



Template syllabus of the new/revised courses

Course Name : Marine Environment and Renewable Energy

Number of credits : 4 ECTS

Period : Second semester

Coordinator	Dr Farah Ellyza Hashim
Credits	4 ECTS
Lecturers	Prof Dr Omar Yaakob / Dr Farah Ellyza Hashim / Dr Arifah Ali
Level	Master
Host institution	School of Mechanical Engineering, Universiti Teknologi Malaysia
Course duration	14 Weeks
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 | <ul style="list-style-type: none"> Apply the physics of oscillations and waves with applications to wind, waves, and tides. |
| Comprehensive | <ul style="list-style-type: none"> Analyze the effects of marine environment on vessels and offshore structures. |
| Application | <ul style="list-style-type: none"> Demonstrate ability on project investment evaluation and design analysis ethically based on available standard guidelines. |
| Analysis | <ul style="list-style-type: none"> Critically analyze problems of available marine energy converters and propose suitable device for selected region. |
| Synthesis | <ul style="list-style-type: none"> 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.

- Learning methods**
- Active learning conducted through in-class activities
 - Case Based Learning
 - Literature review

Course outline

Week 1	Origins of the Atmosphere and Ocean Basins Fluids: Atmosphere and Water
Week 2	Atmospheric pressure and wind
Week 3	Waves and tides
Week 4	Oceanic Circulation
Week 5	Climatology Weather System
Week 6	Weather Observations Weather Forecasting
Week 7	Climate change modelling Influence of climate change on ocean processes 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) Key energy concepts (kinetic energy, potential energy, wave energy, tidal energy, power)
Week 10	Wave energy conversion (wave resource, wave devices, practical resource) Wind energy conversion (wind resource, wind devices, practical resource)
Week 11	Marine current conversion (tidal resource, tidal devices, practical resource)
Week 12	Development appraisal <ul style="list-style-type: none"> - Planning and resource availability - Financial appraisal - Economic viability



Week 13	Practical, environmental, and economic aspects of marine renewable energy Practical constraints and cabling Economic assessment 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 (42 hours)			
Lectures	Understanding theories, concepts, methodology and tools	Class participation	36
Moderated in-class discussions / active learning	Understanding related theories of marine environment (wind, waves, tides) and various aspects of investment appraisals.	Class participation and active contribution to discussions	6
Independent work (73 hours)			
Group work: - Contribution to the group case-study projects - 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. Appraise various aspects of investment in renewable energy development using appropriate techniques and Excel functions for finance	Quality of group project reports	40



Course assignments	Ability to conceptualize on marine environment and renewable energy knowledge	Quality of assignments	33
Total			115

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

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