SEMESTER S3

ANALOG ELECTRONICS

Course Code	**PBEET304**	**CIE Marks**	60
Teaching Hours/Week (L: T:P: R)	3:0:0:1	**ESE Marks**	40
Credits	4	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	None	**Course Type**	Theory

Course Objectives:

1. At the end of the course the student will be able to design of analog electronic systems using BJT, FET and OP-Amp

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	**Review of Bipolar Junction Transistor**- Introduction to DC Biasing – Base Bias – Voltage Divider Bias **Common Emitter Amplifier** – AC concepts —Role of coupling capacitors and emitter bypass capacitor- Common Emitter AC equivalent circuit- Amplifier Gain - Calculation of amplifier gains and impedances using h parameter equivalent circuit. **Emitter Follower Amplifier** **Power Amplifiers** -AC load line – RC Coupled amplifiers – Transformer coupled Class A amplifiers – Class B amplifiers(Derivation of efficiency) – Class AB amplifiers – Class C and Class D amplifiers	**9**
2	**Introduction to JFET** – JFET biasing circuits – Common Source Amplifier **Introduction to MOSFET** -MOSFET construction -D-MOSFET, E-MOSFET-Complementary MOSFET **Amplifier Frequency Response** – Basic concepts – BJT amplifier Frequency response – FET amplifier Frequency Response **Feedback and Oscillator circuits** – Feedback concepts – Feedback connection types – Practical Feedback circuits **Oscillators** – Phase Shift Oscillator (Expression of frequency oscillation)–	**9**

	Wien Bridge Oscillator – Tuned Oscillator circuits – Crystal Oscillator	
3	**Introduction to Operational Amplifiers (Op-Amps)** – Operation Overview – Differential amplifiers and Op-Amp Specifications -Gain, CMRR and slew rate **Op- Amp Circuits** – Inverting Amplifiers – Non inverting Amplifiers – Summing and Difference Amplifiers – Instrumentation Amplifiers Differentiator and Integrator circuits-practical circuits Comparators: Zero crossing and voltage level detectors, Schmitt trigger.	**9**
4	**Active Filters** – Butterworth, Chebyshev and Bessel Filters, Low pass filter – high pass filter -band pass and notch filters- Butterworth **Wave form generation using Op-Amps**: Square, triangular and ramp generatorcircuits using Op-Amp- Effect of slew rate on waveform generation. **Timer555 IC**: Internal diagram of 555 IC– Astable and Monostable multi-vibrators using 555 IC	**9**

Suggestion on Project Topics

In this curriculum Analog Electronics is the first Project Based Learning Course for the Electrical and Electronics Engineering students.

Project-Based Learning (PBL) is a student-centered teaching approach where the teacher serves as a facilitator and advisor.

Students are encouraged to think the need of the society and industry. Select a project topic relevant to the present society as well as covers topics in the syllabus.

In the first step they start defining problem statement with requirements and specifications.

In the second step, students work in groups to discover optimal and creative solutions by sharing their unique and inventive ideas for solutions.

They begin designing and developing components using contemporary tools and technology in the third level. Design the circuit and simulate it using available simulation tools. Also perform the hardware implementation to make it a product.

Project Topic Suggestions:

1. Regulated power supply
2. Electronic Thermometer with diode/transistor/instrumentation amplifier
3. Audio Amplifier
4. Multistage amplifiers
5. Biomedical signal processing devices
6. RF Transmitter

Course Assessment Method
(CIE: 60 marks, ESE: 40 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Project	Internal Ex-1	Internal Ex-2	Total
5	30	12.5	12.5	60

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 2 marks **(8x2 =16 marks)**	• 2 questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 2 sub divisions. • Each question carries 6 marks. **(4x6 = 24 marks)**	**40**

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Design BJT and FET amplifier circuits	**K3**
CO2	Design Oscillator circuits	**K3**
CO3	Design and develop various OPAMP application circuits.	**K3**
CO4	Implementation of active filters	**K4**
CO5	Implement an electronic hardware circuit for the solution of a real time problem	**K4**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	3	3	3							
CO2	3	3	3	3	3							
CO3	3	3	3	3	3							
CO4	3	3	3	3	3							
CO5	3	3	3	3	3	3	2	1	3	3	3	3

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Introductory Electronic Devices and Circuits	Robert T Paynter	Pearson Education	
2	Electronic devices and Circuit Theory	Boylestad R. L. and L. Nashelsky	Pearson Education	
3	Electronic Circuits : Analysis and Design	Donald A Neaman	McGraw Hill Companies	

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Fundamentals of Analog Circuits	Floyd T.L.	Pearson Education	
2	Op-Amps and Linear Integrated Circuits	Gayakward R. A.	PHI Learning Pvt. Ltd.	
3	Electronic Devices and Circuits	David A Bell	Oxford Higher Education	
4	Linear Integrated Circuits	Choudhury R.	New Age International Publishers	

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	https://archive.nptel.ac.in/courses/108/105/108105158/
2	https://archive.nptel.ac.in/courses/108/102/108102112/
3	https://nptel.ac.in/courses/108106084

PBL Course Elements

L: Lecture (3 Hrs.)	**R: Project (1 Hr.), 2 Faculty Members**		
	Tutorial	**Practical**	**Presentation**
Lecture delivery	Project identification	Simulation/ Laboratory Work/ Workshops	Presentation (Progress and Final Presentations)
Group discussion	Project Analysis	Data Collection	Evaluation
Question answer Sessions/ Brainstorming Sessions	Analytical thinking and self-learning	Testing	Project Milestone Reviews, Feedback, Project reformation (If required)
Guest Speakers (Industry Experts)	Case Study/ Field Survey Report	Prototyping	Poster Presentation/ Video Presentation: Students present their results in a 2 to 5 minutes video

Assessment and Evaluation for Project Activity

Sl. No	Evaluation for	Allotted Marks
1	Project Planning and Proposal	5
2	Contribution in Progress Presentations and Question Answer Sessions	4
3	Involvement in the project work and Team Work	3
4	Execution and Implementation	10
5	Final Presentations	5
6	Project Quality, Innovation and Creativity	3
Total		**30**

1. Project Planning and Proposal (5 Marks)

- Clarity and feasibility of the project plan
- Research and background understanding
- Defined objectives and methodology

2. Contribution in Progress Presentation and Question Answer Sessions (4 Marks)

- Individual contribution to the presentation
- Effectiveness in answering questions and handling feedback

3. Involvement in the Project Work and Team Work (3 Marks)

- Active participation and individual contribution
- Teamwork and collaboration

4. Execution and Implementation (10 Marks)

- Adherence to the project timeline and milestones
- Application of theoretical knowledge and problem-solving
- Final Result

5. **Final Presentation (5 Marks)**

- Quality and clarity of the overall presentation
- Individual contribution to the presentation
- Effectiveness in answering questions

6. **Project Quality, Innovation, and Creativity (3 Marks)**

- Overall quality and technical excellence of the project
- Innovation and originality in the project
- Creativity in solutions and approaches