MODULE DESCRIPTION FORM

DEPARTMENT OF MECHANICAL AND AEROSPACE ENGINEERING

ME946 PRESSURISED SYSTEMS

Module Registrar: Prof D Nash d.nash@strath.ac.uk	**Taught To (Course): Year 5, MSc and Exchange Students**		
Other Lecturers Involved:	**Credit Weighting: 10**	**Semester: 1 (distance learning)**	
Assumed Prerequisites: Level 3 Structural Mechanics	**Optional Class**	**Academic Level: 5**	**Suitable for Exchange: Y**

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

Lecture	Tutorial	Laboratory	Groupwork	External	Online	Project	Assignments	Private Study	**Total**
20	10						30	40	100

Educational Aim

This module aims to introduce the subject of industrial Pressurised Systems and ensure competency in the use of Standards and Design Codes. Pressurised Systems are inherently dangerous since they contain stored energy which must be carefully controlled.
The class aims to set down a methodology whereby a range of pressurised components (spheres, cylinders, cones, etc.) can be designed, manufactured, installed and operated to a high degree of safety.

Learning Outcomes

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

LO1 understand the basic philosophy behind Pressure Vessel Codes and Standards

LO2 know their way around such a Standard - since they will have undertaken an industrial design exercise using the appropriate British Standard (PD 5500)

LO3 have some ability to examine the unusual non-standard pressure vessels and understand the use of design-by-analysis and finite element assessment

LO4 be aware of the limitations of such Standards and appreciate the assumptions contained

Syllabus

The module will teach the following:

Provide a basic understanding of the behaviour of components used in pressure and storage containment.
30% of the class is devoted to a fundamental development of the appropriate stress analysis of thin shells, including spheres, cylinders, cones, etc. under pressure, temperature and local loadings; discontinuity analysis is employed to derive the forces and moments that arise at nozzle/shell, shell/head junctions, etc.
The remainder of the class uses the ideas developed above to examine design methodologies established in the British/American and EU Pressure Vessel Design Codes. In these, ‘design by rule’, ‘design by analysis’, stress categorisation - primary and secondary stresses and peak stresses are explored. These are applied to the design of pressure and storage vessels of various geometries, treatment of local loads, openings and branches, supports, heads and the design for external pressure loading and stability and design for fatigue.

The syllabus is as follows:

An introduction to the design philosophy and the manufacture of pressurised systems. The stress analysis of thin shells including cylinders, cones and spheres under pressure and temperature. Pressure vessel design: British and American Design Codes, design by rule, design by analysis. Stress categorisation - primary and secondary stresses, peak stress. Applications to the design of pressure vessel components, cylindrical and spherical pressure vessels,

treatment of local loadings, openings, supports and heads. External pressure loading, buckling and stability. Local loads, supports and fatigue assessment. Simple piping systems design. Use of computer packages for pipework and pressure vessel design.

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
C1 understand the historical development of codes and standards (exam)
C2 understand and be able to apply the background to thin shell theory (edge bending exercises and exam)
C3 understand the design philosophy include the rationale for safety and know the key failure mechanisms/modes (exam)

LO2 – LO4
C1 be able to design a range of pressure equipment on a component by component basis to industry standards by exam and design exercise)
C2 know and articulate the weaknesses of the main design methods (design exercise and exam)
C3 be able to assess the safety of pressurised system and deal with non-standard arrangements (design exercise)

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/staff/policies/academic/)

Informal feedback will be provided at regular tutorial sessions primarily through personal e-mail discussion with individual student or groups on tutorial exercises attempted in advance by students (Note:- to receive this feedback students should undertake in these tutorial exercise but participation is not mandatory).

Written comments and feedback on the Design Exercise will also be given via MyPlace

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

Examination				Coursework		Practical		Project	
Number	Month(s)	Duration	***Weighting***	Number	***Weighting***	Number	***Weighting***	Number	***Weighting***
2	TBC (online)	1 hour each	50%	1	50%				
* LO1 - LO4				* 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*):

Design Exercise assignment to be issued in Week 5 – online submission windows will be given via MyPlace.
Submitted by 12noon on first Monday of December Exam diet.
Online exams/tests will be run in Week 6 (shell theory) and second week of December Exam diet.

Resit Assessment Procedures:
Submission of revised and extended coursework prior to the August resit diet.

As soon as a student knows that they require a resit assessment for this class they should contact the class registrar to confirm these resit requirements and deadlines for this class.

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)**
All *
"Guide to Pressure Equipment", by S W Earland, D H Nash & W Garden, PE Publishing
"Stresses in Shells" by W Flügge, Springer Verlag
"Pressure Vessel Design" by H H Bednar, Van Nostrand Reinhold
"Pressure Vessel Design - Principles and Concepts" by J Spence and A S Tooth, E & F Spon (in imprint of Chapman & Hall)

Additional Student Feedback

ME946 Pressurised Systems is a 10 credit first semester class. Feedback is given on an on-going basis via online sessions.

Informal feedback will be provided at regular tutorial sessions primarily through forum discussion with individuals or groups on the elements of the edge bending tutorial sheets or the main design exercises attempted in advance by students (note:- to receive this feedback students should participate in these forums but participation is not mandatory).

Formal, summative feedback will be given after marking of the Design Exercise and feedback will be provided by the return of assignment marks to students after assessment. This will be done via MyPlace.

Formal, summative feedback will be provided by the return of examination marks to students after assessment (note:- online exam screens will not be available students and no individual or collective discussion of exam performance will be facilitated).

Date	Time	Room No
Weekly forums	TBC	Check timetable webpages for details

Session: 2019/20

Approved:

Course Director Signature: ***E Henderson***

Date of Last Modifications: **05/09/2019**

(Updated August 2019)

MODULE TIMETABLE

Module Code:	**ME946**	**Module Title:**	**Pressurised Systems**

Brief Description of Assessment:

Design Exercise – a major, structured design report with fully typed or hand written calculations and sketches
Exam

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 and will 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.	Design Exercise Start	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.	Design Exercise Submit	Exam

Semester Two	C&D Wk	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	WK10	WK11	Exam Period