Unit summary

Unit Title: Marine Electrical Powering and Systems
Unit Code: JEE486
Semester: 1 Year 2011
Pre-Requisites: JEE114 Electrical Fundamentals

Prior knowledge &/or skills: JEE451 Marine and Offshore Engineering and Design
Able to produce electrical schematics of ship’s systems. Students without the equivalent of the expected prior learning are to make good any deficiency in their own time.

Courses: BE (Marine and Offshore Systems)
Credit Points: 12.5
National Centre: Maritime Engineering and Hydrodynamics
Campus: Launceston

Teaching staff

<table>
<thead>
<tr>
<th>Title</th>
<th>Name</th>
<th>Office</th>
<th>Email</th>
<th>Phone</th>
<th>Consultation Days &amp; Times</th>
</tr>
</thead>
<tbody>
<tr>
<td>Co-ordinator</td>
<td>Hung Nguyen</td>
<td>G86</td>
<td><a href="mailto:nguyenhd@amc.edu.au">nguyenhd@amc.edu.au</a></td>
<td>6324-9350</td>
<td>Appointment</td>
</tr>
<tr>
<td>Lecturer 1</td>
<td>Hung Nguyen</td>
<td>G86</td>
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<td>6324-9350</td>
<td>Appointment</td>
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</table>
Unit description
The purpose of this unit is to develop engineering ability for system level design and commissioning of electrical powering and systems within marine and offshore sectors. The unit focuses on estimation of plant power electrical loads, electrical machines, electrical distribution and protection, electrical safety and power electronics.

Learning outcomes
On successful completion of this unit, students should be able to:

1. Explain operating principles of electric machines, including DC machines, AC machines and gas turbine diesel generator sets, electrical distribution and protection systems, explosion, fire prevention, detection, protection, break circuits, safe operation of electrical power systems and solid state semiconductors used in power electronics and marine and offshore industries
2. Estimate plant electrical load and determine the required power supply capacity using single-line diagrams, schematic drawings of electrical wiring, distribution and protection based on classification society regulations, rules and standards
3. Perform basic calculations of DC, AC 1 phase and 3 phase power systems
4. Design and test marine electrical powering and systems

Graduate attributes

BE Degree Outcomes

A. Demonstrate technical knowledge
B. Design for the maritime environment
C. Solve maritime engineering problems
D. Manage, create, use and disseminate information
E. Communicate effectively
F. Work in teams
G. Manage self and others
H. Negotiate the business environment
I. Behave as a professional
J. Consider wider context of engineering knowledge and work

The relevant BE Degree Attributes are in the BE Course Rules at:
http://www.amc.edu.au/be.course.content.rules

Content

Theory:
a) Estimation of Plant Electrical Load
Determination of power supply capacity, standby capacity of plain cable feeders and transformer feeders, rating of motors in relation to their prime movers, rating of generators in relation to their prime movers.
b) Active, reactive and apparent power
Three phase circuits with balanced and unbalanced loads. Technical specifications and per-unit quantities. Real power; reactive power, apparent power, power factor and power factor correction.

c) **DC Motors**

d) **Three Phase AC Motors**

e) **Three Phase AC Generators**
Construction and principle of operation, salient and cylindrical pole types. Shaft generators, excitation methods, automatic voltage regulators, synchronising, parallel operation and load sharing. Gas turbine and Diesel Gen-sets characteristics.
PTO/PTI systems (shaft alternators that can be used as propulsion)

f) **Earthed and Insulated Neutral Distribution Systems**

g) **Safety**
Applicable Safety standards. Safe voltages. Safe operation and maintenance. Requirements for electrical equipment in hazardous areas on vessels and oil rigs.

h) **Introduction to Maritime Electrical Systems Analysis**
Typical systems and wiring diagrams for Ships, boats and oil rigs. Harmonics and filtering, EM disturbances and counter measures, surge protection.

i) **Power Electronics**
Elements of power electronics, devices (Thyristers, MOSFETs). Rectifiers, inverters / frequency controllers, and converters. PWM. Soft starters.

**Practicals/Labs/Site Visits:**
- **Lab 1:** Electrotechology Power Lab (AC and DC machines and distribution systems)
- **Lab 2:** Electrotechology Power Lab (System load and stability practical)
- **Lab 3:** Power Electronics Lab (Inverters and frequency control of motors and generators in Control Lab using microcontrollers and solid state devices)
- **Lab 4/Site Visits:** TBA when organized.

**Learning resources required**

**Requisite texts**

**Recommended reading**

**E- (electronic) resources**

TBA.

**MyLO:** Under construction


Lectures, assessed individual tutorials and self-directed learning. Online lecture notes and material.

**Equipment & materials**

**Materials to be provided by the student**

Standard Engineering study equipment including any calculator.

Lab coats, safety boots and other PPE per AMC OH&S policy.

**Materials to be provided by AMC:**

Course notes can be purchased from the UnitPrint Shop in Newnham.

**Extra costs:**

Photocopying and printing of support material.

**Computer hardware & software**

TBA

**Occupational health and safety (OH&S)**

The University is committed to providing a safe and secure teaching and learning environment. In addition to specific requirements of AMC and this unit you should refer to the University’s policy at: [http://www.admin.utas.edu.au/hr/ohs/pol_proc/ohs.pdf](http://www.admin.utas.edu.au/hr/ohs/pol_proc/ohs.pdf)

All laboratory work requires students to follow OH&S requirements stipulated for the areas utilised. Students must wear lab coats or overalls and safety shoes for all laboratory sessions.

**Other requirements**

TBA

**Details of teaching arrangements**

**Learning strategies**

Lectures, tutorials, Workshops in the ElectroTech Power Lab, Lab site visits
## Class times

<table>
<thead>
<tr>
<th>Class</th>
<th>Day</th>
<th>Time</th>
<th>Location</th>
<th>Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture</td>
<td>Mon</td>
<td>14:00-15:50</td>
<td>G81</td>
<td>All</td>
</tr>
<tr>
<td>Lecture</td>
<td>Thu</td>
<td>12:00-13:50</td>
<td>G81</td>
<td>All</td>
</tr>
<tr>
<td>Laboratory^1</td>
<td>TBA</td>
<td>TBA</td>
<td>TBA</td>
<td>TBA</td>
</tr>
</tbody>
</table>

(1) Check tutorial groups and lab timetable/groups to identify your designated time and day.

## Syllabus and Learning Schedule

<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Topic</th>
<th>Readings / Problems</th>
<th>Assessment</th>
</tr>
</thead>
</table>
| 1    | 21-25/2    | Introduction  
Fundamentals of Electricity, magnetism and circuit | Chapter 1            |                       |
| 2    | 28/2-4/3   | Estimate of plant power                             | Chapter 2  
Tutorial 1 |                       |
| 3    | 7/3        | 8 Hours Day  
Electrical machines and drives  
DC Motors | Chapter 3  
Tutorial 2 | Assignment tasks out |
| 4    | 14-18/3    | Electrical machines and drives (con.)  
Three phase circuits | Chapter 3  
Tutorial 3-1 |                       |
| 5    | 21-25/3    | Electrical machines and drives (con.)  
Active, reactive and apparent power  
Revision 1 | Chapter 3  
Tutorial 3-2 |                       |
|      | Lab TBA    |                                                      |                      |                       |
| 6    | 28/3-1/4   | Electrical machines and drives (con.)  
Three phase AC motors | Chapter 3  
Tutorial 3-3 |                       |
|      | Lab TBA    |                                                      |                      |                       |
| 7    | 4-8/4      | Electrical machines and drives (con.)  
Three phase AC generators | Chapter 3  
Tutorial 3-4 | Class Test (8/4)  
After Easter Break |                       |
|      | Lab TBA    |                                                      |                      |                       |
| 8    | 11-15/4    | Fundamentals of power electronics                    | Chapter 4  
Tutorial 4-1 |                       |
|      | Lab TBA    |                                                      |                      |                       |
| 9    | 18-24 & 28-  
29/4 | Fundamentals of power electronics | Chapter 4  
Tutorial 4-2 |                       |
|      | Lab TBA    |                                                      |                      |                       |
| 10   | 2-6/5      | Fundamentals of power electronics                    | Chapter 4  
Tutorial 4-3 | Lab report         |
| 11   | 9-13/5     | Safety, earthing, distribution and protection systems | Chapter 5  
Tutorial 5-1 |                       |
| 12   | 16-20/5    | Safety, earthing, distribution and protection systems (cont.) | Chapter 5  
Tutorial 5-2 | Due date for Assignment (20/5) |
| 13   | 23-27/5    | Safety, earthing, distribution and protection systems (cont.) | Chapter 5  
Revision 2 |                       |
| 14   |           |                                                      |                      | Study Period          |
Specific attendance/performance requirements

Attendance at all assigned class times is expected. You are responsible for all information (both academic and administrative) presented during class times. Should you miss a class for whatever reason it is your responsibility to obtain information and content that was missed. Attendance at all laboratory and practical sessions is compulsory.

Assessment

Assessment schedule(*)

<table>
<thead>
<tr>
<th>Assessment Task</th>
<th>Due Date / Details</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class Test</td>
<td>Week 7 (8/4)</td>
<td>15</td>
</tr>
<tr>
<td>Assignment</td>
<td>Week 12 (20/5)</td>
<td>30</td>
</tr>
<tr>
<td>Tutorials</td>
<td>Continuous</td>
<td>5</td>
</tr>
<tr>
<td>Practical/Lab/Visit 1&amp;2</td>
<td>TBA</td>
<td>10</td>
</tr>
<tr>
<td>Practical/Lab/Visit 3&amp;4</td>
<td>TBA</td>
<td>10</td>
</tr>
<tr>
<td>Final examination</td>
<td>TBA</td>
<td>30</td>
</tr>
</tbody>
</table>

(*) Any changes will be advised.

Assessment details

Types and Weighting of Assessment:

Design Assignment (30%):

Task Description:

- Gather information on a type of vessel and classification society requirements
- Estimate plant electrical power loads and draw diagrams/schematics
- Select types of electrical machines (generators and motors)
- Perform necessary calculations based on relevant theories
- Produce documents by referring to classification society rules and regulations

Links to Learning Outcomes: 1, 2, 3, 4

Assessment Criteria:

- Demonstrate and apply theoretical and practical knowledge of electrical engineering and power electronics and related engineering principles to design and analysis of electrical power plant and systems used in marine and offshore systems
- Solve problems in the design and analysis of electrical powering and systems
- Evaluate the performance of the electrical systems through relevant calculations, results and analysis
- Communicate in writing in the form of a technical report.

Due Date for Assignment: Week 12 (20/5)
Practical/Labs/Site Visits (20%):

Task Description:
Attendance is compulsory. Write-up due two weeks afterwards. Practical/Labs/Site Visits require preparation, participation and individual reporting. One practical/lab/site visit is scheduled (see Syllabus and Learning Schedule). Format for the reports will be discussed prior to the first submission. Practical reports, teamwork and written and graphical communication skills will be emphasised and assessed.

Links to Learning Outcomes: 1, 3, 4

Assessment Criteria:

- Demonstrate and apply theoretical and practical knowledge of electrical engineering and power electronics and related engineering principles to explanation of electrical and electronic systems and components in laboratories
- Solve problems in the design and analysis of electrical powering and systems
- Evaluate the performance of the electrical systems through relevant calculations, results and experimental data analysis
- Communicate in writing in the form of a technical lab report.

Due date for Each Lab Report: Two weeks after commencing experiments

Class Test (15%): An hour class test will cover fundamentals of marine electrical powering and systems. The primary emphasis will be (i) problem identification, formulation and solution, and (ii) demonstration of basic fundamentals.

Due Date for Class Test: Week 7 (8/4)

Exam (30%): Students are responsible for material from lecture, tutorial, practical, and text. A 3-hour exam will cover all aspects of the unit. The primary emphasis will be (i) conditions evaluation through to material selection and (ii) knowledge of Engineering materials use. The exam timetable will be finalised several weeks before the examination period. Do not make travel plans until the exam timetable is finalised. Failure to attend a test or exam results in an automatic zero mark. Alternative times cannot be made for individuals.

Due Date for Exam: TBA

Tutorials (5%): Participation in tutorials is assessable so attendance is mandatory. Problem lay out and written communication skills are very important in engineering problem solving. The tutorials involve in solving problems and support class tests and exam. Students have to keep their own personal tutorial notebooks and submit at the end of semester.

Due Date for Tutorials: Continuous

Submission of assignments and reports
All assignments, reports, etc. must be completed using the template provided on the web, (http://www.amc.edu.au/beng.templates), unless otherwise specified by the lecturer. The accompanying cover sheet must be completed. All descriptive components of the assignments and reports should be typed. Group reports must be signed by all participants.
Assignments and reports must be placed in the lecturer’s assignment box by the due dates (ground floor in the Swanson Building).

Electronic submissions are not acceptable (unless otherwise instructed by lecturer). The assessed work will be returned during lecture or as agreed between the students and the lecturer.

**How your final result is determined**

The grade that you receive for this unit will be determined by a committee of examiners. The raw marks that you receive from each piece of assessable material will be combined in order to determine a letter grade for the unit (see Assessment Schedule for percent weighting). The raw marks may undergo a scaling process.

Assignment/work handouts will include an assessment matrix when criterion based grading is to be applied. The matrix identifies the level of performance by indicative characteristics associated with each level against each criterion, like amount and complexity of the work. Criteria graded assignments will be awarded a grade of work from HD to NN according to the assessment matrix.

<table>
<thead>
<tr>
<th>Grade of work</th>
<th>HD</th>
<th>DN</th>
<th>CR</th>
<th>PP</th>
<th>NP</th>
<th>NN (Fail)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transposed mark</td>
<td>100-80</td>
<td>79-70</td>
<td>69-60</td>
<td>59-50</td>
<td>49-45</td>
<td>&lt; 45</td>
</tr>
</tbody>
</table>

**Penalties**

Late submissions of assignments and reports will receive a penalty of 10% for each overdue day. Failure to submit any piece of assessable work will be deemed a fail and receive a zero mark. Non-attendance or non-participation of laboratory sessions will result in a fail grade for the unit. Obtain permission from lecturer if you are not able to attend any sessions.
Problems with your assessment

If you have questions or problems with your assessment, you should discuss this with the following people:

(1) The person who marked the assessment.

(2) Unit Coordinator.

(3) Head, Maritime Engineering.

(4) Director, National Centre for Maritime Engineering and Hydrodynamics.

If this does not resolve the issue, you may file a formal appeal. The procedure is given at: http://www.studentcentre.utas.edu.au/examinations_and_results/results/result_review_results.htm

Course rules

More information with regard to content, assessments, grading, etc. is found in the Course Rules Document at: http://www.amc.edu.au/be.course.content.rules

Academic referencing

In your written work you will need to support your ideas by referring to scholarly literature, works of art and/or inventions. It is important that you understand how to correctly refer to the work of others and maintain academic integrity.

Failure to appropriately acknowledge the ideas of others constitutes academic dishonesty (plagiarism), a matter considered by the University of Tasmania as a serious offence.

For information on presentation of assignments, including referencing styles:


Please read the following statement on plagiarism. Should you require clarification please see your unit coordinator or lecturer.

Academic misconduct

Academic misconduct includes cheating, plagiarism, allowing another student to copy work for an assignment or an examination and any other conduct by which a student:

a) seeks to gain, for themselves or for any other person, any academic advantage or advancement to which they or that other person are not entitled; or

b) improperly disadvantages any other student.

Students engaging in any form of academic misconduct may be dealt with under the Ordinance of Student Discipline, and this can include imposition of penalties that range from a deduction/cancellation of marks to exclusion from a unit or the University. Details of
Plagiarism is a form of cheating. It is taking and using someone else's thoughts, writings or inventions and representing them as your own; for example, using an author's words without putting them in quotation marks and citing the source, using an author's ideas without proper acknowledgment and citation, copying another student's work. If you have any doubts about how to refer to the work of others in your assignments, please consult your lecturer or tutor for relevant referencing guidelines, and the academic integrity resources on the web at: http://www.academicintegrity.utas.edu.au/

The intentional copying of someone else’s work as one’s own is a serious offence punishable by penalties that may range from a fine or deduction/cancellation of marks and, in the most serious of cases, to exclusion from a unit, a course or the University.

The University and any persons authorised by the University may submit your assessable works to a plagiarism checking service, to obtain a report on possible instances of plagiarism. Assessable works may also be included in a reference database. It is a condition of this arrangement that the original author’s permission is required before a work within the database can be viewed.

For further information on this statement and general referencing guidelines, see http://www.utas.edu.au/plagiarism/ or follow the link under ‘Policy, Procedures and Feedback’ on the Current Students homepage.

Further information and assistance

If you are experiencing difficulties with your studies or assignments, have personal or life planning issues, disability or illness which may affect your course of study, you are advised to raise these with your lecturer in the first instance.

There is a range of University-wide support services available to you including Teaching & Learning, Student Services, and International Services. Please refer to the Current Students homepage at: http://www.utas.edu.au/students/

Should you require assistance in accessing the Library visit their website for more information at: http://www.utas.edu.au/library/