oscillator Circuits</strong></td>
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<tr>
<td>Feedback Concepts, Feedback Connection Types, Practical Feedback Circuits, Feedback Amplifier—Phase and Frequency Considerations, Oscillator Operation Phase-Shift Oscillator, Wien Bridge Oscillator, Tuned Oscillator Circuit, Crystal Oscillator, Unijunction Oscillator</td>
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<td><strong>Module 3: Voltage Regulators</strong></td>
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<tr>
<td>Introduction, General Filter Considerations, Capacitor Filter, RC Filter, Discrete Transistor Voltage Regulation, IC Voltage Regulators, Practical Applications</td>
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<td><strong>Module 4: Operational Amplifier</strong></td>
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<td><strong>Module 5: Operational Amplifier application</strong></td>
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<tr>
<td>Constant-Gain Multiplier, Voltage Summing, Voltage Buffer, Controlled Sources, Instrumentation Circuits, Active Filters</td>
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<td><strong>Module 6: Linear - Digital ICs</strong></td>
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<td>Introduction, Comparator Unit Operation, Digital–Analog Converters, Timer IC Unit Operation, Voltage-Controlled Oscillator, Phase-Locked Loop, Interfacing Circuitry.</td>
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**Total Hours** 44
Suggested Text book/Main Reference:

Suggested List of Experiments:
Students are required to complete 10 experiments.
1. To build transistor based RC phase shift oscillator circuit, and measure and verify its frequency of operation.
2. Measurement of input and output offset voltage of 741 ICs.
3. To configure op-amp in voltage follower mode and to measure its slew rate.
4. To configure op-amp in inverting and non-inverting amplifier mode and measure their gain and bandwidth.
5. To prepare precision rectifier using op-amp and verify its operation using measurements.
6. To prepare full-wave rectifier using op-amp and verify its operation using measurements.
7. To measure PSRR and CMRR of given op-amp.
8. To design Schmitt trigger circuit using op-amp and take measurements.
9. To design, build astable and monostable multivibrators using 741 IC and verify their operation using measurements by observing waveforms.
10. To design, build and obtain the frequency responses of first order low pass and band pass active filters.
11. To build op-amp based Weigh bridge oscillator circuit, and measure and verify its frequency of operation.
12. Design and test the integrator for a given time constant.
13. Design a second order butter-worth band-pass filter for the given higher and lower cut-off frequencies
14. Design and test a notch filter to eliminate the 50Hz power line frequency.
15. Design and test a function generator that can generate square wave and triangular wave output for a given frequency.
16. Design and test voltage controlled oscillator for a given specification (voltage range and frequency range).
17. Design and test a Low Dropout regulator using op-amps for a given voltage regulation characteristic and compare the characteristics with standard IC available in market.
18. Design and test an AGC system for a given peak amplitude of sine-wave output.
Instruction Methods
1. The course delivery method will depend upon the requirement of content and need of the students. The teacher in addition to conventional teaching method (Chalk and Talk) may use any of the tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc. for effective teaching.

2. The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.

3. Practical examination will be conducted at the end of the semester for evaluation of performance of students in laboratory.

4. Students may use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory, etc.

5. The course delivery method will depend upon the requirement of content and need of the students. The teacher in addition to conventional teaching method (Chalk and Talk) may use any of the tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc. for effective teaching.

Supplementary Learning Resources / Open Source Software:
1. PSpices and NGSpice
2. Xcircuit
3. NPTEL website and IITs virtual laboratory
4. Quartus Student Version

Major Equipment
C.R.O., Function Generator, Power Supply, Multi-meter, Digital Storage Oscilloscope, Experimental Trainer Kits (e.g. Analog System Lab Kits, Operational Amplifier Trainer Kits, Linear IC Trainer, etc. ), Bread Board, General Purpose PCB, 741/082 op-amp, 555 Timer, Resistors, Capacitors, Diodes, etc.

Special skill development (Self-study / Communication):
Each student group (2-3 members) has to prepare any one of the syllabus topic allotted by the faculty using PPT/functional model and submit the video of presentation as part of the laboratory term work submission.

Suggested Theory Distribution:
The suggested theory distribution as per Bloom’s Taxonomy is as per follows. This distribution serves as guidelines to teachers and students for effective teaching-learning process.
<table>
<thead>
<tr>
<th></th>
<th>Remember</th>
<th>Understand</th>
<th>Apply</th>
<th>Analyze</th>
<th>Evaluate</th>
<th>Create</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distribution of Theory for course delivery and evaluation</td>
<td>15%</td>
<td>20%</td>
<td>30%</td>
<td>20%</td>
<td>10%</td>
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