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SARVAJANIK UNIVERSITY
Sarvajani College of Engineering and Technology



Bachelor of Technology (B.Tech)

B.Tech. Semester VI

Subject Name: Fertilizer Technology

Subject Code: BTCH14602

Type of course: Professional Elective Course-IV

Prerequisite: Basics of Chemical Process Industries and Chemical Technology

Rationale:

Synthetic fertilizers are must for producing good crops. It is therefore vital for chemical engineers to understand for each fertilizer product, its flow diagram for Industry production. For this purpose, students should have skills for arranging treatment, reaction and separation steps in a flow diagram for variety of fertilizers including Nitrogenous fertilizers, Phosphatic fertilizer, Potash Fertilizer, Complex fertilizer and Biofertilizers is essential. Hence this course is designed to achieve this objective.

Teaching and Examination Scheme:

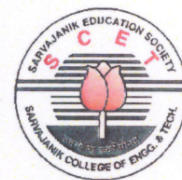
TEACHING SCHEME				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	
3	0	2	4	60	25	15	30	20	150

CA1: Continuous Assessment (assignments/projects/open book tests/closed book tests CA2: Sincerity in attending classes/class tests/ timely submissions of assignments/self-learning attitude/solving advanced problems TEE: Term End Examination TEP: Term End Practical Exam (Performance and viva on practical skills learned in course) CA3: Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in course

Content:

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1.	Overview of Fertilizer: Synthetic fertilizers, Classification of fertilizers, Role of essential Elements in plant Growth, Macro elements and Micro elements, Application of fertilizers considering Nutrient, Balance and types of crop. Development of fertilizer industry; Fertilizer production and consumption in India; Nutrient contents of fertilizers; Secondary nutrients; Feedstock and raw materials for nitrogenous, phosphatic and potassic fertilizers	5	10%
2.	Nitrogenous Fertilizers: Introduction to Ammonia: Physical & chemical properties, applications, Synthesis gas by Catalytic partial oxidation Steam Hydrocarbon reforming, Ammonia converters: Design aspect of Single bed and multi-bed converter, Kellogg process and Haldor Topsoe process, Storage and Transportation of Ammonia. Introduction to Nitric acid: Chemical, physical properties and applications, Manufacturing of Nitric Acid by Pressure ammonia oxidation process and Intermediate pressure ammonia oxidation process, Concentration of Nitric acid by $Mg(NO_3)_2$. Urea: Physical, chemical properties, Manufacturing of Urea by Stamicarbon's CO_2 stripping process, Toyo-Koatsu total recycle process, Manufacturing of Ammonium nitrate by Prilling process, Ammonium sulphate from Ammonium carbonate and gypsum,	20	35%





	Ammonium chloride from Ammonium sulphate and sodium chloride		
3.	Phosphatic Fertilizer: physical and chemical properties Phosphorus and Phosphoric acid, manufacturing process of Phosphorus, Ammonium Phosphates, Nitro phosphate Fertilizers, Potash Fertilizers	9	18%
4.	Potassium Fertilizers: Physical, chemical properties and uses of Potassium Chloride, Potassium nitrate, Potassium sulphate, Manufacturing of potassium chloride, Potassium nitrate and Potassium sulphate	7	15%
5	Miscellaneous Fertilizer and Bio Fertilizers: Manufacturing of NPK, Ammonium Sulphate Phosphate (ASP), Calcium Ammonium Nitrate (CAN), Bio fertilizers, Types of Bio fertilizers, Nitrogen fixing bio fertilizers, Phosphate-solubilizing bio fertilizers, Preparation of abio fertilizers	5	12%
6	Environmental Issues Related to the Use of Fertilizers, Impact of Fertilizers on the environment Environmental impact of Solid Fertilizer Industry	5	10%

Suggested Specification table with Marks (Theory/Practical):

% Distribution of Marks					
R Level	U Level	A Level	N Level	E Level	C Level
25	20	15	-	-	-

Legends: R: Remembrance, U: Understanding; A: Application, N: Analyze, E: Evaluate C: Create and above Levels (**Revised Bloom's Taxonomy**)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Text Books:

Sr. No.	Title of book /article	Author(s)	Publisher and details like ISBN	Year of publication	Publication Edition
1.	Shreve's Chemical Process Industries	Austin G. T,	Mc. Graw Hill Publications.	2016	5th
2.	Dryden's Outlines of Chemical Technology	M. Gopala Rao & Marshall Sittig,	East-West Press	1997	3rd
3.	Commercial Fertilizers	Collings, G.H.	McGraw Hill, New York	1955	5th.
4.	Handbook of fertilizer technology	Editorial board	The Fertilizer Association of India, New Delhi	2016	--
5.	Chemistry and Technology of Fertilizers	Slacks, A.V.	Interscience New York	1966	--
6.	Bio fertilizers in Agriculture,	N S Subba Rao	Oxford & IBH Publishing Company	2017	4 th





Course Outcome:

Sr. No.	CO Statement After learning this subject, students will be able to	Marks % weightage
CO-1	To make student understand micro and macro nutrients and fertilizers role in different plant's growth	15
CO-2	Characterize fertilizers on the basis of different properties	10
CO-3	Use reactions and unit operations steps in manufacturing of various fertilizers	50
CO-4	Identify engineering problems in fertilizer manufacturing.	10
CO-5	To make student understand requirement to develop bio fertilizer and their role in sustainable development of agriculture	15

Mapping with POs:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	P O1 0	PO 11	P O1 2	PS O1	PS O2	PS O3
CO-1	3	3	2	1	1	3	3	3	2	2	2	3	2	2	2
CO-2	3	3	2	1	1	3	3	3	2	2	2	3	2	2	1
CO-3	3	3	2	1	1	3	3	3	2	2	2	3	1	1	1
CO-4	3	3	2	1	1	3	3	3	2	2	2	2	2	2	3
CO-5	3	3	2	1	1	3	3	3	2	2	2	2	2	2	3
Rationale*	15	15	10	5	5	15	15	15	10	10	10	13	9	9	10

LIST OF PRACTICALS:

1. Prepare chart for fertilizer classification with chemical formula and nutrient content
2. Estimate percentage of Nitrogen in Ammonium sulphate by substitution method
3. Estimate percentage of Nitrogen in Ammonium chloride by substitution method
4. Estimate percentage of Nitrogen in Ammonium sulphate by back titration
5. Estimate percentage of Nitrogen in Ammonium chloride by back titration
6. Analysis of Urea by Formaldehyde method
7. Estimate biuret content in Urea sample by colour comparison
8. Estimate percentage of Nitrogen in DAP by Kjeldhal's method
9. Prepare potassium chloride
10. Prepare bio-fertilizer
11. Prepare potassium nitrate
12. Estimate percentage of Nitrogen in DAP by Formaldehyde method
13. Estimate nutrient content (% N, %P₂O₅, % K₂O) in different fertilizers from their chemical formula

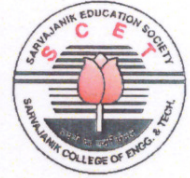




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List of Open Source/learning website:

- <https://nptel.ac.in/courses>
- www.fnca.mext.go.jp/bf/bfm/pdf/Biofertilizer_Manual.pdf

