GUJARAT TECHNOLOGICAL UNIVERSITY

BACHELOR OF PHARMACY

SEMESTER - IV

TEACHING SCHEME

SUBJECT CODE	SUBJECT	TEACHING SCHEME(HOURS)			CREDITS
		THEORY	TUTORIAL	PRACTICAL	
240001	DISPENSING PHARMACY - I	3	0	3	6
240002	FORENSIC PHARMACY - I	2	0	0	2
240003	PHARMACEUTICAL CHEMISTRY - IV	3	0	3	6
240004	PHARMACEUTICAL ANALYSIS - II	3	0	3	6
240005	PHARMACOLOGY - I	2	0	3	5
240006	PHARMACOGNOSY - III	2	0	3	5
	TOTAL	**15**	**0**	**15**	**30**

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Semester: 4

Subject Code: **240001**
Subject Name: **Dispensing Pharmacy – I**

Sr. No.	Course Content	Proposed No. of Hours of Teching
1.	**Definition and scope**	01
2.	**The prescription:** Handling of prescription, source of errors in prescription, care required in dispensing procedures including labeling at dispensed products.	04
3.	**Dispensing techniques:** Compounding and dispensing procedures, packaging, storage and stability of medicines, labeling of dispensed products.	05
4.	**Pharmaceutical calculations:** Posology: Calculations of doses for infants, adults and elderly patients, enlarging and reducing recipes, percentage solutions, allegation, alcohol dilution, proof spirit, isotonic solutions, displacement values, etc.	15
5.	Principles involved and procedures adopted in dispensing of: Mixtures, solutions, emulsions, powders and granules, oral unit dosage forms, inhalations.	20

Dispensing Pharmacy – I – Practical (45 Hours)

The students shall be asked to perform the practical related to the topics mentioned under theory.

Books Recommended:

1. Pharmaceutical Practice – by Diana M. Collett and Michale E. Aulton, ELBS Publishers.
2. Dispensing for pharmaceutical by Cooper and Gunn by S.J. Carter, CBS Publishers.
3. Pharmaceutical Calculations by Mitchell J. Stocklosa and Howard C. Ansel, B. I. Waverly Pvt. Ltd., New Delhi.
4. Pharmaceutical Dosage forms and Drug delivery systems by Howard C. Ansel, Lippincott Williams and Wilkins.
5. Pharmaceutical Practice, Edited by A.J. Winfield and R.M.E. Richards.
6. Hospital Pharmacy by William E. Hassan, Henry Kimpton Publishers, London.
7. Hospital Organization and management by Kurt Dan and Jonathan S. Ratich, CBS Publishers.
8. Remington: The Science and Practice of Pharmacy, Latest Edition, by Mack Publishing Company.

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Semester: 4

Subject Code: **240002**
Subject Name: **Forensic Pharmacy - I**

Sr. No.	Course content	Proposed No. of Hours of Teching
1.	Pharmaceutical legislation-a brief review.	01
2.	Drugs and pharmaceutical industry-a brief review.	01
3.	Pharmaceutical education a brief review)	01
4.	An elaborate (practical rienting) study of the following: 1. Pharmaceutical ethics 2. Pharmacy Act 1948 3. Medicinal and toilet preparations (excise duties) act, 1955 4. Narcotic drugs and psychotropic substances act 1985 and rules 5. Prevention of cruelty of Animal Act 6. Poison Act, The insecticides Act 7. Delhi Shop Establishment Act, The Factories Act, The industries (Development and Regulation) Act 8. Drug Policy 2002	 02 05 05 05 02 03 03 02

NOTE: The teaching of all the above acts should cover the latest amendments.

Books Recommended:

1. A text book of forensic pharmacy by B. M. Mithal, Vallabh Prakashan..
2. The patents act 1970 with patents rules 1972.
3. The narcotic dugs and psychotropic substance act, 1985 with the prevention of illicit traffic in narcotic drugs and psychotropic substance act, 1988 along with Allied rules and orders, 1993.
4. The medical termination of pregnancy act 1971, along with the medical termination of pregnancy rules 1975.
5. Insecticides act 1963 together with insecticides rules 1971 and insecticides (price, stock, display and submission of reports) order 1986 along with selected notifications (5^{th} edition 1998).
6. The drugs (price control) order 1987 – along with new drug policy 1994 and drugs (price control) order 1995.

7. The opium act 1857 with opium act 1878 and opium and revenue laws act 1950.
8. The standards of weights and measures act 1976.
9. The Pharmacy Act 1998.
10. The prevention of illicit traffic in narcotic drugs and psychotropic substances act 1988.
11. The poisons act 1999.
12. The minimum wages act 1948.
13. The drug and cosmetics act 1940.
14. The medicinal and toilet preparation act 1955.
15. The factories act 1948.
16. Prevention of cruelty to animals act 1960.
17. Drugs and consmetics act 1940 by Vijay Malik Eastern Book Company.
18. Pharmaceutical Jurisprudence by G.K. Jani, Atul Prakashan.

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Semester: 4

Subject Code: 240004

Subject Name: Pharmaceutical Analysis - II

Sr. No.	**Course content** (Following topics should be covered with due consideration of pharmacopoeial applications and numerical)	**Proposed No. of Hours of Teching**
1.	Basics of instrumental analytical methods: Advantages, limitations, validation, signal to noise ratio.	03
2.	Chromatography: Classification, theories, retention mechanism, separation efficiency, methodology an pharmacopoeial applications of column, paper and thin layer chromatography.	12
3.	Electroanalytical methods: Basics of electroanalytical methods 3.1 Conductometry: Conductances, factors affecting conductance, Kohlrausch law, conductivity cells, applications 3.2 Potentio and pH metric methods: Standard reduction potentials, various electrodes, electrodes and cell potential, applications of potentiometry and pH metry. 3.3 Polarography, amperometry, biamperometry: Basics of current flow in polarography, dropping mercury electrode, diffusion current, half wave potential, modifications like pulsed and differential pulse polarography, stripping voltametry, biamperometric titrations, amperometric titrations.	03 05 06 09
4.	Calorimetry: Types, thermogravimetric analysis, differential scanning calorimetry, differential thermal analysis, melting point, etc. and their applications	05
5.	Polarimetry: Polarimeter, qualitative and quantitative applications	02

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Pharmaceutical Analysis-II – Practicals (45 Hours)

Quantitative analysis of different compounds involving following techniques:

1. Conductometry
2. Potentiometry
3. PH metry
4. Polarimetry
5. Column chromatography
6. Thin layer chromatography
7. Paper chromatography
8. Polarography, amperometric and biamperometry

Reference Books:

1. Pharmacopoeia: USP, B.P., I.P.
2. Practical Pharm. Chemistry, Vol. B – Backett, The athlone Press of University of London.
3. Textbook of Pharmaceutical Analysis – J. W. Munson, Marcel Dekker Inc., New York.
4. Fundamentals of Analytical Chemistry – Skoog, Harcourt College Publishers.
5. Quantitative chemical analysis – Vogel A.I, Pearson Education.
6. Text Book of Pharmaceutical Analysis – K. A. Connor, John Willey & Sons.

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Semester: 4

Subject Code: **240003**
Subject Name: **Pharmaceutical Chemistry-IV (Organic)**

Sr. No.	Course content	Proposed No. of Hours of Teching
1.	Stereochemistry Chirality, optical activity, stereoisomerism, nomenclature and associated physicochemical properties, specification of configuration, resolution of racemic mixture, reactions involving stereoisomers, stereoselective and stereospecific reactions, conformations – alkanes and cycloalkanes, chiral reagents, stereochemistry of biphenyls, allenes, and spirans – specification of their configuration.	08
2.	Structure, properties, nomenclature, preparation and reactions of the following class of functional groups Benzene, polynuclear aromatic compounds, arenes, amines, phenols, aldehydes and ketones, carboxylic acids and their derivatives.	30
3.	α,β-unsaturated carbonyl compounds, conservation of orbital symmetry and rules, Nucelophilic aromatic substitution	04
4.	Introduction to nanochemistry, microwave synthesis and green chemistry.	03

Pharmaceutical Chemistry-IV (Organic) – Practical (45 Hours)

1. Qualitative analysis of unknown organic compound. **16**

2. Introduction and detailed demonstration to various synthetic techniques and apparatus used therein.
   Heating and cooling methods, distillation, reaction work-up, filtration, extraction, purification, identification. **06**

3. Synthesis of selected organic compounds
   Synthesis of at least fifteen selected compounds based on various reaction mechanisms like halogenation, nitration, alkylation, hydrolysis, oxidation, condensation, diazotization. Purification of the synthesized compound using precipitation or recrystallization. Monitoring progress of reaction by thin layer chromatography**.** **20**

Reference Books:

1. Organic Chemistry, Robert T. Morrison and Robert N. Boyd, 6th Ed., Pearson Education, 2002.
2. Organic Chemistry, G. Marc Loudon, 4th Ed., Oxford University Press, 2004.
3. Organic Chemistry, Vol I and II by I. L. Finar, 6th Ed., Pearson Education, 2000.
4. Advanced Organic Chemistry, Jerry March, 4th Ed., Wiley India, 2007.
5. Vogel's textbook of practical organic chemistry, 5th Edition, Pearson Education Ltd., 2005
6. "Experimental Organic Chemistry" L. M. Harwood, L. J. Moody, J. M. Percy, 2nd Edition, Blackwell Science, 2005.
7. Techniques and Experiment of Organic Chemistry, Addison Ault, 6th Edition, University Science Books, 1998.
8. Introduction to Organic Laboratory Techniques, A Microscale Approach, Donald L. Pavia, Gary M. Lampman, George S. Kriz, 3rd Edition, Harcourt College Pub., 4th Edition, 2007.

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BACHELOR OF PHARMACY

Semester: 4

Subject Code: **240006**
Subject Name: **Pharmacognosy – III**

Sr. No.	Course content	Proposed No. of Hours of Teching
1.	Study of the biological sources, cultivation, collection, commercial varieties, chemical constituents, substitutes, adulterants, uses, diagnostic macroscopic and microscopic features and specific chemical tests of following groups of drugs containing glycosides: i. Saponins: Liquorice, ginseng, dioscorea, Senega, Sarsaparila, Quillaia ii. Cardioactive sterols: Digitalis, squill, strophanthus, Thevetia iii. Anthraquinone cathartics: Aloe, senna, rhubarb, cascara, Cassia iv. Bitter glycosides: Gentian, picrorrhiza, chirata, kalmegh, Quassia v. Coumarins: Psoralea, Ammi majus, Ammi visnaga vi. Cyanogenetic glycosides: Almond, Linseed vii. Isothiocyanate glycosides: Mustard, Black mustard viii. Flavanoids: Rutagraveolens	22
2	Enzymes: Biological sources, preparation, identificatoion test and uses of following Diastase, Papain, Pepsin, Trypsin, Pancreatin	08

Pharmacognosy – III – Practicals (45 Hours)

1. Identification of crude drugs listed in theory.
2. Microscopic study of underlined important glycoside containing crude drugs.

Reference Books:

1. Trease and Evans Pharmacognosy. Fifteenth Edition, William Charles Evans, W. B. Saunders, Edinburg London New York Philadelphia St. Louis Sydney Toronto 2002.
2. Pharmacognosy: V. E. Tyler, L. R. Brady, J. E. Habbers, Lea and Febiger Philadelphia, 9th Edition, 1988.
3. A Text book of Pharmacognosy: C. S. Shah, J. S. Quadry, B. S. Shah Prakashan, Ahmedabad. 13th Edition, 2007-08.

4. Textbook of Pharmacognosy: T. E. Wallis, CBS Publishers and Distributors, New Delhi, 5th Edition, reprinted, 2003.
5. A Textbook of Pharmacognosy. Fifth Edition, T. C. Denston, Pitman Medical Publishing Co. Ltd., London.
6. Modern Pharmacognosy. Egil Ramstad, McGraw-Hill Book Company, London, New York, Toronto.
7. Textbook of Pharmacogonosy. Sixth Edition, 1948, Heber W. Youngken, The Blakiston Company, Toronto.
8. Pharmacognosy: Phytochemistry Medicinal Plants. Jean Bruneton, 2nd Edition; 1999. Intercept Ltd., Londers, Editions TEC & DOC Paris.
9. Laboratory Handbook for the fractionationation of Nattutal extracts by Peter Houghton and Amala Raman, Chapman & Hall Madras, 1998.
10. Cultivation and Utilization of Aromatic Plants, Handa S. S. and Kaul M. K., RRL Jammu.
11. Cultivation and Utilization of Aromatic Plants, Atal C. K. and Kapur B. M., RRL Jammu.

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Semester: 4

Subject Code: **240005**
Subject Name: **Pharmacology –I**

Sr. No.	Course content	Proposed No. of Hours of Teching
1.	**General pharmacology** a. Introduction and scope of pharmacology, b. Sources of drugs and nomenclature of drugs c. Dosage forms and routes of administration. d. Factors modifying drug action, tolerance and dependence e. Phrmacokinetics: Drugabsorption and bio-avaibility of a drug Distribution, Biological half life and its significance, drug distribution, drug metabolism, drug excretion, Methods prolonging the duration of action of a drug. f. Pharmacodynamics: Mechanism of drug action, site of drug action, drug receptors, dose response relationship, combined effects of drugs, structure activity relationship g. Adverse drug Reactions h. Drug interactions i. Development of new drugs: Animal Toxicity study (acute, sub-acute and chronic), clinical trials (various Phases)	**16**
2.	**Pharmacology of peripheral Nervous system** a. Neurohumoral transmission (autonomic and somatic) b. Parasympathomimetics, Parasympatholytics, Sympathomimetics, adrenergic receptor and neuron blocking agents c. Ganglionic stimulants and blocking agents Neuromuscular blocking agents. d. Local anesthetics	**09**
3.	**Autacoids** a. Histamine, 5-HT and their antagonists. b. Prostanglandins, thromboxane and leukotrienes. c. Pentagastrin, cholecystokinin, Angiotensin, Bradykinin and substance P	**05**

Pharmacology – I – Practical (45 Hours)

1. Introduction to experimental pharmacology: preparation of different solutions for experiments. Drug dilutions, use of molar and W/V solutions in experimental pharmacology, common laboratory animals, Legal regulations for the use of experimental animals, anesthetics used in animal studies, commonly used instruments in experimental pharmacology. Some common and standard techniques for drug administration (intravenous injection, intra gastric administration) and collection of blood samples. Euthanasia of laboratory animals.
2. Experiments on urinary excretion of drugs/their metabolites
3. To study the effects of various agonists (pD_2) and antagonist (pA_2) using isolated preparations.
    a. To record the concentration response curve (CRC) of acetylcholine using rat ileum/chicken preparation.
    b. To study the effect of atropine on concentration response curve (CRC) of acetylcholine using rat/chicken ileum preparation.
    c. To record the concentration response curve (CRC) of Histamine on guinea pig/chicken ileum
    d. To study the effect of mepyramine on concentration response curve (CRC) of Histamine using guinea pig /chicken ileum preparation
4. To study the effects of acetylcholine, Histamine, $BaCl_2$, physostigmine, atropine, mepyramine and papaverine using rat/guinea pig/chicken ileum preparation
5. Demonstration Experiments
    a. To study the effects of autonomic drugs on rabbits eye
    b. To study the effect of hepatic microsomal enzyme inhibitors and inducers on pentobarbitone sleeping time
    c. To study the effects of various drugs on rat fundus preparation
    d. To study the effects of various drugs on rat anococcygeus muscle preparations.
    e. To study the effects of various drugs on rat vas deference preparations.

Reference Books: (Latest Editions)

1. Satoskar, R.S. and Bhadarkar, S.D. Pharmacology and pharmacotherapeutics. 16th edition (single volume), 1999. Publisher: Popular, Dubai.
2. Rang, H.P. & Dale, M.M. Pharmacology. 4th edition, 1999. Publisher: Churchill Living stone.
3. Goodman Gilman, A., Rall, T.W., Nies, A.I.S. and Taylor, P. Goodman and Gilman's The pharmacological Basis of therapeutics. 9th Ed, 1996. Publisher Mc Graw Hill, Pergamon press.
4. Katzung, B.G. Basic and clinical pharmacology. Latest edition. Publisher: Prentice Hall, Int.
5. Ghosh, M.N. Fundamentals of experimental pharmacology. Latest edition, Publisher: Scientific book agency, Kolkata.
6. R.K.Goyal. Practicals in Pharmacology: B.S. Shah Prakashan, Ahmedabad.