Unit outline

Unit summary

Unit Title: Marine Electrical Powering and Systems
Unit Code: JEE486
Semester: 2  Year  4
Pre-Requisites: JEE114 Electrical Fundamentals
JEE344 Applied Control Engineering
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>
<td><a href="mailto:nguyenhd@amc.edu.au">nguyenhd@amc.edu.au</a></td>
<td>6324-9350</td>
<td>Appointment</td>
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<tr>
<td>Lecturer 2</td>
<td></td>
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<tr>
<td>Lecturer 3</td>
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Unit description
To develop engineering ability for system level design and commissioning of electrical powering and systems within the marine and offshore sectors.

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

- Estimate plant electrical load and determine the required power supply capacity.
- Perform basic DC, 1 phase and 3phase power systems calculations.
- Explain the operational principles of 3-phase A.C. motors, generators and transformers, used within Maritime Engineering.
- Explain the operational principles of typical D.C. motors used within Maritime Engineering.
- Describe solid state drive controllers, frequency and phase controllers, and motor start systems.
- Explain common electrical system operational states and fault conditions.
- Describe electrical distribution systems, components and protective devices.
- Understand and produce documents and basic wiring diagram drawings to standard format.
- Produce electrical wiring, distribution and protection schematics based on classification society regulations and standards using commercial software package in coordination with other subjects.
- Produce single-line diagrams for electrical and powering plants on a ship and/or offshore platform.
- SAFELY operate and fault-find on a basic power electrical system including switching and synchronisation.
- Identify electrical risk mitigation approaches and safe practice.
- Work safely with high voltage systems and identify their protective devices and safety requirements.
- Describe rules and regulations, diagrams and equipment comprising the Safety Case for marine electrical and powering systems on a ship and/or an offshore platform.
- Explain explosion/fire prevention, detection, protection, break circuits while operating and installing marine electrical and powering systems on a ship and/or an offshore platform.

Graduate attributes
The GGAs of the unit within the NCMEH courses will be able to:

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; and
I. Behave as a professional.
Contents

**Theory:**

*a) 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.

*b) Three Phase AC Motors*

*c) 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)

*d) Earthed and insulated neutral distribution systems.*

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

*f) DC Motors*

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

*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) 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.
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

**Lecturer’s website**: [http://academic.amc.edu.au/~hnguyen](http://academic.amc.edu.au/~hnguyen)

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

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>Tue</td>
<td>1:10-3:00</td>
<td>G83</td>
<td>All</td>
</tr>
<tr>
<td>Lecture</td>
<td>Wed</td>
<td>3:10-4:00</td>
<td>G83</td>
<td>All</td>
</tr>
<tr>
<td>Tutorial1</td>
<td>Tue</td>
<td>4:10-5:00</td>
<td>G83</td>
<td>All</td>
</tr>
<tr>
<td>Laboratory1</td>
<td>TBA</td>
<td>TBA</td>
<td>TBA</td>
<td>TBA</td>
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</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>
<tbody>
<tr>
<td>1</td>
<td>13 &amp; 14/7</td>
<td>Introduction Fundamentals of Electricity, magnetism and circuit</td>
<td>Chapter 1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>20 &amp; 21/7</td>
<td>Estimate of plant power</td>
<td>Chapter 2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>27 &amp; 28/7</td>
<td>Electrical machines and drives DC Motors</td>
<td>Chapter 3</td>
<td>Assignment tasks out</td>
</tr>
<tr>
<td>4</td>
<td>3 &amp; 4/8</td>
<td>Electrical machines and drives (con.) Three phase circuits</td>
<td>Chapter 3</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>10 &amp; 11/8</td>
<td>Electrical machines and drives (con.) Active, reactive and apparent power</td>
<td>Chapter 3</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Revision 1</td>
<td>Tutorial 3-2</td>
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<td></td>
<td></td>
<td>Lab</td>
<td>TBA</td>
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<tr>
<td>6</td>
<td>17 &amp; 18/8</td>
<td>Electrical machines and drives (con.) Three phase AC motors</td>
<td>Chapter 3</td>
<td>Class Test</td>
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<tr>
<td></td>
<td></td>
<td>Lab</td>
<td>Tutorial 3-3</td>
<td></td>
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<tr>
<td>7</td>
<td>24 &amp; 25/8</td>
<td>Electrical machines and drives (con.) Three phase AC generators</td>
<td>Chapter 3</td>
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<td>Lab</td>
<td>Tutorial 3-4</td>
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<td></td>
<td>TBA</td>
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</tbody>
</table>

Mid-term break (from 30/8 to 3/9)

8 7 & 8/9 Safety, earthing, distribution and Chapter 4
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 6</td>
<td>15</td>
</tr>
<tr>
<td>Assignment</td>
<td>Week 13</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>
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</table>

✓ Will be based on the work assigned, weighted according to the indicated percentages.

(*) Any changes will be advised.

Dates and weightings may be changed by the lecturer as required. You will be notified in a class session at least one week in advance of any changes to assessable work. Additional assessable work will be set if learning objectives are not achieved.

Repeat students are not eligible for any exemptions. Supplementary/deferred examinations may be set to allow for the extra study time available.

Assessment details

Types and Weighting of Assessment:
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 6 (18/8)

Design Assignment (30%). The design assignment is scheduled as in Syllabus and Learning Schedule. This will demonstrate the majority of your self-directed learning work. The design assignment is a project-based design assessment and requires preparation, practice of drawing and programming (if necessary) and individual reporting. Design assignment will cover all aspects of the unit. Students are expected to start the design assignment in the beginning of semester 2, submit at the end of semester 2 before the final exam.

Due Date for Assignment: Week 13 (15/10)

Practical/Labs/Site Visits (20%): 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.

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

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.

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.

Criterion based grading:

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 A to E according to the assessment matrix.

<table>
<thead>
<tr>
<th>Grade of work</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F (Fail)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transposed mark</td>
<td>85</td>
<td>75</td>
<td>65</td>
<td>55</td>
<td>45</td>
<td>Lecturer to assess</td>
</tr>
</tbody>
</table>

Coursework assessment variations:

Dates and weightings may be changed by the lecturer if required. You will be notified in a class session and by your notified contact email address at least one week in advance of any
changes to assessable work. In the event of a variation, the coursework total will be factored back to 50%, weighted by the percentage indicated against each piece of work set.

*Repeat students* are not eligible for any default exemptions.

**Submission of assignments and reports**

All assignments, reports, etc. must be completed using the template provided on the web, ([http://www.amc.edu.au/maritime.engineering/beng.templates/](http://www.amc.edu.au/maritime.engineering/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. 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.

**Penalties**

Late submissions of assignments and reports will receive a penalty of 10% for each working day. Failure to submit any piece of assessable work will be deemed a fail and receive a zero mark.

**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 a file formal appeal. The procedure is given at: [http://www.studentcentre.utas.edu.au/examinations_and_results/results/result_review_results.htm](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:
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.

Plagiarism

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. Details of penalties that can be imposed are available in the Ordinance of Student Discipline – Part 3 Academic Misconduct, see: http://www.utas.edu.au/universitycouncil/legislation/

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/