The University of Jordan
School of Engineering
Chemical Engineering Department

0905456 Fertilizers Technology (2019 study plan)
Semester /

Course Catalog
3 Credit hours. Need for fertilizer in crop production. Nutrients and their classification. Organic and inorganic fertilizers. Fundamentals of fertilizer application. Raw materials and their availability. Fertilizers classification, types and application methods Fundamentals of the types and manufacture of nitrogen, phosphorus and potassium fertilizers. The manufacture and properties of mixed fertilizers. Numerical Exercises in the compounding of fertilizers.

Instructor		
Instructor	**Dr. Yousef Mubarak** **E-mail**: ymubarak@ju.edu.jo	**Office**: CHE 3rd Floor Office 315 **Tel**: 22891 **Web**: fetweb.ju.edu.jo/staff/che/ymubarak

Prerequisites	
Prerequisites by topic	*Mass Transfer Operation*
Prerequisites by course	*935441*

	Text book
Title	*Fertilizer Manual*
Author(s)	United Nations Industrial Development Organization (*UNIDO*) and International Fertilizer Development Center (*IFDC*).
Publisher	Kluwer Academic Publishers
Year	1998
Edition	3rd Edition

References	
Books	1- George T. Austin. "*Shreve's Chemical Process Industries*". 5th Edition, 1984, McGraw Hill. 2- Derek A. Palgrave. "*Fluid Fertilizer Science and Technology*", 1991, Marcel Dereck Inc. 3- Max Appl. "*Ammonia Principles and Industrial Practice*". 1999, WILEY-VCH Verlag GmbH.

Objectives and Outcomes	
Objectives	**Outcomes**
The objectives of this course are to: 1. Introduce students to the different types of nutrients that plants need to grow up. [1]Introduce students to the use of fertilizers to improve soil productivity and crop yield. [1]	Students who have successfully completed this course will have full understanding of the following concepts: 1. Understand the basic concepts of fertilizer industries. [1]

3. Introduce students to different organic and inorganic fertilizer production methods. [1] 4. Introduce students to the classification of fertilizers: solid, liquid, and suspension fertilizers. [1] 5. Introduce students to the different types of the nitrogenous, phosphatic and potash fertilizers. [1,2,4] 6. Expose students to numerical exercises in the compounding of fertilizers. [1] 7. Expose students to a practical exercises to produce NPK fertilizers. [1, 6, 5]	2. Be familiar with: [1, 2, 4] • Various aspects of fertilizers [1] • Various types of phosphate fertilizers • Various types of potash fertilizers • Various types of NPK fertilizers • Bio fertilizers, fluid and mixed fertilizers • Various pollution standards of fertilizer industries 3. They will understand the various methods of production and the processes involved in the manufacture of various fertilizers. [1,2, 4] 4. They will be able to manage and produce NPK fertilizers (liquid, solid, and suspension) practically. [1, 6, 5]

Topics Covered

Week	Topics
1	***General Concepts, Classification, Terminology, and Definitions.*** o *Plant Nutrients.* o *Fertilizer Grade.* o *Fertlizer Regulations.* o *Fertlizer Specifications.* o *Terminology and Definitions.*
2	***The Role of Fertilizers in Agriculture.*** o *Demand for Agricutural Products and Plant Nutrients.* o *The Soil Resource.* o *Concepts of Soil Fertility.* o *Fundamentals of N, P, anf K.* o *Diagnosis of Nutrient Problems.*
3	***Status of the Fertlizer Industry.*** o *Short History of Fertlizer Development.* o *Statistical Overview of Fertilizer Production.* o *Statistical Overview of Fertilizer Consumption.* o *Future Outlook for Fertilizer Demand.* o *Future Outlook for Fertilizer Supply.* o *Fertlizer Supply-Demand Balances.*
4	***Fertlizer Raw Materials and Reserves.*** o *Availability and Sources of Raw Materials.* o *Nitrogen Feedstocks.* o *Phosphate Rock.* o *Potash and Sulfur*
5-7	***Sulfuric and Phosphoric Acids.*** o *Sulfuric Acid* o *Wet-Process Phosphoric Acid.* o *Superphosphoric Acid.* o *Purification of Phosphoric Acid.* o *Phosphoric Acid Production by the Electric Furnace Process.* o *Phosphoric Acid Production by the Blast-Furnace Process.*
8	***Fertlizers Derived From Phosphoric Acid.*** o *Triple Superphosphate.* o *Ammonium Phosphates.* o *Nongranular MAP.* o *Ammonium Polyphosphate.* o *Single Superphosphate.*

	○ *Potasium Phosphates.* ○ *Urea Phosphate.* ○ *Dicalcium Phosphate.*
9-10	***Potash and Potassium Nitrate Fertilizers.*** ○ *Potash in Agriculture.* ○ *Potash Production, Consumption, and Price.* ○ *Other Potassium Fertilizers.* ○ *Chemical-Grade Potash.* ○ *Potassium Nitrate*
11	***Production of Ammonia.*** ○ *Ammonia Early Process Development.* ○ *Physical Properties of Ammonia.* ○ *Feedstock for Ammonia Production.* ○ *Production Technology of Ammonia.* ○ *Ammonia Storage and Transportation.*
12-13	***Nitric Acid, Niitrates, Ammonium Salts, and Urea.*** ○ *Nitric Acid.* ○ *Ammonium Nitrate and Calcium Ammonium Nitrate.* ○ *Properties of Urea.* ○ *Urea Processes.*
14	***Liquid Fertlizers.*** ○ *Nitrogen.* ○ *Fluid Phosphates.* ○ *Suspension Fertlizers.* ○ *Speciality Fluid Fertlizers.*
15	***Environmental Protection and Pollution Prevention.*** ○ *Environmental Issues Related to the Use of Fertlizers.* ○ *Environmental Impact of the Fertlizer Industry.* ○ *Phosphogypsum.* ○ *Environmental Impact Assessment.* ○ *The Role of International Organizations.* ○ *Best Available Technology.*

Course Assessment: The assessment of objectives will be achieved through a practical project, quizzes, and common examinations with common grading.

Evaluation		
Assessment Tool	**Expected Due Date**	**Weight**
Quizzes and Practical Project	Quizes will be given from time to time during the lectures. Also, you will be asked to perform an experimental work to produce one of the fertilizers in the lab then present your results in a proper way.	20 %
Mid Exam	According to the department schedule	30 %
Final Exam	According to the University final examination schedule	50 %

Trips: Mainly two trips will be arranged to have a close look at the Arab Potash and Jordan Phosphate Mines companies.

Relationship to Chemical Engineering Program Objectives

PEO1	PEO2	PEO3	PEO 4	PEO 5	PEO 6
√	√	√	√	√	√

Document control

Prepared by	Dr. Yousef Mubarak
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