COURSE SPECIFICATION (Fluid Flow)

HIGHER EDUCATION PERFORMANCE REVIEW:
PROGRAMME REVIEW

COURSE SPECIFICATION

This Course Specification provides a concise summary of the main features of the course and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. It should be cross-referenced with the programme specification.

1. Teaching Institution	University of Technology
2. University Department/Centre	Chemical Engineering Department
3. Course title/code	Fluid Flow / CE.242
4. Programme(s) to which it contributes	Second stage
5. Modes of Attendance offered	Full
6. Semester/Year	2 semester/year
7. Number of hours tuition (total)	Theory (3Hr/weak) Practical (2Hr/weak)
8. Date of production/revision of this Specification	1 / June / 2016
9. Aims of the Course	

- Demonstrate knowledge of incompressible and compressible fluid flows, two phase flow, fluid statics, kinematics of flows and essential basic hydrodynamics.
- Define and solve problems in fluid dynamics in various engineering applications. Provide the ability to describe energy variation and its application in flow and pressure measurement and frctional energy losses calculations.
- Provide the ability to estimate the required energy for fluid pumping (selection the size and type of appropriate pumping for liquid and gas) and to design the liquid mixing equipment.
- Predict necessary fluid parameters of full scale projects by performing simple model experiments.
- Share ideas and work in a team in an efficient and effective manner under controlled supervision or independently.

10· Learning Outcomes, Teaching ,Learning and Assessment Method

A- Knowledge and Understanding

A1- Define fluid properties, stresses in fluids at rest and in motion and types of fluid flows, application of Newton law of viscosity and dimensional analysis methods…

A2- Derive and define the governing equations of fluid flow: continuity, energy and momentum equations from principles of mass, energy and momentum conservation and define the terms of Bernoulli's equation, include major and minor losses and required energy for flow…

A3 –Define the types of fluid pumping devices and its characteristics and how to select the appropriate type and size for fluid pumping…

A4 –Define the types on Non-Newtonian and two-phase fluids flow and their pressures drop calculations…

A5 – Derive the flow rate equations and explain the principles of flow measuring devices in open and closed channels…

A6 – Define and description for liquid mixing equipment and its design calculations with the energy consumption by this equipment...

A7 – Derive the terminal falling velocity and description drag coefficient for flow through packed columns and pressure drop calculation for fixed and fluidized beds and transport of particles...

B. Subject-specific skills

B1 - Analyze fluid michanics for static and flow problems, conclude solutions and demonstrate creative thinking.

B2 - Improve theoretical skills in energy and pressure drop calculations for fluids flow and specify the difference between compressible and incompressible fluids and Newtonian and Non-Newtonian fluids.

B3- Predict correlations using dimentional analysis by analyzing the relationships between the effected variables which effect in fluid flow, mass transfer and heat transfer.

B4 - Improve professional and practical skills by work in teams through perform of LAB experiments in fluid flow and write a technical reports that deal with the analysis the experimental data and discuss it

Teaching and Learning Methods

- Lectures, notes tutorials and discussion sessions.
- Submittion and discussions, the annual report in fluid flow.
- Improve the work skills in teams.
- Team working and presentation skills are developed by carrying out LAB experiments and submitting periodical reports.

Assessment methods

- Written exams (Quizzes, terms and finals) to assess the understanding of the basic concepts and the ability to solve problems.
- Oral LAB exams to assess the skills of analysis and discussion, for submitted reports.
- Class and home work to assess the ability to appropriate solution.
- Siminar discussion of the submitted annual repor.

C. Thinking Skills

C1- An ability to apply effective, creative and innovative solutions, both independently and cooperatively, to current and future problems.

C2- Communicate effectively and logically, both orally and in writing;

C3. An ability of scientific analysis for fluid flow problems and evaluate their solutions.

C4. Work in teams with the ability to use modern sources (PC, references).

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D. General and Transferable Skills (other skills relevant to employability and personal development)

D1- apply mathematical skills to practical problems;

D2-communicate effectively, both orally and in writing;

D3-manage time and modern resources (PC, references);

D4- work in teams;

D5- be creative, particularly in mathematical analysis and solution of problems;

D6- extract information from published sources.

11. Course Structure

Week	Hours	ILOs	Unit/Module or Topic Title	Teaching Method	Assessment Method
1st semester					
1	3	Ability to characterize and specify of the fluids types issues related to the fluid mechanics.	Introduction, Types of fluids, Physical properties, mass and energy conservation laws, Newton laws of motion. Newton law of viscosity with applications.	Lectures, tutorials, example classes, practical applications	partial test (oral questions :- multiple choice, alternative response), open questions that have a definite answer, or do not have a definite answer
2	3				
3	3	Ability to characterize and specify of the units and their fundamental dimensions, dimensional homogeneity of equations.	Dimensional analysis, definition, dimensional homogeneity, dimensional analysis methods,	Lectures, tutorials, example classes, practical applications	partial test (oral questions :- multiple choice, alternative response), Quez, open questions that have a definite answer, or do not have a definite answer
4	3				
5	3	Ability to characterize	Fluid statics, definition, pressure measurement devices	Lectures, tutorials,	partial test (oral questions :- multiple

6	3	and specify the pressure measurement methods and devices used.	with applications	example classes, practical applications	choice, alternative response), open questions that have a definite answer, or do not have a definite answer
7	3	Ability to estimate the pressure drop and energy losses for fluid (single-phase), flow through piping systems, and specify the major and minor frictions,	Fluid dynamics, Reynolds experiment and flow patterns, derive the Euler equation of motion and Bernoulli's equation.	Lectures, tutorials, example classes, practical applications	partial test (oral questions :- multiple choice, alternative response), Quez, open questions that have a definite answer, or do not have a definite answer
8	3		Derie the velocity distribution and average velocity in laminar and turbulent flow, Poiseuille's equation, Darcy equation and, types of frictions (major, minor)		
9	3		Modification of Bernoulli's equation with applications.		
10	3	Ability to estimate the pressure drop and energy losses for fluid (two phase) flow through piping systems, select the appropriate pump type and pipe size.	Selection of pump and pipe size, unsteady state and network problems.	Lectures, tutorials, example classes, practical applications	partial test (oral questions :- multiple choice, alternative response), open questions that have a definite answer, or do not have a definite answer
11	3		Define momentum boundary layer. Two phase flow in horizontal and vertical pipes, flow regiems and pressure drop calculations with applications		
12	3	Ability to specify the pumps types, heads, NPSH, cavitation and how avoid it, characterization pump curves.	Pumping of liquids, types of pumps, heads types, NPSH, cavitation, characterization pump curves with applications	Lectures, tutorials, example classes, practical applications	partial test (oral questions :- multiple choice, alternative response), Quez,open questions that have a definite answer, or do not have a definite answer
13	3		centrifugal pump relations, pumps connection in series and in parallel with applications		
14	3	Ability to characterize and specify the Non-Newtonian fluids, types, apparent viscosity, energy losses.	Non-Newtonian fluids types, specification, apparent viscosity	Lectures, tutorials, example classes, practical applications	partial test (oral questions :- multiple choice, alternative response), Quez, open questions that have a definite answer, or do not have a definite answer
15	3		Drive the velocity distribution of power law fluid, pressure drop calculations, with applications.		
2nd semester					
16	3	Ability to characterize	Define the flow measurements methods and devices and their	Lectures,	partial test (oral

		and specify the	principles	tutorials,	questions :- multiple
17	3	flow rate measurement methods and devices used.	Derive of local velocity equation of Pitot tube and flow rate in Venturi meter with applications	example classes, practical applications	choice, alternative response), Quez,open questions that have a definite answer, or do not have a definite answer
18	3	Ability to characterize and specify the	Derive of flow rate in orifice meter, nozzle, Rotameter with applications.	Lectures,	partial test (oral questions :- multiple
19	3	flow rate measurement methods and devices used	Define weirs and weirs types, derive of flow rate in weirs with applications	tutorials, example classes, practical applications	choice, alternative response), open questions that have a definite answer, or do not have a definite answer
20	3	Ability to characterize and specify the compressible fluid flow at various	Define the compressible fluids, derive of velocity of propagation of pressure wave, Mach Number and general equation of energy for compressible fluid flow.	Lectures,	partial test (oral questions :- multiple
21	3	velocities (subsonic, sonic, or supersonic), the energy losses and energy equations	Derive the energy equation for compressible fluid flow at isothermal conditions and equation of maximum flow and equation of critical pressure with applications	tutorials, example classes, practical applications	choice, alternative response), Quez,open questions that have a definite answer, or do not have a definite answer
22	3	Applications of the energy losses and energy equations	Derive the energy equation for compressible fluid flow at adiabatic conditions and equation of maximum flow and equation of critical pressure with applications	Lectures,	partial test (oral questions :- multiple
23	3	(isothermal, or adiabatic) maximum flow conditions, Laval nozzle,	Derive the equation of velocity and flow and area of flow through conversion /diversion (Laval) nozzle with describe the flow at sonic and supersonic velocity through Laval nozzle with applications.	tutorials, example classes, practical applications	choice, alternative response), open questions that have a definite answer, or do not have a definite answer
24	3	Define the types of gas pumping and devices, estimate the	Define the gas pumping devices (fans, blowers, compressors), ideal and real gas compression cycle, clearance and swept volume with applications	Lectures,	partial test (oral questions :- multiple
25	3	work done by the compressor (single and multistage).	Drive the equation of work done for compression in single stage and multi-stages for ideal and real compression cycles	tutorials, example classes, practical applications	choice, alternative response), Quez,open questions that have a definite answer, or do not have a definite answer

			with applications		
26	3	Ability to characterize and specify the liquid mixers types, devices, power consumption, power curves.	Define the mixing of liquids and types of mixing equipments, design of standard mixing system with applications	Lectures, tutorials, example classes, practical applications	partial test (oral questions :- multiple choice, alternative response), open questions that have a definite answer, or do not have a definite answer
27	3		Define the forces arise in mixing process and dimensionless numbers and power consumption calculation and power curves with application.		
28	3	Ability to characterize and specify the backed columns, packing types, pressure drop estimation, fluidization, transport of particles.	Define the packing types and packed columns, derive the terminal falling velocity, drug coefficient with applications	Lectures, tutorials, example classes, practical applications	partial test (oral questions :- multiple choice, alternative response), Quez, open questions that have a definite answer, or do not have a definite answer
29	3		Darcy law and permeability, pressure drop equations and Ergun equation with applications		
30	3		Define fluidization, types, drive the minimum velocity and porosity for fluidization, pressure drop calculation and transportation of particles with applications.		

12. Infrastructure	
Required reading: · CORE TEXTS · COURSE MATERIALS · OTHER	o **Lecturers** o **"Chemical Engineering" Vol. I and II by Coulson and Richardson; 6th ed., Butterworth-Heinemann, 1999** o **"Fluid Flow for Chemical Engineers", by F.A. Holland and R. Bragg 2nd Ed. (1995) Elisevier Ltd.** o **"Chemical Enginering Fluid Mechanics", by DARBY. R. , M. Dekker 2nd Ed. (2001)** o **"Fluid Mechanics for Chemical Engineers", by James O. Wilkes, Prentice Hall PTR, New Jersey, USA, 1999.** o **"Fluid Mechanics for Chemical Engineers", by De Nevers, N. (1991) McGraw-Hill, Singapore.** o **"Fluid Mechanics", by Streeter and Wylie, McGraw-Hill (1981).**
Special requirements (include for example workshops, periodicals, IT software, websites)	websites
Community-based facilities (include for example, guest Lectures, internship, field	field trips

13. Admissions	
Pre-requisites	Before undertaking this module the student should have undertaken the following: Basic Principles of chemical engineering I, mathematics I, as well simultaneous courses:- Physical chemistry, Principles of chemical engineering II. mathematics II
Minimum number of students	Central admision
Maximum number of students	Central admision