



**Subject:** Unit operation and Unit processes - II -MSCIN13513

**Type of course:** Major

**Prerequisite:** Students should have a basic knowledge of Industrial methods. These subjects provide the theoretical and mathematical framework for analyzing and designing chemical and physical transformations on an industrial scale.

**Rationale:** To understand the fundamentals to chemical engineering and the design of chemical plants. They provide a framework for understanding, analyzing, and designing industrial-scale manufacturing processes.

**Teaching and Examination Scheme:**

Teaching Scheme			Credits	Examination Marks					Total Marks
CI	T	P		C	Theory Marks		Practical Marks		
			ESE		MSE	V	P	ALA	
4	0	0	4	60	30	10	00	50	150

*Legends: CI-Class Room Instructions; T – Tutorial; P - Practical; C – Credit; ESE - End Semester Examination; MSE- Mid Semester Examination; V – Viva; CA - Continuous Assessment; ALA- Active Learning Activities.*

**Course Content:**

Unit No.	Course content	Hrs	% Weight age
1	<b>Filtration:-</b> Theory of filtration, calculation of filters, equipments (Filter Press, Centrifuge, Bag filter) <b>Drying:-</b> Theory of drying, calculation of drying, equipments (Try Dryer, Spray Dryer, Drum Dryer) Introduction & Mechanism of Mechanical Separation. Introduction & Mechanism of Handling of Solids.	15	25

Unit operation and Unit processes - II -MSCIN13513



2	<b>Extraction:-</b> Calculation of number of stages for extraction, equipments (Spray column, Packed column, RDC) <b>Distillation:-</b> Construction and working of distillation column, sieve plate & bubble cap and packed towers. Introduction & Mechanism of Mixing.	15	25
3	Introduction, Kinetics & Mechanism of Alkylation/Arylation. (Industrial production of any two compound by Alkylation/Arylation) Introduction, Kinetics & Mechanism of Oxidation. (Industrial production of any two compounds by Oxidation.)	15	25
4.	Introduction, Kinetics & Mechanism of Reduction. (Industrial production of any two compound by Reduction) Introduction, Kinetics & Mechanism of Esterification. (Industrial production of any two compounds by Esterification.)	15	25
<b>Total</b>		60	100

#### Continuous Assessment:

Sr. No	Active Learning Activities	Marks
1.	<b>Filtration:</b> Compare batch vs continuous filtration; optimize filter selection for given slurry. Make a report and upload it on the GMIU Web portal.	10
2.	<b>Mechanical Separation &amp; Handling of Solids:</b> Design a solid handling system including hoppers, feeders, conveyors; discuss bridging/clogging prevention Upload the details on GMIU Web portal.	10
3.	<b>Chemical Safety Regulations Simulation:</b> Students need to prepare a detailed report on Cumene production (alkylation) & bromobenzene synthesis (arylation); identify rate-limiting steps) and upload it to GMIU web Portal.	10
4.	<b>Simulation:</b> Provide students an Calculate filtration time and filter area using Carman-Kozeny equation; simulate effect of particle size & pressure. with templates or instructions and Upload it to GMIU web Portal.	10



5.	<b>Chemistry in the News:</b> Instruct students to find recent news articles related to chemistry. They can explore topics like new discoveries, environmental issues, or advancements in technology. Make a report and upload it on GMIU Web Portal.	10
<b>Total</b>		<b>50</b>

**Suggested Specification table with Marks (Theory):60**

<b>Distribution of Theory Marks</b> (Revised Bloom's Taxonomy)						
Level	Remembrance (R)	Understanding (U)	Application (A)	Analyze (N)	Evaluate (E)	Create (C)
Weightage	30%	30%	30%	10	00	00

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.

**Course Outcome:**

After learning the course the students should be able to:	
CO1	Understand the theory of filtration and distinguish between different filtration mechanisms.
CO2	Utilize the working and industrial applications of spray columns, packed columns, and rotating disc contactors (RDCs).
CO3	Apply and analyze the industrial production of at least two compounds via alkylation/arylation.
CO4	Develop and explain the construction and working of distillation columns including sieve plates, bubble cap trays, and packed towers.

**Instructional Method:**

The course delivery method will depend upon the requirement of content and the needs of students. The teacher, in addition to conventional teaching methods by black board, may also use any tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.

From the content 10% topics are suggested for flipped mode instruction.

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Students will use supplementary resources such as online videos, NPTEL/SWAYAM videos, e-courses, Virtual Laboratory

The internal evaluation will be done on the basis of Active Learning Assignment

Practical/Viva examination will be conducted at the end of semester for evaluation of performance of students in the laboratory.

**Reference Books:**

1. Introduction to chemical engineering By Walter L. Badger, J. T. Bancharo, McGraw Hill Book Co..
2. Chemical engineering Vol. 1 to 6 By Coulson and J.F.Richardson, Pergaman Press
3. Chemical process principles Vol.1 by Hodgen
4. Elementary principles of chemical processes by Richa Ronald, W. Rousseau, John Willey and Son.
5. Unit processes in organic synthesis by P. H. Groggins.

