

SYLLABUS RELATING  
TO  
BACHELOR OF PHARMACY  
(B.PHARM.)

DEGREE COURSE

FIRST SYLLABUS OF ICT  
UNDER ITS AUTONOMOUS STATUS  
YEAR OF IMPLEMENTATION: ACADEMIC YEAR 2008-09

INSTITUTE OF CHEMICAL TECHNOLOGY  
MATUNGA, MUMBAI 400 019

## STRUCTURE OF THE COURSE

1. Nomenclature of the Course : Bachelor of Pharmacy
2. Abbreviation : B. Pharm.
3. Pattern : Semester
4. Number of Semesters : Eight
5. Nomenclature of the Semesters : Semester-I -VIII
6. Duration of the Semester : 15 Weeks Instructions (90 Working Days)
7. Duration of the Course : Four Years
8. Eligibility and Admission : As per AICTE and DTE norms
9. Ordinances, rules and regulations : Same as the general Ordinances, rules and regulations of ICT UG program.
10. Examinations, periodic test, Class work : Same as the general Ordinances, rules and regulations of ICT UG program.
11. Results, ATKT, award of class, : Same as the general Ordinances, rules and regulations of ICT UG program.
12. In-plant training : Same as the general Ordinances, rules and regulations of ICT UG program.
13. Seminar, Project, : Same as the general Ordinances, rules and regulations of ICT UG program.
14. Community Service Project : To be treated at par with Project in para 13 above

## SUMMERY OF SYLLABUS

### First Year B. Pharm.

#### SEMESTER-I

<b>THEORY</b>			
<b>No.</b>	<b>Subject Head</b>	<b>Hours/ Weeks</b>	<b>Maximum Marks</b>
1	Organic Chemistry-I	2	50
2	Mathematics-I	2	50
3	Pharmaceutics-I	2	50
4	Pharmaceutical Engineering-I	2	50
5	Anatomy, Physiology & Pathophysiology-I	2	50
6	Pharmaceutical Chemistry –I	2	50
7	Microbiology	2	50
<b>Total</b>		<b>14</b>	<b>350</b>
<b>PRACTICALS</b>			
8	Organic Chemistry Laboratory-I	4	50
9	Microbiology Laboratory	4	50
10	Anatomy, Physiology & Pathophysiology Laboratory	4	50
<b>Total</b>		<b>12</b>	<b>150</b>
<b>Grand Total</b>		<b>26</b>	<b>500</b>

#### SEMESTER-II

<b>THEORY</b>			
<b>No.</b>	<b>Subject Head</b>	<b>Hours/ Weeks</b>	<b>Maximum Marks</b>
1	Organic Chemistry-II	2	50
2	Mathematics- II	2	50
3	Pharmaceutics-II	2	50
4	Pharmaceutical Engineering-II	2	50
5	Physical Pharmacy- I	2	50
6	Anatomy, Physiology & Pathophysiology-II	2	50
7	Pharmaceutical Analysis-I	2	50
8	Assignments (Pharmaceutical Engineering)	2	50
<b>Total</b>		<b>16</b>	<b>400</b>
<b>PRACTICALS</b>			
10	Organic Chemistry Laboratory-II	4	50
11	Pharmaceutics Laboratory - I	4	50
12	Pharmaceutical Engineering Laboratory	4	50
<b>Total</b>		<b>12</b>	<b>150</b>
<b>Grand Total</b>		<b>28</b>	<b>550</b>

## Second Year B. Pharm

### SEMESTER-III

#### THEORY

No.	Subject Head	Hours/ Weeks	Maximum Marks
1	Organic Chemistry-III	2	50
2	Pharmaceutics- III	2	50
3	Physical Pharmacy- II	2	50
4	Biochemistry -I	2	50
5	Anatomy, Physiology & Pathophysiology-III	2	50
6	Psychology and Sociology	2 ( 1+1)	50
7	Hospital Pharmacy & Drug Store Management	2 ( 1+1)	50
8	Assignments(Pharmaceutics)	2	50
<b>Total</b>		<b>16</b>	<b>400</b>
<b>PRACTICALS</b>			
9	Pharmaceutics Laboratory - II	4	50
10	Physical Pharmacy Laboratory	4	50
11	Biochemistry Laboratory	4	50
12	Pharmaceutical Analysis Laboratory-I	4	50
<b>Total</b>		<b>16</b>	<b>200</b>
<b>Grand Total</b>		<b>32</b>	<b>600</b>

### SEMESTER-IV

#### THEORY

No.	Subject Head	Hours/ Weeks	Maximum Marks
1	Organic Chemistry-IV	2	50
2.	Pharmacology- I	2	50
3	Biochemistry - II	2	50
4	Pharmaceutical Analysis-II	2	50
5	Pharmaceutical & Medicinal Chemistry – II	2	50
6	Dispensing Pharmacy	2	50
7	Anatomy, Physiology & Pathophysiology-IV	2	50
8	Pharmaceutical Management-I	2	50
9	Assignments (Anatomy, Physiology & Pathophysiology-III)	2	50
10	Assignments (Organic Chemistry)	2	50
<b>Total</b>		<b>20</b>	<b>500</b>
<b>PRACTICALS</b>			
11	Dispensing Pharmacy Laboratory	4	50
12.	Community Service Project	6	100
<b>Total</b>		<b>10</b>	<b>150</b>
<b>Grand Total</b>		<b>30</b>	<b>650</b>

### Third Year B. Pharm

#### SEMESTER-V

##### THEORY

No.	Subject Head	Hours/ Weeks	Maximum Marks
1	Pharmaceutics- IV	2	50
2	Pharmacology- II	2	50
3	Biochemistry III	2	50
4	Pharmaceutical & Medicinal Chemistry – III	2	50
5	Pharmaceutical Analysis-III	2	50
6	Pharmaceutical Management-II	2	50
7	Cosmetics	2	50
8	Molecular Biology & Biotechnology	2 (1+1)	50
9	Assignments (Biochemistry)	2	50
<b>Total</b>		<b>18</b>	<b>450</b>
<b>PRACTICALS</b>			
10	Computer Applications in Pharmacy	4	50
11	Pharmacology Laboratory-I	4	50
12	Cosmeticology Laboratory	4	50
13	Molecular Biology & Biotechnology Laboratory	4	50
<b>Total</b>		<b>16</b>	<b>200</b>
<b>Grand Total</b>		<b>34</b>	<b>650</b>

#### SEMESTER-VI

##### THEORY

No.	Subject Head	Hours/ Weeks	Maximum Marks
1	Pharmaceutics- V	2	50
2	Pharmacology- III	2	50
3	Pharmacognosy-I	2	50
4	Pharmaceutical Analysis-IV	2	50
5	Pharmaceutical & Medicinal Chemistry – IV	2	50
6	Assignments (Pharmaceutical Analysis)	2	50
<b>Total</b>		<b>12</b>	<b>300</b>
<b>PRACTICALS</b>			
7	Pharmaceutics Laboratory –III	4	50
8	Pharmaceutical & Medicinal Chemistry Laboratory-I	4	50
9	Pharmaceutical Analysis Laboratory-II	4	50
10	Pharmacognosy Laboratory-I	4	50
11	Seminar	4	50
<b>Total</b>		<b>20</b>	<b>250</b>
<b>Grand Total</b>		<b>32</b>	<b>550</b>

## Fourth Year B. Pharm

### SEMESTER -VII

<b>THEORY</b>			
<b>No.</b>	<b>Subject Head</b>	<b>Hours/ Weeks</b>	<b>Maximum Marks</b>
1	Pharmaceutics – VI	2	50
2	Pharmacology- IV	2	50
3	Pharmacognosy-II	2	50
4	Pharmaceutical & Medicinal Chemistry – V	2	50
5	Pharmaceutical Analysis-V	2	50
6	Biopharmaceutics and Pharmacokinetics	2	50
7	Pharmaceutical Biotechnology	2	50
8	Assignments (Medicinal Chemistry)	2	50
9	Assignments (Biopharmaceutics)	2	50
<b>Total</b>		<b>18</b>	<b>450</b>
<b>PRACTICALS</b>			
10	Pharmacology Lab-II	4	50
11	Pharmacognosy Lab-II	4	50
12	Pharmaceutical Analysis Lab-III	4	50
13	Pharmaceutics IV and Biopharmaceutics Lab.	4	50
<b>Total</b>		<b>16</b>	<b>200</b>
<b>Grand Total</b>		<b>34</b>	<b>650</b>

### SEMESTER-VIII

<b>THEORY</b>			
<b>No.</b>	<b>Subject Head</b>	<b>Hours/ Weeks</b>	<b>Maximum Marks</b>
1	Pharmaceutics – VII	2	50
2	Pharmacognosy-III	2	50
3	Pharmaceutical & Medicinal Chemistry – VI	2	50
4	Clinical Pharmacy and Drug Interactions	2	50
5	Assignments (Pharmaceutics)	2	50
6	Assignments (Pharmacology)	2	50
7	Assignments (Pharmacognosy)	2	50
<b>Total</b>		<b>14</b>	<b>350</b>
<b>PRACTICALS</b>			
8	Pharmaceutics Lab- V	4	50
9	Pharmacognosy Lab-III	4	50
10	Pharmaceutical & Medicinal Chemistry – II	4	50
11	Project	8	100
<b>Total</b>		<b>20</b>	<b>250</b>
<b>Grand Total</b>		<b>34</b>	<b>600</b>

## First Year B.Pharm.

### SEMESTER-I

<b>Title of the Course</b>	<b>Organic Chemistry-I</b>
Marks	50
Number of Hours per Week	2
Total Hours	30
Class	F.Y. B. Pharm
Semester	I

Sr.No.	Topic	Hrs.
<b>Aliphatic Compounds Including Alicyclic</b>		
	Discussion of the following classes of compounds with regard to IUPAC nomenclature, nature of bond, polarity, strengths, pKa, etc. sources, methods of preparation, structure and physical properties (Structure property relationships), and general reactions:	
1	Hydrocarbons (alkanes, alkenes, alkynes), halogen compounds,	3
2	alcohols, ethers, thiols and thioethers, carbonyl compounds (aldehydes and ketones, carboxylic acids, esters, anhydrides, amides), thiocarbonyl compounds,	5
3	Amines, imines, amides, nitro, Sulfoxides and sulphones,	3
4	Combination functional groups: enones, ketone-carboxylic acids, amine-carboxylic acids, C=C - nitro, and changes in properties.	4
<b>Aromatic Compounds</b>		
	Discussion of the following classes of compounds with regard to IUPAC nomenclature, nature of bond, polarity, strengths, pKa, etc. sources, methods of preparation, structure and physical properties (Structure property relationships), and general reactions:	
1	Concepts of aromaticity and aromatic character, Huckel's rule, structure of and resonance in benzene;	3
2	Hydrocarbons: monocyclic, bicyclic, tricyclic, Compounds containing one, two and three hydroxy groups, thiols,	3
3	Ethers, Thioethers, carbonyl compounds (aldehydes and ketones, carboxylic acids, esters, anhydrides, amides), thiocarbonyl compounds, sulfonic acids	4
4	Amines, imines, amides, nitro, Sulfoxides and sulfones	3
5	Multiple functional groups and property changes	2

#### Books Recommended

Sr.No.	Title of the Book	Author/Editor	Edition/Year	Publisher
1	Organic Chemistry	Morrison, R. T	6 <sup>th</sup> 2005	Pearson Education
2	Organic Chemistry	Solomons, T.W.G	8 <sup>th</sup> 2004	John Wiley & Sons,
3	Organic Chemistry	Loudon G. Marc	2002	Oxford University
4	Adv.Org. Chemistry	Jerry March	4 <sup>th</sup> 2004	John Wiley & Sons,

<b>Title of the Course</b>	<b>Mathematics-I</b>
Marks	50
Number of Hours per Week	2
Total Hours	30
Class	F.Y. B. Pharm.
Semester	I

Sr.No	Topic	Hrs.
1	<b>Matrices &amp; Determinants:</b> Types of matrices, transpose of a matrix , inverse of a matrix, determinant of a matrix and its properties, elementary row and column operations on matrices, rank of a matrix, Solution of system of linear equations, gauss elimination method eigenvalues and eigenvectors of a matrix, Cayley-Hamilton theorem and its applications.	9
2	<b>Differential calculus:</b> Successive derivatives, Leibnitz's rule for nth derivative- Lagrange's and Rolle's mean value theorems, Taylor's and Maclaurin's series expansions, functions of two or three variables , Partial Differentiation, Euler formula and its applications, Local /absolute maxima and minima and its applications to least square problems. Notion of improper integral and its convergence. Introduction to Beta-Gamma functions, Curve Tracing	12
3	<b>Integral Calculus:</b> Reduction formulae; properties of integrals, determination of: length of the curve, area of a bounded region, surface area of surface and volume of solids, double and triple integrals, change of variables, applications to area, volume, centre of gravity and moment of inertia etc	9

#### Books Recommended

Sr.No.	Title Of The Book	Author/Editor	Edition/Year	Publisher
1.	Advanced Engineering Mathematics	R. K. Jain, S. R. K. Iyengar	3 <sup>rd</sup> , 2007	Narosa
2.	Calculus	G. B. Thomas, R. L. Finney	9 <sup>th</sup> , 2004	Pearson Education
3.	Elements Of Applied Mathematics	P. N. Wartikar & J. N. Wartikar	6 <sup>th</sup> ,1977	Pune Vidyarthi Graha
4.	Advanced Engineering Mathematics	Erwin Kreyszig	9 <sup>th</sup> , 2005	Wiley International



<b>Title of the Course</b>	<b>Pharmaceutics-I</b>
Marks	50
Number of Hours per Week	2
Total Hours	30
Class	F.Y. B. Pharm.
Semester	I

Sr.No	Title	Hrs.
1.	History of Pharmaceutics: Events leading to the formation of pharmaceutical society of Great Britain,	2
2.	Development of profession of pharmacy & pharmaceutical industry in India	2
3.	Origin & Development of the pharmacopoeia – IP/BP/USP.	3
4.	Introduction to dosage form & routes of administration	4
5.	Dosage form design, Biopharmaceutical consideration	5
6.	Introduction to GMP	4
7.	Alternate system of medicine Brief introduction to Ayurvedic & Homeopathic formulations.	2
8.	GALENICALS: Introduction, size reduction, General properties of drug constituents – solvents used in extraction of drugs, processes used for extraction (infusion, decoction, maceration, & modifications, percolation, hot extraction & modifications). Equipments used for large scale extractions. Study of official extracts	8

#### Books Recommended

Sr.No.	Title	Author/Editor	Edition/Year	Publisher
1	Pharmaceutical Dosage Form And Drug Delivery Systems	Howard C. Ansel, Nicholas G. Popovich, Lord V. Alien	6 <sup>th</sup> , 1995	B.I.Waverly Pvt.Ltd.,New Delhi
2	Remington-The Science And Practice Of Pharmacy (Vol.1& 2)	David B.Troy	21 <sup>st</sup> , 2006	Lippincott Williams & Wilkins
3	Tutorial Pharmacy	J.W. Cooper, Colin Gunn	4 <sup>th</sup> , 1950	Sir Isaac Pitman & Sons Ltd.,London
4	Pharmaceutics: The Science Of Dosage Form Design	Michael E. Aulton	1998	Churchill-Livingstone

<b>Title of the Course</b>	<b>Pharmaceutical Engineering - I</b>
Marks	50
Number of Hours per Week	2
Total Hours	30
Class	F.Y. B. Pharm.
Semester	I

Sr.No.	Topic	Hrs
1.	Unit operations- Introduction, classification of unit operations, fundamental principles	2
2.	Fluid flow-mention of fluid properties such as viscosity, surface tension of fluid, and hydrostatic infusing fluid flow, Bernoulli's Theorem, flow of liquids in pipes, laminar and turbulent flow;	3
3.	Heat transfer-mention of different modes of heat transfer e.g. conduction, convection and radiation;	2
4.	Mass transfer and molecular diffusion in liquids, mass transfer in turbulent and laminar flow, interfacial mass transfer	3
5.	Refrigeration, air condition and humidification; hygrometry, humidification and dehumidification;	2
6.	Mixing : A) liquid-liquid mixing, B) Mixing small quantities of solids in liquids, C) Mixing large quantities of solids in liquids, perfect mixing and random mixing, degree of mixing, mechanism of mixing and demixing, rate of mixing, impellers and propeller mixers, baffles in tanks, trough mixers, mixers, sigma and ribbon blenders, paddle mixers, double cone blender, cube mixers, planetary mixers,	5
7.	Emulsification and Homogenization: Process and equipment used and equipment selection for, including colloid mills, Silverson type homogenizer.	5
8.	Filtration and clarification- factors influencing rate of filtration, filter media and filter aids, Nutsch filter, plate and frame filter, sparkler, leaf filters, rotary vacuum filters, sintered glass and membrane filters-selection of filters,	4
9.	Filtration of air, primary filters and HEPA filters and their evaluation;	2
10.	Centrifugation- objective and requirements – hydroextractors.	2

#### Books Recommended

Sr.No.	Title	Author/Editor	Edition	Publisher
1	Introduction To Chemical Engineering	Walter L. Badger, Julius T. Banchero	International Student Edn.	McGraw Hill Book Company
2	Perry's Chemical Engineer's Handbook	Perry Robert H. Green Don W.	7 <sup>th</sup> , 1997	McGraw Hill
3	Tutorial Pharmacy	J.W. Cooper, C. Gunn	4 <sup>th</sup> , 1950	Sir Isaac Pitman
4	Introduction To Pharmaceutical Engg.	A.R. Paradkar	6 <sup>th</sup> , 2004	Nirali Prakashan

<b>Title of the Course</b>	<b>Anatomy, Physiology &amp; Pathophysiology-I</b>
Marks	50
Number of Hours per Week	2
Total Hours	30
Class	F.Y. B. Pharm.
Semester	I

Sr.No	Topic	Hrs.
1	Structural Organization of human body, structure of human cell, cell membrane, membrane potential, Intracellular messengers: cyclic AMP, Adenyl cyclase, protein kinase, Phosphodiesterase, Cell injury and Inflammation	7
2	Blood and Lymphatic system Elements of blood, properties of blood, haemopoiesis, clotting of blood, significance of Rh, factor clotting disorders, anemia. Anatomy- Physiology and Importance of Lymphatic system Immunity – Cell mediated/humoral/Active/Passive Diseases- AIDS, allergy, Myasthemis gravis, SLE, Rheumatic heart disorder	15
3	Respiratory system: Anatomy – Physiology Exchange of gases, mechanism of respiration at lung and tissue level, Respiratory volumes, Neural and chemical regulation of respiration, O <sub>2</sub> , CO <sub>2</sub> carriage, hypoxia. Diseases: COPD, Asthma, pneumonia, emphysema, pulmonary embolism, acute respiratory failure.	8

Books Recommended: Same as under Anatomy, Physiology and Pathophysiology-IV

<b>Title of the Course</b>	<b>Pharmaceutical Chemistry-I</b>
Marks	50
Number of Hours per week	2
Total Hours	30
Class	F.Y. B.Pharm.
Semester	I

Sr.No	Topic	Hrs.
1	Introduction - study of monographs of official compounds in IP; Water – detail study of water as universal pharmaceutical vehicle.	3
2	Sources of contamination in pharmaceutical compounds (which are official in pharmacopeias).	2
3	Limit tests prescribed – e.g. chloride, sulphate, arsenic, lead, iron, nitrate, alkali & alkaline earth metals	3
4	Limits of – insoluble matter, soluble matter, nonvolatile matter, volatile matter, residue on ignition & ash value.	2

5	Study of – major intracellular electrolytes & ions: chloride, phosphates, bicarbonate, Na, K, Ca, Mg (including their general, physiological properties and uses such as infusion fluids)	3
6	Study of essential and trace ions: Fe, Zn, Mn, Se, S and I- official compounds and uses	1
5	Study of Gastrointestinal Agents: antacids, protectives and adsorbants, saline cathartics-official compounds	5
6	Study of Topical Agents: protectives, antimicrobials and astringents-official compounds	5
7	Study of Important Inorganic Gases: oxygen, nitrogen, nitrous oxide, carbondioxide, helium and ammonia	3
8	Study of Expectorants	1
9	Study of Inorganic Compounds: talc, barium sulphate, and other pharmaceutical aids.	2

#### Books Recommended

Sr. No.	Title of the Book	Author/Editor	Edition	Publisher
1	Inorganic, Medicinal and Pharmaceutical Chemistry	J. H. Block, E. B. Roche	1986	-
2	IP, BP, USP	-	Current	-
3	Concise Inorganic Chemistry	J. D. Lee,	5 <sup>th</sup> , 1996	Oxford Blackwell
4	Bentley & Driver's Text Book of Pharmaceutical Chemistry	L. M. Atherden,	8 <sup>th</sup> 1989	Oxford Medical Publications.
5	Remington's-The Science and Practice of Pharmacy(vol.1 & 2)	David B. Troy	21 <sup>st</sup> , 2006	Lippincott Williams & Wilkins

<b>Title of the Course</b>	<b>Microbiology</b>
Marks	50
Number of Hours per Week	2
Total Hours	30
Class	F.Y. B. Pharm
Semester	I

Sr.No.	Topic	Hrs.
1	History (main focus on discovery of microscope, Louis Pasteur's contribution, Koch Postulates)	<b>1</b>
2	Application of Microbiology in the field of pharmacy	
3	Different types of microscopes	<b>1</b>
4	Different types of staining techniques (with reference to bacteria) <ul style="list-style-type: none"> <li>▪ Monochromatic staining</li> <li>▪ Gram staining</li> <li>▪ Acid fast staining</li> </ul>	<b>1</b>

	<ul style="list-style-type: none"> <li>▪ Capsule, flagella spore, cell wall staining</li> <li>▪ Negative staining</li> <li>▪ Motility</li> </ul>	
5	Classification of microorganisms as bacteria, yeast, mould, virus, rickettsiae, algae, protozoa (with reference to eukaryotic and prokaryotic micro-organisms)	1
6	<p>Bacteria: * Morphology</p> <p>* Cell characteristics, habitat, nutrition</p> <p>* Reproduction, cultivation</p> <p>*Growth phases of bacteria, measurement of growth, factors affecting growth</p> <p>*Isolation and identification of pure cultures of bacteria with reference to some special biochemical testes (IMVic to diff between E. Coli and enterobacter</p> <p>*Culture media such as cultivation, storage media, enrichment media, diferencialia media and microbiological assay media</p>	<p>1</p> <p>1</p> <p>1</p> <p>2</p> <p>2</p>
7	<p>Virus: * Morphological characteristics</p> <p>* Cultivation of viruses, Reproduction</p> <p>* Oncogenic and HIV viruses</p>	2
8	<p>Yeasts / Molds: * Morphology, habitat, nutrition</p> <p>* Reproduction in yeast</p> <p>* Molds of Clinical significance</p>	1
9	<p>Algae * Morphology habitat</p> <p>* Economic significance of algae</p>	1
10	<p>Protozoa * Morphology</p> <p>* Clinical significance of protozoa</p>	1
11	<p>Rickettsiae * Morphology (diseases caused malaria, amoebic dysentery)</p> <p>* Diseases caused by rickettsiae</p>	1
12	<p>Microbial Mutation</p> <p>* Types of mutation</p> <p>* Mutagenic agents</p> <p>* Mechanism of mutation</p>	2
13	<p>Diseases caused by the following microorganisms and their detection</p> <p>1) Mycobacterium</p> <p>2) Salmonella</p> <p>3) E. coli</p> <p>4) Clostridium</p> <p>5) Staphylococcus</p>	2
14	<p>Sterilization - Different methods of sterilization</p> <p>- Aseptic techniques</p>	5
15	Disinfection and disinfectants	1
16	Tutorials	3

### Books Recommended

Sr. No.	Title Of The Book	Author/Editor	Edition/Year	Publisher
1	Microbiology Concepts And Applications	M. J. Pelczar Jr., E. C. S. Chan And N. R. Krieg	5 <sup>th</sup> , 1996	McGraw Hill, Inc., USA
2	Fundamentals Of Microbiology	M.Frobisher, R. D. Hinsdill, K. T. Crabtree And C. R. Goodheart	9 <sup>th</sup> , 1968	Saunders College Publishing, Philadelphia
3	Pharmaceutical Microbiology	W. B.Hugo And A. D. Russel	6 <sup>th</sup> , 2003	Blackwell Science Ltd. Uk,
4	Text Book Of Microbiology	R. Ananthanarayan And C.K. J. Paniker	7 <sup>th</sup> , 2005	Orient Longman Pvt. Ltd. Hyderabad,

## Laboratory

<b>Title of the Course</b>	<b>Organic Chemistry Laboratory-I</b>
Marks	50
Number of Hours per Week	4
Total Hours	60
Class	F.Y. B.Pharm
Semester	I

Sr.No	Experiment	Hrs.
Organic Spotting: Qualitative analysis of organic compounds -aspects to be covered are:		
1	Solubility, characterization and preliminary tests,	16
2	Elements detection,	8
3	Functional group characterization,	20
4	Derivative preparation.	16

Books Recommended Will be recommended by the teacher

<b>Title of the Course</b>	<b>Microbiology Laboratory</b>
Marks	50
Number of Hours per Week	4
Total Hours	60
Class	F.Y B.Pharm.
Semester	I

Sr.No.	Experiment	Hrs.
1	Study of microscope	4
2	Study of common laboratory equipments: autoclave, incubator, hot air oven etc.	4
3	Gram Staining	4
4	Monochrome staining	4
5	Negative staining	4
6	Cell Wall Staining	4
7	Spore Staining	4
8	Capsule Staining	4
9	Motility by hanging drop technique	4
10	Preparation and sterilization of nutrient broth, agar, slants, stab etc.	4
11	Inoculation techniques: Colony characteristics, Growth patterns in broth, slant- pour & streak plate technique.	4
12	Total count by Haemocytometer Growth by optical density+	4
13	Total plate count, TDP, TDT	4
14	Study of yeast- Aspergillus, Penicillium with respect to morphology	4
15	Studies as prepared sides – malarial parasite in blood smear, intestinal amoeba in stools.	4

Books Recommended: Will be recommended by teacher

<b>Title of the Course</b>	<b>Anatomy, Physiology &amp; Pathophysiology Laboratory</b>
Marks	50
Number of Hours per Week	4
Total Hours	60
Class	F.Y B. Pharm
Semester	I

Sr. No.	Experiment	Hrs.
1	<b>HEMATOLOGY</b> <ol style="list-style-type: none"> <li>1. Red Blood Cell (RBC) Count,</li> <li>2. Total leukocyte Count</li> <li>3. Differential Leukocyte (WBC) count</li> <li>4. Hemoglobin content of blood</li> <li>5. Bleeding/Clotting time</li> <li>6. Blood groups</li> <li>7. Erythrocyte Sedimentation rate (ESR)/Hematocrit (Demonstration)</li> <li>8. Measurement of blood pressure</li> </ol>	<p>4</p> <p>4</p> <p>4</p> <p>4</p> <p>4</p> <p>4</p> <p>2</p> <p>2</p>
2	Study of human skeleton	4
3	Microscopic study of permanent slides Tissues: <ul style="list-style-type: none"> <li>- Columnar, Cuboidal, Squamous, Ciliated Epithelium</li> <li>- Cardiac/Skeletal/Smooth muscle</li> <li>- Ovary, testis, Liver, Pancreas, Thyroid, Tongue, Stomach, Intestine, Kidney, Lung, Spinal Cord, Cerebrum, Artery, Vein</li> </ul>	12
4	Discussion on some common investigational procedures used in diagnosis of diseases with the help of charts/ slides Name and Importance of following Tests: <ol style="list-style-type: none"> <li>1) Electroencephalogram(EEG) in diagnosis of epilepsy</li> <li>2) Electrocardiogram (ECG) in diagnosis of cardiac arrhythmia</li> <li>3) Liver Function tests-               <ul style="list-style-type: none"> <li>- Serum Bilirubin, Serum glutamate oxaloacetate transaminase (SGOT), Serum glutamate pyruvate transaminase (SGPT)</li> <li>- Urine Bilirubin, Urine Urobilinogen</li> </ul> </li> </ol> Kidney Function Tests Serum Creatinine, Serum Urea, Uric acid, Serum Urea Nitrogen (BUN) Blood Glucose Serum Cholesterol/Triglycerides Serum Alkaline phosphatase (ALP) Serum acid phosphatase (AP) Serum Lipase, Serum Amylase, Serum Calcium	12



Serum Lactate dehydrogenase ( LDH) Thyroid Function tests- T3, T4 Diagnostic tests for infectious diseases like - Malaria, Tuberculosis, Dengue, Leptospirosis	
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Books Recommended

Sr.No.	Title Of The Book	Author/Editor	Edition/Year	Publisher
1	Textbook Of Medical Laboratory Technology	Praful B. Godkar	2 <sup>nd</sup> 2006	Bhalani Publishing House, Mumbai
2	A Textbook Of Practical Physiology	V.G. Ranade, P.N. Joshi And Shalini Pradhan	3 <sup>rd</sup> 1982	P.V.G. Prakashan, Pune-30

**First Year B.Pharm.**

**SEMESTER-II**

<b>Title of the Course</b>	<b>Organic Chemistry-II</b>
Marks	50
Number of Hours per Week	2
Total Hours	30
Class	F. Y. B.Pharm
Semester	II

Sr.No.	Topic	Hrs.
<b>Heterocyclic Compounds</b>		
	Discussion of the following classes of compounds including (aromatic to saturated) with regard to IUPAC nomenclature, structure, pKa, etc. sources, methods of preparation, structure and physical properties (Structure property relationships), and reactivity:	
1	Three and four member ring compounds containing N, O	3
2	Five membered rings containing N,O,S	10
3	Six membered rings containing N,O,S	5
4	Seven membered rings containing N, O, S	2
<b>Stereochemistry</b>		
5	Enantiomers, diastereomers, configuration notations, Properties to characterize the enantiomers	4
6	Conformations and conformational analysis: n-butane, alicyclic, and saturated heterocyclic systems and implication on reactivity	6

### Books Recommended

Sr.No	Title of the Book	Author/Editor	Edition/Year	Publisher
1	Adv.Org. Chemistry	Carey	4 <sup>th</sup> , 2001	Plenum Press NY
2	Organic Chemistry	Morrison, R. T	6 <sup>th</sup> , 1992	Pearson Education
3	Organic Chemistry	Solomons, T. W.G	8 <sup>th</sup> , 2004	John Wiley & Sons, Inc
4	Organic Chemistry	Loudon, G. Marc	4 <sup>th</sup> , 2002	Oxford University Press
5	Introduction to Organic Chemistry	Andrew	4 <sup>th</sup> , 1992	Macmillan Publishing
6	Organic Chemistry Structure and Reactivity	Seyhan Ege	5 <sup>th</sup> , 2004	Houghton Millin Company, NY
7	Chemistry of Heterocyclic Compounds	Weissberger, N.	1972	John Wiley & Sons, Inc

<b>Title of the Course</b>	<b>Mathematics-II</b>
Marks	50
Number of Hours per Week	2
Total Hours	30
Class	F. Y. B. Pharm.
Semester	II

**Prerequisites:** Notions of sets and functions, basic probability theory, Measures of central tendency: Arithmetic mean, median and mode; Measures of dispersion: Range, quartile deviation, mean deviation and standard deviation; Coefficient of variation, moments, skewness and kurtosis.

Sr. No.	Topic	Hrs.
1	<b>Probability Distributions:</b> Discrete and continuous random variables, Probability distribution functions, expectation of random variables, mean, variance and moments of random variables, moment generating function, Binomial, Poisson and Geometric distributions, Normal, uniform and Gamma-beta distribution functions, chi-square distribution, F-distribution, Joint distributions, notion of covariance.	9
2	Sampling distribution, Point and interval estimations of mean, variance and proportion of single and multiple samples.	4
3	<b>Hypothesis testing:</b> Inferences concerning mean, variance and proportions, Chi-square test, goodness of fit.	4
4	Regression and Correlation: Linear non linear regression, Correlation, multilinear regression.	5
5	Design of experiments: One-way and two way ANOVA tests.	5
6	Non Parametric tests: Sign test, Rank sum test, Wilcoxon and Kruskal-Vallis test.	3

### Books Recommended

Sr.No.	Title of The Book	Author/Editor	Edition/Year	Publisher
1.	A First Course In Probability	Sheldon Ross	6 <sup>th</sup> , 2002	Prentice Hall
2.	Miller & Freund's Probability And Statistics For Engineers	Richard Johnson, Irwin Miller, John Freund	7 <sup>th</sup> , 2005	Pearson Education
3.	Pharmaceutical Statistics: Practical And Clinical Applications	Sanford Bolton, Charles Bon	4 <sup>th</sup> , 2004	Marcel Dekker
4.	Essential Statistics For The Pharmaceutical Sciences:	Philip Rowe	1 <sup>st</sup> , 2007	John Wiley & Sons Ltd
5.	Pharmaceutical Statistics	David Jones	1 <sup>st</sup> , 2002	Pharmaceutical Press UK
6.	Applied Statistics And Probability For Engineers	Douglas C M., Alasdair G M Nairn, G. Runger	4 <sup>th</sup> , 2006	Wiley
7	Statistics Methods	S. P. Gupta	2 <sup>nd</sup> , 1969	S. Chand & Co.

<b>Title of the Course</b>	<b>Pharmaceutics-II</b>
Marks	50
Number of Hours per Week	2
Total Hours	30
Class	F.Y. B. Pharm.
Semester	II

Sr.No.	Title	Hrs
1.	Monophasic liquid orals: Preformulation considerations	2
2.	Principles of Solubilization and Taste masking	3
3.	Formulation considerations in the development of Monophasic liquid oral dosage forms and quality control of : aromatic waters, solutions, syrups, elixirs, linctuses, drops, glycerites, paints, lotions, liniments, sprays. examples of official preparations belonging to this class.	10
4.	Large scale manufacture and packaging	2
5.	Biphasic disperse systems: Suspensions: Preformulation considerations and Physicochemical principles underlying the formulation of suspensions including principles of wetting, Zeta potential etc.	4
6.	Formulation considerations in the development of suspensions for internal and external use and quality control - examples of official preparations belonging to this class.	5
7.	Large scale manufacturing, packaging	3
8.	Layout design of liquid section.	1

### Books Recommended

Sr.No.	Title	Author/Editor	Edition	Publisher
1	Pharmaceutical Dosage Forms And Drug Delivery Systems	Howard C. Ansel, Nicholas G. Popovich, Loyd V.	6 <sup>th</sup> , 1995	B.I. Waverly Pvt.Ltd., New Delhi
2	Remington's-The Science And Practice Of Pharmacy (Vol.1 & 2)	David B. Troy	21 <sup>st</sup> , 2006	Lippincott Williams & Wilkins
3	Dispensing For Pharmaceutical Students	Cooper & Gunn's Revised By S.J.Carter	12 <sup>th</sup> , 1975	Cbs Publishers & Distributers
4	Pharmaceutics:The Science Of Dosage Form Design	Michael E.Aulton	6 <sup>th</sup> , 1998	Churchill-Livingstone
5	Physical Pharmacy-Physical Chemical Principles In Pharmaceutical Sciences	Alfred N.Martin,James Swarbrick,Arthur Cammarata	2 <sup>nd</sup> , 1969	Lea & Febiger,Philadelphia
6	Theory & Practice Of Industrial Pharmacy	Leon Lachman,Herbert A.Lieberman & Joseph Kanig	2 <sup>nd</sup> , 1976 3 <sup>rd</sup> , 1987	Lea & Febiger, Philadelphia
7	Prescription Pharmacy	Goseph. B. Sprowls	2 <sup>nd</sup> , 1970	-
8	Bentley's Textbook Of Pharmaceutics	Bentley	8 <sup>th</sup> , 1977	E. A. Rawlins
9	Introduction Of Pharmaceutical Dosage Forms	Howard Ansel	3 <sup>rd</sup> , 1981	Lea & Febiger

<b>Title of the Course</b>	<b>Pharmaceutical Engineering-II</b>
Marks	50
Number of Hours per Week	2
Total Hours	30
Class	F.Y. B. Pharm.
Semester	II

Sr.No.	Topic	Hrs.
1.	<i>Fluidization:</i> Particulate fluidization, aggregate fluidization-	3
2.	<i>Separation by mass transfer:</i> Solid-liquid extraction and liquid extraction, equipment and methods of operation- distillation, batch fractionation, vacuum and still distillation, azeotropic and extractive distillation, fractional distillation and fractionating columns; Recovery of solvents.	6
3.	<i>Energy and mass transfers:</i> Crystallisation-crystal shapes and habits, crystal growth, crystallisation in melts, nucleation, crystallisation from solutions, rate of crystallisation,	5

4.	.Energy effect in the process, size of crystal, different crystallisers, principles underlying the design and operations;	4
5.	Theories of Absorption and adsorption, Absorption of gases in liquids, Adsorption of liquids on carriers	6
6.	Drying: Fluid bed dryers, Microwave dryers, Freeze dryers, Spray dryers, tray dryer, tunnel dryer, turbo dryer	6

#### Books Recommended

Sr.No.	Title	Author/Editor	Edition	Publisher
1	Introduction to Chemical Engineering	Walter L.Badger, Julius T. Banchemo	International Student Edi.	McGraw Hill Book Company
2	Perry's Chemical Engineer's Handbook	Perry Robert H. Green Don W.	7 <sup>th</sup> , 1997	McGraw Hill Book Company
3	Tutorial Pharmacy	J.W. Cooper, Colin Gunn	4 <sup>th</sup> , 1950	Sir Isaac Pitman & Sons, London
4	Introduction to Pharmaceutical Engineering	A.R. Paradkar	6 <sup>th</sup> , 2004	Nirali Prakashan

<b>Title of the Course</b>	<b>Physical Pharmacy-I</b>
Marks	50
Number of Hours per Week	2
Total Hours	30
Class	F.Y. B. Pharm.
Semester	II

Sr.No.	Topic	Hrs
1.	State of matter: Gases: Ideal and Nonideal gases, van der Waals equation, critical phenomenon, determination of gas constants, liquefaction	5
2.	Thermodynamics: first law, second law, third law, thermochemistry, free energy function and its applications, chemical potential, Clausius-Clapeyron equation, free energy and equilibrium, the van't Hoff equation	5
3.	Physical properties of Drug Molecules: Dipole moment and its determination, refractive index and molar refraction, viscosity.	4
4.	Solutions of Nonelectrolytes: Units for expressing concentration and calculations involving the same, ideal and real solutions, Raoult's law, Henry's law	5
5.	Colligative properties, elevation of b.p., depression of freezing point, osmotic pressure, molecular weight determination based on colligative properties, molecular weight by steam distillation.	5
6.	Solution of electrolytes: Properties of solutions of electrolytes, Arrhenies theory of electrolytic dissociation, theory of strong electrolytes, coefficients for expressing colligative properties.	6

Books Recommended

Sr.No.	Title	Author/Editor	Edition	Publisher
1	Physical Pharmacy-Physical Chemical Principles in Pharmaceutical Sciences	Alfred N. Martin, James Swarbrick, Arthur Cammarata	2 <sup>nd</sup> , 1969	Lea & Febiger, Philadelphia
2	Tutorial Pharmacy	J.W. Cooper, Colin Gunn	4 <sup>th</sup> , 1950	Sir Isaac Pitman & Sons Ltd., London
3	Essentials of Physical Chemistry	Bahl B.S.	23 <sup>rd</sup>	S.Chand & Sompany
4	Remington's-The Science and Practice of Pharmacy(vol.1 & 2)	David B. Troy	21 <sup>st</sup> , 2006	Lippincott Williams & Wilkins

<b>Title of the Course</b>	<b>Anatomy, Physiology &amp; Pathophysiology-II</b>
Marks	50
Number of Hours per Week	2
Total Hours	30
Class	F.Y. B. Pharm
Semester	II

Sr.No	Topic	Hrs.
1	Muscular system: Anatomy-Physiology of smooth and skeletal muscles Physiology of NMJ, Skeletal muscles contraction, energy metabolism, types of contraction of muscles. Definition: Myasthemis gravis, tetanus, spasticity.	10
2	Physiology of pain: Headache, Types of Headache (migraine, tension headache, headache affecting elderly) Joint pain (RA/Osteoarthritis/gout)	2
3	Reproductive System: Anatomy- Physiology of male and female reproductive system, Menstruation, oocytogenesis, spermatogenesis.	5
4	Endocrine system: Anatomy- Physiology of pituitary, thyroid, parathyroid, adrenal, pancreas, testis, ovaries, control of hormone secretion. Diseases associated with hypo-hypersecretion of hormones. Pathophysiology of Diabetes Mellitus	13

Books : Same as under Anatomy, Physiology and Pathophysiology-IV

<b>Title of the Course</b>	<b>Pharmaceutical Analysis-I</b>
Marks	50
Number of Hours per week	2
Total Hours	30
Class	F. Y. B.Pharm.
Semester	II

Sr. No.	Topic	Hrs.
1.	Introduction: a. Significance of quantitative analysis in quality control, different techniques of analysis, preliminaries and definitions, types of errors, selection of sample, precision and accuracy. b. Fundamentals of volumetric analysis, methods of expressing concentrations, primary and secondary standards. Calculation of equivalent weight and stoichiometry.	3
2.	Aqueous Acid-Base titrations: a. Law of mass action, hydrolysis of salts, neutralization curves, and theory of indicators, choice of indicators, mixed indicator. b. Application** in assay of Benzoic acid, Boric acid, Aspirin.	4
3.	Non-Aqueous titrations: a. Types of solvents, end point detection, b. Application** in assay of Sodium acetate, Sodium benzoate, Norfloxacin tablet.	3
4.	Oxidation-Reduction titrations: a. Theory of redox titration, measurement of electrode potential, oxidation-reduction curves, redox Indicators. Titrations involving b. Potassium permanganate, potassium dichromate, potassium bromate, potassium iodate, cerium (IV) sulfate, Iodine (Iodimetry and Iodometry), titanous chloride. c. Applications** in assay of Ferrous sulfate, Ascorbic acid, Isoniazide, Hydrogen peroxide.	5
5.	Complexometric Titrations: a. Theory, formation of complex and its stability, titration curves, metallochrome indicators, types of EDTA titrations, b. Application** in assay of Magnesium sulfate, Lead nitrate and calcium gluconate.	3
6.	Argentometric Titrations: a. Theory, factors affecting solubility of a precipitate, titration methods- Mohr's, Volhard's, Gay lussac, and Fajan's method, indicators. b. Applications** in assay of Potassium chloride, Sodium chloride and Ammonium chloride.	3
7.	Miscellaneous methods of analysis:** a. Diazotisation titrations, b. Kjeldahl's method of nitrogen determination c. Oxygen flask combustion method.	3

8.	Gravimetric analysis: a. Precipitation techniques, solubility products, colloidal state, supersaturation, co-precipitation, post precipitation, digestion, filtration, ignition, weighing and calculation. b. Application** in assay of Alum by oxime reagent, Calcium as calcium oxalate and magnesium as magnesium pyrophosphate.	3
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\*\*Applications should cover all different techniques and methods and may also include other compounds to which the techniques are applicable.

#### Books Recommended

Sr.No.	Title of the Book	Author/Editor	Edition/ Year	Publisher
1.	Vogel's Textbook of Quantitative Inorganic Analysis	Bassett J, Denny R C, Jeffery G H, Mendharn J,	7 <sup>th</sup> , 1998	ELBS/Longman, London.
2.	Statistical Quality control 6. Instrumental methods of Analysis- Ewing.	Grant	6 <sup>th</sup> , 1988	McGraw Hill
3.	A Textbook of Pharmaceutical Analysis,	Connors K A	3 <sup>rd</sup> , 1982	Wiley Interscience, New York.
4.	Practical Pharmaceutical Chemistry Vol. I	Beckett A. H. and Stenlake J B,	4 <sup>th</sup> , 1988	TheAnthlone Press of University of London.
5.	Analytical Chemistry an Introduction,	Skoog/ West/ Holler	4 <sup>th</sup> , 1986	CBS Publications, Japan
6.	The Quantitative Analysis of Drug	Garrat	3 <sup>rd</sup> , 2005	Toppan & Co.
7.	Analytical Chemistry	Gary Christian-	3 <sup>rd</sup> , 1971	John Wiley
8.	IP, BP, USP, EP and International Pharmacopoeia.		Current Editions	



<b>Title of the Course</b>	<b>Assignments (Pharmaceutical Engineering)</b>
Marks	50
Number of Hours per week	2
Total Hours	30
Class	F. Y. B.Pharm.
Semester	II

Sr. No.	Topic
1.	There will be several problem solving sessions where there will be discussions on methodology and approaches to solve problems including discussions on how to gather information from internet and literature. The problems will be given to the students as home assignments where students can go through the literature and come out with solutions and present it in the class. There shall be many assignments. No assignment shall be of more than 10 marks. The student shall submit the assignment in A4 size paper either hand written or typed and pinned together. Marks will be awarded by the teacher and at the end of the semester teacher will submit the marks along with the assignment copies of all the students to the office.

## Laboratory

<b>Title of the Course</b>	<b>Organic Chemistry Laboratory-II</b>
Marks	50
Number of Hours per Week	4
Total Hours	60
Class	F.Y. B.Pharm
Semester	II

Sr.No	Experiment	Hrs.
Techniques in Organic Chemistry:		
1	Qualitative separation of binary organic mixture by physical and chemical methods -mixture of different types including compounds with more than one functional group to be given, characterization of individual components by physical constants; followed by preparation of suitable derivative;	16
2	testing purity by TLC.	4
3	Purification techniques solvent selection for recrystallisation, recrystallisation techniques simple distillation, fractional distillation, steam distillation.	16 16
4	Exercises	8

Books Recommended Will be recommended by the teachers

<b>Title of the Course</b>	<b>Pharmaceutics Laboratory -I</b>
Marks	50
Number of Hours per Week	4
Total Hours	60
Class	F.Y. B.Pharm
Semester	II

Sr.No.	Experiment
1	At least one representative example of each formulation type included in theory (Preparation and evaluation, WITH STRESS ON OFFICIAL FORMULATIONS)

<b>Title of the Course</b>	<b>Pharmaceutical Engineering Laboratory</b>
Marks	50
Number of Hours per Week	4
Total Hours	60
Class	F.Y. B.Pharm
Semester	II

Sr.No.	Experiment
1	Examples of topics covered in theory

## S.Y. B. Pharm.

### SEMESTER- III

<b>Title of the Course</b>	<b>Organic Chemistry-III</b>
Marks	50
Number of Hours per Week	2
Total Hours	30
Class	S.Y. B.Pharm.
Semester	III

Sr.No	Topic	Hrs.
Organic Molecular Transformations and Mechanism		
1	Reactive intermediates, Formation, structure, reactivity, properties such as half life, stability, and others. Carbonium ion, carbanion, free radicals, carbenes Effect of other functional groups including aromatic rings on the structure and reactivity of the above	5
2	Classification and nomenclature of transformations	1
3	Nucleophile, electrophile, nucleophilicity, electrophilicity, nucleophilic and electrophilic reactions in aliphatic and aromatic systems.	5
4	Investigation of Reaction Mechanism	3
5	Electron deficient O, N, and Rearrangement reactions	2
6	Oxidizing and reducing agents	2
7	Organometallic reagents and reactions	2
8	Pericyclic reactions	3
9	Vitamins structure and stability, mechanism of biochemical reactions	7

#### Books Recommended

Sr.No.	Title of the Book	Author/Editor	Edition/Year	Publisher
1	Adv.Org. Chemistry	Carey	4 <sup>th</sup> Edition, 2000	Plenum Press NY
2	Organic Chemistry	Morrison, R. T	6 <sup>th</sup> Edition, 2006	Pearson Education
3	Organic Chemistry	Finar	6 <sup>th</sup> Edition, 1973	Longman Group Ltd
4	Organic Reaction Mechanism	M. Gomer Gallego	2004	Springer Privt. Ltd.
5	Organometalics	Elschenbroich	3 <sup>rd</sup> , 2005	Wiley-VCH Verlag & Co.
6	Lehninger: Principles of Biochemistry.	David Nelson, Michael Cox	4 <sup>th</sup> Edition, 2005	W. H. Freeman and Company, New York.

<b>Title of the Course</b>	<b>Pharmaceutics – III</b>
Marks	50
Number of Hours per Week	2
Total Hours	30
Class	S.Y. B. Pharm.
Semester	III

Sr.No.	Topic	Hrs.
1.	Biphasic disperse systems: Emulsions: Preformulation considerations and theories of emulsion formation	3
2.	Formulation considerations in the development of emulsions for internal and external use and quality control, emulsifying agents - examples of official preparations belonging to this class.	3
3.	Large scale manufacturing, packaging of emulsions	2
4.	<i>Semi solid dosage forms</i> : Introduction to the anatomy of skin- percutaneous absorption and penetration,	2
5.	<i>Ointments</i> different bases, factors influencing the choice of base,- processing of ointments and creams and quality control	4
6.	Formulation and evaluation of pastes, gels, poultice	3
7.	Large scale manufacturing, packaging of semisolid dosages including ointments creams and gels	3
8.	Introduction to Multiple emulsions, submicron emulsions, microemulsions	1
9.	<i>Aerosols</i> : Components, manufacture and evaluation.	4
10.	<i>Suppositories</i> : Rectal Delivery- Physico-chemical factors affecting rectal absorption, advantages, limitations, Formulation of suppositories and pessaries, suppository bases, evaluation, packaging, and manufacture	5

#### Books Recommended

Sr.No.	Title of The Book	Author/Editor	Edition/Year	Publisher
1	Theory & Practice Of Industrial Pharmacy	L. Lachman, Herbert A.Lieberman & J. Kanig	3 <sup>rd</sup> , 1987	Lea & Febiger, Philadelphia
2	Pharmaceutical Dosage Form: Dispersed Systems (Vol.1 &2 )	Herbert A. Lieberman, Martin A.Rieger,G.S.Banker	2 <sup>nd</sup> , 1993	Marcel Dekker Inc.
3	Modern Pharmaceutics	Gilbert S.Banker, C.T. Rhodes	2 <sup>nd</sup> , 1990	Marcel Dekker Inc.
4	Cooper & Gunn's Dispensing For Pharmaceutical Students	Revised By S.J.Carter	12 <sup>th</sup> , 1987	Cbs Publishers & Distributers
5	Pharmaceutics: The Science Of Dosage Form Design	Michael E.Aulton	2 <sup>nd</sup> , 1998	Churchill-Livingstone

6	Remington-The Science And Practice Of Pharmacy (Vol.1 & 2)	David B.Troy	21 <sup>st</sup> , 2006	Lippincott Williams & Wilkins
7	American Pharmacy: Text Book Of Pharmaceutical Principles,Processes & Preparations	Rufus Lyman	4 <sup>th</sup> , 1955	J.B.Lippincott Company

<b>Title of the Course</b>	<b>Physical Pharmacy- II</b>
Marks	50
Number of Hours per Week	2
Total Hours	30
Class	S.Y. B. Pharm.
Semester	III

Sr.No.	Topic	Hrs
1.	Ionic Equilibria and buffers: Modern theories of acids and bases, Acid-Base equilibria, Sorensen's pH scale, calculation of pH, effect of pH on ionization of weak acid and weak bases, calculation of fraction unionized; The buffers in pharmaceutical and biological systems, buffered solutions, methods of adjusting pH;	4
2.	Electromotive force and Oxidation-Reduction: Electrochemical cells, Nernst equation, Types of electrodes, electrode, electrode potential, redox potential, concentration cell, measurement of pH;	5
3.	Solubility: Solubility of gases in liquids, solubility of oxygen in blood, solubility of anaesthetic gases in blood, solubility of volatile anaesthetics in oil, miscible liquids, partial miscibility, solubility of solids in liquids, ideal solubility, solubility parameters and prediction of solubility in regular solutions, partition phenomena, partitioning of weak electrolytes;	5
4.	Complexation: Organic molecular complexes, inclusion compounds, methods of analysis, protein binding, Scatchard plot	4
5.	Chemical kinetics: Molecularity and order of a reaction, specific reaction rate constant, zero order, first order and second order reactions, methods to determine order of a reaction, Energy of activation, photochemical reactions and quantum yield.	
6.	Catalysis: Positive, negative catalyst, autocatalysis. Homogenous and heterogenous catalysis;	2
7.	Interfacial phenomena: Surface tension (Surface free energy), Young equation, Kelvin equation, measurement of surface and interfacial tension, wetting and contact angle, spreading of liquids on liquids and on solids, Surface activity and soluble monolayers, Gibb's Duhem equation, insoluble monolayers and the film balance.	6
8.	Adsorption at solid surfaces, Freundlich and Langmuir treatment to Type-I adsorption isotherm, electrical properties of interfaces-Nernst and Zeta potential.	4

Books Recommended: Will be recommended by the teacher

<b>Title of the Course</b>	<b>Biochemistry-I</b>
Marks	50
Number of Hours per Week	2
Total Hours	30
Class	S.Y. B.Pharm
Semester	III

Sr.No	Topic	Hrs.
1	Carbohydrates: Fundamentals of chemistry of carbohydrates, concept of ring structures and straight chain structure of common carbohydrates glucose, fructose, galactose, Lactose, maltose, sucrose, polysaccharides, starch, glycogen, cellulose, mucopolysaccharides like hyaluronic acid heparin. Qualitative tests / colour reaction. Selected reaction: With phenyl hydrazine, alkali – oxidation reduction with practical significance, Glycolysis, TCA, pentose- phosphate. Pathway gluconeogenesis, glycogenolysis.	4
2	Lipids: Fatty acids, waxes, phospholipids, sphingolipids, terpenoids. With representative structure and significance. Functions & comparative distribution of lipids Lipoproteins: $\beta$ oxidation of fatty acids, Oxidation of unsaturated fatty acids, functions of cholesterol & significance. Rancidity, saponification value, Iodine value & hydrogenating	4
3	Proteins & Amino acids: Structure of protein: globular, fibrous (helix & $\beta$ sheet) Amino acids: Structures, pK – isoelectric point, Essential & non-essential Aa: Colour reaction of A.a. Elementary idea about chromatography & electrophoresis. Protein Metabolism: Transamination SGOT / SGPT, Deamination & urea cycle, & Decarboxylation of A.a. Nucleic acids and their components: DNA & RNA bases, Nucleosides, Nucleotides, chemistry of Nucleic acids, structure, of RNA & DNA. Types of RNA: mRNA, t-RNA & r-RNA. Function of DNA & role in protein synthesis salient features of protein biosynthesis & Idea of genetic code.	12 4 4 4
4	Enzymes: Causation, Mechanism of enzyme action, factors affecting rate of enzymatic reaction, Activators & inhibitors of enzymes, Competitive & Non – Competitive types of enzyme inhibition. Enzyme induction & lysozyme.	5
5	Vitamins & Co-enzymes: Structures & function of Nicotinamide, nicotinic acid, riboflavin, lipoic acid, biotin, thiamine, B <sub>6</sub> , folic acid, B <sub>12</sub> , pantothenic acid, ascorbic acid, vitamins A, D, K, and E.	5

Books Recommended : Same as under Biochemistry -III

<b>Title of the Course</b>	<b>Anatomy, Physiology &amp; Pathophysiology-III</b>
Marks	50
Number of Hours per Week	2
Total Hours	30
Class	S.Y. B. Pharm
Semester	III

Sr.No	Topic	Hrs.
1	Nervous System/sense organs. Anatomy-Physiology of CNS (Central N.S), PNS (Peripheral NS) and ANS (Autonomic NS) Neurotransmitters, Neurotransmission, Sensory- Motor pathways Cranial – Spinal Nervous Blood –Brain Barrier, Blood flow to brain Diseases – Parkinsonism, Alzheimer’s, epilepsy, hypoxia, stroke, Anxiety, depression, mania, schizophrenia. Sense organs: Anatomy and Physiology Physiology of sensations (special)	17
2	Digestive System : Anatomy-Physiology including liver, pancreas Diseases: Peptic Ulcers, Inflammatory Bowel Disorders, hepatitis, cholecystitis, Cirrhosis, achacia, reflux oesophytis	13

Books Recommended : Same as under Anatomy, Physiology and Pathophysiology-IV

<b>Title of the Course</b>	<b>Psychology and Sociology</b>
Marks	50
Number of Hours per Week	2 (1+1)
Total Hours	30
Class	S.Y. B. Pharm.
Semester	III

Sr.No	Topic	Hrs.
Psychology NOTE: <i>All relevant topics can be dealt with special reference to the Pharmaceutical Industry</i>		
1	Definition of Psychology, sub fields of Psychology; Industrial Psychology: definition, nature and scope, history, premisses, development, and hurdles;	5
2	Personnel Selection: occupational information, individual differences, personnel specifications -its types. and objectives; Methods of job analysis; Uses of job analysis; Types of personnel actions: Selection techniques : Application blanks, reference, interview; Psychological Tests: Intelligence (Otis, Standford-Binet, Weehster adult Intelligence test, Multifactor tests) aptitude (DAT), personality (Rorschaeh, TAT and MMPI);	5
3	Personnel Development : Motivation – theories of motivation (Marlowe, Vroom) motivation and organization ; Incentives – financial and non-financial job satisfaction, Herberg’s two factor theory, factors affecting satisfaction; Morale and Monotony; Definition and nature of Leadership, functions of leaders, trait theory of	5

	leadership – Managerial grid, Field less Contingency Model; Accident Prevention and Safety Measures.	
<b>Sociology</b>		
1	Introduction to Sociology: What is Sociology? the relevance of Sociology to industry; Personality and social behavior, social adjustment of workers, definition and levels of communication, improving communication in organization;	5
2	Industrial Democracy: What is Industrial Democracy? worker participation in management; Trade unions: History of labour movement in India, problems of trade unions in India, collective bargaining, industrial disputes, its causes and methods to resolve;	5
3	Science, Technology, Industry and society: Impact of science & technology on industry and society, the role of industry in national development, cottage, small and large scale industries, problems of industrialization with special reference to the pharmaceutical industry .	5

Books Recommended: Will be recommended by the teacher

<b>Title of the Course</b>	<b>Hospital Pharmacy and Drug Store Management</b>
Marks	50
Number of Hours per Week	2
Total Hours	30
Class	S.Y. B. Pharm.
Semester	III

Sr.No.	Topic	Hrs
<b>Hospital Pharmacy</b>		
1.	HOSPITAL: Classification, Organization, Administration & Functions	1
2.	Hospital Pharmacy: History, Development, Duties & responsibilities of Pharmacist	1
3.	PHARMACY & THERAPEUTIC COMMITTEE	1
4.	HOSPITAL FORMULARY	1
5.	PURCHASE: Procedure, Storage, Inventory Control.	1
6.	DISPENSIGN OF CONTROLLED SUBSTANCES	1
7.	BULK COMPOUNDING: Large volume parenterals total parenteral Nutrition, Intravenous additives.	1
8.	CENTRAL STERILE SERVICE: Advantages, Plan, Location, Activities management	1
9.	STERILISATION & DISPOSAL OF SURGICAL MATERIALS: Rubber gloves, Syringes, Needles, Catheters, Surgical Instruments, Powders, etc.	1
10.	MEDICAL GASES: Different gases & their uses, Color coding of Cylinders & Care of Cylinders	2
11.	HEALTH ACCESSORIES: Wheel chairs, Canes, Crutches, Bed panes, Syringes, Needles etc.	1
12.	CLINICAL APPLICATIONS OF RADIOPHARMACEUTICALS: Therapeutic & Diagnostic radiopharmaceuticals.	1



13.	APPLICATION OF COMPUTERS: In maintenance of Records, Inventory control, Medication monitoring, Drug information, etc. (Current)	1
14.	HEALTH INSURANCE (Current)	1
<b>Drug Store Management</b>		
15	Introduction to Retail (Community) Pharmacy as a Career. 1. Retail Pharmacy Origin and Concept 2. Pharmacy as Profession 3. Role of Retail (Community) Pharmacist	1
16	Retailing: Single Store (Model Pharmacy), Departmental Stores, Malls, Chain Stores, Co-operative Pharmacy and Internet Pharmacy	2
17	Forms of Business Organizations- Sole Proprietorship, Partnership, and Corporate Structure including Co-operative Societies	2
18	Building of a Model Pharmacy	3
19	Stocking / Inventory Control and Recordkeeping	2
20	Sales Promotion Methods	1
21	Banking and finance	2
22	Prevention of Frauds and Risk insurance	2

#### Books Recommended

Sr.No.	Title	Author / Editor	Edition/Year	Publisher
1	A Text Book Of Hospital Pharmacy	S.H. Merchamt & J.S. Quadry	3 <sup>rd</sup> , 1989	Mr. S.B. Shah
2	Hospital & Clinical Pharmacy	A.R. Paradkar & S.A.Chunawala	9 <sup>th</sup> , 1999	Nirali Publications Pune
3	Cooper & Guns. Dispensing For Pharmaceutical Students	S.J. Carter	12 <sup>th</sup> , 1987	Pitman Books

<b>Title of the Course</b>	<b>Assignments (Pharmaceutics)</b>
Marks	50
Number of Hours per week	2
Total Hours	30
Class	S. Y. B.Pharm.
Semester	III

Sr. No.	Topic
1.	There will be several problem solving sessions where there will be discussions on methodology and approaches to solve problems including discussions on how to gather information from internet and literature. The problems will be given to the students as home assignments where students can go through the literature and come out with solutions and present it in the class. There shall be many assignments. No assignment shall be of more than 10 marks. The student shall submit the assignment in A4 size paper either hand written or typed and pinned together. Marks will be awarded by the teacher and at the end of the semester teacher will submit the marks along with the assignment copies of all the students to the office.

## Laboratory

<b>Title of the Course</b>	<b>Pharmaceutics Laboratory -II</b>
Marks	50
Number of Hours per Week	4
Total Hours	60
Class	S.Y. B. Pharm.
Semester	III

Sr.No.	Experiment
1	At least one representative example of each formulation type included in theory (Preparation and evaluation, <b>with stress on official formulations</b> )

<b>Title of the Course</b>	<b>Physical Pharmacy Laboratory</b>
Marks	50
Number of Hours per Week	4
Total Hours	60
Class	S.Y. B. Pharm.
Semester	III

Sr.No.	Experiment
1.	<i>Kinetics</i> : Experiments to determine order of reaction- First order Reaction a) degree of hydrolysis b) relative strength of two acids c) equal fraction method;
2.	Second order reaction a) $a=b$ b) equal fraction method c) Oswald's dilution method;
3.	Energy of activation and determination of shelf life;
4.	Kinetics of inversion of cane sugar, <i>Molecular Weight</i> ; 1. F.P. Method, 2. B.P. Method, 3. Rast camphor method 4. Molecular weight of polymer by viscosity method, 5. Brookfield viscometer (Demonstration). 6. Victor Meyer method.
5.	<i>Surface Tension</i> : 1. Using stalagmometer 2. Critical micelle concentration of a surfactant; <i>HLB</i> : Determination of HLB of glyceryl monostearate;
6.	Conductivity: 1. Normality of an acid by conductometric titration, 2. Dissolution constant of an acid (verification of Ostwald's dilution (w), 3. Solubility of a sparingly soluble salt; pH meter.
7.	1. Potentiometric titration, 2. Dissolution constant of a weak acid, 3. To determine buffer capacity at various stages of titrations of a weak acid against strong base and hence to determine pKa of the acid;
8.	Adsorption: adsorption of acetic acid on activated charcoal and determination of specific surface area of charcoal; Partition; partition coefficient of Iodine between carbontetrachloride and water, partition coefficient of benzoic acid between water and benzene;
9.	Chromatography – paper chromatography (aqueous phase only), Rf value; Critical solution temperature phenol water system; Heat of solution – by solubility method; Heat of neutralisation – using a thermosflask.

<b>Title of the Course</b>	<b>Biochemistry Laboratory</b>
Marks	50
Number of Hours per Week	4
Total Hours	60
Class	S.Y B.Pharm
Semester	III

Sr.No.	Experiment	Hrs.
1	Qualitative tests for Carbohydrates.	4
2	Quantitative test for Carbohydrates Lane Eynon's Method Willstatters Method DNS Method Folin- Wu Method (Blood Sugar)	4 4 4 4
3	Qualitative tests for Amino acids, Proteins and Precipitation of proteins	4
4	Quantitative tests for Proteins Folin Lowery Method Biuret Method	4 4
5	Enzymes Activity of Salivary Amylase Study of factors affecting rate of an enzymatic reactions: Determination of Optimum pH, Temperature, $K_M$ , $V_{Max}$ .	4 4 4
6	Vitamins; Quantitative determination of Vitamin C	4
7	Lipids; Determination of acid value and iodine value of lipids.	4
8	Estimation of RNA and Blood Cholesterol.	4
9	Tutorials	4

#### Books Recommended

Sr.No.	Title of the Book	Author/Editor	Edition/Year	Publisher
1	An Introduction to Practical Biochemistry	David T. Plummer.	2 <sup>nd</sup> , 1978	McGraw Hill Book Co., London.

<b>Title of the Course</b>	<b>Pharmaceutical Analysis Laboratory-I</b>
Marks	50
Number of Hours per week	4
Total Hours	60
Class	S.Y. B.Pharm.
Semester	III

Sr.No	Experiment	Hrs.
1.	The students should be introducing to the main Analytical tools through demonstration. They should have a clear understanding of a typical analytical balance, weights, care and use of balance, methods of weighing and errors of weighing. The students should also be acquainted with the general apparatus required in various analytical procedures.	4

2.	Standardization of analytical weights and calibration of balances and volumetric apparatus.	4
3.	Perform following assays as per IP including preparation and standardization of titrants. Such as 0.1 N HCL, 0.1 N NaOH, 0.1 N KMnO <sub>4</sub> , 0.1 N Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> , 0.1 N AgNO <sub>3</sub> , 0.1 N HClO <sub>4</sub> , 0.05 M disodium EDTA, 0.1 N CH <sub>3</sub> ONa, 0.1 N Iodine, 0.1 N Oxalic acid	8
4.	Hydrogen ion concentration, pH, and potentiometric titrations	4
5.	Acid-base titrations**: Benzoic acid, Boric acid, Aspirin, Determination of total alkalinity and sodium carbonate of sodium hydroxide	4
6.	Non-Aqueous titrations**: Sodium acetate, Sodium benzoate, Norfloxacin tablet., assay of pyridoxine HCl	4
7.	Oxidation-Reduction titrations**: assay of sodium nitrite Ferrous sulfate, Ascorbic acid, Isoniazide, Hydrogen Peroxide. assay of iodine solution, determination of percentage of ascorbic acid	8
8.	Complexometric titrations**: Magnesium sulfate, Lead nitrate, calcium gluconate, Ca & Mg in a mixture, Al & Zn in a mixture ,assay of aluminium hydroxide gel	4
9.	Argentometric titrations**: Potassium chloride, Sodium chloride and Ammonium chloride.	4
10.	Gravimetric analysis**: Alum by oxime reagent, Calcium as calcium oxalate and magnesium as magnesium pyrophosphate.	4
11.	Miscellaneous methods of analysis:** Estimation by Kjeldahl's method, sodium nitrite titration, hydroxyl value, acid value, iodine value, saponification value, ester value	8
12.	Physicochemical Methods** – specific gravity and density, solubility, viscosity, melting, congealing, and boiling temperatures.	4

\*\*Applications may also include other compounds to which the techniques are applicable.

Books Recommended

Books recommended under Pharmaceutical Analysis-I And in addition the following

Sr.No.	Title Of The Book	Author/Editor	Edition/ Year	Publisher
1.	Instrumental Methods Of Analysis	Ewing.	4 <sup>th</sup> , 1975	McGraw Hill New York
2.	Text Book Of Practical Organic Chemistry –	Vogel	5 <sup>th</sup> , 1989	Longman Scientific

## S.Y. B. Pharm.

### SEMESTER-IV

<b>Title of the Course</b>	<b>Organic Chemistry-IV</b>
Marks	50
Number of Hours per Week	2
Total Hours	30
Class	S.Y. B. Pharm.
Semester	IV

Sr. No.	Topic	Hrs.
Organic Synthesis		
1	Retro-synthetic analysis of simple organic molecules including aliphatic, aromatic, heterocyclic	20
Macrocyclic Compounds		
2	Polymer chemistry Introduction; properties, different types of polymers, structures, properties and synthesis, Polysaccharides,	5
3	Peptides, structures, properties and synthesis protecting groups	3
4	Dendrimers, Cyclodextrins,	2

#### Books Recommended

Sr. No.	Title of the Book	Author/Editor	Edition/Year	Publisher
1	Organic Synthesis-The Disconnection Approach	Stuart Warren	2002	John Wiley & Sons, Inc
2	Adv.Org. Chemistry	Carey	4 <sup>th</sup> , 2000	Plenum Press NY
3	Adv.Org. Chemistry	Jerry March	4 <sup>th</sup> , 2003	John Wiley & Sons, Inc
4	The Logic of Chemical Synthesis	E. J. Corey	1989	John Wiley & Sons, Inc

<b>Title of the Course</b>	<b>Pharmacology-I</b>
Marks	50
Number of Hours per Week	2
Total Hours	30
Class	S.Y. B. Pharm
Semester	IV

Sr.No	Topic	Hrs.
1	General Principle of pharmacology: Routes of administration with special reference to their advantages and disadvantages. Drug ADME	5
2	Mechanism of drug action: Brief introduction of physiological receptors-structural and functional families, cytoplasmic second messengers, drug receptor interaction, dose response relationship, drug antagonism	6

3	Factors modifying the actions of drugs; Drug toxicity in humans-toxic effects of drugs on different systems, organs and tissue. Drugs used in the disorders of gastrointestinal tract: Emetics and antiemetics and prokinetic drugs. Purgatives and antidiarrheals, antispasmodics, Drugs used in the treatment of hyperacidity and peptic ulceration and anti-inflammatory bowel disease.	7
4	Miscellaneous: Histamines and antihistaminics, 5-HT and antagonists, kinins, eicosanoids, cytokines, PAF, oxytocin, local anesthetics, antidiabetic agents, antithyroid agents, oral contraceptive.	7
5	Drugs affecting blood and blood forming organs: Drugs effective in various types of anemias, anticoagulants, antithrombotics, thrombolytics.	5

Books recommended: Will be recommended by teacher.

<b>Title of the Course</b>	<b>Biochemistry -II</b>
Marks	50
Number of Hours per Week	2
Total Hours	30
Class	S.Y. B. Pharm
Semester	IV

Sr.No	Topic	Hrs.
1	Biochemical Energetics: Concept of free energy, standard free energy vs transformed free energy vs free energy for a reaction. Relationship of standard free energy to reaction equilibrium constant, concepts of enthalpy and entropy, introduction to first and second law of thermodynamics. Standard free energy changes of some important biological reactions. Concept of oxidation –reduction reactions, standard electrode potential, transformed standard electrode potential, standard electrode potentials of some biological important redox couples. Concept of high energy phosphate bond and ATP as a carrier of energy. Concept of oxidation states of carbon in different compounds. Introduction to the terms metabolism, anabolism and catabolism.	7
2	Digestion of food and absorption of monosaccharides, amino acids and fatty acids into circulation. Fate of absorbed nutrients and relationship with regard to immediate use, storage, re-release and interconversion. Role of different organs in these processes especially liver, kidney, muscle, adipose tissue, brain and rbc.	5
3	Carbohydrate metabolism: Discussion of glycolysis, reversal of glycolysis, glycogen synthesis and breakdown, pentose phosphate pathway, TCA cycle, glyoxalate shunt, gluconeogenesis, NADH/NAD <sup>+</sup> shuttles, with respect to the location, intermediates, enzymes, energy yield, and regulation. Examples of drugs related to carbohydrate metabolism modulation.	7
4	Lipid metabolism: Discussion of the oxidation and biosynthesis of saturated and unsaturated fats with respect to location, intermediates, enzymes, energy yields or requirements, and regulation, formation of ketone bodies, acetate mevalonate pathway, biosynthesis of cholesterol. Examples of drugs that are related to lipid metabolism modulation.	5

5	Electron transport chain: Components of the ETC, oxidative phosphorylation vs substrate level phosphorylation, comparison of this with photosynthesis and photophosphorylation, absorption of light by chlorophyll and energy conservation. Discussion on proton motive force and generation of ATP by use of proton gradients. Examples of some toxins that interfere with ETC.	6
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Books Recommended : Same as under Biochemistry -III

<b>Title of the Course</b>	<b>Pharmaceutical Analysis-II</b>
Marks	50
Number of Hours per week	2
Total Hours	30
Class	S.Y. B.Pharm.
Semester	IV

Sr.No	Topic	Hrs.
1.	<i>Introduction:</i> Pharmacopoeial monograph, literature collection, data handling and expression of analytical results – documentation and record keeping	6
2.	a. Standardization of finished products and their characteristics; b. Official methods of control – Pharmacopoeia and other compendia, c. monographs and their criteria with reference to the drugs and pharmaceutical aids	8
3.	Melting point, congealing point as per I.P	4
4.	<i>Discussions:</i> On analysis of gases – oxygen, mercury, Nitrogen determination, Halogen determination;	6
5.	Principles and theory of aquametry.	4

Books Recommended : same as under Pharmaceutical Analysis-I

<b>Title of the Course</b>	<b>Pharmaceutical &amp; Medicinal Chemistry-II</b>
Marks	50
Number of Hours per week	2
Total Hours	30
Class	S.Y. B.Pharm.
Semester	IV

Sr. No.	Topic	Hrs.
Chemotherapeutic agents: Study of the following classes of drugs with respect to their classification, chemical nomenclature, structure including stereochemistry, generic names, chemistry, physicochemical properties, SAR, metabolism, molecular mechanism of action and synthesis and introduction to rational development, if any.		
1.	Antibacterial agents – a) Antibiotics: beta-lactam antibiotics including-penicillin, cephalosporins, carbapenems, monobactams. b) Tetracyclines and glycylyclins.	4 1



	c) Marcolides and ketolides. d) Aminoglycosides. e) Miscellaneous including chloramphenicol, vancomycin, bacitracin etc. f) Sulfonamides and DHFR inhibitors: g) Quinolones h) Oxazolidinones and other miscellaneous agents.	1 1 1 2 1 1
2	Antiparasitic agents- a) Antiamoebics, b) Antimalarials, c) Anthelmintics d) Miscellaneous including drugs versus Trypanosomiasis, leishmaniasis, scabies, filaria etc	5
3	Antifungal agents- a) Azoles, b) Polyene antibiotics and Miscellaneous including Allyl amines, Tolnaftate, griseofulvin etc.	1 1
4	Antimycobacterial agents- a) Antitubercular agents b) Antileprotic agents Drugs versus MAC	1 1
5	Anticancer agents – a) DNA alkylating agent b) Nitrosoureas Procarbazines, Triazines and misc. Organoplatinum agents c) Antibiotics d) Antimetabolites including DNA polymerase inhibitors, Pyrimidine and purine antagonists and misc. agents. e) Mitosis inhibitors and other misc. anticancer agents.	1 1 1 1 1
6	Antiviral agents – a) General aspects b) Agents interfering with nucleic acid replication including those with modification with bases sugars and phosphate. c) Amantidine and its analogs, interferon and its inductors. Nuraminidase inhibitors d) Antiretroviral drugs including NRTI, NNRTI and protease inhibitors.	1 1 1 1

#### Books Recommended

Sr.No.	Title	Author/Editor	Edition	Publisher
1	Foye's Principles Of Medicinal Chemistry	W. O. Foye	6 <sup>th</sup> , 2008	Lippincott Williams & Wilkins
2	Textbook Of Medicinal And Pharmaceutical Chemistry	Wilson And Gisvold	11 <sup>th</sup> , 2004	Lippincott Williams & Wilkins –Philadelphia
3	Burger's Medicinal Chemistry & Drug Discovery(Vol. 1- 6)	A. Burger And M.E. Wolff;	6 <sup>th</sup> , 2003	John Wiley & Sons-New Jersey

4	Remington's The Science And Practice Of Pharmacy		21 <sup>st</sup> , 2006	Lipincott, William And Wilkins
5	Pharmaceutical Substances: Synthesis, Patents, Applications(N-Z)	Kleemann	4 <sup>th</sup> , 2001	Georg Thieme Verlag-Stuttgart. Thieme
6	Synthesis Of Drugs: A Synthon Approach Vol-1	R. P. Iyer, M. S. Degani	2 <sup>nd</sup> , 2008	Sevak Publications Pvt. Ltd.
7	The Organic Chemistry Of Drug Synthesis Vol. 1-6	Daniel Lednicer	1999	John Wiley & Sons INC
8	The Organic Chemistry Of Drug Design And Drug Action.	R. B. Silverman	2 <sup>nd</sup> , 2004	Elsevier Publication

<b>Title of the Course</b>	<b>Dispensing Pharmacy</b>
Marks	50
Number of Hours per Week	2
Total Hours	30
Class	S.Y. B. Pharm
Semester	IV

Sr.No.	Topic	Hrs
1.	Definition of Dispensing & Prescription, Parts of prescription, types of prescription, procedure, dispensing the prescription, refilled prescription, prescription pricing, and recording of prescription.	2
2.	Calculations: Involved in compounding and Dispensing: Weight and measures, % calculations dilutions and concentrations, isotonic solutions HLB values.	6
3.	Posology, imperial system Latin teems and abbreviations	2
4.	Basic principles in dispensing: Types of dosage forms, formulation, storage, containers and closures for products, labeling of dispensed products	4
5.	Products included are: solutions (oral external use, body cavities) suspensions & emulsions Ointments, creams, gels, pastes, Suppository & pessaries Powders & Granules, Lozenges, pastilles, pills, Tablets, capsules, Tables triturates.	10
6.	Prescription Accessories	1
7.	Dispensing of Proprietary	1
8.	Incompatibilities	4

#### Books Recommended

Sr.No.	Title	Author/Editor	Edition	Publisher
1	Cooper & Gunn's Dispensing For Pharmaceutical Students	Revised By S.J.Carter	12 <sup>th</sup> , 1987	CBS Publishers & Distributors

2	Husa's Pharmaceutical Dispensing	Eric W.Martin	5 <sup>th</sup> , 1971	Mack Publishing Company
3	The Art, Science & Technology Of Pharmaceutical Compounding	Loyd V Allen	2 <sup>nd</sup> , 2002	American Pharmaceutical Association
4	Pharmaceutical Calculations	Mitchell J.Skotlosa, Howard C.Ansel	8 <sup>th</sup> , 1986	Lea & Febiger
5	American Pharmacy: Textbook Of Pharmaceutical Principles, Processes & Preparations	Rufus Lyman	4 <sup>th</sup> , 1955	J.B.Lippincott Company
6	Pharmaceutical Practice	Diana M. Collett, & Michael E. Aulton	1998	Churchill London
7	Pharmaceutical Practice	A.J. Winfield & R.M.E. Richards	2 <sup>nd</sup> , 1998	Churchill Livingstone

<b>Title of the Course</b>	<b>Anatomy, Physiology &amp; Pathophysiology-IV</b>
Marks	50
Number of Hours per Week	2
Total Hours	30
Class	S.Y. B. Pharm
Semester	IV

Sr.No	Topic	Hrs.
1	<p>Cardiovascular System: Anatomy - Physiology</p> <p>Structure and conducting systems of heart. Generation of action potential in SA node and its conduction/ Action potential in cardiac muscle. Cardiac cycle, ECG, (P-QRS-T)</p> <p>Blood pressure-factors modifying blood pressure</p> <p>Baroreceptors, Chemoreceptors, Vasomotor centre, humoral and neuronal regulation of Blood pressure and Circulation</p> <p>Diseases: Hypertension, CCF, Arrhythmia, angina pectoris, IHD, arteriosclerosis, varicose veins, hemorrhoids.</p>	15
2	<p>Urinary System: Anatomy – Physiology</p> <p>Function of kidneys and formation of urine. Maintenance of acid-base and electrolyte balance, Renin-angiotensin system.</p> <p>Formation of body fluids – Buffers of body, Respiratory and Metabolic acidosis and alkalosis.</p> <p>Urine analysis- Volume, colour, odour, specific gravity, normal and abnormal constituents with associated diseases.</p> <p>Diseases: Acute and Chronic renal failure, Urinary tract infection, Glomerulonephritis</p>	15

Books Recommended

Sr.No.	Title of the Book	Author/Editor	Edition/Year	Publisher
1	Ross and Wilson's Anatomy and Physiology in Health and Illness	Anne Waugh and Allison Grant	10 <sup>th</sup> , 2006	Churchill Livingstone, London,
2	Principles of Anatomy and Physiology	Gerald J.Tortora and Sandra et.al	10 <sup>th</sup> , 2003	John Wiley and Sons Inc, New York, USA.
3	Textbook of Medical Physiology	Arthur C.Guyton and John E.Hall	10 <sup>th</sup> , 2000	W.B.Saunders Company, Pennsylvania, U.S.A.
4	Illustrated Physiology	B.R.Mackenna and R.Callander	6 <sup>th</sup>	Churchill Livingstone, New York, London

<b>Title of the Course</b>	<b>Pharmaceutical Management-I</b>
Marks	50
Number of Hours per Week	2
Total Hours	30
Class	S.Y. B. Pharm.
Semester	IV

Sr.No.	Topic	Hrs.
1	Historical perspective; Business management thought -concept, functions, advantages and limitations	5
2	Principles of organizations -authority, performance, productivity	10
3	Techniques of communication, direction, participation, delegation, decision making, control tools (PERT, CPM), systems, policies, procedures, methods to operate organization	10
4	Skills like leadership, motivation, business forecasting, conflict resolution, creativity and innovation.	5

Books Recommended: Will be recommended by the teacher

<b>Title of the Course</b>	<b>Assignments (Anatomy, Physiology &amp; Pathophysiology)</b>
Marks	50
Number of Hours per week	2
Total Hours	30
Class	S. Y. B.Pharm.
Semester	IV

Sr. No.	Topic
1.	There will be several problem solving sessions where there will be discussions on methodology and approaches to solve problems including discussions on how to gather information from internet and literature. The problems will be given to the students as home assignments where students can go through the literature and come out with solutions and present it in the class. There shall be many assignments. No assignment shall be of more than 10 marks. The student shall submit the assignment in A4 size paper either hand written or typed and pinned together. Marks will be awarded by the teacher and at

	the end of the semester teacher will submit the marks along with the assignment copies of all the students to the office.
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<b>Title of the Course</b>	<b>Assignments (Organic Chemistry)</b>
Marks	50
Number of Hours per week	2
Total Hours	30
Class	S. Y. B.Pharm.
Semester	IV

Sr.No	Topic
1.	There will be several problem solving sessions where there will be discussions on methodology and approaches to solve problems including discussions on how to gather information from internet and literature. The problems will be given to the students as home assignments where students can go through the literature and come out with solutions and present it in the class. There shall be many assignments. No assignment shall be of more than 10 marks. The student shall submit the assignment in A4 size paper either hand written or typed and pinned together. Marks will be awarded by the teacher and at the end of the semester teacher will submit the marks along with the assignment copies of all the students to the office.

### Laboratory

<b>Title of the Course</b>	<b>Dispensing Pharmacy Laboratory</b>
Marks	50
Number of Hours per Week	4
Total Hours	60
Class	S.Y. B. Pharm.
Semester	IV

Sr.No.	Experiment
1	At least one representative example of each formulation type included in theory

<b>Title of the Course</b>	<b>Community Service Project</b>
Marks	100
Number of Hours per Week	6
Total Hours	90
Class	S.Y. B. Pharm.
Semester	IV

Sr.No.	Activity
1	A supervisor will be assigned to each student. The student will carry out community project under their guidance and submit report in the standard format (A4 size spiral bound). The report will be assessed by teachers appointed as examiners and conduct viva and awarded marks.

## T.Y. B. Pharm.

### SEMESTER – V

<b>Title of the course</b>	<b>Pharmaceutics-IV</b>
Marks	50
Number of hours per week	2
Total hours	30
Class	T.Y.B.Pharm.
Semester	V

Sr.No.	Topic	Hrs.
1.	Preformulation considerations in design of tablets, advantages of tablets	2
2.	Granulation: Need for granulation, Methods and equipment, Direct compression, Advances in granulation equipment	4
3.	Single stroke and Rotary Tablet Machines, physics of tablet compression, tablet tooling	2
4.	Formulation of tablets: Excipients in tableting	4
5.	Quality control of tablets	2
6.	Types of tablets: effervescent, lozenges, chewable, buccal and sublingual, dispersible, orodispersible , soluble	3
7.	Problems in tableting	1
8.	Capsules: Advantages and limitations of Hard gelatin and soft gelatin capsules:	1
9.	Gelatin extraction and manufacture of Hard gelatin capsules	1
10	Equipment for filling hard gelatin capsules, formulation considerations and quality control	3
11.	Manufacture, formulation considerations and quality control of soft gelatin capsules	3
12.	Packaging machinery and materials for tablets and capsules	2
13.	Layout design of tableting section and capsule section	2
14.	<i>Tablets:</i> and compressions of tablets, packaging including materials, quality control, evaluation and official standards, manufacturing equipment, different types of tablets including various processing problems, - Drying and mixing of powders: equipment and theory	3
15.	<i>Capsules:</i> Principles, materials and equipment involved in the formulation, manufacture and filling of hard and soft gelatin capsules and their quality control, Layout design of capsule section, packaging;	9
16.	<i>Suppositories:</i> Formulation of suppositories and pessaries, suppository bases, evaluation, packaging, and manufacture.	4

Books Recommended

Sr.No.	Title	Author/Editor	Edition	Publisher
1	Theory & Practice Of Industrial Pharmacy	Leon Lachman, Herbert A.Lieberman & Joseph Kanig	3 <sup>rd</sup> , 1970	Lea & Febiger, Philadelphia
2	Pharmaceutical Dosage Forms:Tablets (Vol 1-3)	Herbert A.Lieberman, Leon Lachman & Joseph B.Schwartz	2 <sup>nd</sup> , 1989	Marcel Dekker Inc., New York
3	Remington-The Science And Practice Of Pharmacy(Vol.1 & 2)	David B.Troy	21 <sup>st</sup> , 2006	Lippincott Williams & Wilkins
4	Modern Pharmaceutics	Gilbert S.Banker, Christopher T.Rhodes	2 <sup>nd</sup> , 1990	Marcel Dekker Inc.
5	Pharmaceutics:The Science Of Dosage Form Design	Michael E.Aulton	1 <sup>st</sup> , 1988	Churchill-Livingstone
6	Pharmaceutical Production Facilities:Design & Applications	Graham C.Cole	1 <sup>st</sup> , 1990	Ellis Horwood

Title of the course	Pharmacology - II
Marks	50
Number of hours per week	2
Total hours	30
Class	T.Y.B.Pharm.
Semester	V

Sr. No.	Topic	Hrs.
1	Local anaesthetics	3
2	Antidiabetic and Antithyroid agents	3
3	Chemotherapy Basic concepts and general principles; Antibiotics and Principles of antibacterial , Chemotherapy Sulfonamides – Trimethoprim, Quinolones and fluroquinolones , Penicillins and Cephalosporins; Macrolides, Tetracyclines, Chloramphenicols, Antifungal agents, Antiviral agents, Anticancer agents, Chemotherapy of Parasitic diseases, Amoebiasis, Antimalarial, Anthelmintics, Chemotherapy of Tuberculosis/Leprosy	24

### Books Recommended

Sr.No.	Title of the Book	Author/Editor	Edition/Year	Publisher
1	Essentials of Pharmacotherapeutics	F.S.K.Barar	1 <sup>st</sup> Edition 2004	S.Chand and Company Ltd, New Delhi
2	Essentials of medical Pharmacology	Tripathi K.D.,	6 <sup>th</sup> Edition, 2008	Jaypee Brothers Medical Publishers Pvt Ltd, New Delhi,
3	Pharmacology	H.P.Rang, M.M.Dale,J.M.Ritter	5 <sup>th</sup> Edition, 2003	Churchill Livingstone; Edinburgh
4	Pharmacology and Pharmacotherapeutics	R.S.Satoskar, S.D.Bhandarkar	15 <sup>th</sup> Edition, 1997	Popular Prakashan, Mumbai

<b>Title of the Course</b>	<b>Biochemistry III</b>
Marks	50
Number of Hours per Week	2
Total Hours	30
Class	T.Y. B. Pharm
Semester	V

Sr.No	Topic	Hrs.
1.	Nucleic acid metabolism: Discussion of biosynthesis of purines and pyridines with respect to location, intermediates, enzymes, cofactors, and regulation. Salvage pathways for nucleic acids. Examples of drugs interfering with these pathways.	5
2	Solid phase peptide synthesis, Edman reaction based protein sequencing and its automation.	4
3	Enzyme kinetics: Classification of enzymes. Effects of enzyme concentration, substrate concentration, temperature, pH on enzyme reactions. General mechanisms of enzyme catalysis – acid base catalysis, oxidation-reductions, proximity effects, transition state theory, etc. Michaelis – Menten equation and meanings of Km and Vmax, Lineweaver Burke method.	5
4	Enzyme inhibition – competitive, non-competitive and uncompetitive reversible inhibition of enzymes. Effect of these inhibitors on Km and Vmax and Identification of inhibition patterns via LWB plots. Examples of drugs that are enzyme inhibitors.	5
5	Fermentation Technology: Introduction to industrial fermentations, factors affecting fermentation processes or fermenter designs, typical fermentation types – batch, continuous, fed-batch, aerobic, anaerobic, pure culture, mixed culture etc. Typical fermenter designs and explanation of design characteristics with emphasis on automation for process control. Examples of one or two commercial production protocols – penicillin and dextran.	6
6	Immobilization of cells/enzymes: Definition of immobilization, advantages and limits, different approaches to cell/enzyme immobilization with examples of adsorption, covalent coupling and matrix/polymer based systems	5



Books Recommended

Sr.No	Title of the Book	Author/Editor	Edition/Year	Publisher
1	Lehninger: Principles of Biochemistry.	David Nelson, Michael Cox	4 <sup>th</sup> , 2005	W. H. Freeman and Company, New York.
2	Outlines of Biochemistry	Eric Conn & Paul K Stumpf	5 <sup>th</sup> , 1987	John Wiley and Sons
3	Harpers Biochemistry-	Robert Murray, Daryl Granner.	25 <sup>th</sup> , 2000	Appleton and Lange, Connecticut.

Title of the Course	Pharmaceutical & Medicinal Chemistry-III
Marks	50
Number of Hours per week	2
Total Hours	30
Class	T.Y. B.Pharm.
Semester	V

Sr.No	Topic	Hrs.
1.	Basics principles of medicinal chemistry:	
	a) Physicochemical properties of drug molecules like aqueous solubility, log P, pKa and their relation to drug transport.	3
	b) Functional group and their effects of on drug action, concept of isosterism, bioisosterism, homologs and analogs.	3
	c) Steric properties of drugs- enantiomers and diastereomers, geometrical isomerism etc.	2
	d) Drug metabolism principles- Phase I and Phase II.	4
	e) Drug receptor interaction	2

Study of the following classes of drugs with respect to their classification, chemical nomenclature, structure including stereochemistry, generic names, chemistry, physicochemical properties, SAR, metabolism, molecular mechanism of action and synthesis and introduction to rational development, if any.

2	a) Non Steroidal Anti-inflammatory Agents:	
	i) Antipyretic analgesics	1
	ii) Salicylates	1
	iii) Aryl alcanoic acids	3
	iv) N-aryl anthranillic acids	1
	v) Oxicams	1
	vi) Selective COX-2 inhibitors	1
	b) Antihistaminic agents:	
	i) H <sub>1</sub> antagonists- Classical antagonists & Non-sedative H <sub>1</sub> antagonists	4
	c) Antiulcer agents:	
	ii) H <sub>2</sub> antagonists	1
	iii) Proton Pump inhibitors	1
	iv) Others	1

Books Recommended: As under Pharmaceutical Medicinal Chemistry-II

<b>Title of the Course</b>	<b>Pharmaceutical Analysis-III</b>
Marks	50
Number of Hours per week	2
Total Hours	30
Class	T.Y. B.Pharm.
Semester	V

Sr. No.	Topic	Hrs.
1.	Solvent extraction-basic principles, classification, mechanism of extraction, equilibria, techniques and applications,	4
2.	<i>Absorption spectroscopy</i> : Introduction to interaction between electromagnetic – radiation and matter ,absorption of radiation by molecules, quantitative uses of absorption spectroscopy – Beer and Lambert’s law and its derivation, limitation. Application of Beer’s law to single component analysis and multi component systems, measurement of equilibrium constant and rate constants by spectroscopy,	6
3.	Molecular structure and electronic spectra – theory of electronic transitions and electronic spectra, spectra of isolated chromophores –auxochromes, bathochronic shifts and hypsochromic shift; Hyperchromisms and hypochromism, conjugated chromophores and aromatic molecules; Effect of solvent on absorption spectra;	2
4.	Molecular structure and infra red spectra, vibrational transition, frequency – structure correlations, various regions of IR bands – hydrogen stretching, C-C stretching, C=C stretching and bending effect of hydrogen bonding: Measurement of absorption spectra;	3
5.	Instrumentation- discussions of light sources, frequency selector, intensity control, detectors, samples preparation, ray diagrams of typical UV-Visible (double beam) and I.R. spectrophotometers;	5
6.	<i>Fluorescence Spectroscopy</i> ; Theory of fluorescence phenomenon – origin of fluorescence and phosphorescence multiplicities, singlet and triplet states; Excitation and fluorescence spectra; Molecular structure and fluorescents; Quantitative fluorescence analysis; Practical fluorescence analysis, Application of fluorescence analysis to drug; Instrumentation;	4
7.	Refractometry; theory, instrumentation and application.	3
8.	Polarimetry. theory, instrumentation and application.	3

Books Recommended: As under Pharmaceutical Analysis –II and additional as follows

Sr.No	Title Of The Book	Author/Editor	Edition/Year	Publisher
1	Pharmaceutical Analysis-	Higuchi & Brochmann- Hanssen-	1961	Interscience
2	Analytical Profiles Of Drug Substances	Florey-	1990	Academic Press
3	Instrumental Methods Of Analysis	Willard, Dean, Merrit And Settle-	6 <sup>th</sup> , 1986	Wadsworth Pub. Co.

4	Pharmaceutical Drug Analysis	Ashutosh Kar.	2001	
5	Calculation Of Analytical Chemistry	Hamilton, Simpson And Ellis-	5 <sup>th</sup> , 1954	McGraw Hill

<b>Title of the Course</b>	<b>Pharmaceutical Management-II</b>
Marks	50
Number of Hours per Week	2
Total Hours	30
Class	T.Y. B. Pharm.
Semester	V

Sr. No.	Topic	Hrs.
1	Sales & Marketing Management: Marketing Management Concepts, behavior of doctors, retailers and customers; Marketing research;	5
2	Advertising and sales promotion; Pricing; Distribution; Selling; Sales management; Retail management; Product management;	5
3	Legal frame work of industry; Budes; Human resource planning & audit; New product management;	5
4	Sales forecasting; Medium planning; Budgeting; Operations management: Production planning & control systems; Materials management systems; Quality management systems; Financial planning and control systems; Inventory & third party	10
5	money management; Labour laws; Project Management. Taxation; Direct taxes - Income tax, corporate tax; Indirect taxes -excise duty, sales tax and octroi;.	5

Books Recommended: Will be recommended by teacher.

<b>Title of the course</b>	<b>Cosmetics</b>
Marks	50
Number of hours per week	2
Total hours	30
Class	T.Y. B.Pharm.
Semester	V

Sr.No.	Topic	Hrs.
1.	Definition of cosmetics; historical background, classification of cosmetics and primary functions	1
2.	Structure of skin, hair, nails, tooth and skin appendages and interactions with cosmetics	2
3.	Microbial contamination in cosmetics; Perfumes, colours and other raw material used in cosmetics- a brief review	2
4.	Toxicology of cosmetics- irritation and sensitization reactions to cosmetics, tests to predict such reactions	2
5.	Study of following Skin cosmetics with respect to raw materials, formulations,	5

	processing equipment and quality control: skin creams and lotions- cold creams, vanishing creams, bleach creams, acne creams, hand and body creams and lotions (barrier preparations), emollient creams, sunscreen products- sun tan and anti sunburn products, insect repellants, face powder, lipstick, rouge, face packs- cleansing preparations- moisturizers, bath oils	
6.	Study of following Hair care cosmetics with respect to raw materials, formulations, processing equipment and quality control: shampoos, women's hair dressings, men's hair dressings, hair tonics, hair conditioners, hair rinses, hair colorants, hair waving and straightening preparations, depilatories, shaving preparations and aids (after shave solution/ lotion/ cream), anti-lice preparations;	5
7.	Study of following Nail products with respect to raw materials, formulations, processing equipment and quality control: pedicure and manicure preparations (nail polish, nail paint removers, cuticle removers, nail whiteners etc);	4
8.	Study of following Dental care products with respect to raw materials, formulations, processing equipment and quality control: toothpaste, tooth powder, mouth washes and denture cleansers;	2
9.	Study of following Eye makeup products with respect to raw materials, formulations, processing equipment and quality control: eye shadow, eye liner, mascara etc	2
10.	Baby cosmetics;	1
11.	Herbal cosmetics	2
12.	Schedule S of Drug and Cosmetics Act in relation to cosmetic manufacture- hygiene pollution control-ecological concern.	2

#### Book Recommended

Sr.No	Title	Author/Editor	Edition	Publisher
1	Harry's Cosmeticology	Rieger	8 <sup>th</sup> , 2000	Leonard Hill Book & Intertext Publisher, London
2	Cosmetic Science(Vol 2)	M.M. Breuer	1978	Academic Press, London
3	Cosmetics:Formulation,Manufacturing & Quality Control	P.P. Sharma	1998	Vandana Publications, New Delhi
4	A Formulary Of Cosmetic Preparations	Michael & Irene Ash	1 <sup>st</sup> , 1977	George Godwin Ltd., London
5	Drugs & Cosmetics Act 1940	Vijay Malik	16 <sup>th</sup> 1997	Eastern Book Company

<b>Title of the Course</b>	<b>Molecular Biology &amp; Biotechnology</b>
Marks	50
Number of Hours per Week	2
Total Hours	30
Class	T.Y. B. Pharm
Semester	V

Sr. No	Topic	Hrs.
1	Nucleic acids: Definition of DNA and RNA, nitrogenous bases, nucleosides, nucleotides, structure of DNA, shorthand notation of DNA polymers, melting and annealing of DNA, brief introduction to semiconservative replication and information flow via mRNA to proteins. Types of RNA-mRNA, tRNA and rRNA – their structure and their biological role.	8
2	Solid phase DNA synthesis, DNA sequencing (Maxim-Gilbert method, Sanger dideoxy method and automation of DNA sequencing)	2
3	DNA replication: Conceptual introduction to DNA replication. Conceptual explanation of replication of circular and linear chromosomes. Error correction during DNA replication. Examples of drugs that are used due to role in interaction with DNA or interfering with DNA replication.	4
4	Protein Biosynthesis: Conceptual introduction to DNA transcription and RNA translation, differences between prokaryote and eukaryotes, concepts of introns and exons and intron splicing, concept of posttranslational modifications (examples of glycosylated proteins, conjugated proteins, insulin). Examples of protein synthesis inhibitors used and drugs.	8
5	Recombinant DNA technology: Introduction to the concept, introduction to prokaryotic and eukaryotic cell systems and their DNA organization, plasmids, restriction enzymes, methods to prepare rDNA molecules (plasmids and phages), methods for introduction of DNA into cells, selection methods. Differences between cloning and expression. Properties of cloning and expression vectors & cloning and expression systems. Examples of production of insulin and human growth hormone.	8

Books Recommended: As recommended by the Teacher

<b>Title of the Course</b>	<b>Assignments (Biochemistry)</b>
Marks	50
Number of Hours per week	2
Total Hours	30
Class	T. Y. B.Pharm.
Semester	V

Sr.No	Topic
1.	There will be several problem solving sessions where there will be discussions on methodology and approaches to solve problems including discussions on how to gather information from internet and literature. The problems will be given to the students as home assignments where students can go through the literature and come out with solutions and

	present it in the class. There shall be many assignments. No assignment shall be of more than 10 marks. The student shall submit the assignment in A4 size paper either hand written or typed and pinned together. Marks will be awarded by the teacher and at the end of the semester teacher will submit the marks along with the assignment copies of all the students to the office.
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## Laboratory

Title of the Course	Computer Applications in Pharmacy
Marks	50
Number of Hours per Week	4
Total Hours	60
Class	T.Y B.Pharm
Semester	V

Sr.No.	Experiment	Hrs.
1	Application of mathematical and statistical packages like (R, Mupad, MatLab, Excel etc) Basic	15
2	Applications in Pharmacy of the packages and others	15

<b>Title of the course</b>	<b>Pharmacology Laboratory-I</b>
Marks	50
Number of hours per week	4
Total hours	60
Class	T.Y. B.Pharm
Semester	V

Sr. No.	Experiments	Hrs.
1	Studies of commonly used instruments, common and standard technique used and animal handling in experimental pharmacology.	4
2	Study of different routes of administration of drugs in mice/rats.[DEMO]	4
3	Effect of autonomic drugs on rabbit's eye. [DEMO]	4
4	Effect of various agonists and antagonists and their characterization using suitable isolated preparations.	48

### Books Recommended

Sr. No.	Title of the book	Author/Editor	Edition/Year	Publisher
1	Hand Book of Experimental Pharmacology,	Kulkarni S.K.,	3 <sup>rd</sup> 1999	Vallabh Prakashan, New Delhi
2	Practicals in Pharmacology	R.K.Goyal,	6 <sup>th</sup> , 2006-2007	B.S.Shah Prakashan, Ahmedabad
3	Selected Topics in Experimental Pharmacology	U.K.Seth, N.K.Dadkar, Usha G.Kamat,	1 <sup>st</sup> 1972	Kothari Book Depot Mumbai
4	Fundamentals of Experimental Pharmacology	Ghosh M.N.	3 <sup>rd</sup> 2005	Hilton and Co, Kolkata

<b>Title of the course</b>	<b>Cosmeticology Laboratory</b>
Marks	50
Number of hours per week	4
Total hours	60
Class	T.Y. B.Pharm
Semester	V

Sr.No.	Experiment
1	At least one representative example of each formulation type included in theory

Books Recommended : As recommended by teacher

<b>Title of the Course</b>	<b>Molecular Biology &amp; Biotechnology Laboratory</b>
Marks	50
Number of Hours per Week	4
Total Hours	60
Class	T.Y B.Pharm
Semester	V

Sr.No.	Experiment	Hrs
1	Sterility testing Aqueous and oily injectables, Powders, Eye drops and Ointments	8
2	Microbial assay of antibiotics	4
3	Microbial Limit test on Starch, gelatin, talc and lactose of pharmaceutical grade.	4
4	Special Biochemical Tests: Sugar fermentation, hydrolysis of gelatin, starch and urea, Nitrate reduction, Coagulase test, Oxidase test, Catalase test, IMIVC test	8
5	Observation of Pathogens on Selective media: McConkey, Vogel- Johnson, and Cetrimide agar.	4

6	Air and Water analysis	8
7	Demonstrations: Alcohol production by Yeast Lactic acid fermentation in milk Widal test	4 4 4
8	Enzyme Production Ammonium Sulphate Precipitation  Demonstrations: Immobilization of enzymes Electrophoresis Isolation and Extraction of DNA & RNA.	12

Books Recommended: As recommended by Teacher

### T.Y. B.Pharm.

### SEMESTER VI

<b>Title of the course</b>	<b>Pharmaceutics-V</b>
Marks	50
Number of hours per week	2
Total hours	30
Class	T.Y. B.Pharm
Semester	VI

Sr.No.	Topic	Hrs.
1.	Tablet Coating: Need, advantages, types	1
2.	Sugar coating: Method, advantages, coating formulation, problems	2
3.	Film coating : Polymers for coating, properties and selection, Coating formulation development, Evaluation of free films, enteric and non enteric film coating	3
4.	Equipment for sugar and film coating: Coating pan, Modified coating pans, Fluid bed coating, spray systems,	4
5.	Quality control of coated tablets: Enteric and non enteric	2
6.	Problems in coating, Introduction to Aqueous coating	2
7.	Microencapsulation: Introduction, advantages, applications in dosage forms	1
8.	Methods of microencapsulation: Physical, Physicochemical and chemical, Phase separation coacervation, Mutiorifice centrifugal process, spray drying and congealing, orifice methods, polymerization techniques	4
9.	Formulation of microcapsules into dosage forms and evaluation of microcapsules and dosage forms.	1
10.:	Stability testing: Accelerated stability testing and shelf life determination using Arrhenius equation, determination of overages, Degradation kinetics from dosage	4



	forms,	
11.	Routes of degradation((physical, chemical and microbiological)	2
12.	Factors affecting stability and methods of stabilization, interactions with containers and closures	3
13.	Introduction to ICH guidelines	1

Books Recommended: As under Pharmaceutics-II and in addition the following

Sr.No.	Title	Author/Editor	Edition/Year	Publisher
3	Microencapsulation & Related Drug Processes	Patrick B.Deasy	1984	Marcel Dekker Inc.
4	Microcapsule Processing & Technology	Asaji Kondo	1 <sup>st</sup> , 1979	Marcel Dekker Inc.
5	Treatise On Controlled Drug Delivery	Kydonieus ,Agis	1978	Marcel Dekker Inc.
6	Controlled Drug Delivery:Fundamentals & Applications	Joseph R.Robinson, Vincent H.Lee	2 <sup>nd</sup> , 1987	Marcel Dekker Inc.

<b>Title of the course</b>	<b>Pharmacology - III</b>
Marks	50
Number of hours per week	2
Total hours	30
Class	T.Y.B.Pharm.
Semester	VI

Sr. No.	Topic	Hrs.
1	Drugs acting on CNS: Alcohol: Ethanol, Methanol, Disulfiram General Anaesthetics: History, classification, stages of anaesthesia, preanaesthetic medicine, Basal anaesthetic agents, Neuroleptanalgesia, Latest agents: Sedative, hypnotics, anxiolytics. Anticonvulsants; Antidepressants; Antiparkinsonism. CNS stimulant, Opioid analgesics/NSAIDS.Centrally acting muscle relaxants	18
2	Drugs acting on ANS: Cholinergic, anticholinergic agents Adrenergic, adrenergic blocking agents Drugs acting on NMJ; Ganglion Blockers/stimulators	12

Books Recommended: Same as under Pharmacology-II

<b>Title of the Course</b>	<b>Pharmacognosy - I</b>
Marks	50
Number of Hours per Week	2
Total Hours	30
Class	T.Y. B. Pharm.
Semester	VI

Sr.No	Topic	Hrs.
1	<b>General Pharmacognosy:</b> Definition, history, indigenous systems of medicine. Source of drugs, organized drugs and unorganized drugs	2
2	<b>Scope of Pharmacognosy:</b> Origin, geographical source & habitat, history, cultivation, pest control, preparation for market, identification, chemical constituents, uses, allied drugs, substitutes, adulterants	4
3	<b>Plant growth regulators :</b>	1
4	<b>Cell cultures as source of drugs</b>	1
5	<b>Classification of crude drugs:</b> Alphabetical, biological, morphological, pharmacological, chemical, chemo-taxonomical	2
6	<b>Standardization of drugs of natural origin:</b> Organoleptic, microscopic, macroscopic, biological, chemical, spectral, and physical methods. Application of chromatographic techniques in evaluation of herbal drugs. Evaluation of crude drugs, extracts and phytoconstituents	3
7	<b>Plant description, morphology, cell differentiation and ergastic cell contents:</b> Study of plant parts, cell and tissue, underground or subterranean drugs, roots, rhizomes, corms, bulb, tubers, stolon, runners, and suckers; Leaves: Simple and compound, stomata, stomata number, stomatal index, palisade - ratio, hydathodes and water pores, epidermal trichomes, calcium oxalate crystals, vein-islet number, vein termination number; Inflorescence and flowers; Fruits; Seeds; Barks, and wood.	4
8	<b>Unorganised drugs:</b> Dried latex, dried juices, dried extracts, gums and mucilages, resins.	1
9	<b>Phytochemistry:</b> General properties, structures, classification, methods of extraction, etc. of Carbohydrates, proteins, enzymes, lipids, volatile oils, glycosides (anthraquinone, cyanogenic, steroidal, triterpenoidal, coumarin, flavonoid, glucosinolate, etc.) tannins, alkaloids.	8
10	<b>Biosynthesis :</b> Building blocks, reactions involved in the biosynthesis, biosynthesis of building blocks. (acetate, isopenntenyl pyrophosphate, phenyl propane, etc.,)	3
11	<b>Extraction:</b> Methods employed for the extraction of natural products mentioned under phytochemistry. Types of extracts. Methods used for separation of phytoconstituents	2
12	<b>Minerals-</b> Kiselghur, Chalk, Talc, and Bentonite	1

Books Recommended ; Will be recommended by the teacher

<b>Title of the Course</b>	<b>Pharmaceutical Analysis- IV</b>
Marks	50
Number of Hours per week	2
Total Hours	30
Class	T.Y. B.Pharm.
Semester	VI

Sr.No	Topic	Hrs.
1.	<i>Electrochemical methods:</i> Theory, introduction and application of voltametry, coulometry, polarography, amperometry, introduction to pulse polarography, electrogravimetry	5
2.	<i>Chromatography:</i> Terminologies, development of chromatogram, dynamic of chromatography, classification (absorption, partition, gas, liquid, exclusion, electrochromatography, ion exchange), thin layer chromatography (TLC), high performance thin layer chromatography (HPTLC), gas liquid chromatography (GLC), and high performance liquid chromatography (HPLC), column chromatography, paper chromatography, ion pair chromatography, details of components of instruments (eg. Rheodyne injector, pumps, etc) and accessories (eg, detectors, integrators autosampler, etc.) Introduction to UPCL, Instrumentation, application, advantages and disadvantages.	10
3.	Introduction, theory, instruments, and applications of <sup>1</sup> H NMR; <sup>13</sup> C NMR; Mass Spectrometry; Near IR	6
4.	Problem solving based on UV, IR, NMR, MS of simple molecules and drug substances	5
5.	Hyphanated techniques: LC-MS; GC-MS	4

Books Recommended As Recommended under Pharmaceutical Analysis –III

<b>Title of the Course</b>	<b>Pharmaceutical &amp; Medicinal Chemistry-IV</b>
Marks	50
Number of Hours per week	2
Total Hours	30
Class	T.Y. B.Pharm.
Semester	VI

Sr.No	Topic	Hrs.
	Study of the following classes of drugs with respect to their classification, chemical nomenclature, structure including stereochemistry, generic names, chemistry, physicochemical properties, SAR, metabolism, molecular mechanism of action and synthesis and introduction to rational development, if any.	
1	Adrenergic Drugs or drugs affecting adrenergic neurotransmission: a) General aspects of adrenergic receptors and Non-selective adrenergic agonists- nor-epinephrine and epinephrine. b) Selective $\alpha_1$ -adrenergic agonists and $\alpha_2$ -adrenergic agonists	2 1

	c) $\beta_1$ and $\beta_2$ . adrenergic agonists d) Mixed-acting sympathomimetics e) Non-selective and Selective $\alpha$ -adrenergic antagonists f) $\beta$ -adrenergic antagonists g) Mixed $\alpha/\beta$ -adrenergic antagonists Ergot alkaloids.	1 1 1 2 1
2	Cardiovascular Drugs: a) Cardiac agents: i. Cardiac glycosides and non-glycosides. ii. Antianginal agents: iii. Nitrates and nitrites, nitric oxide donors iv. Calcium channel blockers v. Antiarrhythmic drugs: Class I to IV. b) Diuretics: i. Osmotic diuretics ii. Carbonic anhydrase inhibitors. iii. Thiazide and thiazide like diuretics iv. Loop diuretics v. Aldosterone antagonists vi. Potassium sparing diuretics c) Antihypertensive agents: i. ACE inhibitors ii. Ca channels blockers iii. Adrenergic blockers iv. Vasodilators v. Misc. d) Antihyperlipidemic agents and cholesterol reducing agents. e) Drugs affecting blood clotting -Anticoagulants: Heparin and oral, Direct thrombin inhibitors, Thrombolytics, antiplatelet drugs and Anitfibrinolytic agents.	2  1 2 2 4       5   2 3

Books Recommended: As recommended under Pharmaceutical and Medicinal Chemistry-II

Title of the Course	Assignments (Pharmaceutical Analysis)
Marks	50
Number of Hours per week	2
Total Hours	30
Class	T. Y. B.Pharm.
Semester	VI

Sr.No	Topic
1.	There will be several problem solving sessions where there will be discussions on methodology and approaches to solve problems including discussions on how to gather information from internet and literature. The problems will be given to the students as home

	assignments where students can go through the literature and come out with solutions and present it in the class. There shall be many assignments. No assignment shall be of more than 10 marks. The student shall submit the assignment in A4 size paper either hand written or typed and pinned together. Marks will be awarded by the teacher and at the end of the semester teacher will submit the marks along with the assignment copies of all the students to the office.
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## Laboratory

<b>Title of the course</b>	<b>Pharmaceutics Laboratory - III</b>
Marks	50
Number of hours per week	4
Total hours	60
Class	T.Y. B.Pharm
Semester	VI

Sr.No.	Experiment
1	At least one representative example of each formulation type included in theory of Pharmaceutics IV and V(Preparation and evaluation, <b>with stress on official formulations</b> )

Books Recommended: As recommended by the teacher

<b>Title of the Course</b>	<b>Pharmaceutical &amp; Medicinal Chemistry Laboratory - I</b>
Marks	50
Number of Hours per week	4
Total Hours	60
Class	T.Y. B.Pharm.
Semester	VI

Sr.No.	Topic	Hrs.
Functional group transformation: Minimum one exercise to be given for each of the preceding types of transformations, if possible leading to synthesis of drugs or drug intermediates		
1	Esterification (synthesis of acetyl salicylic acid)	8
2	Hydrolysis	4
3	Amide formation (acetylation, benzoilation),	8
4	Diazotization and coupling	4
5	Bromination	4
6	Nitration and Sulfonation in aromatic rings	8
7	Simple oxidation and reduction reactions	8
8	Synthesis of Heterocycles (e.g. Hydantoin, Benzimidazole )	8
9	Aliphatic substitution reactions	4
10	Clasien / aldol condensation	4

### Books Recommended

Sr.No.	Title	Author/Editor	Edition	Publisher
1	Vogel's A Text book of Practical Organic Chemistry	A. Vogel	3 <sup>rd</sup> , 1962	Longman group limited, London
2	Advanced Practical Organic Chemistry	J. Leonard, Trevor P. Toube, B. Lygo, G. Proctor	2 <sup>nd</sup> , 1990	Stanley Thornes
3	Practical Organic Synthesis: A Student's Guide	<u>Reinhart Keese,</u> <u>Martin P.</u> <u>Brändle</u>		

<b>Title of the Course</b>	<b>Pharmaceutical Analysis Laboratory-II</b>
Marks	50
Number of Hours per week	4
Total Hours	60
Class	T.Y. B.Pharm.
Semester	VI

Sr.No	Experiment	Hrs.
1	Atomic absorption spectroscopy (Alkali earth metal determinations) **	4
2	Absorption spectroscopy (UV, Visible); **	8
3	Fluorescence spectroscopy (Quinine salt), Quenching phenomenon. **	4
4	Chromatography (PC, CC, TLC) application to reaction monitoring, purity assessment of drugs, separation of the mixtures.	12
5	Medicaments in formulations**: Liquid oral, tablet, injectable, aerosol, capsule, ointment, eye drops, suppositories, lozenges, etc. (one each);	16
6	<i>Multi component analysis for drugs in combination</i> **. eg: Using simultaneous equation method, using iso absorption point method, Using solvent extraction method, Using colorimetric and UV methods.	8
7	Refractometry** Calibration of Abbe's Refractometer, Estimation of refractive index of natural oils and laboratory solvents, determination of the percentage of glycerin in the unknown by calibration curve.	4
8	Polarimetry ** Instrument information, Optical rotation of dextrose solution, determination of specific optical rotation of ethambutol,	4

\*\*Applications may also include the compounds to which the techniques are applicable.

<b>Title of the Course</b>	<b>Pharmacognosy Laboratory-I</b>
Marks	50
Number of Hours per Week	4
Total Hours	60
Class	T.Y. B. Pharm.
Semester	VI

Sr.No.	Experiment
1	Study of simple and compound microscope, magnification, micrometry, and microscopical drawing using camera lucida, Projection microscope. etc.
2	Studies on morphological features of leaves, roots and rhizomes, stem, flowers, fruits, seeds, barks, woods, etc
3	Studies of plant tissues : palisade, epidermis, cork, parenchyma, collenchyma, sclerenchyma, vascular tissues, secretory organs, spores, etc
4	Studies of stomata (diacytic, paracytic, anisocytic, dumb-bell shaped stomata, etc.)
5	Studies of covering and glandular trichomes (minimum of 5 each type).
6	Studies of calcium oxalate crystals (acicular, prism, rosette, sandy, microneedles, crystal sheath, etc.
7	Studies on starches (maize, wheat, rice, potato, etc.).
8	Determination of stomatal number and stomatal index
9	Determination of palisade ratio.
10	Determination of vein-islet and vein termination number
11	Quantitative microscopy using lycopodium spores.
12	Determination of total ash and acid insoluble ash
13	Determination of alcohol and water soluble extractive values
14	Development of thin layer chromatography for two drugs (alkaloids, volatile oils, glycoside, etc
15	Evaluation of volatile oil/fixed oil by R.I
16	Determination of swelling factor (isabgol seed or husk)
17	Determination of moisture content by (Karlfisher method, LOD, etc.)

Seminar:

Every student will be assigned a supervisor. The student will select a topic in consultation with the supervisor. The seminar will be submitted in spiral bound form well in advance of presentation. The seminar will be presented by the student as per the schedule put up.

## Final Year B. Pharm.

### SEMESTER VII

<b>Title of the course</b>	<b>Pharmaceutics -VI</b>
Marks	50
Number of hours per week	2
Total hours	30
Class	Final Year B. Pharm.
Semester	VII

Sr.No.	Topic	Hrs
1.	<i>Sterile Products</i> : Introduction to sterile dosage forms, parenteral preparations-types, general requirements,	1
2.	Containers and closures(glass, plastic, rubber) for parenterals, evaluation and selection,	2
3.	Routes of parenteral administration, Formulation considerations in the development of a small volume parenterals including solutions, suspensions, emulsions, dry powders, water for injection (preparation and testing)	5
4.	Manufacture of small volume parenterals in ampoules and vials, Freeze drying of small volume parenterals	3
5.	Sterilization methods and evaluation using biological indicators	1
6.	Production facilities, layout of production facilities, Air systems, Filters, HEPA filters, Class considerations, Environment control,	3
7.	Quality control tests of small volume parenterals	3
8.	Ophthalmics: anatomy and physiology of eye, Factors affecting topical ophthalmic delivery	1
9.	Ophthalmic solutions, suspensions, ointments, gels, advantages and limitations, Formulation considerations, manufacture and packaging, Quality control of ophthalmics, preservative efficacy test	4
10.	Contact lens solutions and their formulation and evaluation	1
11.	Blood products and Plasma substitutes: collection and storage of blood, whole human blood, and products obtained from it, methods used for these and packaging employed for them, quality control of blood and its constituents; Plasma substitutes their properties and quality control	2
12.	Glandular products: Extraction and isolation of insulin from of pancreas, insulin injections;	2
13.	Sutures and ligatures	1

Books Recommended: As under Pharmaceutics IV



<b>Title of the course</b>	<b>Pharmacology - IV</b>
Marks	50
Number of hours per week	2
Total hours	30
Class	Final Year B. Pharm.
Semester	VII

Sr. No.	Topic	Hrs.
1	CVS: Drugs used in the treatment of Hypertension Congestive cardiac failure Arrhythmia Hyperlipidemia Angina Pectoris	6
2	Diuretics	4
3	Pharmacology of bronchial asthma and cough	3
4	Immunomodulators: immunostimulants/suppressants	6
5	Principle of toxicology: Heavy metal poisoning, Pesticides, Poisoning, opium poisoning	4
6	Use of radioisotopes in medicine	3
7	Development of new drug: (Importance of preclinical and clinical studies, phases of clinical trial and placebo)	4

#### Books Recommended

Sr.No.	Title of the book	Author/Editor	Edition/Year	Publisher
1-4	All Books under Pharmacology –II and			
5	The Pharmacological Basis of Therapeutics	Goodman and Gilman,	11 <sup>th</sup> 2006	McGraw –Hill Medical Publishing

<b>Title of the Course</b>	<b>Pharmacognosy - II</b>
Marks	50
Number of Hours per Week	2
Total Hours	30
Class	Final Year B.Pharm.
Semester	VII

Sr.No.	Topic	Hrs.
1	<b>Carbohydrates</b> – Agar, Alginic acid, Acacia, Aloe vera gel, Bael, Chitin, Dextrans, Guar gum, Honey, Inulin, Irish moss, Ispaghula, Pectins, Starches, TKP, Tragacanth. Biosynthesis of carbohydrates in brief	4
2	<b>Acids</b> - Citrus, Tamarind pulp, <b>Garcinia, Amla</b>	1
3	<b>Fatty acids and their esters</b> - Almond oil, Arachis, <b>Castor</b> , Chaulmoogra oil, Coconut oil, Cotton seed oil, Croton, <b>Linseed</b> , Jajoba, Olive oil, <b>Mustard oil</b> , Neem, Sesame, Wheatgerm oil, <b>Fish liver oil</b> , Cocoa butter, Kokum butter, <b>Woolfat, Beeswax</b> , Carnauba wax, lecithin, Spermaceti. Biosynthesis of fatty acids and triglycerides.	4

4	<b>Protein sand enzymes</b> - Protein hydrolysate, <b>Gelatin</b> ,; Pepsin, Renin, Trypsin, Chymotrypsin, Thrombin, Papain, Ficin, Bromelain, Pancreatin, Hyaluronidase	2
5	<b>Peptide toxins</b> : Abrin, Botulinum toxin, Ricin, Bee venom, Snake venom, Scorpion venom	1
6	<b>Alkaloids: Derived from Ornithine: Belladonna*, Coca, Datura, Hyoscyamus, Stramonium</b> <i>Derived from Lysine :Black pepper*, Lobelia</i> <i>Derived from Nicotinic acid: Areca, Tobacco</i> <i>Derived from Phenylalanine: Ephedra</i> <i>Derived from tyrosine and tyramine : Colchicum*, Opium*, Ipecac</i> <i>Derived from tryptophan: Cathatharanthus, Cinchona*, Ergot*, Nuxvomica, Rauwolfia</i> <i>Derived from anthranilic acid : Vasaka</i> <i>Derived from histidine : Pilocarpus</i> <i>Purine alkaloids : Cocoa , Coffee, Cola, Tea</i> <i>Terpenoid alkaloid : Aconite</i> <i>Steroidal alkaloid : Kurchi, Solanum</i>	20
7	<b>Study of fibers (animal, vegetable, mineral, &amp; synthetic) : Cotton, Jute, Flax, Viscose, Cellulosics, Silk, Wool, Asbestos, Glasswool, Nylon, Terylene, Polythene</b>	3

Books Recommended ; Will be recommended by the teacher

<b>Title of the Course</b>	<b>Pharmaceutical &amp; Medicinal Chemistry-V</b>
Marks	50
Number of Hours per week	2
Total Hours	30
Class	Final Year B.Pharm.
Semester	VII

Sr. No.	Topic	Hrs.
1	Antidiabetic agents: a) Insulin b) Sulfonylureas c) PPAR-agonists and Misc.	1 2 1
2	Steroids: a) Nomenclature and 3-D structure of steroids. b) Biosynthesis and metabolism of steroids. c) Corticosteroids – Glucocorticoids - systemic topical and inhaled, Mineralocorticoids. d) Male sex steroids and other related agents – Androgens and anabolic steroids, Antiandrogens, androgen biosynthesis inhibitors, Drugs for erectile dysfunction. e) Estrogens- steroidal and non-steroidal, antiestrogens, SERMs. Aromatase inhibitors. Progestins & its inhibitors.	1 1 3 2 2 1

3	Thyroid Agents: a) Thyroid hormone and analogs. b) Antithyroid agents	1
4	Introduction to eiconosides	1
5	Drugs for calcium homeostasis.	1
6	Vitamins and their involvement in metabolism : a) Water soluble vitamins b) Lipid soluble vitamins c)	2
7	Introduction to pharmaceutical biotechnology:	1
8	Peptide and protein drugs	2
9	Introduction to antisense agents	1
10	Introduction to drug discovery: a) Drug discovery from natural products. b) Molecular modeling and drug design-ligand and structure based. c) Enzymes and receptors in drug design. Analog design and prodrugs	1 2 2 1
11	Emerging areas in medicinal chemistry. e.g. drugs based on PDEs and other topics of current interest.	1

Books Recommended: As under Pharmaceutical Medicinal Chemistry –IV

<b>Title of the Course</b>	<b>Pharmaceutical Analysis-V</b>
Marks	50
Number of Hours per week	2
Total Hours	30
Class	Final Year B.Pharm.
Semester	VII

Sr.No	Topic	Hrs.
1.	Raw material analysis (RMA), Quality control of pharmaceutical excipient	5
2.	Packaging material testing (PMT): Packaging material testing, permeability of plastic, testing of foil, bottles, carriers, shipment.	6
3.	<i>Thermal analysis:</i> Theory, introduction and applications of thermogravimetric analysis (TGA), differential thermal analysis, DSC (Differential Scanning Calorimetry), thermogravimetry – instruments available;	7
4.	<i>Atomic emission and atomic absorption spectrophotometry:</i> Theory, introduction and application;	5
5.	<i>Statistics and statistical quality control:</i> Statistics in quality control – definition of terms, normal distribution, T-test, F-test, linear regression, correlation coefficient, statistical validation of analytical procedures – application to analysis; Methods of statistical analysis as applied to sampling and interpretation of results, regression regression lines – sampling procedures; Statistical quality control charts; Case studies to be included.	7

Books Recommended: As under Pharmaceutical analysis –IV

<b>Title of the course</b>	<b>Biopharmaceutics And Pharmacokinetics</b>
Marks	50
Number of hours per week	2
Total hours	30
Class	Final Year B. Pharm.
Semester	VII

Sr.No.	Topic	Hrs
1.	Introduction: Definition: absorption, distribution, metabolism, excretion, elimination, first pass effect, enterohepatic cycling, bioavailability, biopharmaceutics, pharmacokinetics and pharmacodynamics	2
2.	Pharmacokinetics parameters: biological half life, volume of distribution, clearance: renal clearance, nonrenal clearance, additively of clearance, absolute bioavailability relative bioavailability, bioequivalence, and other parameters	2
3.	Concepts of compartment models: Pharmacokinetics of one compartment model, mathematical treatment to pharmacokinetics upon i.v. bolus dosing, i.v. infusion and first order extra vascular input; Methods of estimation of pharmacokinetic parameters and parameters for bioavailability/ bioequivalence – including method of residuals, excretion rate method, and sigma minus method of estimation of renal clearance, renal clearance, mean residence time; Wagner Nelson method	8
4.	Multicompartment models: Concepts and examples (excluding derivation or mathematical treatment)	1
5.	Plasma concentration and therapeutic response and introduction to pharmacodynamics;	1
6.	Non-linear pharmacokinetics: Non-linearities in absorption distribution, metabolism and elimination, examples of drug showing nonlinear pharmacokinetics	2
7.	Dosage regimens: Factors affecting dosage regimens, individualization of dosage regimens, therapeutic window, multiple dose pharmacokinetics, fluctuation, accumulation index, steady state concept, time to reach steady state, loading dose, maintenance dose, dose requiring individuation of dosage regimens	2
8.	Drug absorption: Different mechanism of drug transport, passive transport and pH partition theory, facilitated diffusion, active transport, blood and its drug binding constituents as carriers of drugs in the body; Perfusion limitation and permeability limitation and permeability limitation in drug transport; Physicochemical and physiological factors affecting the absorption of drugs	4
9.	Distribution: rate of distribution, perfusion limitation and permeability limitation, extent of distribution , plasma and tissue binding of drugs, drugs with small, intermediate and high volume of distribution and their relative plasma and tissue binding	3
10.	Elimination: Organ clearance concepts, hepatic clearance, hepatic extraction ratio, blood flow limitation in hepatic clearance, first pas effect; Clinical application : Effect of enzyme induction, enzyme inhibition, blood flow and protein binding on hepatic clearance, bioavailability, steady state plasma concentration and dosage	3

	regimens, renal clearance and mechanisms of renal excretion, estimation of renal clearance, factors affecting renal elimination, clinical applications, biliary clearance, enterohepatic circulation and other miscellaneous modes of drug elimination	
11.	In vitro: in vivo Correlation: Official and unofficial methods of estimation of dissolution / in – vitro release of drugs from dosage forms; In-vitro in-vivo correlation and its significance.	2

#### Books Recommended

Sr.No.	Title	Author/Editor	Edition	Publisher
1	Biopharmaceutics & Pharmacokinetics-A Treatise	D.M. Brahmankar, Sunil B. Jaiswal	1 <sup>st</sup> , 1995	Vallabh Prakashan
2	Biopharmaceutics & Clinical Pharmacokinetics-An Introduction	Robert E. Notari	4 <sup>th</sup> , 1971	Marcel Dekker Inc.
3	Clinical Pharmacokinetics- Concepts & Applications	Malcolm Rowland Thomas N. Tozer	2 <sup>nd</sup> , 1989	Lea & Febiger, Philadelphia
4	Biopharmaceutics & Clinical Pharmacokinetics	Milo Gibaldi	3 <sup>rd</sup> , 1984	Lea & Febiger, Philadelphia
5	Pharmacy Review	Leon Shargel	1990	Wiley Medical Publication
6	Principles & Applications of Biopharmaceutics & Pharmacokinetics	Dr.H.P.Tipnis Dr.Amrita Bajaj	2004	Career Publication

<b>Title of the Course</b>	<b>Pharmaceutical Biotechnology</b>
Marks	50
Number of Hours per Week	2
Total Hours	30
Class	Final Year B. Pharm.
Semester	VII

Sr. No	Topic	Hrs.
1	Defintition of biotechnology, the different aspects of biotechnology, pharmaceutical biotechnology and its role in producing therapeutics and diagnostics and in health care	4
2	Therapeutic proteins, Nucleic acids (Antisense RNA technique).Animal and plant cell culture: Brief introduction to cell culture with respect to the properties of animal and plant cells, media requirements, typical media used, typical methods for setting up primary culture, cell strains vs cell lines. Use of plant/animal cell culture for production of pharmaceuticals. Recombinant DNA technology for plant cell culture via use of Agrobacterium species.	6

3	Genomics in Clinical Diagnostics: Restriction fragment length polymorphism, Gel electrophoresis techniques (PAGE, SDS-PAGE and agarose gel electrophoresis), immunoblotting, Southern blotting, Northern blotting, Western blotting, PCR and RT PCR, Sanger dideoxy method of sequencing.	3
4	Immunity, methods of immunization, principles of serology, antigen antibody reactions, generation of immune response, polyvalent antibodies, hypersensitivity responses. Preparation and characterization of immune sera, and allergenic extracts. Monovalent antibodies or monoclonal antibodies, hybridoma technology, humanization of monoclonal antibodies, application of monoclonals in therapeutics and diagnostics RIA and ELISA diagnostic methods.	6
5	Vaccines: Preparation and standardization of vaccines. Discussion of different types of vaccines, different approaches for vaccine preparation and their quality control parameters	4
6	Pharmacogenomics	4
7	Tutorials	3

Books Recommended : Will be recommended by the teacher

<b>Title of the Course</b>	<b>Assignments (Medicinal Chemistry)</b>
Marks	50
Number of Hours per week	2
Total Hours	30
Class	Final Year B.Pharm.
Semester	VIII

Sr. No.	Topic
1.	There will be several problem solving sessions where there will be discussions on methodology and approaches to solve problems including discussions on how to gather information from internet and literature. The problems will be given to the students as home assignments where students can go through the literature and come out with solutions and present it in the class. There shall be many assignments. No assignment shall be of more than 10 marks. The student shall submit the assignment in A4 size paper either hand written or typed and pinned together. Marks will be awarded by the teacher and at the end of the semester teacher will submit the marks along with the assignment copies of all the students to the office.

<b>Title of the Course</b>	<b>Assignments (Biopharmaceutics)</b>
Marks	50
Number of Hours per week	2
Total Hours	30
Class	Final Year B.Pharm.
Semester	II

Sr.No	Topic
1.	There will be several problem solving sessions where there will be discussions on methodology and approaches to solve problems including discussions on how to gather information from internet and literature. The problems will be given to the students as

	home assignments where students can go through the literature and come out with solutions and present it in the class. There shall be many assignments. No assignment shall be of more than 10 marks. The student shall submit the assignment in A4 size paper either hand written or typed and pinned together. Marks will be awarded by the teacher and at the end of the semester teacher will submit the marks along with the assignment copies of all the students to the office.
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## Laboratory

<b>Title of the course</b>	<b>Pharmacology Laboratory-II</b>
Marks	50
Number of hours per week	4
Total hours	60
Class	Final Year B.Pharm.
Semester	VII

Sr.No.	Topic	Hrs.
1	To record concentration response curve of acetylcholine, gallamine, histamine and oxytocin using suitable isolated preparations.	48
2	Study of analgesia, anti-inflammatory activity and muscle relaxant activity of drugs using simple experiments. [DEMO]	4
3	To study the effect of drugs on normal and hypodynamic heart using suitable animals. [Use of CDs and other materials to show experiments] [DEMO]	4
4	Brief explanation of regulatory toxicity studies.	4

Books Recommended : Same as under Pharmacology Lab-I

<b>Title of the Course</b>	<b>Pharmacognosy Laboratory -II</b>
Marks	50
Number of Hours per Week	4
Total Hours	60
Class	Final Year. B.Pharm.
Semester	VII

Sr.No.	Experiment
1	Detailed histological studies including powder characters of barks: Cinchona and Kurchi
2	Detailed histological studies including powder characters of leaves : datura leaf, vasaka leaf, vinca leaf
3	Detailed histological studies including powder characters of roots : ipecac root, rauwolfia root
4	Detailed histological studies including powder characters of seeds : linseed, nux vomica seed
5	Detailed histological studies including powder characters of ephedra stem
6	Gross identification of drugs containing fixed oils, fats and waxes (10 drugs). Identification of fixed oils by chemical tests.

7	Gross identification of drugs containing carbohydrates (10 drugs). Identification of drugs by chemical tests
8	Gross identification of Alkaloidal drugs (20 drugs).
9	Identification of fibers by chemical tests and microscopy (animal, vegetable, mineral and synthetic fibers)
10	Separation of starch from potato tubers
11	Isolation of mucilage by alcohol precipitation (aloe juice)
12	Preparation of extract by Soxhlet extractor and evaluation of extract by for phytoconstituent by spectrophotometry. (e.g. quinine, strychnine, brucine).
13	Extraction and isolation of piperine from blackpepper

Books Recommended; Will be recommended by the teacher

<b>Title of the Course</b>	<b>Pharmaceutical Analysis Laboratory-III</b>
Marks	50
Number of Hours per week	4
Total Hours	60
Class	Final Year B.Pharm.
Semester	VII

Sr.No	Experiment	Hrs.
1	Atomic absorption spectroscopy (Alkali earth metal determinations) **	8
2	Raw material analysis: Drugs **	10
3	Pharmaceutical excipients **	10
4	Demonstrations: HPTLC, HPLC (With various detectors), GC (With various detectors), Particle size analyzer, LC-MS, GC-MS, GPC,	16
5	FTIR, <sup>1</sup> HNMR recording of spectra and interpretations**	08
6	Differential Scanning Calorimetry (DSC) recording and interpretations**	08

\*\*Applications may also include the compounds to which the techniques are applicable.

<b>Title of the Course</b>	<b>Pharmaceutics IV And Biopharmaceutics Laboratory</b>
Marks	50
Number of Hours per week	4
Total Hours	60
Class	Final Year B.Pharm.
Semester	VII

Sr.No.	Experiment
1	At least one representative example of each formulation type included in theory of Pharmaceutics VI.(Preparation and evaluation, WITH STRESS ON OFFICIAL FORMULATIONS)
2	Dissolution testing of conventional marketed formulations representing- soluble drug, poorly soluble drug (selection of medium) ; Dissolution testing of sustained released marketed formulation; Bioavailability of an oral formulation in rabbits (demonstration) and calculation of pharmacokinetic parameters. Problem solving sessions with $t_{max}$ , $C_{max}$ , AUC, and other pharmacokinetic parameters.



## Final Year B.Pharm.

### SEMESTER VIII

<b>Title of the course</b>	<b>Pharmaceutics-VII</b>
Marks	50
Number of hours per week	2
Total hours	30
Class	Final Year B.Pharm.
Semester	VIII

Sr.No.	Topic	Hrs.
1.	Oral Sustained and Controlled release formulations: Terminologies, Basic Principles & mechanisms of sustained drug release, materials and methods, large-scale manufacture, evaluation and quality control, packaging	4
2.	Novel Oral DDS: Gastro retentive DDS, Osmotic DDS, Pulsatile DDS , Colonic DDS	10
3.	Introduction to principles and concepts of transdermal, transmucosal, ocular and targeted delivery	6
4.	CGMP. and quality assurance	2
5.	Documentation:	3
6.	Qualification and Validation; : Types of validation, Product and process validation	5
7.	Schedule M: Factory Layout, Focus on department layouts, services, etc.	5
8.	Pilot plant scale up technique – groups responsibilities, facilities, example of scaling up of liquid/solid oral formulations; biobatch preparation	4
9.	Production Management; Total quality management, materials, inventories, ABC concept, EOQ, Cost controls	5
10.	IPR: Introduction to Indian Patent law:, Gatt, WTO. TRIPS; Types of patents, Introduction to patents, parts of a patent	4
11.	NDA and ANDA filing: CDER guidelines	4
12.	ICH Guidelines	4
13.	Packaging: Primary packaging materials including glass, plastics, rubber, materials for strip and blister packaging, specifications, testing, selection, compatibility evaluation, advantages and limitations ; secondary and tertiary packaging materials.	4

Books Recommended : Same as under Pharmaceutics – VII

<b>Title of the Course</b>	<b>Pharmacognosy - III</b>
Marks	50
Number of Hours per Week	2
Total Hours	30
Class	Final Year B.Pharm.
Semester	VIII

Sr.No.	Topic	Hrs.
1	<b>Phenyl propanoids</b> ; Peru and Tolu Balsams, <b>Asafoetida</b> , Vanilla, Salicin, <b>Capsicum*</b> , <b>Ginger</b> , <b>Benzoin</b> , <b>Clove</b> , <b>Nutmeg</b> , <b>Cinnamon*</b> , <b>Turmeric</b>	4
2	<b>Coumarins</b> : Psoralea, Tonco	1
3	<b>Lignans and lignins</b> : Podophyllum, Phyllanthus,	1
4	<b>Flavonoids</b> : Fagopyrum, Orange peel, Soya isoflavone	1
5	<b>Terpenoids</b> : Ajowan*, Alpinia, Abelmoschus, Anise,, Amomum, Calamus, <b>Cardamom</b> , Caraway, <b>Citrus oils*</b> , <b>Coriander</b> , Cummin, Dill, Eucalyptus oil, <b>Fennel*</b> , Jatamansi, Lemongrass, <b>Mints*</b> Palmarosa, Rose, Sandalwood, Saussurea, Star anise,, <b>Turpentine*</b> , Wintergreen, Vetiver, , Valerian, Jasmine, Artemisia, <b>Pyrethrum</b> , <b>Colophony*</b> , Matricaria; Taxus, <b>Myrrh</b> , <b>Shellac</b> , <b>Quassia</b> , Picrorhiza, Andrographis	12
6	<b>Triterpenes</b> : Acacia concinna, <b>Bacopa</b> , Colocynth, Gymnema, <b>Hydrocotyl</b> , <b>Licorice*</b> , Momordica, Quillaia, Senega, Sapiandus	3
7	<b>Cardioactive glycoside</b> : <b>Digitalis*</b> , Nerium, <b>Strophanthus</b> , <b>Squill</b> , Thevetia	2
8	<b>Steroid saponin</b> : Agave, <b>Asparagus</b> , <b>Dioscorea*</b> , <b>Fenugreek</b> , <b>Guggul</b> , Smilax	2
9	<b>Carotenoids</b> : <b>Saffron</b> , Bixa, <b>-carotene</b>	1
10	<b>Naphthelene derivatives</b> : Plumbago, Alkanna, <b>Henna</b>	1
11	<b>Anthraquinone</b> : <b>Aloes</b> , Andira, <b>Cascara</b> , Cochineal, Hypericum, <b>Rhubarb</b> , Rubia, <b>Senna</b>	2
12	<b>Tannins</b> : <b>Black catechu</b> , <b>Galls*</b> , Hammamalis, Kinos, <b>Myrobalans</b> , <b>Pale catechu</b> .	2
13	<b>Polyacetylenes</b> :	
14	<b>Cyanophoric glycosides</b> : Almonds, <b>Wild cherry</b>	
	<b>Isothiocyanate glycosides</b> : Mustard	
	<b>Sulphur containing compounds</b> : Garlic	1
	<b>Plant Allergens</b>	1
	<b>Aflatoxin</b> , <b>Marine drugs</b> , <b>Poisonous plants</b>	1

Drugs which are in **bold** are representatives of the class, meant for detailed study.

**with \* mark are meant for biosynthesis study of major constituent.**

Books recommended; Will be recommended by the teacher

<b>Title of the Course</b>	<b>Pharmaceutical &amp; Medicinal Chemistry- VI</b>
Marks	50
Number of Hours per week	2
Total Hours	30
Class	Final Year B.Pharm.
Semester	VIII

Sr.No	Topic	Hrs.
<p>Study of the following classes of drugs with respect to their classification, chemical nomenclature, structure including stereochemistry, generic names, chemistry, physicochemical properties, SAR, metabolism, molecular mechanism of action and synthesis and introduction to rational development, if any.</p>		
1.	Drugs Affecting the Central Nervous System-	
	a) General introduction to biogenic amines and other biomolecules involved in neurotransmission.	2
	b) General anaesthetics: Inhaled general anesthetics and Intravenous general anesthetics.	1
	c) Sedatives and hypnotics: Benzpdiazepines, Non-benzodiazepine, Barbiturates, Misc.	3
	d) Antiseizure drugs or anticonvulsant agents: Clinical drugs and newer agents	2
	e) Antidepressants: Selective norepinephrine reuptake inhibitors (SNRIs), Selective 5-HT reuptake inhibitors (SSRIs), Nonselective reuptake inhibitors (NSRIs), Dopamine and norepinephrine reuptake inhibitors (DNRI), Serotonin antagonist/reuptake inhibitors (SARIs), nonadrenergic specific serotonergic antidepressants (NaSSAs), monoamine oxidase inhibitors (MAOIs), Mood stabilizers.	3
	f) Antipsychotics: phenothiazes, thioxanthenes, benzamide, benzapines, benzisoxazole and benzisothiazoles, misc. agents.	2
	g) Anxiolytics: Benzodiazepines, Misc agents.	1
	h) Hallucinogens, Stimulants and related drugs of abuse or analeptics, xanthenes, psychedelics: Non classical Hallucinogens- cannabinoids, classical hallucinogens- Indolealkylamines, phenylalkylamines, Central stimulants-amphetamine related agents, cocaine related agents.	2
	i) Drugs used to treat neuromuscular disorder: Antiparkinsonian and spasmolytic agents.	1
	j) Drugs affecting serotonergic neurotransmission- drugs for migraine, Irritable Bowel Syndrome, Antemetemetic agents.	2
2	Cholinergic Drugs or Drugs affecting cholinergic neurotransmission:	
	a) General aspects of cholinergic receptor and acetylcholine	1
	b) Acetyl choline mimetics- muscarinic agonist or cholinergic agonists.	1
	c) Anticholinesterases	1
	d) Drugs for the treatment of Alzheimer's.	1
	e) Acetylcholine antagonists muscarinic antagonists.	1
	f) Neuromuscular blocking agents.	1

3	Analgesics: a) Opioid or narcotic analgesics: $\mu$ -agonists, other analgesics, mixed agonist/antagonist analgesics, $\mu$ -antagonists. b) Antidiarrheal agents c) Cough suppressants, anti-tussives narcotic and others.	4
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Books Recommended: Same as recommended under Pharmaceutical and Medicinal Chemistry-V

<b>Title of the course</b>	<b>Clinical Pharmacy and Drug Interactions</b>
Marks	50
Number of hours per week	2
Total hours	30
Class	Final Year B.Pharm.
Semester	VIII

Sr.No.	Topic	Hrs.
1	Introduction: History and Scope of Clinical Pharmacy	4
2	Concept of Clinical Pharmacy	4
3	Role of Clinical Pharmacy in Patient care	4
4	Patient Counselling and Communication Skills	4
5	Adverse drug reactions	4
6	Drug Problems in geriatrics and pediatrics	4
7	Drug Interactions: Review of theoretical basis of possible interactions with examples of interactions of clinical significance	6

#### Books Recommended

Sr.No	Title Of The Book	Author/Editor	Edition/Year	Publisher
1	The Science And Practice Of Pharmacy	Remington	2005	Lippincott Williams &Wilkins
2	Clinical Pharmacy And Therapeutics	Roger Walker And Clive Edwards.	2 <sup>nd</sup> , 1999	Churchill Livingstone, Edinburgh
3	Drug Interactions: Clinical Significance Of Drug Interactions	Hansten P.D.,	5 <sup>th</sup> , 1985	Lea And Febiger, Philadelphia
4	Elements Of Clinical Pharmacy	Dr R.K.Goyal, Dr P.A.Bhatt, Dr M.D.Burande,	2 <sup>nd</sup> , 2004-2005	B.S.Shah Prakashan, Ahmedabad
5	A Handbook Of Clinical Pharmacy	A.V.Yadav, B.V.Yadav, T.I.Shaikh	2 <sup>nd</sup> , 2004	Nirali Prakashan, Pune

<b>Title of the Course</b>	<b>Assignments (Pharmaceutics)</b>
Marks	50
Number of Hours per week	2
Total Hours	30
Class	Final Year B.Pharm.
Semester	VIII

Sr. No.	Topic
1.	There will be several problem solving sessions where there will be discussions on methodology and approaches to solve problems including discussions on how to gather information from internet and literature. The problems will be given to the students as home assignments where students can go through the literature and come out with solutions and present it in the class. There shall be many assignments. No assignment shall be of more than 10 marks. The student shall submit the assignment in A4 size paper either hand written or typed and pinned together. Marks will be awarded by the teacher and at the end of the semester teacher will submit the marks along with the assignment copies of all the students to the office.

<b>Title of the Course</b>	<b>Assignments (Pharmacology)</b>
Marks	50
Number of Hours per week	2
Total Hours	30
Class	Final Year B.Pharm.
Semester	VIII

Sr. No.	Topic
1.	There will be several problem solving sessions where there will be discussions on methodology and approaches to solve problems including discussions on how to gather information from internet and literature. The problems will be given to the students as home assignments where students can go through the literature and come out with solutions and present it in the class. There shall be many assignments. No assignment shall be of more than 10 marks. The student shall submit the assignment in A4 size paper either hand written or typed and pinned together. Marks will be awarded by the teacher and at the end of the semester teacher will submit the marks along with the assignment copies of all the students to the office.

<b>Title of the Course</b>	<b>Assignments (Pharmacognosy)</b>
Marks	50
Number of Hours per week	2
Total Hours	30
Class	Final Year B.Pharm.
Semester	VIII

Sr.No	Topic
1.	There will be several problem solving sessions where there will be discussions on methodology and approaches to solve problems including discussions on how to gather information from internet and literature. The problems will be given to the students as home assignments where students can go through the literature and come out with solutions and present it in the class. There shall be many assignments. No assignment shall be of more than 10 marks. The student shall submit the assignment in A4 size paper either hand written or typed and pinned together. Marks will be awarded by the teacher and at the end of the semester teacher will submit the marks along with the assignment copies of all the students to the office.

## Laboratory

<b>Title of the Course</b>	<b>Pharmaceutics Laboratory – V</b>
Marks	50
Number of Hours per week	4
Total Hours	60
Class	Final Year B.Pharm.
Semester	VIII

Sr.No.	Experiment
1	Accelerated stability testing of at least two pharmaceutical formulations.
2	Oral sustained release matrix tablets – formulation and evaluation
3	Oral multiparticulate sustained release formulation - formulation and evaluation
4	Floating DDS, Pulsatile DDS, Osmotic DDS
5	Demonstration of scaleup of a liquid/solid formulation
6	Documentation of certain standard records related to manufacture and quality control

<b>Title of the Course</b>	<b>Pharmacognosy Laboratory -III</b>
Marks	50
Number of Hours per Week	4
Total Hours	60
Class	Final Year B.Pharm.
Semester	VIII

Sr.No.	Experiment
1	Detailed histological studies including powder characters of rhizomes: Ginger and Glycyrrhiza

2	Detailed histological studies including powder characters of fruits : Coriander and Fennel
3	Detailed histological studies including powder characters of leaves : Senna and Digitalis
4	Detailed histological studies including powder characters of Cinnamon bark and Quassia wood
5	Detailed histological studies including powder characters of Clove and Cardamom
6	Gross identification of drugs containing volatile oils (20 drugs)
7	Gross identification of drugs containing steroids and triterpenoids (10 drugs)
8	Gross identification of anthraquinones, tannins, lignan and coumarin, etc. containing drugs (10 drugs)
9	Evaluation of unorganised drugs mentioned under theory by chemical tests
10	Separation of volatile oil from crude drug (e.g. clove, eucalyptus, etc)
11	Isolation of calcium Senoside from senna leaves
12	Demonstration of column chromatography and preparative TLC.
13	Preparation of herbarium sheet
14	Visit to medicinal plant garden

<b>Title of the Course</b>	<b>Pharmaceutical &amp; Medicinal Chemistry Laboratory-II</b>
Marks	50
Number of Hours per week	4
Total Hours	60
Class	Final Year B.Pharm.
Semester	VIII

Sr.No	Experiment	Hrs.
1	Experimental determination of pKa and comparison with software generated data	4
2	Experimental determination of log P values and comparison with software generated data	4
3	Experimental determination of simple in-vitro activity of analogs	4
4	Structure property relationship from data of experiments 1,2 and 3	4
5	Demonstration of pharmacophore development and QSAR	4
6	Demonstration of structure based drug design	4
7	Multistep drug synthesis a) acetanilide to sulphanilamide. b) p-nitro toluene to benzocaine	18
8	Synthesis of analogs e.g. series of esters from suitable carboxylic acids	18

<b>Title of the Course</b>	<b>Project</b>
Marks	100
Number of Hours per week	8
Total Hours	120
Class	Final Year B.Pharm.
Semester	VIII

Sr.No	Topic
1.	Project supervisor will be assigned to each student and student will work on a project Assigned and a report will be submitted in a bound form. The project will be evaluated by the examiners and hold viva. Marks will be awarded on the basis of project and viva.

