MODEL CURRICULUM

FOR

POST XII (HSC) PROGRAMME

IN

B. Tech. / B.E in Pharmacy 2011

ALL INDIA COUNCIL FOR TECHNICAL EDUCATION

7th Floor, Chandralok Building, Janpath

New Delhi – 110 001

Foreword

It is with great pleasure and honour that I write a forward for the Model scheme of instruction and syllabi for the Post HSC Pharmacy program prepared by the All India Board of Technician Education with **Prof. S. Y. Gabhe** as its Chairman and other members. All India Council for Technical Education has the onerous responsibility for uniform development and qualitative growth of the Technical Education system and preparation of syllabi to maintain uniform standards throughout the county. In pursuance to clause 10 (2) of the AICTE Act 1987 AICTE has the objective of bringing about uniformity in the curriculum of Engineering. In that direction, the efforts of the All India Board of Technician Education has been quite commendable and praiseworthy. A painstaking effort was made by the Chairman, members of the Board and various working groups composed of experts from leading institutions in framing of the Instruction and Syllabi. The Board was ably assisted by the official of the Academics Bureau in successfully organizing the meetings making available necessary documents and follow up action on the minutes of the meetings.

Chairman

All India Council for Technical Education

SCHEME OF SYLLABUS

Sem	Code	SN	Subject	Hrs. Per week.		The. (Marks)	Pra. (Marks)	Credits (T)	Credits (P)
				The.	Pra.				
I	110	1	Physical chemistry	4	6	100	100	4	4
I	120	2	Pharmaceutical Chemistry - I	4	--	100	--	4	--
I	130	3	Anatomy, Physiology & Health Education	4	6	100	100	4	4
I	140	4	Functional English & Communication Skills	3	--	100	--	4	--
I	150	5	Remedial Mathematics (College Exam)	3	--	100	--	4	--
I	151	5	Remedial Biology (College Exam.)	2	3	50	50	2	2
II	210	1	Microbiology	4	6	100	100	4	4
II	220	2	Pharmaceutics-I	4	6	100	100	4	4
II	230	3	Organic Chemistry – I	4	6	100	100	4	4
II	240	4	Environmental Sciences	2	--	50	--	2	--
III	310	1	Physical Pharmacy	4	6	100	100	4	4
III	320	2	Organic Chemistry – II	4	6	100	100	4	4
III	330	3	Biotechnology	4	6	100	100	4	4
III	340	4	Pathophysiology	4	--	100	--	4	--
IV	410	1	Pharmaceutics – II	4	6	100	100	4	4
IV	420	2	Pharmaceutical Chemistry - II	4	--	100	--	4	--
IV	430	3	Pharmaceutical analysis - I	4	6	100	100	4	4
IV	440	4	Pharmacognosy – I	4	--	100	--	4	--
V	510	1	Computers & Statistics	4	6	100	100	4	4
V	520	2	Pharmaceutical Chemistry – III	4	--	100	--	4	--
V	530	3	Pharmaceutical Analysis - II	4	6	100	100	4	4
V	540	4	Pharmacology – I	4	--	100	--	4	--
VI	610	1	Hospital & Dispensing Pharmacy	4	6	100	100	4	4
VI	620	2	Pharmacology – II	4	6	100	100	4	4
VI	630	3	Pharmacognosy – II	4	6	100	100	4	4
VI	640	4	Pharmaceutical Jurisprudence	4	--	100	--	4	--
VI	650	5	Electives/ Seminar (Literature Review)	2	--	100	--	4	--
VII	710	1	Pharmaceutics – III	4	6	100	100	4	4
VII	720	2	Pharmaceutical Chemistry - IV	4	6	100	100	4	4
VII	730	3	Clinical Pharmacy and Therapeutics	4	--	100	--	4	--
VII	740	4	Pharmaceutical Engineering	4	--	100	--	4	--
VIII	810	1	Biopharmaceutics Pharmacokinetics	4	--	100	--	4	--
VIII	820	2	Biochemistry	4	6	100	100	4	4
VIII	830	3	Pharmacognosy – III	4	6	100	100	4	4
VIII	840	4	Pharmaceutical Management	4	--	100	--	4	--
Total				**130**	**117**	**340**	**1950**	**134**	**76**

Name of the Course : PHYSICAL CHEMISTRY	
Course code: T-110	**Semester :** I
Duration : 60 Hrs.	**Maximum Marks :** 100
Teaching Scheme	**Examination Scheme**
Theory : 04 Hrs. Per week	Mid Semester Exam: 20 Marks
Tutorial: Hrs. Per week [As required]	Assignment & Quiz: 10 Marks
Practical : Hrs. Per week [N A]	End Semester Exam: 70 Marks
Credit : **04 [FOR ALL THEORY & PRACTICALS ONE CREDIT = 25 MARKS]**	

Aim :-

Objective :-

S. No	
1	To acquaint the students with the fundamental principles & their applications with reference to Pharmacy.
2	To study the physical, colligative and thermodynamic properties of matter.
3	To study physico- chemical properties of solutions like phase rule, refractive index, electrochemistry etc.
4	To study ionic equilibrium, kinetics and absorption phenomenon.

Pre-Requisite :- Nil

	Contents	Hrs.
Unit -1	**Composition & physical states of matter** Intermolecular forces & their impact on state of the matter. Various physical properties of matter, dipole moment, dielectric constant, Van Der waal's equation & critical phenomenon, liquefaction of gases, aerosols.	04
Unit -2	**Colligative Properties** The liquid state, vapor pressure, ideal & real solutions. Raoult's law, elevation of boiling point, depression of freezing point, osmotic pressure, determination of molecular weight based on colligative properties.	06
Unit – 3	**Thermodynamics** First, second & third law of thermodynamics. Thermochemical laws, isothermic & adiabetic processes, reversible processes, work of expansion, heat content, enthalpy, heat capacity. Gibb's & Helmoltz equation & chemical potential.	10
Unit – 4	Chemical Equillibria	05
Unit - 5	**Phase rule** One, two, & three component systems along with their applications. Solid- solid, solid - liquid, & liquid-liquid systems. Distillation of binary systems, azeotropic mixtures, steam, vacuum, & fractional distillation.	07
Unit – 6	**Refractive index** Refractive index, specific refractivity, molar refractivity, refractometers.	02
Unit – 7	**Solutions** Solubility, factors affecting solubility, solubility curves. Types of solutions, effect of co-solvancy, pH & other factors on solubility. Solubility of gases in liquids, liquids in liquids, & solids in liquids, critical solution temperature, law of partitioning & its applications. Solute solvent interactions. Expression of concentration of pharmaceutical solutions & calculations. Molarity, molality, mole	08

	fraction & percentage expressions.	
Unit – 8	**Electrochemistry** Properties of electrolyte solutions, electrolysis. Faraday's law of electrolysis, electron transport, electrical cell, single electrode potential, concentration cells, half-cells & half cell potential, types of half cells, sign convention, Nerst equation, salt bridge, electromotive series, standard potential, SHE. Measuring the relative voltage of half cells, Calculation of standard potential. Reference & indicator electrodes. Standard oxidation-reduction potential.	06
Unit – 9	**Ionic equilibrium** Theory of conductivity, equivalent conductance, mobility of ions, specific conductance.	06
Unit – 10	**Kinetics** Order of reactions, derivation & internal form of rate laws, molarity of reaction, derivation of rate constants.	06
	Total	**60**

Text books :

Name of Authors	Titles of the Book	Edition	Name of the Publisher
Glasstone , Samuel	Text Book of Physical Chemistry		Mc Milan Publishers
Carstensen , J. T.	Advanced Pharmaceutical Solids		Marcel Dekker
Connors, K. A.	Chemical Stability Of Pharmaceuticals		Wiley J.
Martin, Alfred	Physical Pharmacy		Waverley Publishers
Conners, K. A.	Thermodynamics Of Pharmaceutical Systems		Wiley J.
Raymond, Chang	Physical Chemistry with Applications to Biological System		Collier McMilan International Ed.

Reference Books : Nil

Suggested List of Laboratory Experiments : Nil

Suggested List of Assignments/Tutorial : Nil

Name of the Course : PHYSICAL CHEMISTRY	
Course code: P-110	**Semester :** I
Duration : 90 Hrs.	**Maximum Marks :** 100
Teaching Scheme	**Examination Scheme**
Theory : Hrs. Per week [N A]	Mid Semester Exam: 20 Marks
Tutorial: Hrs. Per week [N A]	Assignment & Quiz: 10 Marks
Practical : 06 Hrs. Per week	End Semester Exam: 70 Marks
Credits :- **04 [FOR ALL THEORY & PRACTICALS ONE CREDIT = 25 MARKS]**	

Aim :-

Objective :-

S.No	
1	**To train students on safe handling of chemicals, glassware, & instruments / equipments.**
2	**To give students training on use of correct technique /s , methodology in setting up the experiment/s.**
3	**To familiarize the students about use of various instruments, including proper handling, precautions during use, & appropriate maintenance techniques.**

Pre-Requisite :- Nil

Contents		Hrs.
S. No	**Nil**	

Text Books: Nil

Reference books :

"It is strongly recommended that some standard book/s be used for practicals. The choice of book/s is left to the concerned teachers".

Suggested List of Laboratory Experiments :

S. No	
1	Introduction to apparatus, equipment, & instruments.
2	Determination of specific gravity of liquid solutions.
3	Determination of critical solution temperature of phenol-water system.
4	Determination of critical solution temperature of triethylamine-water system.
5	Determination of partition coefficient of benzoic acid [or any other simple molecule] in toluene-water.
6	Determination of partition coefficient of iodine in CCI_4 –water.
7	Determination of specific refractivity & molar refractivity using refractometer.
8	Determination of molecular weight by Rast's camphor method.
9	Determination of heat of solubilization of benzoic acid in water.
10	Determination of buffer capacity of a solution of a weak acid & it's salt.
11	Study of mutual solubility of ternary system: benzene-acetone-water.
12	Study of mutual solubility of ternary system: toluene-acetone-water.
13	Determination of order of reaction for hydrolysis of ester.

14	Determination of molecular weight of a macromolecule like [albumin / gelatin / peptone etc.] by osmotic pressure.
15	Determination of half-cell potential of Cu-Cu.
16	Determination of half-cell potential of Zn-Zn.
17	Determination of half cell potential of concentration cells.
18	Multiple experiments from the above list can be given depending on their significance in pharmacy.
Suggested List of Assignments/Tutorial : Nil	

Name of the Course : PHARMACEUTICAL CHEMISTRY – I	
Course code: T-120	**Semester :** I
Duration : 60 Hrs.	**Maximum Marks :** 100
Teaching Scheme	**Examination Scheme**
Theory : 04 Hrs. Per week	Mid Semester Exam: 20 Marks
Tutorial: Hrs. Per week [As required]	Assignment & Quiz: 10 Marks
Practical : Hrs. Per week [NA]	End Semester Exam: 70 Marks
Credits :- **04 [FOR ALL THEORY & PRACTICALS ONE CREDIT = 25 MARKS]**	
Aim :-	
Objective :-	

S. No	
1	**To emphasize the importance of inorganic entities in Pharmaceuticals.**
2	**To provide knowledge about important inorganic Pharmaceuticals in Pharmacopoeia regarding their preparation, quality standard and Pharmaceutical uses.**
3	**To highlight the domain of radiopharmaceuticals used in the diagnostics and therapy.**
4	**To describe typical therapeutic classes and inorganic agents associated with them.**

Pre-Requisite :- Nil

	Contents	Hrs.
Unit -1	**Pharmaceutical Impurities** Impurities in pharmaceutical substances, sources, types & effects of impurities. Limit tests for heavy metals like lead, iron, arsenic, mercury & for chloride & sulphate as per Indian Pharmacopoeia [I. P.].	10
Unit -2	**Monographs** Monograph & its importance, various tests included in monographs as per I. P. A study of the following compounds with respect to their methods of preparation, assay, & pharmaceutical uses: sodium citrate, calcium carbonate, copper sulphate, light & heavy kaolin, ammonium chloride & ferrous gluconate.	15
Unit – 3	**Isotopes** Isotopes- stable & radioactive, mode & rate of decay. Types & measurement of radioactivity. Radiopharmaceuticals & their diagnostic & therapeutic applications in pharmacy & medicine such as ^{125}I, ^{32}P, ^{51}Cr, ^{60}Co, ^{59}Fe, ^{99}Tc-M. Radiocontrast media, use of $BaSO_4$ in medicine.	10
Unit – 4	**Therapeutic classes of drugs** The following topics should be dealt with covering nomenclature [including stereochemical aspects], biological activity [including side & toxic effects], mode of action, structure activity relationship [where ever applicable] & syntheses of reasonable molecules. 1. Dentifrices, desensitizing agents, & anticaris agents. 2. General anesthetics. 3. Local anesthetics. 4. Antiseptics, disinfectants, sterilants, & astringents. 5. Purgatives, laxatives & antidiarrhoeal agents. 6. Diagnostic agents. 7. Coagulants, anticoagulants & plasma expanders.	25

	Total	**60**

Text Books:

Name of Authors	Titles of the Book	Edition	Name of the Publisher
Foye, W. O.	Principles Of Medicinal Chemistry		Varghese & Company, Mumbai, India
Wilson, C., Gisvold, O., & Doerge, J. B.	Text Book Of Organic Medicinal & Pharmaceutical Chemistry		Lippincot Company, Toronto, Canada
Block, J. H., Roche, F. B., Soine, T. I. & Wilson, C. O.	Inorganic Medicinal & Pharmaceutical Chemistry		Varghese Publishing House, Mumbai, India
Atherden , L. M.	Bentley And Drivers Textbook Of Pharmaceutical Chemistry		Oxford Medical Publications.
Govt. of India	Indian Pharmacopoeia (Vol. I & II)		Controller of Publisher, Govt. of India.

Reference Books : Nil

Suggested List of Laboratory Experiments : Nil

Suggested List of Assignments/Tutorial : Nil

Name of the Course : ANATOMY, PHYSIOLOGY AND HEALTH EDUCATION	
Course code: T-130	**Semester :** I
Duration : 60 Hrs.	**Maximum Marks :** 100
Teaching Scheme	**Examination Scheme**
Theory : 04 Hrs. Per week	Mid Semester Exam:20 Marks
Tutorial: Hrs. Per week [As required]	Assignment & Quiz: 10 Marks
Practical : Hrs. Per week [N A]	End Semester Exam: 70 Marks
Credits **: 04 [FOR ALL THEORY & PRACTICALS ONE CREDIT = 25 MARKS]**	
Aim :-	
Objective :-	

S. No	
1	**To impart fundamental knowledge of the structure and functions of the human body.**
2	**To understand homeostasis mechanisms and its relation with various body systems.**
3	**To develop the knowledge regarding various tissues and organs of different systems of human body.**
4	**The knowledge imparted should help the students to understand the pharmacology of drugs.**

Pre-Requisite :- Nil

	Contents	Hrs.
Unit-1	**Cell physiology** Cell, Cell junctions, transport mechanisms, homeostasis, ion channels, secondary messengers.	03
Unit -2	**The Blood** Composition and functions of blood, RBC, WBC, platelets. Homeostasis, blood groups, mechanism of clotting. Introduction to disorders of blood.	06
Unit – 3	**Gastrointestinal tract** Structure of the gastrointestinal tract, functions of its different parts including those of liver, pancreas and gall bladder, various gastrointestinal structures and their role in the digestion and absorption of food.	04
Unit – 4	**Respiratory System** Structure of respiratory organs, functions of respiration mechanism and regulation of respiration, respiratory volumes and vital capacity.	03
Unit – 5	**Autonomic nervous system** Physiology and functions of the autonomic nervous system. Mechanism of neurohumoral transmission in ANS.	06
Unit – 6	**Sense organs** Structure and physiology of eye (vision), ear (hearing), taste buds, nose (smell) and skin.	04
Unit – 7	**Skeletal System** Structure and function of skeleton. Articulation and movement. Disorders of bones and joints.	03
Unit – 8	**Central Nervous system** Functions of different parts of brain and spinal cord. Neurohumoral transmission in the central nervous system, reflex action, electroencephalogram, specialized functions of the brain, cranial nerves and their functions.	06

Unit – 9	**Urinary System** Various parts Structure and functions of the kidney and urinary tract. Physiology of urine formation and acid base balance. Brief Introduction to disorders of kidney.	05
Unit – 10	**Endocrine Glands** Basic anatomy and physiology of pituitary, thyroid, parathyroid, adrenal glands and pancreas. Local hormones. Brief introduction to disorders of various endocrine glands.	06
Unit – 11	**Reproductive System** Structure and functions of male and female reproductive system. Sex hormones, physiology of menstrual cycle, and various stages of pregnancy and parturition.	05
Unit – 12	**Cardio vascular system** Anatomy of heart and blood vessels, physiology of blood circulation, cardiac cycle, conducting system of heart, heart sound, electrocardiogram, blood pressure and its regulation.	07
Unit – 13	**Lymphatic system** Composition, formation and circulation of lymph. Spleen and its functions.	02
	Total	**60**

Text Books:

Name of Authors	Titles of the Book	Edition	Name of the Publisher
Vander, Sherman, Luciano	Human Physiology: The Mechanism Of Body Function		McGraw Hill International
John B. West	Best And Taylor's Physiological Basis Of Medical Practice		Williams & Wilkins
Gerard J. Tortora & Bryan Derikson	Principles of Anatomy and Physiology		John Wiley and Sons, Inc
Arthur C. Guyton And John E. Hall	Text Book Of Medical Physiology		Elsevier India
Anne Waugh Allison Grant	Ross and Wilson Anatomy and Physiology in Health and Illness		Churchill Livingstone Elsevier

Reference Books : Nil

Suggested List of Laboratory Experiments : Nil

Suggested List of Assignments/Tutorial : Nil

Name of the Course : ANATOMY, PHYSIOLOGY AND HEALTH EDUCATION	
Course code: P-130	**Semester :** I
Duration : 90 Hrs.	**Maximum Marks :** 100
Teaching Scheme	**Examination Scheme**
Theory : Hrs. Per week [N A]	Mid Semester Exam: 20 Marks
Tutorial: Hrs. Per week [N A]	Assignment & Quiz: 10Marks
Practical : 06 Hrs. Per week	End Semester Exam: 70 Marks
Credits : **04 FOR ALL THEORY & PRACTICALS ONE CREDIT = 25 MARKS]**	

Aim :-

Objective :-

S. No	
1	**To impart fundamental knowledge on the structure and functions of the human body.**
2	**To understand homeostasis mechanisms and its relation with various body systems.**
3	**To develop the knowledge regarding various tissues and organs of different systems of human body.**
4	**The knowledge imparted should help the students to understand the pharmacology of drugs.**

Pre-Requisite :- Nil

	Contents	Hrs.
S. No	**Nil**	

Text Books: Nil

Reference books :

Name of Authors	Titles of the Book	Edition	Name of the Publisher

*** "It is strongly recommended that some standard book/s be used for practicals. The choice of book/s is left to the concerned teachers".**

Suggested List of Laboratory Experiments :

S. No	
1	Study of compound microscope.
2	Microscopic study of different tissues.
3	Identification of bones and points of identification.
4	Study of different systems with the help of charts and models.
5	Blood experiments: General techniques in Haemocytometry. a. Enumeration of Red Blood Corpuscles (RBC). b. Determination of White Blood Corpuscles (WBC). c. Estimation of Hemoglobin. d. Estimation of different Leukocyte Count (DLC).

	e. Estimation of Erythrocyte Sedimentation Rate (ESR). f. Determination of Blood groups. g. Determination of Bleeding & Clotting time.
6	To record human heart rate and pulse rate.
7	To study the effect of posture and exercise on blood pressure.
8	Recording of human body temperature.
9	Determination of tidal volume & vital capacity.
10	Experiments related to special senses.
Suggested List of Assignments/Tutorial : Nil	

Name of the Course : FUNCTIONAL ENGLISH AND COMMUNICATION SKILLS	
Course code: T-140	**Semester :** I
Duration : 45 Hrs.	**Maximum Marks :** 100
Teaching Scheme	**Examination Scheme**
Theory : 03 Hrs. Per week	Mid Semester Exam: 20 Marks
Tutorial: Hrs. Per week [As required]	Assignment & Quiz: 10 Marks
Practical : Hrs. Per week[N A]	End Semester Exam: 70 Marks
Credits **: 04 [FOR ALL THEORY & PRACTICALS ONE CREDIT = 25 MARKS]**	

Aim :-

Objective :-

S. No	
1	To develop the ability to speak and write grammatically corrects English.
2	To develop skill in listening comprehension.
3	To develop the ability to read, understand and express in English language.

Pre-Requisite :- Nil

	Contents	Hrs.
Unit – 1	**Applied Grammar** Remedial study of grammar, review of grammar and vocabulary. Effective use of dictionary, phonetics.	11
Unit – 2	**Reading Comprehension** To read and comprehend selected materials, articles, magazines, journals related to pharmacy.	10
Unit – 3	**Forms of Composition** Letter writing, note taking, precise writing, essay writing, anecdotal records, diary writing, reports, resume/ curriculum vitae and the likes.	10
Unit – 4	**Communication Skill** Oral report, discussion, lecture/seminar, debate, telephonic conversation.	06
Unit – 5	**Listening Comprehension** Media, audio, video, speeches and the likes.	08
	Total	**45**

Text Books:

Name of Authors	Titles of the Book	Edition	Name of the Publisher
Lesiker, Raymond. V and Maire E Hatley	Basic Business Communication		New York, Tata McGraw Hill
Hamplyons Liz & Ben Heasley	Study writing, Cambridge		Cambridge University Press
Beaumont Digty and Colin Granger	English Grammar		An International reference practice book, London, Heinmann
Elison John,	The right word at the right time A guide to the English		The Reader's Digest

	language and how to use it		
Selva Rose	Career English for nurses		Orient Longman Pvt. Ltd., Hyderabad,
Reference Books : Nil			
Suggested List of Laboratory Experiments : Nil			
Suggested List of Assignments/Tutorial : Nil			

Name of the Course : REMEDIAL MATHEMATICS	
Course code: T-150	**Semester :** I
Duration : 45 Hrs.	**Maximum Marks :** 100
Teaching Scheme	**Examination Scheme [College examination]**
Theory : 03 Hrs. Per week	Mid Semester Exam: 20 Marks
Tutorial: Hrs. Per week [As required]	Assignment & Quiz: 10 Marks
Practical : Hrs. Per week [N A]	End Semester Exam: 70 Marks
Credits **: 04 [FOR ALL THEORY & PRACTICALS ONE CREDIT = 25 MARKS]**	

Aim :-

Objective :-

S. No	
1	**To give broad understanding of mathematical aspects having usefulness in understanding expressions encountered in various subjects during the course.**
2	**To provide basic ideas of matrices, determinants, & fundamentals of calculus.**
3	**To develop the ability to solve simple to moderate problems with reference to Sr. no. 2.**
4	**To establish a bridge between mathematics and applications to Pharmacy.**

Pre-Requisite :-

S. No	
1.	Biology at 10+2 level

Contents		Hrs.
Unit – 1	**Significant figure** Fraction, exponents, power and roots, Ratio & proportions logarithms.	04
Unit – 2	Matrixes and determinants	05
Unit – 3	**Graphs and Equation** Solving simple equations using graphs. Solving simultaneous and quadratic equations.	05
Unit – 4	**Relations and Functions** Concept of proportions, introduction to functions, exponential and log functions, meaning of log and linear forms.	04
Unit – 5	Fundamentals of trigonometry and geometry	04
Unit -6	**Sequences and series** Patternsandformulae,arithmeticprogressions,geometric progression, partial fractions.	06
Unit -7	**Binomial series** Binomial series for positive whole number and applications of binomial series and selections.	06
Unit -8	**Calculus** Functions and limits, Derivatives, Integral calculus, introductory aspects of Laplace transformation.	05
Unit-9	**Integral calculus** Integration by decomposition, by substitution, by parts and by successive reduction, integration of algebraic rational function, integration of trigonometric function	06

	Total	**45**

Text Books:

Name of Authors	Titles of the Book	Edition	Name of the Publisher
Grewal B. S.	Numerical Methods		Khanna Publishers
Steve Dobbs & Jane Miller	Advanced Level Mathematics Statistics		Cambridge University Press
Adams Dany Spencer	Laboratory Mathematics		Carrol & Graphs
Jenny Olive	Maths. A Students Survival Guide		Cambridge University Press
James R Barrante	Applied Mathematics for Physical Chemistry (II ED.)		Prentice Hall Incorporations.

Reference Books : Nil

Suggested List of Laboratory Experiments : Nil

Suggested List of Assignments/Tutorial : Nil

Name of the Course : REMEDIAL BIOLOGY	
Course code: T-151	**Semester :** I
Duration : 30 Hrs.	**Maximum Marks :** 50
Teaching Scheme	**Examination Scheme [College examination]**
Theory : 02 Hrs. Per week	Mid Semester Exam: 10 Marks
Tutorial: Hrs. Per week [As required]	Assignment & Quiz: 10 Marks
Practical : Hrs. Per week [N A]	End Semester Exam: 30 Marks
Credits : **02 [FOR ALL THEORY & PRACTICALS ONE CREDIT = 25 MARKS]**	

Aim :-

Objective :-

S. No	
1	**To understand the nature of biological population**
2	**To provide general knowledge of environmental effects and behavior**
3	**To introduce learner towards the organizational and functional aspects of lower animals**
4	**To introduce students towards the structural and functional aspects of plants kingdom**

Pre-Requisite :-

S. No	
1.	Mathematics at 10+2 level

Contents		Hrs.
Unit – 1	**Plant Cell** It's structure and living and non-living inclusions. Plant cell division. Different types of plant tissues and their functions.	04
Unit – 2	Morphology and Histology of plant parts; Root, stem, bark, wood, leaf, flower, fruit and seed. Modifications of roots and stems.	04
Unit – 3	**Plant Taxonomy** Classification, study of the following families with special reference to Medicinally important plants: Apocynaceae, Solanaceae, Umbelliferae, Abiatae, Leguminosae, and Liliaceae.	05
Unit – 4	**Animal cell** Structure, living and non-living inclusions. Animal cell division. Different types of cells and tissues, their functions.	04
Unit – 5	Study of comparative anatomy of different vertebrates – fish, amphibians, reptiles, aves and mammals.	04
Unit -6	Basic study of the following systems of frog GI, nervous, cardiovascular: genitourinary, musculo-skeletal, respiratory systems.	05
Unit -7	Fundamentals of parasitology Life cycles of some animal parasites that cause human disease - Malarial and filarial parasites and tape worm.	04
	Total	30

Text Books:

Name of Authors	Titles of the Book	Edition	Name of the Publisher
Dutta A.C.	Botany for Degree students		Oxford

Marshall & Williams	Text Book of Zoology		CBS Publishers & Distributors
A. Fahn	Plant Anatomy		Aditya Books Private Limited
Weiz Paul B	Laboratory Manual in Science of Biology		Mc Graw-Hill book company
Reference Books : Nil			
Suggested List of Laboratory Experiments : Nil			
Suggested List of Assignments/Tutorial : Nil			

Name of the Course : REMEDIAL BIOLOGY	
Course code: P-151	**Semester :** I
Duration : 90 Hrs.	**Maximum Marks :** 50
Teaching Scheme	**Examination Scheme [College examination]**
Theory : Hrs. per week [N A]	Mid Semester Exam: 10 Marks
Tutorial: Hrs. Per week [N A]	Assignment & Quiz: 10 Marks
Practical : 03 Hrs. Per week	End Semester Exam: 30 Marks
Credits: **02 [FOR ALL THEORY & PRACTICALS ONE CREDIT = 25 MARKS]**	

Aim :-

Objective :-

S.No	
1	To familiarize students with different morphological characters of plant parts.
2	To train the students for making slides of various dissected plant parts.
3	To impart training on identification of different components from the slides.

Pre-Requisite :- Nil

Contents		Hrs.
S. No	**Nil**	

Text Books:- Nil

Reference books :

Name of Authors	Titles of the Book	Edition	Name of the Publisher

***"It is strongly recommended that some standard book/s be used for practicals. The choice of book/s is left to the concerned teachers".**

Suggested List of Laboratory Experiments :

S. No	
1	Morphology of plant parts indicated in theory.
2	Care, use and type of microscopes.
3	Gross identification of slides of structure and life cycle of lower plants, animals mentioned in theory.
4	Morphology of plant parts indicated in theory.
5	Preparation, microscopic examination of stem, root and leaf of monocot and dicot Plants.
6	Structure of human parasites and insects mentioned in theory with the help of specimens.

Suggested List of Assignments/Tutorial : Nil

Name of the Course : MICROBIOLOGY	
Course code: T-210	**Semester :** II
Duration : 60 Hrs.	**Maximum Marks :** 100
Teaching Scheme	**Examination Scheme**
Theory : 04 Hrs. Per week	Mid Semester Exam: 20 Marks
Tutorial: Hrs. Per week [As required]	Assignment & Quiz: 10 Marks
Practical : Hrs. Per week [N A]	End Semester Exam: 70 Marks
Credits : **04 [FOR ALL THEORY & PRACTICALS ONE CREDIT = 25 MARKS]**	

Aim :-

Objective :-

S. No	
1	To emphasize microbiological aspects of Pharmaceutical importance.
2	To deal with the various aspects of microorganisms, their classification cultivation, identification etc.
3	To provide the thorough knowledge of disinfection and sterilization methods.
4	To give an idea regarding immunological aspects, their significance.
5	To outline the importance of subject in useful diagnostic tests.
6	To provide the knowledge about the use of microbiological techniques in quantification/standardization of selected Pharmaceuticals.
7	To help in providing idea about infectious diseases diagnosis and their control.

Pre-Requisite :- Nil

	Contents	Hrs.
Unit -1	**Introduction to Microbiology** Scope and application to pharmacy field. Whittaker's Five Kingdom concept, historical development – biogenesis vs. a biogenesis, Germ theory of fermentation, Germ theory of disease, contribution of Leeuwenhoek, Robert Koch, Jenner, Louis Pasteur and Ehrlich.	02
Unit -2	**Microscopy and staining technique** Principle, ray diagram, construction, working and applications of light compound, dark field, phase contrast, Fluorescence & electronmicroscope.Concept ofresolvingpower, Magnification power, numerical aperture and angular aperture and working distance. Principle application of oil immersion microscopy. Theory of staining, principle and technique of staining procedure – Monochrome, Gram, acid fast, negative, capsule, endospore.	05
Unit – 3	**Biology of Microorganisms** Cultural characteristics, pure culture techniques a) Bacteria – Morphology and fine structure of bacteria, Nutritional requirement and type of culture media, growth and growth curve of bacteria, physical condition for growth, measurement of bacterial growth (Counting Methods), Reproduction in bacteria, genetic exchange – transformation, conjugation,and transduction, developmentofdrug resistance by recombination and mutation, preservation of bacterial culture. Biochemical properties (sugar fermentation and IMVIC test). Pathogenesis of staphylococcus, Mycobacterium. Salmonella Introductory study of disease causing rickettsia, importance of actinomycetes in antibiotic production.	07

Unit – 4	**Fungi and Viruses** b) Fungi :- Introduction, general characteristics, morphology, industrial and medical significance of Saccharomyces Cerevisae, Penicillium and Aspergillus, Candida Albicans, Epidermophyton and trichophyta. c) Viruses:- Introduction, structure and general properties Bacteriophages – Lytic and Lysogenic cycle, Epidemiological uses of Bacteriophages, human viruses – Cultivation and Multiplication virus host cell interaction, Pathogensis of HIV and Prions, types of Tumor viruses	05
Unit – 5	**Aseptic Technique** Omnipresence of microoganisms, importance of asepsis, sources of contamination and methods of prevention, Principle, construction & working of laminar airflow bench.	03
Unit – 6	**Sterilization & Disinfection** a) Concept and classification, principle and methods of sterilization, Mechanisms of cell injury. b) Construction working & applications of moist heat & dry heat sterilizer, gamma radiation sterilizer, filtration sterilizer. indicators of sterilization, microbial death, kinetic terms-D value, z value c) Terminology of chemical antimicrobial Agents, Chemical classification of different disinfectants, characteristics of idealdisinfectants,factors affecting actionof disinfectants, evaluation methods (RW Coeff), Kelsey Sykes test, Chick Martin test.	06
Unit – 7	**Microbial spoilage** Types of spoilage, factors affecting spoilage of pharmaceutical products.	02
Unit – 8	**Immunology and health** a) Host parasite Relationship :- normal microbial flora of human body, infection vs. disease, Pathogenicity vs. Virulence, Koch & Rivers Postulates, Reservoir of infection-sources of infection, Portals of Entry, Portals of exit, vectors of infection, communicability of disease, recognized symptoms of microbial disease, classification of immunity • External defense mechanism of host: Skin, Mucus membrane, chemical Secretions, Naturally occurring microbial flora • Internal defense Mechanism : Inflammation, fever, naturalkiller Cells, Phagocytic Cells,Soluble mediators-complement Lymphokines, Interferons b) Immune response : • Specific immunity & immune response • Humoral immunity antibody response, mediators ofHumoralimmunity, basic structure of antibody,antibodyclasses& functions, maturation of immune response, immunologic memory • Antigens : specificity & Immunogenicity, Natural vs.artificialAntigens,Soluble, cellular antigens, thymus independent antigen, adjuvant. • hypersensitivity : -Immediate-type or anaphylaxis (type I) -Compliment mediated or cytolytic hypersensitivity (type II) -Immune complexorarthrus hypersensitivity (type III) -Delayed orcellmediated hypersensitivity (type IV) • Cellular immunity -Transplantation immunity -Cellular immunity to viruses -Implications of T-cell response • Acquisition of specific immunity : natural vs. Passive acquisition c) Practical aspects of immunity • Measurement of humoral immunity (antibodies) - Precipitation tests,	22

	Agglutination tests, RIA, ELISA, immune fluorescence • Production of monoclonal antibodies • Measurementofcellmediatedimmunity - Intradermaltests,testsformigration, mixed lymphocyte reaction (MLR), Cell mediated toxicity (CMT)	
Unit – 9	**Vaccines & Sera** Manufacturing (seed lot system) and quality control of bacterial vaccines & Toxoids (Tetanus, TAB, Cholera, BCG, DPT), Viral vaccine (Polio- Salk Sabin, Rabies, MMR, Hepatitis, Chickenpox,influenza),Antisera(diphtheria, tetanus), antiviral Antisera (rabies). preparation of allergenic extracts & diagnostics	06
Unit – 10	**Microbial Assay** Importance, general methods of assay of antibiotics (Cup & plate method, paper disc method, turbidometry, dilution method), methods for fungicidal & antiviral compounds, assay, microbial limit tests.	02
	Total	**60**

Text Books:

Name of Authors	Titles of the Book	Edition	Name of the Publisher
Martin Frobisher	Fundamentals of Microbiology		WB Saunders Co.
Schlegel H.G.	General Microbiology		Cambridge University Press
Pelczar M.J. & Chan E.C.	Microbiology		Tata McGraw Hill
Tortora G. J.	Microbiology : An Introduction		Benjamin Cumming Corp.
Stephen P. Denyer	Hugo and Russes's Pharmaceutical Microbiology		Willey Blackwell

Reference Books : Nil

Suggested List of Laboratory Experiments : Nil

Suggested List of Assignments/Tutorial : Nil

Name of the Course : MICROBIOLOGY	
Course code: P-210	**Semester :** I
Duration : 90 Hrs.	**Maximum Marks :** 100
Teaching Scheme	**Examination Scheme**
Theory : Hrs. Per week [N A]	Mid Semester Exam: 20 Marks
Tutorial: ---Hrs. Per week [N A]	Assignment & Quiz: 10 Marks
Practical : 06 Hrs. Per week	End Semester Exam: 70 Marks
Credits : **04 [FOR ALL THEORY & PRACTICALS ONE CREDIT = 25 MARKS]**	

Aim :-

Objective :-

S. No	
1	**To make students understand the omnipresence of microorganisms.**
2	**To study different properties of some of the microorganisms.**
3	**To train students on various methods for growing bacteria.**
4	**To acquaint students with different techniques used for maintaining sterility.**

Pre-Requisite :- Nil

Text Books: Nil

Reference books :

Name of Authors	Titles of the Book	Edition	Name of the Publisher

"It is strongly recommended that some standard book/s be used for practicals. The choice of book/s is left to the concerned teachers".

Suggested List of Laboratory Experiments :

S. No	
1	To demonstrate the omnipresence of microorganisms.
2	To study the principle and working of microscope and other laboratory equipments.
3	To study the principle and working of laminar airflow.
4	To Study cultural characteristics of microorganisms.
5	To identify isolated bacteria by simple, negative, gram staining and spore staining. Study of Aspergillus and Penicillium with respect to morphology (Wet mount techniques.)
6	To observe motility of bacteria by hanging drop techniques.
7	To prepare and sterilize nutrient broth, nutrient agar, slants, stabs and plates.
8	To study different techniques of Inoculation of culture on different types of media.
9	To isolate pure culture by streak plate technique.
10	To isolate pure culture by pour plate techniques.
11	To study growth of Fungi on Sabroud's agar and Czepodox agar medium.
12	To determine microbial count of air by any suitable method.
13	To determine thermal death temperature and time.
14	To determine phenol coefficient of disinfectant by P.W. coefficient.

15	To study sterility testing of following as per. I.P. : a) Water for injection. b) Ophthalmic preparations.
16	To carry out antibiotic assays of penicillin & streptomycin or some suitable antibiotic.
17	To carry out vitamin B_{12} bioassay.
18	To determine MIC (Minimum Inhibitory concentration) of an antibacterial agent.
19	To study a) antibacterial b) antifungal activity of any medicinal plant.
20	To study microbial limits of the following as per I.P. procedure. a) Aluminum hydroxide gel. b) Starch. C) Talc
21	To demonstration serological test (Widal Test, VDRL Test).
Suggested List of Assignments/Tutorial : Nil	

Name of the Course : PHARMACEUTICS – I	
Course code: T-220	**Semester :** II
Duration : 60 Hrs.	**Maximum Marks :** 100
Teaching Scheme	**Examination Scheme**
Theory : 04 Hrs. per week	Mid Semester Exam: 20 Marks
Tutorial: --Hrs. Per week [As required]	Assignment & Quiz: 10 Marks
Practical : -- Hrs. Per week [N A]	End Semester Exam: 70 Marks
Credits : **04 [FOR ALL THEORY & PRACTICALS ONE CREDIT = 25 MARKS]**	

Aim :-

Objective :-

S. No	
1	**To provide the overview of Pharmacy discipline and its development.**
2	**To introduce students towards various dosage forms, systems of medicine and their therapeutic importance.**
3	**To expose learner to the formulation methodology of galanicals.**

Pre-Requisite :- Nil

	Contents	Hrs.
Unit -1	**Pharmacy Profession** Pharmacy as a career, evaluation of Pharmacy, earlier period middle to modern ages.	02
Unit -2	**Introduction to Pharmaceuticals** Definition, importance of pharmaceuticals, areas concerned, scope of Pharmaceutics, history and development of profession of Pharmacy and Pharmaceutical industry in India. A brief review of present Indian Pharma. Industry in global perspective.	02
Unit – 3	**Introduction to dosage form** Definition of drug. New drug and dosage form. The desirable properties of a dosage form, the need of dosage form. Ideas about available type of dosage forms and new drug delivery system.	03
Unit – 4	**Route of administration** Route of administration with respect to dosage form design, physiological consideration for various routes of administration.	04
Unit – 5	**ADME** Scheme of fate of dosage form after its administration. Definition and introduction to concept of absorption, distribution, biotransformation and elimination of drug. Introduction to bioavailability and various equivalence referring plasma time profile of drug.	04
Unit – 6	**Sources of drug information** Introduction to Pharmacopoeia with reference to IP, BP, USP and International Pharmacopeia. Study of structure / features (index) general notice and compartment of monographs of excipients, drug and drug product. Other sources. textbooks, journals, internet (drug information system, online database, patient/ consumer information and non- print material. Classification of information, primary, secondary and tertiary. Nomenclature of drug.	04
Unit – 7	**Allopathic dosage form**	10

	Merits / demerits, importance, formulation development – vehicles / excipients with examples for the dosage form : liquid dosage form: monophasic liquid dosage form. Aromatic waters, syrup, elixir, linctus, lotion,liniment, glycerites, solutions, spirits, ENTpreparations,mixtures,paints, mouthwash.	
Unit – 8	**Crude extract** Infusion, decoction, maceration, percolation, tincture and extract. Methods of preparations of dry, soft and liquid extract.	05
Unit – 9	**Allergenic extract** Types of allergens, preparation of extract, testing and standardization of extracts.	04
Unit – 10	**Ayurvedic system of medicine** Theory, basic concept, diagnosis, various branches of treatment in ayurveda, types of drug formulation in Ayurveda and important Ayurvedic drugs and their uses, formulation of asavas, arishtas, watika, churna, tailas, ghruta, lep.	05
Unit – 11	**Homeopathic system of medicine** Theory, basic concept, diagnosis, treatment, source of homeopathic medicines and important homeopathic drugs and their uses.	03
Unit – 12	**Biological products** Absorbable and non-absorbable material types, sutures and ligatures, processing. manufacturing, sterilization, packing, QC tests of materials like catgut and nylon	03
Unit – 13	**GMP** Introduction to GMP, QC and QA	04
	Total	**60**

Text Books:

Name of Authors	Titles of the Book	Edition	Name of the Publisher
Ansel's	Introduction to Pharmaceutical dosage forms & Drug Delivery Systems		B. I. Warly Pvt. Ltd.
M. E. Aulton	Pharmaceutics the Science of dosage form Design		Churchill Livingstone
Ginnaro A.R.	Remington's Pharmaceutical Sciences		Mark Publications
Govt. of India	Indian Pharmacopoeia		The Controller of Publication, New Delhi
B. P. Commission	British Pharmacopoeia		H.M.S.O. London
Walter Lund	British Pharmaceutical Codex		The Pharma London
US Govt.	United States sPharmacopoeia		U.S. Govt.
	National Formulary		Royal London
Shivarajan V. V	Ayurvedic Drugs And Their Plant Sources		Oxford and IBH
Mandal P. P.	Text Book Of Homeopathic Pharmacy		New Central Book Agency

Reference books : Nil

Suggested List of Laboratory Experiments : Nil

Suggested List of Assignments/Tutorial : Nil

Name of the Course : PHARMACEUTICS – I	
Course code: P-220	**Semester :** II
Duration : 90 Hrs.	**Maximum Marks :** 100
Teaching Scheme	**Examination Scheme**
Theory : -- Hrs. Per week [N A]	Mid Semester Exam: 20 Marks
Tutorial: -- Hrs. Per week [N A]	Assignment & Quiz: 10 Marks
Practical : 06 Hrs. Per week	End Semester Exam: 70 Marks
Credits : **04 [FOR ALL THEORY & PRACTICALS ONE CREDIT = 25 MARKS]**	

Aim :-

Objective :-

S. No.	
1	**To train students in preparation of simple dosage forms.**
2.	**To train students on dose calculations of some of the dosage forms.**
3.	**To make students familiar with different packaging materials used in dosage forms packaging.**

Pre-Requisite :- Nil

Contents		Hrs.
S. No	**Nil**	

Text Books: Nil

Reference books :

Name of Authors	Titles of the Book	Edition	Name of the Publisher

"It is strongly recommended that some standard book/s be used for practicals. The choice of book/s is left to the concerned teachers"

Suggested List of Laboratory Experiments :

S. No	
1	To study monograph from latest edition of Indian Pharmacopoeia (Chemical / Raw material /Formulation)
2	Preparation of Following classes of products involving the metrology calculation (2 to 4 each) 1. Aromatic water 2. Solution a) Aqueous iodine solution I.P. b) Strong iodine solution I.P. c) Strong ammonium acetate solution I.P. d) Cresol with soap solution I.P. e) Surgical soda solution I.P. 3. Spirits 4. Glycerin 5. Syrup 6. Elixirs 7. Lotion 8. Liniment 9. Ear drops 10. Nasal drops 11. Tinctures
3	Determination of bulk and tap density of Pharmaceutical solids

4	Calculation of displacement value and preparation of suppository
5	Determination of particle size by optical method
6	Determination of particle size by sieving method
7	Evaluation of material using Pharmaceutical packaging
8	Preparation of labels of different formulations
Suggested List of Assignments/Tutorial : Nil	

Name of the Course : ORGANIC CHEMISTRY – I	
Course code: T-230	**Semester :** II
Duration : 60 Hrs.	**Maximum Marks :** 100
Teaching Scheme	**Examination Scheme**
Theory : 04 Hrs. Per week	Mid Semester Exam: 20 Marks
Tutorial: Hrs. Per week [As required]	Assignment & Quiz:10 Marks
Practical : Hrs. Per week N A]	End Semester Exam:70 Marks
Credits : **04[FOR ALL THEORY & PRACTICALS ONE CREDIT = 25 MARKS]**	
Aim :-	
Objective :-	

S. No	
1	**To impart a review of structural aspects of organic compounds & learn arrow based reaction mechanisms.**
2	**To develop understanding of scientific nomenclature of organic compounds.**
3	**To develop the ability to understand chemical reactions related to various functional groups of carbon, oxygen, nitrogen and halogens.**

Pre-Requisite :- Nil

	Contents	Hrs
Unit -1	**General principles** A brief review of classification & sources of organic compounds, sp^3, sp^2, sp hybridization, sigma & pi- bonds, bond lengths, bond angles & bond energies along with their significance in reactions should be carried out. An overview of bond polarization, hydrogen bonds, inductive effects, resonance, and hyper conjugation be taken. Concept of homolytic & heterolytic bond fission, acidity & basicity with different theories should be covered briefly. Ease of formation & order of stabilities of electron deficient & electron rich species along with the reasons for the same should be covered.Relationshipsbetweenenergycontent, stability, reactivity & their importance in chemical reactions should be covered. Calculations for determining empirical & molecular formula should be covered.	06
Unit -2	**Different classes of compounds** The following classes of compounds should be taught in detail with respect to their IUPAC / systematic nomenclature, industrial [wherever applicable] & laboratory methods of preparations, physical properties & chemical reactions with emphasis on reaction mechanisms [arrow based] & stereochemistry [wherever applicable]. • Alkanes [including cyclic compounds] • Alkenes [including cyclic compounds] • Alkynes [only open chain compounds] • Aliphatic hydroxyl compounds • Alkyl halides • Aldehydes & ketones • Carboxylic acids • All functional derivatives of carboxylic acids	03 03 03 03 05 06 04 06
Unit – 3	**Protection & deprotection of groups** Introduction to protection & deprotection of functional groups. Two examples each	03

	for amino, hydroxyl, & carbonyl groups. The significance of these in syntheses should be explained.	
Unit – 4	**Aromaticity & aromatic chemistry** Concept of aromaticity, Huckel's rule & its use in determining the aromatic / non-aromatic character of a compound. A brief coverage of structure of benzene. Detailed coverage of electophilic & nucleophilic aromatic substitution reactions. Reactivity & orientation in these reactions. Reactivity & orientation in mono- & disubstituted benzenes. Benzyne mechanism.	06
Unit – 5	**Different aromatic classes of compounds** The following classes of compounds should be taught in detail with respect to their IUPAC / systematic nomenclature, industrial [wherever applicable] & laboratory methods of preparations, physical properties & chemical reactions with emphasis on reaction mechanisms [arrow based] & stereochemistry [wherever applicable]. • Aromatic hydrocarbons. • Phenolic compounds. • Aromatic & aliphatic amines. • Diazonium salts. • Aromatic nitro- compounds, aryl halides, & ethers.	02 03 03 04 01 02
	Total	**60**

Text Books:

Name of Authors	Titles of the Book	Edition	Name of the Publisher
Morrison R. T. & Boyd R. M.	Organic Chemistry		Prentice Hall Of India, New Delhi -110 001
Hendrickson J. B., Cram D. J., and Hammond G. S	Organic Chemistry		McGraw Hill, Kogakusha Ltd., New Delhi
Finar I. L.	Organic Chemistry (Vol. I and II)		Longman Group Ltd., England, ELBS Series
Norman R. O.	Principles of Organic Synthesis		Chapman & Hall
Carey F. A.	Organic Chemistry		The McGraw Hill Companies Ltd., New York.
Cleyten, , W arren, Worruther,	Organic Chemistry		

Reference Books : Nil

Suggested List of Laboratory Experiments : Nil

Suggested List of Assignments/Tutorial : Nil

Name of the Course : ORGANIC CHEMISTRY – I	
Course code: P-230	**Semester :** II
Duration : 90 Hrs.	**Maximum Marks :** 100
Teaching Scheme	**Examination Scheme**
Theory : Hrs. Per week [N A]	Mid Semester Exam: 20 Marks
Tutorial: Hrs. Per week [N A]	Assignment & Quiz: 10 Marks
Practical : 06 Hrs. Per week	End Semester Exam: 70 Marks
Credit : **04**	

Aim :-

Objective:-

S. No	
1.	**To impress upon students the importance of various safety issues involved in a chemical laboratory & first aid to be given in case of an chemical accident.**
2	**T o train students in determining various physico chemical constants of a compound.**
3	**To train students in using different purification techniques necessary in a chemistry.**

Pre-Requisite :- Nil

Text Books: Nil

Reference books :

Name of Authors	Titles of the Book	Edition	Name of the Publisher

"It is strongly recommended that some standard book/s be used for practicals. The choice of book/s is left to the concerned teachers".

Suggested List of Laboratory Experiments :

S. No	
1	Safety in laboratories. Precautions in handling chemicals, fire hazards with solvents, hair, etc. First aid in all such unfortunate accidents.
2	Determination of physical constants like melting points, boiling points, etc.
3	Demonstration of filtration techniques, sodium fusion technique.
4	Experiments on different purification techniques like a] use of charcoal, b] recrystallization [including criteria for selection of various solvents], c] simple distillation, d] demonstration of vacuum & steam distillations, fractional distillation if feasible, e] sublimation.
5	Element detection [N, S, X except F].
6	Detection of various functional groups.
7	Preparation of different derivatives & their significance.
8	Identification of acidic, basic & neutral solids & liquids [low to high boiling compounds] containing mono- & difunctional groups. Single step synthesis involving O- & N- acylation.
9	Nitration of bromobenzene & nitrobenzene. Comparison of reactivity of these two starting materials with benzene.
10	Oxidations using "Cr" salts & alkaline $KMnO_4$ [any one].
11	Hydrolysis of esters & / or amides [acid & / or base catalyzed, any one].

Suggested List of Assignments/Tutorial : Nil

Name of the Course : ENVORNMENTAL SCIENCES	
Course code: T-240	**Semester :** II
Duration : 30 Hrs.	**Maximum Marks :** 50
Teaching Scheme	**Examination Scheme**
Theory : 02 Hrs. Per week	Mid Semester Exam: 10 Marks
Tutorial: Hrs. Per week [As required]	Assignment & Quiz: 10 Marks
Practical : Hrs. Per week [N A]	End Semester Exam: 30 Marks
Credits : **02 [FOR ALL THEORY & PRACTICALS ONE CREDIT = 25 MARKS]**	

Aim :-

Objective :-

S No	
1	**To study the importance of environmental science and environmental studies**
2	**To know the importance of key to the future of mankind.**
3	**To study continuing problems of pollution, loss of forest, solid waste disposal, degradation of environment, issues like economic productivity and national security.**
4	**Study of Global warming, the depletion of ozone layer and loss of biodiversity, & its impact on environmental issues.**

Pre-Requisite :- Nil

	Contents	Hrs.
Unit -1	**Multidisciplinary nature of environmental studies** Definition, scope and importance. Need for public awareness.	04
Unit -2	**Natural Resources** Renewable and non-renewable resources : Natural resources and associated problems. 1) Forest resources: Use and over-exploitation, deforestation, case studies. 2) Timber extraction, mining, dams and their effects on forest and tribal people. 3) Water resources : Use and over-utilization of surface and ground water, 4) Floods, drought, conflicts over water, dams-benefits and problems. 5) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. 6) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. 7) Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies. 8) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. a. Role of an individual in conservation of natural resources. b. Equitable use of resources for sustainable lifestyles	10
Unit – 3	**Ecosystems** Concept of an ecosystem. 1. Structure and function of an ecosystem. 2. Producers, consumers and decomposers.	08

	3. Energy flow in the ecosystem. 4. Ecological succession. 5. Food chains, food webs and ecological pyramids. 6. Introduction, types, characteristic features, structure and function of the following ecosystems:- a. Forest ecosystem. b. Grassland ecosystem. c. Desert ecosystem. d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).	
Unit – 4	**Biodiversity and its conservation** 1. Introduction: – Definition: genetic, species and ecosystem diversity. 2. Biogeographical classification of India 3. Value of biodiversity : consumptive use, productive use, social, ethical, aesthetic and option values 4. Biodiversity at global, National and local levels. 5. India as a mega-diversity nation 6. Hot-spots of biodiversity. 7. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. 8. Endangered and endemic species of India. 9. Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.	08
Unit – 5	**Environmental Pollution** Definition 1. Causes, effects and control measures of : a. Air pollution. b. Water pollution. c. Soil pollution. d. Marine pollution. e. Noise pollution. f. Thermal pollution & Nuclear hazards. 2. Solid waste management:- Causes, effects and control measures of urban and Industrial wastes. 3. Role of an individual in prevention of pollution. Case studies. 4. Disaster management:- Floods, earthquakes, cyclones and landslides.	09
Unit – 6	**Social Issues and the Environment** From Unsustainable to sustainable development 1. Urban problems related to energy 2. Water conservation, rain water harvesting, watershed management 3. Resettlement and rehabilitation of people, its problems and concerns. Case Studies. 4. Environmental ethics: Issues and possible solutions. 5. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies. 6. Wasteland reclamation. 7. Consumerism and waste products. 8. Environment Protection Act. 9. Air (Prevention and Control of Pollution) Act. 10. Water (Prevention and control of Pollution) Act 11. Wildlife Protection Act 12. Forest Conservation Act 13. Issues involved in enforcement of environmental legislation. Public awareness	09
Unit – 7	**Human Population and the Environment** Population growth, variation among nations. 1. Population explosion – Family Welfare Programmes.	06

	2. Environment and human health. 3. Human Rights. 4. Value Education. 5. HIV/AIDS. 6. Women and Child Welfare. 7. Role of Information Technology in Environment and human health. Case Studies.	
Unit – 8	**Field work** 1. Visit to a local area to document environmental assets, /river/forest/grassland/hill/mountain. 2. Visit to a local polluted site-Urban/Rural/Industrial/Agricultural. 3. Study of common plants, insects, birds. 4. Study of simple ecosystems-pond, river, hill slopes, etc.	06
	Total	60

Text Books:

Name of Authors	Titles of the Book	Edition	Name of the Publisher
Brunner R.C.	Hazardous Waste Incineration,		McGraw Hill Inc.
Gleick H.P	Water in crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute		Oxford Univ. Press
Hawkins R.E	Encyclopedia of Indian Natural History		Bombay Natural History Society, Bombay (R)
Heywood V.H & Waston R.T.	Global Biodiversity Assessment.		Cambridge Univ. Press
Mckinney M.L. & School R.M.	Environmental Science systems & Solutions,		Web enhanced edition. 639p.
Odum E.P.	Fundamentals of Ecology		W.B. Saunders Co. USA,

Reference books : Nil

Suggested List of Laboratory Experiments : Nil

Suggested List of Assignments/Tutorial : Nil

Name of the Course : PHYSICAL PHARMACY	
Course code: T-310	**Semester :** III
Duration : 60 Hrs.	**Maximum Marks :** 100
Teaching Scheme	**Examination Scheme**
Theory : 04 Hrs. Per week	Mid Semester Exam: 20 Marks
Tutorial: -- Hrs. Per week [As required]	Assignment & Quiz: 10 Marks
Practical : ---Hrs. Per week [N A]	End Semester Exam: 70 Marks
Credit : **04 [FOR ALL THEORY & PRACTICALS ONE CREDIT = 25 MARKS]**	

Aim :-

Objective :-

S. No	
1	To establish relationship between chemical nature and physical properties of the molecules.
2	To understand the importance of physicochemical properties of the materials in pharmaceutical discipline.
3	To develop the concepts of applying knowledge of physicochemical properties of material in development of stable and effective dosage form.

Pre-Requisite :- Nil

	Contents	Hrs.
Unit -1	**Matter, properties of matter** States of matter, change in the state of matter, latent heat and vapor pressure, sublimation-critical point, eutectic mixtures, gases, aerosols- inhalers, relative humidity, liquid complexes, liquid crystals, glasses state, solid crystalline and amorphous polymorphism.	07
Unit-2	**Micromeritics and powder rheology** Particle size and distribution, average particle size number and weight distribution, particle number, method of determining particle size and volume, optical microscopy, sieving, sedimentation, determining surface areas, permeability, adsorption, derived properties of powders, porosity, packing arrangement densities, bulkiness and flow properties.	08
Unit – 3	**Surface and interfacial phenomenon** Liquid interface, surface and interfacial tensions, surface free energy, measurement of surface and interfacial tension, spreading coefficient, adsorption and liquid interfaces, surface active agents, HLB classification, solubilization, detergency, absorption at solid interfaces, solid gas and solid liquid interfaces, complex films, electrical properties of interfaces.	09
Unit – 4	**Viscosity and rheology** Newtonian systems, law of flow, kinematics viscosity, effect of temperature, non Newtonian systems, pseudoplastics, dilatant, plastic, thixotropy in formulations, determination of viscosity and thixotropy by capillary, falling ball, rotational viscometer, application of theology in pharmacy.	07
Unit – 5	**Dispersion systems** **a.** Colloidal dispersions: Definition, types, properties of colloids, protective colloids, application of colloids in pharmacy. **b.** Suspensions and emulsions: Interfacial properties of suspended particles settling	09

	in suspension, theory of sedimentation, effect of Brownian movement, sedimentation of flocculated particles, sedimentation parameters, wetting of particles, significance of electrical properties in dispersions,controlled flocculation, flocculation in structured vehicles, rheological considerations, emulsions: types, theories, physical stability.	
Unit – 6	**Complexation** Classification of complexes, methods of preparations and analysis, applications.	06
Unit – 7	**Buffer** Buffer equations and buffer capacity in general. Buffers in pharmaceutical systems, preparations and stability, buffered isotonic solutions. Measurements of tonicity calculations and methods of adjusting isotonicity.	05
Unit-8	**Solubility** a. Miscibility-influenceofforeignsubstances-three component systems-dielectric constant and solubility, solubilityofsolidsinliquids-ideal andnon-ideal solutions-solvation and association in solutions-solubility of salts in water-solubility of slightly soluble and weak electrolyte-calculating solubility of weak electrolytes as influenced by pH, influence of solvents on the solubility of drugs-combined effect of pH and solvents, distribution of solutes between immiscible solvents, effect of ionic dissociation and molecular association on partition, extraction, preservatives action of weak acids in emulsions, drug action and distribution co-efficient. b. Concepts of dissolution and diffusion.	09
	Total	**60**

Text Books:

Name of Authors	Titles of the Book	Edition	Name of the Publisher
Kim Cherhg Ju	Advance Pharmaceutical Physicochemical Principles		CRC Press
M. E. Aulton	Pharmaceutics: The Science of Dosage Form Design		Churchill Livingstone
Martin Alfred	Physical Pharmacy		Lippincott
Moore W.J.	Physical Chemistry		
Raymond Chang	Physical Chemistry for Biosciences		University Sciences Books
Ginnaro A. R.	"Remington: The science and Practice of Pharmacy"		Mack Publishing company.

Reference Books : Nil

Suggested List of Laboratory Experiments : Nil

Suggested List of Assignments/Tutorial : Nil

Name of the Course : PHYSICAL PHARMACY	
Course code: P-310	**Semester :** III
Duration : 90 Hrs.	**Maximum Marks :** 100
Teaching Scheme	**Examination Scheme**
Theory : Hrs. Per week [N A]	Mid Semester Exam: 20 Marks
Tutorial: Hrs. Per week[N A]	Assignment & Quiz: 10 Marks
Practical : 06 Hrs. Per week	End Semester Exam: 70 Marks
Credits : **04 [FOR ALL THEORY & PRACTICALS ONE CREDIT = 25 MARKS]**	

Aim :-

Objective :-

S.No	
1	**To train students about different techniques used in getting some of the important physical constants of a compound.**
2	**To train students on use of methods used to find physical parameters of physiological importance.**
3	**To introduce students to some of the chemical & instrumental methods of analysis.**

Pre-Requisite :- Nil

Contents		Hrs.
S. No	**Nil**	

Text Books: Nil

Reference books :

Name of Authors	Titles of the Book	Edition	Name of the Publisher

"It is strongly recommended that some standard book/s be used for practicals. The choice of book/s is left to the concerned teachers".

Suggested List of Laboratory Experiments :

S. No	
1	To determine the molecular weight of (anthracene/ phenanthrene) by Beckman's thermometer method.
2	To determine the molecular weight of nitrobenzene / toluene / aniline by steam distillation method.
3	To determine the upper convolute temperature and composition of phenol -water system.
4	To construct the ternary phase diagram of water chloroform acetic acid system.
5	To determine the heat of neutralization of strong acid and strong base.
6	To determine the refractive index and refrachor of given sample having molecular weight
7	To determine the wavelength of maximum absorption of given dye u s i n g visible spectrophotometer.
8	To determine the molecular weight of given sample using Lands Berger apparatus.
9	To determine the molecular weight of given sample by Rast's camphor method.
10	To determine the pKa of (benzoic acid / salicylic acid / any solid amine) by acid base titration.

11	To determine the solubility of benzoic acid in given solvent.
12	To determine partition coefficient of benzoic acid / salicylic acid / iodine in chloroform / benzene water system.
13	To determine the effect of potassium iodide on the solubility of iodine.
14	To study the diffusion profile of brilliant green through cellophane membrane.
15	To study the hydrogen peroxide degradation by volumetric measurement of oxygen.
16	To determine the energy of activation of methyl / ethyl acetate hydrolysis.
17	To determine the surface tension and parachore of given sample using stalagmometer.
18	To determine the specific surface of charcoal using acetic acid adsorption.
19	To determine critical micellar concentration (CMC) of given ionic surfactant by conductometric measurement.
20	To determine the effect of surfactant (tween 80) on solubility of salicylic acid.
21	To determine the effect of electrolyte on sedimentation of calamine suspension.
22	To determine the particle size distribution of an emulsion using optical microscopy.
23	To determine the particle size distribution using sieve analysis.
24	To study the effect of lubricant on flow property of given powder.
25	To determine the various densities and porosity of given powder system.
26	To determine the viscosity and rheocor of given sample of liquid.
27	To determine the molecular weight of PVP / PVA using Oswald's viscometer.
28	To determine the optical rotation of given substance.
29	To demonstrate viscosity measurement using Brookfield's viscometer.
30	To determine density/specific gravity of liquids.
Suggested List of Assignments/Tutorial : Nil	

Name of the Course : ORGANIC CHEMISTRY- II	
Course code: T-320	**Semester :** III
Duration : 60 Hrs.	**Maximum Marks :** 100
Teaching Scheme	**Examination Scheme**
Theory : 04 Hrs. Per week	Mid Semester Exam: 20 Marks
Tutorial: Hrs. Per week [As required]	Assignment & Quiz: 10 Marks
Practical : Hrs. Per week [N A]	End Semester Exam: 70 Marks
Credits **: 04 [FOR ALL THEORY & PRACTICALS ONE CREDIT = 25 MARKS]**	
Aim :-	
Objective :-	

S. No	
1	To provide advanced synthetic conversions of organic functional groups.
2	To emphasize the importance of carbonyl group in synthesis of diversified molecules.
3	To expose the students towards heterocyclic compounds & their chemistry.
4	To facilitate the concept of stereochemistry in organic compounds with respect to molecules of biological importance like carbohydrates and amino acids along with their chemistry.

Pre-Requisite :- Nil

Contents		Hrs.
Unit -1	**Polycyclic aromatic hydrocarbons** Syntheses & reactions with mechanisms of bi- & tricyclic fused carbocyclic rings like naphthalene, anthracene, & phenanthrene.	04
Unit -2	**Carbonyl chemistry** Carbonyl chemistry involving group conversions & their reaction mechanisms along with stereochemistry wherever applicable. a. Wolf-Kishner reduction & Huang-Minlong modification. b. Reduction of arylsulfonyl hydrazine / hydrazones to alkanes. c. Bamford Steven reaction. d. DCC Oxidation of alcohol. e. Michael addition / 1,4-addition / conjugate addition. f. Mannich condensation / reaction. g. Robinson annulation. h. Stobbe condensation. i. Darzen's glysidic ester synthesis. j. Beckmann rearrangement. k. Baeyer villiger rearrangement. l. Curtius, Wolff, & Lossen rearrangements. m. Willgerodt rearrangement. n. Pinacol-pinacolone rearrangement. o. Methylene transfer reactions. Use of diazomethane & sulphur ylides in the same. p. Mono- & dialkylations in 1,3-dicarbonyl compounds. q. Formation & use of enol ethers, enol acetates & enamines as protective groups & in regiospecific alkylations.	08
Unit – 3	**Heterocyclic Chemistry**	16

	IUPAC Nomenclature of heterocyclic rings [3-10 membered] containing O, S, & N atoms. Nomenclature of above rings containingmono-,di-, & multiple [same or different] heteroatoms should also be covered. Nomenclature of 2 & 3 fused rings containing mono-, di-, & multiple heteroatoms [same or different] should also be covered. Syntheses & reactions of three to six membered rings be studied in detail. Syntheses of five & six membered rings containing mono- or any di- heteroatoms [O, S, & N] should be covered. Syntheses of quinoline, isoquinoline, benzoxole, benzthiole, & benzazole, benzdiazole, benzoxazole, & benzthiazole should be studied.	
Unit – 4	**Bridged rings** Bridged ring systems & their nomenclature.	03
Unit – 5	**Kinetic & thermodynamic control** Kinetic & thermodynamic control of sulfonation, enolate anion formation & alkylation of enamine reactions.	03
Unit – 6	**Stereochemistry** Stereochemistry. Chirality & asymmetry [introduction of the same to S, P, & N]. Definition & classification [different types of isomerisms]. Enantiomers, diastereomers. Enantiomerism & diastereomerism. Meso compounds & their optical activity. Stereochemistry in acyclic compounds. Newman projection formulae & their significance. Conformational analysis of n- butane. Absolute & relative configuration. Assigning R & S configuration based on Cahn Ingold & Prelog system. Racemic mixture- its definition & resolution. Definitions of terms stereoselective, stereospecific, enantiomericexcess& distereomeric excess. Stereochemistryincyclicsystems. Conformations of cyclohexane. Cis – trans relationship in cyclohehane. Prediction of stability of different conformations of 1, 2- 1,3- & 1,4- disubstituted cyclohexanes. Effect of multiple substitutions on the stability of cyclohexane conformations. Chair conformationations of cis-,trans-decalins, perhydrophenanthrenes, & a tetracyclic steroidal nucleus. An introduction to atropisomerism.	10
Unit – 7	**Carbohydrates** Carbohydrates. Definition & classification. D & L nomenclature in sugars. Different ways of drawing / representing a sugar molecule [including cyclic Structure], interconversion of these representations. Anomers & epimers. Mutarotation. Reactions of glucose. Chain extension & chain reduction of a sugar.	05
Unit-8	**Amino acids & proteins** Amino acids & proteins. Definition & classification. D & L Amino acids, natural, essential, & non-essential amino acids. Denaturation. Strecker, Gabriel phthalamide methods for the preparation of amino acids. Peptide bond & its formation. Two protective groups each, for -NH_2 & -COOH functionalities during protein synthesis. Sequencing of a protein by chemical & enzymatic methods.	05
Unit-9	**Organometalic chemistry** Organometalic chemistry [preparation & few reactions] of Cu & boron.	02
Unit-10	**Pericyclic reactions** Pericyclic reactions. Concept of HOMO & LUMO. Drawing of HOMO & LUMO of 1, 3-butadiene, allylic cation, radical & anion, & 1, 3, 5-hexatriene. Meaning of conrotatory & disrotatory. Allowed & disallowed thermal & photochemical reactions. Introduction to sigmatropic, electrocyclic & (4n + 2) cycloaddition reactions. Cope, oxy-cope [Claisen rearrangement], Diel's-Alder & retro Diel's Alder reaction.	04
	Total	**60**

Text Books:

Name of Authors	Titles of the Book	Edition	Name of the Publisher

Morrison R. T. and Boyd R. M.	Organic Chemistry		Prentice Hall Of India Ltd., New Delhi-110 001.
Finar I. L.	Organic Chemistry (Vol. I and II)		Longman Group Ltd., London. Elbs Series.
House H. O.	Modern Synthetic Reactions		W. A. Benjamin, London
Carey F. A.	Organic Chemistry		The McGraw Hill Companies.
Pine S. H.	Organic Chemistry		Tata McGraw Hill Publishing Company.
Reference Books : Nil			
Suggested List of Laboratory Experiments : Nil			
Suggested List of Assignments/Tutorial : Nil			

Name of the Course : ORGANIC CHEMISTRY- II	
Course code: P-320	**Semester :** III
Duration : 90 Hrs.	**Maximum Marks :** 100
Teaching Scheme	**Examination Scheme**
Theory : Hrs. Per week [N A]	Mid Semester Exam: 20 Marks
Tutorial: Hrs. Per week [N A]	Assignment & Quiz: 10 Marks
Practical : 06 Hrs. Per week	End Semester Exam: 70 Marks
Credits : **04 [FOR ALL THEORY & PRACTICALS ONE CREDIT = 25 MARKS]**	

Aim :-

Objective :-

S.No	
1	**To train students on purification o different solvents used in chemical reactions.**
2	**To separate a binary mixture based on their acidic, basic properties.**
3	**To give synthesis experiments for preparation of different compounds / drug molecules & their characterization.**

Pre-Requisite :- Nil

Contents		Hrs.
S. No	**Nil**	

Text Books: Nil

Reference books :

Name of Authors	Titles of the Book	Edition	Name of the Publisher

"It is strongly recommended that some standard book/s be used for practicals. The choice of book/s is left to the concerned teachers".

Suggested List of Laboratory Experiments :

S. No	
1	Drying of solvents like ether, THF, CH_2Cl_2, $CHCl_3$, C_6H_6, hexane.
2	Separation of binary mixtures of different types based on their functional groups.
3	Combination of acids, bases & neutral compounds.
4	Solid-liquid combinations.
5	Liquid-liquid combinations.
6	Water soluble-water insoluble type.
7	Students are expected to do only the separation of the mixture. Individual compound identification is to be avoided as it is already covered earlier.
8	Diazotization & coupling reactions.
9	O, N, &/or S alkylation reactions.
10	Oxidations of alcohols & aryl alkyl hydrocarbons using "Cr" & "Mn" reagents.
11	Demo of Grignard & Friedel Craft's reactions [rxns].
12	Wolff-Kishner reduction.

13	Alpha halogenation of ketones, acid or base catalyzed.
14	Aldol, Cannizarro's rxns.
15	Pinacol-pinacolone type of preparations & rearrangements.
16	Demo of Beckman, Bayer Villegar rearrangement.
17	Preparation of iodoform from acetophenone.
18	Preparation of osazones & identification of sugars.
19	Heterocyclic synthesis. Preparation of quinoline [Skraup synthesis], isoquinoline [Bishler Napieralski or some such synthesis], indole derivatives [Fischer Indole synthesis].
Suggested List of Assignments/Tutorial : Nil	

Name of the Course : BIOTECHNOLOGY	
Course code: T-330	**Semester :** III
Duration : 60 Hrs.	**Maximum Marks :** 100
Teaching Scheme	**Examination Scheme**
Theory :04 Hrs Per week	Mid Semester Exam: 20 Marks
Tutorial: Hrs Per week [As required]	Assignment & Quiz: 10 Marks
Practical : Hrs. Per week [N A]	End Semester Exam: 70 Marks
Credits : **04 [FOR ALL THEORY & PRACTICALS ONE CREDIT = 25 MARKS]**	

Aim :-

Objective :-

S. No	
1	To impart the knowledge about tools of biotechnology useful in pharmaceutical sciences.
2	To develop theoretical and practical knowledge about tissue culture techniques.
3	To expose the students towards biotechnical process of industrial importance.

Pre-Requisite :- Nil

	Contents	Hrs.
Unit -1	**Plant Cell and Tissue Culture** Structure of plant cell, DNA, Genes and chromosomes. 1. Cell and tissue culture, a. Requirements. b. Callus culture, suspension culture, batch culture. c. Concept of somatic hybridization, somatic embryogenesis. 2. Processes and applications, a. Isolation and immobilization of enzymes and plant cells and application. b. Protoplast and cell fusion. c. Germ plasm conservation. d. Production of secondary metabolites by plant tissue culture. e. Gene transfer techniques.	06
Unit -2	**Animal Cell Culture** Introduction to animal cell culture, medium used in ATC. Use of FCS, primary culture, secondary culture, cell line. Cloning: concept and application with technical hurdles. Transgenic animals as source of food, organs and tissues, concept of xeno transplant.	06
Unit – 3	**Fermentation Technology and Industrial Microbiology** 1. Fermentation as biochemical process, types of fermentations. 2. Fermenter – working and construction, accessory components, modification. 3. Fermentation monitoring and in situ recovery of products.	08
Unit – 4	**Recombinant DNA Technology** BASIC CONCEPTS a. Introduction. d. Role of restriction endonuclease, DNA ligase, DNA polymerase, Reverse transcriptase.	06

Unit – 5	**Process and Applications** A. Constructing Recombinant DNA molecules. I. DNA Clones sources of DNA for cloning. II. DNA vectors, role of expression vectors. III. Host cell for recombinant work. IV. Method for screening and selecting transformants. V. Expression of foreign genes. VI. Uses of recombinant DNA. B. PCR and applications. Human gene therapy concept and applications. C. Drug delivery systems in gene therapy.	09
Unit – 6	**Biotechnology Derived Products** A. Sources and upstream processing. 1. Introduction. 2. Escherichia coli as a source of recombinant, therapeutic protein. 3. Additional production systems, i) Yeast. ii) Fungal production systems. iii) Transgenic animals. iv) Transgenic plants. v) Insects cell based systems. 4. Upstream processing. [Note: Time allotted for point ii and iii is 1 hr] B. Downstream processing. a. Product analysis, 1. Introduction. 2. Protein –based contaminant. 3. Removal of altered form of the protein of interest from the product stream. b. Determination of protein concentration. C. Immunological approaches to detection of contaminant, Endotoxin and other pyrogenic contaminants. i] Pyrogen detection. ii] DNA as contaminant. ii] Microbial and viral contaminant. iv] Viral assays. v] Miscellaneous contaminants. vi] . Validation studies. D. Production and purification of recombinant proteins like, Insulin, Growth hormones, somatostatin, Interferons. Only examples of recombinant blood products.	10
Unit – 7	**Proteomics** 1. Introduction 2. Genomic study, structural and functional genomes, human genome project. 3. Technologies for Proteomics. 4.Protein identification, 1-D-SDS-PAGE (1-dimensional sodium dodecyl sulfate–polyacrylamide gel electrophoresis). 2-Dimensional electrophoresis. 5. Applications of DNA and Protein Microarray Technology. 6.Pharmaceutical and Medical Application of Proteomic	08

Unit-8	**Formulation of Proteins and Peptides** 1. Introduction. 2. Making Small Protein Particles: Precipitation of proteins from Supercritical Fluids. 3. Aseptic Assembly. 4. Quality Control Issues. 5. Lyophilization (Freeze-Drying). 6. Protein Compaction.	07
	Total	**60**

Text Books:

Name of Authors	Titles of the Book	Edition	Name of the Publisher
Keshav Trehan	Biotechnology		New Age International publishers
Daan J A Crommelin and Robert D Sindelar	Pharmceutical Biotechnololgy		Taylor And Francis
Michel G. Grooves	Pharmaceutical Biotechnology		Taylor and Francis group Second ediotion
Gary Walsh	Pharmaceutical Biotechnology Concepts And Application		Wiley Interscience Ltd.
Aluizio Borem Fabrico R. Santos, David E.	Understanding Biotechnology		Bowen, , Prentice And Hall PTR

Reference books : Nil

Suggested List of Laboratory Experiments : Nil

Suggested List of Assignments/Tutorial : Nil

Name of the Course : BIOTECHNOLOGY	
Course code: P-330	**Semester :** III
Duration : 90 Hrs.	**Maximum Marks :** 100
Teaching Scheme	**Examination Scheme**
Theory : Hrs. Per week [N A]	Mid Semester Exam: 20 Marks
Tutorial: ---Hrs. Per week [N A]	Assignment & Quiz: 10 Marks
Practical : 06 Hrs. Per week	End Semester Exam: 70 Marks
Credits : **04 [FOR ALL THEORY & PRACTICALS ONE CREDIT = 25 MARKS]**	

Aim :-

Objective :-

S. No	
1	**To train students to carry out different sterilization experiments.**
2	**To train students in fermentative techniques for production of bioactive molecules.**
3	**To isolate the genetic material from various living organisms.**

Pre-Requisite :- Nil

Contents		Hrs.
S. No	**Nil**	

Text Books: Nil

Reference books :

Name of Authors	Titles of the Book	Edition	Name of the Publisher

"It is strongly recommended that some standard book/s be used for practicals. The choice of book/s is left to the concerned teachers".

Suggested List of Laboratory Experiments :

S. No	
1	Sterilization by autoclave (moist heat) and perform test for sterility by membrane filtration method.
2	Sterilization by autoclave (moist heat) and perform test for sterility by direct inoculation method.
3	Sterilization by dry heat and perform test for sterility by membrane filtration method.
4	Sterilization by dry heat and perform test for sterility by direct inoculation method.
5	Sterilization by treatment with bactericide and perform test for sterility by membrane filtration method.
6	Fermentative method of preparation of penicillin.
7	Fermentative method of preparation of L-glutamic acid.
8	Estimation of DNA by DPA Method.
9	Isolation of DNA from Fungi.
10	Production of lactic acid from lacto bacillus sporogenes.
11	Production of alcohol by fermentation techniques.
12	Immobilization of microbial cells by entrapment in sodium alginate.
13	Isolation of plasmid DNA from bacillus (using standard kit).

14	Isolation of plasmid and genomic DNA from bacterial cell using kits.
15	Isolation of RNA and proteins from E. coli, liver and plant cells.
16	Restriction endonuclease assay (using standard kit).
17	DNA Ligation assay (using standard kit).
18	Plant tissue culture callus /organ.
19	PCR demonstration.
20	Gel electrophoresis (demonstration).
Suggested List of Assignments/Tutorial : Nil	

Name of the Course : PATHOPHYSIOLOGY	
Course code: T-340	**Semester :** III
Duration : 60 Hrs.	**Maximum Marks :** 100
Teaching Scheme	**Examination Scheme**
Theory : 04 Hrs. Per week	Mid Semester Exam: 20 Marks
Tutorial: Hrs. Per week [As required]	Assignment & Quiz: 10 Marks
Practical : Hrs. Per week [N A]	End Semester Exam: 70 Marks
Credits : **04 [FOR ALL THEORY & PRACTICALS ONE CREDIT = 25 MARKS]**	

Aim :-

Objective :-

S. No	
1	To impart a thorough knowledge of pathological aspects of various conditions.
2	To generate the ability to describe etiology and pathogenesis of important diseases states.
3	To develop the ability of naming the sign and symptoms of diseases.
4.	To develop the ability to describe complications of diseases.

Pre-Requisite :- Nil

	Contents	Hrs.
Unit -1	**Basic principles of cell injury and adaptation** Causes, pathogenesis and morphology of cell injury. Abnormalities in lipoproteinemia, glycogen infiltration and glycogen storage disease.	05
Unit -2	**Basic mechanisms of inflammation and repair** Pathogeneses of inflammation. Chemical mediators in inflammation. Pathogenesis of chronic inflammation. Repair of wounds in the skin, factors influencing healing of wounds.	06
Unit – 3	**Hypersensitivity** Hypersensitivity type I, II, III, IV. Biological significance of hypersensitivity. Allergy due to food, chemicals and drugs.	04
Unit – 4	**Auto-immunity & diseases of immunity** Mechanism of autoimmunity. Classification of autoimmune diseases in man. Transplantation and allograft reactions, mechanism of rejection of allograft. Acquired Immune Deficiency Syndrome (AIDS). Amylodosis.	06
Unit – 5	**Neoplastic diseases** Disturbances of growth of cells. General biology of tumors, differences between benign and malignant tumors. Classification of tumors. Historical diagnosis of malignancy. Etiology and pathogenesis of cancer. Invasions, metastasis, patterns of spread of cancer. Environmental carcinogenesis.	08
Unit – 6	**Shock** Types, mechanisms, stages and management.	02
Unit – 7	**Biological effects of radiation** Nuclear radiation, UV, X-ray and other radiations.	01

Unit-8	**Protein calorie malnutrition, vitamins, obesity, starvation** Deficiency of vitamins, study of various syndromes due to obesity and starvation.	04
Unit-9	**Pathophysiology of common diseases** Parkinsonism. Schizophrenia. Depression and mania. Stroke (ischemic and hemorrhage). Hypertension. Angina. Myocardial infarction, CCF. Atherosclerosis. Diabetes mellitus. Peptic ulcer and inflammatory bowel disease. Cirrhosis and alcoholic liver diseases. Acute and chronic renal failure. Asthma and chronic obstructive airway diseases.	14
Unit -10	**Infectious diseases** Hepatitis – Infective hepatitis. Sexually transmitted diseases (syphilis, gonorrhea, HIV). Pneumonia, typhoid, urinary tract infections. Tuberculosis. Leprosy. Malaria. Dysentery (Bacterial and amoebic). Viral oncogenesis.	09
	Total	**60**

Text Books:

Name of Authors	Titles of the Book	Edition	Name of the Publisher
Robins Cotran Kumar	Text Book Of Robins Pathology Basis Of Disease		Prism Indian Edition.
Devlin T.M.	Text Book Of Biochemistry with Clinical Correlations		McGraw Hills
Homes N. H.	Clinical Laboratory Test		Springer Publications
Najih A. Naser	Clinical Chemistry - A Laboratory Manual		Mosby
Russell J. G., Harris N. D.	Pathology & Therapeutics for Pharmacy		Pharmaceutical Press

Reference books : Nil

Suggested List of Laboratory Experiments : Nil

Suggested List of Assignments/Tutorial : Nil

Name of the Course : PHARMACEUTICS – II	
Course code: T-410	**Semester :** IV
Duration : 60 Hrs.	**Maximum Marks :** 100
Teaching Scheme	**Examination Scheme**
Theory : 04 Hrs. Per week	Mid Semester Exam: 20 Marks
Tutorial: --Hrs. Per week	Assignment & Quiz: 10 Marks
Practical : --Hrs. Per week	End Semester Exam: 70 Marks
Credits : **04 [FOR ALL THEORY & PRACTICALS ONE CREDIT = 25 MARKS]**	

Aim :-

Objective :-

S. No	
1	To develop the basis for plant design for the production of Pharmaceuticals.
2	To imbibe the concept of industrial Pharmacy.
3	To impart the knowledge regarding production methodology of non-sterile and sterile dosage Form.

Pre-Requisite :- Nil

	Contents	Hrs.
Unit -1	**Pharmaceutical Plant, location, layout** Plant location and lay out of an industry. Various factors affecting locational aspects of chemical and pharmaceutical plants. Layout of plant building and importance of flow sheet, difference between scientific process and technological process, layout of various departments, equipments, product lay out v/s process layout.	05
Unit -2	**Dosage Form Necessities and Additives** Antioxidants, preservatives, coloring agents, flavoring agents and diluting agents, emulsifying agents, suspending agents, ointment bases, solvents, and others.	05
Unit – 3	**Powers** Advantages and limitations as dosage form, manufacturing procedure and equipments, special care and problems in manufacturing powders, powders of IP, effervescent granules and salts.	06
Unit – 4	**Capsules** Hard gelatin capsules, shell formulation and manufacturing, capsule sizes, storage, filing, cleaning process general formulation contents and evaluation. Soft gelatin capsules, shell formulation, formulation contents, filing, sealing and storage. Microencapsulation, advantages, encapsulation materials, methods of microencapsulation, I.P. formulations.	08
Unit – 5	**Tablets** Types,idealrequirement,classification,granulation methods, general formulation, compression machines, different types of toolings, difficulties in tableting, trouble shooting aspects, evaluation, sugar coating, compression coating, film coating, problems in tablet coatings and their trouble shooting aspects. IP formulations.	08
Unit -6	**Parenterals - product requiring sterile packaging** Definition, types advantages and limitations, general formulation, vehicles, production procedure, production facilities, controls, tests, selected IP injections, sterile powders implants, emulsions, suspensions.	10

Unit -7	**Suspensions** Formulation of deflocculated and flocculated suspension, manufacturing procedure, evaluation methods, IP suspensions.	03
Unit-8	**Emulsions** Types,emulsifyingagents,generalformulation, manufacturing procedure, evaluation methods, IP emulsions.	03
Unit -9	**Suppositories** Idealrequirements,bases,manufacturingprocedure, evaluation methods, IP products.	02
Unit -10	**Semisolids** Definitions, bases, general formulation, manufacturing procedure, evaluation methods, IP products.	02
Unit -11	**Liquids (solutions, syrups, elixirs, spirits, aromatic water, liquid for external uses)** Definition,types,generalformulation,manufacturing procedure, evaluation methods, IP products.	02
Unit -12	**Pharmaceutical Aerosols** Definition, propellants, general formulation, manufacturing and packaging methods, pharmaceutical applications. Impacts of propellants on environment.	04
Unit -13	**Ophthalmic preparations** Requirement,formulation,methodsofpreparation, containers, evaluation, IP products.	02
	Total	**60**

Text Books:

Name of Authors	Titles of the Book	Edition	Name of the Publisher
Govt. of India	Indian Pharmacopoeia		The Controller of Publication
B. P. Comission	British Pharmacopoeia		H.M.S.O. London
Leon Lachman, Leiberman	Pharmaceutical Dosage Form : Table		Churchill Livingston
Leon Lachman, Leiberman	Pharmaceutical Dosage Form : Disperse System		Churchill Livingston
Alfonsa Gennara	Remingtons, The Science Practice of Pharmacy		Lippincott
Bankar Gilbert, Cristofer T. Rhods	Modern Pharmaceutics		Marcel Dekker

Reference books :- Nil

Suggested List of Laboratory Experiments : Nil

Suggested List of Assignments/Tutorial : Nil

Name of the Course : PHARMACEUTICS – II	
Course code: P-410	**Semester :** IV
Duration : 90 Hrs.	**Maximum Marks :** 100
Teaching Scheme	**Examination Scheme**
Theory : -- Hrs. Per week	Mid Semester Exam: 20 Marks
Tutorial: -- Hrs. Per week	Assignment & Quiz: 10 Marks
Practical : 06 Hrs. Per week	End Semester Exam: 70 Marks
Credits : **04 [FOR ALL THEORY & PRACTICALS ONE CREDIT = 25 MARKS]**	

Aim :-

Objective :-

S.No	
1.	To train students on preparation of some dosage forms not covered earlier.
2.	To impart training for analysis of various dosage forms prepared by them

Pre-Requisite :- Nil

Contents		Hrs.
S. No	Nil	

Text Books: Nil

Reference books :

Name of Authors	Titles of the Book	Edition	Name of the Publisher

"It is strongly recommended that some standard book/s be used for practicals. The choice of book/s is left to the concerned teachers".

Suggested List of Laboratory Experiments :

S. No	
1	To prepare and evaluate the salicylic acid ointment (20 gm).
2	To prepare aspirin tablet by dry granulation method.
3	To prepare and evaluate dispersible tablet.
4	To prepare acetyl salicylic acid tablet by wet granulation.
5	To evaluate the marketed uncoated and coated tablet formulations.
6	Quality control of marketed formulations.
7	To study film coating.
8	To study sugar coating.
9	Demonstration of microencapsulation.
10	To study entry procedures in aseptic area.
11	Microbial count of aseptic area in filling zone.
12	To study pyrogen test for sterile product.
13	Preservative sorption of rubber closure.

14	To prepare and evaluate calcium gluconate injection I.P.
15	Preparation and evaluation of ascorbic acid injection I.P.
16	To prepare water for injection and study sealing of ampoules.
17	To prepare tablet by direct compression.
18	To prepare capsule formulations of any one drug.
19	To prepare basic ophthalmic eye drop.
20	To prepare glycerol gelatin suppository.
21	To prepare PEG suppository.
22	To design layout of Pharmaceutical plant for tablet, parenterals.
23	To prepare effervescent granules with iron.
Suggested List of Assignments/Tutorial : Nil	

Name of the Course : PHARMACEUTICAL CHEMISTRY – II	
Course code: T-420	**Semester :** IV
Duration : 60 Hrs.	**Maximum Marks :** 100
Teaching Scheme	**Examination Scheme**
Theory : 04 Hrs. Per week	Mid Semester Exam: 20 Marks
Tutorial: --Hrs. Per week	Assignment & Quiz: 10 Marks
Practical : --Hrs. Per week	End Semester Exam: 70 Marks
Credits : **04 [FOR ALL THEORY & PRACTICALS ONE CREDIT = 25 MARKS]**	

Aim :-

Objective :-

S. No	
1	To develop the linkage between organic chemicals and their transformation to the drug molecule.
2	To develop the ability for nomenclature of drugs having various structural features.
3	To expose students towards different chemical classes of compounds and their relationships according to their biological activity.

Pre-Requisite :- Nil

	Contents	Hrs.
Unit -1	**Drug metabolism** Introduction to drug metabolism based on the functional groups.	05
Unit-2	**Various classes of therapeutic agents** A detailed study of the following classes with respect to drug nomenclature, classification, physicochemical properties, mode of action [MOA], structure activity relationships [SAR], wherever applicable, synthesis of simple & prototype molecules, drug metabolism, therapeutic uses & side effects. Drug resistance, wherever applicable, should be covered in respective classes of drugs. a. Antiamoebic agents. b. Anthelmintic agents. c. Antibacterial sulpha drugs [only]. d. Quinolone antibacterials. e. Antimycobacterial drugs. f. Antifungal agents. g. Antiviral agents including HIV & anti-HIV drugs. h. Thyroid & anti thyroid drugs. i. Antiallergic agents. j. Antiulcer agents & Proton Pump Inhibitors. k. Hypoglycemic agents. l. Antimalerials.	03 04 06 04 03 04 04 05 04 05 05 08
	Total	60

Text Books:

Name of Authors	Titles of the Book	Edition	Name of the Publisher
Foye W. O.	"Principles Of Medicinal Chemistry		K., E., Varghese & Company
Wilson C. Gisvold O. & Doerge. J. B	Text Book Of Organic Medicinal & Pharmaceutical Chemistry		J. B. Lippincot Company,

			Toronto, Canada.
D. J. Abraham Ed.	Burger's Medicinal Chemistry & Drug Discovery		John Wiley & Sons Inc., New York.
Lednicer Daniel	Organic Chemistry Of Drug Synthesis (Vol. I and II)		Wiley-Interscience, USA
Patric G. L.	A Introduction to Medicinal Chemistry		Abingdon, Oxfordshire, UK
Reference books : Nil			
Suggested List of Laboratory Experiments : Nil			
Suggested List of Assignments/Tutorial : Nil			

Name of the Course : PHARMACEUTICAL ANALYSIS – I	
Course code: T-430	**Semester :** IV
Duration : 60 Hrs. Per week	**Maximum Marks :** 100
Teaching Scheme	**Examination Scheme**
Theory : 04 Hrs. Per week	Mid Semester Exam: 20 Marks
Tutorial: -- Hrs. Per week	Assignment & Quiz: 10 Marks
Practical : -- Hrs. Per week	End Semester Exam: 70 Marks
Credits : **04 [FOR ALL THEORY & PRACTICALS ONE CREDIT = 25 MARKS]**	

Aim :-

Objective :-

S. No	
1	To emphasize the importance of quality in drugs & pharmaceuticals.
2	To establish the fundamental conventional methods of drug analysis used in laboratories.
3	To provide the knowledge regarding the principles of titrimetry and gravimetric techniques.
4	To give the basic principles of other analytical techniques used in analytical chemistry.
5	To teach applications of these analytical methods to drugs & pharmaceuticals.

Pre-Requisite :- Nil

	Contents	Hrs.
Unit-1	Importance of quality control in pharmacy.	02
Unit-2	**<u>Acid-base titrations</u>** Definitions of acids & bases according to Arrhenius & Lewis theory. Definitions of normality, molarity, molality, & equivalent weight. Primary & secondary standards with examples, & differences between them. Standardization of strong acids & bases using primary & secondary standards. Preparation of standard solutions of & calculations of equivalent weights of oxalic acid, potassium acid phthalate, calcium chloride dihydrate, & sodium carbonate. Calculation of factors involved in standardization of sodium hydroxide, hydrochloric acid, & oxalic acid. Direct, back & differential titrations.Applicationofdirect&backtitrationsto preparations like boric acid & borax in a mixture, ammoniated mercury, milk of magnesia, & zinc oxide ointment. Law of mass action, acid-base equillibria, pH scale, pH & hydronium ion concentrations in aqueous systems, calculations of pH for weak acids & weak bases. Use & applications of pH meter. Hydrolysis of salts. Strengths of acids & bases, dissociation constant. Theory of acid –base indicators. Neutralization [titration] curves. Definition, different types of buffers [chemical & biological], & their composition. Buffer capacity, buffered isotonic solutions. Calculations involving preparation of various buffer capacity solutions. Biological & pharmaceutical applications of buffers.	12

Unit-3	**Non-aqueous titrations** Need & theory behind it. Acid-base definitions according to Lowry-Bronsted, Lewis & Arrhenius concept. Factors affecting strengths of acids & bases. Intrinsic structure & surrounding environment. Protophilic, protogenic, amphiprotic & aprotic solvents. Acid-base equillibria in non-aqueous media. Titrants & indicators used for assay of acidic & basic substances. Preparation of perchloric acid, formation of onium ion. Assay of 1^o, 2^o, 3^o amines & amine hydrochlorides using perchloric acid & the reactions involved in it. Standardization of sodium ethoxide solution. Assay of phenols & phenobarbitone. General applications of non-aqueous titrations.	08
Unit-4	**Oxidation- reduction titrations** Definition of oxidation, reduction, oxidizing & reducing agent. Equivalent weight , concept of half reactions. Systematic balancing of half reactions with respect to: a. Oxalic acid-$KMnO_4$, b. $FeSO_4$-ceric nitrate, & c. I_2-sodium thiosulphate solution titrations. Calculation of equivalent weight of oxalic acid, $KMnO_4$, $FeSO_4$, permangnate & I_2 from half reactions. Calculation of factors for titrations mentioned in a, b & c. itrations, $KMnO_4$ as self indicator, it's preparation, standardization, & use in the assay of ferrous gluconate tablets, H_2O_2, & $NaNO_2$ solution. b. Iodimetric & iodometric titrations. Definitions & difference between iodimetry & iodometry. Preparation, standardization of iodine solution. Assay of ascorbic acid & sulphur ointment by iodimetry. Assay of copper sulphate & ferric chloride by iodometry. Bromometric titrations. c. Iodate titrations. Definition. Preparation, standardization & use of KIO_3 in the assay of ascorbic acid & KI. d. Cerimetric titrations. Preparation, standardization & use of ceric solutions in the assay of paracetamol tablets. It's advantages over permanganate solutions. romine titrations. Preparation, standardization & use of bromine solution in the assay of phenol & isoniazide tablets. Potassium dichromate titrations. Preparation, standardization & use of potassium dichromate solution in the assay of ferrous ammonium sulphate.	10
Unit-5	**Precipitation titrations** Principle of solubility product & sparingly soluble salts. Titrants & indicators used in Mohr's, Volhard's, & Fajan's methods. Preparation & standardization of silver nitrate & ammonium thiocyanate solutions. Assay of sodium chloride by Mohr's method, use of nitrobenzene in the assay of halides, ammonium chloride, & thiourea by Volhard's method. Calculation of factors in argentimetric titrations. Titration curve method. General applications of precipitation titrations.	06
Unit-6	**Complexometric titrations** Difference between double salts & co-ordinate compounds. Definitions of co-ordination number of metal ions, ligands- uni-, bi-, & multidentate. Complexing, chelating, & sequestering agents with respective examples. Structure of complexes of platinum with ammonia. Ethylene diamine tetraacetate [EDTA] as a multidentate ligand in complexometry. Co- ordinate compounds of EDTA with bi-, tri-, & tetravalent metal ions. Stability of complexes & factors affecting it, use of buffers in EDTA titrations. Selective	08

	analysis of ions based on pH adjustments, use of masking & demasking agents, pM or metal ion indicators. Standardization of EDTA solution, titration curves, examples of assays carried out by direct & back titrations & by replacement of one complex by the other. Applications of complexometry in the assays of calcium gluconate, milk of magnesia, zinc undecenoate ointment, & aluminium hydroxide gel. Assay of NaF by indirect titration.	
Unit-7	**Gravimetry** Principles of gravimetry. Factors affecting precipitation, formation, & properties of precipitate. Colloidal state. Impuritiesinprecipitate,conditions of precipitation. Precipitation from homogenous solutions, washing, drying, & ignition of precipitate. Experimental techniques of drying & ignition. Applications of gravimetry in pharmacy.	03
Unit-8	**Extraction techniques** Liquid-liquid extraction, separation of mixtures by extraction. Distribution law. Successive & multiple extraction [Craig method], continuous counter-current extraction. Effect of temperature & pH on extraction. Inert solute, associate ion pair formation, emulsion problem in extractions. Applications in pharmacy.	04
Unit-9	**Potentiometry** Theory, ion selective electrodes, measurement of potential, red-ox titration curve, pH measurement, relation of pH to potential. Applications in pharmacy.	03
Unit-10	**Miscellaneous methods of analysis** Diazotization titrations. kjeldahl nitrogen estimation. Karl Fisher titrations. Determination of alcohol content in liquid gelenicals. Oxygen flask combustion method.	04
	Total	**60**

Text Books:

Name of Authors	Titles of the Book	Edition	Name of the Publisher
Connors K. A.	A Text Book Of Pharmaceutical Analysis		John Wiley & Sons, New York.
Skoog D. & West	Pharmaceutical Analysis		Brooks Cole Publisher Co.
Christian Garry	Analytical Chemistry		John Willey & Sons
Mendham J.	Vogel's Text Book of Quantitative Chemical Analysis		Prentice Hall
Beckett A.H. and Stenlake J.B.	Practical Pharmaceutical Chemistry		CBS New Delhi

Reference books : Nil

Suggested List of Laboratory Experiments : Nil

Suggested List of Assignments/Tutorial : Nil

Name of the Course : PHARMACEUTICAL ANALYSIS – I	
Course code: P-430	**Semester :** IV
Duration : 90 Hrs.	**Maximum Marks :** 100
Teaching Scheme	**Examination Scheme**
Theory : -- Hrs. Per week	Mid Semester Exam: 20 Marks
Tutorial: -- Hrs. Per week	Assignment & Quiz: 10 Marks
Practical : 06 Hrs. Per week	End Semester Exam: 70 Marks
Credits : **04 [FOR ALL THEORY & PRACTICALS ONE CREDIT = 25 MARKS]**	

Aim :-

Objective :- 1] To familiarize students with the concept of calibration & validation of various items used in analysis.
2] To give training to students in carrying out different experiments having different techniques in analysis of raw materials & finished products.
3] To impart training to students in determining percent purity of some phamacopoeal substances / pharmaceuticals / drugs.

Pre-Requisite :- Nil

Contents		Hrs.
S. No	**Nil**	

Text Books: Nil

Reference books :

Name of Authors	Titles of the Book	Edition	Name of the Publisher

"It is strongly recommended that some standard book/s be used for practicals. The choice of book/s is left to the concerned teachers"

Suggested List of Laboratory Experiments :

S. No	
1	Calibration of weights & glassware.
2	Preparation & standardization of 0.1 N NaOH & 0.1 N H_2SO_4. (Acid base titration)
3	Determination of % purity of borax & ZnO. (Acid base titration)
4	Determination of % purity of sodium benzoate. (Acid base titration)
5	Determination of aspirin content in tablets. (Acid base titration)
6	Preparation & standardization of oxalic acid using $KMnO_4$. (Red-ox titration)
7	Determination of % purity of $NaNO_2$ using $KMnO_4$. (Red-ox titration)
8	Determination of % purity of ferrous fumarate by cerimetry. (Red-ox titration)
9	Preparation & standardization of I_2 solution. (Red-ox titration)
10	Determination of % purity of ascorbic acid by iodimetry. (Red-ox titration)
11	Determination of % purity of $CuSO_4$ by iodometry. (Red-ox titration)
12	Determination of % purity of aspirin by bromimetry. (Red-ox titration)

13	Preparation & standardization of EDTA solution.(Complexometric titration)
14	Determination of % purity of calcium gluconate injection. (Complexometric titration)
15	Determination of % purity of magnesium sulphate. (Complexometric titration)
16	Determination of % purity of aluminium sulphate. (Complexometric titration)
17	Preparation & standardization of silver nitrate solution (argentometric titration.)
18	Determination of % purity of sodium chloride (argentometric titration).
19	Determination of % purity of ammonium chloride (argentometric titration).
20	Determination of % purity of ephedrine hydrochloride (non aqueous titration).
21	Estimation of chlorpromazine (non aqueous titration)
22	Demonstration of water estimation by KF-titration.
23	Diazotization titrations of sulpha drugs.
24	Estimation of diphenylhydantoin.
25	Estimation of tolbutamide.
Suggested List of Assignments/Tutorial : Nil	

Name of the Course : PHARMACOGNOSY – I	
Course code: T-440	**Semester :** IV
Duration : 60 Hrs.	**Maximum Marks :** 100
Teaching Scheme	**Examination Scheme**
Theory : 04 Hrs. Per week	Mid Semester Exam: 20 Marks
Tutorial: -- Hrs. Per week	Assignment & Quiz: 10 Marks
Practical : -- Hrs. Per week	End Semester Exam: 70 Marks
Credits : **04 [FOR ALL THEORY & PRACTICALS ONE CREDIT = 25 MARKS]**	

Aim :-

Objective :-

S. No	
1	To create the awareness regarding importance of Pharmacognosy.
2	To provide the idea regarding cultivation, collection, standardization and storage of crude drugs.
3	To develop the knowledge base regarding source, active constituents and uses of crude drugs.
4	To develop the ability about the understanding of performing chemical tests the identity and quality of natural products.

Pre-Requisite :- Nil

	Contents	Hrs.
Unit -1	**Introductory pharmacognosy** Historical development, modern concept and scope of Pharmacognosy. Significance of Pharmacognosy in various systems of medicine practiced in India *viz*: Ayurveda, Unani, Homeopathic and Siddha.	02
Unit -2	**Classification of crude drugs** Based on alphabetical, morphological, pharmacological, chemical, taxonomical and chemotaxonomical methods: organized and unorganized drugs: official and unofficial drugs.	03
Unit – 3	**Sources of crude drugs** Plants, animals and minerals: marine products: plant tissue culture.	03
Unit – 4	**Factors influencing quality of crude drugs** Exogenous factors: temperature, rainfall, daylight, altitude and soil. Endogenous factors: mutation, polyploidy and hybridizationin medicinal plants. Productionfactors including collection, drying, storage and transport methods.	04
Unit – 5	Study of morphological and histological characters of crude drugs, Ergastic cell inclusions, anatomical structures of both monocot and dicot stems, leaves and roots: barks, fruits and seeds.	04
Unit – 6	**Techniques in microscopy** Details of mountants, clearing agents, chemomicroscopic (microchemical) reagents.	03
Unit – 7	**Introduction to phytoconstituents** Definition, classification, chemical tests and pharmaceutical importance of: carbohydrates and their derivatives, fats and proteins, alkaloids, glycosides, flavonoids, steroids, saponins, tannins, resins, lipids and volatile oils.	05
Unit – 8	**Principles of plant classification** Diagnostic features and medicinal significance of important plants with special reference to: Algae: Rhodophyceae (Agar, Alginic acid, Diatoms). Fungi: Ergot, Yeast and penicillium.	06

	Gymnosperm: Pinaceae (Turpentine, Colophony), Gnetaceae (Ephedra). ▪ Angiosperm: Apocynaceae, Asteraceae, Lamiaceae, Rubiaceae, Rutaceae, Solanaceae, Scrophulariaceae, Leguminosae, Papaveraceae, Acanthaceae and Apiaceae. ▪ Pteridophytes: Male fern.	
Unit – 9	**Pharmaceutical aids** Biological sources, chemical constituents, adulterants and uses of: Starches, acacia gum, tragacanth, sterculia, guargum, pectin, arachis oil, castor oil, sesame oil, cotton seed oil, olive oil, cotton, silk, wool, regenerated fibres, asbestos, kaolin, prepared chalk, kieselghur.	06
Unit – 10	**Animal products** Biological sources, chemical constituents, adulterants and uses of: Shellac, cochineal, cantherides, woolfat, lard, beeswax, honey, musk, lanolin, gelatin.	04
Unit – 11	**Plant products** Introduction to plant bitters, sweeteners, nutraceuticals, cosmeceuticals and photosensitizing agents.	02
Unit – 12	**Toxic drugs** Study of allergens, hallucinogens, narcotics, toxic mushrooms.	02
Unit – 13	**Enzymes** Biological sources, preparation, characters and uses of: diastase, papain bromalain,ficin, yeast,pancreatin, urokinase, pepsin, trypsin, pencillinase, hyaluronidase and stryptokinase.	04
Unit – 14	**Natural pesticides and insecticides** Introduction to herbicides, fungicides, fumigants and rodenticides- tobacco, pyrethrum, neem.	03
Unit – 15	**Adulteration and evaluation of crude drugs** Different methods of adulteration: Evaluation of drugs by organoleptic, microscopic, physical, chemical and biological methods. Deterioration of herbal drugs by insect.	04
Unit – 16	**Quantitative microscopy** Definition and determination of stomatal index, stomatal number, palisade ratio, vein islet number, vein termination number, lycopodium spore method. Micrometers and measurement of microscopic characters.	05
	Total	**60**

Text Books:

Name of Authors	Titles of the Book	Edition	Name of the Publisher
Craker L. E.	Herbs, Spices And Medicinal Plants		CBS Publishers
Trease and Evans,	Pharmacognosy		W. B. Saunders, New York
V. E. Tylor, L. R. Brady and S. B. Robbers	Pharmacognosy		K. M. Varghese Co. Bombay.
Wallis T. E.	Textbook of Pharmacognosy		CBS, Delhi
Jean Bruneton	Pharmacognosy and Phytochemistry		Lavosier Publisher U.K.
Manual K. Lindsey	Plant Tissue Culture		Springer U.K.
Wagner and Bladt	Plant Drug analysis		Springer U.K.
	Indian Herbal Pharmacopoea		IDMA, Mumbai

Reference books : Nil

Suggested List of Laboratory Experiments : Nil

Suggested List of Assignments/Tutorial : Nil

Name of the Course : COMPUTERS AND STATISTICS	
Course code: T-510	**Semester :** V
Duration : 60 Hrs.	**Maximum Marks :** 100
Teaching Scheme	**Examination Scheme**
Theory : 04 Hrs. Per week	Mid Semester Exam: 20 Marks
Tutorial: --Hrs. Per week	Assignment & Quiz: 10 Marks
Practical : --Hrs. Per week	End Semester Exam: 70 Marks
Credits : **04 [FOR ALL THEORY & PRACTICALS ONE CREDIT = 25 MARKS]**	

Aim :-

Objective :-

S. No	
1	To provide the overview of development of computers.
2	To enable students to work in MS Window environment.
3	To impart the knowledge in performing general calculations involved in various disciplines of Pharmacy using spread sheet.
4	To provide the information in designing reports using word processing software.
5	To provide the basis of creating scientific presentations.
6	To enable students in utilizing computers for chemical structure drawing, viewing, and editing using free tools on internet along with the ability of performing literature survey.

Pre-Requisite :- Nil

Contents		Hrs.
A	**Statistics**	
Unit -1	**Basic Statistics** Basic concepts of statistics: Data, data graphics, frequency distribution. Measure of central tendency (mean, median, mode, harmonic mean, geometric mean), application in LAL tests, scattering of data (range, mean, deviation, standard deviation, RSD and SEM etc.).	05
Unit – 2	**Correlation, regression** Correlation analysis, correlation coefficient, Spearman's rank correlation coefficient. Linear regression analysis (applications in Beer Lambert's curve, stability study). Introduction to curve fitting techniques.	08
Unit – 3	**Introduction to probabilities** Binomial and normal probabilities distribution.	04
Unit – 4	**Sample and sampling method** Size and its significance. Sampling techniques and their application in pharmacy. Hypothesis testing [t-statistics (application in dissolution testing of solid dosage form), chi-square test].	04
Unit – 5	**Analysis of variance** Introduction and application of the test in pharmacokinetic study.	04
B	**Computer**	
Unit – 6	**Introduction** Introduction to computers- introduction to I/O devices, binary conversion computer	04

	classification. Application of computers in pharmacy.	
Unit – 7	**Languages** Common languages in computers. Types of languages elementary programming in BASIC language, algorithm flow chart, solution of problems based on biostatistics and other simple problems of pharmaceutical interest.	05
Unit – 8	**MS Word** Typing of text with stress on the following features: typing of text with different fonts and different sizes, indentation, superscripts, subscript, Greek terms such as alpha, betas etc., spell checking, use of thesaurus, cut paste and other features of edit. Preparation of tables for practical of pharmaceutical chemistry, pharmaceutical technology, pharmacology and / or pharmacognosy.	05
Unit – 9	**MS Excel** Calculation in EXCEL. Preparation of templates for application in pharmaceutical chemistry,pharmaceuticaltechnology, pharmacologyandpharmacognosyforexample statistical treatment of data for Beer Lambert's curve, solution of problems based on physical chemistry, pharmaceutical engineering, stability study, area under the curve, bio-assay, bioequivalence study, extraction,$R_f$valueand other elementary problemsof pharmaceutical importance. Special attention must be given to arithmetic expression. Hierarchy of operations, library functions such as logarithm, square root, standard deviation, sum average, t-test, ANOVA etc. Drawing graphs in EXCEL – line graph, histogram, pie chart. At least one graph for each discipline of chemistry, pharmaceutical technology, pharmacology and pharmacognosy. Editing chart features such as annotation, labeling of axis, changing legends etc.	05
Unit – 10	**MS PowerPoint** Typing of text with stress on the following features: Typing of text with different fonts and different sizes, indentation, superscripts, subscript, Greek terms such as alpha, betas etc., spell checking, use of thesaurus, cut paste and other features of edit. Preparation of power point presentation & use of multimedia techniques for advance level presentation. Preparation of tables for practical of pharmaceuticalchemistry, pharmaceutical technology, pharmacology and / or pharmacognosy.	05
Unit – 11	**E -mail and internet** Introduction to E-mail and internet demonstration of sites of pharmaceuticalinterest suchashttp://www.fda.gov, http://www.phyarmpro.com,http://www.pharmacy.org, www.pubmed.com, etc. Search engines. Introduction to sites for patent search and literature search.	05
Unit-12	ISIS	02
Unit-13	RASMOL	02
Unit -14	CHEMSKETCH	02
	Total	**60**

Text Books:

Name of Authors	Titles of the Book	Edition	Name of the Publisher
S. Bolton	Pharmaceutical Statistics		Marcel Dekker
Dromey R. G.	How To Solve It by Computer		PB Books
Korth Henry F.	Database System Concept		Mc Graw Hill
Stephen Sagman	Microsoft Office For Windows		Tata McGraw Hill
T. J. O'Leary , L. I. O'Leary	MS Office		Tata McGraw Hill

Reference books : Nil
Suggested List of Laboratory Experiments : Nil
Suggested List of Assignments/Tutorial : Nil

Name of the Course : COMPUTERS AND STATISTICS	
Course code: P-510	**Semester :** V
Duration : 90 Hrs.	**Maximum Marks :** 100
Teaching Scheme	**Examination Scheme**
Theory : -- Hrs. Per week	Mid Semester Exam: 20 Marks
Tutorial: -- Hrs. Per week	Assignment & Quiz: 10 Marks
Practical : 06 Hrs. Per week	End Semester Exam: 70 Marks
Credits : **04 [FOR ALL THEORY & PRACTICALS ONE CREDIT = 25 MARKS]**	

Aim :-

Objective :-

S. No	
1	**To train students in use of different software.**
2	**To train students in drawing chemical structures using appropriate method.**
3	**To impart training on use of internet & its advantages.**
4	**To give training in preparation of seminar / presentation material in power point.**

Pre-Requisite :- Nil

Contents		Hrs.
S. No	**Nil**	

Text Books: Nil

Reference books :

Name of Authors	Titles of the Book	Edition	Name of the Publisher

"It is strongly recommended that some standard book/s be used for practicals. The choice of book/s is left to the concerned teachers".

Suggested List of Laboratory Experiments :

S. No	
1	Computer Operating System Like DOS and Windows.
2	Windows, Managing Windows, Working with Disk , Folders and files
3	MS-Office (MS Word, MS Power point, MS Excel, MS Access)
4	Internet Features (E- mail, Browser etc.)
5	Practical based on the topics covered in theory MS-EXCEL, stress must be given to topics of pharmaceutical interest only (e.g. statistical analysis of pharmaceutical data, stability study, area under the curve, calculation of molecular weight, calculation of solubility, buffers, filtration, acid-base titration, oxidation - reduction, physical pharmaceutics, pharmaceutical engineering etc.). The equation will be provided at the time of examinations.
6	Practical based on biometrics: Pharmaceutical application of students and paired test SD- SEM, chi-square test – ANNOVA , regression analysis (application to stability testing) – ANNOVA (application in pharmacokinetics).
7	Assignments: Computerization of any two practicals taught (text, tables, figures, calculation, steps etc).

Suggested List of Assignments/Tutorial :- Nil

Name of the Course : PHARMACEUTICAL CHEMISTRY – III	
Course code: T-520	**Semester :** V
Duration : 60 Hrs.	**Maximum Marks :** 100
Teaching Scheme	**Examination Scheme**
Theory : 04Hrs. Per week	Mid Semester Exam: 20 Marks
Tutorial: Hrs. Per week [As required]	Assignment & Quiz: 10 Marks
Practical : Hrs. Per week [N A]	End Semester Exam: 70 Marks
Credits : **04 [FOR ALL THEORY & PRACTICALS ONE CREDIT = 25 MARKS]**	

Aim :-

Objective :-

S. No	
1	To develop the linkage between organic molecules and their transformation to the drug molecule.
2	To develop the ability to name drugs having various structural features.
3	To expose students towards different chemical classes of compounds and their relationships according to their biological activity.

Pre-Requisite :- Nil

	Contents	Hrs.
Unit -1	**Different classes of therapeutic drugs** A detailed study of the following classes with respect to drug nomenclature, classification, physicochemical properties, mode of action [MOA] , structure activity relationships [SAR] , wherever applicable, synthesis of simple & prototype molecules, drug metabolism, therapeutic uses & side effects. Drug resistance, wherever applicable, should be covered in respective classes of drugs. A. Sedative-hypnotics B. Antiepileptic agents. C. Neuroleptics. D. Anti-anxiety drugs. E. Diuretics. F. Antibiotics. Penicillins, cephalosporins & other beta- lactam antibiotics like imipenam & aztreonam. Beta-lactamase inhibitors such as clavulanic acid & sulbactum. Chloramphenicol. Tetracyclines. Aminoglycoside antibiotics. Macrolide antibiotics. Lincomycins. Polypeptide antibiotics. Anticancer antibiotics. G. Steroids. Corticosteroids [gluco- & mineralocorticoids] & anti-inflammatory steroids. Sex steroids. Male & female contraceptive agents. Anabolic steroids. H. Anticancer agents.	05 03 03 04 05 15 15 10
	Total	**60**

Text Books:

Name of Authors	Titles of the Book	Edition	Name of the Publisher
Foye, W. O.	Principles Of Medicinal Chemistry		K., E., Varghese & Company
Wilson, C., Gisvold, O., & Doerge., J., B.	Text Book Of Organic Medicinal & Pharmaceutical Chemistry		J. B. Lippincot Company, Toronto, Canada.

Wolff Manfred E.	Burger's Medicinal Chemistry & Drug Discovery		John Wiley & Sons Inc., New York.
Lednicer Daniel	Organic Chemistry Of Drug Synthesis (Vol. I and II)		Wiley-Interscience
Patric G. L.	A Introduction to Medicinal Chemistry		Abingdon, Oxfordshire UK
Reference books : Nil			
Suggested List of Laboratory Experiments : Nil			
Suggested List of Assignments/Tutorial : Nil			

Name of the Course : PHARMACEUTICAL ANALYSIS – II	
Course code: T-530	**Semester :** V
Duration : 60 Hrs.	**Maximum Marks :** 100
Teaching Scheme	**Examination Scheme**
Theory : 04 Hrs. Per week	Mid Semester Exam: 20 Marks
Tutorial: -- Hrs. Per week [As required]	Assignment & Quiz: 10 Marks
Practical : -- Hrs. Per week [N A]	End Semester Exam: 70 Marks
Credits : **04 [FOR ALL THEORY & PRACTICALS ONE CREDIT = 25 MARKS]**	

Aim :-

Objective :-

S. No	
1	To provide the sound basis of analytical techniques based upon electromagnetic radiations.
2	to develop the ability to solve simple spectroscopic problems involving UV, IR, NMR and Mass Spectrometry.
3	To generate the foundation of electrochemical analytical technique relevant to Pharmaceutical analysis.
4	To emphasize the concept techniques and Pharmaceutical importance of chromatography.

Pre-Requisite :- Nil

	Contents	Hrs
Unit-1	**Calibration** Calibration of instruments.	01
Unit-2	**General principles of spectroscopy** Wave-particle duality, wave properties, particulate properties. Line & band spectrum. Electromagnetic spectrum. Absorption & emission spectroscopy. Understanding of terms such as absorbance, transmittance, absorptivities, molar absorptivity, E 1cm 1%, λmax, effect of solvent & pH on λmax.	03
Unit-3	**Ultraviolet-visible Spectrometry** Different electronic transitions. Auxochromes & their effects, auxochromic, bathochromic & hypsochromic shifts [red & blue shifts] . Beer-Lambert law, its derivation, deviations in Beer's law. Single & double beam spectrophotometers covering sources of radiations, different monochromators, detectors such as barrier cell, photocell, photomultiplier tube. Photodiode array detector. Applications of this technique in qualitative & quantitative estimations giving emphasis on problem solving. Fieser-Woodward rules for calculations of theoretical λmax values.	06
Unit-4	**Spectrofluorimetry** Principle, definitions & types of luminescence. Mechanism of fluorescence & phosphorescence. Singlet & triplet states & intersystem crossing. Fluorescence yield & factors affecting it. Quenching of fluorescence & fluorescence quenchers. Structure & fluorescence. Brief discussion of instrumentation. Applications of fluorimetry in pharmacy.	05
Unit-5	**Flame photometry & atomic absorption spectrometry**	05

	Principle & instrumentation with emphasis on working & importance of different components. Temperature, flame absorption & emission profiles. Interferences & their avoidance. Quantitative estimations & applications.	
Unit-6	**Infrared spectrometry** Infrared region in EM spectrum. Principle, different stretching & bending vibrations. Components [& their working] of a dispersive instrument. Fourier transform [FT] technique, FT instruments & their comparison with dispersive instruments. Sample handling techniques. Functional group & finger print regions in the spectrum. Functional groups identification & their use in characterization of compounds. Problems on identification of functional groups from spectra of unknown compounds.	05
Unit-7	**Proton nuclear magnetic resonance spectrometry** Principle involved in the technique. Knowledge about fundamental terms involved such as quantized absorption, flipping of nucleus, spin number, magnetic moment, magnetogyric ratio, relaxation, etc. Equations relating these terms to frequency of radiation & magnetic field [without derivation of the equations]. Types of relaxation processes. Low & high resolution instruments. A brief discussion on the low resolution instrumentation [60 MHz]. Quantitative knowledge of relationship between MHz & magnetic field. An introduction to superconductivity magnets. Solvents & reference standards used. Setting up of a NMR scale. Sample preparation. Shielding & deshielding of a proton & it's effect on chemical shift, Discussion on & importance of equivalent & non-equivalent protons [number of signals] , chemical shifts [position of signal] & their calculation from the spectrum, chemical shifts of different H's, splitting [multiplicity] of a signal, coupling constants [J values] , integration [area under the signal] . Importance of these terms in identification [or confirmation] of different functional groups should be covered. Significance & contribution of J value in stereochemistry should be emphasized. Prediction [expected theoretical values] of chemical shifts & multiplicities for all protons from simple structures containing up to 12-15 carbons. An introduction to FT-technique & its significance in ^{13}C-NMR spectrometry.	10
Unit-8	**Mass spectrometry** Principle. Low & high resolution instruments. Components & importance of each in brief. Different types of mass spectrometric techniques. Brief knowledge of Chemical Ionization mass spectrometry. Calculations of hydrogen deficiency index [HDI] or unsaturation index [UI] . Base or parent peak, molecular ion, M + 1, M + 2 peaks. Calculations of molecular weight based on M +1 & M + 2 peaks. Formation of molecular ion & further fragmentation. Rearrangements in mass spectrometry. Major modes of fragmentations of hydrocarbons, hydroxyl compounds, halogen compounds, aldehydes, ketones, carboxylic acids, and amines. Introduction [only] to recent advances in MS.	07
Unit-9	**Polarography.** Principle & instrumentation. Ilkovich equation [no derivation] & its importance. Dropping mercury electrode [DME], saturated calomel electrode. Liquid-liquid junction potential, polarographic cell. Explanation of origin of S-shaped C-V curve. Applications of this technique. Amperometric titrations, principles, instrumentation, & applications.	03
Unit-10	**Nephelometry & Turbidimetry** Principles, Tyndall effect. Duboscq turbidimeter. Eeel's nephelometer. Applications.	02

Unit-11	**Chromatography.** Principle, rate & plate theory, Van Deemter equation [no derivation] & the parameters affecting separation/band broadening. Classification of chromatography, retention factor. A detailed study of thin layer chromatography [TLC], preparative TLC, paper chromatography [PC] , column chromatography, gas chromatography [GC / GLC] . Qualitative & quantitative applications of the above techniques. An introduction to high performance TLC [HPTLC, comparison of TLC & HPTLC. A brief introduction to high pressure / performance liquid chromatography [HPLC].	10
Unit-12	**Miscellaneous** An introduction to electrophoresis. An introduction to lasers & masers. Statistical treatment to experimental data. Sampling techniques & applications in pharmaceutical industry.	03
	Total	**60**

Text Books:

Name of Authors	Titles of the Book	Edition	Name of the Publisher
Morrison R., T. and Boyd R., M.,	Organic Chemistry		Prentice Hall Of India Ltd., New Delhi-110 001.
Skoog & West,	Pharmaceutical Analysis		Lippincott
Christian, G	Analytical Chemistry		John Wiley
Silverstein R. M., G. C. Bassler	Spectrometric Identification Of Organic Compounds		John Wiley & Sons, New York.
Dyer J. R.,	Applications Of Absorption Spectroscopy Of Organic Compounds		Englewood, U S A.
	United State Pharmacopoea		U. S. Govt.
B. P. Commission	British Pharmacopoea		H. M. S. O. London
Govt. of India	Indian Pharmacopoea		The Controller of Publications Delhi
Walter Lund	British Pharmaceutical Codex		The Pharm London
	National Formulary		Royal Londons

Reference books : Nil

Suggested List of Laboratory Experiments : Nil

Suggested List of Assignments/Tutorial : Nil

Name of the Course : PHARMACEUTICAL ANALYSIS – II	
Course code: P-530	**Semester :** V
Duration : 90 Hrs.	**Maximum Marks :** 100
Teaching Scheme	**Examination Scheme**
Theory : -- Hrs. Per week [N A]	Mid Semester Exam: 20 Marks
Tutorial: -- Hrs. Per week [N A]	Assignment & Quiz: 10 Marks
Practical : 06 Hrs. Per week	End Semester Exam: 70 Marks
Credits : **04 [FOR ALL THEORY & PRACTICALS ONE CREDIT = 25 MARKS]**	

Aim :-

Objective :-

S. No	
1	**To train students on calibration & validation of sophisticated instruments.**
2	**To give hands on training on these sophisticated instruments.**
3	**To train students on the application the aspects of these sophisticated instruments.**
4	**To give practice on solving spectral problems.**

Pre-Requisite :- Nil

Contents		Hrs.
S. No	Nil	

Text Books: Nil

Reference books :

Name of Authors	Titles of the Book	Edition	Name of the Publisher

"It is strongly recommended that some standard book/s be used for practicals. The choice of book/s is left to the concerned teachers".

Suggested List of Laboratory Experiments :

S. No	
1	Calibration & validation of colorimeter & UV-VIS spectrophotometer, spectrofluorimeter, IR spectrometer.
2	A few experiments [3-4] using colorimeter such as estimation of sugars, amino acids, proteins, etc.
3	Experiments [8-10] involving UV-VIS spectrometry in, A] the assays of different dosage forms such as tablets, capsules, injections, suspensions, gels [official / unofficial] , etc. Calculation of drug content using $E^{1\%}_{1cm}$, calibration curves, & reference standards, B] determination of linearity range, C] determination of limit of detection [LOD] & limit of quantitation [LOQ] .
4	Experiments on flourimetry. Determination of E_{ex} & E_{em}. Quantitative estimations of 2-3 drugs / vitamins.
5	Experiments [5-7] with known & unknown compounds for identification of different functional groups. Use of finger print region in identification of a compound. Study of inter- & intramolecular H-bonding. Interpretation of functional groups in compounds of unknown spectra.
6	Use of paper [ascending & descending methods] & TLC [1-D & 2-D] techniques in qualitative analysis. Calculation of R_f value. Use of reference standard in identification of unknown compound. Demonstration of preparative TLC technique & its usefulness in qualitative & quantitative analysis.
7	Demonstration of column chromatographic technique in qualitative analysis.

8	Determination of ion-exchange capacity of resins.
9	Demonstration of separation of proteins by electrophoresis.
10	Problem solving based on use of different statistical techniques.
11	Identification of simple compounds [containing 6-10 carbons] based on the IR & ^{1}H –NMR spectra [to be taken from literature].
Suggested List of Assignments/Tutorial : Nil	

Name of the Course : PHARMACOLOGY – I	
Course code: T-540	**Semester :** V
Duration : 60 Hrs.	**Maximum Marks :** 100
Teaching Scheme	**Examination Scheme**
Theory :04 Hrs. Per week	Mid Semester Exam:20 Marks
Tutorial: Hrs. Per week [As required]	Assignment & Quiz: 10 Marks
Practical : Hrs. Per week [N A]	End Semester Exam: 70 Marks
Credits : **04 [FOR ALL THEORY & PRACTICALS ONE CREDIT = 25 MARKS]**	

Aim :-

Objective :-

S. No	
1	To understand pharmacokinetic and pharmacodynamic principles involved in the use of drugs.
2	To understand and identify the various factors that can affect the action of drugs.
3	To know the various routes of drug administration.
4	To know the effect of drugs on different systems of the body.
5	To know the drugs used in systemic illness.
6	To understand the methods in experimental pharmacology to correlate drug effects with receptors.

Pre-Requisite :- Nil

	Contents	Hrs.
Unit -1	**General Pharmacology** Introduction to Pharmacology- Definition, scope and source of drugs, dosage form and routes of drug administration. Pharmacodynamics-Mechanism of drug action, Receptors, classification and drug receptors interaction, combined effect of drugs, factors modifying drug action. Pharmacokinetics-Mechanism and principle of Absorption, Distribution, Metabolism and Excretion of drugs. Principles of basic and clinical pharmacokinetics. Pharmacogenetics. Adverse drug reactions.	12
Unit -2	Discovery and development of new drugs-Preclinical and clinical studies.	04
Unit – 3	**Pharmacology of peripheral nervous system** Neurohumoral transmission (Autonomic and somatic). Parasympathomimetics, Parasympatholytics, Sympathomimetics, Sympatholytics, Ganglionic stimulants and blockers. Neuromuscular blocking agents and skeletal muscle relaxants (peripheral). Local anesthetic agents. Drugs used in Myasthenia Gravis	10

Unit – 4	**Pharmacology of cardiovascular system** Introduction of haemodynamics and Electrophysiology of heart. Anti-hypertensive drugs, Anti-anginal agents, Anti-arrhythmic drugs. Drugs used in congestive heart failure. Anti-hyperlipidemic drugs. Drugs used in the therapy of shock. Haematinics, anticoagulants and haemostatic agents Fibrinolytics and antiplatelet drugs. Blood and plasma volume expanders	10
Unit – 5	**Drugs acting on urinary system** Diuretics and anti-diuretics.	04
Unit – 6	**Drugs acting on Respiratory system** Anti-asthmatic drugs, Mucolytics and nasal decongestants, Anti-tussives and expectorants. Respiratory stimulants	04
Unit – 7	**Pharmacology of central nervous System** Neurohumoral transmission in the C.N.S with special emphasis on Pharmacology of various neurotransmitters. General anesthetics. Alcohols and disulfiram. Sedatives, hypnotics and centrally acting muscle relaxants Psychopharmacological agents: Antipsychotics, antidepressants, antianxiety agents, anti-manics and hallucinogens. Anti-epileptic drugs. Anti-parkinsonism drugs. Nootropics.	12
Unit – 8	Narcotic analgesics, Drug addiction, drug abuse, tolerance and dependence	04
	Total	**60**

Text Books:

Name of Authors	Titles of the Book	Edition	Name of the Publisher
Barar F. S. K.	A Text Book Of Pharmacology		Mehta Publications
Katzung B. G.	Basic And Clinical Pharmacology		Lange Medical Publications.
Vogel H. G.	Drug Discovery And Evaluation		Springer House
Barar F. S. K.	Essentials Of Pharmacotherapeutics		S. Chand & Co. Pvt. Ltd.,
Rang. M. P., Dale M. M., Riter J. M./ 4th ed	Pharmacology		Churchill, Livingstone

Reference books : Nil

Suggested List of Laboratory Experiments : Nil

Suggested List of Assignments/Tutorial : Nil

Name of the Course : DISPENSING AND HOSPITAL PHARMACY	
Course code: P-610	**Semester :** VI
Duration : 90 Hrs.	**Maximum Marks :** 100
Teaching Scheme	**Examination Scheme**
Theory : Hrs. Per week [N A]	Mid Semester Exam: 20 Marks
Tutorial: Hrs. Per week [N A]	Assignment & Quiz: 10 Marks
Practical : 06 Hrs. Per week	End Semester Exam: 70 Marks
Credits : **04 [FOR ALL THEORY & PRACTICALS ONE CREDIT = 25 MARKS]**	

Aim :-

Objective :-

S.No	
1	**To train students in different aspects of dispensing medication.**
2	**To impart training on proper use of weighing with different balances.**
3	**To give training on dose calculations for children, older patients.**
4	**To give experience in preparation of various dosage forms for dispensing.**

Pre-Requisite :- Nil

Contents		Hrs.
S.No	**Nil**	

Text Books: Nil

Reference books :

Name of Authors	Titles of the Book	Edition	Name of the Publisher

"It is strongly recommended that some standard book/s be used for practicals. The choice of book/s is left to the concerned teachers".

Suggested List of Laboratory Experiments :

S. No	
1	Introduction to laboratory equipments, weighing methodology, handling of prescriptions, labeling instructions for dispensed products.
2	Preparations based on percolation process.
3	Preparations based on maceration process.
4	Study of difference between marketed and dispensed products of different dosage forms (minimum 10 types of dosage forms).
5	a. Posological calculations involved in calculation of dosage for infants. Enlarging and reducing formula, displacement value. b. Preparations of formulations involving allegation, alcohol dilution, isotonic solution.
6	Study of current patent and proprietary products, generic products and selected brand products, indications, contra indications, adverse drug reactions, available dosage forms and packing of a. Antihypertensive drug b. Antiamoebic drugs c. Anti histaminic drugs d. Anti emetic drugs e. Antacids and ulcer healing drugs.

	f. Anti diarrheals and laxatives g Respiratory drugs h. Antibiotics i. Analgesics and antipyretic drugs.
7	Compounding and dispensing of following prescriptions (minimum 20 prescriptions). a. Mixtures b. Solutions c. Emulsions d. Lotions (External preparations) e. Liniments (External preparations) f. Powder g. Granules h. Suppositories i. Ointments / Paste j. Cream k. Incompatibility: Prescription based on physical, chemical and therapeutic incompatibility (2 each) l. Tablets m. Inhalations
8	Reading and counseling of minimum 20 prescriptions from the clinical practice.
9	Designing from mock Pharmacy: Layout and structure of retail Pharmacy, compounding, dispensing, storing, labeling, pricing, recording and counseling of prescription.
10	Procurement of information for the given drug for drug information services.
11	Preparation of Hospital Formulary (Mock exercise).
Suggested List of Assignments/Tutorial : Nil	

Name of the Course : PHARMACOLOGY – II	
Course code: T-620	**Semester :** VII
Duration : 60 Hrs.	**Maximum Marks :** 100
Teaching Scheme	**Examination Scheme**
Theory : 04 Hrs. Per week	Mid Semester Exam: 20 Marks
Tutorial: Hrs. Per week [As required]	Assignment & Quiz: 10 Marks
Practical : Hrs. Per week [N A]	End Semester Exam: 70 Marks
Credits : **04 [FOR ALL THEORY & PRACTICALS ONE CREDIT = 25 MARKS]**	

Aim :-

Objective :-

S. No	
1	To make student understand drug development and concepts of drug action.
2	To know the drugs used in infections and chemotherapy with mechanism of action and pharmacokinetics, uses, side-effects.
3	To know peptides as drugs and role of antocoids in various process and drugs acting on them.

Pre-Requisite :- Nil

	Contents	Hrs.
Unit -1	**Pharmacology of Endocrine system** Basic concepts in endocrine pharmacology. Hypothalamic and pituitary hormones. Thyroid hormones and ant thyroid drugs, Parathormone, Calcitonin and vitamin-D. Insulin, oral hypoglycemic agents and glucagon. ACTH and corticosteroids. Androgens and anabolic steroids. Estrogens, progesterone and oral contraceptives. Drugs acting on the uterus.	08
Unit -2	**Chemotherapy** General principals of chemotherapy. Sulphonamides and co-trimoxazole. Antibiotics- Penicillins, cephalosporins, chloramphenicol, Macrolides, quinolines and fluoroquinolins, quinolones. Tetracyclines. Aminoglycosides and miscellaneous antibiotics. Chemotherapy of tuberculosis, leprosy, fungal diseases, viral diseases, AIDS, protozoal diseases, worm infections, urinary tract infections and sexually transmitted diseases. Chemotherapy of malignancy.	14
Unit -3	**Autacoids and their Antagonists** Histamine, 5-HT and their antagonists. Prostaglandins, thromboxanes and leukotrienes. pentagastrin, cholecystokinin, angiotensin, bradykinin and substance P. Analgesic, anti-pyretic, anti-inflammatory and anti-gout drugs.	08
Unit -4	**Pharmacology of drug acting on the gastrointestinal tract** Antacids, anti-secretary and antiulcer drugs. Laxatives and antidiarrheal drugs. Appetite stimulants and suppressants. Digestants and carminatives. Emetics and antiemetics	04
Unit -5	**Chronopharmacology** Definition of rhythm and cycles. Biological clock and their significance leading to chronotherapy.	02
Unit -6	**Immnopharmacology** Immunostimulants and immunosuppressants.	03

Unit -7	**Chemotherapy of malignant diseases** Basic principal of chemotherapy. Drugs used in cancer chemotherapy.	04
Unit – 8	**Peptides and proteins as mediators** General Principal of peptide pharmacology Biosynthesis and regulation of peptides Peptide antagonists. Protein and peptide as drugs.	04
Unit – 9	**Nitric oxide** Biosynthesis of nitric oxide and its physiological role. Therapeutic use of nitric oxide and nitric oxide donors. Clinical condition in which nitric oxide may play a part.	03
Unit -10	**Vitamins & Minerals** Vitamin deficiency diseases and their management. Role of minerals in health & diseases.	04
Unit -11	**Principles of toxicology** Definition of poison. General principles of treatment of Poisoning. Treatment of poisoning due toHeavy metals,insecticides,opiods and other addict forming drugs.Study of acute, sub acute and chronic toxicity as per OECD guidelines. Genotoxicity, Carcinogenicity, teratogenicity and mutagenicity studies.	06
	Total	**60**

Text Books: Nil

Reference books :-

Name of Authors	Titles of the Book	Edition	Name of the Publisher
Barar F.S.K.	A Text Book Of Pharmacology		Mehta Publications, Delhi
Katzung B.G.	Basic And Clinical Pharmacology		Tata Mcgraw Hill
C.R Craig & Stitzel	Modern Pharmacology		Little Brown& Co.
Rang H.P. And Dale M.M.	Pharmacology		Elsevier India
Finkel, Richard; Clark, Michelle A.	Lippincott's Illustrated Reviews: Pharmacology,		Lippincott Williams & Wilkins
RPS	British National Formulary	60	Royal Pharmaceutical Society

Suggested List of Laboratory Experiments : Nil

Suggested List of Assignments/Tutorial : Nil

Name of the Course : PHARMACOLOGY – II	
Course code: P-620	**Semester :** VII
Duration : 90 Hrs.	**Maximum Marks :** 100
Teaching Scheme	**Examination Scheme**
Theory : -- Hrs. Per week [N A]	Mid Semester Exam: 20 Marks
Tutorial: -- Hrs. Per week N A]	Assignment & Quiz: 10 Marks
Practical : 06 Hrs. Per week	End Semester Exam: 70 Marks
Credits : 04 **[FOR ALL THEORY & PRACTICALS ONE CREDIT = 25 MARKS]**	

Aim :- To create awareness about use o laboratory animals in experimental Pharmacology.

Objective :-

S. No	
1	**To teach students how to handle laboratory animals.**
2	**To conduct some simple animal experiments to understand drug action.**

Pre-Requisite :- Nil

Contents		Hrs.
S.No	**Nil**	

Text Books: Nil

Reference books :-

"It is strongly recommended that some standard book/s be used for practicals. The choice of book/s is left to the concerned teachers".

Suggested List of Laboratory Experiments :

S.No	
1	Commonly used instruments in experimental pharmacology.
2	Common laboratory animals and anesthetics used for animal studies.
3	Some common and standard techniques. Bleeding and intravenous injection, intra-gastric administration, procedures for rendering animal unconscious and chemical euthanasia.
4	Study of different routes of drugs administration in mice/rats.
5	To Study the effect of hepatic microsomal enzyme inhibitors and inducers on the phenobarbitone sleeping time in mice.
6	Effect of various agonists and antagonists and their characterization using isolated ileum of rat/guinea pig/rabbit.
7	Bioassay of acetyl choline on rat ileum by interpolation method.
8	Experiments on Central nervous system: Recording of spontaneous motor activity, stereotype activity, anti-catatonic activity, analgesic activity, anticonvulsant activity.
9	Anti-inflammatory activity and skeletal muscle relaxant activity of drugs.
10	Local anesthetic activity screening by suitable animal model.
11	Effect of autonomic drugs on rabbit's eye.
12	Experiments based on computer models like Expharm.
13	Statistical calculations in experimental pharmacology. a. Student-t-test b. ANOVA

Suggested List of Assignments/Tutorial : Nil

Name of the Course : PHARMACOGNOSY – II	
Course code: T-630	**Semester :** VI
Duration : 60 Hrs. Per week	**Maximum Marks :** 100
Teaching Scheme	**Examination Scheme**
Theory : 04 Hrs. Per week	Mid Semester Exam: 20 Marks
Tutorial: -- Hrs. Per week [As required]	Assignment & Quiz: 10 Marks
Practical : -- Hrs. Per week [N A]	End Semester Exam: 70 Marks
Credits : **04 [FOR ALL THEORY & PRACTICALS ONE CREDIT = 25 MARKS]**	

Aim :-

Objective :-

S. No	
1	**To study the generation of biodrugs in plants as a result of metabolism.**
2.	**To impart knowledge about important chemical classes of compounds having bio activity.**

Pre-Requisite :- Nil

	Contents	Hrs.
Unit -1	**Biogenetic pathways** Formation of primary and secondary metabolites. Study of Calvin cycle, TCA cycle, Shikimic acid pathway, Embden-Mayerhoff pathway, acetate hypothesis, isoprenoid pathway. Biosynthesis of carbohydrates, lipids and volatile oils.	05
Unit -2	**Carbohydrates & lipids** Biological sources, salient morphological features, chemical constituents, and uses of: Plantago, bael, chalmooogra oil, neem oil, shark liver oil, cod liver oil, guggul lipids.	08
Unit – 3	**Tannins** Biological sources, morphology, chemical constituents, chemical test and uses of: Pale catechu, black catechu, nutgalls, *Terminalia belerica, Terminalia chebula, Terminalia arjuna.*	05
Unit – 4	**Volatile oils** Biological sources, morphology, chemical constituents, adulterants and uses of: Black pepper, turpentine, mentha, coriander, cardamom, cinnamon, cassia, lemon peel, orange peel, lemon grass, citronella, cumin, caraway, dill, spearmint, clove, anise, star anise, fennel, nutmeg, eucalyptus, chenopodium, ajowan, sandal wood.	10
Unit – 5	**Resinous drugs** Classification,formation,sources,chemicalconstituents, identification test, adulterants and uses of: benzoin, peru balsam, tolu balsam, colophony, myrrh, asafoetida, jalap, colocynth, ginger, turmeric, capsicum, cannabis, podophyllum.	08
Unit – 6	**Glycosides** Nature and classification. Biological sources, morphology, chemical constituents, adulterants and uses of: Digitalis, strophanthus, squill, thevetia, oleander, cascara, aloe, rhubarb, senna, quassia, dioscorea, quillaia, glycyrrhiza, ginseng, gentian, wild cherry, withania, bitter almond. Biosynthesis of cardiac and anthraquinone glycosides.	10

Unit – 7	**Alkaloids** Nature, classification, biological sources, morphology, chemical constituents, adulterants and uses of: Areca nut, belladonna, hyoscymous, stramonium, duboisea, coca, coffee, tea, cinchona, opium, ipecac, nux vomica, ergot, rauwolfia, vinca, kurchi, ephedra, colchicum, vasaca, pilocarpus, aconite, *Solanum xanthocarpum*. Biosynthesis of tropane, cinchona and opium alkaloids.	10
Unit – 8	**Herbarium** Preparation of herbarium sheets and their importance in authentication of plants.	04
	Total	**60**

Text Books:

Name of Authors	Titles of the Book	Edition	Name of the Publisher
Craker L. E.	Herbs, Spices And Medicinal Plants		CBS Publishers
Trease And Evans,	Pharmacognosy		W. B. Saunders, New York
V. E., Tylor, L. R. Brady And S. B., Robbers	Pharmacognosy		K.M. Varghese Co. Bombay.
Wallis T. E.	Textbook Of Pharmacognosy		CBS, Delhi
Jean Bruneton	Pharmacognosy and Phytochemistry		Lavosier Publisher U.K.
Manual K. Lindsey	Plant Tissue Culture		Springer U.K.
Wagner and Bladt	Plant Drug analysis		Springer U.K.
	Indian Herbal Pharmacopoea		IDMA, Mumbai

Reference books : Nil

Suggested List of Laboratory Experiments :

Suggested List of Assignments/Tutorial : Nil

Name of the Course : PHARMACOGNOSY – II	
Course code: P-630	**Semester :** VI
Duration : 90 Hrs. Per week	**Maximum Marks :** 100
Teaching Scheme	**Examination Scheme**
Theory : Hrs. Per week [N A]	Mid Semester Exam: 20 Marks
Tutorial: Hrs. Per week [N A]	Assignment & Quiz: 10 Marks
Practical : 06 Hrs. Per week	End Semester Exam: 70 Marks
Credits : 04	

Aim :-

Objective :-

S. No	
1	**To give training in preparation of microscopic slides of various [plant parts] tissues & staining techniques.**
2	**To study the identification of different constituents present in cells / tissues.**
3.	**To understand different aspects of qualitative & quantitative microscopy.**

Pre-Requisite :- Nil

Contents		Hrs.
S.No	**Nil**	

Text Books: Nil

Reference books :

"It is strongly recommended that some standard book/s be used for practicals. The choice of book/s is left to the concerned teachers".

Suggested List of Laboratory Experiments :

S. No	
1	Microscopic preparation. Staining and surface preparation.
2	Microscopical studies of basic tissues, both monocot and dicot stems, leaves and roots: bark, seed, fruits: trichomes, stomata, calcium oxalate crystals, starch, fibers, oil glands and pollen grains.
3	General chemical tests for phytoconstituents given in theory.
4	Study of diagnostic characters of families mentioned in theory.
5	Identification of unorganized drugs through morphological, sensory and chemical characteristic of: Agar, arachis oil, castor oil, tragacanth, acacia, gums, starches, woolfat, lard, beeswax, honey, lanolin, gelatin, cotton, regenerated cellulose, silk, wool and synthetic fibres used in surgical dressings.
6	Morphological description of drugs: Senna, plantago, fennel, black pepper, ginger, rauwolfia, datura, nux vomica, nim, vinca, podophyllum, turmeric, colchicum, cinchona, gokhru, ergot.
7	Quantitative microscopy (Determination of stomatal index, determination of vein islet no., vein termination and determination of palisade ratio) e.g Senna and Datura.
8	Determination of dimensions of starch grains and length of fibers.
9	Microscopic examination of the following powdered drugs and their mixtures: Leaf: Senna, Datura , Root: Rauwolfia, Glycyrrhiza, Seed: Nux vomica, Bark: Cinchona, Cinnamon.

	Fennel & Coriander fruits, Quassia wood, Ginger rhizome.
10	Identification of organized drugs on the basis of morphological characters, microscopy and microchemical tests of: Digitalis, Quassia, Cinchona, Ipecac, Rauwolfia, Caraway, Clove, Coriander, Aconite.
Suggested List of Assignments/Tutorial : Nil	

Name of the Course : PHARMACEUTICAL JURISPRUDENCE	
Course code: T-640	**Semester :** VI
Duration : 60 Hrs.	**Maximum Marks :** 100
Teaching Scheme	**Examination Scheme**
Theory : 04 Hrs. Per week	Mid Semester Exam: 20 Marks
Tutorial: Hrs. Per week [As required]	Assignment & Quiz: 10 Marks
Practical: Hrs. Per week [N A]	End Semester Exam: 70Marks
Credits : **04 [FOR ALL THEORY & PRACTICALS ONE CREDIT = 25 MARKS]**	

Aim :- Nil

Objective :-

S. No	
1	The subject exposes the student to important legislations related to Pharmacy profession in India.
2	It imparts knowledge about the Drug and Cosmetic Act and its Rules.
3	It provides the basic idea regarding DPCO drug policies and patenting in India.

Pre-Requisite :- Nil

Contents		Hrs.
Unit -1	Historical background Drug legislation in India, Code of Ethics for Pharmacists.	01
Unit -2	A detailed study (inclusive of recent amendments) of the Pharmacy Act 1948.	03
Unit – 3	Drugs and Cosmetics Act 1940, Rules 1945, including New Drug applications.	15
Unit – 4	Narcotic Drugs and Psychotropic Substances Act, and Rules there under.	03
Unit - 5	Drugs and Magic Remedies (Objectionable Advertisements) Act 1954.	03
Unit – 6	Medicinal and Toilet Preparations (Excise Duties) Act 1955, Rules 1976.	02
Unit – 7	Medical Termination of Pregnancy Act 1970 and Rules 1975.	02
Unit – 8	Prevention of Cruelty to Animals Act 1960.	02
Unit – 9	Drug (Price Control) Order.	02
	Shops and Establishment Act.	04
	Factory Act.	04
	Consumer Protection Act.	03
	Indian Pharmaceutical Industry- An Overview.	02
	Industrial Development and Regulation act 1951.	03
	Introduction to Intellectual Property Rights and Indian Patent Act 1970.	03
	An Introduction to Standard Institutions and Regulatory Authorities such as BIS, ASTM, ISO, TGA, USFDA, MHRA, ICH, WHO.	04

	Minimum Wages Act 1948.	02
	Prevention of Food Adulteration Act 1954 and Rules 1955.	02
	Bibligraphy	02
	Total	**60**

Text Books:

Name of Authors	Titles of the Book	Edition	Name of the Publisher
	Relevant Acts (Bare acts) and Rules Published		Govt. of India.
Singh Harkishan	History of Pharmacy in India vol-I, II, & III		Vallabh Prakashan, Delhi
S. W. Deshpande	Drug and Cosmetics Act.		CBS Publications
Mittal B. M.	Test Book of Forensic Pharmacy		Vallabh Prakashan, New Delhi
N K Jain	Forensic Pharmacy		Vallabh Prakashan, New Delhi

Reference books : Nil

Suggested List of Laboratory Experiments : Nil

Suggested List of Assignments/Tutorial : Nil

Name of the Course : ELECTIVES / SEMINAR (LITERATURE REVIEW)		
Course code: T-650		**Semester :** VI
Duration : 30 Hrs.		**Maximum Marks :** 100
Teaching Scheme		**Examination Scheme**
Theory : 02 Hrs. Per week		Mid Semester Exam: 20 Marks
Tutorial: -- Hrs. Per week [N A]		Assignment & Quiz: 10 Marks
Practical : -- Hrs. Per week [N A]		End Semester Exam: 70 Marks
Credits : 04		
Aim :-		
Objective :-		
S.No		
1	**To train students for literature search, collection of appropriate material on their selected topic.**	
2	**To impart training on proper sequencing of the collected material for presentation.**	
3	**To develop the written & oral communication skills.**	
Pre-Requisite :- Nil		
Contents		Hrs.
Unit 1.	A student will give a seminar on the literature collected on the given topic to him/her.	30
Text Books: Nil		
Reference books : Nil		
Suggested List of Laboratory Experiments : Nil		
Suggested List of Assignments/Tutorial : Nil		

Name of the Course : PHARMACEUTICS – III	
Course code: T-710	**Semester :** VII
Duration : 60 Hrs.	**Maximum Marks :** 100
Teaching Scheme	**Examination Scheme**
Theory : 04 Hrs. Per week	Mid Semester Exam: 20 Marks
Tutorial: Hrs. Per week[As required]	Assignment & Quiz: 10 Marks
Practical : Hrs. Per week [N A]	End Semester Exam: 70 Marks
Credits : **04 [FOR ALL THEORY & PRACTICALS ONE CREDIT = 25 MARKS]**	

Aim :-

Objective :-

S. No	
1	The module aims to provide specific principles involved in dosage form design.
2	To provide basic idea about the projection of stability in Pharmaceuticals.
3	To get an overview on various novel drug delivery systems, cosmetics & pharmaceutical packaging.

Pre-Requisite :- Nil

	Contents	Hrs.
Unit -1	**Preformulations** Consideration of Importance, physical properties, physical forms, particle size, crystal forms, bulk control, solubility, wetting,flow cohesiveness,compressibility, organoleptic properties and its effect on final product consideration of Chemical properties,hydrolysis, oxidation, recemization, polymerization, isomerization,decarboxylation, enzymatic decomposition, formulation additives, stabilizers, suspending and dispersing agents dyes, solid excipients etc. and its effect on quality of finished product.	07
Unit -2	**Radio Pharmaceuticals** Therapeutic uses, diagnostic uses, facilities and work area, preparation of radio pharmaceuticals, radio pharmaceuticals used in medicines.	03
Unit – 3	**Stability of formulated products** Requirements, drug regulatory aspects, pharmaceutical products stability, self life, overages, containers, closures.	05
Unit – 4	**Kinetic Principles and Stability Testing** Reaction rate and order, acid base catalysis, decomposition reactions, methods of stabilization and accelerated stability testing.	07
Unit – 5	**Prolonged Action Pharmaceuticals** Benefits, limitations, oral products, terminology, drug elimination rate, types and construction of implants products, products evaluation, parenteral products, absorption and evaluation.	05
Unit – 6	**Novel Drug delivery system** Critical fluid technology, transdermal drug delivery system, controlled drug delivery system, multiple emulsion, nano particles, targeted drug delivery system, aerosols, inhalation & new products reported etc.	07
Unit – 7	**Cosmetics** Formulation and preparation of dentifrices, hair creams, lipsticks, face powders, shaving preparations, skin creams, shampoos, hair dyes, depilatories, manicure preparations etc.	11

Unit – 8	**Packaging Materials** Role and features of Pharmaceutical packing materials. Glass, plastic, rubber, metal and paper as pharmaceutical packaging material. General quality control of pharmaceutical packages. Primary, secondary and tertiary packaging materials. Child resistant and pilfer proof packaging.	04
Unit – 9	**GMP and Validation** Concept and need of good manufacturing practice guidelines. Elements of GMP covering controls of area and processes and product. Regulations related to GMP. Introduction of validation process. Types of validation. Brief methodology of process, equipments and instrument validation.	07
Unit – 10	**Pilot plant scale up techniques** Need, organization and layout, scale up techniques for solid and liquid dosage forms. Technology transfer.	04
	Total	**60**

Text Books:

Name of Authors	Titles of the Book	Edition	Name of the Publisher
Leon Lachmann, H. Liebermann	Principles And Practice Of Industrial Pharmacy		Churchill Livingston
Aulton	Pharmaceutics		Churchill Livingston
Ginnaro A. R.	Remington's Science And Practice Of Pharmacy		Merck Publishing Co.
Govt. of India	Indian Pharmacopoeia		The Controller of Publications
B. P. Commission	British Pharmacopoeia		H. M. S. O. London
US Govt.	United State Pharmacopoeia		US Govt.
Chein	Controlled Drug Delivery Systems		Marcel Dekker Publication

Reference books : Nil

Suggested List of Laboratory Experiments : Nil

Suggested List of Assignments/Tutorial : Nil

Name of the Course : PHARMACEUTICS – III	
Course code: P-710	**Semester :** VII
Duration : 90 Hrs.	**Maximum Marks :** 100
Teaching Scheme	**Examination Scheme**
Theory : Hrs. Per week [N A]	Mid Semester Exam: 20 Marks
Tutorial: Hrs. Per week [N A]	Assignment & Quiz: 10 Marks
Practical : 06 Hrs. Per week	End Semester Exam: 70 Marks
Credits : **04 [FOR ALL THEORY & PRACTICALS ONE CREDIT = 25 MARKS]**	

Aim :-

Objective :-

S. No	
1	**To train students in carrying out experiments involving different evaluation parameters in a dosage form.**
2	**To allow the students to study the effects of solubility, pH, oxidation etc. on stability of a preparation.**
3	**To give actual training in preparation of modern drug delivery system / s.**
4	**To train the students on determination of shelf life of a formulation.**

Pre-Requisite :- Nil

Contents		Hrs.
S. No	Nil	

Text Books: Nil

Reference books :

Name of Authors	Titles of the Book	Edition	Name of the Publisher

"It is strongly recommended that some standard book/s be used for practicals. The choice of book/s is left to the concerned teachers".

Suggested List of Laboratory Experiments :

S. No	
1	To compare oxidative degradation of ascorbic acid at different pH.
2	To compare degradation rate constant in presence of metallic ions.
3	To study flow property, compressibility and compactness of the given powder material.
4	To evaluate given suspending agent for F value.
5	To study the effect of anti oxidant on given drug prone to oxidation.
6	Determination of effect of solvent on aspirin solution stability.
7	To determine pH solubility profile of a given drug.
8	To study the component of TDDS system.
9	To prepare o/w/o multiple emulsion.

10	To determine the shelf life of given drug formulation by accelerated stability testing.
11	Preparation and quality control test for 1. Cold cream 2. Vanishing cream 3. Shaving cream 4. Tooth paste 5. Hair setting lotion 6. Moisturizing cream 7. Tooth powder
12	To find out energy of activation at given pH.
13	To evaluate chemically the given plastic material by I. P. method.
14	To perform stability study of given formulation at 45^0C.
15	To evaluate given glass container for hydrolytic resistance test I. P.
16	To prepare liposomes.
17	Determine the partition coefficient of the given drug.
18	To study crystal habits and forms of given drugs.
19	Determination of partition coefficient of a drug.
20	Determination of solubility of a drug.
Suggested List of Assignments/Tutorial : Nil	

Name of the Course : PHARMACEUTICAL CHEMISTRY – IV	
Course code: T-720	**Semester :** VII
Duration : 60 Hrs.	**Maximum Marks :** 100
Teaching Scheme	**Examination Scheme**
Theory : 04 Hrs. Per week	Mid Semester Exam: 20 Marks
Tutorial: -- Hrs. Per week [As required]	Assignment & Quiz: 10 Marks
Practical : -- Hrs. Per week [N A]	End Semester Exam: 70 Marks
Credits : **04 [FOR ALL THEORY & PRACTICALS ONE CREDIT = 25 MARKS]**	

Aim :-

Objective :-

S. No	
1	To expose the students towards drugs related to the treatments of disorders of nervous system.
2	To develop the conceptual knowledge of drug design based upon structure activity relationship.
3	To provide the basic ideas about important technologies used in drug discovery programs.

Pre-Requisite :- Nil

	Contents	Hrs.
Unit -1	**Different classes of therapeutic drugs** A detailed study of the following classes with respect to drug nomenclature, classification, physicochemical properties, mode of action [MOA], biosynthesis, structure activity relationships [SAR], wherever applicable, synthesis of simple & prototype molecules, drug metabolism, therapeutic uses & side effects. Drug resistance, wherever applicable, should be covered in respective classes of drugs.	
Unit -2	A.Narcotic [centrally acting] analgesics [analgetics]. Morphine & all its structural modifications [peripheral & nuclear]. Narcotic agonists & antagonists [dual & pure]. Non-narcotic analgesics [NSAIDS]. Difference between narcotic & non-narcotic agents.	09
Unit -3	B. Adrenergic drugs. Neurotransmitters & their role. General & specific adrenergic agonists & antagonists [up to ά-2 & β-2 only].	08
Unit -4	C. Cholinergic agents. Muscarinic & nicotinic cholinergic agonists & antagonists [up to M_2 & N_2]. Neuronal [transmission] blockers.	08
Unit -5	D. Drugs used in neuromuscular disorders. Drugs used in the treatment of Parkinson's disease. Central & peripheral muscle relaxants.	06
Unit -6	E. Hypertensive, antihypertensive, & antianginal agents.	06
Unit -7	F. Eicosanoids. Prostaglandins, prostacyclins, & thromboxanes. Their biochemical role, biosynthesis, & inhibitors.	05
Unit -8	G. Introduction to quantitative structure activity relationship [QSAR]. Linear free energy relationship. Hammett's equation. Use of substituent constants such as π, σ, E_s, & physicochemical parameters such as pK_a, partition coefficient, Rm, chemical shifts, molar refractivity, simple & valance molecular connectivity to indicate electronic effects, lipophillic effects, & steric effects. Introduction, methodology, advantages & disadvantages / limitations of Hansch analysis.	06

Unit -9	H. Asymmetric synthesis. Chirality, chiral pool, sources of various naturally available chiral compounds. Eutomers, distomers, eudismic ratio. Enantioselectivity & enantiospecificity. Enantiomeric & diasteriomeric excess. Prochiral molecules. Asymmetric synthesis of captopril & propranolol.	06
Unit -10	I. Combinatorial chemistry. Introduction & basic terminology. Databases & libraries. Solid phase synthesis technique. Types of supports & linkers, Wang, Rink, & dihydropyran derivatized linkers. Reactions involving these linkers. Manual parallel & automated parallel synthesis. Houghton's tea bag method, micromanipulation, recursive deconvolution. Mix & split method for the synthesis of tripeptides. Limitations of combinatorial synthesis. Introduction to throughput screening.	06
	Total	60

Text Books: Nil

Reference books :

Name of Authors	Titles of the Book	Edition	Name of the Publisher
Foye W. O.	Principles Of Medicinal Chemistry		K. E. Varghese & Company, Mumbai, India
Wilson, C., Gisvold, O., & Doerge. J., B.	Text Book Of Organic Medicinal & Pharmaceutical Chemistry		J. B. Lippincot Company, Toronto, Canada
Abraham, D. J.	Burger's "Medicinal Chemistry & Drug Discovery		John Wiley & Sons Inc., New York
Lednicer Daniel	Organic Chemistry Of Drug Synthesis (Vol. I to VI)		Wiley-Interscience, U. S. A.

Suggested List of Laboratory Experiments : Nil

Suggested List of Assignments/Tutorial : Nil

Name of the Course : PHARMACEUTICAL CHEMISTRY -IV	
Course code: P-720	**Semester :** VII
Duration : 90 Hrs.	**Maximum Marks :** 100
Teaching Scheme	**Examination Scheme**
Theory : Hrs. Per week	Mid Semester Exam: 20 Marks
Tutorial: Hrs. Per week	Assignment & Quiz: 10 Marks
Practical : 06 Hrs. Per week	End Semester Exam: 70 Marks
Credits : **04 [FOR ALL THEORY & PRACTICALS ONE CREDIT = 25 MARKS]**	

Aim :-

Objective :-

S. No	
1	**To give an understanding regarding the use of different name reactions in preparation of some useful compounds for synthesis of simple drug molecules.**
2	**To give training in use of different commercially available compounds for preparing drug / s.**
3	**To train the students in safe handling of very reactive chemical reagents by giving suitable reactions or demonstration of the same.**

Pre-Requisite :- Nil

Contents		Hrs.
S. No.	**Nil**	

Text Books: Nil

Reference books :

"It is strongly recommended that some standard book/s be used for practicals. The choice of book/s is left to the concerned teachers".

Suggested List of Laboratory Experiments :

S. No	
1	Preparation of cinnamic acid from benzaldehyde.
2	Preparation of salicylaldehyde from phenol.
3	Preparation of 1,3,5-tribromobenzene from aniline.
4	Preparation of anthranilic acid from phthalic anhydride.
5	Preparation of 5,5-diphenyl hydantoin from benzoin.
6	Preparation of benzylic acid from benzoin.
7	Preparation of o-allyl phenol from phenol.
8	Preparation of acetophenone / benzophenone from benzene.
9	Preparation of t-butylbenzene from benzene & t-BuOH.
10	Preparation of ethyl cinnamate from benzyl alcohol.
11	Preparation of benzocaine from toluene.
12	Preparation of quinoline / isoquinoline [or any appropriate heterocycle] by conventional &

	microwave synthesis.
13	Demonstration of experiment involving use of fluorinating agent/s.
14	Demonstration of the use of NaH, $NaBH_4$, B_2H_6, & $LiAlH_4$.
Suggested List of Assignments/Tutorial : Nil	

Name of the Course : CLINICAL PHARMACY AND THERAPEUTICS	
Course code: T-730	**Semester :** VI
Duration : 60 Hrs.	**Maximum Marks :** 100
Teaching Scheme	**Examination Scheme**
Theory :04 Hrs. Per week	Mid Semester Exam: 20 Marks
Tutorial: Hrs. Per week [As required]	Assignment & Quiz: 10 Marks
Practical : Hrs. Per week [N A]	End Semester Exam: 70 Marks
Credits : **04 [FOR ALL THEORY & PRACTICALS ONE CREDIT = 25 MARKS]**	

Aim :-

Objective :-

S. No	
1	To understand the dosage calculations appropriate for the patient and be able to select the proper drug.
2.	To understand the importance of rational prescribing of drugs and concept of essential drugs.

Pre-Requisite :- Nil

Contents		Hrs.
Unit -1	General Principles, preparation, maintenance, analysis of observational records in clinical Pharmacy.	03
Unit -2	Clinical trials, type and phases of clinical trials, placebo, ethical and regulatory issues including Good clinical practice in clinical trials.	03
Unit – 3	Therapeutic drug monitoring, adverse drug reaction (ADR), types of ADR, Mechanism of ADR. Drug interaction, Monitoring and reporting of ADR and its significance.	05
Unit – 4	Drug information services, Drug interactions.	03
Unit - 5	Drug interaction in pediatric and geriatric patients, drug treatment during pregnancy, lactation and menstruation.	05
Unit – 6	Pharmacovigilance, Therapeutic drug monitoring, Neutraceuticals, essential drugs and rational drug usage.	04
Unit – 7	Age related drug therapy: concept of posology, drug therapy for neonates, pediatrics and geriatrics. Drugs used in pregnancy and lactation.	05
Unit – 8	Drug therapy in gastrointestinal, hepatic, renal, cardiovascular and respiratory Disorders.	06
Unit – 9	Drug therapy for neurological and psychological disorders.	06
Unit – 10	Drug therapy in infections of respiratory system, urinary system, infective meningitis, TB, HIV, malaria and filaria.	06
Unit – 11	Drug therapy for thyroid and parathyroid disorders, diabetes mellitus, menstrual cycle disorders, menopause and male sexual dysfunction.	05
Unit – 12	Drug therapy for malignant disorders like leukemia, lymphoma and solid tumors.	05
Unit – 13	Drug therapy for rheumatic, eye and skin disorders.	04
	Total	**60**

Text Books:

Name of Authors	Titles of the Book	Edition	Name of the Publisher

Alain L. I.	Non Prescription Drugs		Blackwell Scientific Publishers
Carter S. J.	Dispensing For Pharmaceutical Student		CBS Publishers
Collet D. M. & Aulton M. E.	Pharmaceutical Practice		Churchill Livingston
Mulholland B. V.	Drug Calculations		Mosby
Stone P. & Curtis S. J.	Pharmacy Practice		SAGE Publisher
Reference books : Nil			
Suggested List of Laboratory Experiments : Nil			
Suggested List of Assignments/Tutorial : Nil			

Name of the Course : PHARMACEUTICAL ENGINEERING	
Course code: T-740	**Semester :** VII
Duration : 60 Hrs.	**Maximum Marks :** 100
Teaching Scheme	**Examination Scheme**
Theory : 04 Hrs. Per week	Mid Semester Exam: 20 Marks
Tutorial: Hrs. Per week [As required]	Assignment & Quiz: 10 Marks
Practical : Hrs. Per week [N A]	End Semester Exam: 70 Marks
Credits : 04 **[FOR ALL THEORY & PRACTICALS ONE CREDIT = 25 MARKS]**	

Aim :-

Objective :-

S. No	
1	To create awareness regarding the unit operations involved in Pharmaceutical industry.
2	To provide overview of Pharmaceutical machineries.
3	To enable students in selecting proper equipment for material processing in Pharma. Industry
4	To educate learners about hazards and safety aspects in industrial environment.

Pre-Requisite :- Nil

Contents		Hrs.
Unit -1	**Fluid flow** Type of flow, Reynold's number, viscosity, concept of boundary layer, basic equation of fluid flow, study of valves, flow meters, manometers and measurement of flow and pressure (mathematical problems included).	04
Unit -2	**Heat transfer** Source of heat, mechanism of heat transfer, the laws of heat transfer, steam and electricity as heating media, determination of requirement of amount of steam/electrical energy , steam pressure, boiler capacity, mathematical problems on heat transfer, steam traps and reducing valve, lagging etc.	05
Unit -3	**Evaporation** Basic concept of phase equilibrium, factors affecting evaporation, evaporators, film evaporators, single effect and multiple effect evaporators, mathematical problems on evaporation.	03
Unit -4	**Distillation** Rault's law, phase diagram, volatility: simple steam and flash distillation, principles of rectification, Mc-Cabe Thiele method for calculations of number of theoretical plates, azeotropic and extractive distillation, mathematical problems on distillation.	06
Unit -5	**Drying** Moisture content and mechanism of drying, rate of drying and time of drying calculations, classifications and types of dryers, dryers used in pharmaceutical industries and special drying methods like freeze drying and lyophilization, mathematical problems in drying.	06
Unit -6	**Size reduction and size separation** Definition, objectives of size reduction, factors affecting size reduction, laws governing in energy and power requirement of a mill, types of mills including ball mill, hammer	07

	mill, fluid energy mill , micronizer, quadro co-mil, multimill etc .	
Unit -7	**Extraction** Theory of extraction, extraction methods, equipment for various types of extraction process.	05
Unit -8	**Mixing** Theory of mixing, solid-solid, solid-liquid and liquid-liquid mixing equipment.	05
Unit -9	**Crystallization** Characteristics of crystals like purity, size, shape, geometry, habit, forms, size and factors affecting them. Solubility curves and calculation curves and calculations of heat balance around S Swanson's Walker crystallizer , super saturation theory and its limitations, Nucleation mechanism, crystal growth, study of various types of crystallizers, tanks, agitated batch, Swensons Walker, single vacuums, circulating magma and crystal crystallizers, cacking of crystals and its prevention. Numerical problems on yields. Introduction to polymorphism.	05
Unit -10	**Filtration and Centrifugation** Theory of filtrations, filter aids, filter media, industrial filters, including filter press, rotary filter, edge filters, filter leaf and laboratory filtration equipments etc., Factors affecting filtration, mathematical problems on filtrations, optimum cleaning cycle in batch filters. Principles of centrifugation, industrial centrifugal filters and centrifugal sedimentars.	04
Unit -11	**Dehumidification and humidity control** Basic concept and definition, wet bulb and adiabatic saturation temperatures, psychometric count and measurement of humidity, application of humidity measurement in pharmacy, equipments for humidification and dehumidification operations.	02
Unit -12	**Refrigeration and air conditioning** Principles and applications of refrigeration and air conditioning.	02
Unit-13	**Material of constructions** General study of composition, corrosion, resistance, properties and applications of the materials of construction with special reference to stainless steel, glass, ferrous metals, cast iron, non ferrous metals, copper and alloys, aluminum and alloys, lead, tin, silver, nickel and alloys, chromium and non metals, stone, slate, brick, asbestos, plastics, rubber, timber, concrete. Corrosion and its prevention with reference to commonly used material in pharmaceutical plants.	02
Unit-14	**Automated process control systems** Process variable, temperature, pressure, flow, level and vacuum and their measurement. Elements of automatic process control and introduction to automatic process control. Elements of computer aided manufacturing(CAM).	02
Unit -15	**Industrial hazards & safety precautions** Mechanical, chemical, electrical, fire, dust, noise hazards, Industrial dermatitis, accident, records, safety requirements/equipments etc.	02
	Total	**60**

Text Books:

Name of Authors	Titles of the Book	Edition	Name of the Publisher
Badger W. L. & Banchero J.T.	Introduction To Chemical Engineering		McGraw Hill, NY
Brown George G.	Unit Operations		CBS Publication
Cooper & Gunn	Tutorial Pharmacy		CBS Publication

Perry R. H.	Perry's Chemical Engineers Hand Book		Tata McGraw Hill
Richardson J. F. & Coulson J.M.	Chemical Engineering		Asian Books Delhi
Reference books : Nil			
Suggested List of Laboratory Experiments : Nil			
Suggested List of Assignments/Tutorial : Nil			

Name of the Course : BIOPHARMACEUTICS AND PHARMACOKINETICS	
Course code: T-810	**Semester :** VIII
Duration : 60 Hrs.	**Maximum Marks :** 100
Teaching Scheme	**Examination Scheme**
Theory : 04 Hrs. Per week	Mid Semester Exam: 20 Marks
Tutorial: Hrs. Per week [As required]	Assignment & Quiz: 10 Marks
Practical : Hrs. Per week [N A]	End Semester Exam: 70 Marks
Credits : **04 [FOR ALL THEORY & PRACTICALS ONE CREDIT = 25 MARKS]**	
Aim :-	
Objective :-	

S. No	
1	To have a basic understanding of scope and impact of biopharmaceutics and pharmacokinetics.
2	To have general knowledge of various factors affecting drug absorption, distribution, metabolism and excretion.
3	To expose the students towards applications of kinetic principles in understanding blood levels of the drug and their effect on therapeutic performance on dosage forms.

Pre-Requisite :-

	Contents	Hrs.
Unit -1	**<u>Bio-pharmaceutics</u>** Fate of drug after drug absorption, various mechanisms for drug absorption, drug concentration in blood, biological factors in drug absorption, physicochemical factors, dosage form consideration for gastrointestinal absorption. Drug Absorption: a. Gastrointestinal absorption-biological considerations. astrointestinal absorption - physicochemical considerations. c. Gastrointestinal absorption-role of the dosage form. Pharmacokinetics. Compartmental and non-compartmental pharmacokinetics. Biotransformation, drug disposition - distribution, drug disposition - elimination. Variability-Body weight, age, sex and genetic factors. Pharmacokinetic variability-diseases. Pharmacokinetic variability-drug interactions. Individualization and optimization of drug dosing regimens.	18
Unit -2	**<u>Bio-availability & Bio-equivalence</u>** Quality parameters of dosage forms. Assay methods & its validation. Physico - chemical properties of drugs & added substances and its effect on preparations and biological availability of dosage forms. Pharmaceutical properties of dosage forms, disintegration, dissolution rate. Biological, pharmacological effects of dosage forms. Factors affecting Bioavailability, Determination of bioavailability. Significance of bio-equivalence studies. Statistical analysis of bioequivalence studies. Development, scale up & post approval changes [SUPAC] & *in vitro* [dissolution] *in vivo* [plasma concentration profile] correlation or IV / IV correlation (IVIVC). Multi stage - Bioequivalence studies. Therapeutic	22

	equivalence. Titration design for clinical rationales. New Drug Application [NDA].	
Unit -3	**Bio- pharmaceutical statistics** Post Marketing Surveillance. Process Validation.	20
	Total	**60**

Text Books:

Name of Authors	Titles of the Book	Edition	Name of the Publisher
Leon Shargel,	Comprehensive Review of Pharmacy		Lippincott
Milo Gibaldi	Bio Pharmaceutics and Clinical Pharmacokinetics		Marcel Dekker Inc. USA
Welling and TSE	Pharmacokinetics Regulatory, Industrial and Academic Prospectives (Vol. 57)		Marcel Dekker Inc. USA
Willing and TSE	Pharmaceutical Bioequivalence (Vol. 48)		Marcel Dekker Inc. USA
Madan P. I.	Biopharmaceutics and Practical Pharmacokinetics		Whittier Publications

Reference books : Nil

Suggested List of Laboratory Experiments : Nil

Suggested List of Assignments/Tutorial : Nil

Name of the Course : BIOCHEMISTRY	
Course code: T-820	**Semester :** VIII
Duration : 60 Hrs.	**Maximum Marks :** 100
Teaching Scheme	**Examination Scheme**
Theory : 04 Hrs. Per week	Mid Semester Exam: 20 Marks
Tutorial: Hrs. Per week [As required]	Assignment & Quiz: 10 Marks
Practical : Hrs. Per week [N A]	End Semester Exam: 70 Marks
Credits : **04 [FOR ALL THEORY & PRACTICALS ONE CREDIT = 25 MARKS]**	

Aim :-

Objective :-

S. No	
1	To impart broad understanding of molecular level of chemical process associated with living cells.
2	To develop the knowledge regarding enzymes and its related issues.
3	To provide idea about metabolic processes involved in illnesses.

Pre-Requisite :- Nil

Contents		Hrs.
Unit -1	**Cell** Revision of ultra structure of cell, functions of various cellular constituents. Applications of biochemical principles to pharmacy.	02
Unit -2	**Carbohydrates** Types of carbohydrates, their functions, digestion, & absorption. Aerobic & anaerobic oxidation with energetics. Glycogenesis, glycogenolysis, & gluconeogenesis. Hexose monophosphate shunt [HMP shunt].Diseases associated with carbohydrate metabolism.	09
Unit -3	**Proteins** Different types of proteins. Their functions, digestion & absorption. Denaturation & its effect on biological activity. Renaturation of proteins. Urea formation, urea cycle, creatinine formation. Transamination & deamination. Proteins as enzymes.	09
Unit -4	**Lipids** Different types of lipids. Their functions, digestion, absorption & metabolism. β-Oxidation of fatty acids with energetics. Biosynthesis of cholesterol [from acetate], adrenocorticoids, androgens, progesterone, estrogens, & bile acids / salts. Ketone bodies, their formation & biochemical significance. Diseases associated with lipid metabolism.	08
Unit -5	**Vitamins** Definition. Classification, structures [except B_{12}] biochemical role, sources, daily requirements, & deficiency symptoms. Vitamins as co-factors in biochemical reactions.	06
Unit -6	**Biological oxidations & reductions** Oxidation reduction systems in the body. Electron transport chain. Cytochromes & their role. Oxidative phosphorylation & inhibitors of the same.	05
Unit -7	**Enzymes** Classification & their various roles. Enzyme co-factors.	06

	Enzyme kinetics. Michaelis-Menton equation along with its transformations. Double reciprocal plot. Factors affecting enzyme action. Enzyme inhibition, competitive & non-competitive, & kinetics.	
Unit -8	**Nucleic acids** Different types of nucleic acids [NAs] & their composition. Purine & pyrimidine bases, sugars, & phosphoric acid. Nucleosides & nucleotides. Formation of NAs & their back bone. Different ways of representing DNA & RNA molecules. Physico-chemical properties of NAs. Their stability in acidic & basic solutions. Isolation, purification & identification, buoyant density, sedimentation coefficient, & Svedberg constant of NAs. De-novo biosynthesis of NAs. DNA & the Watson-Crick model & its features. DNA as the bearer of genetic information. Central dogma of molecular genetics & the processes defined in the same. Replication of DNA. Different types of RNAs with their special features & functions. Minor or rare bases. Transcription & translation. Different post translational modifications of proteins. Triplet codon & the codon dictionary. Mutations. An introduction to different types of mutations. Their nature & repair.	12
Unit -9	**Hereditary diseases.** Eliptocytosis, spherocytosis, HNPCC, diabetes insipidus.	03
	Total	**60**

Text Books:

Name of Authors	Titles of the Book	Edition	Name of the Publisher
David L. Nelson	Lehninger's Principles of Biochemistry		W. H. Freeman And Company
Deb A. C.	Fundamentals of Biochemistry		New Central Book Agency Kolkata 1996
Murray R. K.	Harper's Biochemistry		
Pattab Iraman	Principles of Biochemistry		Gajanan Bangalore
Champe P.	Lippincot's Illustrated Reviews Biochemistry		William and Willkins

Reference books : Nil

Suggested List of Laboratory Experiments : Nil

Suggested List of Assignments/Tutorial : Nil

Name of the Course : BIOCHEMISTRY	
Course code: P-820	**Semester :** VIII
Duration : 60 Hrs.	**Maximum Marks :** 100
Teaching Scheme	**Examination Scheme**
Theory : Hrs. Per week [N A]	Mid Semester Exam: 20 Marks
Tutorial: Hrs. Per week [N A]	Assignment & Quiz: 10 Marks
Practical : 06 Hrs. Per week	End Semester Exam: 70 Marks
Credits : **04 [FOR ALL THEORY & PRACTICALS ONE CREDIT = 25 MARKS]**	

Aim :-

Objective :-

S. No	
1	**To train students in performing experiments involving determination of different bio-constituents in biological fluids.**
2	**To train students in isolation / purification of biologically important macromolecules.**
3	**To train the students in characterization & estimation of biomolecules.**

Pre-Requisite :- Nil

Contents	Hrs. Per week

Text Books: Nil

Reference books :-

"It is strongly recommended that some standard book/s be used for practicals. The choice of book/s is left to the concerned teachers"

Suggested List of Laboratory Experiments :

S. No	
1	Qualitative tests for carbohydrates.
2	Qualitative tests for amino acids & proteins.
3	Estimation of creatinine.
4	Estimation of SGPT & SGOT.
5	Isolation of different enzymes.
6	Purification of enzymes.
7	Effect of temperature, pH, & ions on enzyme activity.
8	Estimation of salivary amylase & β-amylase.
9	Demonstration of separation of proteins by electrophoresis.
10	Preparation of sucrose & / or cesium chloride [CsCl] gradient.
11	Isolation of DNA / RNA from plants or non-pathogenic microorganisms.
12	Purification of DNA / RNA.
13	Identification of DNA / RNA by chromatographic or spectral methods.

14	Measurement of buoyant density of DNA / RNA in sucrose / CsCl gradient.
15	Estimation of DNA / RNA.
Suggested List of Assignments/Tutorial : Nil	

Name of the Course : PHARMACOGNOSY – III	
Course code: T-830	**Semester :** VIII
Duration : 60 Hrs.	**Maximum Marks :** 100
Teaching Scheme	**Examination Scheme**
Theory : 04 Hrs. Per week	Mid Semester Exam: 20 Marks
Tutorial: Hrs. Per week [As required]	Assignment & Quiz: 10 Marks
Practical : Hrs. Per week [N A]	End Semester Exam: 70 Marks
Credits : **04 [FOR ALL THEORY & PRACTICALS ONE CREDIT = 25 MARKS]**	

Aim :-

Objective :-

S. No	
1	To develop the concept of value addition to herbal drugs in terms of quality standards and standardization of herbal drugs.
2	To impart the knowledge of isolating active principles from crude drugs.
3	To make learners aware about the regulatory aspects of intellectual properties related to the herbs.

Pre-Requisite :- Nil

	Contents	Hrs.
Unit -1	**Extraction and Isolation Techniques** General methods used for the extraction, isolation and identification of alkaloids, lipids, glycosides, flavonoids, saponins, volatile oils and resins. Application of column, paper and thin layerchromatographic techniquesfortheisolationof phytopharmaceuticals.	06
Unit -2	**Phytopharmaceuticals** Isolation, identification and estimation of: caffeine, eugenol, digoxin, piperine, tannic acid, diosgenin, hesperidine, berberine, calcium sennosides, rutin, glycyrrhizin, menthol, ephedrine, quinine, andrographolides and guggul lipids.	08
Unit -3	**Quality control and Standardization of herbal drugs** Quality control of herbal drugs as per WHO, AYUSH and Pharmacopoeialguidelines-Extractivevalues,ashvalues, chromatographictechniques(TLC,HPTLCandHPLC)for determination of chromatographic markers. Determination of heavy metals, insecticides, pesticides and microbial load in herbal preparations.	08
Unit -4	**Herbal formulations** Principles involved in Ayurveda, Sidha, Unani, Chinese and Homeopathic systems of medicines. Preparation of Ayurvedic formulations like aristas, asava, ghutika, tailia, churna, avaleha, ghrita and bhasmas: Unani formulations like majooms, Safoofs. Determination of alcohol contents in arishtas and bhasmsa.	08
Unit -5	**Worldwide trade of crude drugs and volatile oils** Study of drugs having high commercial value and their regulations pertaining to trade.	06
Unit -6	**Plant Biotechnology** History and scope of plant tissue culture, growth media, plant growthregulators: callusand suspensionculture, Biotransformation,immobilization,hairyrootculture. Transgenicplants and their applications, plant tissue culture as source of secondary metabolites.	05

Unit -7	**Herbal cosmetics** Importance of herbals as shampoos (soapnut), conditioners and hair darkeners, (amla, henna, hibiscus, tea), skin care (aloe, turmeric, lemon peel, vetiver).	05
Unit -8	**Traditional herbal drugs** Common names, sources, morphology, active constituents and uses (traditional, folklore), pharmacological and clinical uses of: punarnava(*Boerhaviadiffusa*), shankhpushpi(*Convolvulus microphylla*), lehsun (*Allium sativum*), guggul (*Commiphora mukul*), kalmegh (*Andrographis peniculata*), tulsi (*Ocimum sanctum*), valerian (*Valerian officinalis*), artemisia (*Artemisia annua*), chirata (*Swertia chirata*), ashoka (*Saraca indica*).	06
Unit -9	**Plants based industries and research institutes in India** Knowledge about the herbal products being manufactured by premier herbal industries and thrust area of the institutes involved in plant research.	04
Unit-10	**Patents** Indian and International patent laws, proposed amendments as applicable to herbal/natural products and processes: Intellectual Property Rights with special reference to phytoconstituents.	04
	Total	**60**

Text Books:

Name of Authors	Titles of the Book	Edition	Name of the Publisher
Craker L. E.	Herbs, Spices And Medicinal Plants		CBS Publishers
Trease and Evans,	Pharmacognosy		W. .Saunders, New York
V. E., Tylor, L. R. Brady and S. B., Robbers	Pharmacognosy		K. M. Varghese Co. Bombay.
Wallis T. E.	Textbook Of Pharmacognosy		CBS, Delhi
Jean Bruneton	Pharmacognosy and Phytochemistry		Lavosier Publisher U.K.
Manual K. Lindsey	Plant Tissue Culture		Springer U.K.
Wagner and Bladt	Plant Drug analysis		Springer U.K.
	Indian Herbal Pharmacopoea		IDMA, Mumbai

Reference books : Nil

Suggested List of Laboratory Experiments : Nil

Suggested List of Assignments/Tutorial : Nil

Name of the Course : PHARMACOGNOSY – III	
Course code: P-830	**Semester :** VIII
Duration : 60 Hrs. Per week	**Maximum Marks :** 100
Teaching Scheme	**Examination Scheme**
Theory : Hrs. Per week [N A]	Mid Semester Exam: 20 Marks
Tutorial: -- Hrs. Per week [N A]	Assignment & Quiz: 10 Marks
Practical : 06 Hrs. Per week	End Semester Exam: 70 Marks
Credits :04	

Aim :-

Objective :-

S. No	
1	**To train students in performing different chemical tests for identification of different phytoconstituents.**
2	**To impart training extraction / isolation of various biologically important phytoconstituents present in natural sources.**
3	**To train the students in estimation of these diverse biologically important phytochemicals.**

Pre-Requisite :- Nil

Contents		Hrs.
S. No.	Nil	

Text Books: Nil

Reference books :

"It is strongly recommended that some standard book/s be used for practicals. The choice of book/s is left to the concerned teachers"

Suggested List of Laboratory Experiments :

S. No	
1	Chemical tests of: Plantago, Pale catechu, Black catechu, Tannic acid, Clove, Cinnamon, Benzoin, Peru balsam, Tolu balsam, Colophony, Asafoetida, Aloe, Cinchona, Ipecac, Nux vomica.
2	Pharmacognosy tour for field collection of medicinal and aromatic plants.
3	Preparation of herbarium sheets and monograph on one of the collected plants during tour.
4	Extraction, Isolation, estimation and TLC profile of total alkaloids: Rauwolfia, Cinchona, Tea and Datura.
5	Morphology and powder study of traditional herbal drugs.
6	Determination of Moisture content, Ash value, Swelling factor, Extractive values and foreign organic matter in herbal drugs.
7	Extraction and TLC profile of volatile oils: Eucalyptus, Clove, Cumin and Lemon grass.
8	Isolation of Lipids, Resins, Tannic acids, Sennosides and Quinine.
9	Estimation of ascorbic acid and anthraquinone glycosides by UV spectroscopy.

Suggested List of Assignments/Tutorial : Nil

Name of the Course : PHARMACEUTICAL MANAGEMENT	
Course code: T-840	**Semester :** VIII
Duration : 60 Hrs. Per week	**Maximum Marks :** 100
Teaching Scheme	**Examination Scheme**
Theory : 04 Hrs. Per week	Mid Semester Exam: Marks
Tutorial: Hrs. Per week [As required]	Assignment & Quiz: Marks
Practical : Hrs. Per week [N A]	End Semester Exam: Marks
Credits : **04 [FOR ALL THEORY & PRACTICALS ONE CREDIT = 25 MARKS]**	

Aim :-

Objective :-

S. No	
1	To provide various aspects of management in pharmaceutical business.
2	To provide information on planning & forecasting.
3	To familiarize students with the significance of communication, marketing strategies, motivation, leadership aspects in business.

Pre-Requisite :- Nil

	Contents	Hrs.
Unit -1	**Introduction to management** Types of management. Basic concepts of management, management process, function and principles. Levels of management, pharmaceutical management art, science or profession.	04
Unit -2	Social responsibilities of management, functions of management.	03
Unit -3	**Planning and Forecasting** Planning: Nature, process and types of planning, steps in planningprocess, planning premises. Advantages and limitations of planning. Management by objective, meaning, objective features, advantages and limitations. Forecasting: meaning, nature, importance, limitations. Techniques of forecasting.	08
Unit -4	**Organization** Definition, nature, theories, functions, line and staff organization concepts.	04
Unit -5	**Research Management** R&D organizations and research categories. Elements needed for an R&D organization. Technology transfer.	03
Unit -6	**Inventory Management** Objective and functions of inventory control. Types of inventories. Requirements of effective inventory control.	03
Unit -7	**Communication** Nature, types of communication, process, channels and barriers of communication. Limitations of communications. Importance in pharmaceutical industries.	05
Unit -8	**Marketing Research** New product selection, product management, advertising.	03
Unit -9	**Leadership and motivation** Leadership: meaning, nature, leadership styles. Theories of leadership. Motivation:	06

	meaning, nature, importance. Theories of motivation.	
Unit-10	**Human resource and development (HRD)** Definition, HRD methods, HRD process, HRD in Indian industry.	04
Uni-11	**GATT** General Agreement on Tariff and Trade and its impact on pharmaceutical industry. History of GATT, its impact on pharmaceutical industry. Pharmaceutical market in India.	06
Unit-12	**World trade organization (WTO) and trade related intellectual property rights (TRIPS)** Introduction to WTO. Types of intellectual property rights: industrial property and copy rights Indian Patent Acts, 1970 with latest amendment. Definition, types of patents.	06
Unit-13	**Standard institutions and regulatory authorities** 1 Bureau of Indian standards (BIS). 2 International Organization for Standardization (ISO). 3 United States of Food and Drug Administration (USFDA). Central Drug Standard Control Organization (CDSCO). International Conference on Harmonization (ICH). 4 World Health Organization (WHO).	05
	Total	**60**

Text Books:

Name of Authors	Titles of the Book	Edition	Name of the Publisher
Heinz Weihrich and Harold Koontz	Management a Global Perspective		Mc Graw Hills, New Jersey
B. Gupta	Management Theory and Practice		Sultan Chand and Sons, Educational publishers , New Delhi
N. Subbaram	What everyone should know about patents?		Pharma Book syndicate , Hyderabad
Peter Bamfield	Research and Development Management in the Chemical and Pharmaceutical Industry		Wiley-VCH Verlag GmbH & Co. KgaA, Germany
Ian Beardwell , len Holden	Human Resource management A contemporary Perspective		Mac Millan Indian Ltd New Delhi

Reference books : Nil

Suggested List of Laboratory Experiments : Nil

Suggested List of Assignments/Tutorial : Nil