UNIVERSITY of BRADFORD

Module Descriptor

Transport Phenomena

Module Code:	CPE7011-B
Academic Year:	2018-19
Credit Rating:	20
School:	Department of Chemical Engineering
Subject Area:	Chemical and Process Engineering
FHEQ Level:	FHEQ Level 7 (Masters)

Pre-requisites:

Co-requisites:

Contact Hours

Type	Hours
Lectures	40
Tutorials	20
Laboratory	15
Directed Study	125

Availability Periods

Occurrence	Location/Period
BDA	University of Bradford / Semester 1 (Sep - Jan)

Module Aims

Outline Syllabus

1. Introduction to TP, historical perspective to present day CFD modelling
   · Types of Transport Phenomena: Momentum, Energy, Mass
   . Corresponding Constitutive Transport Equation: Newton's, Fourier's and Fick's laws.

2. Momentum Transport
   . Viscosity and the mechanism of momentum transport
   . Conservation of Mass and Momentum Equations, laminar and turbulent flow

3. Momentum Transport
. Application to isothermal laminar flow in pipe
. Application to isothermal turbulent flow in pipe

4. Tutorial Class on Momentum Transport

5. Energy Transport
.Fourier's law of heat conduction
.Temperature distributions in solid and laminar flow
.Interphase Energy Transport (Heat Transfer Coefficient)
.Conservation of Energy Equation

6. Tutorial Class on Energy Transport
.Application to non-isothermal flow in pipes

7 and 8. CFD Simulations of Momentum and Energy Transport situations. Interactive sessions & group work on usage of CFD packages, e.g. Fluent

9. Mass Transport
.Diffusivity and the mechanisms of mass transport
.Concentration distributions in solids and in laminar flow

10. Mass Transport
.Interphase mass transport (Mass Transfer Coefficient)

11. Tutorial Class on Mass Transport
.Ordinary diffusion in gases and liquids.
.Diffusion in solids and in laminar flow
.Interphase transport

12. Consolidation of learning objectives session
.Similarities between momentum, energy and mass transfer.

Module Learning Outcomes

On successful completion of this module, students will be able to...

1 1. Critically evaluate the principles of momemtum, energy and mass transports and apply these principles to the analysis and design of flow, heat transfer and mass transfer situations. [SM1b, SM3b, EA1b, EA2, D2, P1, P2, G2].

2 Interpret data, use mathematical methods and solve problems systematically [EA1b, EA3b, G1].

3 Identify transport properties and analyze the mechanisms of molecular momentum, energy and mass transport [EA2, P2, G2].

4 Select coordinate systems for transport phenomena problems and formulate the differential forms of the equations of change for momentum, heat and mass transfer problems for steady-state and unsteady flows. [EA1b,EA3b,G1]

5 Use CFD packages to obtain non analytical solutions to more complex fluid flow, heat transfer and mass transfer problems [EA1,EA3b,G1].

Learning, Teaching and Assessment Strategy

Theory, implementation, application, and critical analysis is gained through interactive lectures, tutorials, CFD workshops and directed study.

The lectures will be organised so that the students participate by organising them in groups in the class and assigning to them points of discussion throughout the lecture.

The tutorials will be organised so that the students work in groups discussing the problem at hands and its solution. Each group will be asked to raise and share questions with the rest of the class.
All lecture notes and tutorial questions and their solutions will be posted on Blackboard.

CFD application and evaluation is gained using CFD package Fluent installed on dedicated computers in the School. The learning outcome here is to develop skills in using chemical engineering transport processes software packages that are routinely used in industry.

The coursework is intended to consolidate the CFD skills. It consists of a CFD analysis of a particular chemical engineering transport process.The course work (analysis and solution) is to be presented in a concise critical report thus furthering the learning of presentation skills.

The learning outcomes covered by the examinations include an understanding of the fundamental principles of momentum, energy and mass transports and application of these principles to the analyses of chemical engineering transport processes.
Assessment of understanding, application and critical analysis is carried out through one 2hr formal examination (70%) at the end of Semester 2 (LO1-4) and 1 piece of course work (30%) carried out individually or in groups (LO5).
The examination questions are constructed to cover the entire curriculum (LO1-5) with marks allocation clearly identified in the question parts.
The coursework consists of a CFD analysis of a particular chemical engineering transport process carried out individually or in groups (LO5).
The course work (analysis and solution) is to be presented in a concise critical report. For group course work, summative peer evaluation by the group members will be taken into account when calculating the final individual mark (LO5).

Formative assessment will take the form of a mock examination in week 10 followed by feedback and remedial revisions.

Mode of Assessment

Type	Method	Description	Length	Weighting	Final Assess'
Summative	Examination - closed book	Answer 3 questions	2 hours	50%	Yes
Referral	Examination - closed book	Answer 3 questions	2 hours	50%	Yes
Referral	Coursework	Individual report based on a CFD analysis of a flow, heat transfer or mass transfer problem verified by analytical solution	-5000 words	50%	No
Summative	Coursework	One group report based on a CFD analysis of a flow, heat transfer or mass transfer problem verified by analytical solutions		50%	No

Legacy Code (if applicable)

Reading List

To view Reading List, please go to **rebus:list**.