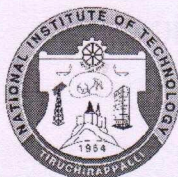


DEPARTMENT OF CHEMICAL ENGINEERING

NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

COURSE PLAN – PART I							
Name of the programme and specialization	B.TECH (CHEMICAL)						
Course Title	Momentum Transfer						
Course Code	CLPC13	No. of Credits		3			
Course Code of Pre-requisite subject(s)	NIL						
Session	July 2023	Section (if, applicable)		NA			
Name of Faculty	Dr.M.Perumalsamy	Department		Chemical Engineering			
Official Email	mpsamy@nitt.edu	Telephone No.		+91-431-2503112			
Name of Course Coordinator	Dr.M.Arivazhagan						
Official Email	hodchl@nitt.edu	Telephone No.		+91-431-2503101			
Course Type (please tick appropriately)	GIR	PC	PE	ELR	OE	MI	HO
		√					
Syllabus (approved in BoS)							
<p>Properties of fluids and concept of pressure: Introduction - Nature of fluids - physical properties of fluids - types of fluids. Fluid statics: Pressure - density - height relationships. Pressure Measurement. Units and Dimensions - Dimensional analysis. Similarity - forces arising out of physical similarity - dimensionless numbers.</p> <p>Momentum Balance and their Applications: Kinematics of fluid flow: Stream line -stream tube - velocity potential. Newtonian and non-Newtonian fluids - Time dependent fluids - Reynolds number - experiment and significance - Momentum balance - Forces acting on stream tubes - Potential flow - Bernoulli's equation - Correction for fluid friction - Correction for pump work.</p> <p>Flow of Incompressible Fluids Through Ducts: Flow of incompressible fluids in pipes - laminar and turbulent flow through closed conduits - velocity profile & friction factor for smooth and rough pipes - Head loss due to friction in pipes, fitting etc. Introduction to compressible flow. Isentropic flow through convergent and divergent nozzles and sonic velocity.</p> <p>Flow of Fluids through Solids: Form drag - skin drag - Drag co-efficient. Flow around solids and packed beds. Friction factor for packed beds. Ergun's Equation - Motion of particles through fluids - Motion under gravitational and centrifugal fields - Terminal settling velocity. Fluidisation - Mechanism, types, general properties - applications.</p> <p>Transportation and Metering: Measurement of fluid flow: Orifice meter, venturi meter, pitot tube,</p>							



rotameter, weirs and notches Wet gas meter and dry gas meter. Hot wire and hot film anemometers. Transportation of fluids: Fluid moving machinery performance. Selection and specification. Air lift and diaphragm pump. Positive displacement pumps: Rotary and Reciprocating pumps. Centrifugal pumps and characteristics.

REFERENCE BOOKS

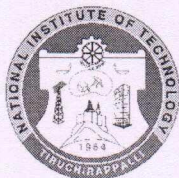
1. Yunus Cengel "Fluid Mechanics: Fundamentals and Applications" McGraw-Hill Higher Education; 4 edition, 2017.
2. Noel. D. Nevers, "Fluid Mechanics for Chemical Engineers", McGraw Hill, 3rd International Edition, 2005.
3. W. L. McCabe, J.C. Smith and P. Harriott, "Unit operations of Chemical Engineering", 7th Edn., McGraw Hill, International Edn., 2004.
4. J. M. Coulson and J. F. Richardson, "Chemical Engineering", Vol 1, 6th Edn. Butterworth-Heinemann, 1999.

COURSE OBJECTIVES

1. To impart the fundamental concepts of fluid statics, pressure distribution and dimensional analysis
2. To nurture the students to solve fluid dynamics problems using Newton's laws of motion.
3. To enable students to compute velocity profile, friction factor and head loss in pipes and fittings
4. To impart the knowledge of metering and transportation of fluids and fluid moving machinery performance

COURSE OUTCOMES (CO)

Course Outcomes	Aligned Programme Outcomes (PO)
The students would have	
the Knowledge of fundamental concepts in fluids statics and to use dimensional analysis for scaling experimental results	1, 2, 3, 5, 8, 11, 12
the ability to solve hydrostatic and fluid flow problems using Newton's laws of motion.	1, 2, 3, 5, 8, 9, 11, 12
the ability to analyse frictional flow in pipes and to compute the head loss and power requirements for chemical process equipment	1, 2, 3, 5, 6, 8, 11, 12
the ability to select the metering equipment and fluid moving machinery for an appropriate chemical engineering operations	1, 2, 3, 5, 6, 8, 10, 11, 12



COURSE PLAN – PART II

COURSE OVERVIEW

The Momentum Transfer course is offered for chemical engineering students in the third semester to acquire the knowledge of basic fluid dynamics and its applications in chemical engineering. The course content includes nature of fluid behavior and its properties, measurement of pressure and its relationship with elevation and density of the fluid. Static and dynamic behaviour of fluids and forces acting upon are studied through macroscopic and microscopic analysis and to use differential equations to understand pressure and velocity variations. Turbulence behaviour, concept of boundary layer, friction factor, pipe flow, pressure loss in fittings, flow past an immersed body, flow through packed & fluidized beds are also studied in detail. Measurement of fluid flow and Fluid moving machinery performance. Selection and specification will be discussed

COURSE TEACHING AND LEARNING ACTIVITIES

S.No.	Week/Contact Hours	Topic	Mode of Delivery
1.	Week 1	Introduction to fluid mechanics. Nature of fluids, Physical properties of fluids	Chalk and talk
2.	Week 2	Newtonian and Non- Newtonian fluids, Pressure - density - height relationships, Pressure Measurement	Chalk and talk
3.	Week 3	Units and Dimensions - Dimensional Analysis, Similarity - forces arising out of physical similarity	Chalk and talk
4.	Week 4	Kinematics of fluid flow: Stream line - stream tube - velocity potential. Reynolds experiment and significant	Chalk and talk
5.	Week 5	Momentum balance - Forces acting on stream tubes - Potential flow - Bernoulli's equation	Chalk and talk
6.	Week 6	Correction for fluid friction - Correction for pump work.	PPT
7.	Week 7	Flow of incompressible fluids in pipes - laminar and turbulent flow through closed conduits	PPT
8.	Week 8	velocity profile & friction factor for smooth and rough pipes -	PPT, Tutorial
9.	Week 9	Head loss due to friction in pipes,	PPT

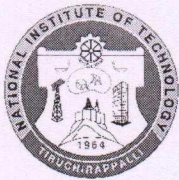


		fitting etc.	
10.	Week 10	Introduction to compressible flow. Isentropic flow through convergent and divergent nozzles	PPT
11.	Week 11	Flow of Fluids through Solids: Form drag - skin drag - Drag co-efficient. - Flow around solids and packed beds.	PPT
12.	Week 12	Friction factor for packed beds. Ergun's Equation	PPT
13.	Week 13	Motion of particles through fluids - Motion under gravitational and centrifugal fields-Terminal settling velocity.	PPT, Tutorial
14.	Week 14	Fluidisation - Mechanism, types, general properties - applications	PPT
15.	Week 15	Measurement of fluid flow: Orifice meter, venturi meter, pitot tube, rotameter, Hot wire and hot film anemometers.	PPT, Tutorial
16.	Week 16	Transportation of fluids: Fluid moving machinery performance. Selection and specification.	PPT

COURSE ASSESSMENT METHODS (shall range from 4 to 6)

S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1	Cycle Test I (Written Test)	On completion of first two Units	1Hr	20%
2	Cycle Test II (Written Test)	On completion of 3 rd and 4 th units	1 Hr	20%
3	Assignment	One after I Cycle test and another after II Cycle test		10%
CPA	Compensation Assessment*	After II Cycle test	1Hr	20%
4	Semester exam*	After completing the syllabus	3 Hrs	50 %

***mandatory; refer to guidelines on page 4**



COURSE EXIT SURVEY (mention the ways in which the feedback about the course shall be assessed)

- Assessing students' performance in the assessment methods
- Questionnaire about the effectiveness of the delivery method, topics and the knowledge gained

COURSE POLICY (preferred mode of correspondence with students, policy on attendance, compensation assessment, , academic honesty and plagiarism etc.)

MODE OF CORRESPONDENCE (email/ phone etc)

Most of the information will be announced in the class room itself.

Any other correspondence (schedule of classes/ schedule of assessment/ course material/ any other information regarding this course) will be done through class representative via Mail/Phone.

Queries (if required) to the course teacher shall be emailed to mpsamy@nitt.edu

ATTENDANCE POLICY (A uniform attendance policy as specified below shall be followed)

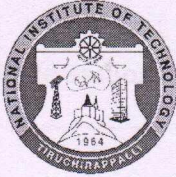
- **At least 75% attendance in each course is mandatory.**
- **A maximum of 10% shall be allowed under On Duty (OD) category.**
- Students with **less than 65% of attendance** shall be prevented from writing the final assessment and **shall be awarded 'V' grade.**

COMPENSATION ASSESSMENT

1. Attending all the assessments are **MANDATORY** for every student.
2. If any student is not able to attend any of the assessments (1, 2 only) due to genuine reason, student is permitted to attend the compensation assessment (CPA).
3. At any case, CPA will not be considered as an improvement test.

ACADEMIC DISHONESTY & PLAGIARISM

- Talking to other students, copying from others during an assessment will be treated as punishable dishonesty.
- Zero mark to be awarded for the offenders. For copying from another student, both students get the same penalty of zero mark.
- The departmental disciplinary committee including the course faculty member, PAC chairperson and the HoD, as members shall verify the facts of the malpractice and award the punishment if the student is found guilty. The report shall be submitted to the Academic office.

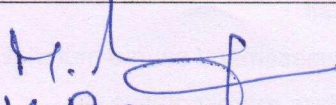


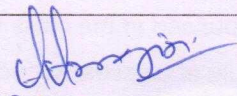
The above policy against academic dishonesty shall be applicable for all the programmes.

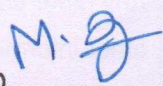
ADDITIONAL INFORMATION

The teachers can be contacted in person for clarifications by the student on a mutually convenient

FOR APPROVAL


M. PERUMALSAMY
Course Faculty _____


(A. ARUNAGIRI)
CC-Chairperson _____


HOD _____
(M. ARIVA MANAGAN)

Guidelines

- a) The number of assessments for any theory course shall range from 4 to 6.
- b) Every theory course shall have a final assessment on the entire syllabus with at least 30% weightage.
- c) One compensation assessment for absentees in assessments (other than final assessment) is mandatory. Only genuine cases of absence shall be considered.
- d) The passing minimum shall be 35% or (Class average/2) whichever is greater.
- e) Attendance policy and the policy on academic dishonesty & plagiarism by students are uniform for all the courses.
- f) Absolute grading policy shall be incorporated if the number of students per course is less than 10.
- g) Necessary care shall be taken to ensure that the course plan is reasonable and is objective.