DETAILED COURSE PLAN

Department of ICT, CoU

Electronic Device and Circuit

Course Code: EEE-1205 | BNQF Code: 07141205 | Credit: 3.00 | Contact: 3.00

1. Course Information

Item	Description
Course title	Electronic Device and Circuit
Course code	EEE-1205 (BNQF Code: 07141205)
Credit/contact hours	3.00 / 3.00
Course type	GED
Prerequisite	None
Proposed duration	14 teaching weeks, following the supplied course outline

2. Course Rationale

This course introduces the operating principles and basic applications of semiconductor devices and electronic circuits, including semiconductor diodes, rectifiers, filters, voltage stabilizers, bipolar junction transistors (BJTs), field-effect transistors (FETs), and operational amplifiers (op-amps). It establishes a foundation for further study and practical work in communication systems, industrial electronics, instrumentation, control systems, and electronic circuit design.

3. Course Objectives

1. Develop foundational knowledge of solid-state electronic devices, including diodes, MOSFETs, BJTs, and operational amplifiers.
2. Develop the ability to analyze and design analog electronic circuits using discrete components.
3. Understand and observe the amplitude and frequency responses of common amplifier circuits.
4. Develop practical ability to design, construct, measure, and compare analog circuits with theoretical results.

4. Course Learning Outcomes (CLOs)

CLO	Learning outcome	Indicative level
CLO1	Recall and identify the basic electronic devices that form the building blocks of electronic circuits.	Remember
CLO2	Describe and illustrate electronic circuits using basic electronic devices.	Understand
CLO3	Explain and analyze networks containing resistors, inductors, capacitors, diodes, transistors, and op-amps under DC and AC conditions.	Understand / Analyze

5. Detailed 42-Class Teaching Plan

The 42 classes divide the existing 14-week topic sequence into three class meetings per week. Class-level activities and evidence are instructional planning suggestions.

Class	Week	Topic	Content focus	Expected learning	Teaching-learning activity	CLO / evidence
1	1	Semiconductor fundamentals	Course orientation; role of electronic devices; semiconductor materials and applications.	Explain course scope and identify common semiconductor devices.	Interactive lecture; diagnostic questions.	CLO1 | Concept check
2	1	Atomic structure and bonding	Atomic structure, valence electrons, covalent bonds, electron-hole pairs.	Describe covalent bonding and electron-hole pair formation.	Board sketches; guided explanation.	CLO1 | Short questions
3	1	Energy bands and materials	Conductors, insulators, semiconductors; energy bands; temperature effect; intrinsic/extrinsic materials.	Distinguish material classes using energy-band concepts.	Diagram-based lecture; quiz.	CLO1 | Energy-band sketch
4	2	Doping and semiconductor types	Doping; donor/acceptor impurities; N-type and P-type materials.	Explain how doping produces N-type and P-type semiconductors.	Annotated diagrams; think-pair-share.	CLO1 | Worksheet
5	2	Charge carriers	Majority/minority carriers; generation and recombination.	Identify majority and minority carriers in N-type and P-type materials.	Guided problem solving.	CLO1 | Short problems
6	2	PN-junction formation	Diffusion; depletion region; barrier potential; equilibrium.	Draw and explain PN-junction formation.	Board diagram; peer explanation.	CLO1 | Labeled diagram
7	3	PN-junction biasing	Forward/reverse bias; depletion-width changes; current flow.	Explain the effect of forward and reverse bias.	Circuit diagrams; discussion.	CLO1 | Concept check
8	3	PN-junction V-I characteristics	V-I curve; knee voltage; reverse saturation current; breakdown.	Interpret forward and reverse regions of diode V-I curve.	Graph interpretation; examples.	CLO1 | Graph questions
9	3	Temperature effects and limitations	Temperature dependence; breakdown; safe operating limits.	Discuss temperature effects and PN-junction limitations.	Lecture; problem solving.	CLO1 | Quiz
10	4	Diode models	Diode symbol and operation; ideal/practical models; resistance; equivalent circuits.	Select a diode model for basic circuit analysis.	Circuit illustration; examples.	CLO1, CLO2 | Model exercises
11	4	Rectification and half-wave circuit	Rectification principle; half-wave rectifier; conduction and waveforms.	Draw and explain half-wave rectifier operation.	Waveform drawing; demonstration.	CLO1, CLO2 | Circuit/waveform
12	4	Half-wave rectifier analysis	Average/RMS output; ripple frequency; efficiency; numerical problems.	Analyze a half-wave rectifier using ideal or practical assumptions.	Worked numerical examples.	CLO1, CLO2 | Problem set

Class	Week	Topic	Content focus	Expected learning	Teaching-learning activity	CLO / evidence
13	5	Full-wave rectification	Full-wave principle; center-tapped rectifier; conduction paths and waveform.	Explain center-tapped full-wave rectifier operation.	Circuit tracing; waveform analysis.	CLO1, CLO2 | Diagram
14	5	Bridge rectifier	Bridge circuit; conduction paths; waveform; peak inverse voltage (PIV).	Explain bridge rectifier operation and PIV.	Board derivation; simulation.	CLO1, CLO2 | Short test
15	5	Full-wave performance	Average/RMS output; ripple frequency; efficiency; rectifier comparison.	Compare full-wave rectifiers and solve numerical problems.	Comparison; guided problems.	CLO1, CLO2 | Numerical exercise
16	6	Ripple and filtering	Ripple factor; rectifier comparison; need for filtering.	Explain ripple and why filtering is required.	Lecture; worked examples.	CLO1, CLO2 | Concept quiz
17	6	Capacitor and inductor filters	Capacitor-input and inductor filters; ripple reduction.	Describe how filters reduce ripple.	Demonstration/simulation.	CLO1, CLO2 | Circuit sketch
18	6	LC and pi filters	LC/pi filters; load effects; selection; numerical problems.	Compare filter configurations and output behavior.	Group comparison; problem solving.	CLO1, CLO2 | Homework
19	7	Zener diode fundamentals	Voltage regulation; Zener construction; reverse breakdown; equivalent model.	Explain Zener breakdown and operating region.	Lecture; curve interpretation.	CLO1, CLO2 | V-I questions
20	7	Zener voltage regulator	Shunt regulator; series resistor; line/load regulation; ratings and limitations.	Analyze a basic Zener shunt regulator.	Worked design; demonstration.	CLO1, CLO2 | Design exercise
21	7	Zener regulator practice	Current, resistance, power, regulation problems; consolidation.	Solve Zener regulator problems within component ratings.	Problem clinic; peer checking.	CLO1, CLO2 | Problem set
22	8	First-half review	Semiconductors, PN junctions, diodes, rectifiers, filters, Zener regulators.	Revise and integrate first-half concepts.	Revision; Q&A; problem clinic.	CLO1, CLO2 | Review worksheet
23	8	Mid-Term Exam 1	Assessment of the first part of the course, as scheduled by the department.	Demonstrate understanding of first-half content.	Written examination.	CLO1, CLO2 | Mid-Term Exam 1
24	8	Feedback and remediation	Common errors; clarification; remedial problem solving.	Identify learning gaps and correct misconceptions.	Feedback; worked solutions.	CLO1, CLO2 | Corrected solutions
25	9	BJT fundamentals	BJT structure/terminals; NPN/PNP symbols; emitter, base, collector.	Identify BJT terminals and distinguish NPN/PNP.	Device diagrams; component identification.	CLO1 | Identification
26	9	Transistor action	Transistor action; current relationships; operating regions; bias concept.	Describe transistor action and current relationships.	Current-flow diagrams; examples.	CLO1, CLO2 | Numerical questions

Class	Week	Topic	Content focus	Expected learning	Teaching-learning activity	CLO / evidence
27	9	Transistor as amplifier	Amplification principle; introductory bias; numerical problems.	Explain basic BJT amplification.	Lecture; signal illustration.	CLO1, CLO2 | Class test
28	10	BJT configurations and CB	Common-base circuit; input/output variables and characteristics.	Draw CB circuit and identify characteristic variables.	Circuit analysis; graph interpretation.	CLO1, CLO2 | CB worksheet
29	10	CB characteristics	Current gain; resistance; phase relationship; applications; numerical problems.	Interpret CB characteristics and solve introductory problems.	Board derivations; guided problems.	CLO1, CLO2 | Numerical exercise
30	10	Common-emitter configuration	CE circuit; input/output characteristics; cutoff, active, saturation regions.	Explain CE operation and identify operating regions.	Curve analysis; examples.	CLO1, CLO2 | CE questions
31	11	CE amplifier behavior	Current/voltage gain; phase reversal; load line; bias considerations.	Analyze basic CE amplification and phase relationship.	Circuit analysis; simulation.	CLO1, CLO2 | Analysis problems
32	11	Common-collector configuration	Emitter follower; input/output characteristics; gain and resistance.	Describe CC operation and characteristics.	Lecture; circuit comparison.	CLO1 | CC exercise
33	11	BJT configuration comparison	Compare CB, CE, CC by gain, resistance, phase, applications.	Compare characteristics and applications of CB, CE, CC.	Group comparison matrix.	CLO1 | Comparative assignment
34	12	FET and JFET fundamentals	FET types; voltage-controlled operation; JFET structure; channel and pinch-off.	Identify FET types and explain JFET operation.	Device diagrams; guided explanation.	CLO1 | Identification quiz
35	12	JFET characteristics	JFET symbols; output/transfer characteristics; operating regions.	Interpret basic JFET characteristics.	Graph interpretation; examples.	CLO1, CLO3 | Curve worksheet
36	12	MOSFET and BJT-FET comparison	MOSFET structure/operation; enhancement/depletion; symbols; BJT-FET comparison.	Explain MOSFET operation and compare FETs with BJTs.	Diagram lecture; review.	CLO1, CLO3 | Comparison table
37	13	Op-amp fundamentals	Op-amp symbol/polarity; terminals; ideal assumptions.	Identify op-amp terminals and ideal characteristics.	Circuit symbols; questions.	CLO1, CLO3 | Quiz
38	13	Op-amp concepts	Open-loop concept; virtual ground/short; summing point.	Use virtual-ground/short concepts to interpret op-amp circuits.	Board derivations.	CLO3 | Circuit questions
39	13	Basic op-amp applications	Inverting, non-inverting, summing amplifiers; gain calculations.	Analyze introductory op-amp circuits and calculate gain.	Worked examples; simulation.	CLO2, CLO3 | Circuit problem

Class	Week	Topic	Content focus	Expected learning	Teaching-learning activity	CLO / evidence
40	14	BJT and FET consolidation	Review BJT configurations, FET types, characteristics, numerical problems.	Summarize and connect transistor and FET concepts.	Revision; Q&A.	CLO1, CLO2, CLO3 | Revision set
41	14	Op-amp and whole-course review	Review op-amps and applications; integrated course revision.	Integrate course concepts and identify topics for further practice.	Problem clinic; peer discussion.	CLO1, CLO2, CLO3 | Review worksheet
42	14	Mid-Term Exam 2 / feedback	Second-half consolidation assessment and feedback as indicated in the weekly sequence; confirm formal arrangement.	Demonstrate learning from second-half content and reflect on feedback.	Assessment/feedback as scheduled.	CLO1, CLO2, CLO3 | Exam/feedback

6. Suggested Teaching-Learning Methods

- Interactive lectures supported by circuit diagrams, device symbols, characteristic curves, and worked examples.
- Guided numerical problem solving, with emphasis on assumptions, units, and interpretation of results.
- Class discussion and think-pair-share activities to compare device operation and circuit configurations.
- Circuit demonstrations and simulation to connect theoretical waveforms and characteristics with observable behavior.
- Short formative quizzes, assignments, and feedback to monitor student progress.

7. Suggested Laboratory / Practical Alignment

The supplied outline states that students should design, construct, and measure analog circuits, but it does not provide a separate laboratory schedule. The following activities are therefore proposed supplementary practicals and should be aligned with the department's available laboratory hours, equipment, and safety procedures.

Practical	Experiment	Suggested student task
1	PN diode V-I characteristics	Measure forward/reverse behavior; plot V-I curves and identify key regions.
2	Half-wave and full-wave rectifiers	Build or simulate rectifiers; compare waveforms, output levels, and ripple frequency.
3	Rectifier filters	Compare unfiltered and filtered outputs; examine ripple variation with filter component values and load.
4	Zener voltage regulator	Measure output regulation for changes in input voltage or load within component ratings.
5	BJT characteristics	Study transistor terminal behavior and plot or interpret CB/CE characteristics.
6	Basic BJT amplifier	Observe voltage amplification and phase relationship in a simple CE stage.
7	JFET/MOSFET characteristics	Identify device terminals and examine transfer/output characteristics using a suitable trainer or simulator.
8	Op-amp basic applications	Build or simulate inverting, non-inverting, or summing amplifier circuits and compare measured and calculated gain.

8. Assessment Strategy and Mark Distribution

Assessment component	Weight	Suggested evidence / purpose
Attendance	5%	Regular participation and engagement.
Class test	5%	Short tests on foundational concepts and circuit interpretation.
Assignment	5%	Analytical or numerical problem set, with clear working and interpretation.
Presentation	5%	Short technical presentation on a device, circuit, or application relevant to the syllabus.
Mid-Semester Exam	20%	Assessment of the first part of the course, consistent with the department examination schedule.
Final Semester Exam	60%	Comprehensive assessment of course concepts, device operation, circuit analysis, and applications.
Total	100%	

9. CLO-Based Assessment Alignment

CLO	Main learning evidence	Suitable assessment methods
CLO1	Accurate recall and identification of semiconductor materials, diodes, BJTs, JFETs, MOSFETs, and op-amps.	Class tests, quizzes, short-answer questions, device-symbol identification.
CLO2	Clear descriptions, circuit diagrams, rectifier/filter/regulator analysis, and transistor circuit interpretation.	Assignments, circuit-based questions, class tests, mid-term/final examination.
CLO3	Explanation and analysis of DC/AC networks involving passive components and op-amp circuits.	Analytical problems, circuit interpretation, examination questions, suggested practical/simulation tasks.

10. Course Evaluation and Feedback

- Use short quizzes and question sessions to identify misconceptions early.
- Provide feedback on assignments and numerical solutions, including common errors in circuit assumptions and units.
- Use student feedback after the mid-semester assessment to adjust revision emphasis and provide remedial support.
- Review CLO attainment using assessment evidence and use the findings to improve the next offering of the course.

11. Learning Materials / References

- ✓ V. K. Mehta, Principles of Electronics.
- ✓ Robert L. Boylestad, Electronic Devices and Circuit Theory.
- ✓ B. L. Theraja and A. K. Theraja, Electrical Technology: Electrical Devices and Circuits.

12. Implementation Notes

- This plan preserves the 14-week topic sequence and the assessment weights in the supplied EEE-1205 course outline.
- The detailed subtopics, weekly learning targets, formative assessments, and practical suggestions are an expanded teaching plan; they are not all explicitly itemized in the source outline.
- The supplied outline places a review and Mid-Term Exam 1 after Week 7, and a review and Mid-Term Exam 2 in Week 14. The exact examination timetable should be confirmed by the department.
- The source outline maps CLO1 to PLO1, CLO2 to PLO2, and CLO3 to PLO1 and PLO2. Confirm this mapping against the department's approved program outcome framework before formal submission.