A INSTITUTE OF TECHNOLOGY AND SCIENCE, Pilani
Pilani Campus
AUGS/ AGSR Division

SECOND SEMESTER 2020-21
COURSE HANDOUT

Date: 03.03.2021

In addition to part I (General Handout for all courses appended to the Time table) this portion gives further specific details regarding the course.

Course No : **EEE F111**
Course Title : **Electrical Sciences**
Instructor-in-Charge : **Karunesh K Gupta**
Instructor(s) : **Arnab Hazra, Sharda Tripathi**
Tutorial/Practical Instructors: Harshavardhan S, Karri Babu Ravi Teja, Shishir Maheshwari, K.K.Gupta, Rahul Kumar, Sandeep Joshi, Praveen kumar A. V, Anantha K Chintanpalli, Ashish Patel, Samatha Benedict, Kishor Bhaskarrao Nandapurkar.

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 of the Course: The principal objective of this course is to teach the principles of three different aspects of electrical sciences: (1) Circuits (2) Electronics and (3) Electromagnetics, to the student composed of mixed disciplines.

3. Text Books:
Leonard S. Bobrow and Navneet Gupta**,** 'Foundations of Electrical Engineering', Oxford University Press, Asian Edition, 2015.

4. Reference Books:

Vincent Del Toro, **'**Electrical Engineering Fundamental', Prentice Hall, 1989.

Robert L. Boylestad, L. Nashelsky, 'Electronic Devices and Circuit Theory', Pearson, 2009.

5. Course Plan:

Module	Lecture No.	Coverage	Ref. (TB)	Learning Outcome
Basic elements and laws	**1-2**	**Voltage and current sources, basic circuit components , Kirchhoff's current law (KCL), Kirchhoff's voltage, law (KVL), Instantaneous power, Inductors, Capacitors**	**1.1-1.7**	**Students will learn basic circuit elements and the laws of electrical science to solve basic electrical circuits**

	3	Independent and dependent sources, Source transformation	1.8, 2.4	Students will learn independent and dependent sources, source transformation
Circuit analysis principles	4-5	Nodal analysis, Mesh analysis	2.1-2.3	Students will be able to solve circuits by nodal and mesh analysis
	6-8	Network theorems (Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Superposition theorem)	2.4,2.6	Students will be able to solve circuits using network theorems.
Time domain analysis	9-12	Transient response of first and second order circuits (natural and forced response)	3.2-3.5	Students will be able to perform time domain analysis of first and second order circuits.
AC analysis	13-14	Time-domain analysis, Waveforms, form factor, Phasor representation of alternating quantities, *j* operator and Phasor algebra, Frequency-domain analysis	4.1-4.3	Students will learn concept of phasor, phasor algebra, frequency domain analysis of AC circuits.
	15-17	Average power, apparent power and complex power	4.4-4.5	Students will learn concepts of power in AC circuits.
	18-19	Three phase circuits (Y and Δ connections)	4.6	Students will learn concepts of three phase circuits (Y and Δ connection)
Frequency response and resonance	20-22	Frequency response, Filters (Low Pass, High Pass and Band Pass), Resonance and Quality factor	5.1-5.2	Students will be able to perform frequency domain analysis of circuits and learn resonance and filters.
Diodes	23-25	Basics of semiconductors, PN junction, Junction diode, Ideal diode and applications (rectifiers and clippers)	6.2, (partly) 6.3,6.4,	Students will study basics of semiconductors, diodes and their use in various electronic circuits.

	26-27	**Zener diode (its model and application as voltage regulator and clipper)**	**6.6**	**Students will learn applications of zener diodes in electronic circuits.**
Bipolar Junction Transistors	**28-30**	**Basic operation and characteristics of BJT**	**7.1-7.3**	**Students will learn the construction and operation of bipolar junction transistors**
Field-Effect Transistors (FET)	**31-33**	**Operation and characteristics of JFET and MOSFET**	**8.1-8.2**	**Students will learn construction and operation of field effect transistors**
Operational amplifier	**34**	**Basics of operational amplifier and its application** **Introduction to digital electronics**	**10.1**	**Students will learn opamp circuits and their applications. Students will also be introduced to digital electronics.**
Magnetic circuits and transformers	**35-36**	**Analogy between electrical and magnetic circuits, B-H curves**	**13.1-13.2 (partly) 13.3, 13.4**	**Students will learn the fundamental concept of electromechanics, magnetic circuits and transformers.**
	37-38	**Lenz's law, Transformers, Ideal transformer**	**13.6-13.7** **13.8, 13.9**	**Students will learn basic concepts of transformers, ideal transformer**
Introduction to machines	**39-40**	**Basics of rotating machines**	**15.1-15.2** **(partly)**	**Students will learn physical structure and operation of DC/AC machines**

6. Evaluation Scheme:

Component	Duration	Weightage (%)	Date & Time	Nature of component (Close Book/ Open Book)
Mid-Semester Test	90 Min.	30	Will be announced by AUGSD	Open Book
Quizzes	20 Min	30	Will be announced in class	Open Book
Comprehensive	120 Min.	40		Closed Book

Examination				

7. Chamber Consultation Hour: To be announced in the class

8. Notices: All notices of this course will be displayed on the **Nalanda only**

9. Make-up Policy: No make-up will be given for surprise quizzes, however for other components; make-up will be given ONLY in cases of sickness (hospitalization) or urgency for going out of station. In such case student must produce the sufficient proof or must have taken the prior permission from the IC.

10. Note (if any):

Instructor-in-charge
Course No. EEE F111