MODULE DESCRIPTION FORM

ME917 Advanced Boiler Technologies 1

Module Registrar: Dr W Dempster
william.dempster@strath.ac.uk

Taught To (Course): MSc Power Plant Engineering/Power Plant Technologies

Other Lecturers Involved:
Dr A Galloway, + Guest lecturers from Doosan Power Systems

Credit Weighting: 10
Semester: 2 (details tbc)

Assumed Prerequisites: BEng level in Mechanical/Chemical Engineering
Optional
Academic Level: 5

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

<table>
<thead>
<tr>
<th>Lecture</th>
<th>Tutorial</th>
<th>Laboratory</th>
<th>Project</th>
<th>Assignments</th>
<th>Private Study</th>
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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 boiler system.

Learning Outcomes

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

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.

LO2 Carry out design based calculations for draft systems, combustion processes, heat exchanger and two phase hydraulics pipe work relating to boiler components.

LO3 Critically evaluate erosion, corrosion and fouling slagging of heat transfer surface

LO4 Critically evaluate the working principles and effectiveness of the technologies associated with boiler emission control for NOx, SOx, particulates and CO2 capture and storage

Syllabus

The module will teach the following:

(i) Boiler types and configurations
(ii) Draft System hydraulics
(iii) Two phase heat transfer and hydraulics: two phase flow regimes, two phase pressure drop, critical heat flux
(iv) Furnace heat transfer using simple thermal design models.
(v) Superheater and reheater heat transfer
(vi) Fuels and combustion calculations
(vii) Erosion and corrosion issues in boilers
(viii) Environmental control technologies for NOx, SOx, particulates and CO2 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 draft systems, combustion processes, heat exchanger and two phase hydraulics pipe work 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 apply basic calculation methods for single phase pressure drop, and fan specifications for boiler draft systems
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 method for Furnace geometry design using simple zero-dimensional models
C5 The ability to apply basic calculation methods for super heat and reheater heat surface design

LO3 Critically evaluate erosion, corrosion and fouling/slagging of heat transfer surfaces
C1 The ability to explain the mechanisms for high temperature corrosion.
C2 The ability to explain mechanism and the factor that influence ash particle erosion
C3 The ability to apply basic calculation techniques to identify erosion and slagging potential of flue gas
C4 The ability to identify and explain preventative design approaches to mitigate corrosion/erosion/slagging effects

LO4 Critically evaluate the working principles and effectiveness of the technologies associated with boiler emission control for NOx, SOx, particulates and CO2 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 CO2 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.

12 Principles of Assessment and Feedback
(on Learning & Teaching web pages: www.strath.ac.uk/learnteach/informationforstaff/staff/assessfeedback/12principles/)

(i) Identification of goals and performance: model solutions provided for all calculation techniques. Previous exam papers provided with solutions. 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 exam format has been devised to suit the part time student since this is the dominant mode of study for the MSc class. Exam is open book and can be submitted any time during 1 week where the timing has been agreed in advance with the class.
(vi) Module focussed feedback forms are provided and analysed at the end of each lecture period. Lecturer investigates teaching and learning issues at the end of each module with spot checks via student interviews.

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

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<tr>
<th>Examinations</th>
<th>Courseworks</th>
<th>Projects</th>
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Coursework / Submissions deadlines: Midway into Semester 2
Resit Assessment Procedures: Submission of coursework prior to the commencement of the August Examination diet

PLEASE NOTE:
Students need to gain a summative mark of 50% to pass the module. Students who fail the module at the first attempt will be re-examined. This re-examination will consist entirely of coursework.
Recommended Reading

****Purchase essential  ***Purchase recommended  **Highly recommended reading
*Simply for reference (do NOT purchase)


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

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

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Session: 2014/15

Approved:

Course Director Signature: P Strachan

Date of Last Modifications: 02 September 2014
**MODULE TIMETABLE**

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<th>Module Code:</th>
<th>ME917</th>
<th>Module Title:</th>
<th>Advanced Boiler Technologies 1</th>
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**Brief Description of Assessment:**

Assessment is by 40% coursework and 60% exam.

**Assessment Timing:**

Indicate on the table below the Start/Submission dates for each Assignment/Project and the timing of each Exam/Class Test(s).

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CW start

CW submit

exam