MODULE DESCRIPTION FORM

DEPARTMENT OF MECHANICAL AND AEROSPACE ENGINEERING

ME950 BOILER THERMAL HYDRAULICS- Online

Module Registrar: Dr W Dempster william.dempster@strath.ac.uk	**Taught To (Course): MSc Advanced Mechanical Engineering**	
Other Lecturers Involved:	**Credit Weighting: 10**	**Semester: 2 (Online Learning)**
Optional class	**Academic Level: 5**	**Suitable for Exchange: N**

Required prerequisites

Note: It is the responsibility of ALL students to ensure that they satisfy the prerequisite knowledge for this module BEFORE adding as part of curriculum selection. If unsure, please contact the Module Registrar or discuss with your Programme/Year Adviser of Studies.

BEng in Mechanical or Chemical Engineering with specific requirements for thermodynamic, fluid flow and heat transfer knowledge normally found in BEng courses
Knowledge of basic mathematical techniques and calculation software – Matlab / MathCAD / Spreadsheets for use in iterative calculations.

Module Format and Delivery (HOURS i.e. 1 credit = 10hrs of study):

Lecture	Tutorial	Laboratory	Groupwork	External	Online	Project	Assignments	Private Study	**Total**
	-	-	-	-	18		32	50	100

Educational Aim

This module aims to provide core knowledge of the modern conventional power plant boiler and to develop a critical awareness of the operation, design and integration of the key components that comprise a steam generation system.

Learning Outcomes

On completion of the module the student is expected to be able to:

LO1 Identify and discuss the key components of steam generation systems for a variety of configurations for power plant use within an operational and thermodynamic context.

LO2 Carry out design based calculations for, combustion processes, two phase hydraulics, critical heat flux and furnace design relating to steam generation components.

LO3 Critically evaluate the working principles and effectiveness of the technologies associated with boiler emission control for NOx, SOx, particulates and CO_2 capture and storage.

Syllabus

The module will teach the following:

(i) Boiler types and configurations
(ii) Two phase heat transfer and hydraulics: two phase flow regimes, two phase pressure drop, critical heat flux
(iii) Furnace heat transfer using simple thermal design models
(iv) Fuels and combustion calculations
(v) Environmental control technologies for NOx, SOx, particulates and CO_2 mitigation

Assessment of Learning Outcomes

Criteria
For each of the Module Learning Outcomes the following criteria will be used to make judgements on student learning:

LO1 Identify and discuss the key components of boiler systems for a variety of boiler configurations for power plant use within an operational and thermodynamic context
C1 The ability to identify and explain the principles of operation of the main components of a boiler system
C2 The ability to explain the reasons for different power plant boiler designs
C3 The ability to explain from a thermodynamic viewpoint the role of Boiler components and the relationship to power plant efficiency

LO2 Carry out design based calculations for, combustion processes, Furnace and two phase hydraulics relating to boiler components.
C1 The ability to apply basic calculation methods for fuel classification, air fuel ratios, and flue gas compositions.
C2 The ability to explain the operating principle for the various hydraulic system used in boiler plant.
C3 The ability to apply basic calculation methods to identify two phase flow regimes, two phase pressure drop, and critical heat flux conditions
C4 The ability to apply basic calculation methods for furnace geometry design using simple zero-dimensional models

LO3 Critically evaluate the working principles and effectiveness of the technologies associated with boiler emission control for NOx, SOx, particulates and CO_2 reduction
C1 The ability to explain the operating principles and effectiveness of technologies for NOx reduction.
C2 The ability to explain the operating principles and effectiveness of technologies for SOx reduction.
C3 The ability to explain the operating principles and effectiveness of technologies for particulate reduction.
C4 The ability to explain the operating principles and effectiveness of technologies for CO_2 capture and storage

The standards set for each criterion per Module Learning Outcome to achieve a pass grade are indicated on the assessment sheet for all assessment.

Principles of Assessment and Feedback
(within Assessment and Feedback Policy at: https://www.strath.ac.uk/professionalservices/staff/policies/academic/)

(i) Identification of goals and performance: model solutions provided for all calculation techniques. Coursework exercises provided with detailed assessment criteria.
(ii) Time and effort: Students provided with a study planner with key learning milestones identified
(iii) Communication with students is primarily by email where response times range from immediate to within a few days depending on scale of question.
(iv) Student to student or teacher to student dialogue is encouraged through online class discussion forums and is monitored by lecturer
(v) Coursework submission timing and format has been devised to suit the part time student since this is the dominant mode of study for the MSc class.
(vi) Coursework focussed feedback forms are provided and analysed at the end of each coursework. Lecturer investigates teaching and learning issues at the end of each coursework with spot checks via student interviews.

Assessment Method(s) Including Percentage Breakdown and Duration of Exams *(individual weightings)*

Examination				Coursework		Practical		Project	
Number	Month(s)	Duration	***Weighting***	Number	***Weighting***	Number	***Weighting***	Number	***Weighting***
				4	20%, 20%, 20%, 40%				
*				* LO1, LO2, LO3		*		*	

* ***L/Os:*** *Indicate which Learning Outcomes (L01, L02, etc) are to be assessed by exam/coursework/practical/project as required.*

Coursework / Submissions deadlines (*academic weeks*):
Coursework submissions in semester 2 - weeks 4, 6, 8 and exam period

Resit Assessment Procedures:
Submission of alternative ^^coursework prior to commencement of the August exam diet.

^^Students must contact the module Registrar for details as soon as results confirm that a resit is required.

PLEASE NOTE:
Students must gain a summative mark of 50% to pass the module. Students who fail the module at the first attempt will be re-assessed prior to the August diet. This re-assessment will consist entirely of coursework. No marks from any previous attempts will be transferred to a new resit attempt.

Recommended Reading

*****Purchase recommended **Highly recommended reading *For reference (do NOT purchase)**

** Basu P., Kefa C.,Jestin L., Boilers and Burners: Design and Theory, Springer, 2000

** Steam, Its Generation and Use, Babcock and Wilcox Publications, 41 edition

Additional Student Feedback
(Please specify details of when additional feedback will be provided)

Date	Time	Room No
On request	Email to arrange	Individual feedback session available on request

Session: 2023/24

Approved:

Course Director Signature:

Date of Last Modifications: 24/08/23

(Updated August23)

MODULE TIMETABLE

Module Code:	**ME950**	**Module Title:**	**Boiler Thermal Hydraulics**

Brief Description of Assessment:

Assessment is by 100% coursework.

Assessment Timing:-

Indicate on the table below the start/submission dates for each assignment/project and the timing of each exam/assessment using the dropdowns provided. Dropdowns can be left blank. Add extra notes below the dropdowns.

Please note: Timings can change, this should only be used as a guide.

Semester One	W&D Wk	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	WK10	WK11	Exam Period
	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item.

Semester Two	C&D Wk	WK1	WK2 (CW 1 set)	WK3	WK4 (CW 2 set)	WK5	WK6 (CW 3 set)	WK7	WK8	WK9	WK10 (CW 4 set)	WK11	Exam Period
	Choose an item. Choose an item.	Choose an item. Choose an item.	Course work Set	Choose an item. Choose an item.	Course work Submit Course work Set	Choose an item. Choose an item.	Course work Submit Course work Set	Choose an item. Choose an item.	Course work Submit	Choose an item. Choose an item.	Course work Set	Choose an item. Choose an item.	Coursework Submit