

**Subject Code: 09CH1507**  
**Subject Name: FERTILIZER TECHNOLOGY**  
**Semester: 5<sup>th</sup>**

**Objective:**

The course objective is to build a link between chemistry and synthetic fertilizers manufacturing. Hence after completion of this course student will be able to demonstrate the knowledge for arranging treatment, reaction and separation steps in a flow diagram for variety of fertilizers including Nitrogenous fertilizers, Phosphate fertilizer, Potash Fertilizer, Complex fertilizer and Bio fertilizers isessential.

**Credits Earned: 4**

**Course Outcomes:** After completion of this course, student will be able to:

1. Classify various types of soil nutrients essential for plantgrowth.
2. Utilize reactions and unit operations steps in manufacturing of various fertilizers such as Nitrogenous Fertilizers, Potassium Fertilizers, Phosphorus Fertilizers, NPK Fertilizersetc.
3. Characterize fertilizers on the basis of different properties.
4. Identify and solve various engineering problems in fertilizermanufacturing.

**Pre-requisite of course:** Basic concepts of Chemical Process Industries and Chemical Technology

**Teaching and Examination Scheme**

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/ Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE (E)	Mid Sem (M)	Internal (I)	Practical Exam (V)	Term work (TW)	
3	0	2	4	50	30	20	25	25	150

**Contents:**

Unit	Topics	Contact Hours
1	<b>INTRODUCTION TO FERTILZERS:</b> Introduction to Plant nutrients, Fertilizer specifications, Terminology and Definitions, Application of fertilizers considering Nutrient, Balance and types of crop. Development of fertilizer industry; Fertilizer production and consumptioninIndia;ClassificationsofSoilnutrients,Macronutrients, Micronutrients.	06
2	<b>NITROGENOUS FERTILIZERS:</b> Ammonium Nitrate: Properties, production and storage, Nitric acid: preparation and process flow diagram; Manufacturing of Nitric Acid by Pressure ammonia oxidation process and Intermediate pressure ammonia oxidation process.Urea: Physical, chemical properties, Manufacturing of Urea by	14

	Stamicarbon's CO <sub>2</sub> stripping process, Toyo-Koatsu total recycle process, Manufacturing of Ammonium nitrate by Prilling process, Ammonium sulphate from Ammonium carbonate and gypsum, Ammonium chloride from Ammonium sulphate and sodium chloride	
3	<b>POTASSIUM FERTILIZERS:</b> Physical, chemical properties and uses of Potassium Chloride, Potassium nitrate, Potassium sulphate, Manufacturing of potassium chloride from sylvinit, Preparation of Potassiumnitrate, Potassium sulphate.	06
4	<b>PHOSPHORUS FERTILIZERS AND POTASH FERTILIZERS:</b> Production Processes of Phosphoric acid; Dihydrate process, Hemihydrate (HH) process, Ammonium Phosphates, Potash Fertilizers; Manufacturing process of potassium sulphate and potassium nitrate.	08
5	<b>MISCELLANEOUS FERTILIZER AND BIO FERTILIZERS:</b> Manufacturing of NPK, Ammonium Sulphate Phosphate (ASP), Calcium Ammonium Nitrate (CAN), Bio fertilizers, Types of Bio fertilizers, Nitrogen-fixing bio fertilizers, Preparation of a bio fertilizers	08
	<b>Total Hours</b>	<b>42</b>

### References:

1. Hand book of Fertilizer Association of India, New Delhi, 1998.
2. Slack A.V., Chemistry & Technology of Fertilizers, Interscience, New York, 1967.
3. M. Gopala Rao & Marshall Sittig, Dryden's Outlines of Chemical Technology, East-West Press, 3rd Edition, New Delhi.
4. Austin G. T, Shreve's Chemical Process Industries, 5th edition, Mc. Graw Hill Publications.
5. Pandey & Shukla, Chemical Technology, Volume I & II, 2nd Edition, Vani Books Company.
6. N S Subba Rao, Bio fertilizers in Agriculture, Oxford & IBH Publishing Company.

### Suggested Theory distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember	Understand	Apply	Analyze	Evaluate	Create
40%	40%	10%	10%	-	-

### List of Experiments:

<b>SR. No.</b>	<b>Practical/Exercise</b>
1.	Prepare chart for fertilizer classification with chemical formula and nutrient content.
2.	Estimate percentage of Nitrogen in Ammonium sulfate by substitution method.
3.	Estimate percentage of Nitrogen in Ammonium chloride by back titration.
4.	Estimate percentage of Nitrogen in Ammonium sulphate by back titration.
5.	Estimate percentage of Nitrogen in Ammonium Chloride/Sulphate by Kjeldhal's method.
6.	Estimate burette content in Urea sample by color comparison
7.	Estimate percentage of Nitrogen in DAP by Formaldehyde method
8.	Estimate percentage of Nitrogen in DAP by Kjeldhal's method
9.	Prepare potassium sulphate
10.	Prepare potassium chloride
11.	Prepare potassium nitrate

### Instructional Method:

- a. The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCsetc.
- b. The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory andclass-room.
- c. Practical examination will be conducted at the end of semester for evaluation of performance of students inlaboratory.
- d. Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory.