GUJARAT TECHNOLOGICAL UNIVERSITY

CHEMICAL TECHNOLOGY (36)
NANOSCIENCE TECHNOLOGY AND PHARMACEUTICAL PACKAGING TECHNOLOGY
SUBJECT CODE: 2183610
B.E. VIIIth SEMESTER

Type of Course: Chemical Technology

Prerequisite: Studied department electives of previous semesters. Basic knowledge of Chemical Engineering,Pharmaceutics, Biochemistry & Chemistry is required

Rationale: The main objective of this subject is to study the Nanosciece technology and Pharmaceutical packing technology

Teaching Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P	C	Theory Marks			Practical Marks			
				ESE (E)	PA (M)		ESE (V)		PA (I)	
					PA	ALA	ESE	OEP		
4	0	0	4	70	20	10	0	0	0	100

Content:

Sr. No.	Topic	Teaching Hours	Module Weightage (%)
01	**Nanoscience Technology**		50
	Definitions, classification of nanostructures and systems, nanotechnology and pharmaceutical applications(Introduction)	3	
	Nanoscale properties as a function of size: structural properties, chemical properties, mechanical properties, thermal properties, optical properties, magnetic properties, electronic properties	5	
	Fabrication methods(general approaches): Top-down, bottom-up and templating approaches	5	
	Characterization methods(general aspects of each methods to be covered rather than in depth): Imaging(microscopy) methods, analysis(spectroscopy) methods, size measurements etc	5	
	Self-assembling nanostructure: principle of self assembly(non-covalent inter actions and intermolecular packing), preparation and characterization of Nanoparticles through vesicular and micellar polymerization, nanofilms	5	
	Gold and silver Nanoparticles: preparation, properties and pharmaceutical/healthcare applications	3	

	Molecular nanomaterials: dendrimers	1	
	Nanotechnology in catalysis: nanostructure and catalysis - fundamental principles, examples of nanocatalyst based synthetic methodologies	3	
02	**Pharmaceutical Packaging Technology**		50
	Introduction to Packaging, Classification of Packaging, Essential Requirements, Functions of Packaging, Importance / significance of Pharma Packaging, Properties of Ideal Package, Packaging formats in Pharma Industry, Packaging recycling symbols, FDA Definitions	2	
	Introduction to Packaging materials, Classification of Packaging materials, Approach to package design, New Trends in the pharmaceutical packaging	2	
	Introduction to plastics and polymers, Raw Materials of Plastics, Types of Plastics, Resin identification code, Plastics and Packaging, testing of plastic containers	2	
	Introduction to glass, Selection of glass as packaging materials for the pharmaceutical products , Advantages and disadvantages of glass containers ,Properties of glass, Production of glass, Types of glass, Manufacturing of Glass containers, Testing of glass containers	3	
	Introduction to metals, Aluminium and Aluminium foil , Collapsible Tubes ,Tin, Stainless steel	1	
	Introduction to blister package, Blister design parameters, Materials, Formation, Types of Blisters, Advantages and disadvantages of Blister Packaging, Types of Problems/ Defects, Blister Packing Machine, Other packages, Strip Packs- High Barrier Laminates, Strip Packaging Process, Properties of Materials, Child-resistant strip package, Strip Sealing Machine, Strip Packing Machinery, Multi-Dose Strip Packaging	3	
	Introduction to Ancillary Materials used in Packaging, Adhesives , Paper , Paperboard, Wood, fibreboard , Packaging inserts , leaflets	1	
	Introduction to natural and synthetic rubber, Types of closures, Classification of contemporary closures by their utility, Special-purpose Closure, Closure Functions, Closure Materials, Types of Plastic Closures, Sealing Systems, Liners, Closure Liner Functions, Classification of Liners, Selection of Lining Material, Options for Closure Liners, Innerseals, Linerless Closures, Types of tapes, Strapping Materials, Evaluating Closure Liners, Standard Liners, Tacseal, Solutions, Liner Description, Liner Designations	3	
	Introduction, Components of Corrugated fibre board, Types of Corrugated Board, Advantages & Disadvantages, Manufacturing, Box	2	

	Structure, Box Dimensions, Types of Box, Applications of C.F.B., New developments in CFB		
	Sterilization of packaging materials Introduction, Pharmaceutical Importance of Sterilization, Physical and Chemical Factors that affect sterilization, Terms commonly used, Classification of Sterilization Methods, Sterilization of Packaging Materials, Tests for Sterility , Incubation and examination of sterility tests, Interpretation of the test results, Evaluation of Sterilization Method, Process of Microbial Destruction, Evaluation and In Process Monitoring of Sterilization Procedures	2	
	Packaging of Parenterals, Ophthalmics, And Aerosols Introduction, Packaging of Sterile Pharmaceuticals, Packaging Components, Inspection of Filled Injectable Products, Storage and Labelling, Packaging of Ophthalmics, Selection of Packaging Materials, Packaging of Aerosols	3	
	Defects In Packages Introduction, Defects in Packaging Material	1	
	Package Testing And Testing of Containers & Closures Introduction, Testing of containers and closures	2	
	Stability of Packages Introduction, Legislation, Regulation, Pharmaceutical Stability Testing in Climatic Cabinets, Pharmaceutical Stability Testing Conditions, Photo-Stability Testing, Review of Pharmaceutical Product Stability, Packaging and the ICH Guidelines	2	
	Packaging Regulations And Legal Requirements	1	

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
60	**10**	**10**	**10**	**10**	**-**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and 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.

References:

1. Nanoscale Sciecne and Technology; R. Ke;sall, I. Hamley, M. Geoghegan;
2. 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; Teacher shall prescribe some latest review articles.
3. D. A. Dean, Roy Evans, Ian Hall. Pharmaceutical packaging technology. Tylor and Francis.
4. Edward J. Bauer, Pharmaceutical Packaging Handbook. Bausch and Lomb, Rochester, New York, USA.
5. Wilmer A. Jenkins, Kenton R. Osborn. Packaging drugs and pharmaceuticals.
6. Salvatore J. Turco, Sterile dosage forms: their preparation and clinical application
7. Remington: The Science and Practice of Pharmacy.
8. Michael E. Aulton, Kevin Tylor (Ed.). Aulton's Pharmaceutics: The design and Manufacture of Medicine.
9. Gilbert Banker and Christopher Rhodes. Modern Pharmaceutics.
10. Leon Lachman; Lieberman Herbert A.; Kanig, Joseph L. The theory and Practice of Industrial Pharmacy.

Course Outcomes:

1. To know the Nanoscience technology & Pharmaceutical packing technology
1. To carry out the synthesis of drug molecules and preparations of pharmaceutical formulations
2. To be able to apply this knowledge in API & Pharmaceutical Formulation industries
3. To build a bridge between theoretical and practical concept used in industry

List of Open Source Software/learning website:

1. L
   iterature available under R&D of Pharmaceutical Industries.
2. Literature available on internet
3. Medical dictionaries
4. Delnet
5. Pharma journals/ e-journals.

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide.