# Module Description Form

**ME929  ELECTRICAL POWER SYSTEMS**

<table>
<thead>
<tr>
<th>Module Registrar: Dr Nick Kelly</th>
<th>Taught To (Course): MSc Renewable Energy Systems and Environment</th>
</tr>
</thead>
<tbody>
<tr>
<td><a href="mailto:nick@esru.strath.ac.uk">nick@esru.strath.ac.uk</a></td>
<td></td>
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</tbody>
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<table>
<thead>
<tr>
<th>Other Lecturers Involved: n/a</th>
<th>Credit Weighting: 10</th>
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<tbody>
<tr>
<td></td>
<td>Semester: 1</td>
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<table>
<thead>
<tr>
<th>Assumed Prerequisites: n/a</th>
<th>Compulsory</th>
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<tr>
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<td>Academic Level: 5</td>
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## Module Format and Delivery (HOURS i.e. 1 credit = 10hrs of study):

<table>
<thead>
<tr>
<th>Lecture</th>
<th>Tutorial</th>
<th>Laboratory</th>
<th>Project</th>
<th>Assignments</th>
<th>Private Study</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>24</td>
<td>12</td>
<td></td>
<td></td>
<td>24</td>
<td>40</td>
<td>100</td>
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## 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 of key electrical devices and systems.

## Learning Outcomes

On completion of the module the student will be expected 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 Kirchoff'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, inductor 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 devices 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.
- An introduction to protection in electrical power systems.
Assessment of Learning Outcomes

Criteria

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

LO1 To assess the degree of understanding of the principles of power system operation and associated energy security and environmental issues, students will be asked to provide a 6 page review based around new developments in power generation, particularly the growth of renewables and microgeneration. This will be assessed based on:
C1 Evidence of significant additional study and use of material not delivered in class.
C2 Use of supporting material to fully explain the development and present form of a power system.
C3 A well-structured essay with good use of referencing.

LO1 Further, students will be required to answer short essay questions as part of the end-of-module examination in which 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 In order to gauge the ability of students to apply analysis techniques introduced in class to basic electrical problems, students will be assessed in an end-of-module examination. This will be based on:
C2 The ability of the student to correctly solve basic problems in circuit analysis and power flow.

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

12 Principles of Assessment and Feedback
(on Learning & Teaching web pages: www.strath.ac.uk/learnteach/teaching/staff/assessfeedback/12principles/)

Assessment of student performance within the module will be based on a combination of written assignments and examination. The written assignment 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. The examination will primarily assess the ability of the student to apply techniques introduced in class to basic technical problems associated with electrical power systems.

Multiple feedback mechanisms will be employed: essay assignments 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 written assignment. Students will also be given the opportunity to critique each other’s assignments in the tutorial class prior to submission.

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

<table>
<thead>
<tr>
<th>L/Outcomes</th>
<th>Examinations</th>
<th>Courseworks</th>
<th>Projects</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
<td>Duration</td>
<td>Weighting</td>
</tr>
<tr>
<td>L01 L02</td>
<td>1</td>
<td>2hrs</td>
<td>70%</td>
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Indicate which learning outcomes (L01, L02 etc) are to be assessed by exam/coursework/project as required.

Coursework / Submissions deadlines:
Week 6

Resit Assessment Procedures:
2hour examination in August diet
PLEASE NOTE:
Students need to gain a summative mark of 50% to pass the module. Students who fail the module at the first attempt will be re-examined during the August diet. This re-examination will consist of an examination.

Recommended Reading

****Purchase essential; ***Purchase recommended; **Highly recommended reading;
*Simply for reference (do NOT purchase)


Extra reading material provided on class Myplace page.

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

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Room No</th>
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</thead>
<tbody>
<tr>
<td>By arrangement</td>
<td>By arrangement</td>
<td>JW814c</td>
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Session: 2014/15

Approved:

Course Director Signature: P Strachan

Date of Last Modifications: 28/08/2014
**MODULE TIMETABLE**

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

**Brief Description of Assessment:**

Assignment: National power system investigation (30% of mark)
Module Examination (70% of mark)

**Assessment Timing:**

Indicate on the table below the Start/Submission dates for each Assignment/Project and the timing of each Exam/Class Test(s).

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<thead>
<tr>
<th>Semester One</th>
<th>WK1</th>
<th>WK2</th>
<th>WK3</th>
<th>WK4</th>
<th>WK5</th>
<th>WK6</th>
<th>WK7</th>
<th>WK8</th>
<th>WK9</th>
<th>WK10</th>
<th>WK11</th>
<th>WK12</th>
<th>Exam Period</th>
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<td></td>
<td></td>
<td>Assign1</td>
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<td>Assign 1 due</td>
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<td>2-hour Exam</td>
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<th>WK2</th>
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<th>WK4</th>
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<th>WK6</th>
<th>WK7</th>
<th>WK8</th>
<th>WK9</th>
<th>WK10</th>
<th>WK11</th>
<th>WK12</th>
<th>Exam Period</th>
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