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## Template syllabus of the new/revised courses

**Course Name : Marine Environment and Renewable Energy**
**Number of credits (Malaysia) : 3**

**Period : Second semester**

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| Coordinator | **Dr Farah Ellyza Hashim** |
| Credits | 3 credits (4 ECTS) |
| Lecturers | **Prof Dr Omar Yaakob / Dr Farah Ellyza Hashim / Dr Arifah Ali** |
| Level | Master |
| Host institution | Universiti Teknologi Malaysia |
| Course duration | 14 Weeks=120 hours student learning time |
| New/revised | New |


**Summary**

Students will first be introduced to fundamentals of oceanography and marine meteorology. It explains the fluid physical characteristics and movement on the earth surface. As such, the student will have a clear understanding of the weather that results from the interaction between the atmosphere and the sea surface. Student will then learn on marine environmental issues related to ship and offshore structure. This course also introduces the main forms of marine renewable energy particularly wind, wave and tidal, focusing on the technology and resource assessment associated with each.


**Target student audiences**

Master students majoring in Ship and Offshore Technology, Renewable Energy or Marine Environment

**Prerequisites**

Required courses (or equivalents): NA

**Aims and objectives**

This course is designed to give students an understanding of the science of marine environment particularly waves and tides, and how this affects efforts to exploit energy from these resources. This course also introduces the main forms of marine renewable energy particularly wind, wave and tidal, focusing on the technology and resource assessment associated with each.

**The Authentic Tasks are:**

- Students are required to conduct case study by critically analyze available marine renewable energy converter and propose suitable design for Malaysia sea state conditions.

**General learning outcomes:**

By the end of the course, successful students will:

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| Knowledge | • Apply the physics of oscillations and waves with applications to wind, waves, and tides. |
| Comprehensive | • Analyze the effects of marine environment on vessels and offshore structures. |
| Application | • Demonstrate ability on project investment evaluation and design analysis ethically based on available standard guidelines. |
| Analysis | • Critically analyze problems of available marine energy converters and propose suitable device for selected region. |
| Synthesis | • Appraise various aspects of investment in renewable energy development using appropriate techniques and Excel functions for finance. |

**Overview of sessions and teaching methods**

The course will make most of interactive and self-reflective methods of teaching and learning and, where possible, avoid standing lectures and presentations.

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| **Learning methods** | • Active learning conducted through in-class activities<br>• Case Based Learning<br>• Literature review |

**Course outline**

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| Week 1 | Origins of the Atmosphere and Ocean Basins<br>Fluids: Atmosphere and Water |
| Week 2 | Atmospheric pressure and wind |
| Week 3 | Waves and tides |
| Week 4 | Oceanic Circulation |
| Week 5 | Climatology<br>Weather System |
| Week 6 | Weather Observations<br>Weather Forecasting |
| Week 7 | Climate change modelling<br>Influence of climate change on ocean processes<br>Environmental issues related to ship and offshore structure |
| Week 8 | Mid-Semester Break |
| Week 9 | Context of marine energy (global/UK context, intermittency, energy roadmaps)<br>Key energy concepts (kinetic energy, potential energy, wave energy, tidal energy, power) |
| Week 10 | Wave energy conversion (wave resource, wave devices, practical resource)<br>Wind energy conversion (wind resource, wind devices, practical resource) |
| Week 11 | Marine current conversion (tidal resource, tidal devices, practical resource) |
| Week 12 | Development appraisal<br>- Planning and resource availability<br>- Financial appraisal<br>- Economic viability |

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| Week 13 | **Practical, environmental, and economic aspects of marine renewable energy**<br>Practical constraints and cabling<br>Economic assessment<br>Environmental impacts assessment (non-physical, physical) |
| Week 14 | Case studies (NW European shelf seas, Orkney & Pentland Firth, Wales etc.) |

**Literature**

Compulsory

- NA
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Recommended:


1. Neill, S. P., & Hashemi, M. R. (2018). *Fundamentals of ocean renewable energy: generating electricity from the sea*. Academic Press.
2. Babarit, A. (2017). *Ocean wave energy conversion: resource, technologies, and performance*. Elsevier.
3. Clark, R. N. (2013). *Small wind: planning and building successful installations*. Academic Press.
4. Pedlosky, J. (2013). *Ocean circulation theory*. Springer Science & Business Media.
5. Cornish, M., & Ives, E. (2013). *Reeds maritime meteorology*. A&C Black.
6. Noone, K. J., Sumaila, U. R., & Diaz, R. J. (2013). *Managing ocean environments in a changing climate: sustainability and economic perspectives*. Newnes.
7. Sørensen, J. D., & Sørensen, J. N. (Eds.). (2010). *Wind energy systems: Optimising design and construction for safe and reliable operation*. Elsevier.


**Course workload**

The table below summarizes course workload distribution:

| **Activities** | **Learning outcomes** | **Assessment** | **Estimated workload (hours)** |
|---|---|---|---|
| **In-class activities ( 56 hours)** | | | |
| Lectures (3 hours/ week) | Understanding theories, concepts, methodology and tools | Class participation | 42 |
| Moderated in-class discussions / active learning 1 hour every week | Understanding related theories of marine environment (wind, waves, tides) and various aspects of investment appraisals. | Class participation and active contribution to discussions | 14 |
| **Independent work (64 hours)** | | | |
| Group work:<br>- Contribution to the group case-study projects<br>- Contribution to the preparation and completion of group projects | Ability to analyze available marine renewable energy converter and propose suitable design for Malaysia sea state conditions.<br><br>Appraise various aspects of investment in renewable energy development using appropriate techniques and Excel functions for finance | Quality of group project reports<br><br>-2 Group report<br>-1 group presentation | 36 |

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| Course assignments | Ability to conceptualize on marine environment and renewable energy knowledge | Quality of assignments<br><br>-Content<br>-Relevant reference | 25 |
| Final Examination | -Apply the physics of oscillations and waves with applications to wind waves and tides-: Bloom Taxonomy C4<br>-Analyze the effects of marine environment on vessels and offshore structures. -: Bloom Taxonomy C4 | Individual | 3 |
| ***Total*** | | | ***120*** |

**Grading**

The students' performance will be based on the following:

**Assessment**

- Progress assessment (60%):
  - Assignment (10%): students have to complete the quiz or exercise of each topic.
  - Test (20%): students have to complete two tests
  - Project Report (30%): The students will be divided into groups of at least 2 students to conduct project on investment evaluation and renewable energy and complete the group project report according to the specific requirements of each topic.

- Final assessment (40%):

  - Final examination (40%)

**Evaluation**

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| Excellent Pass | A+ (90 – 100)<br>A (80 – 89)<br>A- (75 – 79) |
| Good Pass | B+ (70 – 74)<br>B (65 – 69) |
| Pass | B- (60 – 64) |
| Fail | C+ (55 – 59)<br>C (50 – 54)<br>C- (45 – 49)<br>D+ (40 – 44)<br>D (35 – 39)<br>D- (30-34)<br>E (00-29) |