

GUJARAT TECHNOLOGICAL UNIVERSITY

Pharm.D.

1st year

Subject Name: Human Anatomy and Physiology

Subject Code: 818801

Scope: This course is designed to impart a fundamental knowledge on the structure and functions of the human body. It also helps in understanding both homeostasis mechanisms and homeostatic imbalances of various body systems. Since a medicament, which is produced by pharmacist, is used to correct the deviations in human body, it enhances the understanding of how the drugs act on the various body systems in correcting the disease state of the organs.

Objective:

Upon completion of the course the student shall be able to:

- a. describe the structure (gross and histology) and functions of various organs of the human body;
- b. describe the various homeostatic mechanisms and their imbalances of various systems;
- c. identify the various tissues and organs of the different systems of the human body;
- d. perform the hematological tests and also record blood pressure, heart rate, pulse and Respiratory volumes;
- e. appreciate coordinated working pattern of different organs of each system; and
- f. appreciate the interlinked mechanisms in the maintenance of normal functioning (homeostasis) of human body

Teaching Scheme (Hours)				Evaluation Scheme (Marks)				Total marks
Theory	Tutorial	Practical	Total	Theory		Practical		
				External	Internal	External	Internal	
3	1	3	7	70	30	70	30	200

Sr. No.	Course Contents	Hours	Module Weightage
1	Scope of anatomy and physiology , basic terminologies used in this subject (Description of the body as such planes and terminologies)	4	4.5%
2	Structure of cell —its components and their functions.	5	5.5%
3	Elementary tissues of the human body: Epithelial, Connective, Muscular and Nervous tissues—their sub-types and characteristics	4	4.5%
4	a) Osseous system - structure, composition and functions of the Skeleton.(done in practical classes-6hrs) b) Classification of joints, Types of movements of joints and disorders of joints(Definitions only)	4	4.5%
5	Haemopoetic System a) Composition and functions of blood b) Haemopoiesis and disorders of blood components(definition of disorder) c) Blood groups d) Clotting factors and mechanism e) Platelets and disorders of coagulation	6	6.5%

6	Lymph a) Lymph and lymphatic system, composition, formation and circulation. b) Spleen: structure and functions, Disorders c) Disorders of lymphatic system (definition only)	3	3.5%
7	Cardiovascular system a) Anatomy and functions of heart b) Blood vessels and circulation (Pulmonary, coronary and systemic circulation) c) Electrocardiogram (ECG) d) Cardiac cycle and heart sounds e) Blood pressure – its maintenance and regulation f) Definition of the following disorders Hypertension, Hypotension, Arteriosclerosis, Atherosclerosis, Angina, Myocardial infarction, Congestive heart failure, Cardiac arrhythmias	7	8%
8	Respiratory system a) Anatomy of respiratory organs and functions b) Mechanism / physiology of respiration and regulation of respiration c) Transport of respiratory gases d) Respiratory volumes and capacities, and Definition of: Hypoxia, Asphyxia, Dybarism, Oxygen therapy and resuscitation.	6	6.5%
9	Digestive system a) Anatomy and physiology of GIT b) Anatomy and functions of accessory glands of GIT c) Digestion and absorption d) Disorders of GIT (definitions only)	6	6.5%
10	Nervous system a) Definition and classification of nervous system b) Anatomy, physiology and functional areas of cerebrum c) Anatomy and physiology of cerebellum d) Anatomy and physiology of mid brain e) Thalamus, hypothalamus and Basal Ganglia f) Spinal cord: Structure & reflexes – mono-poly-planter g) Cranial nerves – names and functions h) ANS – Anatomy & functions of sympathetic & parasympathetic N.S.	9	10%
11	Urinary system a) Anatomy and physiology of urinary system b) Formation of urine c) Renin Angiotensin system – Juxtaglomerular apparatus - acid base Balance d) Clearance tests and micturition	6	6.5%
12	Endocrine system a) Pituitary gland b) Adrenal gland c) Thyroid and Parathyroid glands d) Pancreas and gonads	7	8%

13	Reproductive system a) Male and female reproductive system b) Their hormones – Physiology of menstruation c) Spermatogenesis & Oogenesis d) Sex determination (genetic basis) e) Pregnancy and maintenance and parturition f) Contraceptive devices	8	9%
14	Sense organs a) Eye b) Ear c) Skin d) Tongue & Nose	6	6.5%
15	Skeletal muscles a) Histology b) Physiology of Muscle contraction c) Physiological properties of skeletal muscle and their disorders (definitions)	5	5.5%
16	Sports physiology a) Muscles in exercise, Effect of athletic training on muscles and muscle performance, b) Respiration in exercise, CVS in exercise, Body heat in exercise, Body fluids and salts in exercise, c) Drugs and athletics	4	4.5%

CourseMaterials:

Text books (Latest edition)

1. Tortora Gerard J. and Nicholas, P. Principles of anatomy and physiology Publisher Harpercollins college New York.
2. Wilson, K.J.W. Ross and Wilson's foundations of anatomy and physiology. Publisher: Churchill Livingstone, Edinburg..

Reference books (Latest edition)

1. Guyton arthur, C. *Physiology of human body*. Publisher: Holtsaunders.
2. Chatterjee,C.C. *Human physiology*. Volume 1&11. Publisher: medical allied agency, Calcutta.
3. Peter L. Williams, Roger Warwick, Mary Dyson and Lawrence, H.
4. *Gray's anatomy*. Publisher:Churchill Livingstone, London.

HUMAN ANATOMYPHYSIOLOGY

Practical (3 Hours/ Week, 6 Credits, 90 Hours)

Sr. No.	Experiments
1	Study of tissues of human body (a) Epithelial tissue. (b) Muscular tissue.
2	Study of tissues of human body (a) Connective tissue. (b) Nervous tissue.
3	Study of appliances used in hematological experiments.
4	Determination of W.B.C. count of blood
5	Determination of R.B.C. count of blood.
6	Determination of differential count of blood.

7	Determination of (a) Erythrocyte Sedimentation Rate. (b) Hemoglobin content of Blood. (c) Bleeding time & Clotting time
8	Determination of (a) Blood Pressure. (b) Blood group.
9	Study of various systems with the help of charts, models & specimens (a) Skeleton system part I-axial skeleton. (b) Skeleton system part II- appendicular skeleton. (c) Cardiovascular system. (d) Respiratory system. (e) Digestive system. (f) Urinary system. (g) Nervous system. (h) Special senses. (i) Reproductive system.
10	Study of different family planning appliances.
11	To perform pregnancy diagnosis test
12	Study of appliances used in experimental physiology.
13	To record simple muscle curve using gastrocnemius sciatic nerve preparation.
14	To record simple summation curve using gastrocnemius sciatic nerve preparation
15	To record simple effect of temperature using gastrocnemius sciatic nerve preparation.
16	To record simple effect of load & after load using gastrocnemius sciatic nerve preparation.
17	To record simple fatigue curve using gastrocnemius sciatic nerve preparation

CourseMaterials:

Text books

1. Goyal, R. K, Natvar M.P, and Shah S.A, Practical anatomy, physiology and biochemistry, latest edition, Publisher: B.S Shah Prakashan, Ahmedabad

Referencebooks

1. Ranade VG, Text book of practical physiology, Latest edition, Publisher: PVG, Pune Anderson Experimental Physiology, Latest edition

Scheme of PracticalExamination

	Internal/Sessional	External
Identification	04	10
Synopsis	04	10
MajorExperiment	07	20
MinorExperiment	03	15
Viva	02	15
Max.marks	20	70
Duration	3 hours	4 hours

Note: Total sessional marks is 30 (20 for practical sessional plus 10 marks for regularity, promptness, viva-voce and record maintenance).

GUJARAT TECHNOLOGICAL UNIVERSITY

Pharm.D.

1st year

SubjectName: Pharmaceutics

SubjectCode: 818802

Scope: This course is designed to impart a fundamental knowledge on the art and science of formulating different dosage forms. It prepares the students for most basics of the applied field of pharmacy.

Objectives:

Upon the completion of the course the student should be able to:

- know the formulation aspects of different dosage forms;
- do different pharmaceutical calculation involved in formulation;
- formulate different types of dosage forms; and
- appreciate the importance of good formulation for effectiveness.

TeachingScheme				EvaluationScheme				Total Marks
Theory	Tutorial	Practical	Total	Theory		Practical		
				External	Internal	External	Internal	
2	1	3	6	70	30	70	30	200

Sr. No.	CourseContents	Hours	ModuleWeightage
1	a. Introduction to dosage forms - classification and definitions b. Prescription: definition, parts and handling c. Posology: Definition, Factors affecting dose selection. Calculation of children and infant doses.	6	10%
2	Historical back ground and development of profession of pharmacy and pharmaceutical industry in brief.	2	3%
3	Development of Indian Pharmacopoeia and introduction to other Pharmacopoeias such as BP, USP, European Pharmacopoeia, Extra pharmacopoeia and Indian national formulary.	2	3%
4	Weights and measures, Calculations involving percentage solutions, allegation, proof spirit, isotonic solutions etc.	5	8.5%
5	Powders and Granules: Classification advantages and disadvantages, Preparation of simple, compound powders, Insufflations, Dusting powders, Eutectic and Explosive powders, Tooth powder and effervescent powders and granules.	8	13.5%
6	Monophasic Dosage forms: Theoretical aspects of formulation including adjuvant like stabilizers, colorants, flavours with examples. Study of Monophasic liquids like gargles, mouth washes, Throat paint, Ear drops, Nasal drops, Liniments and lotions, Enemas and collodions.	7	11.5%
7	Biphasic dosage forms: Suspensions and emulsions, Definition, advantages and disadvantages, classification, test for the type of emulsion, formulation, stability and evaluation.	6	10%
8	Suppositories and pessaries: Definition, advantages and disadvantages, types of base, method of preparation, Displacement value and evaluation.	4	6.5%

9	Galenicals: Definition, equipment for different extraction processes like infusion, Decoction, Maceration and Percolation, methods of preparation of spirits, tinctures and extracts.	5	8.5%
10	Pharmaceutical calculations.	6	10%
11	Surgical aids: Surgical dressings, absorbable gelatin sponge, sutures, ligatures and medicated bandages	3	5%
12	Incompatibilities: Introduction, classification and methods to overcome the incompatibilities.	6	10%

Course Materials: (Latest edition)

Text books

- Cooper and Gunns Dispensing for pharmacy students
- A text book Professional Pharmacy by N.K.Jain and S.N.Sharma.

Reference books

- Introduction to Pharmaceutical dosage forms by Howard C. Ansel.
- Remington's Pharmaceutical Sciences.
- Register of General Pharmacy by Cooper and Gunn.
- General Pharmacy by M.L.Schroff.

**Pharm.D.
1st year.
PHARMACEUTICS**

Practical(3 Hours/ Week, 6 Credits, 90 Hours)

Sr. No.	Experiments
1	Syrups a. Simple Syrup I.P b. Syrup of Ephedrine Hcl NF c. Syrup Vasaka IP d. Syrup of ferrous Phosphate IP e. Orange Syrup
2	Elixir a. Piperizine citrate elixir BP b. Cascara elixir BPC c. Paracetamol elixir BPC
3	Linctus a. Simple Linctus BPC a. b. Pediatric simple Linctus BPC
4	Solutions a. Solution of cresol with soap IP b. Strong solution of ferric chloride BPC c. Aqueous Iodine Solution IP d. Strong solution of Iodine IP e. Strong solution of ammonium acetate IP
5	Liniments a. Liniment of turpentine IP* a. b. Liniment of camphor IP
6	Suspensions* a. Calamine lotion b. Magnesium Hydroxide mixture BP
7	Emulsions* a. Cod liver oil emulsion a. b. Liquid paraffin emulsion
8	Powders □ a. Eutectic powder b. Explosive powder c. Dusting powder d. Insufflations
9	Suppositories □ a. Boric acid suppositories b. Chloral suppositories
10	Incompatibilities a. Mixtures with Physical b. Chemical & Therapeutic incompatibilities

Course Materials:

Text Book & Reference book: (Latest edition)

1. Practical Pharmaceutics, R. S. Gaud & G. D. Gupta
2. A practical book of Pharmaceutics I, Dr. Sanjar Alam & Dr Jaganath Sahoo
3. A practical Handbook of Pharmaceutics, Dr. A. A. Hajare & Dr D. A. Bhagwat
4. Dispensing Pharmacy, R. M. Mehta
5. Indian Pharmacopeia and U S Pharmacopeia
6. The theory and practice of industrial pharmacy, Leon Lachman and Herbert A. Lieberman.

Scheme of Practical Examination

	Internal/Sessional	External
Synopsis	05	15
Major Experiment	10	25
Minor Experiment	03	15
Viva	02	15
Max. marks	20	70
Duration	3 hours	4 hours

Note: Total sessional marks is 30 (20 for practical sessional plus 10 marks for regularity, promptness, viva-voce and record maintenance).

GUJARAT TECHNOLOGICAL UNIVERSITY

Pharm.D.1s

tyear

SubjectName: Medicinal Biochemistry

SubjectCode:818803

Scope of the Subject: Applied biochemistry deals with complete understanding of the molecular level of the chemical process associated with living cells. Clinical chemistry deals with the study of chemical aspects of human life in health and illness and the application of chemical laboratory methods to diagnosis, control of treatment, and prevention of diseases.

Objectives of the Subject (Know, do, appreciate) : The objective of the present course is providing biochemical facts and the principles to the students of pharmacy. Upon completion of the subject student shall be able to –

- understand the catalytic activity of enzymes and importance of iso enzymes in diagnosis of diseases;
- know the metabolic process of biomolecules in health and illness (metabolic disorders);
- understand the genetic organization of mammalian genome; protein synthesis; replication; mutation and repair mechanism;
- know the biochemical principles of organ function tests of kidney, liver and endocrine gland; and
- do the qualitative analysis and determination of biomolecules in the body fluids.

TeachingScheme (Hours)				EvaluationScheme(Marks)				TotalMarks
Theory	Tutorial	Practical	Total	Theory		Practical		
				External	Internal	External	Internal	
3	1	3	7	70	30	70	30	200

Sr. No.	CourseContents	Hours	ModuleWeightage
1	Introduction to biochemistry: Cell and its biochemical organization, transport process across the cell membranes. Energy rich compounds; ATP, Cyclic AMP and their biological significance.	5	5.5%
2	Enzymes: Definition; Nomenclature; IUB classification; Factor affecting enzyme activity; Enzyme action; enzyme inhibition. Isoenzymes and their therapeutic and diagnostic applications; Coenzymes and their biochemical role and deficiency diseases.	7	8%
3	Carbohydrate metabolism: Glycolysis, Citric acid cycle (TCA cycle), HMP shunt, Glycogenolysis, gluconeogenesis, glycogenesis. Metabolic disorders of carbohydrate metabolism (diabetes mellitus and glycogen storage diseases); Glucose, Galactose tolerance test and their significance; hormonal regulation of carbohydrate metabolism.	16	18%
4	Lipid metabolism: Oxidation of saturated (β -oxidation); Ketogenesis and ketolysis; biosynthesis of fatty acids, lipids; metabolism of cholesterol; Hormonal regulation of lipid metabolism. Defective metabolism of lipids (Atherosclerosis, fatty liver, hypercholesterolemia)	12	13%
5	Biological oxidation: Coenzyme system involved in Biological oxidation. Electron transport chain (its mechanism in energy capture; regulation and inhibition); Uncouplers of ETC; Oxidative phosphorylation;	7	8%

6	Protein and amino acid metabolism: protein turn over; nitrogen balance; Catabolism of Amino acids (Transamination, deamination & decarboxylation). Urea cycle and its metabolic disorders; production of bile pigments; hyperbilirubinemia, porphoria, jaundice. Metabolic disorder of Amino acids.	12	13%
7	Nucleic acid metabolism: Metabolism of purine and pyrimidine nucleotides; Protein synthesis; Genetic code; inhibition of protein synthesis; mutation and repair mechanism; DNA replication (semiconservative /onion peel models) and DNA repair mechanism.	10	11%
8	Introduction to clinical chemistry: Cell; composition; malfunction; Roll of the clinical chemistry laboratory.	2	2%
9	The kidney function tests: Role of kidney; Laboratory tests for normal function includes- a) Urine analysis (macroscopic and physical examination, quantitative and semiquantitative tests.) b) Test for NPN constituents. (Creatinine /urea clearance, determination of blood and urine creatinine, urea and uric acid) c) Urine concentration test d) Urinary tract calculi. (stones)	5	5.5%
10	Liver function tests: Physiological role of liver, metabolic, storage, excretory, protective, circulatory functions and function in blood coagulation. a) Test for hepatic dysfunction-Bile pigments metabolism. b) Test for hepatic function test- Serum bilirubin, urine bilirubin, and urine urobilinogen. c) Dye tests of excretory function. d) Tests based upon abnormalities of serum proteins. Selected enzyme tests.	5	5.5%
11	Lipid profile tests: Lipoproteins, composition, functions. Determination of serum lipids, total cholesterol, HDL cholesterol, LDL cholesterol and triglycerides.	3	3.5%
12	Immunochemical techniques for determination of hormone levels and protein levels in serum for endocrine diseases and infectious diseases. Radio immuno assay (RIA) and Enzyme Linked Immuno Sorbent Assay (ELISA)	3	3.5%
13	Electrolytes: Body water, compartments, water balance, and electrolyte distribution. Determination of sodium, calcium potassium, chlorides, bicarbonates in the body fluids.	3	3.5%

CourseMaterials: (Latest edition)

Text books (Theory)

- a. Harpers review of biochemistry - Martin
- b. Text book of biochemistry – D.Satyanarayana
- c. Text book of clinical chemistry- Alex kaplan &Laverve L.Szabo

Reference books (Theory)

- a. Principles of biochemistry -- Lehninger
- b. Text book of biochemistry -- Ramarao
- c. Practical Biochemistry-David T.Plummer.
- d. Practical Biochemistry-Pattabhiraman.

Pharm.D.
1st year
MEDICINAL BIOCHEMISTRY

Practical (3 Hours/ Week, 6 Credits, 90 Hours)

Sr. No.	Experiments
1	Qualitative analysis of normal constituents of urine.*
2	Qualitative analysis of abnormal constituents of urine.*
3	Quantitative estimation of urine sugar by Benedict's reagent method.**
4	Quantitative estimation of urine chlorides by Volhard's method.**
5	Quantitative estimation of urine creatinine by Jaffe's method.**
6	Quantitative estimation of urine calcium by precipitation method.**
7	Quantitative estimation of serum cholesterol by Libermann Burchard's method.**
8	Preparation of Folin Wu filtrate from blood.*
9	Quantitative estimation of blood creatinine.**
10	Quantitative estimation of blood sugar Folin-Wu tube method.**
11	Estimation of SGOT in serum.**
12	Estimation of SGPT in serum.**
13	Estimation of Urea in Serum.**
14	Estimation of Proteins in Serum.**
15	Determination of serum bilirubin**
16	Determination of Glucose by means of Glucoseoxidase.**
17	Enzymatic hydrolysis of Glycogen/Starch by Amylases.**
18	Study of factors affecting Enzyme activity. (pH & Temp.)**
19	Preparation of standard buffer solutions and its pH measurements (any two)*
20	Experiment on lipid profile tests**
21	Determination of sodium,calcium and potassium in serum.**

** indicate major experiments & * indicate minor experiment

Referencebooks (Practical)

- a. Practical Biochemistry-DavidT.Plummer.
- b. Practical Biochemistry-Pattabhiraman.

Assignments:

Format of the assignment

1. Minimum & Maximum number of pages.
2. It shall be computer draft copy.
3. Reference(s) shall be included at the end.
4. Name and signature of the student.
5. Assignment can be a combined presentation at the end of the academic year.
6. Time allocated for presentation may be 8+2 Min.

Scheme of Practical Examination

	Internal/Sessional	External
Synopsis	05	15
MajorExperiment	10	25
MinorExperiment	03	15
Viva	02	15
Max.marks	20	70
Duration	3 hours	4 hours

Note: Total sessional marks is 30 (20 for practical sessional plus 10 marks for regularity, promptness, viva-voce and record maintenance).

GUJARAT TECHNOLOGICAL UNIVERSITY

Pharm.D.

1st year

Subject Name: Pharmaceutical Organic Chemistry

Subject Code: 818804

Scope: This subject deals with general methods of preparation and reaction of organic compounds. Reactivity of organic compounds is also included here. The course emphasizes on mechanism and orientation of reactions.

Objectives:

This course is designed to impart a very good knowledge about

- a. IUPAC/Common system of nomenclature of simple organic compounds belonging to different classes of organic compounds;
- b. Some important physical properties of organic compounds;
- c. Free radical/ nucleophilic [alkyl/ acyl/ aryl] /electrophilic substitution, free radical/ nucleophilic / electrophilic addition, elimination, oxidation and reduction reactions with mechanism, orientation of the reaction, order of reactivity, stability of compounds;
- d. Some named organic reactions with mechanisms; and e. Methods of preparation, test for purity, principle involved in the assay, important medicinal uses of some important organic compounds.

TeachingScheme (Hours)				EvaluationScheme(Marks)				Totalmarks
Theory	Tutorial	Practical	Total	Theory		Practical		
				External	Internal	External	Internal	
3	1	3	7	70	30	70	30	200

Sr. No.	CourseContents	Hours	Module Weight age
1	Structures and Physical properties: a. Polarity of bonds, polarity of molecules, M.P, Inter molecular forces, B.P, Solubility, non ionic solutes and ionic solutes, protic and aprotic Solvents, ion pairs, b. Acids and bases, Lowry bronsted and Lewis theories c. Isomerism	9	10%
2	Nomenclature of organic compound belonging to the following classes Alkanes, Alkenes, Dienes, Alkynes, Alcohols, Aldehydes, Ketones, Amides, Amines, Phenols, Alkyl Halides, Carboxylic Acid, Esters, Acid Chlorides And Cycloalkanes.	8	9%
3	Free radicals chain reactions of alkane : Mechanism, relative reactivity and stability	6	6.5%
4	Alicyclic compounds : Preparations of cyclo alkanes, Bayer strain theory and orbital picture of angle strain.	3	3.5%

5	Nucleophilic aliphatic substitution mechanism: Nucleophiles and leaving groups, kinetics of second and first order reaction, mechanism and kinetics of SN2 reactions. Stereochemistry and steric hindrance, role of solvents, phase transfer catalysis, mechanism and kinetics of SN1 reactions, stereochemistry, carbocation and their stability, rearrangement of carbocation, role of solvents in SN1 reaction, Ion dipole bonds, SN2 versus SN1 solvolyses, nucleophilic assistance by the solvents.	7	8%
6	Dehydro halogenation of alkyl halides: 1,2 elimination, kinetics, E2 and E1 mechanism, elimination via carbocation, evidence for E2 mechanism, absence of rearrangement isotope effect, absence hydrogen exchange, the element effect, orientation and reactivity, E2 versus E1, elimination versus substitution, dehydration of alcohol, ease of dehydration, acid catalysis, reversibility, orientation.	5	5.5%
7	Electrophilic and free radicals addition: Reactions at carbon-carbon, double bond, electrophile, hydrogenation, heat of hydrogenation and stability of alkenes, markownikoff rule, addition of hydrogen halides, addition of hydrogen bromides, peroxide effect, electrophilic addition, mechanism, rearrangement, absence of hydrogen exchange, orientation and reactivity, addition of halogen, mechanism, halohydrin formation, mechanism of free radicals addition, mechanism of peroxide initiated addition of hydrogen bromide, orientation of free addition, additions of carbene to alkene, cyclo addition reactions.	6	6.5%
8	Carbon-carbon double bond as substituents: Free radical halogenations of alkenes, comparison of free radical substitution with free radical addition, free radical substitution in alkenes, orientation and reactivity, allylic rearrangements.	4	4.5%
9	Theory of resonance: Allyl radical as a resonance hybrid, stability, orbital picture, resonance stabilisation of allyl radicals, hyper conjugation, allyl cation as a resonance hybrid, nucleophilic substitution in allylic substrate, SN1 reactivity, allylic rearrangement, resonance stabilisation of allyl cation, hyper conjugation, nucleophilic substitution in allylic substrate, SN2 nucleophilic substitution in vinylic substrate, vinylic cation, stability of conjugated dienes, resonance in alkenes, hyper conjugation, ease of formation of conjugated dienes, orientation of elimination, electrophilic addition to conjugated dienes, 1,4- addition, 1,2-versus 1,4-addition, rate versus equilibrium, orientation and reactivity of free radical addition to conjugated dienes.	6	6.5%
10	Electrophilic aromatic substitution: Effect of substituent groups, determination of orientation, determination of relative reactivity, classification of substituent group, mechanism of nitration, sulphonation, halogenation, friedel craft alkylation, friedel craft acylation, reactivity and orientation, activating and deactivating O,P,M directing groups, electron release via resonance, effect of halogen on electrophilic aromatic substitution in alkyl benzene, side chain halogenation of alkyl benzene, resonance stabilization of benzyl radical.	6	6.5%

11	Nucleophilic addition reaction: Mechanism, ionisation of carboxylic acids, acidity constants, acidity of acids, structure of carboxylate ions, effect of substituent on acidity, nucleophilic acyl substitution reaction, conversion of acid to acid chloride, esters, amide and anhydride. Role of carboxyl group, comparison of alkyl nucleophilic substitution with acyl nucleophilic substitution.	5	5.5%
12	Mechanism of aldol condensation, Claisen condensation, Cannizzaro reaction, crossed aldol condensation, crossed Cannizzaro reaction, Benzoin condensation, Perkin condensation. Knoevenagel, Reformatsky reaction, Wittig reaction, Michael addition.	5	5.5%
13	Hoffman rearrangement: Migration to electron deficient nitrogen, Sandmeyer's reaction, basicity of amines, diazotisation and coupling, acidity of phenols, Williamson synthesis, Fries rearrangement, Kolbe reaction, Reimer-Tiemann's reactions.	5	5.5%
14	Nucleophilic aromatic substitution: Bimolecular displacement mechanisms, orientation, comparison of aliphatic nucleophilic substitution with that of aromatic.	4	4.5%
15	Oxidation reduction reaction.	5	5.5%
16	Study of the following official compounds- preparation, test for purity, assay and medicinal uses of Chlorbutol, Dimercaprol, Glycerol trinitrate, Urea, Ethylene diamine dihydrate, Vanillin, Paraldehyde, Ethylene chloride, Lactic acid, Tartaric acid, citric acid, salicylic acid, aspirin, methyl salicylate, ethyl benzoate, benzyl benzoate, dimethyl phthalate, sodium lauryl sulphate, saccharin sodium, mephensin.	6	6.5%

Course Materials: (Latest edition)

Text books

- T.R. Morrison and R. Boyd - Organic Chemistry,
- Bentley and Driver - Text book of Pharmaceutical chemistry
- I.L. Finer - Organic Chemistry, the fundamentals of chemistry

Reference books

- Organic Chemistry - J.M. Cram and D.J. Cram
- Organic Chemistry - Brown
- Advanced Organic Chemistry - Jerry March, Wiley
- Organic Chemistry - Cram and Hammond, Pine-Hendrickson

Pharm.D.1st year PHARMACEUTICAL ORGANIC CHEMISTRY

Practical (3 Hours / Week; 6 Credits, 90 Hours)

Sr. No.	Experiments
1	<p>Introduction to the various laboratory techniques through demonstration involving synthesis of the following compounds (at least 8 compounds to be synthesised):</p> <ol style="list-style-type: none">1. Acetanilide / aspirin (Acetylation)2. Benzanilide / Phenyl benzoate (Benzoylation)3. P-bromo acetanilide / 2,4,6 – tribromo aniline (Bromination)4. Dibenzylidene acetone (Condensation)5. 1-Phenylazo-2-naphthol (Diazotisation and coupling)6. Benzoic acid / salicylic acid (Hydrolysis of ester)7. M-dinitro benzene (Nitration)8. 9, 10 – Anthraquinone (Oxidation of anthracene) / preparation of benzoic acid from toluene or benzaldehyde9. M-phenylene diamine (Reduction of M-dinitrobenzene) / Aniline from nitrobenzene10. Benzophenone oxime11. Nitration of salicylic acid12. Preparation of picric acid13. Preparation of O-chlorobenzoic acid from O-chlorotoluene14. Preparation of cyclohexanone from cyclohexanol
2	<p>Identification of organic compounds belonging to the following classes by : Systematic qualitative organic analysis including preparation of derivatives Phenols, amides, carbohydrates, amines, carboxylic acids, aldehyde and ketones, Alcohols, esters, hydrocarbons, anilides, nitrocompounds.</p>
3	<p>Introduction to the use of stereo models: Methane, Ethane, Ethylene, Acetylene, Cis alkene, Trans alkene, inversion of configuration.</p>

Course material:**Text book and Reference book:** (Latest edition)

1. Practical Organic Chemistry by Mann and Saunders.
2. Vogel's text book of Practical organic Chemistry
3. Advanced Practical Organic Chemistry by N. K. Vishnoi
4. Introduction to Organic Laboratory techniques by Pavia, Lampman and Kriz

Scheme of Practical Examination

	Internal/Sessional	External
Synopsis	05	15
Major Experiment	10	25
Minor Experiment	03	15
Viva	02	15
Max.marks	20	70
Duration	3 hours	4 hours

Note: Total sessional marks is 30 (20 for practical sessional plus 10 marks for regularity, promptness, viva-voce and record maintenance)

GUJARAT TECHNOLOGICAL UNIVERSITY

Pharm.D

1st year

Subject Name: Pharmaceutical Inorganic Chemistry

Subject Code: 818805

Scope: This course mainly deals with fundamentals of Analytical chemistry and also the study of inorganic pharmaceuticals regarding their monographs and also the course deals with basic knowledge of analysis of various pharmaceuticals.

Objectives:

Upon the completion of the course the student should be able to:

1. understand the principles and procedures of analysis of drugs and also regarding the application of inorganic pharmaceuticals;
2. know the analysis of the inorganic pharmaceuticals their applications
3. appreciate the importance of inorganic pharmaceuticals in preventing and curing the disease

TeachingScheme				EvaluationScheme				Total Marks
Theory	Tutorial	Practical	Total	Theory		Practical		
				External	Internal	External	Internal	
2	1	3	6	70	30	70	30	200

Sr. No.	CourseContents	Hours	ModuleWeightage
1	Errors: Errors in Analysis: Error, Accuracy and Precision, Types of Errors, Methods of expressing precision, Test for rejection of data, Significant figures, Rounding of figures, Confidence limits	2	3.5%
2	Volumetric analysis (Titrimetric analysis)		
2.1	Acid-base titrations: Relative strength and its effect on titration, common ion effect, pH, Henderson-Hasselbach equation, buffers, neutralization curve, acid base indicators, theory of indicators, back titrations, biphasic titrations, pharmacopoeial applications, hydrolysis of salts, ionic products of water and law of mass action.	7	11.5%
2.2	Redox titrations : Theory of redox titrations, redox indicators, types of redox titrations, iodometry, cerimetry, mercury metry, diazotization nitrite titrations, 2,6-dichlorophenolindophenol titrations, titration curve and calculations of potentials during course of titrations.	6	10%
2.3	Nonaqueous titrations : Nonaqueous solvents, titrants and indicators. Differentiating and leveling solvents.	3	5%
2.4	Argentometric or precipitation titrations : Mohrs, Fajans and Volhard methods	3	5%

2.5	Complexometric titrations : Theory of the titrations, titrant, indicators and pharmacopoeial applications.	4	6.5%
3	Gravimetric analysis : Stability, solubility products, types of precipitations ,precipitation techniques, pharmacopoeial applications	3	5%
4	Impurities in Pharmaceuticals: Sources of impurities, tests for purity and identity, limit tests for iron, arsenic, lead, heavy metals, chloride, sulphate.	4	6.5%
5	Gases and Vapors: Oxygen, Anesthetics and Respiratory Stimulants	2	3.5%
6	Acidifying agents: Dilute HCl	1	1.5%
7	Antacids: Types, Ideal characteristics of antacid, Aluminium compounds, Calcium compounds, Magnesium compounds, Sodium compounds, Combination of Antacids	2	3.5%
8	Cathartics: Classification, Magnesium hydroxide, Magnesium sulphate, Sodium Phosphate, Dried Sodium Phosphate, Sodium Potassium tartarate, Potassium bitartarate, Mercurous chloride	2	3.5%
9	Major intra and extra-cellular electrolytes: Physiological ions, electrolytes used for replacement therapy, acids-base balance and combination therapy.	4	6.5%
10	Essential and trace elements: Transition elements and their compounds of pharmaceutical importance: Iron and haematinics, mineral supplements.	3	5%
11	Antimicrobials	2	3.5%
12	Pharmaceutical Aids used in pharmaceutical industry: Anti-oxidants, preservatives, Filter aids, Adsorbents, Diluents	3	5%
13	Dental products: Dentifrices, Anti-caries agents.	2	3.5%
14	Miscellaneous agents: Sclerosing agents, Expectorants, Emetics, poisons and Anti-dotes, Sedatives	4	6.5%
15	Inorganic Radiopharmaceuticals: Nuclear radiopharmaceuticals, reactions, Nomenclature, Methods of obtaining their standards and units of activity, measurements of activity, clinical applications and dosage, hazards and precautions.	3	5%

Course materials: (Latest edition)

Text books

- A text book Inorganic medicinal chemistry by Surendra N. Pandeya
- A. H. Beckett and J. B. Stanlake's Practical Pharmaceutical chemistry Vol-I & Vol-II
- Inorganic Pharmaceutical Chemistry III-Edition P. Gundu Rao

Reference books

- Inorganic Pharmaceutical Chemistry by Anand & Chetwal
- Pharmaceutical Inorganic chemistry by Dr. B. G. Nagavi
- Analytical chemistry principles by John H. Kennedy
- I.P. 1985 and 1996, Govt. of India, Ministry of health

Pharm.D 1st year

PHARMACEUTICAL INORGANIC CHEMISTRY

Practical (3 Hours/ Week, 6 Credits, 90 Hours)

Sr. No.	Experiments
1	Limit test (6 exercises) a. Limit test for chlorides b. Limit test for sulphates c. Limit test for iron d. Limit test for heavy metals e. Limit test for arsenic f. Modified limit tests for chlorides and sulphates
2	Assays (10 exercises) a. Ammonium chloride- Acid-base titration b. Ferrous sulphate- Cerimetry c. Copper sulphate- Iodometry d. Calcilugluconate- Complexometry e. Hydrogen peroxide – Permanganometry f. Sodium benzoate – Nonaqueous titration g. Sodium chloride – Modified volhard’s method h. Assay of KI – KIO ₃ titration i. Gravimetric estimation of barium as barium sulphate j. Sodium antimony gluconate or antimony potassium tartarate
3	Estimation of mixture (Any two exercises) a. Sodium hydroxide and sodium carbonate b. Boric acid and Borax c. Oxalic acid and sodium oxalate
4	Test for identity (Any three exercises) a. Sodium bicarbonate b. Barium sulphate c. Ferrous sulphate d. Potassium chloride
5	Test for purity (Any two exercises) a. Swelling power in Bentonite b. Acid neutralising capacity in aluminium hydroxide gel c. Ammonium salts in potash alum d. Adsorption power heavy Kaolin e. Presence of Iodates in KI
6	Preparations (Any two exercises) a. Boric acids b. Potash alum c. Calcium lactate d. Magnesium sulphate

Course Materials: (Latest edition)

1. A I Vogel, Text Book of Quantitative Inorganic analysis
2. P. Gundu Rao, Inorganic Pharmaceutical Chemistry
3. Practical’s in inorganic and analytical chemistry by Hitesh G Raval
4. Bentley and Drivers Textbook of Pharmaceutical Chemistry
5. Indian Pharmacopoeia

Scheme of Practical Examination

	Internal/Sessional	External
Synopsis	05	15
Major Experiment	10	25
Minor Experiment	03	15
Viva	02	15
Max.marks	20	70
Duration	3 hours	4 hours

Note: Total sessional marks is 30 (20 for practicals sessional plus 10 marks for regularity, promptness, viva-voce and record maintenance)

GUJARAT TECHNOLOGICAL UNIVERSITY

Pharm.D

1st year

Subject Name: Biology

Subject Code: 818806

Scope: This is an introductory course in Biology, which gives detailed study of natural sources such as plant and animal origin. This subject has been introduced to the pharmacy course in order to make the student aware of various naturally occurring drugs and its history, sources, classification, distribution and the characters of the plants and animals. This subject gives basic foundation to Pharmacology.

Objectives: Upon completion of the course the student shall be able to:

1. Should know the history, modern concepts of biology and its relevance to pharmaceutical sciences
2. Know the classification and salient feature of five kingdoms of life
3. Knowledge about morphology of plant, flower, fruit and seed
4. Basic components of anatomy and physiology of plant along with study of microbes.
5. Learn about various tissue system and organ system in animals, Poisonous animals study, with special reference to human beings and detailed study of different system of Frog

Teaching Scheme (Hours)				Evaluation Scheme (Marks)				Total marks
Theory	Tutorial	Practical	Total	Theory		Practical		
				External	Internal	External	Internal	
3	1	3	7	70	30	70	30	200

Sr. No.	Course Contents	Hours	Module Weightage
Part-A			
1	Introduction	2	2%
2	General organization of plants and its inclusions	4	4.5%
3	Plant tissues	4	4.5%
4	Plant kingdom and its classification	4	4.5%
5	Morphology of plants	5	5.5%
6	Root, Stem, Leaf and its modifications	8	9%
7	Inflorescence and Pollination of flowers	6	6.5%
8	Morphology of fruits and seeds	6	6.5%
9	Plant physiology	4	4.5%
10	Taxonomy of Leguminosae, Umbelliferae, Solanaceae, Liliaceae, Zinziberaceae, Rubiaceae	8	9%
11	Study of Fungi, Yeast, Penicillin and Bacteria	10	11%

Part-B			
1	Study of Animal cell	4	4.5%
2	Study animal tissues	4	4.5%
3	Detailed study of frog	6	6.5%
4	Study of Pisces, Reptiles, Aves	8	9%
5	General organization of mammals	4	4.5%
6	Study of poisonous animals	3	3.5%

Course Materials: (Latest edition)

Text books

1. Text book of Biology by S.B.Gokhale
- b. A Textbook of Biology by Dr.Thulajappa and Dr.Seetaram.

Reference books

1. A Text book of Biology by B.V.SreenivasaNaidu
2. A Text book of Biology by Naidu and Murthy
3. Botany for Degree students By A.C.Dutta.
4. Outlines of Zoology by M.Ekambaranathaayyer and T.N.Ananthkrishnan.
5. A manual for pharmaceutical biology practical by S.B.Gokhale and C.K.Kokate.

Pharm.D. 1st year BIOLOGY

Practical (3 Hours/ Week, 6 Credits, 90 Hours)

Sr. No.	Experiments
1	Introduction of biology experiments.
2	Study of cell wall constituents and cell inclusions.
3	Study of Stem modifications.
4	Study of Root modifications.
5	Study of Leaf modifications.
6	Identification of Fruits and seeds.
7	Preparation of Permanent slides.
8	T.S. of Senna, Cassia, Ephedra, Podophyllum.
9	Simple plant physiological experiments.
10	Identification of animals
11	Detailed study of Frog
12	Computer based tutorials

Course Materials: (Latest edition)

1. A manual for pharmaceutical biology practical by S. B. Gokhale and C. K. Kokate.

2. Practical Anatomy and Physiology by R. K. Goyal and Dr. Natvar M. Patel., B. S. Shah Prakashan.
3. Pharmacognosy by T.E Wallis
4. Pharmacognosy: MS. B.K. Shah, Dr. N.S. Kapadia, Nirav & Roopal Prakashan Ahmedabad, 2010-2011.
5. Practical Pharmacognosy, Techniques and experiments, K. R. Khandelwal, Nirali prakashan, 16th edition, 2006.

Scheme of Practical Examination

	Internal/Sessional	External
Identification	04	10
Synopsis	04	10
Major Experiment	07	20
Minor Experiment	03	15
Viva	02	15
Max.marks	20	70
Duration	3 hours	4 hours

Note: Total sessional marks is 30(20forpracticalsessionalplus10marksforregularity, promptness, viva-voce and record maintenance)

GUJARAT TECHNOLOGICAL UNIVERSITY

Pharm.D.

1st year

Subject Name: Remedial Mathematics

Subject Code: 818807

Scope: This is an introductory course in mathematics. This subjects deals with the introduction to matrices, determinants, trigonometry, analytical geometry, differential calculus, integral calculus, differential equations, laplace transform.

Objectives:

Upon completion of the course the student shall be able to : –

- Know Trigonometry, Analytical geometry, Matrices, Determinant, Integration, Differential equation, Laplace transform and their applications;
- solve the problems of different types by applying theory; and
- appreciate the important applications of mathematics in pharmacy.

TeachingScheme (Hours)				EvaluationScheme(Marks)				Totalmarks
Theory	Tutorial	Practical	Total	Theory		Practical		
				External	Internal	External	Internal	
3	1	0	4	70	30	0	0	100

Sr. No.	CourseContents	Hours	ModuleWeightage
1	Algebra : Determinants, Matrices	10	11%
2	Trigonometry : Sides and angles of a triangle, solution of triangles	12	13.5%
3	Analytical Geometry : Points, Straight line, circle, parabola	12	13.5%
4	Differential calculus: Limit of a function, Differential calculus, Differentiation of a sum, Product, Quotient Composite, Parametric, exponential, trigonometric and Logarithmic function. Successive differentiation, Leibnitz's theorem, Partial differentiation, Euler's theorem on homogeneous functions of two variables	18	20%
5	Integral Calculus: Definite integrals, integration by substitution and by parts, Properties of definite integrals	12	13.5%
6	Differential equations: Definition, order, degree, variable separable, homogeneous, Linear, heterogeneous, linear, differential equation with constant coefficient, simultaneous linear equation of second order.	16	17.5%
7	Laplace transform: Definition, Laplace transform of elementary functions, Properties of linearity and shifting	10	11%

Course materials: (Latest edition)

Text books

- a. Differential calculus By Shantinakaran
- b. Text book of Mathematics for second year pre-university by Prof.B.M.Sreenivas

Reference books

- a. Integral calculus By Shanthinakaran
- b. Engineering mathematics By B.S.Grewal c. Trigonometry Part-I By S.L.Loney