BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI –

K. K. BIRLA GOA CAMPUS

II Semester 2022-2023

Course Handout – II

In addition to Part-I (General Handout for all courses appended to the timetable), this portion gives specific details regarding the course.

Course Number:	EEE F111
Course Name:	Electrical Sciences
Instructor-in-charge:	Abhijit Pethe *(abhijitp@goa.bits-pilani.ac.in)*
Team of Instructors:	Hrishikesh Sonalikar, Manish Gupta, Naveen Gupta, Ramesh Vasan, Sudeep Baudha

1. **Course Description:** Course covers basic passive circuit elements, dependent and independent sources, network theorems, circuit analysis techniques and response of first and second order circuits. Introduction to three - phase circuits, magnetic circuits, transformers, basics of rotating machines. Semiconductors - operation of diodes, zener diodes, bipolar junction transistors and field effect transistors. Biasing techniques and applications of diodes and transistors. Introduction to operational amplifiers and applications. Introduction to Digital Electronics
2. **Scope and Objective:**
   - **a.** Understand basic electrical engineering principles and abstraction on which design is based.
   - **b.** Use these abstractions to design simple electronic circuits.
   - **c.** Understand electronic components like diodes and transistors and use them in design.
   - **d.** Understand first- and second-order circuits and their frequency response. Use these to design simple filter circuits.
   - **e.** Understand magnetism and electricity and understand design of electrical circuits using magnetic flux
3. **Textbook**

i. L. S. Bobrow, "Foundations of Electrical Engineering," Oxford University Press, Asian Edition, 2013

4. **Reference Book**

i. W H. Hayt Jr. et.al., "Engineering Circuit Analysis," McGraw Hill, 9th edition, 2019

ii. A. Agarwal and J.H. Lang, "Foundations of Analog and Digital Electronic Circuits," Morgan Kaufmann, 2005

5. **Course Plan**

Lecture #	Topic	Readings
1	Introduction to the class Circuit abstraction signal representation - analog and digital	TB: 1.1 , 1.2 RB1: Ch 1
***Module 1**: Foundations of circuit analysis*		
2-7	Circuit elements - power sources, resistors, ohm's law	TB: 1.2 RB1: Ch 2
	Kirchhoff's Laws and associated examples	TB: 1.3-1.4 RB1: Ch 3
	Nodal and Mesh analysis supernode and supermesh	TB: 2.1-2.3 RB1: Ch 4 RB2: 3.3-3.4
	Thevenin and Norton Theorem	TB: 2.4 RB1: 5.3 RB2: 3.6
	Linearity and superposition	TB: 2.6 RB1: 5.1 RB2: 3.5
***Module 2**: First order, second order systems*		
8-12	Energy storage elements - inductance and capacitance	TB: 1.6-1.7 RB1: 7.1-7.4 RB2: 9.1-9.2, 9.4
	Analysis of RC and RL circuits - different excitations	TB: 3.2-3.3 RB1: Ch 8 RB2: 10.1-10.2
	RLC circuits - driven and undriven (or) natural and forced extension to higher order circuits	TB: 3.4-3.5 RB1: Ch 9 RB2: 12.1-12.3
***Module 3**: Sinusoidal inputs: Frequency response*		
13-19	Frequency response of RLC circuits Resonance in circuits	TB: 5.1-5.2 RB1: Ch 10, 15.3-15.5 RB2: 13.1-13.3
	Introduction to Bode plots	RB1: 15.1-15.2
	Laplace transform and applications	TB: 5.4-5.6 RB1: 14.1-14.5
	Introduction to filter design	RB1: 15.8-15.9 RB2: 14.5
***Module 4**: Diodes and applications*		
20-23	Introduction to the terminal characteristics of the diode Ideal diode model non-ideal model	TB: 6.3-6.5 RB2: 16.1-16.2

	Solving diode circuits Application of diodes: Wave shaping circuits Zener diodes and their applications	TB: 6.6-6.8 RB2: 16.3
***Module 5**: Transistors and their applications*		
24-30	Introduction to a transistor Properties of a 3 terminal device Load line and gain	class notes
	Bipolar juction transistors: working principle terminal characteristics of the BJT	TB: 7.1-7.4
	MOSFETs working principle terminal characteristics of the MOSFET	TB: 8.1-8.2 RB2: 7.3
	Use of MOSFET as a switch and for a amplifier small signal model and applications operating points and their impact on circuit characteristics	TB: 8.3 RB2: 6.1-6.3 RB2: 7.1-7.3, 7.5-7.7
***Module 6**: Operational Amplifiers*		
31-33	Introduction to the OPAMP ideal OPAMP characteristics	TB: 10.1-10.2 RB1: 6.1-6.2 RB2: 15.1-15.2
	Basic OPAMP amplifier configurations.	TB: 10.3 RB1: 6.2-6.3 RB2: 15.3
	Examples of arithmetic circuits and filters using OPAMPs.	RB1: 6.4 RB2: 15.5-15.6
***Module 7**: Introduction to Digital Electronics*		
34-36	Binary numbers and binary arithmetic	TB: 12.1, 12.2 RB2: 5.6
	Digital logic gates, voltage levels, noise margins	TB: 12.3 RB2: 5.1-5.2
	Boolean logic and simple combinatorial circuits	TB: 12.4, 12.7 RB2: 5.3-5.4
***Module 8**: Electromagnetic systems*		
37-41	Introduction to two-port networks	RB1: 16.1-16.3
	Magnetic fields and circuits	TB: 13.1-13.3
	Transformers - ideal and non-ideal	TB: 13.8-13.10
	Introduction to machines	TB: 15.1-15.2

6. **Evaluation Scheme**

No.	Component	Duration	CB/OB	Marks (%)	Date
1	Continuous evaluation – announced quizzes	----	OB	30%	2 Quizzes dates to be announced.
3	Mid-semester Exam	1.5 hours	CB	30%	30/4/23 10:00 am -11:30am
4	Comprehensive Exam	3 hours	CB	40%	6/7/23 FN

7. **Make-up Policy:** Application for Make-up will be considered only for Mid-Sem and Comprehensive Examination. An application in writing with relevant certificates attached (medical from Campus Medical center or SWD) needs to be submitted to the IC of the course at least a day before the scheduled exam. No make-up will be given for surprise tests, tutorials, labs and quizzes. (no exceptions)
8. **Attendance Policy:** Since BITS, Pilani is a residential campus; students are expected to engage in all regular and special lectures/tutorials as announced by the instructors. Attendance and class participation of the student will be considered during final grading and will be based on sole discretion of the instructors.
9. **Grading notice:** All students registered in the course are expected to appear for all evaluation components. Per section 4.19 of the BITS, Pilani Academic regulations, NC may be given to students if they fail to provide a chance for the instructor to evaluate their progress in the class. Absence in any evaluation components without the prior consent of the instructor or submitting blank or incomplete/incoherent answer books may present grounds for awarding NC in the course.
10. **Honor code and disciplinary action:** All submissions by students in this class towards quizzes, tests, and tutorials will be considered their original and individual work. It will be assumed that the students have not resorted to unfair means during the evaluation. If malpractice is discovered, the strictest action will be initiated against the student.
11. **Announcements:** Course management and announcements will be handled through the BITS moodle webpage. However, since 100% class attendance is expected, there might be a delay between class announcements to the information appearing on the moodle webpage.
12. **Chamber consultation hours:** Individual instructors will announce in class.

Instructor-in-Charge

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