ES3E7-15 Power Systems and Electrical Machines

22/23

Department
School of Engineering
Level
Undergraduate Level 3
Module leader
Layi Alatise
Credit value
15
Module duration
10 weeks
Assessment
30% coursework, 70% exam
Study location
University of Warwick main campus, Coventry

Description

Introductory description

ES3E7-15 Power Systems and Electrical Machines

Module web page

Module aims

The aim of this module is to consider, in depth, the design and operation of synchronous, induction and DC machines. In addition, the module aims to provide an in depth knowledge of the modern power system as an interconnection of rotating electrical machines, transformers, transmission lines, switch gear, loads etc.

Outline syllabus

This is an indicative module outline only to give an indication of the sort of topics that may be covered. Actual sessions held may differ.

Electrical Machines

- Recap of 3-Phase AC system (Star systems, delta systems, phase quantities, line quantities)
- Recap of magnetic principles
- Rotating magnetic fields
- Design, control and operation of synchronous generators
- Design, control and operation of synchronous motors
- Design, control and operation of Induction machines
- Design, control and operation of DC Machines
  Power Systems
- Per unit representation of power systems
- Single line models of transmission lines and transformers
- Formulation of the load flow problem
- Newton-Raphson and Gauss Siedel techniques in load flow calculations
- Symmetrical components and Faults in AC power systems
- System protection, Fault current limiters, circuit breakers, switch gear, etc

Learning outcomes

By the end of the module, students should be able to:

- Apply mathematical principles to solve analytical problems on electrical machines: synchronous, induction and DC motors for energy conversion in modern electro-mechanical systems.
- Evaluate the design and efficiency of electrical machines.
- Asses how power systems are designed, operated and controlled.
- Analyse the operation of modern technologies like transformers, transmission lines, circuit breakers etc.
- Laboratory based evaluation of Electrical Machine and Power System parameters

Indicative reading list

Electric Machinery Fundamentals, S.J. Chapman, 5th edition, McGraw-Hill, 2012.
Power System Analysis and Design, J.D. Glover, M.S. Sarma and T.J. Overbye, 6th edition, Cengage Learning, 2017.

Research element

Renewable energy systems research

Subject specific skills

Ability to conceive, make and realize electrical and magnetic systems for electrical energy conversion
Ability to develop economically viable and ethically sound sustainable solutions for power generation, transmission and distribution
Ability to be pragmatic, taking a systematic approach and the logical and practical steps necessary for electrical power generation problems and power systems control problems
Ability to seek to achieve sustainable solutions to electrical machine and power system problems

and have strategies for being creative and innovative
Ability to be risk, cost and value-conscious, and aware of their ethical, social, cultural, environmental, health and safety, and wider professional engineering responsibilities pertaining to electrical machines and power systems

Transferable skills

1. Numeracy: apply mathematical and computational methods to communicate parameters, model and optimize solutions
2. Apply problem solving skills, information retrieval, and the effective use of general IT facilities
3. Communicate (written and oral; to technical and non-technical audiences) and work with others
4. Plan self-learning and improve performance, as the foundation for lifelong learning/CPD

Study

Study time

Type	Required
Lectures	30 sessions of 1 hour (20%)
Practical classes	2 sessions of 2 hours (3%)
Other activity	2 hours (1%)
Private study	114 hours (76%)
Total	150 hours

Private study description

114 hours Guided Independent Learning

Other activity description

2 x 1 hour Revision Class

Costs

No further costs have been identified for this module.

Assessment

You must pass all assessment components to pass the module.

Assessment group D4

	Weighting	Study time
Lab Report	30%	
Written Lab Report (10 pages excluding figures)		
In-person Examination	70%	
Standard Examination		

- Answerbook Gold (24 page)
- Students may use a calculator
- Engineering Data Book 8th Edition

Feedback on assessment

- Support through advice and feedback hours.
- Written feedback on marked laboratory report.
- Cohort-level feedback on final exam.

Past exam papers for ES3E7

Availability

Pre-requisites

To take this module, you must have passed:

- All of
  - ES2C6-15 Electromechanical System Design

Courses

This module is Core for:

- Year 1 of RESA-H6P9 Postgraduate Research Wide Bandgap Power Electronics
- Year 3 of UESA-H605 Undergraduate Electrical and Electronic Engineering
- Year 4 of UESA-H60V Undergraduate Electrical and Electronic Engineering (with Intercalated Year)
- Year 3 of UESA-H606 Undergraduate Electrical and Electronic Engineering MEng
- Year 4 of UESA-H607 Undergraduate Electrical and Electronic Engineering with Intercalated Year

This module is Core optional for:

- Year 3 of UESA-H115 MEng Engineering with Intercalated Year
- Year 2 of RESA-H6P9 Postgraduate Research Wide Bandgap Power Electronics
- Year 1 of TESA-H643 Postgraduate Taught Electrical Power Engineering
- Year 1 of TESA-H642 Postgraduate Taught Energy and Power Engineering
- UESA-H607 Undergraduate Electrical and Electronic Engineering with Intercalated Year
    - Year 3 of H607 Electrical and Electronic Engineering with Intercalated year
    - Year 4 of H607 Electrical and Electronic Engineering with Intercalated year

This module is Optional for:

- Year 3 of UESA-H113 BEng Engineering
- Year 3 of UESA-H114 MEng Engineering
- Year 4 of UESA-H115 MEng Engineering with Intercalated Year
- UESA-H11L Undergradaute Engineering (with Intercalated Year)
    - Year 3 of H11L Engineering (with Intercalated Year)
    - Year 4 of H11L Engineering (with Intercalated Year)

This module is Option list A for:

- Year 4 of UESA-H111 BEng Engineering with Intercalated Year
- UESA-H112 BSc Engineering
    - Year 3 of H112 Engineering
    - Year 3 of H112 Engineering