MODULE DESCRIPTION FORM

DEPARTMENT OF MECHANICAL AND AEROSPACE ENGINEERING

ME929 Electrical Power Systems

Module Registrar: Dr N Kelly nick@esru.strath.ac.uk	**Taught To (Course): MSc Renewable Energy Systems and the Environment (compulsory); MSc Offshore Renewable Energy; MSc Advanced Mechanical Engineering / with Energy Systems / with Aerospace**	
Other Lecturers Involved:	**Credit Weighting: 10**	**Semester: 1**
Compulsory/ optional/ elective class	**Academic Level: 5**	**Suitable for Exchange: Y**

Required prerequisites

Note: It is the responsibility of ALL students to ensure that they satisfy the prerequisite knowledge for this module BEFORE adding as part of curriculum selection. If unsure, please contact the Module Registrar or discuss with your Programme/Year Adviser of Studies.

Maths skills: good maths skills required as classwork includes the calculations using complex numbers, vector arithmetic differentiation and integration and manipulation of algebraic expressions.

Module Format and Delivery (HOURS i.e. 1 credit = 10hrs of study):

Lecture	Tutorial	Laboratory	Groupwork	External	Online	Project	Assignments	Private Study	**Total**
22	10						33	35	100

Educational Aim

This module aims to provide students with an understanding of the operation of modern electrical power systems featuring renewable and low carbon generation, along with the techniques to undertake a basic technical analysis and design of key electrical devices and systems.

Learning Outcomes

On completion of the module the student is expected to be able to:

LO1 Explain the basis of operation of modern electrical power systems incorporating renewable energy technologies and the consequences for the environment and energy security.

LO2 Apply complex numbers and fundamental analysis techniques such as Kirchhoff's current and voltage laws to solve power flow problems and analyse equivalent circuits of electrical systems and devices.

Syllabus

The module will teach the following:

The fundamentals of electrical power: direct current (DC) and voltage, alternating current (AC) and voltage. For AC systems: converting time varying, fixed frequency quantities to phasor form.

The basics of circuit analysis: basic circuit elements (resistor, indictor and capacitor) and their effect on current and voltage in DC and AC systems.

Power in DC and AC systems: looking at the concepts of real, reactive, apparent power and impedance.

An overview of the demand for electricity, looking at the aggregate characteristics of electricity demand and giving a specific example of demand for electricity in a dwelling.

An overview of electricity generation and distribution within the UK, along with a detailed review of the growth of renewable electricity generation.

Microgeneration, storage and power conversion.

The basics of electromagnetism, specifically focusing on how it underpins the operation of electrical equipment.

An overview of electrical machines including the transformer, synchronous generator and induction machines (used as both motors and generators). For each, an equivalent circuit will be developed and used to illustrate the operational characteristics of these devices in power systems.

Power conversion and protection in power systems.

Assessment of Learning Outcomes

Criteria

For each of the Module Learning Outcome the following criteria will be used to make judgements on student learning:

LO1 Explain the basis of operation of modern electrical power systems incorporating renewable energy technologies and the consequences for the environment and energy security.

In their exam the students will be expected to:
C1 Explain the principles behind the operation of different electrical devices or systems.
C2 Correctly identify in which context it is appropriate to apply different types of electrical device.

LO2 Apply complex numbers and fundamental analysis techniques such as Kirchoff's current and voltage laws to solve power flow problems and analyse equivalent circuits of electrical systems and devices.

To gauge the ability of students to apply analysis techniques introduced in class to basic electrical design problems, the assignment and exam will include components in which students will:
C1 Solve basic problems in circuit analysis and power flow.
C2 Use calculations to support their findings and conclusions.

The standards set for each criterion per Module Learning Outcome to achieve a pass grade are indicated on the assessment sheet for all assessment.

Principles of Assessment and Feedback
(within Assessment and Feedback Policy at: https://www.strath.ac.uk/professionalservices/staff/policies/academic/)

Assessment of student performance within the module will be based on a technical assignment and an exam. These will be used to gauge the student's understanding of the principles of operation of modern power systems and the challenges posed by the integration of renewable technologies. Additionally, the assignment will include the need to apply techniques introduced in class to a basic technical and design problem associated with electrical power systems.

Multiple feedback mechanisms will be employed: the assignment will be returned to students with comments on performance. Additionally, clear guidance will be provided in class as to what constitutes an acceptable level of performance in the assignment.

The tutorial class will also be used to provide feedback on the development of a student's technical analysis skills. This will be achieved through direct observation of a student's efforts to tackle technical problems followed by appropriate mentoring. Additionally, peer-peer feedback will be employed in that students will be expected to present to their peers on how they set about tackling a tutorial problem.

Assessment Method(s) Including Percentage Breakdown and Duration of Exams *(individual weightings)*

Examination				**Coursework**		**Practical**		**Project**	
Number	Month(s)	Duration	***Weighting***	Number	***Weighting***	Number	***Weighting***	Number	***Weighting***
1	Dec	2hrs	70%	1	30%				
LO1 LO2				LO1 LO2		*		*	

* ***L/Os:*** *Indicate which Learning Outcomes (L01, L02, etc) are to be assessed by exam/coursework/practical/project as required.*

Coursework / Submission deadlines (*academic weeks*): Wk 7
Resit Assessment Procedures: 2 hr examination in August diet

PLEASE NOTE:
Students must gain a summative mark of 50% to pass the module. Students who fail the module at the first attempt will be re-assessed during the August diet. This re-assessment will consist entirely of an exam. No marks from any previous attempts will be transferred to a new resit attempt.

Recommended Reading

*****Purchase recommended **Highly recommended reading *For reference**

*Wildi T, Electrical Machines Drives and Power Systems, International Edition, Prentice Hall, New Jersey.

Extra reading material provided on class Myplace page.

Additional Student Feedback
(Please specify details of when additional feedback will be provided)

Date	Time	Room No
By Arrangement	By arrangement	JW814c

Session: 2021/22

Approved:

Course Director Signature: E Henderson
Date of Last Modifications: 18/08/2021

(Updated July 2021-MAE)

MODULE TIMETABLE

Module Code:	**ME929**	**Module Title:**	**Electrical Power Systems**

Brief Description of Assessment:

Research and technical analysis of emerging energy supply/demand paradigms in electrical power. Specific topic to be outlined in WK4 (30% of mark) and end of semester exam (70% of mark)

Assessment Timing

Indicated on the table below are the start/submission dates for each assignment/project and the timing of each exam/assessment. Dropdowns may be left blank. Add extra notes below the dropdowns where relevant.

Please note: Timings can and will change, this should only be used as a guide.

Semester One	W&D Wk	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	WK10	WK11	Exam Period
	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Course work Set	Choose an item. Choose an item.	Choose an item. Choose an item.	Course work Submit	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Exam

Semester Two	C&D Wk	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	WK10	WK11	Exam Period
	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item.