Module specification

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Module Code	ENG5B3
Module Title	Solar, Biomass and Energy Storage Engineering
Level	5
Credit value	20
Faculty	Engineering
HECoS Code	100175
Cost Code	GAME

Programmes in which module to be offered

Programme title	Is the module core or option for this programme
MEng / BEng Renewable & Sustainable Engineering	Core
BEng Low Carbon Energy, Efficiency, and Sustainability	Core

Pre-requisites

None

Breakdown of module hours

Learning and teaching hours	20 hrs
Placement tutor support	0 hrs
Supervised learning e.g., practical classes, workshops	16 hrs
Project supervision (level 6 projects and dissertation modules only)	0 hrs
Total active learning and teaching hours	36 hrs
Placement / work-based learning	0 hrs
Guided independent study	164 hrs
Module duration (total hours)	200 hrs

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Initial approval date	22/08/2022
With effect from date	September 2022
Date and details of revision	
Version number	

Module aims

- Create optimum solutions in the design of solar and biomass energy schemes.
- Integrate solar energy production profiles with energy storage to supply a varied demand in a smart grid.
- Challenge the student to develop critical evaluation and selection skills using up-to-date data and techniques.

Module Learning Outcomes - at the end of this module, students will be able to:

1	Demonstrate an engineering knowledge of the theory, practice and functionality of solar energy production and energy storage.
2	Demonstrate an engineering knowledge of the theory, practice, and functionality of biomass energy systems.
3	Analyse ways in which solar and biomass energy sources can be assessed to predict energy production in a variety of situations.
4	Apply knowledge and design skills to select solar and biomass solutions for real world scenarios using self-created evaluation.
5	Evaluate the environmental footprints (both positive and negative) of solar, biomass and energy storage using life cycle analysis.

In addition to the module learning outcomes, students will also cover the following accreditation of higher education programme (AHEP) fourth edition learning outcomes: C1, C2, C3, C4, C12, C13, C17, M1, M2, M3, M4, M12, M13 and M17.

Assessment

Indicative Assessment Tasks:
100% Group coursework:

The student will be asked to design solar and biomass energy schemes. The student will then be tasked with finding the most efficient design to a given real world scenario, with the addition of energy storage using a wide range of considerations. Indicative word count: 3000 words plus software screenshots and/or download self-generated reports.

Assessment number	Learning Outcomes to be met	Type of assessment	Weighting (%)
1	1 - 5	Coursework	100

Derogations

A derogation from regulations has been approved for this programme which means that whilst the pass mark is 40% overall, each element of assessment (where there is more than one assessment) requires a minimum mark of 30%.

Learning and Teaching Strategies

The module is taught through a combination of lectures and workshops. An active and inclusive approach is used to engage learners in the topics and will involve individual, group work and flipped learning experiences aligned to the university's Active Learning Framework (ALF). The approach offers students a flexible and adaptive learning experience that can accommodate a range of options that includes both on campus learning and remote learning where appropriate.

The Moodle VLE and other on-line materials and resources will be available to support learning. ALF offers a balance between the classroom elements and digitally enabled activity incorporating flexible and accessible resources and flexible and accessible feedback to support learning.

Indicative Syllabus Outline

Solar:

- Introduction. Quantifying the suns energy.
- Solar Photovoltaic: Types, principles and nature of solar PV, prediction of energy production. Theory, components, design of systems.
- Solar Thermal. Introduction, types, theory. Principles, nature and availability of solar thermal energy, rooftop water heaters,
- Active and passive solar heating, components.
- Concentrated solar power (CSP), theory, types, and examples.
- Energy production calculations, inefficiencies, and maximising potential.
- Solar systems design
- Carbon reduction possibilities.
- Case studies

Bioenergy:

- Introduction.
- Types and components.
- Theory.
- Primary/ secondary/ processing.
- Theoretical and practical design considerations.
- Prediction of energy production.
- Carbon dioxide footprint analysis
- Case studies.

Energy Storage:

- Energy storage solutions and design.

Indicative Bibliography:

Please note the essential reads and other indicative reading are subject to annual review and update.

Essential Read

E. Hossain and S. Petrovic, *Renewable Energy Crash Course: A Concise Introduction*. Springer, 2021.

Other indicative reading

Lecture resources and online tools

Employability skills – the Glyndwr Graduate

Each module and programme are designed to cover core Glyndŵr Graduate Attributes with the aim that each Graduate will leave Glyndŵr having achieved key employability skills as part of their study. The following attributes will be covered within this module either through the content or as part of the assessment. The programme is designed to cover all attributes and each module may cover different areas.

Core Attributes

Engaged
Enterprising
Creative
Ethical

Key Attitudes

Commitment
Curiosity
Resilience
Confidence
Adaptability

Practical Skillsets

Digital Fluency
Organisation
Leadership and Team working
Critical Thinking
Emotional Intelligence
Communication