GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3173625
Semester-VII
Subject Name: Process Technology of Drugs and Intermediates & Nanotechnology

Type of Course: Chemical Technology

Prerequisite: Studied department electives of previous semesters. Basic knowledge of Pharmaceutics & Organic Chemistry is required**.**

Rationale: The main objective of this subject is to study process technology of drugs, intermediates and nanotechnology.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE Viva(V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs.
1	**Optimization of Organic Reactions & Processes** : Introduction, the purpose of chemical development, discovering the best synthetic route; Selecting the best route for scale-up, Choice of raw materials, reagents etc; case studies, the investigative approach to chemical development, Effect of process variables on yield & quality of products; Quality control in process analysis as an aid to optimization, Designing a robust process & preventing scale-up problems, Solvent effects, Phase transfer catalyst, chiral synthesis.	12
2	**Separation Techniques in Pharmaceutical Industry:** Separation (a) aspect of Chemical Purification & process separation technology (b), Introduction to Separation technology; choosing a separation process, Simulated moving bad (SMB) chromatography	6
3	**Design , development of safe chemical process:** Introduction, Development technologies for safe Process design, Unit operations posing particular hazards during development, Strategies for chemical hazards assessment, Hazards of gas & vapor generation, Identification of highly-energetic materials. Process control considerations & safety critical systems	6
4	**Nanoscience Technology:** Definitions, classification of nanostructures and systems, nanotechnology and pharmaceutical applications(Introduction) Nanoscale properties as a function of size: structural properties, chemical properties, mechanical properties, thermal properties, optical properties, magnetic properties, electronic properties.	8
5	Fabrication methods(general approaches): Top-down, bottom-up and templating approaches	8

	Characterization methods- Imaging (microscopy) method, analysis(spectroscopy) method, size measurement etc.	
6	Gold and silver Nanoparticles: preparation, properties and pharmaceutical/healthcare applications, Molecular nanomaterials: dendrimers	5

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
20	**20**	**10**	**10**	**5**	**5**

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

Reference Books:

1. Practical Process Research & Development, Neal G. Anderson, Academic Press, 2000
2. Principles of Research & Chemical Development in the Pharmaceutical industry, Oligan Repic, Wiley Interscience 1998.
3. From Bench to Market the Evolution Chemical Synthesis, Romano Di Fabio, Oxford University Press, 2000
4. Mixing Equipment (Impeller type),AIChE Publication 2001
5. Chemical Process Quantitative Risk Analysis, AIChE Publication, 2000
6. Pollution Prevention through Process Integration (Systematic Design Tools), Mahmound M. Academic Press, 1997.
7. Nanoscale Sciecne and Technology; R. Ke;sall, I. Hamley, M. Geoghegan
8. Nanobiotechnology(Concepts, applications and perspectives); C.M. Niemeyer and C.A. Mirkin; Nanotechnology in catalysis Vol 1 & 2, B. Zhou, S. Hermans and G.A. Somorjai;
9. Teacher shall prescribe some latest review articles

C**ourse Outcomes:**

Sr. No.	CO statement	Marks % weightage
1	To describe the steps for optimization of organic reactions & process, separation techniques, development of safe process and nanoscience technology and its applications	33
2	To illustrate various methods of process optimization, methods for choosing separation techniques, methods for safe processing, nanoparticle properties.	24
3	To demonstrate the investigative approach of chemical development, process optimization, purification , separation techniques, safe processing, and nano fabrication	13
4	To analyse optimization of organic process, safety in chemical process, separation technologies and nanoparticle fabrication and nanoscience applications	13
5	To explain various methods to achieve process optimization, safe processing, separation techniques and nanotechnology and application in pharmaceutical industry	10
6	To evaluate v.arious characterization methods of nanoparticles and safety in	7

	chemical process	

List of experiments:

1. Preparation of Chalcone
2. Preparation of 1,1-bis hydroxy-2-naphthol by green procedure
3. Preparation of antibacterial drug-Sulphanilide
4. Preparation of p-nitro benzoic acid
5. Preparation of 1-phenylazo-2-naphthol.
6. Preparation of p-Nitro acetanilide

Major Equipment:

1. Mechanical stirrer & heating mantle
2. Sieves
3. Vacuum pump
4. Dryer

List of Open Source Software/learning website:

1. Literature available in any laboratory manual of Pharmaceutical Industries.
2. Literature available on internet
3. Medical dictionaries
4. Delnet
5. Pharmacopoeia