London South Bank University
EST 1892

School of Engineering

Division of Chemical and Energy Engineering (CEE)

Module Guide

Module title: Advanced Fluids and Control

Level: **6**

Module Leader: Dr Elsa Aristodemou
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Room Number: FW307

Teaching Team: Dr Abdel Fenghour
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Lab Demonstrators/HPLs Name(s): Not applicable

Assessment of the module

The module is assessed by closed book examination 60% and coursework 40%.

Examination

The examination will be held in January 2020.
Coursework

Component	Hand out date	Hand in date	Feedback date
Process Control 20%	30/10/2019	11/12/2019	10/01/2020
CFD - 20%	16/10/2019	10/01/2020	25/01/2020

FEEDBACK GUIDELINES

Feedback will normally be given to students within 15 working days after the final submission of an assignment or as advised by their module leader.

General feedback, applying to all students, will also be placed on the module VLE site within 15 working days.

EXTERNAL EXAMINER

Details of the external examiner appointed for this module can be obtained from the course director.

What skills you will develop in this module

Knowledge and Understanding

- Compressible flows; fluidisation, fluidised beds; bubble flow in fluidised beds.
- Control strategies for complex systems – design of control systems.

Intellectual Skills

- Mathematical and physical skills, as well as critical thinking for design purposes.

Practical Skills

- CFD workshops using commercial CFD software. Process control designs.

Transferable Skills

- Numerical/Analytical skills.
- Time management; team work; writing/communication skills.

Short description of the module

The module has two components: (a) compressible fluid flows and fluidised beds and (b) process control. Process control focuses on dynamic modelling and control of first and second order processes. Feedback, feedforward, ratio, cascade and split-range control strategies are studied. The stability of control systems is investigated using Laplace transforms. For the fluid flow component, we look at compressible fluids/gases for reversible and irreversible processes, and entropy changes; adiabatic and isentropic flows in converging and diverging nozzles; compressible flows in isothermal pipes. Fluidisation and fluidised beds together with 2-phase bubble flow in a liquid-gas vertical pipe system.

Evaluation of the module

This course is assessed using Module Evaluation Questionaires (MEQs). There is also the opportunity to provide feedback on the module at the student-staff course board meetings.

Learning resources

Reading List

Core materials for Process Control

1. Stefanopoulos, G. 1984. Chemical Process Control: an Introduction to Theory and Practice, Prentice-Hall International Editions, 1984.
2. Robbins, L. (2011). Distillation Control, Optimization, and Tuning: Fundamentals and Strategies. CRC Press
3. Seborg, D.E., Edgar, T.F., Mellichamp, D.A., and Doyle, F.J. (2011) Process Dynamics and Control, International Student Version, 3rd Edition. Wiley.

Core materials for the Fluids component

4. White, F.M., 2011. Fluid Mechanics. McGraw-Hill Higher Education; 7th edition.
5. Wilkes, J.O, 2005. Fluid Mechanics (2005) for Chemical Engineers. Prentice-Hall.

Optional reading:

6. Holland, F.A. and Bragg, R. (1995). Fluid Flow for Chemical Engineers, 2nd Ed., Arnold, 1995.
7. Kay, J.M. and Nedderman, R.M. (1985). Fluid Mechanics and Transfer Processes, CUP.

Additional Information

Module Title:	Advanced Fluids and Control
Module Level:	6
Module Reference Number:	ENG_6_478
Credit Value:	20
Student Study Hours:	140
Contact Hours:	60
Private Study Hours:	To be confirmed
Pre-requisite Learning:	Thermo-dynamics, Principles of Separation and Reaction, Principles of Control, Fluid flow and Separation Processes.
Course(s):	BEng/Meng -Chemical and Petroleum Engineering
Year and Semester:	3, Semester 1
Module Coordinator:	Dr. Elsa Aristodemou
MC Contact Details:	aristode@lsbu.ac.uk
Teaching Team & Contact Details:	aristode@lsbu.ac.uk; fenghoura@lsbu.ac.uk
Subject Area:	Chemical and Energy Engineering
Summary of Assessment Method:	Exams and written coursework
External Examiner appointed for module:	To be confirmed

AIMS OF THE MODULE

- To study control strategies for complex systems: theoretical and practical tools for a range of industrial processes.
- To acquire fundamentals of compressible fluid flow for engineering systems such as in isothermal pipes, and converging-diverging nozzles; understand fluidisation, fluidised beds, and two-phase flow in a liquid-gas system.

INTRODUCTION TO STUDYING THE MODULE

Overview of the Main Content

Advanced Control

- Feedback and forward control systems,
- Closed loop control and adaptive control systems.
- Controller tuning methods, and digital Control (z-transforms).
- Advanced control strategies, including model predictive control and their application to separation and reaction processes.

Advanced Fluids Content

- Compressible, isothermal fluid flow in horizontal pipes.
- Compressible, adiabatic & isentropic fluid flow in converging and diverging nozzles
- Mass flow rates and choking.
- Fluid flow through packed beds – Ergun's equation.
- Introduction to two-phase fluidisation; Bubble flow.

Overview of Types of Classes

- Dr Aristodemou's lectures – Weds 9:00am to 11:00am.
- Dr Fenghour's lectures – Weds: 11:00am to 1:00pm

Importance of Student Self-Managed Learning Time

- Student responsibility in the learning and development process will be emphasised.
- Students are required to undertake directed self-study and prepare solutions/discussions to questions relative to various topic areas.
- Students will be encouraged to identify for themselves particular problems of difficulty and to use seminar discussions, where appropriate, for the resolution of these.
- Students must regularly access the Moodle site for this module. They should download the class/lecture material from the Moodle site, and do the recommended reading, before each lecture/class.
- Where appropriate, students are also expected to download the relevant seminar questions and study them in advance of each seminar, in order to derive maximum benefit from seminar time.

Employability

Chemical, Energy, Petroleum Industries.