Programme of "FONDAMENTI DELLE OPERAZIONI UNITARIE DELL'INDUSTRIA CHIMICA" UNIT OPERATION FUNDAMENTALS		
• Code: I0534 • type of course unit: COMPULSORY • level of course unit: FIRST cycle, Industrial Engineering, Specialization in Chemical Engineering • year of study: 3rd; semester: 2nd		
Number of ECTS credits: 6 (workload is 60 hours; 1 credit = 25/30 hours)		
Teacher: Alberto Gallifuoco (alberto.gallifuoco@univaq.it)		
1	Course objectives	**At the end of the course the students should acquire the ability to:** • identify, model, and solve problems which commonly arise in the industrial separation processes; • develop the basic comprehension of the interrelations between thermodynamics and rate of mass transfer in the main separation processes; • develop a basic ability to choose the correct separation unit;
2	Course content and Learning outcomes (Dublin descriptors)	**Expected results at the end of the course**: • Acquiring basic knowledge and understanding on the phenomena occurring in the industrial separation units; • Applying knowledge and understanding for solving simple the mass balances in different separation process layouts; • Making informed judgments and choices on the operational conditions which could assure the highest yields of separation; • Acquiring capacities to continue learning in the field of industrial separation processes. **Topics of the module include**: Overview of the separation processes and unit operations; mass transfer between phases; concept of driving force, thermodynamic limits, and rate of mass transfer; use of partition diagrams of phase equilibria; phase rule and lever arm rule; graphical calculation techniques; single stage calculation; concurrent, countercurrent and cross flow; interphases and mass transfer; mass transfer coefficient and diffusion; mass balances over separation equipments; operating lines, separation effectiveness; concept of HTU and NTU; overview of mechanical separations: filtration, centrifugation, membrane processes, cyclone. **On successful completion of this module, the student should:** - have basic knowledge of separation processes; - demonstrate skill in identifying the governing phenomena occurring during industrial separation process; - understand and explain criteria for selecting the proper separation unit; - acquire the ability to perform mass balances preliminary to the separation process design;
3	Prerequisites and learning activities	To benefit from the course, students should must possess basic knowledge on chemistry, chemical engineering thermodynamics, and transport phenomena.
4	Teaching methods and language	Lectures, exercises, home work Language: Italian/English (when required by students) Ref. Text books: Notes prepared by the Teacher; Treybal "Mass transfer operations", McGraw-Hill Seder Henley "Separation process principles", Wiley Griskey "Transport Phenomena and Unit Operations: A Combined Approach", Wiley
5	Assessment methods and criteria	Oral exam

ANNEX 1

List of verbs to be used for describing LO

Level of cognitive ability	What does it mean?	What verbs are useful?	Example outcomes – 'By the end of this module students will be able to…'
Knowledge	What do we expect students to know? This basic level focuses on recall and description	Know; Define; Memorise; List; Recall; Name; Relate; Identify; State; Describe; Show; Quote; Present	List the operation principles of common digital circuit applications Identify key features of single celled organisms Identify and describe different forms of the sonnet
Comprehension	What do we expect students to be able to interpret? How do students convey their understanding as well as their recall?	Discuss; Review; Explain; Locate; Illustrate; Clarify; Select; Summarise; Conclude;	Explain how the life cycle of a lytic virus operates Review a range of social science research methods
Application	Can students use a theory or information in different situations? Are students able to articulate the relevance of teaching in other circumstances?	Solve; Examine; Modify; Interpret; Apply; Use; Practise; Demonstrate; Classify;	Use P200 and P1000 Gilson pipettes independently and accurately Use a Lineweaver-Burke plot to calculate Vmax and Km Apply appropriate statistical tests to a dataset
Analysis	Can students identify and explain relationships between material? Can they break knowledge down into constituent parts and show how these parts relate to each other?	Differentiate; Investigate; Appraise; Criticise; Debate; Compare; Contrast; Distinguish; Analyse	Calculate how many white blood cells are in a litre of blood Compare the replication processes of RNA and DNA viruses Analyse recent news stories using the IPA's seven common propaganda devices
Synthesis	Can students take the elements of what they have learnt and put them together in a different way? Can they develop a plan or a proposal from a set of knowledge?	Assemble; Organise; Compose; Propose; Construct; Design; Create; Manage; Develop; Specify; Modify	Construct a dichotomous classification key to identify plant specimens Design programs using selection statements Manage the budget for a practical film production project
Evaluation	Can students make judgements about knowledge? Can they construct an argument or compare opposing views?	Judge; Select; Evaluate; Choose; Assess; Rate; Measure; Argue; Defend.	Evaluate the possible approaches to film-editing Debate the statement "There is a gene for every behaviour" Assess to what extent educational theory is applicable to education policy