



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Bachelor of Engineering

Level: UG

Branch: Robotics and Automation

Subject Code: BE04041021

Subject Name: Electronic Devices and Circuits

WEF Academic Year :	2025-26
Semester :	4
Category of the Course :	PCC-05

Prerequisite :	Basic knowledge of electronic components and laws such as KCL, KVL, etc.
Rationale :	Electronics is playing a key role in all engineering applications. All engineers should have the basic knowledge of electronics. Purpose of this course is to make students familiar with basic electronic devices, circuits and their applications. Students will be able to operate electronic test and measurement equipment like digital multi-meter, CRO, DC power supply and function generator.

Course Outcome :

After Completion of the Course, Student will able to :

No	Course Outcomes	RBT Level*
01	Analyze BJT circuits in small-signal domain	AN
02	Design and analyze amplifier circuits using BJT and FET.	CR
03	Understand concept of feedback amplifier.	UN
04	Understand operational amplifier and open loop characteristics.	UN
05	Understand data sheet of op-amp and various parameters of op-amp from it.	UN

*RM: Remember, UN: Understand, AP: Apply, AN: Analyze, EL: Evaluate, CR: Create

- Teaching and Examination Scheme:**

Teaching / Learning Scheme (in Hours per semester)					Total Credits	Assessment Pattern and Marks					Total Marks
L	T	P	PBL*	Total no of hours per semester		Theory		Tutorial / Practical			
						ESE (E)	PA / CA (M)	PA/CA (I)	PBL (I)	ESE (V)	
45	0	30	45	120	4	70	30	20	30	50	200



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* Problem Based Learning (PBL) aims to accommodate learning beyond syllabus as per clause 9.4 of NBA manual.

Course Content :

Sr. No.	Course Content	Total Hrs	% Weightage
1	Re-visit: Transistor biasing BJT and FET, AC analysis of BJT circuits	6	15
2	AC Models: Base-Biased Amplifier, Emitter-Biased Amplifier, SmallSignal operation, AC Beta, AC Resistance of the Emitter Diode, Two Transistor models, Analyzing an Amplifier, AC Quantities on the data sheet	4	15
3	Voltage amplifier: Voltage gain, The loading effect of input impedance, multistage amplifiers, swamped amplifier, two-stage feedback, Frequency Effects: Frequency Response of an Amplifier, Decibel Power gain, Decibel voltage gain, Impedance matching, The Miller Effect	4	15
4	CC and CB Amplifier: CC Amplifier, Output Impedance, Cascading CE and CC, Darlington Connections, Voltage Regulation, The Common Base Amplifier	4	15
5	Power Amplifiers: Amplifier Terms, Two Load Lines, Class-A Operation, Class-B Operation, Class-B Push Pull Emitter Follower, Biasing Class B/AB Amplifiers, Class B/AB Driver, Class-C Operation	4	10
6	Feedback Amplifier: Introduction, The Basic concepts of Feedback, Effect Of Negative Feedback, Types Of Negative Feedback Connections, Method Of Identifying Feedback Topology and Feedback Factor , Stability Of Feedback Amplifier.	4	10
7	Introduction to Operational Amplifiers: Introduction, Block diagram representation of a typical op-amp, its equivalent circuit, types of ICs, Manufacturers' designations and package types for ICs, Power supplies for ICs	4	5
8	Interpretation of Data Sheets and Characteristics of an op-amp: Interpreting datasheet, Ideal op-amp, Equivalent circuit of an op-amp, Ideal voltage transfer curve, Open-loop op-amp configurations	4	5
9	An Op-amp with Negative Feedback: Voltage-series feedback amplifier, Voltage-shunt feedback amplifier, Differential amplifier	4	5



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10	The Practical op-amp: Introduction, Input offset voltage, Input bias current, Input offset current, Total output offset voltage, Thermal drift, Effect of variation in power supply voltage on offset voltage, Change in input offset voltage and input offset current with time, Other op-amp parameters which changes with change in temperature and supply voltage, noise, Common-mode configuration and common-mode rejection ratio, Slew rate and it equations, Effect of slew rate in applications, Difference between bandwidth, Transient response and slew rate	4	5
	Total	42	100

Reference Book :

1. David A. Bell, "Electronic Devices and Circuits", Oxford University Press, Fifth Edition
2. Jacob Millman, Christos Halkias, Chetan D. Parikh, "Integrated Electronics", Tata McGraw Hill, Second Edition
3. Op-amps and Linear Integrated Circuits, by Ramakant A. Gayakwad.
4. Design with Operational Amplifiers and Analog Integrated Circuits, by Sergio Franco, Tata McGraw-hill 2009 Edition.
5. Linear Integrated Circuits, by D. Roy Choudhury and Shail B. Jain, New Age International Publishers, 3rd Edition.

Suggested Course Practical List :

1. BJT CE configuration characteristics
2. Measure DC and AC Beta of CE amplifier.
3. Frequency response of an CE amplifier.
4. DC and AC analysis of CB amplifier
5. DC and AC analysis of CC amplifier
6. Voltage gain and current gain of a CS amplifier using FET/JFET.
7. Measurement of input and output offset voltage of 741 ICs.
8. To configure op-amp in voltage follower mode and to measure its slew rate.
9. To configure op-amp in inverting and non-inverting amplifier mode and measure their gain and bandwidth.
10. To prepare precision rectifier using op-amp and verify its operation using measurements.
11. To prepare full-wave rectifier using op-amp and verify its operation using measurements.
12. To measure PSRR and CMRR of given op-amp.

List of Laboratory/Learning Resources Required:

- i. Function Generator



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- ii. Oscilloscope
- iii. Digital Multi-meter
- iv. DC Power Supply (0-30 V)
- v. Multisim, SCILAB, PSpice, NGSpice (Open-Source Software)

• **Activities suggested under Problem Based Learning:**

Sl. No.	Name of the activity	No. of hours	Evaluation Criteria
1.	Industry/Research laboratory visit	Visit = 5h, Report preparation = 5h Total = 10h	Based on report submitted. Report should contain observations and calculations based on industry/ lab data.
2.	Technical Video based learning related to the subject	Duration of video = 5h Report preparation = 5h Total = 10h	Report /presentation based on the video learning outcomes.
3.	Assignment writing. Numericals based assignment is preferable.	5 assignments of 2h each. Total = 10h	Based on the assignment submitted.
4.	Problem solving/Coding using C, C++, Python, SCILAB, MATLAB, MS-EXCEL or any other relevant software	5 small coding based assignment of 2h each. Total = 10h	Based on the coding solution submitted.
5.	Self learning on-line course	Minimum duration of the course should be 10h.	Examination based assessment at the end of course. Based on the certificate produced.
6.	Complex problem solving	Maximum 2 problem. Study of the problem and solution finding, Total = 10h	Based on the depth of the solution submitted.
7.	Videos on Industrial safety aspects based on subject	Duration of video = 5h Report preparation = 5h Total = 10h	Based on quiz/report submitted
8.	Discussion on research paper based on relevant subject	5 research paper = 20 h	Summarize research paper and evaluation critical parameters
9.	Poster/chart/power point preparation on technical topics	Duration = 6 h	Based on poster/chart preparation and presentation skills



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10	Working/non-working model on technical topics	Working = 12 h Non- working = 8 h	Based on inter department/external evaluation
11	Industrial exposure for 2-3 days to observe and provide tentative solutions on society/environment/health/any other issue	Duration = 15 h for industrial exposure Problem identification and tentative solution = 10 h Total = 20 h	Based on evaluation of critical problems and solutions
12	Group Discussion on emerging/trending technical topics based on subject	Duration = 1 h each	Based on performance in group discussion, technical depth, knowledge etc.
13.	Real world case studies-based learning	Duration of data collection/study = 5h Report preparation = 5h Total = 10h	Based on in-depth study, technical depth, data collected, fact finding, etc.
14.	Application/Software development	Duration = 10 h	Depending on the complexity of the Application/Software

Note:

1. All the suggested activity should be related to the subject.
2. The number of hours are suggestive. Faculty can sub-divide the number of hours based on the activity. However, total number of hours is fixed.
3. Rubrics for the evaluation can be prepared by the faculty.

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