Module Specification

Electrical Machines and Power Systems

Version: 2024-25, v1.0, 19 Jun 2023

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Part 1: Information

Module title: Electrical Machines and Power Systems

Module code: UFMEY1-30-2

Level: Level 5

For implementation from: 2024-25

UWE credit rating: 30

ECTS credit rating: 15

College: College of Arts, Technology and Environment

School: CATE School of Engineering

Partner institutions: None

Field: Engineering, Design and Mathematics

Module type: Module

Pre-requisites: None

Excluded combinations: None

Co-requisites: None

Continuing professional development: No

Professional, statutory or regulatory body requirements: None

Part 2: Description

Overview: This module teaches the conceptual and technological details of electrical machines and power systems engineering. The module extends the basic knowledge of electrical and electronic engineering as gained in year-1 of the degree. The advanced concepts of electrical machines, transformers and polyphase circuits will be taught and applied to various electrical power systems design. The module also delivers advanced knowledge of AC and DC power distributions and transmission methods and networks. In addition, this will include system analysis,

operation, management and automation of the electric power networks. The module ensures basic and advanced concepts are implemented within the lab to provide confidence to students in analysing and designing various aspects of electrical power engineering systems.

Features: Not applicable

Educational aims: The aim of this module is to embed advanced electrical and electronic engineering principles considered essential to the practice of electrical power engineering within the curriculum of BEng (Hons) degree course.

Outline syllabus: Introduction to machines basic: Concepts of electromotive force, torque, torque angle, multipolar and linear machines

Theoretical aspects of magnet/electromagnet: Theory of magnetism used in electrical machines and transformers, magnetic circuits, behaviour and applications of electromagnets used in electrical power plants.

Developments of emf and mmf in electric machines windings: Winding arrangements and emf and mmf produced by the armature windings,

DC Commutator motors: Armature reaction, commutation, construction and output equation, characteristics of motors and generators, parallel operation and DC machines applications

Asynchronous Machines: Construction and equivalent circuit, machine equations, circle diagram and speed control methods and performance.

Synchronous Machines: Theory and construction, machine equation, circle diagram, efficiency and mode of operations.

Electrical Machine Drives: DC Machine drives, power electronic control of AC machines and mathematical and simulation of machine systems.

Transformers: Transformer with or without load, types and operational features, parallel operation and efficiency.

Polyphase Circuits: Generation of polyphase voltages, phases sequences, star and delta connections on both loads and generation sides, star and delta conversion, power measurements, power factor improvements balanced and unbalanced loads and four-wire star connection and three-wire delta connection.

DC Transmission and Distribution Systems: Two-wire and three-wire Systems and comparison, Voltage drop and transmission efficiency, DC distributors for various loads, and distributor fed at single and both ends.

AC Transmission and Distribution: Power systems and Networks, Single and Three-Phase Distribution Systems, Effects of voltage variations on transmission line efficiency, Transmission System analysis (Nominal T and Pi methods) and analysis of components under constraints.

Distribution Automation: Energy management, conventional networks and automated systems, Typical SCADA system and load management for substation automation.

Part 3: Teaching and learning methods

Teaching and learning methods: In order to develop and progress to advanced knowledge of electrical and electronic engineering, the module tailors the already learnt basic concepts with the new and advanced knowledge and the scope of the concepts through lectures. These will be supported by directed reading, tutorial exercises, practical and simulation laboratory-based works.

Module Learning outcomes: On successful completion of this module students will achieve the following learning outcomes.

MO1 Demonstrate knowledge and understanding of working principles of electrical machines, transformers, magnetic and power systems engineering circuits to support design, analysis and solution of engineering problems. (SM1 and SM2)

MO2 Describe the performance of electrical machines, components and power systems through the use of analytical methods and modelling techniques (EA2)

MO3 Implement theory of operation design of electrical machines and components to evaluate cost effective performance of electrical power distribution & transmission systems. (D5)

MO4 Understand the requirements of operation and management of electric power networks to promote sustainable development of electric power and ability to apply quantitative techniques for economical power networks operation. (EL4 and P1)

Hours to be allocated: 300

Contact hours:

Independent study/self-guided study = 228 hours

Face-to-face learning = 72 hours

Total = 300

Reading list: The reading list for this module can be accessed at readinglists.uwe.ac.uk via the following link https://rl.talis.com/3/uwe/lists/5F80E8F6-CC03-4136-6B1A-81D7B8730425.html?lang=en&login=1

Part 4: Assessment

Assessment strategy: In this module we are teaching the advanced theory and practice that underpin Electrical Power Systems and are providing practical experiences that allow students to bring concepts and practice together. The laboratory reinforces the material learned in the lecture sessions.

The assessment is designed so that students build their understanding and confidence in applying new concepts as they progress through the course. The assessment takes the form of two tasks. In the first task there will be two online exams of equal weighting at the end of each teaching term assesses conceptual understanding, analysis and design skills and in the second task there will be an

online submission of a group CW assignment based on conceptual design and implementation using simulation software where students complete the design and its implementation followed by a written report. This task will assess design and implementation skills.
The resit assessment will consist of two online exams and a group CW assignment Online Blackboard submission based on conceptual design and implementation using simulation software where students complete the design and its implementation followed by a written report.

Assessment tasks:

Examination (Online) (First Sit)
Description: Written online exam at the end of the first term
Weighting: 30 %
Final assessment: No
Group work: No
Learning outcomes tested: MO1, MO2, MO3

Examination (Online) (First Sit)
Description: Written online exam at the end of the second term
Weighting: 30 %
Final assessment: Yes
Group work: No
Learning outcomes tested: MO1, MO2, MO3, MO4

Written Assignment (First Sit)
Description: Design and analysis exercise (5000-6000 words)
Weighting: 40 %
Final assessment: No
Group work: Yes
Learning outcomes tested: MO2, MO3, MO4

Examination (Online) (Resit)
Description: Written online exam

Weighting: 30 %

Final assessment: No

Group work: No

Learning outcomes tested: MO1, MO2, MO3

Examination (Online) (Resit)

Description: Written online exam

Weighting: 30 %

Final assessment: Yes

Group work: No

Learning outcomes tested: MO1, MO2, MO3, MO4

Written Assignment (Resit)

Description: Design and analysis exercise (5000-6000 words)

Weighting: 40 %

Final assessment: No

Group work: Yes

Learning outcomes tested: MO2, MO3, MO4

Part 5: Contributes towards

This module contributes towards the following programmes of study:

Electrical and Electronic Engineering [Frenchay] BEng (Hons) 2023-24