C. U. SHAH UNIVERSITY

Faculty: - Pharmaceutical Sciences
Department: Pharmaceutics & Pharmaceutical Technology
Semester: VII
Name of Subject: Pharmaceutical Technology I (Theory)
Subject Code: 4PS07PTE1

Teaching & Evaluation Scheme:-

Sr. No	Branch Code	Subject Code	Subject Name	Teaching hours/ week				Credit	Evaluation Scheme/ Semester				
									Theory				Total
									Sessional Exam		University Exam		
				Th	Tu	Pr	Total		Marks	Hrs	Marks	Hrs	
1	04	4PS07PTE1	Pharmaceutical Technology I	3	0	0	3	3	20	1	70	3	100
									10 (CEC)	--			

Objective of Course:-

- Pharmaceutical Technology provides students with the technological and regulative knowledge and competences required to work, in all sectors directly or indirectly connected with the design, development, manufacture, evaluation and commercialization of medications and health products.

Prerequisites:-

- To have a more thorough theoretical background in many of the topics covered in this course; students should have basic knowledge of Pharmaceutical Engineering and dispending pharmacy.

Course outline:-

Sr. No.	Course Contents	Hours
1	**Liquid Dosages Forms**: Introduction, types of additives used in formulations, Vehicles, stabilizers, preservatives, suspending agents, emulsifying agents, solubilizers, colours, flavours and others, manufacturing, packaging and evaluation of clear liquids, suspensions and emulsions official in pharmacopoeia.	8
2	**Semisolid Dosage Forms**: Definitions, types, mechanisms of drug penetration, factors influencing penetration, semisolid bases and their selection. General formulation of semisolids, clear gels manufacturing procedure, evaluation and packaging, Suppositories: Ideal requirements, bases, manufacturing procedure, packaging and evaluation.	9
3	**Sterile dosage forms**: Definitions, Advantages, Disadvantages, Ideal requirements and Formulation of sterile dosage forms, Water for injection-Preparation and quality control, Design and requirements for production area-Aseptic techniques, sources of contamination and methods of prevention, design of aseptic area, laminar flow benches, services and maintenance, containers and closures, methods of filling including form fill and seal technology. Evaluation of sterile dosage forms, Parenteral suspensions, Prefilled syringes, Parenteral nutrients, Freeze dried products, Nanosuspensions etc, I.P. Products. Ophthalmic preparations: Requirements, formulations, methods of preparations, containers and evaluation. I.P. Products.	10

4	**Pharmaceutical Aerosols:** Definition, propellants, general formulation, manufacturing, packaging methods, pharmaceutical applications and evaluation.	6
5	**Cosmeticology and cosmetic preparations:** Fundamentals of cosmetic science, structure and functions of skin and hair, formulation, preparation and packaging of cosmetics for skin - Sunscreen, moisturizers, cold cream, vanishing cream, Anti-ageing and anti-wrinkle preparation hair - Shampoo and conditioners, dentifrice- powders, gels, paste and manicure preparations like- nail polish, lipsticks, eye lashes, brief introduction to cosmeceuticals, baby care products, shaving cream, hygienic products.	6
6	**Supercritical fluids**: Introduction to supercritical fluids, Pharmaceutical applications of supercritical fluids in extraction, size reduction, preparation of inclusion complexes, preparation of solid dispersions, etc., Equipments for SCF processing such as GAS, RESS, SAS.	6
	Total	**45**

C. U. SHAH UNIVERSITY

Faculty: - Pharmaceutical Sciences
Department: Pharmaceutics & Pharmaceutical Technology
Semester: VII
Name of Subject: Pharmaceutical Technology I (Practical)
Subject Code: 4PS07PTEP

Teaching & Evaluation Scheme:-

Sr. No	Branch Code	Subject Code	Subject Name	Teaching hours/ week				Credit	Evaluation Scheme/ Semester				
				Th	Tu	Pr	Total		Practical				Total
									Sessional Exam		University Exam		
									Marks	Hrs	Marks	Hrs	
1	04	4PS07PTEP	Pharmaceutical Technology I	0	0	3	3	1.5	20	3	70	3	100
									10 (CEC)	--			

The students would perform the experiments related to the topics mentioned under theory.

- Preparation, evaluation of liquid dosage form.
- Preparation, evaluation of Semisolid dosage form.
- Preparation, evaluation of sterile dosage form.
- Formulation of various types of cosmetics for skin, hair, dentifrices and manicure preparations.

Learning Outcomes:-

- The course would help the student to achieve more confidence in manufacturing different dosage forms.

Teaching & Learning Methodology:-

- Lectures will be conducted with the aid of multimedia projector, black board etc
- Assignments based on course content will be given to the students at the end of each Unit/topic and will be evaluated at regular interval.
- Specific discussion questions will be assigned each week.

Books Recommended:-

Text Book

1. The Theory and Practice of Industrial Pharmacy by L Lachman, H Lieberman and J Kanig.
2. Gennaro, Alfonso R., Remington: The Science and Practice of Pharmacy, Vol. - I & II, Lippincott Williams & Wilkins, New York.
3. Pharmaceutical Dosage Forms and Drug Delivery Systems by Ansel & others.
4. Pharmaceutics: The Science of Dosage Form Design by Michael E. Aulton.

Reference Book

1. Pharmaceutical Dosage Forms: Disperse systems: Vol. - 1, Vol. - 2 and Vol. - 3, Ed. by Lieberman, Leon Lachman and Joseph B. Schwartz, Marcel Dekker Inc., New York.
2. Pharmaceutical Dosage Forms: Parenteral Medication: Vol.1, Vol. 2 and Vol.3, Ed. by Lieberman, Leon Lachman and Joseph B. Schwartz, Marcel Dekker Inc., New York.
3. Cosmetics by Poucher.
4. Latest editions of IP, BP, USP.

C. U. SHAH UNIVERSITY

Faculty: - Pharmaceutical Sciences
Department: Pharmaceutics & Pharmaceutical Technology
Semester: VII
Name of Subject: Pharmaceutical Dosage Form Design I (Theory)
Subject Code: 4PS07DFD1

Teaching & Evaluation Scheme:-

Sr. No	Branch Code	Subject Code	Subject Name	Teaching hours/ week				Credit	Evaluation Scheme/ Semester				
									Theory				Total
									Sessional Exam		University Exam		
				Th	Tu	Pr	Total		Marks	Hrs	Marks	Hrs	
1	04	4PS07DFD1	Pharmaceutical Dosage Form Design I	3	0	0	3	3	20	1	70	3	100
									10 (CEC)	--			

Objective of Course:-

- Pharmaceutical Dosage Form Design provides students with the physical, chemical, technological and regulative knowledge and competences required to work in the design, development, manufacture, evaluation and commercialization of Dosage from.

Prerequisites:-

- To have a more thorough theoretical background in many of the topics covered in this course; students should have basic knowledge of Physical Pharmacy.

Course outline:-

Sr. No.	Course Contents	Hours
1	**Preformulation studies:** • Study of physical properties of drug like physical form, particle size, shape, density, wetting, dielectric constant, solubility, dissolution and organoleptic property and their effect on formulation, stability and bioavailability. • Study of chemical properties of drug like hydrolysis, oxidation, reduction, racemization, polymerization and their influence on formulation, stability and bioavailability. • Crystal Characteristics: Crystalline structures, polymorphic nature of drugs, methods to identify polymorph (XRD, DSC studies). • Drug-Excipient compatibility studies and the role of DSC and FTIR techniques to evaluate compatibility.	10
2	**Pharmaceutical necessities:** Study of various additives or adjuvants used during formulation of various dosages forms: Natural gums, cellulose and their derivatives and other bio-degradable polymers used for controlled release or modified release.	4
3	**Stability of pharmaceuticals:** Kinetic principles and stability testing: Reaction rate and order. Product stability: Requirements, Shelf life, overages, containers, closures. Pathway of drug degradation and stabilization techniques: Hydrolysis, oxidation, reduction, racemization, polymerization, acid base catalysis etc. and their influence on formulation and stability of products. A Brief introduction to ICH guidelines, Accelerated stability testing procedures. Stability protocols for various pharmaceutical products.	8

4	**Biopharmaceutics:** An introduction to Biopharmaceutics and its role in formulation development, Passage of drug across the biological barriers, Factors influencing absorption, Physiochemical, Physiological and Pharmaceutical, Drug distribution in the body, plasma protein binding and drug excretion.	12
5	**Bioavailability and Bioequivalence:** Definition, Measures of bioavailability, C_{max}, t_{max} and Area under the Curve (AUC), Physiochemical factors influencing bioavailability, Dosage form factors influencing bioavailability, Review of regulatory requirements to conduct bioavailability and bioequivalence studies.	6
6	**Introduction to BCS and dissolution study:** Definition: BCS, BDDCS(Biopharmaceutical Drug Disposition Classification System), Dissolution mechanisms, Factors affecting dissolution, Intrinsic dissolution rate measurement, Dissolution apparatus for various dosage forms, Dissolution profile comparison using model independent method (similarity factor, dissimilarity factor).	5
	Total	**45**

C. U. SHAH UNIVERSITY

Faculty: - Pharmaceutical Sciences
Department: Pharmaceutics & Pharmaceutical Technology
Semester: VII
Name of Subject: Pharmaceutical Dosage Form Design I (Practical)
Subject Code: 4PS07DFDP

Teaching & Evaluation Scheme:-

Sr. No	Branch Code	Subject Code	Subject Name	Teaching hours/ week				Credit	Evaluation Scheme/ Semester				
									Practical				
									Sessional Exam		University Exam		Total
				Th	Tu	Pr	Total		Marks	Hrs	Marks	Hrs	
1	04	4PS07DFDP	Pharmaceutical Dosage Form Design I Practical	0	0	3	3	1.5	20	3	70	3	100
									10 (CEC)	--			

The students would have to perform the experiments related to the topics mentioned under theory.

- Determination of the angle of repose, Carr's index, Hausner's ratio.
- Determination of solubility of given drug at different pH.
- To study the compression characteristic of different diluents.
- To optimize the concentration of suspending agents and emulsifying agents.
- To study the effect of various binders on performance of tablet.
- To study the effect of various disintegrants on performance of tablet.
- To evaluate the physical stability of emulsion and compare with marketed product.
- To evaluate the physical stability of suspension and compare with marketed product.
- To study the Influence of temperature on the stability of aspirin solution.
- Compendial dissolution testing and data evaluation for given tablets and capsules.
- *In-vitro* dissolution profile comparison of given tablet with reference product using similarity and dissimilarity factor.
- Enhancement of solubility of poorly water soluble drug by solid dispersion.
- Enhancement of solubility of poorly water soluble drug by β-Cyclodextrin complexation.
- Preformulation studies including drug - excipient compatibility studies.
- Calculation of bioavailability parameters from the given pattern of drug absorption from oral & IV formulations.

Learning Outcomes:-

- The course would help the student to achieve more confidence in development of different dosage forms.

Teaching & Learning Methodology:-

- Lectures will be conducted with the aid of multimedia projector, black board, etc
- Assignments based on course content will be given to the students at the end of each
- Unit/topic and will be evaluated at regular interval.
- Specific discussion questions will be assigned each week.

Books Recommended:-

Text Book

1. Gennaro, Alfonso R., Remington: The Science and Practice of Pharmacy, Vol-I & II, Lippincott Williams & Wilkins, New York.

2. Pharmaceutical Dosage Forms and Drug Delivery Systems by Ansel & others.
3. Pharmaceutics: The Science of Dosage Form Design by Michael E. Aulton.
4. Pharmacokinetics by Milo Gibaldi and Donald Perrier.

Reference Book

1. Pharmaceutical Dosage Forms: Disperse systems: Vol.1, Vol. 2 and Vol.3, Ed. by Lieberman, Leon Lachman and Joseph B. Schwartz, Marcel Dekker Inc., New York.
2. Pharmaceutical Dosage Forms: Parenteral Medication: Vol.1, Vol. 2 and Vol.3, Ed. by Lieberman, Leon Lachman and Joseph B. Schwartz, Marcel Dekker Inc., New York.
3. Handbook of Pharmaceutical excipients, Royal society of Great Britain, U.K.
4. Latest editions of IP, BP, USP.
5. Stability Studies, Marcel Dekker.
6. Pharmaceutical dissolution testing by Umesh V. Banker, Marcel Dekker Inc

C. U. SHAH UNIVERSITY

Faculty: - Pharmaceutical Sciences
Department: Pharmaceutical Chemistry
Semester: VII
Name of Subject: Pharmaceutical Chemistry-VII (Medicinal Chemistry-IV) (Theory)
Subject Code: 4PS07PCH1

Teaching & Evaluation Scheme:-

Sr. No	Branch Code	Subject Code	Subject Name	Teaching hours/ week				Credit	Evaluation Scheme/ Semester				
									Theory				Total
									Sessional Exam		University Exam		
				Th	Tu	Pr	Total		Marks	Hrs	Marks	Hrs	
1	04	4PS07PCH1	Pharmaceutical Chemistry-VII (Medicinal Chemistry-IV)	3	0	0	3	3	20	1	70	3	100
									10 (CEC)	--			

Objective of Course:

- The course is designed to make students familiar with the principles of medicinal chemistry as applied to pharmaceuticals and to study the synthetic approaches and structure activity relationship of different therapeutic class of drugs and about molecular modeling.

Prerequisites:

- Basic understanding of concepts related to Synthetic chemistry along with pharmacology and biochemical studies.

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Course outline:-

Sr. No.	Course contents	Hours
Introduction, history, classification, mechanism of action, adverse effects, therapeutic uses, structure activity relationship (SAR) and synthetic procedures of selected drugs and recent developments of following categories to be covered. (Synthesis of drugs mentioned in each category for Chapter 1 to 3)		
1.	**Drugs acting on Cardiovascular system**	
a	**Cardiotonic agents** SAR: Cardiac glycosides. Synthesis: Dobutamine.	04
b	**Antihypertensive Agents** SAR: ACE Inhibitors, Dihydropyridnes Synthesis: Nifedipine, Amlodipine, Atenolol, Metoprolol, Carvedilol, Captopril, Hydralazine.	08
c	**Antiarrhythmic Agents** Synthesis: Lignocaine, Flecainide.	04
d	**Antianginal Agents:** Synthesis: Glyceryl trinitrate, Isosorbide dinitrate.	02
e	**Antihyperlipidemic Agents** SAR: HMG CoA Reductase inhibitors Synthesis: Clofibrate.	03
f	**Coagulants and Anticoagulants** Synthesis: Warfarin.	02
g	**Antiplatelet Agents**	01

h	**Thrombolytic Agents**	01
i	**Plasma expanders**	01
2	**Diuretics :** SAR: Thiazide diuretics, 5-Sulfamoyl benzoic acid derivatives. Synthesis: Hydrochlorthiazide, Acetazolamide, Furosemide, Dihydroflumethiazide, Ethacrinic acid.	05
3	**Antiobesity Drugs**	01
4	**Drug Design and Development**	
a	**QSAR** (i) Hansch Linear Free Energy Relationship (LFER) model. (ii) Free Wilson Mathematical Model.	04
b	**De novo Drug Design** (i) Molecular modelling (ii) Computer Aided Drug Design.	04
c	**Methods of Lead Discovery** Optimization of Lead.	03
d	Brief introduction to Combinatorial Chemistry and Parallel Synthesis.	02
	Total	45

C. U. SHAH UNIVERSITY

Faculty: - Pharmaceutical Sciences
Department: Pharmaceutical Chemistry
Semester: VII
Name of Subject: Pharmaceutical Chemistry-VII (Medicinal Chemistry-IV) (Practical)
Subject Code: 4PS07PCHP

Teaching & Evaluation Scheme:-

Sr. No	Branch Code	Subject Code	Subject Name	Teaching hours/ week				Credit	Evaluation Scheme/ Semester				Total
				Th	Tu	Pr	Total		Practical				
									Sessional Exam		University Exam		
									Marks	Hrs	Marks	Hrs	
1	04	4PS07PCHP	Pharmaceutical Chemistry-VII (Medicinal Chemistry-IV) Practical	0	0	3	3	1.5	20	3	70	3	100
									10 (CEC)	--			

Detailed Syllabus (Practical):

The practical exercises are based on topics described under theory. The experiments should broadly cover the following

1. Separation and qualitative analysis of Organic binary mixtures containing water insoluble components having salt, acidic, phenolic, amphoteric, basic and neutral nature (Solid + Solid, Solid + liquid, Liquid + liquid and Eutectic mixtures) with derivative preparations. (5 practicals)
2. Synthesis and purification of following organic compounds:
   a) Anthranilic acid from Phthalic anhydride
   b) Dihydroxytriptycene from Anthracene and p-Benzoquinone
   c) Fluorescein from Resorcinol and Phthalic anhydride and Purification by Column Chromatography.
   d) 3-Phenylpropionic acid from Diethyl malonate
   e) Microwave assisted synthesis of any Three Compounds.
   f) Sulphanilamide from Acetanilide
   g) Hippuric acid from Glycine
3. Demonstration of QSAR Models (Any Three Exercises):
   a) Literature survey of any QSAR Model and calculation of various physicochemical
   b) parameters
   c) Perform multiple regression analysis in MS Excel.
   d) Generation of Best Equation.

Learning outcomes:

4. By the end of this course, the student should have a good understanding of the basic concepts of Medicinal chemistry along with combinatorial chemistry.
5. Students should be able to describe detail synthetic approaches, mechanisms of action as well as structure activity relationship of some important therapeutic class of Drugs.
6. The course may help the students in understanding rational approaches towards the design of important therapeutic agents and their biological implications.

Teaching Methodology:

- Using blackboard and one-way communication from a teacher to a student. Using an overhead and LCD projector.

Books recommended:-

Text Books

6. J. N. Delagado and W. A. R. Remers, edn, Wilson and Giswolds Textbook of organic medicinal and pharmaceutical chemistry, J. Lippincott Co. Philadelphia.
7. W. C. Foye, Principles of medicinal chemistry, Lea and febiger, Philadelphia.
8. H. E. Wolff, edn, Burgers Medicinal chemistry, John Wiley and sons, New York.
9. Text Book of Medicinal Chemistry by Alagaraswamy, Elsevier Publication, New Delhi.
10. Text Book of Medicinal Chemistry by Kadam & Bothara, Volume I & II, Nirali Publication, New Delhi.

Reference Books

1. Daniel Lednicer, Strategies for organic drug synthesis and design, John Wiley and Sons USA.
2. B. N. Ladu, H. G. Mandel and E. L. Way. Fundamentals of drug metabolism and disposition. William and Willkins co. Baltimore.
3. I. L. Finar. Organic chemistry Vol. I and Vol. II. ELBS/Longman, London.
4. Vogels Text books practical organic chemistry, ELBS/Longman, London.
5. Mann and Saunders, Practical organic chemistry, Orient Longman, UK.
6. Shriner, Hermann, Morill, Curtin and Fusion. The systematic identification of organic compounds, John Wiley and Sons.
7. Strategies for Organic Drug Synthesis & Design by Daniel Lednicer, John Wiley & sons, USA.

C. U. SHAH UNIVERSITY

Faculty: - Pharmaceutical Sciences
Department: Pharmacology
Semester: VII
Name of Subject: Pharmacology IV (Theory)
Subject Code: 4PS07COL1

Teaching & Evaluation Scheme:-

Sr. No	Branch Code	Subject Code	Subject Name	Teaching hours/ week				Credit	Evaluation Scheme/ Semester				
									Theory				Total
									Sessional Exam		University Exam		
				Th	Tu	Pr	Total		Marks	Hrs	Marks	Hrs	
1	04	4PS07COL1	Pharmacology IV	3	0	0	3	3	20 10 (CEC)	1 --	70	3	100

Objective of Course:-

- Exploration and analysis of selected topics in pharmacology with a specific theme indicated by course title listed in a syllabus. This subject will take three times for credit as long as different topics are selected. (3 lecture per week)

Prerequisites:-

- Pharmacology studies required in a seventh semester, it is the base (core) of the major subjects in pharmaceutical studies like Bio pharmaceutics and Biochemistry and the application of medicinal chemistry.

Course outline:-

Sr. No.	Course Contents	Hours
1	**Chemotherapy** a. General principles of chemotherapy b. Sulfonamides, cotrimoxazole and quinolones c. Beta lactam antibiotics d. Tetracycline and chloramphenicol e. Aminoglycoside antibiotics f. Macrolides g. Antitubercular drugs h. Antileprosy drugs i. Antifungal drugs j. Antiviral drugs k. Antiprotozoal (Antimalarial, Antiamoebic etc.) drugs l. Anthelmintic drugs m. Anticancer drugs n. Miscellaneous	22
2	**Pharmacology of Endocrine system** a. Hypothalamic & pituitary hormones b. Thyroid and antithyroid drugs, parathormone, calcitonin and vitamin D c. Glucagon, insulin and oral hypoglycaemic drugs d. Corticosteroids e. Androgens and anabolic steroids	12

	f. Estrogens, progesterone and oral contraceptives g. Oxytocics and Tocolytics	
3	**Pharmacology of drugs acting on Respiratory system** a. Drugs used in bronchial asthma b. Antitussive agents c. Expectorants	03
4	**Drug Acting on the Gastrointestinal Tract** a. Anti-ulcer drugs (Antacids, Anti-secretory agents etc.) b. Laxatives and anti-diarrhoeal drugs c. Emetics and anti-emetics	03
5	**Drugs acting on immune system** a. Immunosuppressive agents b. Immunostimulant Agents	3
6	**Pharmacology of nitric oxide**	2
	Total	**45**

C. U. SHAH UNIVERSITY

Faculty: - Pharmaceutical Sciences
Department: Pharmacology
Semester: VII
Name of Subject: Pharmacology IV (Practical)
Subject Code: 4PS07COLP

Teaching & Evaluation Scheme:-

Sr. No	Branch Code	Subject Code	Subject Name	Teaching hours/ week				Credit	Evaluation Scheme/ Semester				
									Practical				
									Sessional Exam		University Exam		Total
				Th	Tu	Pr	Total		Marks	Hrs	Marks	Hrs	
1	04	4PS07COLP	Pharmacology IV Practical	0	0	2	2	1	20	2	70	3	100
									10 (CEC)	--			

Detailed Syllabus (Practical):-

Sr. No	Course Contents
1	**Bioassay** a. Introduction to general principles of bioassay, pharmacopoeial bioassays and biostandardization of various drugs. b. Introduction to cell based assay: Definition, Types, Advantages, limitations of cell based assay and application to High throughput screening. c. Bioassay of Acetylcholine using Chick/Rat ileum by graphical method. d. Bioassay of Acetylcholine using Chick/Rat ileum by matching method. e. Bioassay of Acetylcholine using Chick/Rat ileum by three point method. f. Bioassay of Acetylcholine using Chick/Rat ileum by four point method. g. Bioassay of Histamine using Chick/ Guinea pig by matching, method. h. Bioassay of Histamine using Chick/ Guinea pig by three point method. i. Bioassay of Histamine using Chick/ Guinea pig by four point method. j. Bioassay of Atropine using Chick/Rat ileum by graphical method. k. Bioassay of Mepyramine using Chick/ Guinea pig by graphical method.
2	**Demonstration experiments:** a. To demonstrate effect of antihistaminic drugs on guinea pigs. b. To demonstrate effect of antiulcer drugs using rats. c. To demonstrate the effect of anti-motility drugs using mice/rat. d. To demonstrate bioassay of oxytocin using rat uterus. e. To demonstrate effect of l-thyronine on respiration rate. f. To demonstrate the effect of hypoglycemic agents on blood sugar level (metformin, glibenclamide/Insulin) using experimental animals.

Learning Outcomes:-

- Define and correctly use scientific terminology in regard to human body and processes.
- Apply principles of scientific inquiry, differentiate a theory from a hypothesis, and differentiate fact from opinion in regard to use of drugs in different human system.
- Describe and practice laboratory safety guidelines relating to working with drugs, experimental animals and body fluids.
- Show proficiency in taking lab practical exams, responding to questions quickly and accurately, effectively handling the pressure of a timed exam.

Teaching & Learning Methodology:-

- Lectures will be conducted with the aid of multimedia projector, black board, OHP etc.
- Assignments based on course content will be given to the students at the end of each Unit/topic and will be evaluated at regular interval.
- Specific discussion questions will be assigned each week.

Books Recommended:-

Text Books:-

1. Rang, H.P. and Dale, M.M. Pharmacology, 5th ed, 2010, Publisher: Churchil Livingstone.
2. Tripathi K.D., Essentials of medical pharmacology 6th ed, 2010, Jaypee brothers medical publishers pvt, ltd.
3. Satoskar, R.S. and Bhadarkar, S.D. Pharmacology and Pharmacotherapeutics. 16th edition (single volume), 1999. Publisher: Popular, Dubai.

Reference Books:-

1. Katzung, B.G. Basic and clinical pharmacology. Latest edition. Publisher:
2. Prentice Hall, Int.
3. Goodman Gilman, A., Rall, T.W., Nies, A.I.S. and Taylor, P. Goodman andGilman's the pharmacological Basis of therapeutics. 9th Ed, 1996. Publisher McGraw Hill, Pergamon press.
4. Ghosh, M.N. Fundamentals of experimental pharmacology. Latest edition,
5. Publisher: Scientific book agency, Kolkata.
6. R.K. Goyal. Practicals in Pharmacology: B.S. Shah Prakashan, Ahmedabad.
7. Seth, S.D. Text Book of pharmacology, B.l. Churchill, 1997.
8. Harvel, R.A., Champe P.C. et al — Pharmacology (1997) 2nd Edn. Lippincott- Raven Company, Philadelphia, New York.
9. Kulakarni S.K.- handbook of Experimental Pharmacology (1993)2fld Edn. Vallabh Prakashan, New Delhi.
10. Sheth U.K. et al-Selected topics in Experimental Pharmacology (1972)15t Edn. The Kothari Book Depot, Mumbai.

C. U. SHAH UNIVERSITY

Faculty: - Pharmaceutical Sciences
Department: Pharmacognosy
Semester: VII
Name of Subject: Pharmacognosy-VI (Theory)
Subject Code: 4PS07COG1

Teaching & Evaluation Scheme:-

Sr. No	Branch Code	Subject Code	Subject Name	Teaching hours/ week				Credit	Evaluation Scheme/ Semester				
									Theory				Total
				Th	Tu	Pr	Total		Sessional Exam		University Exam		
									Marks	Hrs	Marks	Hrs	
1	04	4PS07COG1	Pharmacognosy - VI	3	0	0	3	3	20	1	70	3	100
									10 (CEC)	--			

Objectives: -

- To make students familiar with holistic concept of medication and drugs used in traditional system of medicine and understand the safety aspects of plants used as medicine.

Prerequisites:-

- The students should have a clear concept of Pharmacognosy.

Course outline:-

Sr. No.	Course Contents	Hours
1	**Biosynthetic studies and basic metabolic pathways:** Brief introduction to biosynthetic pathways of secondary metabolite. Biogenesis of pharmaceutically important compounds Acetate mevalonate: Menthol, Diosgenin, β-amyrin, Glycyrrhetinic acid, Carotenoids Shikimic acid: Atropine, Quinine, Reserpine, Morphine, Podophyllotoxin, Ephedrine, Colchicine, Ergot Alkaloids Acetate malonate: Linoleic acid, Omega-3 fatty acid	15
2	Natural allergens, Photosensitizing agents, Fungal toxins, Toxic plants and toxicological risk of plant drugs**.**	5
3	Pesticides and herbicides	3
4	Herbal cosmetics	5
5	Concept of Ayurveda, Ayurvedic formulations and their quality control: Introduction and principles of Ayurvedic, Unani, Siddha and Homeopathic systems of medicines. The holistic concept of Ayurvedic system of medicine. A study on different types of Ayurvedic formulations like Churna, Kwath, Gutika, Taila, Ghrita, Avaleha, Asavas, Arista, Bhasma and Pisti. Evaluation of Ayurvedic formulations.	8
6	Detail study of Ayurvedic Drugs: Studies of traditional drugs, Common vernacular names, Botanical sources, Morphology, Chemical nature of chief constituents, Pharmacological categories, common uses and marketed formulations of following indigenous drugs Entire herb- Shankhpushpi, Brahmi, Neem; Leaf- Talispatra; Bark: Shirish, Kanchnar; Rhizome & Roots- Rasna, Nagarmoth; Fruit- Colocynth	9
	Total	**45**

C. U. SHAH UNIVERSITY

Faculty: - Pharmaceutical Sciences
Department: Pharmacognosy
Semester: VII
Name of Subject: Pharmacognosy VI (Practical)
Subject Code: 4PS07COGP

Teaching & Evaluation Scheme:-

Sr. No	Branch Code	Subject Code	Subject Name	Teaching hours/ week				Credit	Evaluation Scheme/ Semester				
									Practical				
				Th	Tu	Pr	Total		Sessional Exam		University Exam		Total
									Marks	Hrs	Marks	Hrs	
1	04	4PS07COGP	Pharmacognosy -VI Practical	0	0	3	3	1.5	20	3	70	3	100
									10 (CEC)	--			

The practical exercises are based on topics describe under theory. The experiments should broadly cover the following:

1. Study of Morphology, Microscopy & TLC study of traditional crude drugs (T.S., Powder, Microscopy & TLC)
2. Study of plant used as insecticide, pesticide and herbicides
3. Preparation and evalulation of Herbal Cosmetics (Hair oil, Shampoo, Cream)
4. Preparation and evalulation of Churna (Triphala & Trikatu)
5. Preparation, Physical and chemical evaluation of Ayurvedic Preparations Asavas, Aristha, Taila, Pills/Tablets.
6. Preparation of Avaleha and Kwath.
7. Study of Toxic Plants
8. Study of Plant Sweeteners

Learning Outcomes:-

- The students are expected to understand Pharmacognostic aspects, uses and pharmacological properties of traditional plant drugs.
- To learn about uses of the herbal extracts in various cosmetic and herbal formulations.
- To learn about various poisonous plants.

Teaching Methodology:-

- Lectures will be conducted with the aid of multimedia projector, black board, OHP etc.
- Assignments based on course content will be given to the students at the end of each Unit/topic and will be evaluated at regular interval.
- Specific discussion questions will be assigned each week.

Books Recommended:

Text Book

1. A Text book of Pharmacognosy: Shah C. S., Quadry J. S., B. S. Shah Prakashan, Ahmedabad. 15th Edition, 2009.
2. Pharmacognosy: Kokate C. K., Purohit A. P., Gokhale S. B., Nirali Prakashan Pune, 42nd edition, 2008.
3. Trease and Evans Pharmacognosy. 16h Edition, William Charles Evans, W.
4. Textbook of Pharmacognosy: Wallis T. E., CBS Publishers and Distributors, New

a. Delhi, 5th Edition, reprinted, 2009.
5. Study of Crude drugs, Iyengar M. A. and Nayak S.G.K. Manipal Power Press, Manipal.
6. Practical Pharmacognosy, Technique and Experiment by Kokate C. K. and Gokhale S. B., Nirali Prakashan, Pune, 8th edition, 2005.

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1. Cultivation and Utilization of Medicinal Plants, Atal C. K. and Kapur B. M., RRL Jammu, 1st Edition, 1989.
2. Supplement to Cultivation and Utilization of Medicinal Plants, Handa, S.S. and Kaul, M.K., 1996. RRL, CSIR Publication, Jammu Tawi.
3. Pharmacognosy: C. K. Kokate, A. P. Purohit, S. B. Gokhale, Nirali Prakashan Pune, 42nd edition, 2008.
4. Trease and Evans Pharmacognosy. 16th Edition, William Charles Evans, W. Saunders, Edinburg, London, New York, Philadelphia, St. Louis, Sydney, Toronto, 2013.
5. Natural Products, Vol I & II, 28th edi Agrawal O. P., Goel Publishing House, Meerut, 28th Edition, 2004.
6. Chemistry of Natural products. Bhat SV, Nagasampagi BA, Meenakshi S. Narosa Publishing House, New Delhi, 2005.
7. Medicinal Natural Products, A Biosynthetic Approach. Dewick Paul M, John Wiley and Sons, West Sussex, 2009.
8. The Organic Constituents of Higher Plants. Their chemistry and interrelationships. Trevor Robinson, Burges Publishing Company, Minneapolis, USA, 1963.
9. Quality Control, Herbal Drugs, An approach to evaluation of Botanicals. Mukherjee P K, Business Horizons Pharmaceutical Publishers; 2002
10. The Ayurvedic Pharmacopoeia of India, Part I, (Vol. I–V) , part II (I & II) Govt. of India, Ministry of Health and Family Welfare, Dept. of Indian Systems of Medicine and Homeopathy, New Delhi 2008.
11. The Ayurvedic Formulary of India, Vol. I, II and III, Published by Government of India, New Delhi, 1st Edition, 2000.
12. The Wealth of India (Raw Material & Industrial Product), Published by Council of Scientific Research, New Delhi, 1st Edition, 2005.
13. Indian Medicinal Plants, Kirtikar and Basu, 1st Edition, International Book Distributors, Dehradun, 1999.
14. Ayurveda Unravelled, Sharadini Dahanukar and Urmila Thatte, 1st Edition, 1996, National Book Trust, New Delhi.
15. Compendium of Indian Medicinal Plant Vol. 1 to 6, Rastogi R. P., Mehrotra B. N., CDRI & NISCOM, 1st Edition, New Delhi, 1998
16. Indian Herbal Pharmacopoeia, 1st revised Edition, Published by RRL, Jammu and IDMA, Mumbai, 2002.
17. Quality standards of Indian medicinal plants, Volume I to XI (2003 to 2013) Editor: Neeraj Tundon & Parul Sharma; By : Medicinal plant Unit, ICMR, New Delhi.
18. Malati G Chanhan & A. P.G Pillai, Microscopic profile of powdered drugs used in Indian system of medicine, Volume I, Bark drugs 2005, Institute of Ayurvedic medicinal plant science, Gujarat ayurved unit Jamnagar; CPTA.
19. Malati G Chauhan & A.P.G Pillai, "Microscopic profile of powdered drugs used in Indian systems of Medicine, Leaf Drugs, Vol 2, 2007, Institute of P.G Teaching & Research in Ayurveda, Gujarat Ayurved University, Jamnagar.

20. Malati G Chauhan & A.P.G Pillai, "Microscopic profile of Drugs used in Indian system of Medicine, Seed drugs, Volume- 3, part- 1, 2011; Publisher: Prof Malati G Chauhan, P.G T- S.F C cell, I.P. G T. & R.A, Gujarat Ayurved University, Jamnagar.
21. Review on Indian Medicinal Plants, Vol I to XI (2004 to 2012) Editor: A K Gupta & Neeraj Tundon. By: Indian council of medicinal Research (ICMR), New Delhi.
22. R. D Chaudhry, Herbal Drug Industry, Eastern Publications, New Delhi.

C. U. SHAH UNIVERSITY

Faculty: - Pharmaceutical Sciences
Department: Pharmaceutics & Pharmaceutical Technology
Semester: VII
Name of Subject: Quality by Design and Process Analytical Technology
(Elective Subject)
Subject Code: 4PS07QBD1

Teaching & Evaluation Scheme:-

Sr. No	Branch Code	Subject Code	Subject Name	Teaching hours/ week				Credit	Evaluation Scheme/ Semester				
									Theory				Total
									Sessional Exam		University Exam		
				Th	Tu	Pr	Total		Marks	Hrs	Marks	Hrs	
1	04	4PS07QBD1	Quality by Design and Process Analytical Technology	3	0	0	3	3	20	1	70	3	100
									10 (CEC)	--			

Objective:-

- To understand Quality by Design (QbD) and Process Analytical Technology (PAT) in Pharmaceutical Development and Quality Risk Management Process

Prerequisites:-

1. 10 + 2 level mathematics knowledge.
2. Fundamental understanding of biostatistics

Course outline:-

Sr. No.	Course Contents	Hours
1	**Introduction to QbD**: History, Current approach and its limitations. Why QbD is required, Advantages, Elements of QbD and Terminology: QTPP. CMA, CQA, CPP, RLD, Design space, Design of Experiments, Risk Assessment and mitigation/minimization.	2
2	**Pharmaceutical Development:** Introduction, Pharmaceutical Development, Submission of Pharmaceutical Development And Related Information In Common Technical Documents (CTD) Format, Design of experiments – Methods and applications Optimization techniques: Concept of optimization, optimization parameters, classical optimization. Statistical designs, Question based Review (QbR).	10
3	**Quality Risk Management:** Introduction - What is quality? Relevance of quality with respect to pharmaceuticals, Scope, Principles of Quality Risk Management-ICHQ9, HACCP, FMEA, General Quality Risk Management Process.	3
4	**Pharmaceutical Quality Management**: Pharmaceutical Quality System, Management Responsibility, Continual Improvement of Process Performance and Product Quality, Continual Improvement of the Pharmaceutical Quality System.	5
5	**Detailed case study of QbD:** for Immediate release dosage forms, Modified release dosage forms. Emphasis should be given to prototype QbD for various dosage forms considering manufacturing process variables, raw materials and desired attributes.	15
6	**Process Analytical Technology:** Introduction, Scope, Background, PAT Framework, PAT Tools, Risk-Based Approach, Integrated Systems Approach, Real Time Release, Strategy For Implementation, Regulatory Approach,	10

	Examples of PAT Implementation.	
Total		45

Learning Outcomes:-

- Students will able to identify, analyze and solve problems related to biostatistics using statistical software.
- Students can apply biostatics application in order to understand various pharmaceutical process variables, understand significance effect on parameters in clinical trials

Teaching & Learning Methodology:-

- Lectures will be taken in class room with the aid of multi-media presentations/black board or mix of both.
- Assignments based on the course content will be given at the end of the topic.

Books Recommended:-

Text Book

1. Stanford Bolton, Charles Bon (2004), Pharmaceutical Statistics, Practical and Clinical Applications (Fourth rev. edn.) Marcel Dekker, Inc.

Reference Book

1. Dowdy, S., and Wearden, S. (1991), Statistics for Research (2nd ed.), New York: John Wiley.
2. Freund, R. J., and Wilson, W. J. (1997), Statistical Methods (rev. ed.), San Diego, CA: Academic Press Biostatistics Casebook, New York: John Wiley.
3. Steel, R. G. D., and Torrie, J. H. (1980), Principles and Procedures of Statistics: A Biometrical Approach (2nd ed.), New York: McGraw-Hill.
4. Woolson, R. F. (1987), Statistical Methods for the Analysis of Biomedical Data, New York: John Wiley.
5. Wackerly DD, Mendenhall W, Schaeffer RL. Mathematical Statistics with Applications, 7th edition, 2008, Duxbury Press, USA.
6. Piantadosi S. (2005), Clinical Trials a Methodological Perspective, 2nd edition. John Wiley & Sons.
7. Latest updates on subject from various web resources like USFDA, ICH, WHO etc.

C. U. SHAH UNIVERSITY

Faculty: - Pharmaceutical Sciences
Department: Pharmaceutical Chemistry
Semester: VII
Name of Subject: Green Chemistry (Elective Subject)
Subject Code: 4PS07GCH1

Teaching & Evaluation Scheme:-

Sr. No	Branch Code	Subject Code	Subject Name	Teaching hours/ week				Credit	Evaluation Scheme/ Semester				
									Theory				Total
									Sessional Exam		University Exam		
				Th	Tu	Pr	Total		Marks	Hrs	Marks	Hrs	
1	4	4PS07GCH1	Green Chemistry	3	0	0	3	3	20	1	70	3	100
									10 (CEC)	--			

Objective of Course:

- The course is designed to make students familiar with the principles of green chemistry as applied to pharmaceuticals and to study the synthetic approaches and structure activity relationship of different therapeutic class of drugs and about their environment friendly nature.

Prerequisites:

- Basic understanding of concepts related to Synthetic chemistry along with environmental science and biochemical studies.

Course outline:-

Sr. No.	Course Contents	Hours
1.	**Introduction to Green Chemistry:** Definition. Need for Green Chemistry & eco efficiency. Goals of Green Chemistry. Limitations / Obstacles in the pursuit of the goals of Green Chemistry. Twelve principles of Green Chemistry with their explanations and examples. Inception of Green Chemistry. Designing a green synthesis – Prevention of waste / by products – Atom economy. Awards for Green Chemistry & international organizations promoting green chemistry.	10
2.	**Designing Green Synthesis:** Designing and choice of starting materials / solvents / reagents. Bio catalysts. Polymer Supported Catalysts. Green solvents, solvent free processes, immobilized solvents and ionic liquids; energy requirements for reactions - use of microwaves, ultrasonic energy Avoidance of unnecessary derivatization. Careful uses of blocking / protecting groups & use of catalytic reagents, Microwave-assisted organic synthesis (MAOS).	15

3.	**Green Reactions:** Green Synthesis of the following compounds: adipic acid, catechol, BHT, 4- aminodiphenylamine, benzyl bromide, acetaldehyde, citral, ibuprofen, paracetamol. • Microwave assisted reactions in water: Hofmann Elimination, Hydrolysis (of benzyl chloride, benzamide, n-phenyl benzamide), Oxidation (of toluene, alcohols). • Fries rearrangement. • Claisen Rearrangement • Diels Alder Reaction • Decarboxylation. • Microwave assisted solid state reactions: Deacetylation, Saponification of esters • Reductions:, synthesis of nitriles from aldehydes; anhydrides from dicarboxylic acid • Ultrasound assisted reactions: Esterification, saponification, substitution reactions, Alkylations, oxidation, reduction, coupling reaction, Cannizaro reaction, Strecker synthesis, Reformatsky reaction.	15
4	**Future Trends in Green Chemistry:** Oxidation reagents and catalysts; Biomimetic, multifunctional reagents. Combinatorial Green Chemistry. Proliferation of solvent free reactions. Non-covalent Derivatization & Green Chemistry Applications. Green chemistry in sustainable development.	5
	Total	45

Learning outcomes:-

- By the end of this course, the student should have a good understanding of the basic concepts of Medicinal chemistry along with environmental chemistry.
- The success of green chemistry depends on the training and education of a new generation of chemists. Students at all levels have to be introduced to the philosophy and practice of green chemistry.
- The course may help the students in understanding rational approaches towards the use of important green chemistry -principles and their biological implications.

Teaching & Learning Methodology:-

- Using blackboard and one-way communication from a teacher to a student. Using an overhead and LCD projector

Books recommended:-

Text Books

1. M.A. Ryan & M. Tinnesand, Introduction to Green Chemistry, American Chemical Society, Washington (2002).
2. V.K. Ahluwalia & M.R. Kidwai: New Trends in Green Chemistry, Anamalaya Publishers (2005).

Reference Books:

1. P.T. Anastes & J.K. Warmer: Oxford Green Chemistry- Theory and Practical, University Press (1998).
2. A.S. Matlack: Introduction to Green Chemistry, Marcel Deckkar, (2001).
3. M.C. Cann & M.E. Connely: Real-World cases in Green Chemistry, American Chemical

4. Society, Washington (2000).
5. P.T. Anastas, J.C. Warner, Green Chem Theory and Practice, Oxford Univ. Press, New York (1998).
6. P.T. Anastas, I.T. Hovarsth, Innovations and Green Chemistry, Chem.Rev.107, 2169 (2007).
7. S. Ravichandran, Int. J. ChemTech Res., 2(4)2191 (2010).

C. U. SHAH UNIVERSITY

Faculty: - Pharmaceutical Sciences
Department: Pharmacology
Semester: VII
Name of Subject: Pharmacy Practice I **(**Elective Subject**)**
Subject Code: 4PS07PHP1

Teaching & Evaluation Scheme:-

Sr. No	Branch Code	Subject Code	Subject Name	Teaching hours/ week				Credit	Evaluation Scheme/ Semester				
									Theory				Total
									Sessional Exam		University Exam		
				Th	Tu	Pr	Total		Marks	Hrs	Marks	Hrs	
1	04	4PS07PHP1	Pharmacy Practice	3	0	0	3	3	20	1	70	3	100
									10 (CEC)	--			

Objective of Course:-

- Exploration and analysis of selected topics in pharmacology with a specific theme indicated by course title listed in a syllabus. This subject will take three times for credit as long as different topics are selected. (3 lecture per week)

Prerequisites:-

- Pharmacology studies required in a seventh semester, it is the base (core) of the major subjects in pharmaceutical studies like Bio pharmaceutics and Biochemistry and the application of medicinal chemistry.

Course outline:-

Sr. No.	Course Contents	Hours
1.	Introduction to daily activities of a clinical / community / hospital pharmacist	1
2.	Prescription processing: Accurate interpretation of prescription orders, Appropriateness of medication choice, dosage form, dosage, route of administration, regimen and duration of therapy, Review drug-drug / food interaction and drug allergies. Compliance issues (adherence) and financial consideration	5
3.	Medication review: Significance, components, collection and interpretation of patient -specific information, assessment of therapeutic goals and identification of drug related problems, clinical progress review	3
4.	Drug utilisation evaluation (DUE) : Definition, objectives, DUE cycle, types of DUE, Role of pharmacist in DUE	2
5.	Communication skills: Dialogue and interview techniques, verbal and non-verbal listening, probing and gathering information	2
6.	Participation in ward round: Goals and objectives, ward rounds-the Indian scenario, pre-ward round preparation, intervention and communication during ward round, ward round follow-up	2
7.	Drug information: Selection of suitable drug information resources: Primary, secondary and tertiary resources, Journals, Cochrane collaborative library, Medline, Answering drug information questions	3

8.	Patient counselling: Patient counselling on self diagnostic/monitoring tools: Home blood glucose monitor, blood pressure monitoring and home pregnancy test kits Patient counselling on OTC medications: Patient counselling on prescription medications: Direction for proper use of medicine Duration of therapy and onset of action Management of common adverse effects, interaction and missed doses Storage and handling requirements Patient counselling to promote adherence to regimens and therapy: Strategies to optimize adherence, identification of under-utilization and over-utilization of medications	4
9.	Medication and patient safety practices: Essential Drugs concept and Rational Drug Therapy Development of Therapeutic guidelines; Meaning, need for guideline, development, evidences for effectiveness and limitations of guideline Therapeutic guidelines for management of various diseases (Asthma, Hypertension, Tuberculosis) Dispensing errors Prescription Audit Pharmacovigilance - adverse drug reaction monitoring and reporting	10
10.	Promotion of healthy life style and preventive health (immunization and tobacco, alcohol cessation etc.)	2
11.	Paediatric pharmacy practice: Dose calculation, pharmacokinetic aspects of drug therapy, therapeutic drug monitoring in paediatrics.	2
12.	Geriatrics pharmacy practice: Precaution in medication, pharmacokinetic and dynamic changes with ageing, common problems in the elderly and role of clinical pharmacist.	2
13.	Pharmacy practice in pregnant and lactating women: Estimation of risks during pregnancy and lactation, dietary supplements requirement, pharmacokinetic and dynamic aspects, discontinuation of medications associated with withdrawal	3
14.	Inventory control: Purchasing, Pricing, Outdated medications, Return to wholesaler and Return to stock/Returns from patients	2
15.	Quality assurance of pharmacy services	2
Total		**45**

Learning Outcomes:-

- Define and correctly use scientific terminology in regard to human body and processes.
- Apply principles of scientific inquiry, differentiate a theory from a hypothesis, and differentiate fact from opinion in regard to use of drugs in different human system.
- Describe and practice laboratory safety guidelines relating to working with drugs, experimental animals and body fluids.
- Show proficiency in taking lab practical exams, responding to questions quickly and accurately, effectively handling the pressure of a timed exam.

Teaching & Learning Methodology:-

- Lectures will be conducted with the aid of multimedia projector, black board, OHP etc.
- Assignments based on course content will be given to the students at the end of each Unit/topic and will be evaluated at regular interval.
- Specific discussion questions will be assigned each week.

Books Recommended:-

Text Books:-

1. A textbook of Clinical pharmacy practice- Parthasarthi G., 2nd edition-2012.
2. Clinical Pharmacy and Therapeutics Roger walker and Clive Edwards,Churchill Livingstone Edinburgh, 3rd edition-2006.
3. Davidson's Principle and Practice of Medicine, EDs Christopher, Haslett, Edwin R. Chilvers.
4. Textbook of Therapeutics Drug Disease Management- Eric T.Herfindal and Dick R.Gourley, 7th edition.
5. Harrison's Principles of Internal medicine- Vol 1 and 2 Braunwald, 17th edition, Eugene & Others.
6. Melmon and Morrells Clinical Pharmacology, 4th Edition – S George Carrythers.
7. Clinical Pharmacology- P.N. Bennett, M. J. Brown, 9th edition-2003.
8. A text book of clinical pharmacology and therapeutics- James M. Ritter, Lionel D. Lewis- 5th edition-2008.

Reference Books:-

1. Katzung, B.G. Basic and clinical pharmacology. Latest edition. Publisher:
2. Prentice Hall, Int.
3. Goodman Gilman, A., Rall, T.W., Nies, A.I.S. and Taylor, P. Goodman andGilman's the pharmacological Basis of therapeutics. 9th Ed, 1996. Publisher McGraw Hill, Pergamon press.
4. Ghosh, M.N. Fundamentals of experimental pharmacology. Latest edition,
5. Publisher: Scientific book agency, Kolkata.
6. R.K. Goyal. Practicals in Pharmacology: B.S. Shah Prakashan, Ahmedabad.
7. Seth, S.D. Text Book of pharmacology, B.l.Churchill, 1997.
8. Harvel, R.A., Champe P.C. et al — Pharmacology (1997) 2nd Edn. Lippincott- Raven Company, Philadelphia, New York.
9. Kulakarni S.K.- handbook of Experimental Pharmacology (1993)2fld Edn. Vallabh Prakashan, New Delhi.
10. Sheth U.K. et al-Selected topics in Experimental Pharmacology (1972)15t Edn. The Kothari Book Depot, Mumbai.

C. U. SHAH UNIVERSITY

Faculty: - Pharmaceutical Sciences
Department: Pharmacognosy
Semester: VII
Name of Subject: Nutraceuticals (Elective Subject)
Subject Code: 4PS07NUT1

Teaching & Evaluation Scheme:-

Sr. No	Branch Code	Subject Code	Subject Name	Teaching hours/ week				Credit	Evaluation Scheme/ Semester				
									Theory				Total
									Sessional Exam		University Exam		
				Th	Tu	Pr	Total		Marks	Hrs	Marks	Hrs	
1	04	4PS07NUT1	Nutraceuticals	3	0	0	3	3	20	1	70	3	100
									10 (CEC)	--			

Objectives: -

- To make students familiar with holistic concept of medication and drugs used in traditional system of medicine and understand the safety aspects of plants used as medicine.

Prerequisites:-

- The students should have a clear concept of Botany.

Course outline:-

Sr. No.	Course Contents	Hours
1	Historical perspective, classification, scope & future prospects. Applied aspects of the Nutraceutical Science. Sources of Nutraceuticals. Relation of Nutraceutical Science with other Sciences, current market trend in nutraceuticals industry, sourcing information of various nutraceuticals through web data mining	8
2	Food as remedies: Nutraceutical remedies for common disorders like arthritis, bronchitis, circulatory problems, hypoglycemia, nephrological disorders, liver disorders, osteoporosis, psoriasis and ulcers etc.	9
3	Nutraceutical rich supplements like green tea, lecithin, mushroom extract, chlorophyll, spirulina, glucosamine, octacosanol, lycopene, carnitine, melatonin, grape products, flaxseed, Soy proteins and soy isoflavones in human health	8
4	Health Food: Dietary fibers, prebiotics and probiotics vegetables, cereals, milk and dairy products as functional foods. Health effects of common beans, capsicum annum, mustards, ginseng, garlic, citrus fruits, fish oils and sea foods	8
5	Bioavailability enhancers and Herbal beverages and drinks: health drink	3
6	Packaging strategies for nutraceutical products and labeling and claims for nutraceuticals products	3
7	Toxicity studies and regulatory guidelines for nutraceutical products, current Good Manufacturing Practices (cGMPs), DSHEA act and Global regulatory agencies and bodies for nutraceuticals in different countries.	6
	Total	**45**

Learning Outcomes:-

- The students are expected to understand Nutraceutical aspects, uses and pharmacological properties of traditional plant drugs.
- To learn about uses of the herbal extracts in various nutraceutical formulations.

Teaching Methodology:-

- Lectures will be conducted with the aid of multimedia projector, black board, OHP etc.
- Assignments based on course content will be given to the students at the end of each Unit/topic and will be evaluated at regular interval.
- Specific discussion questions will be assigned each week.

Books Recommended:

Text Book

1. A Text book of Pharmacognosy: Shah C. S., Quadry J. S., B. S. Shah Prakashan, Ahmedabad. 15thEdition, 2009.
2. Pharmacognosy: Kokate C. K., Purohit A. P., Gokhale S. B., Nirali Prakashan Pune, 42nd edition, 2008.
3. Trease and Evans Pharmacognosy. 16h Edition, William Charles Evans, W.
4. Textbook of Pharmacognosy: Wallis T. E., CBS Publishers and Distributors, New Delhi, 5th Edition, reprinted, 2009.

References Books

1. Pathak YV. Handbook of Nutraceuticals Volume I: Ingredients, Formulations, and Applications, CRC Press, 2009. Ed: 1st
2. Aluko RE. Functional Foods and Nutraceuticals, Springer Verlag GMBH, 2012
3. Hildebert Wagner and Sabine Bladt, Plant Drug Analysis: A Thin Layer Chromatography Atlas;, New Delhi: Springer (India) Pvt. Ltd., 2nd ed. 1996
4. D'Amelio, Frank S. Sr., Botanical: A Phytocosmetic Desk Reference; New York: CRC Press, I Llc, Boca Raton, Florida, U.S.A. 1999
5. Stephen J. Cutler and Horace G. Cutler, Biologically Active Natural Products: Pharmaceuticals; CRC Press, Boca Rotan London, New York. Washington DC 2000
6. Marc Paye, André O. Barel, Howard I. Maibach, Handbook of Cosmetic Sciences, Informa Press, Tylor and Francis, LLC, 2006
7. Vermeer BJ, Definition In: Peter Elsener, Howard I. Maibach, editors Cosmeceuticals: Drugs vs. Cosmetics, New York, Marcel Dekker, 2000.