MODULE DESCRIPTION FORM

16587 PRESSURISED SYSTEMS

<table>
<thead>
<tr>
<th>Module Registrar: Prof D H Nash</th>
<th>Taught To (Course): Cohorts for whom class is elective</th>
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<tbody>
<tr>
<td><a href="mailto:d.nash@strath.ac.uk">d.nash@strath.ac.uk</a></td>
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<tr>
<td>Other Lecturers Involved: none</td>
<td>Credit Weighting: 10</td>
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<tr>
<td>Assumed Prerequisites: Level 3 Structural Mechanics</td>
<td>Semester: 1</td>
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<td>Elective class</td>
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<td>Academic Level: 5</td>
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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>Groupwork</th>
<th>External</th>
<th>Online</th>
<th>Project</th>
<th>Assignments</th>
<th>Private Study</th>
<th>Total</th>
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<tbody>
<tr>
<td>24</td>
<td>18</td>
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<td>5</td>
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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 (mid-

session assignment, 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.

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

Informal feedback will be provided at regular tutorial sessions primarily through verbal discussion with individuals or groups on tutorial exercises attempted in advance by students (note:- to receive this feedback students should participate in these tutorials but attendance is not mandatory).

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

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

<table>
<thead>
<tr>
<th>LO/Outcomes</th>
<th>Examinations*</th>
<th>Courseworks</th>
<th>Projects</th>
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<tbody>
<tr>
<td>Number</td>
<td>Month(s)</td>
<td>Duration</td>
<td>Weighting</td>
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<tr>
<td>1</td>
<td>Jan</td>
<td>2 hrs</td>
<td>70%</td>
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<tr>
<td>LO1-4</td>
<td>LO2-3</td>
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*NOTE: Exam will be Open Book exam and only course notes and copies of British Standard extracts as supplied on MyPlace will be permitted into the Examination Hall.

Coursework / Submissions deadlines:
Mid-session assignment to be issued in Week 3 and submitted in Week 5 – online submission windows will be given via MyPlace. Design exercise to be submitted by 3.30pm on Monday week13 at the latest.

Resit Assessment Procedures:
Resit exam (3hrs) in August 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 during the August diet. This re-examination will consist entirely of examination.

Recommended Reading

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

16587 Pressurised Systems is a 10 credit first semester class. Feedback is given on an on-going basis during class discussion and tutorials sessions.

Informal feedback will be provided at regular tutorial sessions primarily through verbal discussion with individuals or groups on mid-session assignments or the main design exercises attempted in advance by students (note:- to receive this feedback students should participate in these tutorials but attendance is not mandatory).

Formal, summative feedback will be given mid-session (Week 6) on the assignment. This will build towards the final main design exercise will be provided by the return of examination 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:- exam scripts will not be returned to students and no individual or collective discussion of exam performance will be facilitated).

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<tr>
<th>Date</th>
<th>Time</th>
<th>Room No</th>
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<tr>
<td>Weekly (Tuesdays)</td>
<td>1400-1500</td>
<td>TBC</td>
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Session: 2014/15

Approved:

Course Director Signature: [Signature]

Date of Last Modifications: 29 August 2014
**MODULE TIMETABLE**

<table>
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<th>Module Code:</th>
<th>16587</th>
<th>Module Title:</th>
<th>Pressurised Systems</th>
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**Brief Description of Assessment:**
Design Exercise – a 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(s).

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<th>WK6</th>
<th>WK7</th>
<th>WK8</th>
<th>WK9</th>
<th>WK10</th>
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