Lesson & Evaluation Plan
EN560: Foundation for Energy Engineering
Autumn 2020

School:	Engineering
Department:	Energy
Course name:	Foundation for Energy Technology
Course code:	EN560
Total credit:	3–0–0 (L–T–P)
Course Instructor:	BK Kakati

1. Abstract:

It is intended to provide basic knowledge of different engineering disciplines which are essential for an interdisciplinary field like energy studies. It is expected to minimize the differences in level of understanding among the students coming from different background. This course deals with the fundamentals of thermodynamics, fluid mechanics, electrical systems, and energy and environment correlations.

2. Course Objectives:

(a) To provide knowledge on basic thermodynamics, fluid mechanics and electrical engineering
(b) To provide knowledge of different forms of energy and their conversion processes
(c) To present an overview of electrical machines and power systems.

3. Prerequisites of the course:

The students should have basic knowledge of under-graduate level physics, chemistry, mathematics and thermodynamics.

4. Course outline and suggested readings:

Details as in section 5 and 8.

5. (a) Time plan

Module/Units	Topics	No. of classes
Basics of energy:	Different forms of energy, energy conversion process, indirect and direct energy conversion; Different energy sources; Conventional energy systems: engines, power plants, various methods of power generation; Thermodynamic analysis of conventional power plants	6
Thermodynamics:	Laws of thermodynamics and applications, Concepts of internal energy, entropy, enthalpy; Gas laws, Thermodynamic cycles, Irreversible and Reversible processes, Carnot cycle, Carnot engine; Heat engines and heat pumps/refrigeration, Psychometrics and use of psychrometric chart	8
Fluid Mechanics:	Properties of fluids, Bernoulli's equation, Navier-stokes equation, conservation equations for mass, momentum and energy; Uses of non-dimensional numbers to describe flow conditions; Theory and principles of flow measuring devices; Viscous flow in a pipe, Flow through packed and fluidized bed; Introduction to turbulence	8
Electrical Machines:	Principles of Transformer, motor and generators, characteristics and applications; DC machines: characteristics and Applications	6
Power systems:	Load and load duration curves, selection of generating units, Introduction to power generation, transmission and distribution, power systems losses and compensation, High voltage AC (HVAC) and High voltage DC (HVDC) transmission; Interconnected grid system	8
Energy and environment correlations:	Environmental degradation due to energy production and utilization, global warming; Environmental Impact Assessment, Life cycle analysis (LCA) and sustainability issues	6
Total		**42**

Lesson & Evaluation Plan
EN560: Foundation for Energy Engineering
Autumn 2020

5 (b) Evaluation plan:

Tests	Tests	*Date	Marks	Time
Test 1	Descriptive/ Objective/ Quiz	As per the notification of CoE	20	30 min
Test 2 (Major I)	Descriptive/ Objective		20	30 min
Test 3	*Assignment/**Quiz**/Case study & Seminar*		20	30 min
Test 4 (Major II)	Descriptive/ Objective		40	75 min
Total			100	

*As per the notification of CoE

6. Pedagogy:

The primary methods of the course will be classroom teaching and learning followed by laboratory visits. Laboratory visits in the Department of Energy will be arranged, where, various energy systems, and equipment (both conventional and renewable) are installed. The classroom teaching and/or online teaching will include lectures; audio/video tools; interactive sessions on the topics of the course; seminars on the current issues of energy and environment. Students will be required to submit one write-up on any of the topics covered in the syllabus. The teaching learning method adopted here will be flipped and blended with the following components:

- Online lectures using Google Classroom and Google Meet
- Lecture/Discussion/Tutorial using LCD projector and white board (as and when offline classes start)
- Audio-video aids
- Interactive sessions (online and/or offline)
- Assignment and/or case studies
- Seminar by the student (online & offline)
- Quiz

7. Expected learning outcomes

Successful students are will be able to

- Understand different forms of energy and its inter-conversion
- Identify different power cycles and analyze its thermodynamics
- Review of fluid mechanics and relevance for energy conversion processes
- Analyse performance of electrical components, power transmission and distribution
- Assessment of environmental impact and Life cycle analysis (LCA)

8. Suggested reading materials

Textbooks

[1] Nag P. K. (2014); *Basic and Applied Thermodynamics*, McGraw Hill.
[2] Theraja B. L. and Theraja A. K. (1998); *A Text Book in Electrical Technology*, S. Chand and Co.

Reference Books

[1] Kothari D. P. and Nagrath I. (2009); *Basic Electrical Engineering*, Third Edition, McGraw Hill, India
[2] Zemansky M. and Dittman R. (2011); *Heat and Thermodynamics*, McGraw Hill, India
[3] Wadhwa C. L. (2012); *Generation, Distribution and Utilization of Electrical Energy,* Third Edition, New Age International
[4] Balachandran P. (2010); *Engineering Fluid Mechanics*, Prentice Hall India
[5] Dessler A. (2011); *Introduction to Modern Climate Change*, Cambridge University Press