Course title: Fundamentals of thermal and electrical engineering			
Course code: ENR 119	**No. of credits:** 0	**L-T-P:** 30-00-00	**Learning hours:** 30
Pre-requisite course code and title (if any): No			
Department: Sustainable Engineering			
Course coordinator: Prof. Naqui Anwer		**Course instructor(s):** Prof. Naqui Anwer / Dr Ramkishore Singh	
Contact details: naqui.anwer@terisas.ac.in			
Course type: Bridge course audit		**Course offered in:** Semester 1	

Course Description

The course is designed to provide basic knowledge of thermal and electrical engineering. It incorporates the fundamentals of thermodynamic principles and their applications. This course provides the required level of knowledge of thermal engineering to understand the mechanical engineering and related courses to the students not having background of mechanical Engineering. It also incorporates the fundamentals of electrical circuit components, electrical and magnetic circuits, DC and AC sources. This course provides the required level of knowledge of electrical engineering to understand power system and related courses to the students not having background of electrical engineering

Course objectives

- Providing basic knowledge of thermodynamic principles.
- Providing knowledge related to thermodynamic processes.
- Providing knowledge about use of steam tables.
- Provide basic knowledge of electrical circuit components.
- Providing knowledge related to characteristics and behaviour of electrical circuits on AC and DC sources and their applications.
- Providing knowledge of magnetic circuits.

Course content

Module	Topic	L	T	P
	Fundamentals of thermal engineering (1 credit)			
1	**Zeroth law of thermodynamics** System, surroundings and properties. Energy and Processes. Work and heat. Zeroth law of thermodynamics.	3	0	0
2	**First law of thermodynamics** First law of thermodynamics. Constant pressure process. Adiabatic and Polytropic Process. Steady state flow process. Limitations.	4	0	0
3	**Second law of thermodynamics** Kelvin-Plank statement and Clausius statement. Reversibility, irreversibility and carnot cycle. Entropy. Temperature entropy diagram.	4	0	0
4	**Power and refrigeration cycles** Reheat, regeneration and binary vapour cycle. Gas power cycle. Refrigeration cycle – Vapor compression and vapor absorption. Thermodynamics of ideal gas mixture.	4	0	0
	Fundamentals of electrical engineering (1 credit)			
5	**Circuit components** Resistance (R), Inductance (L) and Capacitance (C). Ohm's law. DC and AC sources – voltage and current, ideal and practical, dependent and independent. Source transformation.	3	0	0
6	**DC circuits** KCL & KVL, loop or mesh analysis, nodal analysis, star↔delta transformation, Thevenin's and Norton's theorem, superposition theorem, maximum power transfer theorem.	4	0	0
7	**AC circuits** Representation of sinusoidal quantities, steady state analysis of R-L-C series and parallel circuits, resonance in electrical circuits, energy and power, complex power – apparent, active and reactive power, three phase ac circuits – phase & line voltages and currents	4	0	0

8	**Magnetic circuits** Magnetic flux and mmf, analogy between electrical and magnetic circuits, magnetic materials, eddy current & hysteresis losses.	4	0	0
		30	**0**	**0**

Evaluation criteria

- Assignments: (after completion of module 6) - 10%
- Written Test 1: (after completion of modules 1, 2, and 3) - 20%
- Written Test 2: (after completion of modules 4, 5, and 6) - 20%
- Written Test 3: (at the end of the semester after completion of modules 8) - 50%

Learning outcomes

- Understanding the basics of characteristics and behaviour of laws of thermodynamics. (Test 1)
- Solving the problems related to thermodynamic applications. (Test 2)
- Solving the problems related power and refrigeration cycles. (Test 2)
- Understanding the use of steam tables and apply them to real problems. (Test 1 and 2)
- Understanding the basics of DC and AC sources along with their applications on electrical circuits. (Test 2)
- Solving the problems related to applications of network theorems and solving complex DC circuits. (Test 2)
- Solving the problems related to R-L-C circuits connected to single phase and three phase AC. (Test 3)
- Solving the problems related to magnetic circuits. (Test 3)

Pedagogical approach

A combination of class-room interactions, tutorials, assignments and projects.

Materials

RE Sonntag, C Borgnakke, GJ Van Wylen: Fundamentals of Thermodynamics, Sixth Edition, (Wiley-India, 2007).
PK Nag: Engineering Thermodynamics, Third Edition (Tata McGraw-Hill, 2005)
YA Cengel and MA Boles: Thermodynamics: An Engineering Approach, Sixth Edition (Tata McGraw-Hill, 2008)
SR Turns: An Introduction to Combustion: Concepts and Applications, Second Edition (McGraw Hill, 2000)
.Theraja, A.K.Theraja, "A text book of Electrical Technology", S.Chand Publication, 2012
.Kothari, I.J.Nagrath, "Fundamentals of electrical engineering", Tata Mc Graw-Hill Publication, 2016

Additional information (if any): NA

Student responsibilities

Attendance, feedback, discipline: as per university rules

Reviewers

1. Dr. Sanjay Agrawal, Associate Professor, Department of Electrical Engineering, SOET, IGNOU, New Delhi
2. Dr. M. Rizwan, Assistant Professor, Department of Electrical Engineering, Delhi Technological University, New Delhi