Liverpool John Moores University

Title:	Energy Transport and Conversion
Status:	Definitive
Code:	**4510ELESBC** (120265)
Version Start Date:	01-08-2016
Owning School/Faculty:	Maritime and Mechanical Engineering
Teaching School/Faculty:	The Sino-British College

Team	Leader
Russell English	Y

Academic Level:	FHEQ4	**Credit Value:**	20	**Total Delivered Hours:**	74
Total Learning Hours:	200	**Private Study:**	126		

Delivery Options
Course typically offered: Standard Year Long

Component	Contact Hours
Lecture	48
Tutorial	24

Grading Basis: 40 %

Assessment Details

Category	Short Description	Description	Weighting (%)	Exam Duration
Exam	AS1	Examination	70	2
Report	AS2	Coursework-Laboratory based assignments x 2 (15% each)	30	

Aims

This module aims to introduce key concepts in energy systems and their application to both conventional and renewable electrical power generation. It provides the students with an introduction to the mechanisms used in electrical engineering to transform mechanical energy into electrical and vice versa. It covers overall view of the transmission of the produced electrical energy over the power system to the point of utilisation together with distribution network and demand-side management

in a simple treatment.

Learning Outcomes

After completing the module the student should be able to:

1	Apply basic principles of mechanics to energy conversion and be able to analyse mechanical and electrical systems
2	Understand the principles of electro-mechanical conversion
3	Have knowledge of variation in electricity demand and of the operation of traditional and renewable power plant
4	Understand transmission and distribution systems

Learning Outcomes of Assessments

The assessment item list is assessed via the learning outcomes listed:

Examination	1	2	3	4
C/W Lab based assignments	1	2		

Outline Syllabus

Mechanics and energy conversion
Units and dimensions ; Linear & angular velocity and acceleration ; Mass and inertia ;
Moment/torque ; Mechanical work/energy(potential, kinetic) and Power ; Newton's laws of motion and its application to linear and angular motion. System in equilibrium

Principle of conversation of energy (first law of thermodynamics). Examples of different energy conversions in a closed system.

Electro-mechanical conversion
Direct current circuits ; Resistivity, Ohm's Law ;Power, energy ; Series circuit ; Parallel circuit ;Kirchhoff's Laws ;Mesh analysis

Introduction to Electromagnetic systems ;Magnetic field around a current carrying conductor ;Toroid, Flux and flux density ;Magnetomotive force ;Reluctance, Permeability ;Magnetic field strength, B versus H characteristics ;Electromagnetic induction, Inductance ;Coil with inductance and resistance ;Force on a current-carrying conductor ;Fleming's Left-Hand Rule

DC Machines; The action of commutator ;Construction;Shunt ;Series and compound windings ;emf generated in an armature winding ;DC Generators ;Types of dc generator and their characteristics

Machine losses ;Efficiency of a dc generator ;Introduction to alternator. ;Dc motors Torque of a dc machine ;Types of dc motor and their characteristics ;The efficiency of a dc motor ;Dc motor starter ;Speed control of dc motors ;Motor cooling

Demand and generation
Demand for electric energy ;Matching generation and demand ;
Introduction to conventional generation technologies ;Carnot efficiency for heat engines; heat engines, entropy and Carnot heat engine ;Steam-cycle power plants; basic steam power plants, coal-fired steam power plants ;Combustion gas turbines; basic gas turbine, steam-injected gas turbines ; Combined-cycle power plants ; Gas turbines and combined-cycle cogeneration.

Introduction to Distributed Generation (DG) ;DG with fossil fuels; HHV and LHV, microcombustion turbines, reciprocating internal combustion engines, Stirling engines, Biomass for electricity ;
Micro-hydropower systems; power from a micro-hydro plant, pipe losses, measuring flow, turbines, electrical aspects of micro-hydro ;Fuel cells; basic operation of fuel cells, fuel cell thermodynamics,

Introduction to Renewable resources ;Renewable- Solar ;The solar spectrum ;The earth's orbit ; Altitude angle of the sun at solar noon ;Introduction to photovoltaic materials and electrical characteristics ;Basic semi-conductor physics ;The simplest equivalent circuit for a photovoltaic cell
V & I curve and cell connections ;Examples of the major photovoltaic system types

Renewables – Wind ; Wind power systems ; Historical development of wind power ; Types of wind turbines ; Power in the wind; Temperature correction for air density, altitude correction for air density ; Impact of tower height ;Maximum rotor efficiency ;Wind turbine generators, the asynchronous induction ;Average power in the wind ;Wind farms, environmental impact of wind turbines, simple wind turbine economics

Electrical Power Systems
Fundamental of Electric Power ; Effective values of voltage and current ;Idealised components (resistor, capacitor & inductor) subjected to sinusoidal voltage ;Power factor
The power triangle and power factor correction ;Three wire, single-phase residential wiring ;Transmission and distribution networks

Introduction to 3-phase AC ; Three phase generator ;Three phase connections; Star connection ; Power dissipation in a Star-connected load ; Delta connection Power dissipation in a Delta connected load

Introduction to transformers ; Ideal transformers ; Transformer losses and efficiency. Demand-side management

Learning Activities

Lectures, tutorial and practicals

Notes

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