

TEMPLATE FOR COURSE SPECIFICATION (Transport Phenomena)

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	Transport Phenomena /343
4. Programme(s) to which it contributes	CE.442
5. Modes of Attendance offered	Fall time
6. Semester/Year	2 semester/year
7. Number of hours tuition (total)	3
8. Date of production/revision of this Specification	
9. Aims of the Course	
1. To provide an understanding of the general principles of separation processes to allow students to make sensible options given a separation task (Humidification, Dehumidification and Cooling tower, Evaporation, Liquid - liquid extraction, Solid – Liquid Filtration, and Wet Solid Drying).	
2. A comprehensive understanding of the transport processes related to chemical engineering operations, with focus on both theory and applications.	
3. Ability to select appropriate equipment for the separation of materials in process plant.	
4. Introduce and develop an understanding of concerned mainly with the physical nature of the processes that take place in industrial units, and, in particular, with determining the factors that influence the rate of transfer of material.	
5. Understand the analogy between fluid dynamics of the unit, as well as the heat and mass transfer relationships.	
6. Provide practice at developing critical thinking skills, solving open ended problems and to work in teams.	

10• Learning Outcomes, Teaching, Learning and Assessment Method
A-Knowledge and Understanding A1. Basic information, concepts and terminology of the general principles of separation processes of humidification, dehumidification and cooling tower, evaporation, liquid - liquid extraction, solid - liquid filtration, and wet solid drying. A2. Demonstrating a broad and integrated knowledge and a deep understanding of issues related to separation processes in a chemical process and important role it plays in the success of the process both economically and environmentally. A3. Ability to design separation system for the effective solution of intended problem.
B. Subject-specific skills B1. The economic, management and statutory requirements involved in the practice of separation processes in chemical engineering. B2. Gain and/or improve their ability to synthesize, integrate and utilize process information in solving separations and analogy problems. B3. Analyze and interpret data and, when necessary, design experiments to gain new data. B4. Give an awareness and understanding of professional responsibilities concerned mainly with nature of the separation processes that take place in industrial units, and, in particular, with determining the factors that influence the rate of transfer of material. B5. Use laboratory, engineering and measuring equipment to provide data in support of theoretical understanding.
Teaching and Learning Methods
Lectures, Tutorials, Example Classes, Informal and formal teamwork, Weekly homework problems
Assessment methods
Midterm exams, Final exam, Quizzes, Weekly homework, Team and homework problems, partial test (Oral questions :- multiple choice, alternative response), Open questions that have a definite answer, or do not have a definite answer
C. Thinking Skills C1. An ability to apply effective, creative and innovative solutions, both independently and cooperatively, to current and future problems in separation processes and transport phenomena. C2. Apply course concepts in solving interdisciplinary problems, solve the problems through logic and improve their ability to work effectively in a group of peers. C3. Present and evaluate information and ideas in the handling of separation processes and transport phenomena issues. C4. Analyze and solve engineering problems often on the basis of limited and contradictory information.
Teaching and Learning Methods
Lectures, Tutorials, Example Classes, Informal and formal teamwork, Weekly homework problems, Analysis of cases linked to the work environment, Practical Applications
Assessment methods
Midterm exams, Final exam, Quizzes, Weekly homework, Team and homework problems, partial test (Oral questions :- multiple choice, alternative response), Open questions that have a definite answer, or do not have a definite answer

D. General and Transferable personal development).

Skills (other skills relevant to employability and

D1. Work together in same-discipline teams to solve engineering problems.

D2. Be creative, particularly and analytical in the formulation and solution of problems.

D3. Speed intuitive, predictability and evaluate information and ideas in the handling of separation processes and transport phenomena issues.

11. Course Structure

Week	Hours	ILOs	Unit/Module or Topic Title	Teaching Method	Assessment Method
1 st semester					
1	3	provide an understanding of the general principles of Drying wet solid	Drying wet solid:- introduction and general principle in drying, rate of drying, the mechanism of moisture movement.	Lectures, 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		Basic principles of drying depend on rate regime (constant and falling regime)	Calculation of rate of drying, moisture transport in solids at constant in continuous dryers.	Lectures , Example Classes , Practical Applications	Exams , Weekly homework, Team and homework problems , Open questions that have a definite answer ,
3		Demonstrating a broad and integrated knowledge and a deep understanding of issues related to Drying wet	Types of dryers and falling rate period , capillary movement , material and energy balances	Lectures, Tutorials , Example Classes , Practical Applications	Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer, partial test
4		provide an understanding of the general principles of Humidification ,saturation , dew point , wet and adiabatic saturation temperature ,humid heat and volume	Humidification, temperature humidification chart, enthalpy –humidification temperature chart.	Lectures, Tutorials , Example Classes , Informal and formal teamwork , Weekly homework problems Analysis of cases linked to the work environment	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer, partial test (Oral questions)

5		evaluate information and ideas in the handling of transport phenomena issues	Addition of steam to gas stream , Addition of gas to gas stream	Lectures, Tutorials , Example Classes , Informal and formal teamwork , Weekly homework problems	Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer, partial test (Oral questions)
6		Apply course concepts in solving interdisciplinary problems of cooling tower	Mechanism of cooling tower , minimum gas flow rate	Lectures, Tutorials , Example Classes , Informal and formal teamwork , Weekly homework problems	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer
7		Apply to use concepts in solving interdisciplinary problems of dehumidification tower	Mechanism of dehumidification tower , minimum gas flow rate	Lectures, Tutorials , Example Classes , Informal and formal teamwork , Weekly homework problems	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer
8		understanding of the transport processes related to Evaporation	Evaporation : introduction , types of evaporators , forward , backward and parallel evaporators, heat transfer in evaporation process boiling point rise	Lectures, Tutorials , Example Classes , Informal and formal teamwork , Weekly homework problems	Exams , Weekly homework, Team and homework solve problems , partial test (Oral questions), Open questions that have a definite answer , or do not have a definite answer
9		Design of single evaporators	Arrangement of evaporators :- single evaporators	Lectures, Tutorials , Example Classes , Informal and formal teamwork , Weekly homework	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer
10		Design of double evaporators	Arrangement of evaporators :- Design of double evaporators , comparison of forward and backward evaporators	Lectures, Tutorials , Example Classes , Informal and formal teamwork , Weekly homework problems	Exams , Weekly homework, Team and homework solve problems , partial test (Oral questions), Open questions that have a definite answer , or do not have a definite answer

11		Factors influence on the arrangement of evaporators and design	Arrangement of evaporators :- Design of triple evaporators , comparison of forward and backward evaporators	Lectures, Tutorials , Example Classes , Informal and formal teamwork , Weekly homework problems	Exams , Weekly homework, partial test (Oral questions), Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer
12		Understand the selection of proper equipment for filtration process and operation process	Filtration of liquid solid :- types of filtration , filtration theory, filtration at constant pressure drop and at constant filtrate	Lectures, Tutorials , Example Classes , Informal and formal teamwork , Weekly homework problems	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer
13		Understand the operation of plate and frame filter	Plate and frame filter (filtration at constant pressure drop and at constant filtrate) , washing time	Lectures, Tutorials , Example Classes , Informal and formal teamwork , Weekly homework problems	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer
14		Understand the operation of leaf filter	Leaf filter(filtration at constant pressure drop and at constant filtrate) , washing time	Lectures, Tutorials , Example Classes , Informal and formal teamwork , Weekly homework problems	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer
15		Determine the optimum cake thickness and max. throughput	Maximum rate of filtration for Plate and frame filter	Lectures, Tutorials , Example Classes , Informal and formal teamwork , Weekly homework problems	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer
2nd semester					
16		Understand the selection of proper equipment for extraction process and operation process	Extraction (liquid-liquid):- definition ,extraction process, equilateral triangle coordinates system of liquid –one pair partially soluble ,choice solvent	Lectures, Practical Applications	partial test (Oral questions :- multiple choice ,alternative response), Open questions that have a definite answer , or do not have a definite answer

17		Understand the partial soluble system	Equipment of extractor partial soluble system in cross-current extraction single and multistage	Lectures , Example Classes , Practical Applications	Exams , Weekly homework, Team and homework problems , Open questions that have a definite answer , or do not have a definite answer, partial test (Oral questions)
18		Understand the insoluble solvent system	Equipment of extractor insoluble solvent in cross-current extraction single and multistage	Lectures, Tutorials , Example Classes , Practical Applications	Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer, partial test (Oral questions)
19		Design continuous counter-current extraction single and multistage	Equipment of extractor partial soluble system in continuous counter-current extraction single and multistage	Lectures, Tutorials , Example Classes , Informal and formal teamwork , Weekly homework problems Analysis of cases linked to the work environment	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer, partial test (Oral questions)
20		Design continuous counter-current extraction single and multistage	Equipment of extractor insoluble solvent in continuous counter-current extraction single and multistage	Lectures, Tutorials , Example Classes , Informal and formal teamwork , Weekly homework problems	Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer, partial test (Oral questions)
21		Minimum solvent required	Minimum solvent required	Lectures, Tutorials , Example Classes , Informal and formal teamwork , Weekly homework problems	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer

22		Understand the analogy between fluid dynamics of the unit, laminar stream regime	Boundary layer in plane surface , laminar stream regime	Lectures, Tutorials , Example Classes , Informal and formal teamwork , Weekly homework problems	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer
23		Understand the analogy between fluid dynamics of the unit, in , turbulent regime	Boundary layer in plane surface , turbulent regime	Lectures, Tutorials , Example Classes , Informal and formal teamwork , Weekly homework problems	Exams , Weekly homework, Team and homework solve problems , partial test (Oral questions), Open questions that have a definite answer , or do not have a definite answer
24		Understand the analogy between fluid dynamics of the unit, in laminar-sub-layer regime	Boundary layer in plane surface , laminar-sub-layer regime	Lectures, Tutorials , Example Classes , Informal and formal teamwork , Weekly homework	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer
25		Understand the analogy between fluid dynamics of the unit, through pipe	Boundary layer through pipe	Lectures, Tutorials , Example Classes , Informal and formal teamwork , Weekly homework problems	Exams , Weekly homework, Team and homework solve problems , partial test (Oral questions), Open questions that have a definite answer , or do not have a definite answer
26		The fundamental analyses in all three subfields of heat, momentum, and mass transport in molecular diffusion	Reynolds analogy: momentum , heat and mass transfer in molecular diffusion	Lectures, Tutorials , Example Classes , Informal and formal teamwork , Weekly homework problems	Exams , Weekly homework, partial test (Oral questions), Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer

27		Understand the analogy between fluid dynamics of the unit, in eddy transfer	momentum , heat and mass transfer in eddy transfer	Lectures, Tutorials , Example Classes , Informal and formal teamwork , Weekly homework problems	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer
28		The convective transport of mass, momentum and heat normally occurs through a thin boundary layer close to the wall in ignoring sub -layer	Simple Reynolds analogy	Lectures, Tutorials , Example Classes , Informal and formal teamwork , Weekly homework problems	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer
29		Understand the analogy between fluid dynamics of the unit, as well as the heat and mass transfer relationships in concerned sub - layer	Modified Reynolds analogy	Lectures, Tutorials , Example Classes , Informal and formal teamwork , Weekly homework problems	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer
30		Understand the analogy between fluid dynamics of the unit, as well as the heat and mass transfer relationships	Chilton and Coburn analogy	Lectures, Tutorials , Example Classes , Informal and formal teamwork , Weekly homework problems	Exams , Weekly homework, Team and homework solve problems , Open questions that have a definite answer , or do not have a definite answer

12. Infrastructure	
<p>Required reading:</p> <ul style="list-style-type: none"> · CORE TEXTS · COURSE MATERIALS · OTHER 	<ul style="list-style-type: none"> ○ Lecturers ○ Book -References <p>Colulsson ,J.M and Richardson J.F. “Chemical Engineering , volume 1”, 3ed edition ,Robert Maxwell.M.C.</p> <p>Colulsson ,J.M and Richardson J.F. “Chemical Engineering , volume 2”, 3ed edition ,Robert Maxwell.M.C.</p> <p>Colulsson ,J.M and Richardson J.F. “Chemical Engineering , volume 6”, 3ed edition, Robert Maxwell.M.C.</p> <p>Other support books :-</p> <p>Perry,J.H,” chemical engineering handbook ”,Mc-Graw – Hill Book com.1975.</p> <p>Binay.K.Dutta “mass transfer and separation process “2007.</p> <p>Trebal Robert E.,”mass transfer operation”2ed edition, Mc-Graw –Hill Book com.1975.</p>
Special requirements(include for example workshops,periodicals, IT software, websites)	Websites , Laboratory
Community-based facilities (include for example,guest Lectures, internship,field studies)	field trips

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