

Bachelor of Pharmacy (B .Pharm) Degree Semester Course

Syllabus / Curriculum 2013-2014



KLE Academy of Higher Education & Research

(Established under Section 3 of the UGC Act, 1956,
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VISION

To be an outstanding University of excellence ever in pursuit of newer horizons to build self reliant global citizens through assured quality educational programs.

MISSION

- To promote sustainable development of higher education consistent with statutory and regulatory requirements.
- To plan and continuously provide necessary infrastructure, learning resources required for quality education and innovations.
- To stimulate to extend the frontiers of knowledge, through faculty development and continuing education programs.
- To make research a significant activity involving staff, students and society.
- To promote industry/organization, interaction/collaborations with regional / national / international bodies.
- To establish healthy systems for communication among all stakeholders for vision oriented growth.
- To fulfill the national obligation through rural health missions.

OBJECTIVES

The objectives are to realize the following at University and its constituent institutions:

- To implement effectively the programs through creativity and innovation in teaching, learning and evaluation.
- To make existing programs more career oriented through effective system of review and redesign of curriculum.
- To impart spirit of enquiry and scientific temperament among students through research oriented activities.
- To enhance reading and learning capabilities among faculty and students and inculcate sense of life-long learning.
- To promulgate process for effective, continuous, objective oriented student performance evaluation.
- To co-ordinate periodic performance evaluation of the faculty.
- To incorporate themes to build values, civic responsibilities & sense of national integrity.
- To ensure that the academic, career & personal counseling are in- built into the system of curriculum delivery.
- To strengthen, develop and implement staff and student welfare programs.
- To adopt and implement principles of participation, transparency and accountability in governance of academic and administrative activities.
- To constantly display sensitivity and respond to changing educational, social and community demands.
- To promote public- private partnership.

INSIGNIA



The Emblem of the University is a Philosophical statement in Symbolic.

The Emblem...

A close look at the emblem unveils a pillar, a symbol of the “University of Excellence” built on strong values & principles.

The Palm and the Seven Stars...

The Palm is the palm of the teacher - the hand that acts, promises & guides the students to reach for the Seven Stars...

The Seven Stars signify the ‘Saptarishi Dnyanamandal’, the Great Bear- a constellation made of Seven Stars in the sky, each signifying a particular Domain. Our culture says: The true objective of human birth is to master these Knowledge Domains.

The Seven Stars also represent the Saptarishis, the founders of KLE Society whose selfless service and intense desire for “Dnyana Dasoha” laid the foundation for creating the knowledge called KLE Society.

Hence another significance of the raised palm is our tribute to these great Souls for making this University a possibility.

Empowering Professionals...

‘Empowering Professionals’, inscription at the base of the Emblem conveys that our Organization with its strength, maturity and wisdom forever strive to empower the student community to become globally competent professionals. It has been a guiding force for many student generations in the past and will continue to inspire many forth coming generations.

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Section- I

AIMS AND OBJECTIVES

Pharmacy graduates are required to learn and acquire adequate knowledge, necessary skills to practice the Profession of Pharmacy including thorough and exhaustive knowledge of synthesis and assay of medicinal agents including mode of action, drug interactions, patient counseling and professional information exchange with physicians and other health professionals. The graduates are required to acquire an in-depth knowledge of formulations, storage and analysis of various pharmaceutical dosage forms including herbal medicines required for both large scale commercial production & research. The graduates should understand the concept of Community Pharmacy and be able to participate in rural and urban health care projects/programmes of the State and Central government. The graduates are also required to detail the physicians, community and market the medicinal agents for diagnosis, prevention and therapeutic purposes. The pharmacist should act as a bridge between Physicians and Patients and strive for better health care.

PROGRAMME EDUCATIONAL OBJECTIVES:

The Programme Educational objectives are covered under three headings namely:

- (A) Knowledge and understanding
- (B) Skills
- (C) Attitude

(A) Knowledge & Understanding

The graduates should acquire the following during their four-year B. Pharm course.

- Adequate knowledge and scientific information regarding basic concepts of Pharmaceutical chemistry, Pharmaceutics including cosmetics, Pharmacology and Pharmacognosy including herbal drugs.
- Adequate knowledge of practical aspects of synthesis, formulation and analysis of various pharmaceutical and herbal medicinal agents.
- Adequate knowledge of practical aspects of delivering a quality assured product as per Government guidelines, pharmacopoeias, WHO and ISO standards.

- Adequate knowledge of practical aspects of pharmacological screening, biological standardization and *in-vivo* drug interactions.
- Adequate knowledge of clinical pharmacy for patient counseling leading to physical and social wellbeing of patients.
- Adequate knowledge of practical aspects of product detailing and ethical marketing of pharmaceutical products.

(B) Skills

A graduate should be able to demonstrate the following skills necessary for practice as a pharmacist.

- Able to synthesize, purify, identify and analyze medicinal/therapeutic agents.
- Able to formulate, store, dispense, analyze the prescriptions and / or manufacture the medicinal agents at commercial level.
- Able to screen various medicinal agents using animal models for pharmacological activity.
- Able to learn and apply the principles of quality assurance including legal and ethical aspects of pharmaceuticals.
- Able to extract, isolate, purify, identify and assess the therapeutic value of herbal / crude / natural products.

(C) Attitudes

The students should develop the following attitudes during their four-year B.Pharm course.

- Willing to apply the current knowledge of pharmacy in the best interest of patients and the community.
- Maintain the high standards of professional ethics in discharging professional obligations.
- Continuously upgrade professional information and to be conversant with current advances in the field of Pharmacy to serve the community better.
- Willing to participate in continuing education programmes of PCI and AICTE to upgrade knowledge and professional skills.
- To help and to participate in the implementation of National Health Programmes.

SECTION -II

REGULATIONS GOVERNING B.PHARM DEGREE SEMESTER COURSE

1. Eligibility

1.1 Candidates who have passed two year Pre-University course examination of Karnataka PUC Board or an equivalent examination of any other approved Board or University with not less than 45% marks in any combination comprising Physics, Chemistry with Mathematics/ Biology/ Computer Science (minimum eligibility should be based on the aggregate percentage of marks obtained from PCM or PCB or PCCS) or PCMB.

Note: With respect to candidates who have studied PCMB combination, the aggregate of PCM or PCB or PCCS whichever is higher shall be considered for admission to B.Pharm course.

1.2 In case of students belonging to SC/ST/or Category-I, the minimum percentage of marks for admission to B.Pharm Course shall be not less than 40% in P.U.C. or its equivalent examination (PCB/ PCM or PCMB or PCCS)

1.3 Candidates who have passed with 50% marks in Diploma in Pharmacy course approved by Pharmacy Council of India shall also be eligible to this course through lateral entry and shall be admitted directly to III Semester (10% over and above the sanctioned intake is permitted for admissions under this category).

2. Duration of the course

The course of study for B.Pharm is comprised of eight semesters of six months each and six semesters for those admitted directly to III semester through lateral entry. The curricula and syllabi for the course shall be as prescribed from time to time.

3. Course of study

The course of study for B.Pharm I, II, III, IV, V, VI, VII and VIII semesters shall include the respective Theory and Practical subjects as shown in Table - I, II, III, IV, V, VI, VII and VIII respectively along with number of teaching hours for theory and practical for each subject. The number of hours to be devoted to each theory and practical subject in an academic semester shall not be less than that shown in Tables.

Medium of Instruction and Examination shall be English.

4. Attendance and progress

A candidate is required to have **75% attendance in both theory and practical subjects separately**. The candidate shall be deemed eligible to appear for the respective examinations based on the attendance criteria.

A record of attendance both in Theory and Practical shall be maintained regularly by the teaching staff of respective subjects.

5. Examinations

5.1 Internal Assessment/ Sessional Examination

Theory: Two internal assessment of theory of 20 marks for each subject will be evenly spread during each semester shall be conducted by the constituent colleges. The marks of the best one examination shall constitute the sessional award in theory. Provided further, the college may conduct one special theory sessional examination towards the end of the academic session for those who might have missed any one of the regular sessional examination on genuine grounds. For special theory sessional examination, the portion prescribed shall be the entire syllabus of the subject.

Practical: Students shall perform the laboratory experiments as listed in the respective semester syllabus. The number of experiments is also listed.

Internal assessment of practical of 20 marks for each subject will be based on day to day attendance, viva, laboratory record, etc.

The college shall maintain all documents of the sessional examinations i.e. work books of the students and the record of sessional award of the students.

A regular record of both theory and practical class work and sessional examinations conducted shall be maintained for each student in the department. Marks shall be awarded as per the schemes given in Table- IX to XVI.

5.2 Improvement of sessional marks

Candidates who wish to improve the sessional marks only in theory subjects can do so by appearing in the special re-sessional examinations conducted by the college. A minimum of one and maximum of two sessional examinations shall be conducted by the college out of which the marks of the best one of the two special re-sessional examinations shall be forwarded to the university at least 15 days prior to the commencement of the next University Examination. In case the marks scored by the students in the re-sessional examination are less than regular sessional examination, the Head of the Institution shall forward highest marks obtained amongst all sessional examinations of that particular semester attended by the candidate.

5.3 University Examinations.

There shall be eight examinations for the entire course namely, First, Second, Third, Fourth, Fifth, Sixth, Seventh and Eighth Semester examination. The examination shall be conducted at the end of each semester. The details regarding the duration of papers, maximum marks for each paper including the sessional marks allotted to each subject is given in Table- IX to XVI.

Scheme of Theory Examination				
Type of Questions	No. of Questions	No. of Questions to be answered	Marks for each Question	Total Marks
Multiple Choice Questions (MCQ)	20	20	01	20
Long Essay Questions	03	02	10	20
Short Essay Questions	05	04	05	20
Short Questions	10	10	02	20

Scheme of Practical Examination		
	Type of Question	Marks distributed
1	Synopsis	10 marks
2	Major Experiment**	40 marks
3	Minor Experiment *	20 marks
4	Viva-voce	10 marks
	Total	80 marks

5.4 Criteria for pass

5.4.1 Candidates who have secured a minimum of 40% marks in the Theory (including sessional marks) and Practical (including sessional marks) separately in any subject or subjects shall be declared to have passed in that subject/s and exempted from appearing in that subject/s at subsequent examination.

Theory and Practical of a particular subject are considered as individual subjects for the purpose of pass criteria.

5.4.2 Conditions under which candidates are permitted to proceed to next higher class:

The candidate has to pass in the following subjects where college examinations are held during the course of study.

i) I semester:

- a) Mathematics – Theory.
- b) Biology – Theory and practical.
- c) Communication Skills & Spoken English –Theory

ii) II Semester:

- a) Constitution of India

iii) III Semester:

- a) Computer Science

iv) VI Semester:

- a) Environmental Studies

The marks obtained in the college examination including the internal marks in the above mentioned subjects will be converted into grades and these grades will be entered in the university examination marks card. These grades will not be counted for declaring rank or total percentage. The candidate has to reappear if he has got 'E' grade in earlier examination. However the grades will not affect his /her progress to higher classes.

A grade: 75 and above

B grade: 60 to 75

C grade: 50 to 60

D grade: 40 to 50

E grade: Less than 40 (fail)

v) A candidate seeking eligibility to 5th semester should have passed in all subjects of 1st and 2nd semesters. A candidate seeking eligibility to 7th semester should have passed in all the subjects of 3rd & 4th semester.

vi) A candidate who has passed in all the subjects of eight semesters of B.Pharm will be eligible for the award of B.Pharm degree and he/she has satisfactorily completed the practical training as mentioned under clause (6).

5.4.3 Declaration of Class

Class shall be awarded at the end of each semester of B.Pharm examination as shown below:

- | | |
|-----------------|---------------------------------|
| 1) Distinction | 75% and above |
| 2) First Class | 60% and above and less than 75% |
| 3) Second class | 50% and above and less than 60% |
| 4) Pass Class | 40% and above and less than 50% |

Pass class shall be awarded to such of the candidates who would have passed the examination in more than one attempt. However, this shall not be applicable to candidates who are exempted in Remedial Mathematics / Biology by the University.

6. Practical Training:

Every candidate shall undergo practical training in Pharmaceutical Manufacturing House / Approved Hospital / Recognized Research Laboratory for a period of not less than 30 days after completing VIII semester.

Candidate should submit two copies of the training report duly certified by the authorities of the training center in which he / she has undergone training duly accepted and certified by the Head of the Institution.

Industrial Tour:

Candidates studying in final year of the course shall visit several Pharmaceutical Manufacturing Houses/Approved Hospitals/ as a supplement to their academic training and submit a report to the satisfaction of the Head of the Institution where he /she has studied.

7. Award of Degree and Ranks

Candidates who fulfill the requirements mentioned in 5.4.2(d) and (6) will be eligible for the award of degree.

Ranks and Medals shall be awarded on the basis of aggregate of all the eight university examinations. However, candidates who fail in one or more subjects during the B.Pharm courses shall not be eligible for award of ranks.

Moreover, the candidates should have completed the B.Pharm course in minimum prescribed number of years, (four years) for the award of Ranks.

Table –I
SEMESTER - I

S. NO	SUBJECT	THEORY (hrs)	TUTORIAL (hrs)	PRACTICALS (hrs)
3.1.1	Remedial Mathematics/ Biology*	04/03	--/01	0/3
3.1.2	Human Anatomy & Physiology-I	03	01	-
3.1.3	Pharmaceutical Organic Chemistry-I	03	01	06
3.1.4	Pharmaceutical Inorganic Chemistry	03	01	03
3.1.5	Communication Skills & Spoken English*	03	01	-
	TOTAL	16/15	04/05	09/12
*College Examinations only				29/32 hrs/week

Table –II
SEMESTER - II

S. NO	SUBJECT	THEORY (hrs)	TUTORIAL (hrs)	PRACTICALS (hrs)
3.2.1	Pharmaceutical Organic Chemistry -II	03	01	06
3.2.2	Pharmaceutics	03	01	06
3.2.3	Human Anatomy & Physiology-II	04	--	03
3.2.4	Pharmacognosy-I	04	--	-
3.2.5	Constitution of India*	03	--	-
	TOTAL	17	02	15
*College Examinations only				34 hrs/ week

Table –III
SEMESTER - III

S. NO	SUBJECT	THEORY (hrs)	TUTORIAL (hrs)	PRACTICALS (hrs)
3.3.1	Pharmaceutical Microbiology	03	01	06
3.3.2	Pharmacognosy –II	03	01	03
3.3.3	Pharmaceutical Analysis	03	01	06
3.3.4	Physical Pharmaceutics –I	04	--	-
3.3.5	Computer Science*	03	-	02
	TOTAL	16	03	17
*College Examinations only				36 hrs/ week

Table –IV
SEMESTER - IV

S. NO	SUBJECT	THEORY (hrs)	TUTORIAL (hrs)	PRACTICALS (hrs)
3.4.1	Physical Pharmaceutics –II	03	01	06
3.4.2	Applied Biochemistry	03	01	03
3.4.3	Pharmaceutical Engineering	03	01	06
3.4.4	Pathophysiology	04	--	-
3.4.5	Pharmacognosy & Phytochemistry	04	--	-
	TOTAL	17	03	15
				35hrs/ week

Table –V
SEMESTER - V

S. NO	SUBJECT	THEORY (hrs)	TUTORIAL (hrs)	PRACTICALS (hrs)
3.5.1	Hospital and Community Pharmacy	03	01	06
3.5.2	Pharmaceutical Technology- I	03	01	06
3.5.3	Pharmaceutical Biotechnology	04	01	-
3.5.4	Medicinal Chemistry –I	04	01	-
3.5.5	Pharmacology -I	04	01	-
	TOTAL	18	05	12
35 hrs/ week				

Table –VI
SEMESTER - VI

S. NO	SUBJECT	THEORY (hrs)	TUTORIAL (hrs)	PRACTICALS (hrs)
3.6.1	Pharmacology II	04	--	06
3.6.2	Pharmaceutical Technology-II	03	01	03
3.6.3	Advanced Pharmacognosy	03	01	06
3.6.4	Pharmaceutical Jurisprudence & Ethics	04	--	-
3.6.5	Environmental Studies *	03	01	-
	TOTAL	17	03	15
*Class Examination only				35 hrs/ week

Table –VII
SEMESTER - VII

S. NO	SUBJECT	THEORY (hrs)	TUTORIAL (hrs)	PRACTICALS (hrs)
3.7.1	Instrumental Methods of Analysis	04	01	06
3.7.2	Industrial Pharmacognosy	03	01	03
3.7.3	Medicinal Chemistry –II	03	01	06
3.7.4	Biopharmaceutics & Pharmacokinetics	03	01	-
3.7.5	Pharmaceutical Management and Marketing	03	01	-
	TOTAL	16	05	15
36 hrs/ week				

Table –VIII
SEMESTER - VIII

S. NO	SUBJECT	THEORY (hrs)	TUTORIAL (hrs)	PRACTICALS (hrs)
3.8.1	Medicinal Chemistry –III	03	01	06
3.8.2	Advanced Pharmaceutics	03	01	06
3.8.3	Pharmacotherapeutics	04	01	-
3.8.4	Regulatory affairs	03	01	-
3.8.5	Optional subjects(Any one) 1) Nanopharmaceutics (Nanomedicine) 2) Clinical Trials Research Methodology 3) Standardization & QC of Herbal drugs 4) Pharmaceutical Manufacturing Management	03	01	--
	TOTAL	16	05	12
33 hrs/ week				

Table-IX**Scheme of Examination for B. Pharm Course- I Semester**

Code No	Subject	THEORY					PRACTICALS				Grand Total
		No. of Papers	Duration of papers (Hrs)	Sessional Maximum	Max. Marks for written papers (Uni. exam)	Total	Duration of examination (Hrs)	Internal maximum marks	Max. Marks for Uni. practical examination	Total	
3.1.1	Remedial Mathematics / Biology *	1	03	20	80	100	04	20	80	100	100/200
3.1.2	Human Anatomy & Physiology-I	1	03	20	80	100	No Practicals				100
3.1.3	Pharmaceutical Organic Chemistry-I	1	03	20	80	100	04	20	80	100	200
3.1.4	Pharmaceutical Inorganic Chemistry	1	03	20	80	100	04	20	80	100	200
3.1.5	Communication skills & Spoken English*	1	03	20	80	100	No Practicals				100

Total: Theory 300 Practical 200 Grand Total: 500

* College examinations only and grades are mentioned in marks card

Table-X**Scheme of Examination for B.Pharm course- II Semester**

Code No	Subject	THEORY					PRACTICALS				Grand Total
		No. of Papers	Duration of papers (Hrs)	Mid semester Maximum	Max. Marks for written papers (Uni. exam)	Total	Duration of examination (Hrs)	Internal maximum marks	Max. Marks for Uni. practical examination	Total	
3.2.1	Pharmaceutical Organic Chemistry-II	1	03	20	80	100	04	20	80	100	200
3.2.2	Pharmaceutics	1	03	20	80	100	04	20	80	100	200
3.2.3	Human Anatomy & Physiology-II	1	03	20	80	100	04	20	80	100	200
3.2.4	Pharmacognosy-I	1	03	20	80	100	No Practicals				100
3.2.5	Constitution of India*	1	03	20	80	100	No Practicals				100

Total: Theory 400 Practical 300 Grand Total: 700

* College examinations only and grades are mentioned in marks card

Table-XI**Scheme of Examination for B.Pharm course- III Semester**

Code No	Subject	THEORY					PRACTICALS				Grand Total
		No. of Papers	Duration of papers (Hrs)	Sessional Maximum	Max. Marks for written papers (Uni. exam)	Total	Duration of examination (Hrs)	Sessional maximum marks	Max. Marks for Uni. practical examination	Total	
3.3.1	Pharmaceutical Microbiology	1	03	20	80	100	04	20	80	100	200
3.3.2	Pharmacognosy –II	1	03	20	80	100	04	20	80	100	200
3.3.3	Pharmaceutical Analysis	1	03	20	80	100	04	20	80	100	200
3.3.4	Physical Pharmaceutics –I	1	03	20	80	100	No Practicals				200
3.3.5	Computer Science*	1	03	20	80	100	04	20	80	100	200

Total: Theory 400 Practical 300 Grand Total: 700

* College examinations only and grades are mentioned in marks card

Table-XII**Scheme of Examination for B.Pharm course- IV Semester**

Code No	Subject	THEORY					PRACTICALS				Grand Total
		No. of Papers	Duration of papers (Hrs)	Sessional Maximum	Max. Marks for written papers (Uni. exam)	Total	Duration of examination (Hrs)	Sessional maximum marks	Max. Marks for Uni. practical examination	Total	
3.4.1	Physical Pharmaceutics –II	1	03	20	80	100	04	20	80	100	200
3.4.2	Applied Biochemistry	1	03	20	80	100	04	20	80	100	200
3.4.3	Pharmaceutical Engineering	1	03	20	80	100	04	20	80	100	200
3.4.4	Pathophysiology	1	03	20	80	100	No Practicals				100
3.4.5	Pharmacognosy & Phytochemistry	1	03	20	80	100	No Practicals				100

Total: Theory 500 Practical 300 Grand Total: 800

Table-XIII**Scheme of Examination for B.Pharm course- V Semester**

Code No	Subject	THEORY					PRACTICALS				Grand Total
		No. of Papers	Duration of papers (Hrs)	Sessional Maximum	Max. Marks for written papers (Uni. exam)	Total	Duration of examination (Hrs)	Sessional maximum marks	Max. Marks for Uni. practical examination	Total	
3.5.1	Hospital & Community Pharmacy	1	03	20	80	100	04	20	80	100	200
3.5.2	Pharmaceutical Technology - I	1	03	20	80	100	04	20	80	100	200
3.5.3	Pharmaceutical Biotechnology	1	03	20	80	100	No Practicals				100
3.5.4	Medicinal Chemistry-I	1	03	20	80	100	No Practicals				100
3.5.5	Pharmacology -I	1	03	20	80	100	No Practicals				100

Total: Theory 500 Practical 200 Grand Total: 700

Table-XIV**Scheme of Examination for B.Pharm course- VI Semester**

Code No	Subject	THEORY					PRACTICALS				Grand Total
		No. of Papers	Duration of papers (Hrs)	Sessional Maximum	Max. Marks for written papers (Uni. exam)	Total	Duration of examination (Hrs)	Sessional maximum marks	Max. Marks for Uni. practical examination	Total	
3.6.1	Pharmacology –II	1	03	20	80	100	04	20	80	100	200
3.6.2	Pharmaceutical Technology-II	1	03	20	80	100	04	20	80	100	200
3.6.3	Advanced Pharmacognosy	1	03	20	80	100	04	20	80	100	200
3.6.4	Pharmaceutical Jurisprudence & Ethics	1	03	20	80	100	No Practicals				100
3.6.5	Environmental studies*	1	03	20	80	100	No Practicals				100

Total: Theory 400 Practical 300 Grand Total: 700

* College examinations only and grades are mentioned in marks card

Table-XV**Scheme of Study and Examination for B.Pharm course- VII Semester**

Code No	Subject	THEORY					PRACTICALS				Grand Total
		No. of Papers	Duration of papers (Hrs)	Sessional Maximum	Max. Marks for written papers (Uni. exam)	Total	Duration of examination (Hrs)	Sessional maximum marks	Max. Marks for Uni. practical examination	Total	
3.7.1	Instrumental Methods of Analysis	1	03	20	80	100	04	20	80	100	200
3.7.2	Industrial Pharmacognosy	1	03	20	80	100	04	20	80	100	200
3.7.3	Medicinal Chemistry –II	1	03	20	80	100	04	20	80	100	200
3.7.4	Biopharmaceutics & Pharmacokinetics	1	03	20	80	100	No Practicals				100
3.7.5	Pharmaceutical Management and Marketing	1	03	20	80	100	No Practicals				100

Total: Theory 500 Practical 300 Grand Total: 800

Table-XVI
Scheme of Examination for B.Pharm course- VIII Semester

Code No	Subject	THEORY					PRACTICALS				Grand Total
		No. of Papers	Duration of papers (Hrs)	Sessional Maximum	Max. Marks for written papers (Uni. exam)	Total	Duration of examination (Hrs)	Sessional maximum marks	Max. Marks for Uni. practical examination	Total	
3.8.1	Medicinal Chemistry–III	1	03	20	80	100	04	20	80	100	200
3.8.2	Advanced Pharmaceutics	1	03	20	80	100	04	20	80	100	200
3.8.3	Pharmacotherapeutics	1	03	20	80	100	No Practicals				100
3.8.4	Regulatory Affairs	1	03	20	80	100	No Practicals				100
3.8.5	<u>Optional subjects (ANY ONE)</u> 1) Nanopharmaceuticals (Nanomedicine) 2) Clinical Trials and Research Methodology 3) Standardization and QC of Herbal drugs 4) Pharmaceutical Manufacturing Management	1	03	20	80	100	No Practicals				100

Total: Theory 500, Practical 200 Grand Total: 700

Name of the Course: Remedial Mathematics* (Theory)		
Course code: 3.1.1	Semester: I	
Duration: Theory 60 hours	Maximum Marks: 100	
Teaching Scheme:	Examination Scheme	
Theory: 04 hrs/week	Sessional Exam: 20 Marks:	
Tutorial: -- hr /week	End Semester Exam: 80 Marks:	
Practical: -- hrs/week		
Objective:-		
S.No		
1.	To give broad understanding of mathematical aspects having usefulness in understanding expressions encountered in various subjects during the course.	
2.	To provide basic ideas of matrices, determinants, & fundamentals of calculus.	
3.	To develop the ability to solve simple to moderate problems with reference to Sr. no. 2.	
4.	To establish a bridge between mathematics and applications to Pharmacy.	
Pre- Requisite:-		
S.No		
1.	Basic & Preliminary knowledge of Mathematics is essential	
Units	Contents	Hrs/week
Unit - 1	Significant figure Fraction, exponents, power and roots, Ratio & proportions logarithms.	05
Unit – 2	Matrixes and determinants	05
Unit – 3	Graphs and Equation Solving simple equations using graphs. Solving simultaneous and quadratic equations.	08
Unit – 4	Relations and Functions Concept of proportions, introduction to functions, exponential and log functions, meaning of log and linear forms.	05
Unit – 5	Fundamentals of trigonometry and geometry	05
Unit- 6	Sequences and series Patterns and formulae, arithmetic progressions, geometric progression, partial fractions.	06
Unit -7	Binomial series Binomial series for positive whole number and applications of binomial series and selections.	06
Unit -8	Calculus Functions and limits, Derivatives, Integral calculus, introductory aspects of Laplace transformation.	10
Unit-9	Integral calculus Integration by decomposition, by substitution, by parts and by successive reduction, integration of algebraic rational function, integration of trigonometric function	10

Text Books:		
Name of Authors	Titles of the Book & Edition	Name of the Publisher
Grewal B. S.	Numerical Methods	Khanna Publishers
Steve Dobbs & Jane Miller	Advanced Level Mathematics Statistics	Cambridge University Press
Adams Dany Spencer	Laboratory Mathematics	Carrol & Graphs
Jenny Olive	Maths. A Students Survival Guide	Cambridge University Press

Name of the Course: Remedial Biology* (Theory & Practical)		
Course code: 3.1.1	Semester: I	
Duration: 45 hours	Maximum Marks: 100	
Teaching Scheme:	Examination Scheme	
Theory: 03 hrs/week	Sessional Exam: 20 Marks:	
Tutorial: 01 hr /week	End Semester Exam: 80 Marks:	
Practical: 03 hrs/week		
Objective:-		
S.No		
1.	To understand the nature of biological population	
2.	To provide general knowledge of environmental effects and behavior	
3.	To introduce learner towards the organizational and functional aspects of lower animals	
4.	To introduce students towards the structural and functional aspects of plants kingdom	
Pre- Requisite:-		
1.	Basic & Preliminary knowledge of Biology is essential	
Units	Contents	Hrs/week
Unit - 1	Plant Cell Its structure and living and non-living inclusions. Plant cell division. Different types of plant tissues and their functions.	06
Unit – 2	Morphology and Histology of plant parts; Root, stem, bark, wood, leaf, flower, fruit and seed. Modifications of roots and stems.	06
Unit – 3	Plant Taxonomy Classification, study of the following families with special reference to Medicinally important plants: Apocyanaceae, Solanaceae, Umbelliferae, Labiatae, Leguminosae, and Liliaceae.	12
Unit – 4	Animal cell Structure, living and non-living inclusions. Animal cell division. Different types of cells and tissues, their functions.	05
Unit – 5	Study of comparative anatomy of different vertebrates – fish, amphibians, reptiles, aves and mammals.	06
Unit- 6	Basic study of the following systems of frog GI, nervous, cardiovascular: genitourinary, musculo-skeletal, respiratory systems.	05
Unit -7	Fundamentals of parasitology Life cycles of some animal parasites that cause human disease - Malarial and filarial parasites and tape worm.	05
3.1.1	Remedial Biology (Practicals)	45 Hours 3Hours/ week
1	Care, use and type of microscopes.	
2	Morphology of plant parts indicated in theory.	

3	Gross identification of slides of structure and life cycle of lower plants/ animals mentioned in theory.	
4	Morphology of plant parts indicated in theory.	
Text Books:		
Name of Authors	Titles of the Book & Edition	Name of the Publisher
A.C.Dutta	Text of Botany	
Dhami and Dhami	Invertebrate Zoology	

Name of the Course: Human Anatomy and Physiology-1		
Course code: 3.1.2	Semester: I	
Duration: 45 hours	Maximum Marks: 100	
Teaching Scheme:	Examination Scheme	
Theory: 03 hrs/week	Sessional Exam: 20 Marks:	
Tutorial: 01 hr /week	End Semester Exam: 80 Marks:	
Practical: --		
Objective:-		
S.No		
1.	To impart fundamental knowledge on the structure and functions of the human body.	
2.	To understand homeostasis mechanisms and its relation with various body systems.	
3.	To develop the knowledge regarding various tissues and organs of different systems of human body.	
4.	The knowledge imparted should help the students to understand the pharmacology of drugs.	
Pre- Requisite:-		
1.	Basic & preliminary knowledge of biology is essential	
Units	Contents	Hrs/week
Unit-1	Introduction Definition, scope of Anatomy & Physiology and its related sciences. Description of body such as planes and terminologies used.	02
Unit-2	Cell Physiology Cell components, structure of cell membrane, transport mechanism and ion channels.	04
Unit-3	Elementary tissues of the human body Epithelial, Connective, Muscular and Nervous tissue- sub types and characteristics.	05
Unit-4	Musculo-skeletal system Anatomy and Physiology of muscle contraction. Physiological properties of skeletal muscles and their disorders. Structure, composition and functions of skeleton. Articulation and movements. Disorders of bones and joints.	08
Unit-5	Haemopoietic System Haemopoiesis, composition and functions of blood. Haemoglobin and its functions. Blood groups and their significance. Physiology of blood coagulation. Common disorders of blood (anemia, leukemia, thrombocytopenia, haemophilia). Physiology and functions of spleen.	08

	Composition, formation and circulation of lymph.		
Unit-6	Respiratory System Anatomy and Physiology of respiratory organs. Regulation and factors affecting respiration. Respiratory volumes, vital capacity and their clinical significance.	06	
Unit-7	Digestive System Anatomy and Physiology of gastro-intestinal tract and accessory organs. Digestion and absorption – carbohydrates, fats, proteins and other nutrients.	06	
Unit-8	Sensory organs Basic anatomy and physiology of skin, eye, ear, tongue and nose.	06	
Text Books			
Sl. No	Name of the Book	Author	Publisher
01	Ross and Wilson Anatomy and Physiology in Health and Illness	A. Waugh and A. Grant	Churchill Living Stone, Edinburgh.
02	“Human Physiology” (Vol. I & Vol. II)	C.C. Chatterjee	Medical Allied Agency, Calcutta.
03	Principles of Anatomy and Physiology	G. J. Torotora,	John-Wiley & sons New York.
04	Concise Medical Physiology	S.K. Chaudhry	New Cenrtal Book Agency, Calcutta.
05	Illustrated Physiology	AB Mc Naught & R. Callander	B.I. Churchill Living Stone, New Delhi.
06	Text Book of Medical Physiology	A. C. Guyton and J.E. Hall.	W.B. Saunders company.
07	Bailey`s Text Book of Microscopic Anatomy	Douglas E., Kelly, Richard Wood and Allen C. Enders	Williams and Wilkins publishers, London.
08	Human Anatomy and Physiology	E.N. Marieb.	Addison Wesley, New York.

Name of the Course: Pharmaceutical Organic Chemistry-I (Theory & Practical)		
Course code: 3.1.3	Semester: I	
Duration: Theory 45 hours & Practical 90hrs	Maximum Marks: 100	
Teaching Scheme:	Examination Scheme	
Theory: 03 hrs/week	Sessional Exam: 20 Marks:	
Tutorial: 01 hr /week	End Semester Exam: 80 Marks:	
Practical: 06 hrs/week		
Objective:-		
S.No		
1.	To impart a review of structural aspects of organic compounds & learn arrow based reaction mechanisms.	
2.	To develop understanding of scientific nomenclature of organic compounds.	
3.	To develop the ability to understand chemical reactions related to various functional groups of carbon, oxygen, nitrogen and halogens.	
Pre- Requisite:-		
1	Basic & preliminary knowledge of Organic Chemistry is essential	
Units		
	Contents	Hrs/week
Unit-1	Current Concept of Molecular orbital theory, intramolecular and intermolecular forces, bond length and bond dissociation energy, dipole moment, polarity of bond, Hydrogen bonding, protic-aprotic solvents.	3 hrs
Unit-2	Nomenclature of organic compounds belonging to the following classes: alkanes, alkenes, dienes, alkynes, alcohols, aldehydes, ketones, amides, amines, phenols, alkylhalides, carboxylic acids, esters, acid chlorides, cyclo alkanes and aromatic compounds.	5 hrs
Unit-3	Stereochemistry. Stereo isomerism, tetrahedral carbon, optical activity, enantiomerism, diastereo isomerism, meso-structures, elements of symmetry, chirality, chiral centers, reactions of chiral molecules, Relative and absolute configurations, specification of D and L configuration. Geometrical isomerism: its nature of formation, rotation about bonds, nomenclature of isomers, E and Z forms, determination of configuration.	8hrs
Unit-4	Free radical chain reactions of alkanes: mechanism, relative reactivity and stability.	2 hrs
Unit-5	Nucleophilic aliphatic substitution mechanism: Nucleophiles and leaving groups, kinetics of second and first order reaction. Mechanism of SN1 and SN2 reactions. Rearrangement of carbocation, SN2 versus SN1 reaction. Reactivity of alkyl halides in SN ¹ and SN ² reactions. E ₁ and E ₂ reactions.	4 hrs

Unit-6	Electrophillic addition: Reactions at carbon-carbon double bond, hydrogenation, Markovnikov's rule, addition of hydrogen halides, addition of hydrogen bromides-peroxide effect. Electrophillic addition mechanism. Mechanism of cyclo addition reactions with examples. Addition of carbenes to alkenes, Diel's Alder reaction.	5 hrs
Unit-7	Theory of Resonance: Allyl radical as a resonance hybrid, stability and orbital picture. Resonance stabilization of allyl cations: hyper conjugation, stability of conjugated dienes, and mechanisms of 1, 2 and 1, 4 additions.	2 hrs
Unit-8	Concept of aromaticity, Huckel's rule. Electrophillic aromatic substitution: Effect of substituent groups, determination of orientation, determination of relative reactivity, classification of substituent groups, mechanism of nitration, sulphonation, halogenation, Friedel-Crafts alkylation and Friedel-Crafts acylation, reactivity and orientation, activating and deactivating (o,m,p-directing) groups, orientation and synthesis, orientation in di-substituted benzenes, theory of reactivity, theory of orientation, effects of halogens. Unsaturated carbonyl compounds; Conservation of orbital symmetry and rules. Electrocyclic, Cycloaddition and sigmatropic reactions; study of neighbouring group effects; Catalysis by transition metal complexes	8 hrs
Unit-9	Nucleophillic addition reactions in aldehydes and ketones, mechanisms with examples. Aldol condensation, Crossed aldol condensation, Claisen condensation, Cannizzaro, Crossed Cannizzaro reaction, Benzoin condensation, Perkin condensation, Knoevenagel and Reformatsky reactions. Fries rearrangement, Beckmann rearrangement, Birch reduction, Hofmann's hypobromite reaction, Oppenauer oxidation. MPV reduction, Arndt-Eistert synthesis.	8 hrs
	Pharmaceutical Organic Chemistry-I Practical	90hrs 6hrs/week
I	Introduction to the various laboratory techniques through demonstrations involving synthesis, MP/BP, recrystallization and its TLC analysis of the following compounds <ol style="list-style-type: none"> 1. Acetanilide/Asprin (acetylation) 2. Benzanilide/Phenyl Benzoate (Benzoylation) 3. Dibenzylidene acetone (condensation) 4. Benzoic acid / Salicylic acid (Hydrolysis of esters) 5. Benzophenoxime (oxime formation) 6. m-Dinitrobenzene(Nitration) 7. Preparation of o-Chlorobenzoic acid from o-Chlorotoluene. 	
II	Identification of organic compounds belonging to the following classes by systematic qualitative organic analysis including preparation of derivatives, MP/BP, TLC analysis <ol style="list-style-type: none"> 1. Phenols 2. Amides 	

	3. Carboxylic acids 4. Aldehydes and Ketones 5. Alcohols 6. Esters 7. Amines 8. Nitro compounds 9. Anilides		
Text Books			
Sl.No	Name of the Book	Author	Publisher
01	Text Book of Organic Chemistry	T.R.Morrison and R.Boyd	Prentice Hall of India Pvt. Ltd., New Delhi.
02	Bentley and Driver's Text Book of Pharmaceutical Chemistry	L.M. Atherden	Prentice Hall of India Pvt. Ltd., New Delhi.
03	Organic Chemistry: The Fundamental Principles	I.L. Finar	Longman Publishers.
04	Fundamentals of Organic Chemistry	T.W.Graham Solomons	John Wiley & Sons Inc., USA.
05	Organic Chemistry	J.M.Catm and D.J.Carm	Saunders college of Publishing.
06	Advanced Organic Chemistry	Jerry and March	Wiley Eastern Limited, New Delhi.
07	Practical Organic Chemistry	Mann and Sounders	ELBS and Longman group Ltd.
08	Introduction to Organic Laboratory Techniques	D.L.Pavia, G.Lampman and G.D.Kriz.	ELBS and Longman group Ltd.
09	Text Book of Practical Organic Chemistry	A. I. Vogel	ELBS Longman, London.
10	Elementary Practical Organic Chemistry	A.I. Vogel	ELBS and Longman group Ltd., London.

Name of the Course: Pharmaceutical Inorganic Chemistry-I (Theory & Practical)		
Course code: 3.1.4	Semester: I	
Duration: Theory 45 hours & Practical 45hrs	Maximum Marks: 100	
Teaching Scheme:	Examination Scheme	
Theory: 03 hrs/week	Sessional Exam: 20 Marks:	
Tutorial: 01 hr /week	End Semester Exam: 80 Marks:	
Practical: 03 hrs/week		
Objective:-		
S.No		
1.	To provide knowledge about important inorganic Pharmaceuticals in Pharmacopoeia regarding their preparation, quality standard and Pharmaceutical uses.	
2.	To highlight the domain of radiopharmaceuticals used in the diagnostics and therapy.	
3.	To describe typical therapeutic classes and inorganic agents associated with them.	
Pre- Requisite:-		
1	Basic & preliminary knowledge of Inorganic chemistry is essential	
Units		
Units	Contents	Hrs/week
Unit-1	Fundamentals of volumetric analysis, theory of indicators and methods of expressing concentrations (Normality, molarity, molality, percentage v/v and w/v). Characters of primary standards. Preparation, standardization and storage of various volumetric solutions like oxalic acid, sodium hydroxide, hydrochloric acid, sodium thiosulfate, potassium permanganate and iodine solution.	10
Unit-2	Introduction to compendial methods related to inorganic impurities. a. Sources of impurities b. Standards and limits c. Tests and methods d. Principle and procedures to evaluate commonly occurring impurities viz: chlorides, sulphates, iron, heavy metals, lead and arsenic. e. Special/modified procedures for limit tests	10
Unit-3	Inorganic pharmaceuticals: Study of general methods of preparation, properties, medicinal uses and storage conditions of official inorganic compounds belonging to the following classes (Assay methods and principles of underlined compounds to be studied). 3.1 Medicinal Gases: Oxygen, Nitrous oxide, Carbon dioxide 3.2 Gastrointestinal agents a. Acidifiers: Dilute hydrochloric acid b. Antacids: Ideal characteristics of an antacid, antacid combination therapy Aluminum hydroxide gel, Calcium carbonate, <u>Sodium bicarbonate</u> , Magnesium trisilicate, Magnesium carbonate (light and heavy), <u>Magnesium hydroxide mixture</u> . c. Cathartics: <u>Magnesium sulphate</u> , Sodium orthophosphate, Sodium	01 05

	<p>sulphate.</p> <p>3.3 Major intra and extra cellular electrolytes: Major physiological ions and electrolytes used for the electrolyte replacement therapy, introduction to physiological acid-base balance, electrolyte combination therapy and oral rehydration solutions (ORS). Study of Sodium chloride injection, Dextrose and Sodium chloride injection, Calcium gluconate injection.</p> <p>3.4 Topical agents and Dermatological preparations: a. Protectives: Kaolin, Talc, Zinc oxide, Zinc stearate, Titanium dioxide. b. Antimicrobials: <u>Potassium permanganate</u>, <u>Chlorinated lime</u>, Iodine preparations, <u>Boric acid</u>, Borax. c. Silicon polymers – Dimethicone.</p> <p>3.5 Dental Products: Dentifrices, anti-caries agents, desensitizing agents: Calcium carbonate, sodium fluoride, Stannous fluoride, Zinc chloride, Zinc eugenol cement.</p> <p>3.6 Miscellaneous agents: a. Expectorants : <u>Ammonium chloride</u> (Formal method), Potassium iodide. b. Haematinics : <u>Ferrous sulfate</u>, Ferrous gluconate, Ferrous fumarate, Iron dextran injection, Iron and Ammonium citrate c. Emetics: <u>Copper sulphate</u>. d. Antidotes: Sodium thiosulphate, Sodium nitrite and activated Charcoal e. Anti-oxidants: <u>Sodium metabisulphite</u> f. Pharmaceutical aids: Bentonite and <u>Barium sulphate</u></p>	07
		04
		02
		06
3.1.4	Pharmaceutical Inorganic Chemistry (Practicals)	45 Hours 03 Hrs/week
1	Preparation and standardization of the following volumetric solutions (2 exercises). * a. 0.1N Sodium hydroxide (NaOH) b. 0.1N Potassium permanganate (KMnO ₄) c. 0.1N Ceric ammonium sulphate d. 0.05M Di sodium Ethylenediaminetetraacetate (EDTA)	
2.	Assay of the following compounds (2 exercises)** a. Ammonium chloride-acid base titration (Formal titration) b. Boric Acid	
3.	Limit tests (4 exercises) a. Limit test for chlorides* b. Limit test for sulphates* c. Limit test for Iron* d. Limit test for heavy metals* e. Limit test for Arsenic ▪ Modifications in limit tests* for chloride and sulphates in	

	Potassium permanganate, Sodium bicarbonate, Sodium benzoate and Sodium salicylate.	
4.	Test for identify of the following (3 exercises)* a. Sodium bicarbonate b. Ferrous sulphate c. Potassium chloride d. Calcium chloride	
5.	Test for purity of the following (2 exercises)* a. Swelling power in Bentonite b. Ammonium salts in Potash alum. c. Presence of iodates in Potassium iodide	
6.	Preparation of inorganic pharmaceuticals (2 exercises)* a. Boric acid b. Potash alum c. Magnesium hydroxide. d. Magnesium sulphate	

Text Books

Sl.No	Name of the Book	Author	Publisher
01	Pharmaceutical Chemistry Part II: Inorganic –Volume I and II.	M.L.Schroff	National Book Centre, Calcutta.
02	Practical Pharmaceutical Chemistry Vol I & II.	A.H.Beckett & J.B. Stenlake	Stahlong Press of University of London.
03	Bentley & Drivers Text Book of Pharmaceutical Chemistry	A.Y Bentley	University Press, London.
04	Concise Inorganic Chemistry	J.D.Lee,	University Press, London.
05	Modern Inorganic Pharmaceutical Chemistry	C.A.Discher,	University Press, London.
06	Inorganic Medicinal and Pharmaceutical Chemistry	J.H.Block, E.B.Roche, T.O.Soine and C.O.Wilson,	University Press, London.
07	Analytical Chemistry-Principles	John H.Kennedy	Sunders College Publication New York.
08	Practical Pharmaceutical Chemistry Vol I & II.	A.H.Beckett & J.B. Stenlake	Stahlong Press of University of London.

Name of the Course: Communication Skills & Spoken English* (Theory)			
Course code: 3.1.5		Semester: I	
Duration: Theory 45 hrs		Maximum Marks: 100	
Teaching Scheme:		Examination Scheme	
Theory: 03 hrs/week		Sessional Exam: 20 Marks	
Tutorial: 01 hr /week		End Semester Exam: 80 Marks	
Practical: -- hrs/week			
Objective:-			
S.No			
1.	To develop the ability to speak and write grammatically correct English.		
2.	To develop skill in listening comprehension.		
3.	To develop the ability to read, understand and express in English language.		
4.			
Pre- Requisite:-			
Ability to read and write in English language			
Units	Contents		Hrs/week
Unit-1	Applied Grammar Remedial study of grammar, review of grammar and vocabulary. Effective use of dictionary, phonetics.		15
Unit-2	Reading Comprehension To read and comprehend selected materials, articles, magazines, journals related to pharmacy.		12
Unit-3	Forms of Composition Letter writing, note taking, precise writing, essay writing, anecdotal records, diary writing, reports, resume/ curriculum vitae and the likes.		06
Unit-4	Communication Skill Oral report, discussion, lecture/seminar, debate, telephonic conversation.		06
Unit-5	Listening Comprehension Media, audio, video, speeches and the likes.		06
Text Books			
Name of Authors	Titles of the Book	Edition	Name of the Publisher
Lesiker, Raymond. V and Maire E Hatley	Basic Business Communication		New York, Tata McGraw Hill
Hamplyons Liz & Ben Heasley	Study writing, Cambridge		Cambridge University Press
Beaumont Digty and Colin, Granger	English Grammar		An International reference practice book,London, Heinmann
Elison John,	The right word at the right time A guide to the English		The Reader's Digest

Name of the Course: Pharmaceutical Organic Chemistry- II (Theory & Practical)		
Course code: 3.2.1		Semester: II
Duration: Theory 45 hrs & Practical 90 hrs		Maximum Marks: 100
Teaching Scheme:		Examination Scheme
Theory: 03 hrs/week		Sessional Exam: 20 Marks
Tutorial: 01 hr /week		End Semester Exam: 80 Marks
Practical: 06 hrs/week		
Objective:-		
S.No		
1.	To provide advanced synthetic conversions of organic functional groups.	
2.	To facilitate the concept of stereochemistry in organic compounds with respect to molecules of biological importance like carbohydrates and amino acids along with their chemistry.	
3.	To expose the students towards heterocyclic compounds & their chemistry.	
Pre- Requisite:-		
1	Basics of Organic Chemistry, IUPAC and mechanisms	
Units	Contents	Hrs/week
Unit-1	Stereochemistry	4 hrs
	1. Racemic modification and resolution of racemic mixture, conformational isomers, asymmetric synthesis.	
	2. Stereo selective and stereo specific reactions. Stereochemical mechanisms for the following reaction such as addition of halogens to alkanes. Stereo chemistry of E1 and E2 reactions, <i>syn</i> and <i>anti</i> reaction and Nucleophilic substitution reactions.	4 hrs
	3. Stereochemistry of alicyclic compounds, biphenyls and oximes.	2 hrs.
	4. Chemistry of Biomolecules:	
Unit-2	Lipids: Definition, composition and reactions of oils and fats. Analysis of oils and fats. Composition of waxes.	2 hrs
Unit-3	Carbohydrates: Definition, classification, stereoisomers of monosaccharides, reactions of monosaccharides and interconversions. Monosaccharides: structure, configuration, ring structure and ring size of glucose. Structure and properties of fructose (ketose) Disaccharides: Structure and properties of sucrose, lactose and maltose. Polysaccharides: Composition of starch, cellulose and cellulose derivatives	6 hrs
Unit-4	Aminoacids and Proteins: Amino acids: Definition, classification, essential aminoacids. Synthesis and reactions of aminoacids. Proteins: Definition, classification, primary structure and synthesis of peptides, C-terminal and N-terminal amino acid determinations (CTAA	5 hrs

	and NTAA).	
Unit-5	Polymer chemistry: Introduction and Chemistry of biopolymers.	1 hrs
Unit-6	Specific synthetic applications of the following reagents: Preparation, storage and applications of: Grignard reagent, Lithium Aluminum Hydride (LAH), Lead Tetra Acetate (LTA), N-Bromosuccinimide (NBS), Selenium oxide, Sodium periodate, Perchloric acid, Phase transfer catalysts (PTC), Sodium borohydride, Palladium carbon catalyst (Pd/C),	9 hrs
Unit-7	Heterocyclic Chemistry: General classification of heterocyclic compounds, nature and nomenclature, reactions, synthesis and properties of the following heterocyclic systems and their derivatives a) Pyrrole, Furan and Thiophen b) Fused ring systems involving Pyrrole, Furan, Thiophen, Indole and Benzofuran Bezothiophene c) Pyridine d) Quinoline, Isoquinoline, Acridine e) Pyrazole, Imidazole, Oxazole and Isoxazole f) Pyrimidine, Pyrazine, Pyridazine, Purine, Quinoxaline	10 hrs
Unit-8	Polynuclear hydrocarbons: Synthesis (Haworth's and Diel's alder), properties and reactions of Naphthelene, Phenanthrene and Anthracene.	2 hrs
3.2.1	Pharmaceutical Organic Chemistry-II (Practicals)	90 Hours 6Hours/ week
I	Quantitative determination of organic compounds via functional groups(major experiments) 1. Phenolic groups by bromination method 2. Alcoholic group by acetylation method 3. Carbonyl group by hydroxyl amine hydrochloride-pyridine method 4. Aldehyde group by sodium sulphite-sulphuric acid procedure 5. Amino group by bromination method 6. Aminoacid by formal titration method 7. Equivalent weight of an acid by acid-base titration 8. Ester by hydrolysis	
II	Synthesis/ Preparations involving more than 1 step (minor experiments) recrystallization, MP/BP, chemicals test/s, derivative, its MP/BP and Characterization by TLC/ UV/IR 1. Benzilic acid from benzoin 2. p-Nitroaniline from acetanilide 3. p-Bromoaniline from acetanilide 4. Benzimidazole from <i>o</i> -phenylenediamine 5. Benzotriazole from <i>o</i> -phenylenediamine	

III	Demonstration to use 3D models 1. Methane 2. Ethane 3. DL-glyceraldehyde 4. Acetylene 5. cis-alkene 6. trans-alkene Inversion of configuration	
Text Books		
Name of the Book	Author	Publisher
Text Book of Organic Chemistry	T.R.Morrison and R.Boyd	Prentice Hall of India Pvt. Ltd., New Delhi.
Bentley and Driver's Text Book of Pharmaceutical Chemistry	L.M. Atherden	Prentice Hall of India Pvt. Ltd., New Delhi.
Organic Chemistry: The Fundamental Principles	I.L. Finar	Longman Publishers.
Fundamentals of Organic Chemistry	T.W.Graham Solomons	John Wiley & Sons Inc., USA.
Organic Chemistry	J.M.Catm and D.J.Carm	Saunders college of Publishing.
Advanced Organic Chemistry	Jerry and March	Wiley Eastern Limited, New Delhi.
Practical Organic Chemistry	Mann and Sounders	ELBS and Longman group Ltd.
Introduction to Organic Laboratory Techniques	D.L.Pavia, G.Lampman and G.D.Kriz.	ELBS and Longman group Ltd.
Text Book of Practical Organic Chemistry	A. I. Vogel	ELBS Longman, London.
Elementary Practical Organic Chemistry	A.I. Vogel	ELBS and Longman group Ltd., London.
Heterocyclic Chemistry	Raj K Bansal	New Age Publications.
Heterocyclic Chemistry	J A Joule & K mills	Backwell Science

Name of the Course: Pharmaceutics (Theory & Practical)		
Course code: 3.2.2	Semester: II	
Duration: Theory 45 hrs& Practical 90 hrs	Maximum Marks: 100	
Teaching Scheme:	Examination Scheme	
Theory: 03 hrs/week	Sessional Exam: 20 Marks	
Tutorial: 01 hr /week	End Semester Exam: 80 Marks	
Practical: 06 hrs/week		
Objective:-		
S.No		
1.	To provide the overview of Pharmacy discipline and Pharmaceutical industrial development.	
2.	To train students on dose calculations of some of the dosage forms.	
3.	To expose learner to the various dosage forms & formulation methodology.	
4.	To make learner know about the prescription format and reading of it.	
Pre- Requisite:-		
1	Basic knowledge about Physical Chemistry	
Units		
Units	Contents	Hrs/week
Unit-1	History of Pharmacy: Historical background, Development of Pharmacy profession, Pharmaceutical industry and Pharmaceutical Education in India in brief. Pharmacist Oath.	03 hrs
Unit-2	Development of Indian pharmacopoeia and introduction to other pharmacopoeia- B.P., U.S.P., European pharmacopoeia, Extra pharmacopoeia and National Formulary.	04 hrs
Unit-3	Introduction to dosage forms: a) Classification and definitions. b) Prescription: Definition, parts of prescription and prescription handling. c) Modern prescriptions. Posology: Definition, factors affecting dose selection, calculation of child and infant doses. Different types of weights and measures, calculation involving percentage of solutions, allegation method, proof spirit, isotonic solution (calculation based on depression of freezing point and sodium chloride equivalent method).	09 hrs
Unit-4	Introduction to different types of processes: Fusion, desiccation, sublimation, Exsiccation and Ignition and their applications.	02hrs
Unit-5	Galenicals: Definition, Equipments for different extraction processes: Expression, Infusion, Decoction, Maceration and Percolation. Method of preparation of Spirits, Tinctures and Extracts. Soxhlet extraction- Process including modifications.	06hrs
Unit-6	Powders and granules: Classification with examples, advantages and disadvantages. Preparation of dusting powders and effervescent granules.	04hrs
Unit-7	Incompatibility: Definition, types of incompatibility. Brief study on Physical and chemical incompatibilities for barbiturates, Herapath reaction	04hrs

	and Tannins.	
Unit-8	Biphasic dosage forms: i. Suspensions- Definition, classification, advantages and disadvantages. Diffusible and indiffusible suspensions, Classification of suspending agents ii. Emulsion: Definition, types of emulsions, identification tests, emulsifying agents, creaming and cracking of emulsions.	09 hrs
Unit-9	Suppositories and Pessaries: Definition, advantages and disadvantages, types of bases, method of preparation, displacement value, packing and storage.	04hrs
3.2.2		PHARMACEUTICS (PRACTICAL) 90 Hrs 06Hrs/ week
	Preparation, principle involved and labeling of the following;	
1	Syrups	Simple syrup IP Orange syrup IP** Syrup of Ephedrine HCl NF
2.	Elixirs, Linctus	Piperazine citrate elixir BP Simple linctus BPC Codeine phosphate linctus BPC
3.	Solutions	Aqueous Iodine solution IP Weak iodine solution Mandl's Throat paint** Cresol with soap solution IP** Strong solution of ammonium acetate**
4.	Liniments	Turpentine liniment IP** Benzyl benzoate application BP
5.	Gargles	Potassium chlorate gargle
6.	Mouthwash	Chlorhexidine antiseptic mouthwash
7.	Suspensions	Calamine lotion IP** Sulphur lotion Magnesium hydroxide mixture BP**
8.	Emulsion	Liquid paraffin emulsion IP** Castor oil emulsion** To identify emulsion by dye test
9.	Galenicals	Simple maceration
10.	Powders	Dusting powder Eutectic powder Effervescent granules**
11.	Incompatibility	Herapathite reaction**
12.	Suppositories	Boric acid suppositories** Zinc oxide suppository**
13.	Ointments	Sulphur ointment IP Non staining ointments**

Reference Books (Latest edition)			
S.No	Titles of the Book	Name of Authors	Name of the Publisher
01	Cooper and Gunn's Dispensing for Pharmaceutical Students	Carter S.J.	CBS Publishers, New Delhi.
02	Cooper and Gunn's Tutorial Pharmacy	Carter S.J.	CBS Publishers, New Delhi.
03	Pharmaceutics- The Science of Dosage Form Design	M.E.Aulton	Churchill Livingstone, Edinburgh.
04	Bentley's Text Book of Pharmaceutics	E.A.Rawlins	English language book Society.
05	Pharmaceutical Dosage Forms and Drug Delivery Systems	H. C. Ansel et.al.	Lippincott Williams and Wilkins, New Delhi.
06	Pharmaceutical Calculations	M.J. Stoklosa and H.C. Ansel	B I Waverley Pvt. Ltd., New Delhi.
07	Remington The Science and Practice of Pharmacy, Vol: I and II	Alfonso R. Gennaro	Lippincott Williams.
08	Theory & Practice of Professional Pharmacy	S. N. Sharma N.K. Jain.	VallabhPrakashan, Delhi.
09	Indian Pharmacopoeia –latest edition	Govt. of India	Published by The Controller of Publications, Delhi.
10	Martindale Extra Pharmacopoeia	--	Pharmaceutical Press, London.
11	British Pharmaceutical Codex		Pharmaceutical SocietyO Great Britan(PSGB)
12	Registered pharmacy	Cooper and Gunn	CBS Publishers, New Delhi

Name of the Course: Human Anatomy & Physiology-II (Theory & Practical)		
Course code: 3.2.3	Semester: II	
Duration: Theory 60 hrs & Practical 45 hrs	Maximum Marks: 100	
Teaching Scheme:	Examination Scheme	
Theory: 04 hrs/week	Sessional Exam: 20 Marks	
Tutorial: -- hr /week	End Semester Exam: 80 Marks	
Practical: 03 hrs/week		
Objective:-		
S.No		
1.	To impart fundamental knowledge on the structure and functions of the human body.	
2.	To understand homeostasis mechanisms and its relation with various body systems.	
3.	To develop the knowledge regarding various tissues and organs of different systems of human body.	
4.	The knowledge imparted should help the students to understand the pharmacology of drugs.	
Pre- Requisite:-		
1	Knowledge about human basic cell structure, tissues and muscular skeletal system is essential	
Units		
Units	Contents	Hrs/week
Unit-1	Cardiovascular System: Anatomy of the heart and blood vessels. Blood circulation. Conducting system of heart, cardiac cycle. Electrocardiogram and its significance. Blood pressure and its regulation. Cardiac output and its regulation. Significance of heart sounds.	15
Unit-2	Nervous System: Central nervous system: Structure of neuron, excitation and conduction of nerve impulse Anatomy of brain. Functions of cerebrum, cerebellum, thalamus, hypothalamus, midbrain, pons and medulla oblongata. Spinal cord and spinal nerves. Reflex action and reflex arc. Autonomic nervous system: Anatomy and functions of sympathetic and parasympathetic nervous system. Neurotransmitters and their receptors. Somatic nervous system	17
Unit-3	Endocrine system: Anatomy and physiology of pituitary, thyroid, parathyroid, adrenal, pancreas, thymus and gonads.	10
Unit-4	Urinary System:	09

	Components, structure and functions of the kidney. Physiology of urine formation, acid-base balance. Renin- angiotensin system, clearance tests and micturition.	
Unit-5	Reproductive System: Male and female reproductive systems and their hormones. Spermatogenesis and oogenesis. Sex differentiation Physiology of menstruation, coitus and fertilization. Pregnancy, its maintenance and parturition.	09
3.2.3	Human Anatomy and Physiology (Practicals)	45 Hrs 03 hrs/week
1	Study of compound microscope.	
2	Microscopic study of different tissues.	
3	Identification of bones.	
4	Study of different systems with the help of models.	
5	Haematology experiments- a. Determination of Red Blood Corpuscles (RBC) count. ** b. Determination of White Blood Corpuscles (WBC) count. ** c. Estimation of Hemoglobin content.* d. Determination of Differential Leukocyte Count (DLC). ** e. Determination of Erythrocyte Sedimentation Rate (ESR). f. Determination of Blood groups.* g. Determination of Bleeding & Clotting time.*	
6	To record human heart rate, pulse rate and blood pressure.	
7	Determination of tidal volume & vital capacity.	
8	Experiments related to special senses.	
9	Interpretation of graphical recordings of skeletal muscle preparation.	
10	Study of family planning devices.	

Text Books

Sl.No	Name of the Book	Author	Publisher
01	Ross and Wilson Anatomy and Physiology in Health and Illness	A. Waugh and A.Grant	Churchill Living Stone, Edinburgh.
02	Human Physiology (Vol. I & Vol. II)	C.C. Chatterjee	Medical Allied Agency, Calcutta.
03	Principles of Anatomy and Physiology	G. J. Toratora	John-Wiley & sons New York.
04	Concise Medical Physiology	S.K.Chaudhary.	New Cenrtal Book Agency, Calcutta.
05	Illustrated Physiology	AB Mc Naught & Callander R	B.I. Churchill Living Stone, New Delhi.
06	Text Book of Medical Physiology	A. C. Guyton and J.E. Hall	W.B. Saunders company.
07	Bailey`s Text Book of	Douglas E., Kelly,	Williams and Wilkins

	Microscopic Anatomy	Richard Wood and Allen C. Enders	publishers, London.
08	Human Anatomy and Physiology	E.N. Marieb	Addison Wesley, New York.
09	Text Book of Human Histology with Colour Atlas	Inderbir Singh	Jaypee Brothers, New Delhi.
10	A Practical Human Anatomy & Physiology	R. K. Goyal & N. M. Patil	B.S. Shah Prakashan, Ahmadabad.

Name of the Course: Pharmacognosy-I (Theory)		
Course code: 3.2.4	Semester:II	
Duration: Theory 60 hours	Maximum Marks: 100	
Teaching Scheme:	Examination Scheme	
Theory: 04 hrs/week	Sessional Exam: 20 Marks	
Tutorial: -- hr/week	End Semester Exam: 80 Marks	
Practical: -- hrs/week		
Objective:-		
S.No		
1.	To create awareness regarding importance of Pharmacognosy.	
2.	To provide the idea regarding cultivation, collection, standardization and storage of crude drugs.	
3.	To develop the knowledge base regarding source, active constituents and uses of crude drugs.	
4.	Understanding of performing chemical tests for identity and quality of natural products.	
Pre- Requisite:-		
1	Knowledge about botany at HSC level .	
Units	Contents	Hrs/week
Unit-1	Definition, History and Scope of Pharmacognosy.	2
Unit-2	Plant cell and ergastic cell constituents.	4
Unit-3	Sources of crude drugs (Plant, Animal & Mineral) with examples.	2
Unit-4	Classification of crude drugs. Alphabetical, Morphological, Taxonomical, Chemical, Pharmacological and Chemotaxonomical methods with examples.	6
Unit-5	General methods of cultivation, collection, processing and storage of crude drugs.	5
	Factors affecting the cultivation of medicinal plants.	2
	Pests and pest control- Study of natural pesticides Neem, Pyrethrum and Tobacco (with respect to their biological source and chemical constituents).	4
Unit-6	Definition, chemistry, classification and method of analysis of Proteins. Study of biological source, method of production, chemical constituents, chemical tests, uses, storage, adulterants and substitutes for following drugs: Gelatin, Collagen and their products.	4
Unit-7	Study of fibers used in surgical dressings. Study of biological source, morphology, chemical constituents, chemical tests and uses of following fibers:	4

	Cotton, Silk, Wool, Nylon, Asbestos	
Unit-8	Study of of secondary metabolites. Definition and pharmaceutical importance of Alkaloids, Glycosides, Resins, Tannins, Volatile oils and Carotenoids with examples.	7
Unit-9	Definition, chemistry and classification of lipids. a. Study of biological source, method of production, storage, chemical constituents, chemical tests, uses, adulterants and substitutes for following drugs: Bees wax, castor oil, cod liver oil, Hydnocarpus oil and wool fat. b. Evaluation of oils and fats – Acid value, saponification value, ester value, iodine value, peroxide value, acetyl value, hydroxyl value and their significance.	10
Unit-10	Carbohydrates- Definition, chemistry and classification. Study of biological source, method of production, chemical constituents, identification tests, uses, storage, adulterants and substitutes of following drugs: Agar, Acacia, Honey, Isabgol, Starch, Tragacanth, Cellulose and its products.	2 8

Text Books

Name of Authors	Titles of the Book	Edition	Name of the Publisher
Kokate C.K., Purohit A.P and Gokhale S.P	Text Book of Pharmacognosy	35 th	Nirali Prakashan, Pune
Trease and Evans,	Pharmacognosy	15 th	W.B.Saunders, New York
V.E., Tylor, L.R. Brady and S. B., Robbers	Pharmacognosy	9 th	K.M. Varghese Co. Bombay.
Wallis T.E.	Textbook of Pharmacognosy	4 th	CBS, Delhi
Iyengar M.A and Nayak S.G.K.	Anatomy of Crude Drugs	12 th	Manipal power press, Manipal.
Kokate C.K.	Practical Pharmacognosy	12 th	Vallabh Prakashan, Delhi.

Name of the Course: Constitution of India* (Theory)			
Course code: 3.2.5		Semester: II	
Duration: Theory 45 hrs		Maximum Marks: 100	
Teaching Scheme:		Examination Scheme	
Theory: 03 hrs/week		Sessional Exam: 20 Marks	
Tutorial: -- hr /week		End Semester Exam: 80 Marks	
Practical: -- hrs/week			
Objective:-			
S. No			
1.	To know the fundamental rights of the constitution		
2.			
Pre- Requisite:-			
1	School level knowledge about social science subject is essential		
Units	Contents	Hrs/week	
Unit-1	Historic background-Developments in England since 1946 and their impact on Indian independence.	02	
Unit-2	Territory and Citizenship.	02	
Unit-3	Fundamental Rights-Directive principles of State Policy and Fundamental Duties.	07	
Unit-4	Union Executive and State Executive-including formation of Council of Ministers etc.	06	
Unit-5	Union and state Legislature-Composition, duration and qualification of members.	06	
Unit-6	Devolution of Powers on the Local self Govts. Ic Panchayat Raj Institutions their composition etc.	04	
Unit-7	Judiciary	03	
Unit-8	Legislative relations	04	
Unit-9	Financial relations	03	
Unit-10	Emergency Powers.	02	
Unit-11	Public Service Commissions.	01	
Unit-12	Inter-state trade & Commerce, liability of Government and security of tenure of public servants.	03	
Unit-13	Election commission of India and amendment to the Constitution.	02	
Text Books			
Name of Authors	Titles of the Book	Edition	Name of the Publisher
V.Shukla	Constitution of India		

Name of the Course: Pharmaceutical Microbiology (Theory & Practical)		
Course code: 3.3.1	Semester: III	
Duration: Theory 45 hrs& Practical 90 hrs	Maximum Marks: 100	
Teaching Scheme:	Examination Scheme	
Theory: 03 hrs/week	Sessional Exam: 20 Marks	
Tutorial: 01 hr /week	End Semester Exam: 80 Marks	
Practical: 06 hrs/week		
Objective:-		
S.No		
1.	To make students understand the omnipresence of microorganisms.	
2.	To study different properties of some of the microorganisms.	
3.	To train students on various methods for growing bacteria.	
4.	To acquaint students with different techniques used for maintaining sterility.	
Pre- Requisite:-		
1	Knowledge about microorganism study at HSC level is essential.	
Units		
Units	Contents	Hrs/week
Unit-1	Historical background of microbiology: Contributions of various scientists for the development of microbiology: Louis Pasteur, Paul Erlich, Robert Koch, Alexander Flemming, Edward Jenner. Pharmaceutical applications of microbiology	02
Unit-2	General classification of micro-organisms: Morphological studies on bacteria and virus.	02
Unit-3	Identification of bacteria: A] Staining techniques- Simple, Gram's, Acid fast and Special staining (flagella and spore) technique. B] Biochemical tests of bacteria – Sugar fermentation test, Catalase test, Indole test and Voges Proskauer test.	05
Unit-4	Nutritional requirements, Growth and Cultivation of bacteria. Study on important culture media required for growth of aerobic, anaerobic bacteria and fungi. Types of culture media- basal, enriched, selective, transport, storage and indicator media. Factors affecting growth of micro-organisms.	04
Unit-5	Isolation and Maintenance of pure culture of bacteria.	02
Unit-6	Disinfectants: Definitions for disinfectants, antiseptics and preservatives. Classification and mode of action of disinfectants and preservatives. Factors influencing disinfection. Evaluation of disinfectants and preservatives.	06
Unit-7	Sterilization: Principles of sterilization, definitions of 'D' value, 'Z' value & thermal death time. Study on different methods of sterilization in detail viz Physical (Moist heat, dry heat, heating with bactericide,	11

	sterilization by radiation) chemical (Gaseous method – ethylene oxide) and mechanical method (sterilization by filtration) including Equipment employed in these sterilization techniques. Validation of sterilization method using sterility indicators.	
Unit-8	Test for sterility: Methods and media used. Sterility testing of pharmaceutical preparation.	02
Unit-9	Microbiological Assay: Assay of cephalixin and vitamin B12. General method of testing of antimicrobial activity of a new substance.	02
Unit-10	Immunology: Definition, types of immunity, structure of antigen and antibody. Immunoglobulin classes, antigen-antibody reactions. Diagnostic tests- Shick’s test, ELISA test, Widal test, Wassermann test (VDRL) and Mantoux test. Vaccines- Types of vaccines, preparation of different methods of cultivation of virus, Tetanus toxoid.	09
3.3.1	Pharmaceutical Microbiology (Practicals)	90 Hours 06 hrs/week
1	To demonstrate the omnipresence of microorganisms.	
2	To study the principle and working of microscope and other laboratory equipments.	
3	To study the principle and working of laminar airflow.	
4	To identify isolated bacteria by simple, negative, gram staining and spore staining. Study of Aspergillus and Penicillium with respect to morphology (Wet mount techniques.)	
5	To observe motility of bacteria by hanging drop techniques.	
6	To prepare and sterilize nutrient broth, nutrient agar, slants, stabs and plates.	
7	To study different techniques of Inoculation of culture on different types of media.	
8	To isolate pure culture by streak plate technique.	
9	To isolate pure culture by pour plate techniques.	
10	To study growth of Fungi on Sabroude’s agar and Czepodox agar medium.	
11	To determine microbial count of air by any suitable method.	
12	To determine thermal death temperature and time.	
13	To determine phenol coefficient of disinfectant by P.W. coefficient.	
14	To study sterility testing of following as per. I.P. : a) Water for injection. b) Ophthalmic preparations.	
15	To carry out antibiotic assays of penicillin & streptomycin or some suitable antibiotic.	
16	To determine MIC (Minimum Inhibitory concentration) of an antibacterial agent.	

Text Books			
Sl. No	Name of the Book	Author	Publisher
01	Microbiology	Michel. J. Pelczar, JR	Tata McGraw-Hill Publishing Company, Ltd.
02	Text Book of Microbiology	Ananthanarayan & C. K. T. Panikar.	Orient Longmann Pub.
03	Introduction to Microbiology	Tortora	Harper & Row, New York.
04	Dispensing for Pharmaceutical students	Cooper & Gunn	The Kothari Book, New Delhi.
05	Bentley & Drivers Text Book of Pharmaceutical Chemistry	Bentley	Oxford University Press, New York.
06	Tutorial Pharmacy	Cooper & Gunn	CBS Publishers Distributors
07	Practical Microbiology	Gaud P.S. Gupta MGD	NiraliPrakashan
08	Pharmaceutical Microbiology	Russell, A.D. Huga W.D	Blackwell Scientific Publications
09	Immunology in Plant Sciences Vol IV	Linskens H.F. Jacksons J.F	Springer Verlag, New York
10	Industrial Microbiology	Casida. L.E.	John Wiley-Sons, INC
11	A) Indian Pharmacopoeia B) British Pharmacopoeia C) U.S.P	Govt. of India British Pharmacopoeia U.S.P	The Indian Pharmacopoeia Commission The Stationary office United State Pharmacopoeia Convention, INC.

Name of the Course: Pharmacognosy-II(Theory & Practical)		
Course code: 3.3.2		Semester: III
Duration: Theory 45 hours & Practical 45hrs		Maximum Marks: 100
Teaching Scheme:		Examination Scheme
Theory:	03hrs/week	Sessional Exam: 20 Marks
Tutorial:	01hr /week	End Semester Exam: 80 Marks
Practical:	03 hrs/week	
Objective:-		
S.No		
1.	To study the generation of bio-drugs in plants as a result of metabolism.	
2.	To impart knowledge about important chemical classes of compounds having bioactivity.	
Pre- Requisite:-		
1	Knowledge about crude drugs, chemical test and collection and collection of medicinal plants	
Units		
Units	Contents	Hrs/week
Unit-1	Volatile Oils: Definition, chemistry, classification, properties and method of isolation of volatile oils Study of Biological source, morphology, chemical constituents, chemical tests, uses, adulterants and substitutes for following drugs: Coriander, Mentha, Cinnamon, Clove, Cardamom, Sandalwood,	7
Unit-2	Extraction of crude drugs	3
	a. Different methods of extraction: Maceration, Percolation, Soxhlet extraction and Supercritical fluid extraction, choice of the suitable solvent and suitable method of extraction.	4
	b. Preliminary phytochemical screening of natural compounds. c. General methods used for isolation and purification of phytoconstituents.	6
Unit-3	Definition, chemistry and classification of Resins. Study of biological source, morphology, chemical constituents, chemical tests, uses, adulterants and substitutes of following drugs: Ginger, Asafoetida, Cannabis, Capsicum, Benzoin	6
Unit-4	Definition, chemistry and classification of Tannins. Study of biological source, morphology, chemical constituents, chemical tests, uses, adulterants and substitutes for following drugs: Black Catechu, Pale Catechu, Myrobalan, Nutgall.	4
Unit-5	Definition, chemistry, classification, properties, method of isolation and analysis of Glycosides. Study of biological source, morphology, chemical constituents, chemical tests, uses, adulterants and substitutes for following drugs:	3
	i. Cardiac Glycosides: Digitalis, Squill, and Strophanthus	2

	ii. Saponin Glycosides: Liquorice, Ginseng, Dioscorea, iii. Anthraquinone Glycosides: Aloe, Senna, Rhubarb and Cascara. iv. Flavonoid Glycosides: Lemon peel v. Cyanogenetic Glycosides: Bitter almond. vi. Bitter Glycosides: Kalmegh, Gentian, Chirata, Quassia.	3 3 1 1 2
3.2.4	Pharmacognosy-II (Practicals)	45 Hours 03 hrs/week
1	Study of morphology of following drugs:* i. Leaf - Senna, Datura ii. Root - Rauwolfia, Liquorice iii. Fruit - Fennel, Coriander iv. Rhizome - Ginger, Podophyllum v. Bark - Cinchona, Cinnamon vi. Seed - Isabgol, Nux vomica vii. Flower bud - Clove viii. Stem - Ephedra	
2	Study of Transverse section for following drugs:** i. Datura leaf ii. Rauwolfia root iii. Coriander fruit iv. Ginger rhizome v. Cinchona bark vi. Nux vomica seed vii. Ephedra stem viii. Clove flower bud	
3	Systematic chemical analysis of drugs containing unorganized drugs* i. Agar ii. Acacia iii. Honey iv. Starch v. Tragacanth vi. Gelatin vii. Benzoin viii. Asafoetida ix. Black catechu and x. Pale catechu	
4	Analysis of oils and fats* i. Acid value ii. Saponification value iii. Ester value iv. Iodine value	

Text Books			
Name of Authors	Titles of the Book	Edition	Name of the Publisher
Kokate C.K., Purohit A.P and Gokhale S.P	Text Book of Pharmacognosy	35 th	Nirali Prakashan, Pune
Trease and Evans,	Pharmacognosy	15 th	W. B. Saunders, New York
V.E Tylor, L.R. Brady and S.B., Robbers	Pharmacognosy	9 th	K.M. Varghese Co. Bombay.
Wallis T.E.	Textbook Of Pharmacognosy	4 th	CBS, Delhi
Iyengar M.A and Nayak S.G.K.	Anatomy of Crude Drugs	12 th	Manipal power press, Manipal.
Kokate C.K.	Practical Pharmacognosy	12 th	Vallabh Prakashan, Delhi.
Harborne J.B.	Phytochemical Methods	3 rd	Chapman and Hall, International Edition, London.

Name of the Course: Pharmaceutical Analysis (Theory & Practical)		
Course code: 3.3.3	Semester:III	
Duration: Theory 45hrs & Practical 90 hrs	Maximum Marks: 100	
Teaching Scheme:	Examination Scheme	
Theory: 03 hrs/week	Sessional Exam: 20 Marks	
Tutorial: 01 hr /week	End Semester Exam: 80 Marks	
Practical: 06 hrs/week		
Objective:-		
S.No		
1.	To study the fundamentals of analytical techniques	
2.	To study the principles of titrimetry and chromatography	
3.		
Pre- Requisite:-		
1	Basic & preliminary knowledge of Inorganic chemistry is essential	
Units	Contents	Hrs/week
Unit-1	Introduction to pharmaceutical calculations and application of statistical analysis. a. Significance of statistical methods: determination of correlation coefficient, linear regression, standard deviation and relative standard deviation and analysis of co-variance. b. Arithmetic mean and geometric mean.	04hrs
Unit-2	Sources of errors, types of errors and methods of minimizing errors	02hrs
Unit-3	Analytical techniques: Weights and balances, Construction of calibration curves and application to linear regression.	02hrs
Unit-4	Titrimetric analysis: Theoretical considerations, scope and limitations.	04hrs
Unit-5	Nonaqueous titrations: a.Principle, solvents and indicators used. b.Examples of titration of Sodium benzoate and Ephedrine HCl c.Pharmaceutical applications and advantages.	04hrs
Unit-6	Redox titrations: a. Concepts of oxidation & reduction, Oxidising & Reducing agents. b. Theory of redox reactions (Viz. Half reaction, Redox potential, calculation of Redox potential, Nernst equation & Standard potential) c. Strength and equivalent weights of oxidizing and reducing agents d. Indicators in redox titrations e. Cerimetry, Iodometry, Iodimetry and Bromometry.	09hrs
Unit-7	Complexometric titrations: a. Basic principles: Complex formation, chelation, Werner's co-ordination number, stability of complexes, titrants and titration curves of complexometric analysis, including theories of complex ions, chelating agents, properties of metal complexes with particular reference to	07hrs

	disodium EDTA. Types of complexometric reactions. Methods of detecting end points and indicators employed. Pharmaceutical applications with suitable examples (Calcium gluconate, Magnesium sulphate).	
Unit-8	Chromatography: Introduction to chromatographic techniques, principle, instrumentation, applications of instruments in drug analysis of pharmacopoeial products. Thin layer chromatography (TLC) Paper chromatography Column chromatography High performance thin layer chromatography (HPTLC)	06hrs
Unit-9	Electrochemical analysis: Introduction, Dielectric cell, Electrode potential, Salt bridge, Standard potential, Reference and indicator electrodes. Measuring the relative voltage of cell. Principle, instrumentation and applications of a. Potentiometry b. Conductometry	07hrs
3.3.3	Pharmaceutical Analysis (Practical)	90 Hrs 06 hrs/week
1	Preparation & standardization of 0.1 N NaOH. (Acid base titration) * Preparation & standardization of 0.1 N H ₂ SO ₄ . (Acid base titration) * Determination of % purity of sodium benzoate. (Acid base titration) * Determination of aspirin content in tablets. (Acid base titration) ** Assay of the following compounds (2 exercises)** Ammonium chloride-acid base titration (Formal titration) Boric Acid	7x3=21
2	Non aqueous Titrations: Preparation and standardization of perchloric acid.* Assay of Sodium benzoate and Metronidazole tablets. **	2x6=12
3	Redox titrations: ** Preparation & standardization of oxalic acid using KMnO ₄ . (Redox titration) Determination of % purity of NaNO ₂ using KMnO ₄ . (Redox titration) Determination of % purity of ferrous fumarate/sulphate by cerimetry. (Redox titration) Preparation & standardization of I ₂ solution. (Redox titration) Determination of % purity of ascorbic acid by iodimetry. (Redox titration) Determination of % purity of CuSO ₄ by iodometry. (Redox titration) Determination of % purity of chlorinated lime by iodometry.	9x3=27

	(Redox titration) Preparation & standardization of silver nitrate solution (Argentometric titration.) Determination of % purity of sodium chloride (Argentometric titration).	
4	Potentiometric titration of Strong acid Vs Strong base using pH meter or Potentiometer. eg. HCl Vs NaOH.**	1x6=6
5	Complexometric titration** Preparation & standardization of EDTA solution. (Complexometric titration) Determination of % purity of calcium gluconate injection. (Complexometric titration)	2x3=6
6	Chromatographic Analysis*: a. Separation and Identification of amino acids by paper chromatography. b. Alkaloids by thin layer chromatography.	2x6=12
7	Demonstration of water estimation by KF-titration.	1x6=6

Text Books

Name of Authors	Titles of the Book	Edition	Name of the Publisher
V. Alexeyev	Quantitative analysis	1 st edition 1994.	Mir Publishers, Moscow
Kenneth A. Connors	A Text Book of Pharmaceutical Analysis	3 rd edition, 1982.	John Wiley and sons
John H. Kennedy	Principles of Analytical Chemistry	2 nd edition, 1990.	Saunders College Publishing N. Y.
John Dean	Analytical Chemistry Handbook	1 st edition, 1995	Mc Graw Hill Inc. N.Y
Skoog, West and Holler	Introduction to Analytical Chemistry	7 th edition. 1996.	Saunders College Publishing,
R. M. Verra	Analytical Chemistry	2 nd edition, 1991.	CBS Publishers
Bently and Driver	T.B. of Pharmaceutical chemistry	8 th edition, 1994.	Oxford University Press Bombay
T. Higuchi	Pharmaceutical Analysis	1 st edition, 1973	CBS Publishers, New Delhi,
A. H. Beckett and J. B. Stenlake	Practical Pharmaceutical Chemistry, Part – I	4 th edition	CBS Publications, New Delhi,
B. H. Jeffery and R. C. Denny,	Vogel's Text book of Quantitative Chemical Analysis	6 th edition,	Pearson Education, Delhi.
	Indian Pharmacopoeia	1996.	Controller of Publications, Delhi

Name of the Course: Physical Pharmaceutics-I (Theory)		
Course code: 3.3.4	Semester: III	
Duration: Theory 60 hrs	Maximum Marks: 100	
Teaching Scheme:	Examination Scheme	
Theory: 04 hrs/week	Sessional Exam: 20 Marks	
Tutorial: -- hr /week	End Semester Exam: 80 Marks	
Practical: -- hrs/week		
Objective:-		
S.No		
1.	To know the chemical nature and physical properties of the drug molecules.	
2.	To develop the concepts of applying knowledge of physicochemical properties of material in development of stable and effective dosage form.	
Pre- Requisite:-		
S.No		
1.	Basic knowledge about physical chemistry is essential	
Units	Contents	Hrs/week
Unit-1	Physical properties of drug molecules: Refractive index, optical rotation, dielectric constant, dipole moment, dissociation constant, determination and applications.	08
Unit-2	pH, buffers and isotonic solutions: Sorensen's pH scale, determinations (electrometric and calorimetric), applications, buffer equation, buffer capacity, buffers in pharmaceutical systems, preparation, stability, buffered isotonic solutions.	10
Unit-3	Solubility phenomena: Solvent-solute interactions, solubility of gas in liquids, solubility of liquids in liquids (binary solutions, ideal solutions, Raoult's law, real solutions, distillation of binary mixtures, azeotropic mixtures and fractional distillation). Partially miscible liquids (conjugate mixtures), Critical solution temperatures, applications, phenol-water system, triethylamine-water system, nicotine-water system. Solubility of solids in liquids: Definitions, determinations, factors influencing the solubility.	12
Unit-4	Distribution law: Explanation, limitations and applications, effect of molecular association, dissociation and complexation.	08
Unit-5	Kinetics and Drug Stability: Rate and molecularity of a reaction, determination of order, factors influencing rate of reactions, half-life determination, Accelerated stability study, Shelf life.	12
Unit-6	Surface and Interfacial Phenomenon: Liquid interface, surface and interfacial tensions, surface free energy, measurement of surface and interfacial tensions, spreading coefficient, adsorption at liquid interfaces, surface active agents, HLB value and scale, classification of surfactants, solubilization and detergency. Adsorption at solid interfaces: solid-gas and solid-liquid interfaces, adsorption isotherms, Gibb's adsorption	10

	equation, complex films, electrical properties.		
Text Books			
Sl.No.	Name of the Book	Author	Publisher
01	Physical Pharmacy	Alfred Martin, P. Bustamante, A.H.C. Chun.	B.I. Waverly, Pvt. Ltd., New Delhi.
02	Bentley's Text Book of Pharmaceutics	E.A. Rawlins.	English language book society.
03	Cooper and Gunn, Tutorial Pharmacy	Carter S.J.	CBS Publishers, New Delhi.
04	Remington: The Science and Practice of Pharmacy. Vol. I and II	Alfonso R Gennaro.	Lippincott Williams and Wilkins, Philadelphia, USA.
05	Physical Pharmaceutics	C.V.S.Subramanyam.	VallabhPrakashan, New Delhi.

Name of the Course: Computer Science* (Theory & Practical)		
Course code: 3.3.5	Semester: III	
Duration: Theory 45 hours & Practical 45hrs	Maximum Marks: 100	
Teaching Scheme:	Examination Scheme	
Theory: 03 hrs/week	Sessional Exam: 20 Marks	
Tutorial: -- hr /week	End Semester Exam: 80 Marks	
Practical: 02 hrs/week		
Objective:-		
S.No		
1.	To train students in use of different software.	
2.	To train students in drawing chemical structures using appropriate method.	
3.	To impart training on use of internet & its advantages.	
4.	To give training in preparation of seminar / presentation material in power point.	
Pre- Requisite:- Nil-		
Units	Contents	Hrs/week
Unit-1	Introduction Introduction to computers- introduction to I/O devices, binary conversion computer classification. Application of computers in pharmacy.	02
Unit-2	Languages Common languages in computers. Types of languages elementary programming in BASIC language, algorithm flow chart, solution of problems based on biostatistics and other simple problems of pharmaceutical interest.	05
Unit-3	MS Word Typing of text with stress on the following features: typing of text with different fonts and different sizes, indentation, superscripts, subscript, Greek terms such as alpha, betas etc., spell checking, use of thesaurus, cut paste and other features of edit. Preparation of tables for practical of pharmaceutical chemistry, pharmaceutical technology, pharmacology and / or pharmacognosy.	05
Unit-4	MS Excel Calculation in EXCEL. Preparation of templates for application in pharmaceutical chemistry, pharmaceutical technology, pharmacology and Pharmacognosy for example statistical treatment of data for Beer Lambert's curve, solution of problems based on physical chemistry, pharmaceutical engineering, stability study, area under the curve, bio-assay, bioequivalence study, extraction, Rfvalue and other elementary problems of pharmaceutical importance. Special attention must be given to arithmetic expression. Hierarchy of operations, library functions such as logarithm, square root, standard deviation, sum average, t-test, ANOVA etc. Drawing graphs in	10

	EXCEL – line graph, histogram, pie chart. At least one graph for each discipline of chemistry, pharmaceutical technology, pharmacology and pharmacognosy. Editing chart features such as annotation, labeling of axis, changing legends etc.	
Unit-5	MS PowerPoint Typing of text with stress on the following features: Typing of text with different fonts and different sizes, indentation, superscripts, subscript, Greek terms such as alpha, betas etc., spell checking, use of thesaurus, cut paste and other features of edit. Preparation of power point presentation & use of multimedia techniques for advance level presentation. Preparation of tables for practical of pharmaceutical chemistry, pharmaceutical technology, pharmacology and / or pharmacognosy.	08
Unit-6	E -mail and internet Introduction to E-mail and internet demonstration of sites of pharmaceutical interests such as http://www.fda.gov , http://www.phyarmpro.com , http://www.pharmacy.org , www.pubmed.com , etc. Search engines. Introduction to sites for patent search and literature search.	08
Unit-7	ISIS	03
Unit-8	RASMOL	02
Unit-9	CHEMSKETCH	02
3.3.5	Computer Science (Practicals)	45 Hours 03 hrs/ week
1.	MS DOS, Unix, MS-office commands.	
2.	Study of software package: MS-OFFICE.	
3.	Study of simple C programmes as follows: <ul style="list-style-type: none"> ▪ Get a character and display the same using get char () and put char (). ▪ Printing the reverse of an integer. ▪ Printing the odd and even series of N numbers. ▪ Get a string and convert the lowercase to uppercase and vice-versa using get char () and put char (). ▪ Finding the occurrence of a particular character in a string. ▪ Accept N words and make it as a sentence by inserting blank spaces and a full stop at the end. ▪ Finding the first N terms of Fibonacci sequence. ▪ Printing and multiplication tables of 2 matrices. ▪ Printing and subtraction of two matrices. Converting a hexadecimal number into its binary equivalent.	

Text Books	
Sl.No	Reference Books
01	V.Rajaraman and H.V.Sahasraboudhe, Computer programming in Cobol.
02	C Programming: A Modern Approach by K N King's, W. W. Norton & C
03	The c programming language by Brian W. Kernighan and Dennis M. Ritchie, Prentice Hall.
04	Thinking in C By Bruce Eckel , Prentice Hall
05	Absolute Beginner's Guide to Computer Basics by Michael Miller, Que.
06	Introduction to Biostatistics and Computer Science by Sahaik V. I., Paradkhar A.R. and Dhavagude G., Nirali Publication.
07	NIIT Computer Books by National Institute of Information Technology.
08	Microsoft Office For Windows, MS Office, Tata McGraw Hill

Name of the Course: Physical Pharmaceutics-II (Theory & Practical)		
Course code: 3.4.1	Semester: IV	
Duration: Theory 45 hrs& Practical 90 hrs	Maximum Marks: 100	
Teaching Scheme:	Examination Scheme	
Theory: 03 hrs/week	Sessional Exam: 20 Marks	
Tutorial: 01 hr /week	End Semester Exam: 80 Marks	
Practical: 06 hrs/week		
Objective:-		
S.No		
1.	To know the chemical nature and physical properties of the drug molecules.	
2.	To develop the concepts of applying knowledge of physicochemical properties of material in development of stable and effective dosage form.	
Pre- Requisite:-		
S.No		
1.	Knowledge of basic principles of Physical Pharmaceutics are essential	
Units	Contents	Hrs/week
Unit-1	Micromeretics: Particle size and distribution, average particle size, number and weight distribution. Methods for determining particle size, derived properties of powders- porosity, packing arrangement, densities, bulkiness and flow properties.	08
Unit-2	Viscosity and Rheology: Newtonian systems, Law of flow, kinematic viscosity, effect of temperature, Non-Newtonian systems, pseudoplastic, dilatant and plastic flow. Thixotropy in formulation, determination of viscosity by capillary flow, falling ball and rotational viscometers.	08
Unit-3	Coarse dispersions: i. Suspensions: Interfacial properties of suspended particles, theory of sedimentation, effect of Brownian movement, wetting of particles, controlled flocculation, flocculation in structured vehicles and rheological considerations. ii. Emulsions: Theories of emulsification, physical stability and rheological considerations.	08
Unit-4	Colloids: Definition, types, preparation, purification, stabilization of colloids, optical properties, kinetic properties, electrical properties and applications of colloids in pharmacy.	07
Unit-5	Complexation: Classification of complexes, methods of preparation, analysis and applications.	06
Unit-6	Diffusion and dissolution: steady state diffusion, types of diffusion, diffusion equation, diffusion cells, dissolution of tablets and capsules, Hixon-crowell cube root equation, dissolution apparatus, factors affecting dissolution.	08

3.4.1	Physical Pharmaceutics-II (Practicals)	90 Hours 06 hrs/ week
1	Determination of partition coefficient of iodine between water and carbon tetrachloride. **	
2.	Determination of partition coefficient of benzoic acid between benzene and water. **	
3.	Determination of rate constant for first order reactions. ** Determination of rate constant for second order reactions. **	02 No's
4.	Determination of HLB value of a surfactant. ** [Tweens/ Spans]	02 No's
5.	Determination of particle size by optical microscopy. **	
6.	Determination of density and porosity of powder.	
7.	Determination of compressibility Index and angle of repose of powder/ granules	
8.	Determination of Surface Tension of liquids by Stalagmometer	02 No's
9.	Determination of viscosity of liquids using Ostwald's viscometer.	02 No's
10.	Preparation of deflocculated and flocculated suspensions and their evaluation. **	
11.	Preparation and stability studies of emulsions. **	
12.	Preparation and evaluation of hydrophobic colloids. **	
13.	Determination of stability constant of Glycine-Copper complex by pH titration method. **	

References (Text Books)

Sl.No.	Name of the Book	Author	Publisher
01	Physical Pharmacy	Alfred Martin, P. Bustamante, A.H.C. Chun.	B.I. Waverly, Pvt. Ltd., New Delhi.
02	Bentley's Text Book of Pharmaceutics	E.A. Rawlins.	English language book society.
03	Cooper and Gunn, Tutorial Pharmacy	Carter S.J.	CBS Publishers, New Delhi.
04	Remington: The Science and Practice of Pharmacy. Vol. I and II.	Alfonso R Gennaro	Lippincott Williams and Wilkins, Philadelphia, USA.
05	Physical Pharmaceutics	C.V.S. Subramanyam	VallabhPrakashan, New Delhi.
06	Physical Pharmaceutics	E. Shotton and K. Ridgway	Clarendon Press, Oxford.

	<ul style="list-style-type: none"> ➤ Uronic acid pathway <p>b. Lipids:</p> <ul style="list-style-type: none"> ➤ Biosynthesis of saturated and unsaturated fatty acids. ➤ Oxidation of fatty acids – Saturated & Unsaturated. ➤ Biosynthesis of ketone bodies and their utilization. ➤ Cholesterol ➤ Phospholipids and sphingolipids ➤ Thromboxanes and leukotrienes 	07
Unit-6	<p>Amino acids:</p> <ul style="list-style-type: none"> ➤ Biosynthesis, Overview of amino acid metabolism ➤ Catabolism of amino acid. ➤ Urea cycle ➤ Aromatic and sulphur containing amino acids. ➤ Conversion of amino acids to specialized products: Creatine, Creatinine, Histamine, Dopamine, Noradrenaline, Adrenaline, 5-HT. ➤ Porphyrin biosynthesis, formation of bile pigments and hyperbilirubinemia. 	08
Unit-7	<p>Nucleic acids and Nucleotides:</p> <ul style="list-style-type: none"> ➤ Purine and Pyrimidine biosynthesis. ➤ Catabolism of Nucleotides ➤ Biosynthesis of DNA and its replication. ➤ DNA repair ➤ Biosynthesis of RNA <p>Genetic code and Protein biosynthesis</p>	08
Unit-8	<p>Diagnostic biochemistry: Lipid profile, liver and kidney function tests and biomarkers.</p>	02
	Applied Biochemistry (Practicals)	45 Hours 03 hrs/week
	Major Experiments:	
1	Preparation of standard buffers (citrate, phosphate and carbonate) and measurement of pH.	
2	Titration curve for amino acids.	
3	Separation of amino acids by two dimensional paper chromatography.	
4	The separation of carbohydrates /lipids by TLC.	
5	Estimation of Glucose in Urine by benedict's quantitative reagent (BQR).	
6	Estimation of Glucose in Blood.	
7	Estimation of reducing sugar by DNSA reagent method.	
8	Estimation of Cholesterol by Zaks method.	
9	Estimation of Creatinine.	
10	Estimation of SGPT and SGOT.	
11	Estimation of enzyme: salivary amylase.	
12	Polymerase chain reaction (PCR) / estimation of DNA/ RNA.	

Minor Experiments:		
13	Identification of Carbohydrates (Glucose, Lactose, Fructose, Maltose, Sucrose, Starch).	
14	Identification of Proteins (Albumin, Casein, Gelatin, Peptone).	
15	Qualitative analysis of normal and abnormal urine constituents.	
Text Books		
Name of the Book	Author	Publisher
Biochemistry	John L Tymoczko, Jeremy M, Berg, Lubert Stryer, Freeman and Co	Kalyani Publisher.
Harper's Biochemistry	Daryl K Granner, Peter A. Mayes, Victor W. Rodwell, Robert K Murray, Appleton and Lange L.M. Atherden	Prentice-Hill International Inc.
Biochemistry and Molecular Biology	William H Elliott and Daphne C. Elliot,	Oxford University Press
Biochemistry	Albert. L. Lehninger	Kalyani Publisher. New Delhi
Biochemistry (Basic and Applied)	R.A. Fursule, Dr J.S. Kulkarni, Mrs. O.H. Agarkar.	Nirali Prakashan. Pune
Fundamentals of Biochemistry	Dr A.C. Deb	. New Central Book Agency Ltd
Biochemistry	U Satyanarayana and U. Chakrapani.	Allied (p) Ltd New Delhi
Text Book of Biochemistry	Dr O.P. Agarwal.	Goel Publishing House. New Delhi
Biochemistry	Pankaja Naik	Jaypee Brothers
General Biochemistry	J.H. Well	New age International New Delhi
Biochemistry	John L Tymoczko, Jeremy M, Berg, Lubert Stryer, Freeman and Co	Kalyani Publisher.

Name of the Course: Pharmaceutical Engineering (Theory & Practical)		
Course code: 3.4.3	Semester: IV	
Duration: Theory 45 hrs & Practical 90 hrs	Maximum Marks: 100	
Teaching Scheme:	Examination Scheme	
Theory: 03 hrs/week	Sessional Exam: 20 Marks	
Tutorial: 01 hr /week	End Semester Exam: 80 Marks	
Practical: 06 hrs/week		
Objective:-		
S.No		
1.	To create awareness regarding the unit operations involved in Pharmaceutical industry.	
2.	To provide overview of Pharmaceutical machineries.	
3.	To enable students in selecting proper equipment for material processing in Pharma. Industry	
4.	To educate learners about hazards and safety aspects in industrial environment.	
Pre- Requisite:-		
1	Basic knowledge of pharmaceutics is essential	
Units	Contents	Hrs/week
Unit-1	Filtration and Centrifugation: Theory of filtration and Kozeny's equation, classification of industrial filters, Construction and working of filter press, filter leaf, meta filter, candle filter. Filter aids. Theory and principle of centrifugation, classification of industrial centrifuges. Construction working -Centrifuges, - basket, tubular bowl, conical disc, semi continuous and continuous horizontal centrifuges.	07 Hrs
Unit-2	Size reduction: Definition, objectives of size reduction, factors affecting size reduction, laws governing energy and power requirements of a mill, types of mills, construction and working of ball mill, hammer mill, fluid energy mill, Edge runner and end runner mill. Size separation: Different techniques of size separation- sieves, sieve shakers, sedimentation tanks, Mechanical classifiers, Cyclone separators, Air separators, Bag Filter.	08 Hrs
Unit-3	Mixing: Theory of mixing, solid-solid, solid-liquid and liquid – liquid mixing. Equipments-tumbler mixer, V-cone, double cone, ribbon blenders, Sigma blade, planetary and zigzag mixers. Mixing devices, - Propeller, turbine, paddle mixers. Vortex formation and prevention. Homogenization and homogenizers.	06 Hrs
Unit-4	Drying: Moisture content and mechanism of drying, factors affecting drying. Classification and types of dryers, dryers used in pharmaceutical industries. Construction and working of tray dryer, fluidized bed dryer, drum dryer, vacuum Dryer, Freeze dryer and Spray dryer.	06 Hrs
Unit-5	Evaporation: Basic concept of phase equilibria, factors affecting	05 Hrs

	evaporation. Classification, construction and working of film evaporator, single effect and multiple effect evaporators, theory and economy.		
Unit-6	Crystallization: Crystal habits, solubility curves, Mier's supersaturation theory, construction and working of agitated batch crystalliser, Swenson-walker, Krystal and Vaccumcrystallisers. Caking of crystals.	05 Hrs	
Unit-7	Refrigeration and Air Conditioning, Dehumidification and Humidity Control: Principle and applications of refrigeration and air conditioning. Basic concepts and definition, wet bulb and adiabatic saturation temperatures. Psychrometric chart and measurement of humidity, application of humidity and measurement. Equipments for dehumidification operations.	05 Hrs	
Unit-8	Plant Location and layout: Lay out facilities, utilities and services, industrial hazards- chemical, mechanical and fire hazards and safety measures.	03 Hrs	
3.4.3	Pharmaceutical Engineering (Practicals)	90 Hours 06 hrs/week	
1	Determination of rate of drying curves, free moisture content and bound moisture content **		
2.	Evaporation: Factors affecting rate of evaporation*		
3.	Method of Crystallization by – a) salting out b) temperature change c) non-solvent addition and study of Crystal habit*		
4.	Experiment based on steam distillations*		
5.	Operation of Ball mill **		
6.	Rate of Filtration studies *		
7.	Particle size determination by sieve analysis **		
8	Determination of mixing index by bottle method for a solid mixture **		
9.	Determination of mixing index by blenders for a solid mixture **		
10.	Determination of Solid liquid mixing efficiency *		
11.	Determination of Liquidliquid mixing efficiency *		
Text Books			
Sl.No.	Name of the Book	Author	Publisher
01	Cooper and Gunn's Tutorial Pharmacy	Carter S.J.	CBS Publishers, New Delhi.
02	Bentley's Text Book of Pharmaceutics	E.A. Rawlins	English language book Society.
03	Introduction to Chemical Engineering	Walter. L. Badger and Julius T. Banchemo.	McGraw Hill Series.
04	Elementary Chemical Engineering	Max Peters	McGraw Hill International Book Company.

05	Chemical Engineer's Handbook	Don. W. Green and James. O. Maloney, Perry's	McGraw Hill Book Company.
06	Chemical Engineering, Vol I.	J. M. Coulson and J. F. Richardson.	Pergemon Press.
07	Introduction to Pharmaceutical Engineering.	A.R. Paradkar.	NiraliPrakashan, Pune.
08	Text Book of Engineering.	Sambamurthy	New age International (P) Ltd., New Delhi.
09	Pharmaceutical Engineering Principles and Practices	Subramanyam and Kusumdevi	VallabhPrakashan, New Delhi.

Name of the Course: Pathophysiology (Theory)		
Course code: 3.4.4		Semester: IV
Duration: Theory 60 hrs		Maximum Marks: 100
Teaching Scheme:		Examination Scheme
Theory: 04 hrs/week		Sessional Exam: 20 Marks
Tutorial: -- hr /week		End Semester Exam: 80 Marks
Practical: -- hrs/week		
Objective:-		
S.No		
1.	To impart a thorough knowledge of pathological aspects of various conditions.	
2.	To generate the ability to describe etiology and pathogenesis of important disease states.	
3.	To develop the ability of naming the sign and symptoms of diseases.	
4.	To develop the ability to describe complications of diseases.	
Pre- Requisite:-		
1	Basic knowledge of human physiology and disease conditions is essential	
Units	Contents	Hrs/week
Unit-1	Cell Injury and Adaptation: Definition, etiology and pathogenesis of ischemic, hypoxic, chemical and free radical mediated cell injury. Immune mechanism of cell injury. Types of hypersensitivity reactions. Cellular adaptations: Atrophy, Hypertrophy, Hyperplasia, Anaplasia and Metaplasia.	10
Unit-2	Inflammation: Definition, types and chemical mediators of inflammation. Vascular and cellular events during acute inflammation and its outcome. Chronic inflammatory cells and granulomatous inflammation. Systemic effects of inflammation. Brief outline of repair and factors influencing wound healing.	7
Unit-3	Etiology, pathogenesis, signs and symptoms of Rheumatoid arthritis, Myasthenia gravis, Epilepsy, Parkinsonism, Alzheimer's disease, Bipolar disorders and Schizophrenia, Glaucoma, Stroke, Shock, Atherosclerosis, Essential hypertension, Angina pectoris, Congestive heart failure, Myocardial infarction, Diabetes mellitus, Gastric ulceration, Crohn's disease, Ulcerative colitis, Viral hepatitis, Renal failure, COPD, Tuberculosis, Leprosy, AIDS, H1N1, Dengue and Chikungunya.	32
Unit-4	Neoplasia: Nomenclature and characteristic features of neoplasm. Epidemiology of cancer, metastasis. Types of carcinogens and mechanism of chemical, radiation and viral carcinogenesis.	6
Unit-5	Environmental and nutritional disorders: Air pollution and its consequences. Consequences of tobacco smoke and obesity. Injury due to acute and chronic exposure to radiation. PEM and Vitamin deficiencies.	5

Text Books			
Sl.No	Name of the Book	Author	Publisher
01	Basic Pathology	Kumar, Cotran and Robbins	M/s WB Saunders company
02	Text Book of Pathology	Harsh Mohan	M/s Jaypee Brothers Medical publishers.
03	Essential of Pathophysiology for Pharmacy	Martin M Zdanowicz	CRC Press, USA
04	Pharmacotherapy: A Pathophysiological Approach	Dipiro J.L.	Elsevier.
05	Essential Pathology	Emanuel Rubin, John L., Farber J.B.	Lipponcott Williams & Wilkins, Philadelphia.

Name of the Course: Pharmacognosy & Phytochemistry (Theory)		
Course code: 3.4.5	Semester: IV	
Duration: Theory 60 hrs	Maximum Marks: 100	
Teaching Scheme:	Examination Scheme	
Theory: 04 hrs/week	Sessional Exam: 20 Marks	
Tutorial: -- hr /week	End Semester Exam: 80 Marks	
Practical: -- hrs/week		
Objective:-		
S.No		
1.	To study the generation of biodrugs in plants as a result of metabolism.	
2.	To impart knowledge about important chemical classes of compounds having bioactivity.	
Pre- Requisite:-		
1	Basic knowledge of Pharmacognosy, extraction process is essential	
Units	Contents	Hrs/week
Unit-1	Study of Plant biosynthesis a. Techniques of elucidation of biosynthetic pathway b. Basic biosynthetic pathways Shikimic acid pathway, Isoprenoid pathway. c. Detailed study of biosynthesis of Glycosides – Steroidal, Anthraquinone Alkaloids – Tropane, Quinoline and Indole	4 5 6
Unit-2	Marine Pharmacognosy- Definition, present status and classification of important bioactive agents including their chemistry and uses.	6
Unit-3	Definition, chemistry, classification and properties of alkaloids. Method of isolation of total alkaloids. Study of biological source, morphology, chemical constituents, chemical tests, uses, adulterants and substitutes for following drugs: i. Pyridine - Piperidine: Areca nut, Lobelia. ii. Tropane: Belladonna, Hyoscyamus, Datura, Duboisia. iii. Quinoline and Isoquinoline : Cinchona, Ipecac, Opium. iv. Indole : Ergot, Rauwolfia, Catharanthus, Nux-vomica. v. Imidazole: Pilocarpus. vi. Steroidal: Ashwagandha, Veratrum and Kurchi. vii. Alkaloidal amine: Ephedra and Colchicum. viii. Glycoalkaloid: Solanum sp ix. Purines: Tea, Coffee.	5 3 3 3 3 2 2 2 3 3
Unit-4	Chromatographic methods used in identification of phytoconstituents	6

Text Books			
Name of Authors	Titles of the Book	Edition	Name of the Publisher
Kokate C.K., Purohit A.P and Gokhale S.P	Text Book of Pharmacognosy	35 th	Nirali Prakashan, Pune
Trease and Evans,	Pharmacognosy	15 th	W.B.Saunders, New York
V.E., Tylor, L.R. Brady and S.B., Robbers	Pharmacognosy	9 th	K.M. Varghese Co. Bombay.
Wallis T.E.	Textbook Of Pharmacognosy	4 th	CBS, Delhi
Iyengar M.A and Nayak S.G.K	Anatomy of Crude Drugs.	12 th	Manipal power press, Manipal.
Kokate C.K.	Practical Pharmacognosy	12 th	Vallabh Prakashan, Delhi.
Harborne J.B.	Phytochemical Methods	.3 rd	Chapman and Hall, International Edition, London

Name of the Course: Hospital & Community Pharmacy (Theory & Practical)		
Course code: 3.5.1	Semester: V	
Duration: Theory 45 hrs & Practical 90 hrs	Maximum Marks: 100	
Teaching Scheme:	Examination Scheme	
Theory: 03 hrs/week	Sessional Exam: 20 Marks	
Tutorial: 01 hr/week	End Semester Exam: 80 Marks	
Practical: 06 hrs/week		
Objective:-		
S.No		
1.	To study the role and organization of hospital pharmacy	
2.	To study the role of the community pharmacy and its functionary to the patients	
3.	To make students aware about the pharmacoconomics & Pharmacoepidemiology	
Pre- Requisite:-		
S.No		
1.	Students should be aware about the knowledge about medicines and its chemistry and pharmacology	
Units		
	Contents	Hours
Unit-1	The role of Hospital Pharmacy department and its relationship to other hospital department and staff.	2
Unit-2	Hospital Drug Policy: - Drug Committee Formulary and guidelines, other hospital committee such as Infection control committee and Research and Ethics committee.	4
Unit-3	Hospital Pharmacy Management: - Staff (professional and non professional), Materials (drugs, non drugs, consumables), Financial (drug budget, cost, centers, sources of revenue, revenue collection). Policy and planning, Infrastructure requirement for inpatient, outpatient, Casualty/Emergency, Operation theatres, ICU/CCU.	6
Unit-4	Organization of hospital pharmacy service Drug distribution ➤ Purchasing, Warehousing (storage conditions, expiry date control, recycling of drugs, stocking, drug recalls), Drug distribution methods (ward stock, individual patient dispensing, unit dose), Specific requirements for inpatient, Casualty/Emergency, operation Theaters, ICC/CCU. Drugs of dependence, Hospital waste management.	6
Unit-5	Manufacturing:- Sterile and non-sterile production, including total parenteral nutrition, Cytotoxics, Radiopharmaceuticals, IV additive service, Prepackaging, labeling and Quality control.	4
Unit-6	The role of the community pharmacy and its relationship to other local healthcare providers.	2
Unit-7	Prescribed medication order-interpretation and legal requirements.	2

	Communication skills-communication with prescribers and patient.	
Unit-8	Over-the-counter (OTC) sales Rational use of common OTC medications (Vitamins and tonics, iron preparations, Analgesics, NSAIDs, Cough mixtures, anti-diarrhoeal preparations)	3
Unit-9	Primary health care in community pharmacy Family Planning, First aid, Participation in primary health programs, Smoking Cessation, Screening Programs	2
Unit-10	Services to nursing homes/clinics	2
Unit-11	Community pharmacy management Financial, materials, staff, infrastructure, requirements, drug information resources. Computers.	6
Unit-12	Code of ethics for community pharmacists.	2
Unit-13	Pharmacoepidemiology Definition, types and applications.	2
Unit-14	Pharmacoeconomics Definition, models and applications.	3
3.5.1	Hospital and community Pharmacy (Practicals)	45 hours 03 hrs/week
1	Comparison of prescription handling in two community pharmacies,	3
2	Audit of OTC sales over a 24 hour period in a local community pharmacy	3
3	Role of community pharmacists in health education, family planning, first aid, smoking cessation screening programmes, immunization, etc.	3
4	Critical study of two community pharmacies in large hospitals.	3
5	Code of ethics for community pharmacies.	3
6	Describe and evaluate the layout and workflow patterns in the dispensary of a local hospital. Include in your report any improvements, which you would recommend to achieve more efficient work practices	3
7	Examine and report on the drug distribution used in a local hospital	3
8	Prepare one Inventory for the following a. Drugs and Surgicals, based on ABC and VED Analysis. b. Injection ASV c. Injection Adrenaline d. Injection Deriphylline e. Injection Gentamycin f. Bandage cloth, Vasofix g. Disposable Syringes h. Antacid tablets I. Tablet Erythromycin J. Vitamin combination tablets	12

9	Study the store management in Teaching \District\ Mission hospital following aspects: a) Receipt of stores b) Storage c) Issue d) Documentation.	3
10	Preparation of Drug Information leaflets on: a)Antihypertensive Drugs b)Antimicrobial drugs c)Antiemetic drugs d)Antiepileptic drugs e) Anti-diabetic drugs	9

Text Books

Name of authors	Titles of the book	Edition	Name of the publisher
Hassan WE. Lee	Hospital Pharmacy	Latest	Febiger pulication
Allwood MC and Black well	Textbook of Hospital Pharmacy	Latest	
Reference books :			
Name of Authors	Titles of the Book	Edition	Name of the Publisher
Avery	Avery's Drug Treatment	th 4 Edn	Adis International Limited
Remington	Remington Pharmaceutical Sciences		

Name of the Course: Pharmaceutical Technology-I (Theory & Practical)		
Course code: 3.5.2	Semester: V	
Duration: Theory 45 hrs & Practical 90 hrs	Maximum Marks: 100	
Teaching Scheme:	Examination Scheme	
Theory: 03 hrs/week	Sessional Exam: 20 Marks	
Tutorial: 01 hrs/week	End Semester Exam: 80 Marks	
Practical: 06 hrs/week		
Objective:-		
S.No		
1.	To develop the basis for plant design for the production of Pharmaceuticals.	
2.	To imbibe the concept of industrial Pharmacy.	
3.	To impart the knowledge regarding production methodology of non-sterile and sterile dosage form.	
Pre- Requisite:-		
1	Knowledge about basic pharmaceuticals, equipments etc	
Units	Contents	Hrs/week
Unit-1	Preformulation Studies: Study on physical properties of drug: Physical form, particle size, shape, density, wetting, dielectric constant, solubility, dissolution and organoleptic properties and their effect on formulation, stability and bioavailability.	06 hrs
Unit-2	Tablets: Classification and Formulation of different types of tablets, granulation technology on large-scale by various techniques, physics of tablets making, different types of tablet compression machinery and the equipments employed, evaluation of tablets.	08 hrs
	Tablet coating: Types of coating, Sugar coating, film forming materials, formulation of coating solution, equipments for coating process, evaluation of coated tablet, stability kinetics and quality assurance.	05 hrs
Unit-3	Capsules: Advantages and disadvantages of capsule dosage form, material for production of hard gelatin capsule, size of capsules, methods of capsule filling, soft gelatin capsule shell and capsule content, importance of base absorption and minimum/gm factors in soft capsule, manufacture, quality control, stability testing and storage of capsule dosage forms.	06 hrs
Unit-4	Liquid Dosage Forms: Introduction, types of additives used in formulations, vehicles, stabilizers, preservatives, suspending agents, emulsifying agents, solubilizers, colorants, flavors and other excipients. Manufacturing, packaging and evaluation of clear liquids, suspensions and emulsions.	07 hrs
Unit-5	Semisolid Dosage Forms: Definitions, types, mechanisms of drug penetration, factors influencing penetration, ointment and gel bases and their selection. General formulation of ointments, clear gels and manufacturing procedure, evaluation and packaging.	07 hrs
Unit-6	Packaging of Pharmaceutical Products: Packaging components, types,	06 hrs

	specifications and methods of evaluation, stability aspects of packaging. Packaging equipments, factors influencing choice of containers, legal and other official requirements for containers and package testing.	
3.5.2	Pharmaceutical Technology-I (Practicals)	45 Hours 03 hrs/week
1	Manufacture of tablets**	a. Formulation of Compressed tablet-wet granulation b. Tablets prepared by direct compression c. Soluble tablet d. Chewable tablet
2	Formulation and filling of hard gelatin capsules**	a. Aspirin capsules
3	Evaluation of Solid dosage formulations (Q.C.tests)*	a. Tablets b. Capsules
4	Formulation of liquid oral preparations* and evaluation by assay**	a. Solution: Paracetamol syrup b. Antacid suspensions - Aluminum hydroxide gel
5	Preparation of Semisolids	a. Salicylic acid and benzoic acid ointment* b. Diclofenac sodium gel*
6	Tablet Coating:	Demonstration
7	Preformulation studies:	pH and solubility profile of paracetamol

Text Books

Sl.No.	Title	Authors	Publishers
1	Remington's The Science and Practice of Pharmacy (Vol I & II)	Marie Abate BS, Steven R Abel.	Lippincott Williams & Wilkins, Maryland USA.
2	Tutorial Pharmacy	J.W. Cooper & G. Gunn.	Petman Books Ltd., London.
3	Theory and Practice of Industrial Pharmacy	Lachman L., Lieberman H.A, Kanig J.L.	Lea & Febiger, Philadelphia, U.S.A.
4	Introduction to Pharmaceutical Dosage Forms	H.C. Ansel	Lea & Febiger, Philadelphia, U.S.A.
5	Drug Delivery Systems	R.L. Juliano	Oxford University Press, Oxford.
6	Modern Pharmaceutics	Banker GS, Rhode CT	Informa Healthcare, New York.
7	Pharmaceutical Dosage Forms: Tablets (Vol I-III)	Lieberman HA, Lachman L, Sachwartz JB	Marcel Dekker Inc., New York.

Name of the Course: Pharmaceutical Biotechnology (Theory)		
Course code: 3.5.3	Semester: V	
Duration: Theory 60 hrs	Maximum Marks: 100	
Teaching Scheme:	Examination Scheme	
Theory: 04 hrs/week	Sessional Exam: 20 Marks	
Tutorial: 01 hr /week	End Semester Exam: 80 Marks	
Practical: -- hrs/week		
Objective:-		
S.No		
1.	To impart the knowledge about tools of biotechnology useful in pharmaceutical sciences.	
2.	To develop theoretical and practical knowledge about tissue culture techniques.	
3.	To expose the students towards biotechnical process of industrial importance.	
Pre- Requisite:-		
S.No		
1.	Knowledge of microbiology is essential	
Units		
Units	Contents	Hrs/week
Unit-1	APPLIED MICROBIAL TECHNOLOGY Definition, Scope and Applications of Biotechnology. Study of Important groups of microorganisms and their products. Screening, Isolation, Preservation and Strain improvement of important microorganisms. Large scale production of Ethanol, Penicillin, Streptomycin, Citric acid, Vitamin B2, Vitamin B12.	12
Unit-2	ENZYME TECHNOLOGY Sources and Applications of microbial enzymes Biocatalysis : Types of Biocatalysis, Advantages and disadvantages Study of Immobilization techniques for enzymes and whole cells	06
Unit-3	BIOPROCESS TECHNOLOGY Overview of process development of biotechnological (fermentation) products. Steps and unit operations involved in Upstream and Downstream processing Types of fermentors, design considerations, components, control of process parameters in a fermentor.	06
Unit-4	GENETIC ENGINEERING Advantages and Applications of genetic engineering. Recombinant DNA technology and study of steps involved PCR (Polymerase chain reaction) and its applications Restriction digestion, cloning strategies, transformation and ligation Protein expression systems: Bacterial, yeast, fungal and insect cell and mammalian expression systems Bioinformatics and its applications	12

Unit-5	BIOLOGICS AND BIOPHARMACEUTICALS Definition, Classification of Biologics and Biopharmaceuticals with examples Biopharmaceutical Drug manufacturing process, formulation and quality assurance considerations Study of biopharmaceuticals: Insulin, Human growth hormone, Hepatitis B surface antigen, Erythropoietin and Monoclonal antibodies Overview of Vaccines, Approaches for Vaccine design, preparation, standardization, formulation and storage	12
Unit-6	MEDICINAL PLANT BIOTECHNOLOGY AND ANIMAL CELL TECHNOLOGY: Salient features and applications Techniques for cultivation of plant and animal cells Biotechnological approaches for development and improvement of phyto-pharmaceuticals. Transgenic Plants and Transgenic Animals	6
Unit-7	PROTEOMICS AND GENOMICS Overview of human genome project, proteomics, genomics and their pharmaceutical applications. Overview and applications of DNA and protein micro array technology	4
Unit-8	NANO MEDICINE AND NANO BIOTECHNOLOGY Introduction, products and applications, General techniques	2

Textbooks:

1	Principles of Fermentation Technology by P F Stanbury and A Whitaker, Pergamon press.
2	Industrial Microbiology by A.H. Patel, Macmillan India Ltd.
3	Industrial Biotechnology by S.N. Jogdand, Himalaya Publishing House.
4	Comprehensive Biotechnology Vol I to IV, by M.Moo young. Pergamon Press.
5	Industrial Microbiology by L.E. Casida. New Age International (P) Ltd.
6	Biopharmaceuticals by Gary Walsch John Wiley and Sons Ltd
7	Microbiology by Pelczar MJ Jr., Chan ECS and Kreig NR. Tata McGraw Hill
8	Biotechnology: A Text Book of Industrial Microbiology by Crueger, Wulf. Crueger, Anneliese, Sinaeur Associates.
9	Text book of Pharmaceutical Biotechnology by Kokate C.K., Jalalpure S.S and Pramod H.J., Edition 1., Elsevier publications
10	Molecular Biotechnology by S.B. Primrose. Blackwell Scientific Publishers.
11	Plant Tissue Culture Theory and Applications Bhojwani SS and Razdan, Elsevier Publication.
12	Fundamentals of Immunology by W Paul, Lippincott. Williams and Wilkins.
13	Bioinformatics: Sequence and Genome Analysis by David W. Mount, CSHL Press.
14	Handbook of Enzyme Biotechnology by Allan Wiseman, PharmaMed Press.
15	Essential Bioinformatics: by Jin Xiong, Cambridge University Press.
16	Informatics in Proteomics by Sudhir Srivasthava, CRC Publishers.
17	Biocatalysis: Fundamentals & Applications by Andreas S. Bommarius , Bettina R. Riebel., Wiley VCH
18	Biochemical Engineering Fundamentals by Bailey JE and Ollis DF, McGraw-Hill.

Name of the Course: Medicinal chemistry-I (Theory)		
Course code: 3.5.4	Semester: V	
Duration: Theory 60 hours	Maximum Marks: 100	
Teaching Scheme:	Examination Scheme	
Theory: 04 hrs/week	Sessional Exam: 20 Marks	
Tutorial: 01 hr/week	End Semester Exam: 80 Marks	
Practical: -- hrs/week		
Objective:-		
S.No		
1.	Concepts of chemistry in medicinal compounds	
2.	To provide knowledge of medicinal compound with respect to their structure, chemical name, SAR, mechanism and synthesis	
Pre- Requisite:-		
1	Knowledge of basic organic chemistry and human physiology is required	
Units		
Units	Contents	Hrs/week
Unit-1	Basic principles of Medicinal Chemistry: Physico-Chemical aspects of drug molecule on biological activity, Solubility, Partition Coefficient, Hydrogen bonding, Protein binding, Chelation, Optical and Geometrical isomers and Bioisosterism	8 hrs
Unit-2	Principles of Drug Design: Drug receptor interactions, QSAR: brief account of various descriptors (lipophilic, electronic, steric, and topological) and Free Wilson approaches. Fundamentals of computer aided drug design (CADD) and molecular modeling.	6 hrs
Unit-3	Brief introduction to diagnostic agents like Sodium iodide, Iohexol and propyl iodone	2 hrs
Unit-4	History and development of the following classes of drugs: definition, classification with examples including structure and chemical name, SAR, MOA and Synthesis of underlined compounds. Drugs acting at synaptic & neuro-effector junction sites Adrenergic drugs: a) Adrenergic neurotransmitters: Biosynthesis & metabolism of Noradrenaline, adrenergic receptors b) Sympathomimetic agents: Isoproterenol, Clonidine, Pseudoephedrine, Phenylpropanolamine, Naphazoline, Xylometazoline. c) Adrenergic blocking agents: <u>Phenoxybenzamine</u> , Prazosin, <u>Propranolol</u> , <u>Metoprolol</u> , Sotalol	7 hrs
Unit-5	Cholinergic drugs: Biosynthesis and Metabolism of Acetyl choline, Cholinergic receptors, Physostigmine, Parathion. Cholinergic blocking agents: Atropine, Scopolamine, Methscopolamine. Dicyclomine, Propantheline, Chlorphenoxamine, Mecamylamine, d-	7 hrs

	Tubocurarine chloride and Decamethonium bromide, Donepezil	
Unit-6	Histamine & Antihistamines Histamine receptors Antihistaminic agents: H1-antagonists: Diphenhydramine, Doxylamine, Tripeleminamine, Pyrilamine, Pheniramine, Chlorpheniramine, Promethazine, Trimeprazine, Cyclizine, Meclizine, Cyproheptadine H2-antagonists: Cimetidine, <u>Ranitidine</u> , Azelastine. Gastric Proton Pump Inhibitors: <u>Omeprazole</u> and <u>Rabeprazole</u>	8 hrs
Unit-7	Eicosanoids: Occurrence, chemical nature, biosynthesis and medicinal applications	6 hrs
Unit-8	Analgesic & anti-inflammatory agents: Morphine, Codeine, Nalorphine, Noscapine, Dextromethorphan, Modifications of Morphine. <u>Aspirin</u> , Sodium salicylate, <u>Mefenamic acid</u> , <u>Ibuprofen</u> , Piroxicam, <u>Acetaminophen</u> , Antipyrine, <u>Diclofenac sodium</u> , Aceclofenac, Remifentanil Hcl.	10hrs
Unit-9	Local anesthetics:Hexylcaine, Cyclomethycaine, Piperocaine, <u>Benzocaine</u> , <u>Procaine</u> , Procainamide, Lidocaine, Prilocaine, Dimethisoquin, Dibucaine.	6 hrs

Text Books

Name of Authors/Editors	Titles of the Book	Edition	Name of the Publisher
	Indian Pharmacopoeia		Ministry of Health & Family welfare, Govt. of India.
Donald J. Abraham	Burger's Medicinal Chemistry and Drug Discovery	6 th Ed	John Wiley and sons, Inc.
John M. Beale, Jr. John H. Block	Wilson & Gisvolds Text Book of Organic, Medicinal and	12 th Ed	Lippincott Williams and Wilkins Chemistry Pharmaceutical
Thomas L. Lemke David A. Williams	William O Foye's Principles of Medicinal Chemistry	6 th Ed	Lippincott Williams and Wilkins Chemistry Pharmaceutical
James E.F. Reynolds	Martindale, The Extra Pharmacopoeia,	29 th Ed	Pharmaceutical Press, England
Lednicer and Mitscher	Organic Chemistry Drug Synthesis	--	John Wiley and sons
Corwin Hansch	Comprehensive Medicinal Chemistry by Hansch series	Vol I-VI	Elsevier Press
--	Cumulative Index of Medicinal Substances (CIMS).	--	--
Surendranath Pandeya	Text Book of Medicinal Chemistry Vol. I & II	--	S.G.Publisher, Varanasi
Surendranath Pandeya	Text Book of Medicinal Chemistry Vol. I & II		S.G.Publisher, Varanasi

Name of the Course: Pharmacology I (Theory)		
Course code: 3.5.5	Semester: V	
Duration: Theory 60 hrs	Maximum Marks: 100	
Teaching Scheme:	Examination Scheme	
Theory: 04 hrs/week	Sessional Exam: 20 Marks	
Tutorial: 01 hr /week	End Semester Exam: 80 Marks	
Practical: -- hrs/week		
Objective:-		
S.No		
1.	To understand pharmacokinetic and pharmacodynamic principles involved in the use of drugs.	
2.	To understand and identify the various factors that can affect the action of drugs.	
3.	To know the various routes of drug administration.	
4.	To know the effect of drugs on different systems of the body.	
5.	To know the drugs used in systemic illness.	
Pre- Requisite:-		
1	Basic knowledge of human physiology, pathophysiology, etc is essential	
Units	Contents	Hrs/week
Unit-1	General Pharmacology Introduction to Pharmacology- Definition, scope and source of drugs, dosage form and routes of drug administration. Pharmacodynamics- Mechanism of drug action, Receptors, classification and drug receptors interaction, combined effect of drugs, factors modifying drug action. Pharmacokinetics-Mechanism and principle of Absorption, Distribution, Metabolism and Excretion of drugs. Principles of basic and clinical pharmacokinetics. Pharmacogenetics. Adverse drug effects.	12
Unit-2	Discovery and development of new drugs-Preclinical and clinical studies. NOTE: The term Pharmacology used here refers to the classification, mechanism of action, pharmacokinetics, pharmacodynamics, adverse effects, contraindications, therapeutic uses and dosage.	04
Unit-3	Pharmacology of drugs acting on peripheral nervous system Neurohumoral transmission (Autonomic and somatic). Parasympathomimetics, Parasympatholytics, Sympathomimetics, Sympatholytics, Ganglionic stimulants and blockers. Neuromuscular blocking agents and skeletal muscle relaxants (peripheral). Local anesthetic agents. Drugs used in Myasthenia Gravis.	10
Unit-4	Pharmacology of drugs acting on cardiovascular system Introduction of haemodynamics and Electrophysiology of heart. Anti-hypertensive drugs, Anti-anginal agents, Anti-arrhythmic drugs. Drugs used in congestive heart failure. Anti-hyperlipidemic drugs. Drugs used in the therapy of shock. Haematinics, anticoagulants and haemostatic agents	10

	Fibrinolytics and antiplatelet drugs. Blood and plasma volume expanders.		
Unit-5	Pharmacology of drugs acting on urinary system Diuretics and anti-diuretics.	04	
Unit-6	Pharmacology of drugs acting on Respiratory system Anti-asthmatic drugs, Mucolytics, Nasal decongestants, Anti-tussives , Expectorants and Respiratory stimulants.	04	
Unit-7	Pharmacology of drugs acting on central nervous System Neurohumoral transmission in the C.N.S with special emphasis on Pharmacology of various neurotransmitters. General anaesthetics. Alcohols and disulfiram. Sedatives, hypnotics and centrally acting muscle relaxants. Psychopharmacological agents: Antipsychotics, antidepressants, antianxiety agents, anti-manics and hallucinogens. Anti-epileptic drugs. Drugs used in Parkinsonism, Alzheimer's and Huntington's disease. Nootropics.	12	
Unit-8	Narcotic analgesics, drug addiction, drug abuse, tolerance and dependence.	04	
Text Books - Latest edition			
Sl.No	Name of the Book	Author	Publisher
01	Essentials of Medical Pharmacology	Tripathi KD	Jaypee brothers, New Delhi.
02	Pharmacology and Pharmacotherapeutics	Satoskar R.S., Bhandarkar K. S. Nirmala N Rege	Popular Prakashan, Mumbai.
03	Goodman and Gilman's The Pharmacological basis of therapeutics.	A Goodman Gilman, T.W. Rall, ALS. Nies, P. Taylor	McGraw – Hill, New Delhi.
04	Basic and Clinical Pharmacology	Katzung, B. G.	Prentice Hall, International. New Delhi.
05	Pharmacology	M. P. Rang, M.M. Dale, J.M. Ritter	Churchill Livingstone, New Delhi.
06	Modern Pharmacology	C. R. Craig and R.E. Stitzel	Little, Brown and company, Boston.
07	Lippincott's Illustrated Reviews: Pharmacology	Mycek M. J,Harvey RA and Champe PC	Lippincott Williams & Wilkins. Philadelphia.

Name of the Course: Pharmacology II (Theory & Practical)		
Course code: 3.6.1	Semester: VI	
Duration: Theory 60 hrs & Practical 90 hrs	Maximum Marks: 100	
Teaching Scheme:	Examination Scheme	
Theory: 04 hrs/week	Sessional Exam: 20 Marks	
Tutorial: -- hr /week	End Semester Exam: 80 Marks	
Practical: 06 hrs/week		
Objective:-		
S.No		
1.	To know the drugs used in disease conditions and chemotherapy of Antibiotics	
2.	To understand the methods in experimental pharmacology to correlate drug effects with receptors.	
3.	To understand basics about laboratory animals and to carry out some simple pharmacological experimental techniques to evaluate new products	
Pre- Requisite:-		
S.No		
1.	Knowledge of physiology, General principles of pharmacodynamics and microbiology etc.	
Units	Contents	60 hrs 04 Hrs /week
Unit-1	Pharmacology of drugs acting on Endocrine system Basic concepts in endocrine pharmacology. Hypothalamic and pituitary hormones. Thyroid hormones and anti thyroid drugs, Parathormone, Calcitonin and vitamin-D. Insulin, oral hypoglycemic agents and glucagon. ACTH and corticosteroids. Androgens and anabolic steroids. Estrogens, progesterone and oral contraceptives. Drugs acting on the uterus.	08
Unit-2	Chemotherapy General principles of chemotherapy. Sulphonamides and co-trimoxazole. Antibiotics - Penicillins, Cephalosporins, Chloramphenicol, Macrolides, Quinolones and Fluoroquinolones, Tetracyclines, Aminoglycosides and miscellaneous antibiotics. Chemotherapy of tuberculosis, leprosy, fungal diseases, viral diseases, AIDS, protozoal diseases, worm infestations, urinary tract infections and sexually transmitted diseases.	14
Unit-3	Autacoids and their Antagonists Histamine, 5-HT and their antagonists. Prostaglandins, thromboxanes and leukotrienes. pentagastrin, cholecystokinin, angiotensin, bradykinin and substance P. Analgesic, anti-pyretic, anti-inflammatory and anti-gout drugs.	08

Unit-4	Pharmacology of drugs acting on gastrointestinal tract Antacids, anti-secretory and antiulcer drugs. Laxatives and antidiarrhoeal drugs. Appetite stimulants and suppressants. Digestants and carminatives. Emetics and antiemetics.	04
Unit-5	Chronopharmacology Definition of rhythm and cycles. Biological clock and their significance leading to chronotherapy.	02
Unit-6	Immunopharmacology Immunostimulants and immunosuppressants.	03
Unit-7	Chemotherapy of malignant diseases Basic principle of chemotherapy. Drugs used in cancer chemotherapy.	04
Unit-8	Peptides and proteins as mediators General Principle of peptide pharmacology Biosynthesis and regulation of peptides. Peptide antagonists. Protein and peptide as drugs.	04
Unit-9	Nitric oxide Biosynthesis of nitric oxide and its physiological role. Therapeutic uses of nitric oxide and its donors.	03
Unit-10	Vitamins and Minerals Vitamin deficiency diseases and their management. Role of minerals in health and diseases.	04
Unit-11	Principles of Toxicology Definition of poison. General principles of treatment of poisoning. Treatment of poisoning due to heavy metals, insecticides, opioids and other addict forming drugs. Study of acute, sub acute and chronic toxicity as per OECD guidelines. Genotoxicity, Carcinogenicity, Teratogenicity and Mutagenicity studies.	06
3.6.1	Pharmacology – II Practical	90 hrs 6 Hrs/ week
1	Commonly used instruments in experimental pharmacology	
2	Common laboratory animals and anesthetics used for animal studies.	
3	Some common and standard techniques. Bleeding and intravenous injection, intra-gastric administration, Procedures for rendering animal unconscious and chemical euthanasia.	
4	Study of different routes of drug administration in mice/rats.	
5	To study the effect of hepatic microsomal enzyme inhibitors and inducers on the phenobarbitone sleeping time in mice. (Computer aided experiments)	
6	To study the effect of drugs on ECG recordings in rats. (Computer aided experiments)	
7	Analgesic activity by hot plate method. (Computer aided experiments)	
8	Anti-inflammatory activity by rat paw edema. (Computer aided experiments)	
9	Determination of locomotor activity by actophotometer. (Computer aided experiments)	

10	Experiments based on few ex-vivo experiments like matching bioassay.		
11	Statistical calculations in experimental pharmacology a. Student-t-test b. ANOVA		
Text Books: Latest edition			
Sl.No	Name of the Book	Author	Publisher
01	Essentials of Medical Pharmacology	Tripathi K.D.	Jaypee Brothers, New Delhi.
02	Pharmacology and Pharmacotherapeutics	Satoskar R.S., Bhandarkar K. S. Nirmala N Rege	Popular Prakashan, Mumbai.
03	Goodman and Gilman's The Pharmacological basis of therapeutics	A Goodman Gilman, T.W. Rall, ALS. Nies, P. Taylor	McGraw – Hill, New Delhi.
04	Basic and Clinical Pharmacology	Katzung, B. G.	Prentice Hall, International. New Delhi.
05	Pharmacology	M. P. Rang, M.M. Dale, J.M. Riter	Churchill Livingstone, New Delhi.
06	Modern Pharmacology	C. R. Craig and R.E. Stitzel	Little, Brown and company, Boston.
07	Lippincott's Illustrated Reviews: Pharmacology	Mycek M. J, Harvey RA and Champe PC.	Lippincott Williams &Wilkins. Philladelphia.
08	Handbook of Experimental Pharmacology	S.K.Kulkarni	Vallabha Prakshan, New Delhi.

Name of the Course: Pharmaceutical Technology II (Theory & Practical)		
Course code: 3.6.2	Semester: VI	
Duration: Theory 45 hrs& Practical 45 hrs	Maximum Marks: 100	
Teaching Scheme:	Examination Scheme	
Theory: 03 hrs/week	Sessional Exam: 20 Marks	
Tutorial: 01 hr /week	End Semester Exam: 80 Marks	
Practical: 03 hrs/week		
Objective:-		
S.No		
1.	To get acquainted with the concept of industrial Pharmacy.	
2.	To impart the knowledge regarding production methodology of non-sterile and sterile dosage form.	
3.	To study the manufacture of surgical products	
Pre- Requisite:-		
1	Knowledge about basic principles of pharmaceuticals, equipments etc	
Units	Contents	Hrs/week
Unit-1	Parenteral Products: Definition, types, advantages and limitation. Additives used in the formulation of parenterals, production facilities and controls, layout of parenterals section, design, maintenance of aseptic area, service area and production area. Formulation of injections: Solutions, Emulsions, Suspensions, Powders and Implants. Containers, closures for sterile preparations. Pharmacopoeial Quality Control Tests.	12
Unit-2	Ophthalmic Preparations: Requirements, formulation of eye drops, eye lotions and eye ointments; containers, closures, sterilization and evaluation.	04
Unit-3	Pharmaceutical Aerosols: Definition, propellants, containers, valves and actuators. General formulation, manufacturing, quality control, packaging methods and pharmaceutical applications.	08
Unit-4	Cosmetology and Cosmetic Preparations: Structure of skin, formulation of cold cream, vanishing cream, cleansing cream, all purpose cream, protective cream, antiperspirants, deodorants and face powder. Hair structure, Shampoos, Conditioners, Shaving and after shaving products, Dentifrice and Mouthwash, Lipsticks, Nail lacquer.	08
Unit-5	Blood Products and Plasma Substitutes: Collection, processing and storage of whole blood, concentrated human blood cells, dried human plasma, extraction of plasma fractions and plasma substitutes (Manufacture of Dextran).	05
Unit-6	Surgical Products: Definition, primary wound dressing, absorbent surgical cotton, surgical gauzes etc., bandages, adhesive tape, protective cellulosic haemostatic, official dressings, absorbable and non-absorbable	08

	sutures and ligatures.		
3.6.2	Pharmaceutical Technology-II (Practicals)		45 Hours 03 hrs /week
1	Manufacture of Parenterals **	a. Ascorbic acid injection I.P. b. Calcium gluconate injection I.P. c. Ringers lactate injection (Ingredients based on milliequivalents) d. Oily Phenol injection	
2	Ophthalmic Preparations*	a. Ciprofloxacin eye drops b. Diclofenac sodium eye drops	
3	Cosmetic preparations*	a. Lipstick. b. Cold cream and vanishing cream. c. Clear liquid shampoo. d. Tooth paste and tooth powder. e. Face & Talcum powder.	
4	Evaluation of Absorbent cotton wool	As per Indian Pharmacopoeia	

Text Books

Sl. No	Name of the Book	Author	Publisher
01	Remington: The Science and Practice of Pharmacy & Pharmaceutical Sciences Vol. I, II & III.	Marie Abate BS, Steven R Abel	Mack Publishing Company, U.S.A.
02	Pharmaceutical Dosage Form- Parenteral Medication	Lachmann and Liebermann	Marcel Dekker Inc., New York.
03	Introduction to Pharmaceutical Dosage Forms	H.C. Ansel	Lea &Febiger, Philadelphia, U.S.A.
04	Drug Delivery Systems	R.C. Juliano	Oxford University Press, Oxford.
05	Theory & Practice of Industrial Pharmacy	Herbert A. Liebermann & Leon Lachman	Lea &Febiger, Philadelphia, U.S.A.
06	Cosmetics: Science and Technology	Balsam and Sagarin	John Wiley & Sons.
07	Modern Cosmetics	Thomssen E.G.	Universal Publishing Corporation.
08	A Handbook of Cosmetics	Mittal B.M. & Saha R.N.	VallabhPrakashan, New Delhi.
09	Cooper and Gunn's Dispensing for Pharmaceutical Students	Carter S.J.	CBS Publishers, New Delhi.

Name of the Course: Advanced Pharmacognosy (Theory & Practical)		
Course code: 3.6.3	Semester: VI	
Duration: Theory 45hours & Practical 90hrs	Maximum Marks: 100	
Teaching Scheme:	Examination Scheme	
Theory: 03 hrs/week	Sessional Exam: 20 Marks	
Tutorial: 01 hr/week	End Semester Exam: 80 Marks	
Practical: 06 hrs/week		
Objective:-		
S.No		
1.	To study the generation of bio-drugs in plants as a result of metabolism.	
2.	To impart knowledge about important chemical classes of compounds having bioactivity.	
Pre- Requisite:-		
1	Knowledge of Pharmacognosy and preliminary awareness about alternative systems of medicine	
Units	Contents	Hrs/week
Unit-1	Natural products used as color pigments, biopolymers, photosensitizing agents and flavors,	5
Unit-2	Adulteration of crude drugs and their types Evaluation of crude drugs: Morphological, microscopical, Physical, chemical and biological methods with examples	6
Unit-3	Plant bitters and sweeteners. Natural sweeteners and their role in health care.	3
Unit-4	Plant hormones	2
Unit-5	Introduction to Alternative systems of medicine. a) Basic principles of Ayurveda, Siddha, Unani, Traditional Chinese Medicine and Homoeopathy b) Introduction to Ayurvedic preparations and method of preparation of Asava, Arista, Gutika, Taila, Churna, Lehya and Bhasma	2 5
Unit-6	Introduction to alternative system of medicine a) Basic principles of ayurveda, siddha, Unani, traditional, Chinese system and Homeopathy b) Introduction to ayurvedic preparations and method of preparation of asava, arista, gutica, taila, churna, lehya and bhasma	7
Unit-7	Stability studies of phytpharmaceuticals as per ICH guide	3
Unit-8	Extraction and analytical profile of following phytopharmaceuticals a) Glycyrrhiza glabra	12

	b) Centella asiatica c) Curcuma longa d) Berberis aristata e) Piper longum f) Aloes		
3.6.3	Advanced Pharmacognosy (Practicals)	90 Hours 06 hrs/ week	
1.	Study of powder microscopy of the following drugs:** i. Digitalis ii. Rauwolfia iii. Coriander iv. Ginger v. Cinchona vi. Nux vomica vii. Ephedra viii. Clove		
2.	Determination of Stomatal number and index of Vinca, Vasaka. **		
3.	Determination of Vein islet number and Vein-let termination number of Senna, Datura.**		
4.	Quantitative microscopy (Lycopodium spore method).*		
5.	Determination of length and width of phloem fibres. **		
6.	Determination of diameter of starch grains. **		
7.	Physical parameters for standardization of phytopharmaceuticals* a) Determination of moisture content b) Extractive values c) Ash value d) Swelling Index		
8.	Extraction of Phytopharmaceuticals.** a) Caffeine from Tea b) Lawsone from Henna c) Pectin from Orange peel d) Starch from Potatoes e) Glycyrrhizin from Liquorice		
9.	General test for alkaloids		
10.	TLC of alkaloids		
Text Books			
Name of Authors	Titles of the Book	Edition	Name of the Publisher
Kokate C.K., Purohit A.P and Gokhale S.P	Text Book of lines Pharmacognosy	35 th	Nirali Prakashan, Pune
Trease and Evans,	Pharmacognosy	15 th	W.B.Saunders, New York
V.E., Tylor, L.R. Brady and S.B., Robbers	Pharmacognosy	9 th	K.M. Varghese Co. Bombay.
Wallis T.E.	Textbook Of	4 th	CBS, Delhi

	Pharmacognosy		
Iyengar M.A and Nayak S.G.K.	Anatomy of Crude Drugs	12 th	Manipal power press, Manipal.
Kokate C.K.	Practical Pharmacognosy	12 th	Vallabh Prakashan, Delhi.
Harborne J.B.	Phytochemical Methods	3 rd	Chapman and Hall, International Edition, London
Brain K.R and Turner T.D	The Practical Evaluation of Phytopharmaceuticals.		Wright-Sciotechnica, Bristol.
Raphael Ikan	Natural Products – A Laboratory Guide	2 nd	Academic Press, New York, USA.
Wagner H., Blatt S., Zagajski E.M.	Plant Drug Analysis	2 nd	Springer-Verlag, Berlin, London.
Pulok K, Mukherjee	Quality control methods of Herbal drugs	1 st	Business Horizons, New Delhi.
WHO	Quality control methods for medicinal plant materials	3 rd	WHO, Geneva
Smith P. M	. The Chemotaxonomy of Plants	2009	Edinburgh

Name of the Course: Pharmaceutical Jurisprudence & Ethics (Theory)		
Course code: 3.6.4	Semester: VI	
Duration: Theory 60 hrs	Maximum Marks: 100	
Teaching Scheme:	Examination Scheme	
Theory: 04 hrs/week	Sessional Exam: 20 Marks	
Tutorial: -- hr /week	End Semester Exam: 80 Marks	
Practical: -- hrs/week		
Objective:-		
S.No		
1.	To expose the student to important legislations related to Pharmacy profession in India.	
2.	It imparts knowledge about the Drug and Cosmetic Act and its Rules.	
3.	It provides the basic idea regarding DPCO drug policies and patenting in India.	
Pre- Requisite:-		
1	Basic knowledge of Pharmacy profession, pharmacology of drugs, drug posology is essential	
Units		
	Contents	Hrs/week
Unit-1	Introduction to Pharmaceutical legislations & History	03
Unit-2	An elaborate (practical oriented) study of the following: a) Code of Pharmaceutical ethics b) Pharmacy Act 1948 c) Drugs and Cosmetics Act 1940 and rules 1945 d) Medicinal and Toilet Preparations (Excise Duties) Act 1955 e) Narcotic Drugs and Psychotropic Substances Act 1985 and rules f) Drugs Price Control Order and Pharmaceutical Policy 2002	02 04 27 04 10 03
Unit-3	A brief study of the following with special reference to the main provisions a) Drugs and Magic Remedies (Objectionable Advertisements) Act 1954 b) Prevention of Cruelty to Animals Act 1960 including study of CPSCEA guidelines, INSA & ICMR guidelines c) Factories & Minimum Wages Act 1948	02 03 02
Unit-4	A brief study of the various prescription/non-prescription products, Medical/surgical accessories, diagnostic aids, appliances available in the market. (Individual report to be submitted by each student on any one above market survey)	

Text Books			
Sl.No	Name of the Book	Author	Publisher
1	A Text Book of Forensic Pharmacy	N.K.Jain	VallabhPrakashan, New Delhi.
2	A Text Book of Forensic Pharmacy	Mithal, B. M.	National Book Depot, Kolkatta.
3	Pharmaceutical Jurisprudence &Ethics	Dr S. P Agarwal&Rajesh Khanna	Birla Publications Pvt. Ltd.
4	D & C Act 1940	Vijay Malik	Eastern Book Company.
5	Remington: The Science and Practice of Pharmacy & Pharmaceutical Sciences Vol. I, II & III,	Marie Abate BS, Steven R Abel.	Mack Publishing Company, U.S.A.
6	Latest issues of CIMS, MIMS, PDR, DDR		
7	Latest issues of IDMA Bulletin		
8	CPSCEA and ICMR Guidelines		
9	Drugs & Cosmetics Act 1940	Nilesh Gandhi	

Name of the Course: Environmental studies * (Theory)		
Course code: 3.6.5	Semester: VI	
Duration: Theory 45 hrs	Maximum Marks: 100	
Teaching Scheme:	Examination Scheme	
Theory: 03 hrs/week	Sessional Exam: 20 Marks	
Tutorial: -- hrs/week	End Semester Exam: 80 Marks	
Practical: -- hrs/week		
Objective:-		
S.No		
1.	To study the importance of environmental science and environmental studies	
2.	To study continuing problems of pollution, loss of forest, solid waste disposal, degradation of environment, issues like economic productivity and national security.	
3.	Study of Global warming, the depletion of ozone layer and loss of biodiversity, & its impact on environmental issues.	
Pre- Requisite:-		
1	Basics of life science	
Units		
Units	Contents	Hrs/week
Unit-1	Environment studies A- Definition, scope & importance B- Natural Resources-renewable & non-renewable C-Use, utilization, exploitation and associated problems of forests, Water resources, Mineral resources, Food resources, Energy resources, Land resources. D-Equitable use of resources for sustainable life style, role of an individual in conservation.	10 hrs
Unit-2	Ecosystems A. Introduction, type features and function of different ecosystems-Forest Grassland, Desert and Aquatic. B. Biodiversity & its conservation with special reference to India.	08 hrs
Unit-3	Environmental pollution -Air, Water, Soil, Marine, Noise, Thermal, Nuclear-Introduction, causes and control measures. Law related to Environmental Protection Air (Prevention and control of pollution) Act 1987 Water Prevention & control of pollution Act. 1974	6 hrs
Unit-4	Environmental Protection Act 1986 Noise Pollution Hazardous Wastes Hazardous Chemical Hazardous Microorganism Biomedical Waste Provisions applicable to drugs and cosmetics	9 hrs
Unit-5	Natural Resources	12 hrs

	<p>Renewable and non-renewable resources : Natural resources and associated problems.</p> <p>1) Forest resources: Use and over-exploitation, deforestation, case studies. 2) Timber extraction, mining, dams and their effects on forest and tribal people. 3) Water resources : Use and over-utilization of surface and ground water, 4) Floods, drought, conflicts over water, dams-benefits and problems. 5) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. 6) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. 7) Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies. 8) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. a. Role of an individual in conservation of natural resources. b. Equitable use of resources for sustainable lifestyles</p>	
	<p>Reference Books</p> <p>1 Principles of Environmental Studies, C Manoharachary, P. Jayaranama Reddy, Pharma Book Syndicate, Hyderabad. 2 Handbook of Environmental Laws, Acts, Guidelines, Compliances & Standards Vol. I & II. R.K. Trivedy, Pharma Book Syndicate, Hyderabad. 3 Relevant Acts & Rules published by Govt. of India with latest amendments. 4 Text Book of Environmental Sciences & Technology by Reddy M. Anji.</p>	
Textbooks		
	Titles of the Book	Name of Authors
	Principles of Environmental Studies	C. Manoharachary, P. Jayaranama Reddy
	Fundamentals of ecology	Odium E.P
	Handbook of Environmental Laws, acts, Guidelines, Compliances and Standards Volume 1&2	R.K Trivedi
	Text book of Environmental Science & technology	Reddy M.Anji
	Encyclopedia of Indian Natural History	Hawkins R.E
	Environmental science systems and solutions	McKinney M.L and School R.M
	Global Biodiversity Assessment	Hey wood V.H School R.M
	Water in crises	Gleick H.P
	Hazardous Waste Incineration	Brunner R.C
		Pharma book Syndicate
		W.B Sunders Co U.S.A
		Pharma book Syndicate
		Pharma book Syndicate
		Bombay Natural History society
		Web enhanced Edition
		Cambridge university Press
		Oxford University Press
		Mc Grawhill Inc.

Name of the Course: Instrumental Methods of Analysis (Theory & Practical)		
Course code: 3.7.1	Semester: VII	
Duration: Theory 60 hours & Practical 90hrs	Maximum Marks: 100	
Teaching Scheme:	Examination Scheme	
Theory: 04 hrs/week	Sessional Exam: 20 Marks	
Tutorial: 01 hrs/week	End Semester Exam: 80 Marks	
Practical: 06 hrs/week		
Objective:-		
S.No		
1.	To establish instrumental methods of analysis in laboratories	
2.	To provide basic knowledge of analytical techniques based upon electromagnetic radiations.	
3.	To provide basic knowledge of advanced spectroscopic techniques like NMR and Mass Spectrometry.	
4.	To emphasize the importance of widely used chromatographic techniques in pharmaceutical analysis	
Pre- Requisite:-		
1	Basic & preliminary knowledge of analytical method of analysis and chemistry of drug molecules is essential	
Units		
Units	Contents	Hrs/week
Unit-1	General principles of spectroscopy Wave-particle duality, wave properties, particulate properties. Line & band spectrum. Electromagnetic spectrum. Absorption & emission spectroscopy. Understanding of terms such as absorbance, transmittance, absorptivities, molar absorptivity, E 1cm 1%, λ_{max} .	5
Unit-2	Ultraviolet-visible Spectroscopy Different electronic transitions. Study of chromophores and auxochromes, Bathochromic & hypsochromic shifts [red & blue shifts], Hyperchromic and Hypochromic effects, effect of solvent & pH on λ_{max} . Beer-Lambert law, its derivation, deviations in Beer's law. Application to single and multi-component analysis. Single & double beam spectrophotometers covering sources of radiations, different monochromators, detectors such as barrier cell, photocell, photomultiplier tube and Silicon Photodiode detector. Spectrophotometric titrations. Applications of this technique in qualitative & quantitative estimations.	11
Unit-3	Spectrofluorimetry Principle, definitions & types of luminescence. Mechanism of fluorescence & phosphorescence. Singlet & triplet states & intersystem crossing. Factors affecting Fluorescence. Quenching of fluorescence. Brief discussion of instrumentation. Applications of fluorimetry in pharmacy.	6

Unit-4	Flame photometry & atomic absorption spectroscopy Principle & instrumentation with emphasis on working & importance of different components. Flames and flame temperature. Sources of Interferences. Applications.	5
Unit-5	Infrared spectroscopy Infrared region in EM spectrum. Principle, different stretching & bending vibrations. Components [& their working] of a dispersive instrument. Fourier transform [FT] technique, Sample handling techniques. Functional group & finger print regions in the spectrum. Functional groups identification (like alcohol, carboxyl, amide, esters, amine, aldehyde, ketone, nito and phenol) & their use in characterization of compounds.	10
Unit-6	Chromatography Principle, instrumentation and applications of A) Gas Chromatography (GC) B) High Performance Liquid Chromatography (HPLC)	10
Unit-7	Proton nuclear magnetic resonance spectroscopy Principle involved in the technique. Knowledge about fundamental terms involved such as flipping of nucleus, spin number, magnetic moment, magnetogyric ratio, relaxation, etc. Types of relaxation processes. A brief discussion on the low resolution instrumentation [60 MHz]. Solvents & reference standards used. Shielding & deshielding of a proton & it's effect on chemical shift. Applications of NMR Spectroscopy.	8
Unit-8	Mass spectrometry Principle. Basic instrumentation. Components & importance of each in brief. Brief knowledge of Chemical Ionization mass spectrometry. Base or parent peak, molecular ion, M + 1, M + 2 peaks.	5
	Total	60
3.7.1	Instrumental Methods of Analysis (Practicals)	90 Hrs 06 hrs/ week
1.	Experiment [1] involving determination of absorption Maximum for a given solution of drug. *	1x3=3
2.	Experiments [2-6] involving UV-VIS spectrometry in assays using calibration curve method. ** Colorimetric estimation of ferrous ions using 1, 10-phenanthroline. Colorimetric estimation of Sulphanilamide using Bratton-Marshall reagent. Assay of Dextrose I.V. solution by colorimetry. UV Spectrophotometric estimation of Paracetamol. UV Spectrophotometric estimation of Ibuprofen.	5x6=30
3.	Experiments [7-12] involving UV-VIS spectrometry in the assays of different dosage forms such as tablets, capsules, injections, suspensions, gels [official / unofficial], etc. and calculation of drug content using E 1% 1cm. *	6x3=18

4.	Experiment [13] to indicate the effect of pH on absorption spectrum of Sulphanilamide. *	1x6=6
5.	Experiment [14] to indicate the effect of solvents on absorption spectrum of a substance (e.g. phenol). *	1x6=6
6.	Experiment [15] involving the determination of isobestic point of bromothymolblue indicator. *	1x6=6
7.	Experiments [16-19] on fluorimetry. ** A) Quantitative estimations of 2-3 drugs / vitamins. B) Quenching of fluorescence.	4x3=12
8.	Experiment [20] involving estimation of Na ⁺ , K ⁺ ions using flame photometry.	1x3=3
9.	Experiment [21] involving interpretation of IR spectra of compounds with different functional groups (-COOH, -COOR, -CONHR, -NH ₂ , -NHR, -OH, etc).	1x6=6

Text Books

Name of Authors	Titles of the Book	Edition	Name of the Publisher
Willard, Merritt, Dean and Settle	Instrumental Methods of Analysis	7 th Ed.	CBS Publishers and Distributors
Skoog, Holler, Crouch	Instrumental Analysis	Indian Edition	CENAGE Learning
A.I. Vogel	Textbook of Quantitative Chemical Analysis	4 th Ed.	ELBS Publications
K.A. Connors	Textbook of Pharmaceutical Analysis	3 rd Ed., 1982.	John Wiley and sons
P.D. Sethi	Quantitative Analysis of Drugs in Pharmaceutical Formulations	3 rd Ed.	CBS Publications
	Indian Pharmacopoeia	2007	The Indian Pharmacopoeia Commission, Govt. of India, Ministry of Health and Family Welfare
	British Pharmacopoeia	2007	The Stationary Office on behalf of the MHRA
A.H. Beckett and J.B. Stenlake	Practical Pharmaceutical Chemistry	4 th Ed.	CBS Publications

Name of the Course: Industrial Pharmacognosy (Theory & Practical)		
Course code: 3.7.2	Semester: VII	
Duration: Theory 45 hours & Practical 45hrs	Maximum Marks: 100	
Teaching Scheme:	Examination Scheme	
Theory: 03 hrs/week	Sessional Exam: 20 Marks	
Tutorial: 01 hr /week	End Semester Exam: 80 Marks	
Practical: 03 hrs/week		
Objective:-		
S.No		
1.	To develop the concept of value addition to herbal drugs in terms of quality standards and standardization of herbal drugs.	
2	To make learners aware about the regulatory aspects of intellectual properties related to the Herbs	
Pre- Requisite:-		
1	Basic knowledge of chemistry, structure elucidation and advance Pharmacognosy etc	
Units	Contents	Hrs/week
Unit-1	World-wide trade in medicinal plants and derived products with special reference to Taxol (Taxus sp.) Digitoxin (Digitalis), Atropine (Datura), Quinine (Cinchona), Vincristine (Vinca), Glycyrrhizin (Liquorice), Aloin (Aloe).	07
Unit-2	Herbs as health foods – Minerals, Vitamins and Nutraceuticals	3
Unit-3	Natural allergens a. Classification of allergens b. Preparation of allergenic extracts c. Sensitivity testing and treatment of allergy	3
Unit-4	WHO guidelines for assessment of herbal medicine. Assessment of the efficacy of herbal medicines and Pharmacovigilance of herbal medicinal products Study of GLP and GMP with reference to herbal drugs	9
Unit-5	Conservation of medicinal plants. Different techniques involved in conservation of medicinal plants with their advantages and disadvantages	5
Unit-6	Study of traditional drugs, common vernacular names, botanical sources, morphology, chemical nature of chief constituents, uses and marketed formulations of following indigenous drugs: Amla, Brahmi, Tulsi, Kantakari, Satavari, Bilwa, Rasna, Punarnava	5
Unit-7	Herbal drug development: a. Methods involved in monoherbal and polyherbal formulations with their merits and demerits. b. Quality control of herbal formulations.	2 2
Unit-8	Raw materials used in herbal cosmetics: i. Shampoo- Soap nut, Hibiscus. ii. Hair colorants- Amla , Henna. iii. Skin care- Aloe vera, Turmeric.	4
Unit-9	Introduction to Indian and International Patent laws and WTO related to	5

	natural products.	
3.7.2	Industrial Pharmacognosy (Practicals)	45 Hours 03 hrs /week
1.	Isolation and estimation of Phytoconstituents: ** i. Curcumin from Turmeric ii. Piperine from Pepper iii. Hesperidin from Orange peel iv. Caffeine from tea leaves v. Glycyrrhizin from licorice	
2.	Preparation of Herbal Shampoos*-aloe vera, hibiscus, lemon, henna	
3.	Demonstration of HPLC	
4.	Field visit (Collection and preparation of medicinal and aromatic plants - herbarium sheets	
5.	Evaluation of Crude Drugs: i. Volatile oil content of crude drug-vlove oil, eucalyptus oil. ii. TLC of alkaloids.*	

Text Books

Name of Authors	Titles of the Book	Edition	Name of the Publisher
Text Book of Pharmacognosy	Kokate C.K., Purohit A.P and Gokhale S.P	.35 th	Nirali Prakashan, Pune
Trease and Evans,	Pharmacognosy	15 th	W.B.Saunders, New York
V.E., Tylor, L.R. Brady and S.B., Robbers	Pharmacognosy	9 th	K.M. Varghese Co. Bombay.
Wallis T.E.	Textbook Of Pharmacognosy	4 th	CBS, Delhi
Iyengar M.A and Nayak S.G.K.	Anatomy of Crude Drugs	12 th	Manipal power press, Manipal.
Kokate C.K	.Practical Pharmacognosy	12 th	Vallabh Prakashan, Delhi.
Harborne J.B.	Phytochemical Methods	.3 rd	Chapman and Hall, International Edition, London
Brain K.R and Turner T.D.	The Practical Evaluation of Phytopharmaceuticals	1975	Wright-Sciotechnica, Bristol.
Raphael Ikan	Natural Products – A Laboratory Guide	2 nd	Academic Press, New York, USA.
Wagner H., Blatt S., Zagajski E.M.	Plant Drug Analysis	2 nd	Springer-Verlag, Berlin, London.
Pulok K, Mukherjee	Quality control methods of Herbal drugs	1 st	Business Horizons, New Delhi.
WHO	Quality control methods for medicinal plant materials	3 rd	WHO, Geneva
Smith P. M.	The Chemotaxonomy of Plants	2009	Edinburgh

Name of the Course: Medicinal Chemistry-II (Theory & Practical)		
Course code: 3.7.3		Semester: VII
Duration: Theory 45 hours & Practical 90 hrs		Maximum Marks: 100
Teaching Scheme:		Examination Scheme
Theory: 03 hrs/week	Sessional Exam: 20 Marks	
Tutorial: 01 hr/week	End Semester Exam: 80 Marks	
Practical: 06 hrs/week		
Objective:-		
S.No		
1.	Concepts of chemistry in medicinal compounds	
2.	To provide knowledge of medicinal compound with respect to their structure, chemical name, SAR, mechanism and synthesis	
Pre- Requisite:-		
1	Knowledge of chemistry, SAR, basic pharmacology etc	
Units		
Units	Contents	Hrs/week
Unit-1	History and development of the following classes of drugs: Definition, classification with examples including structure and chemical name, SAR, MOA and synthesis of underlined compounds. Central Nervous System Depressants A. General Anaesthetics: Inhalation anaesthetics: <u>Halothane</u> , Methoxy flurane, Nitrous oxide.Ultra short acting barbiturates: <u>Methohexital sodium</u> , Thiopental sodium.Dissociative anaesthetics: Ketamine hydrochloride.	03hrs
Unit-2	B. Anxiolytic sedative and hypnotic agents: Benzodiazepines: <u>Chlordiazepoxide</u> , <u>Diazepam</u> , Alprazolam. Barbiturates: <u>Barbital</u> , Methabarbital, <u>Amobarbital</u> , Butabarbital. <u>Pentobarbital</u> , Secobarbital. Miscellaneous: <u>Glutethimide</u> , Ethchlorvynol, Ethinamate, <u>Meproamate</u> . Paraldehyde.	05hrs
Unit-3	C. Skeletal muscle relaxants: Chlorphenesin, Methocarbamol.	0.5hr
Unit-4	D. Drugs used in spasticity: Baclofen.	0.5hr
Unit-5	E. Anticonvulsants: Barbiturates: Phenobarbitone. Hydantoins: Phenytoin sodium, Ethotoin, . Oxazolidine diones: <u>Trimethadione</u> ^s , Paramethadone. Succinimides: Phensuximides, <u>Methsuximide</u> , Ethosuximide. Urea and monoacylureas: <u>Phenacetamide</u> , <u>Carbamazepine</u> . Miscellaneous: <u>Primidone</u> ^s Valproic acid. Benzodiazepines: Clonazepam,	05hrs
Unit-6	F. Stimulants; <u>Nikethamide</u> , Pentylene tetrazole, Xanthine derivatives, Phenelzine, Imipramine, Nisoxetine and Trazodone,	04hrs
Unit-7	Cardiovascular Agents: Antianginal agents and vasodilators: Amyl nitrite, Nitroglycerin, Isosorbide	01hr

	dinitrate.	
Unit-8	Antiarrhythmic drugs and Calcium antagonists: Class I- Membrane depressant drugs: Quinidine <u>Procainamide</u> , Phenytoin, Tocainide. Class II- Beta adrenergic blocking agents: Propranolol. Class III- Repolarization prolongators: Bretylium, Amiodarone. Class IV- Calcium channel blockers: Diltiazem, <u>Verapamil</u> , Nifedipine, Amlodipine.	04hrs
Unit-9	Antihypertensive agents: Beta-blockers: Timolol, Atenolol. ACE Inhibitors: Captopril, Enalapril, Losartan potassium. α 1 – antagonist: Doxazocin α 2- agonist: Guanabenz Miscellaneous: Reserpine, Hydralazine, Minoxidil.	05hrs
Unit-10	Antihyperlipidemic agents: Clofibrate, Lovastatin. Anticoagulants: Dicoumarol, <u>Warfarin</u> , Phenindione.	1.5hrs
Unit-11	Hypoglycaemic agents: Insulin, <u>Chlorpropamide</u> , Metformin, Gliclazide, Nateglinide and Pioglitazone	1.5hrs
Unit-12	Thyroid and Antithyroid agents: Thyroxine, Thyronine, Propyl thiouracil and Methimazole.	02hrs
Unit-13	Diuretics: Carbonic anhydrase inhibitors: <u>Acetazolamide</u> , Torsemide. Thiazide and Thiazide like diuretics: <u>Chlorothiazide</u> , Benzthiazide, Xipamide High-ceiling or loop diuretics: <u>Furosemide</u> , Ethacrynic acid. Potassium sparing diuretics: Spironolactone, <u>Triamterene</u> , Amiloride. Miscellaneous: Mannitol.	05hrs
Unit-14	Steroids and related drugs: Steroidal nomenclature, stereochemistry and biosynthesis, Testosterone, Oxandrolone, Flutamide, Estradiol, Estrone, <u>Diethylstilbestrol</u> , <u>Tamoxifen</u> , Progesterone, Megestrol, Norgestrol, Cortisone Hydrocortisone, Betamethasone, Fludrocortisone,	06hrs
Unit-15	Current trends in photodynamic therapy: History and development.	01hr
3.7.3	Medicinal Chemistry-II Practical	90 Hours 06 hrs/ week
Unit – 1	Monograph analysis of following drugs: Aspirin, Ascorbic acid, Paracetamol, Phenobarbitone, Isonicotinic acid hydrazide (INH), Atropine, Ibuprofen, Analgin and Acetazolamide. **	
Unit – 2	Synthesis and characterization of the following drugs involving two or more steps and their spectral analysis: * Chloramine-T, Dichloramine-T, Sulphacetamide, Phenytoin, Cinnamic acid, Barbituric acid, 7-hydroxy -4- methyl coumarin, Paracetamol and Benzocaine	

Text Books			
Name of Authors	Titles of the Book	Edition	Name of the Publisher
Indian Pharmacopoeia Committee	Indian Pharmacopoeia	--	Ministry of Health & Family welfare, Govt. of India.
Donald J. Abraham	Burger's Medicinal Chemistry and Drug Discovery	6th	John Wiley and sons.
John M. Beale, Jr. John H. Block	Wilson & Gisvolds Text Book of Organic & Medicinal Chemistry	12 th Ed	Lippincott Williams and Wilkins.
Thomas L. Lemke David A. Williams	William O Foye's Principles of Medicinal Chemistry	6 th	Lippincott Williams and Wilkins.
James E.F. Reynolds	Martindale, The Extra Pharmacopoeia	29 th	Pharmaceutical Press, England
Lednicer and Mitscher	Organic Drug Synthesis	--	John Wiley and sons
A.I. Vogel, A.R. Tatchell, B.S. Furnis, A.J. Hannaford, P.W.G. Smith	Vogel's Text Book of Practical Organic Chemistry	5 th Ed	Pearson Education
Corwin Hansch	Comprehensive Medicinal Chemistry by Hansch series	Vol 1-6	Elsevier Press.
Becket A.H. and Stanlake	Practical Pharmaceutical Chemistry, Vol.I & II	--	CBS Publishers.
Surendranath Pandeya	Text Book of Medicinal Chemistry Vol. I & II	--	S.G.Publisher, Varanasi

Name of the Course: Biopharmaceutics & Pharmacokinetics (Theory)		
Course code: 3.7.4	Semester: VII	
Duration: Theory 60 hours	Maximum Marks: 100	
Teaching Scheme:	Examination Scheme	
Theory: 03 hrs/week	Sessional Exam: 20 Marks	
Tutorial: 01 hr /week	End Semester Exam: 80 Marks	
Practical: -- hrs/week		
Objective:-		
S.No		
1.	To construct kinetic models to describe drug absorption, distribution and elimination in the body.	
2.	To calculate pharmacokinetic parameters from the given data	
3.	To apply the principles of pharmacokinetics in new drug development as well as in the design of new formulations.	
Pre- Requisite:-		
1	Basics of physiology, drug distribution, absorption, pharmacokinetics, bioavailability of drugs etc	
Units		
Units	Contents	Hrs/week
Unit-1	Introduction to Biopharmaceutics and Pharmacokinetics: Role in product development and clinical setting.	03 hrs
Unit-2	Absorption : Fate of drug after administration, routes of drug administration, drug absorption, disposition, Factors involved and their mechanisms – detailed study on physicochemical, biological and dosage form considerations in drug absorption.	12 hrs
Unit-3	Drug distribution: Definition, distribution in blood and body fluids, cellular distribution, drug penetration to CNS, placental transfer of drugs and blood flow, factors affecting drug distribution, volume of distribution, plasma protein binding.	10 hrs
Unit-4	Metabolism of drugs: Definition, brief overview of Phase I and Phase II reactions. Factors affecting biotransformation.	05 hrs
Unit-5	Excretion of Drugs: Definition, renal and nonrenal excretion, Concept of clearance-Renal clearance, Organ clearance and Hepatic clearance.	05 hrs
Unit-6	Pharmacokinetics: Introduction, compartment models, blood level curves, pharmacokinetic parameters, biological half-life, apparent volume of distribution, renal clearance, absorption rate, Area Under Curve (AUC) - their significance, Kinetics of blood levels following IV, oral, single and repeated administrations.	10 hrs
Unit-7	Bioavailability and bioequivalence: a. Measures of bioavailability, C_{max} , T_{max} and AUC. b. Design of single dose bioequivalence study and relevant statistics. c. Review of regulatory requirements for condition of bioequivalent	10 hrs

	studies.		
Unit-8	Dosage Regimen: Multiple dosing with respect to IV and oral route, concept of loading dose, maintenance dose and accumulation index.		05 hrs
Text Books			
Sl.No	Name of the Book	Author	Publisher
01	Biopharmaceutics and Clinical Pharmacokinetics	Milo Gibaldi.	Pharma book syndicate, Hyderabad.
02	Biopharmaceutics and Pharmacokinetics	A. Treatise, D. M. Brahmankar and Sunil B. Jaiswal.	Vallabh Prakashan, Delhi.
03	Applied Biopharmaceutics and Pharmacokinetics	Shargel. L. and Yu ABC.	Connecticut, Appleton Century Crofts, USA.
04	Text Book of Biopharmaceutics and Pharmacokinetics	Dr. Shobha Rani R. Hiremath	Prism Books Pvt Ltd, Bangalore.
05	Pharmacokinetics	Gibaldi.M, Perrier.D.	Marcel Dekker Inc., New York.
06	Current Concepts in Pharmaceutical Sciences: Biopharmaceutics	Swarbrick. J.	Lea And Febiger, Philadelphia.
07	Clinical Pharmacokinetics: Concepts and Applications	Malcolm Rowland and Thomas N. Tozer.	Lea And Febiger, Philadelphia.
08	Dissolution, Bioavailability and Bioequivalence	Abdou. H. M.	Mack Publishing company, Pensylvania.
09	Biopharmaceutics and Clinical Pharmacokinetics: An Introduction	Robert.E. Notari	Marcel Dekker Inc., New York.
10	Biopharmaceutics and relevant Pharmacokinetics	John G. Wagner and M.Pernarowski	Drug Intelligence Publications, Hamilton, Illinois.
11	Biopharmaceutics and Pharmacokinetics	V. Venkateshwarlu	Pharma book syndicate, Hyderabad.

Name of the Course: Pharmaceutical Management and Marketing (Theory)		
Course code: 3.7.5		Semester: VII
Duration: Theory 45 hours		Maximum Marks: 100
Teaching Scheme:		Examination Scheme
Theory:	03 hrs/week	Sessional Exam: 20 Marks
Tutorial:	01 hr /week	End Semester Exam: 80 Marks
Practical:	-- hrs/week	
Objective:-		
S.No		
1.	To provide various aspects of management in pharmaceutical business.	
2.	To provide information on planning & forecasting.	
3.	To familiarize students with the significance of communication, marketing strategies, motivation, leadership aspects in business.	
Pre- Requisite:-		
1	Basic & preliminary knowledge of communication, time management	
Units	Contents	Hrs/week
Unit-1	Introduction to management Basic concepts and principles of management, Levels of management, pharmaceutical management art, science or profession. Functions of management.	05
Unit-2	Planning and Forecasting Planning: Nature, types of planning, steps in planning process, planning premises. Advantages and limitations of planning. Management by objectives, meaning, objective features, advantages and limitations. Forecasting: meaning, nature, importance, limitations. Techniques of forecasting.	05
Unit-3	Organization Definition, principles and line and staff organization.	03
Unit-4	Communication Nature, types of communication, process and barriers of communication. Importance in pharmaceutical industries.	03
Unit-5	Leadership and motivation Leadership: meaning, nature, leadership styles. Motivation: meaning, nature, theories, importance.	04
Unit-6	Control and decision-making Definition and steps in process of control. Definition and steps in process of decision-making	02
Unit-7	Marketing: The meaning and scope of marketing. Marketing concepts. Pharmaceutical market- Quantitative and qualitative aspects, demographic descriptions and socio psychological characteristics of the	06

	consumer. Market segmentation. Market research. Motivation and prescribing habits of the physician.	
Unit-8	The Pharmaceutical product: Meaning and classification of products; Marketing mix, Product life cycle (PLC), Product differentiation, me-too products, New product development-All stages from the new product idea to the stage of marketing the developed product (bulk drugs and formulations). Branding- Concept of brand, Different types of brand, importance. Packaging.	07
Unit-9	Distribution: The wholesaler-His role in distribution of Pharmaceutical services offered to the manufacturer and the retailer, advantages and disadvantages of distribution through wholesaler. The retailer-Classification of retail institutions, advantages and disadvantages of retail institutions, the hospital as retail outlet.	03
Unit-10	Pricing: Meaning and importance. Pricing competition- types, pricing strategies. Non-pricing competition- All types of non-price competition with special emphasis on competition through research and development, competition through quality, patents, trademarks.	03
Unit-11	Promotion: Different ways of promotion- Advertising, direct mail, professionals, journals, sampling, retailing, medical exhibition, public relations. Professional sales representative-duties of PSR, purpose of detailing, selection, training and compensation of PSR.	04
	Total	45

Text Books

Name of Authors	Titles of the Book	Edition	Name of the Publisher
B. Gupta	Management Theory and Practice		Sultan Chand and Sons, Educational publishers, New Delhi
Peter Bamfield	Research and Development Management in the Chemical and Pharmaceutical Industry		Wiley-VCH Verlag GmbH & Co. KgaA, Germany
P. C. Tripathi, P.N.Reddy	Principles of Management		Tata McGraw Hill Publishing Company, Ltd
C.Subba Rao	Pharmaceutical Marketing in India		Asian Institute of Pharmaceutical Marketing, Hyderabad
Mickey C. Smith	Principles of Pharamceutical Marketing		CRS Publishers and Distributors, New Delhi
Mickey C. Smith	Pharmaceutical Marketing in the 21 st Century		Viva Books Pvt. Ltd.
Davar R.S.	The Management Process		Progressive Corporation Pvt. Ltd.
Saksena S.C.	Business Administration and Management		Sahitya Bhavan Agra, UP.

Name of the Course: Medicinal Chemistry-III (Theory & Practical)		
Course code: 3.8.1		Semester: VIII
Duration: Theory 45 hours & Practical 90 hrs		Maximum Marks: 100
Teaching Scheme:		Examination Scheme
Theory: 03 hrs/week	Sessional Exam: 20 Marks	
Tutorial: 01 hr /week	End Semester Exam: 80 Marks	
Practical: 06 hrs/week		
Objective:-		
S.No		
1.	Concepts of chemistry in medicinal compounds	
2.	Importance of prodrugs, combinatorial chemistry, microwave synthesis in drug design	
Pre- Requisite:-		
1	Knowledge of chemistry, SAR, mechanism, pharmacology etc	
Units		
Units	Contents	Hrs/week
Unit-1	Brief introduction and concepts of prodrugs, Combinatorial chemistry and Microwave synthesis.	01
Unit-2	History and development of the following classes of drugs: Definition, classification with examples including structure and chemical name, SAR, MOA and synthesis of underlined compounds.	02
Unit-3	Anti-infective agents: Isopropyl alcohol, Chlorophenol, Hydrogen peroxide, Povidone-Iodine, Thimerosal, Gentian violet and Parabens	03
Unit-4	Antifungal agents: Griseofulvin, Clotrimazole, Terconazole, Tolnaftate, Fluconazole, Amphotericin-B and Flucytosine	03
Unit-5	Urinary tract anti-infective agents: Nalidixic acid, <u>Norfloxacin</u> , Ciprofloxacin, Sparfloxacin, Ofloxacin and Gemifloxacin.	03
Unit-6	Antitubercular agents: <u>PAS</u> , INH, Ethambutol, Cycloserine and Rifampicin.	03
Unit-7	Antiviral agents: Acyclovir, Idoxuridine, Ribavirin, Zidovudine, Stavudine, Nevirapine, <u>Delavirdine</u> , Saquinavir and Ritonavir	06
Unit-8	Antiprotozoal and Anthelmintics: Diloxanide furoate, <u>Metronidazole</u> , <u>Albendazole</u> , <u>Thiabendazole</u> , Diethyl carbamazepine and Niclosamide	03
Unit-9	Sulphonamides: Sulfamethizole, <u>Sulfisoxazole</u> , Sulfacetamide, Sulfamethoxazole, <u>Trimethoprim</u> , Sulfasalazine and <u>Dapsone</u>	03
Unit-10	Antimalarials: <u>Chloroquine</u> , <u>Pamaquine</u> , <u>Proguanil</u> , <u>Cycloguanil</u> and Artemisinin	04
Unit-11	Antibiotics: Penicillins- Penicillin G, Penicillin V, Cloxacillin, Ampicillin, <u>Amoxicillin</u> and Clavulanic acid. Imipenem-Cilastatin	08

	Cephalosporins –Cephalexin, <u>Cefaclor</u> , Cefuroxime, Ceftributen and Cefpirome. Monbactams - Aztreonam, Aminoglycosides - Streptomycin, kanamycin, and Gentamicin Macrolides - Erythromycin, Clarithromycin and Azithromycin Tetracyclines- Chlortetracycline, Oxytetracycline, Doxycycline and Minocycline. Miscellaneous - <u>Chloramphenicol</u>		
Unit 12	Antineoplastic agents: <u>Chlorambucil</u> , Cyclophosphamide, Lomustine, Benzotepa, <u>Busulfan</u> , Dacarbazine, <u>Methotrexate</u> , Mercaptopurine, 5-Fluorouracil, Cytarabine, Daunorubicin, Actinomycin-D, Vincristine, Vinblastine, Megestrol, <u>Tamoxifen</u> , Cisplatin, Imatinib, Mesna, and Dexrazoxane	06	
3.8.1	Medicinal Chemistry-III Practical	90 hrs 06 Hrs/ week	
Unit – 1	Assay (Major Experiment) Sulphadiazine by diazotization. Chloroquine by nonaqueous titration Ascorbic acid by Iodimetry. Isonicotinic acid by KBrO ₃ (bromimetry) Benzyl penicillin by Iodometry Dapsone by diazotization.		
Unit – 2	Preparation and Characterization (by conventional /microwave) (Minor Experiment) PAS from p-nitro salicylic acid. Fluorescein from Phthalic anhydride. Phenothiazine from Diphenylamine Sulphanilamide from Acetanilide. INH from Isonicotinic acid. Chlorobutanol		
Text Books			
Name of Authors	Titles of the Book	Edition	Name of the Publisher
Indian Pharmacopoeia Committee	Indian Pharmacopoeia	--	Ministry of Health & Family welfare, Govt. of India.
Donald J. Abraham	Burger's Medicinal Chemistry and Drug Discovery	6 th Ed	John Willey and sons.
John M. Beale, Jr. John H. Block	Wilson & Gisvolds Text Book of Organic & Medicinal Chemistry	12 th Ed	Lippincott Williams and Wilkins.
Thomas L. Lemke David A. Williams	William O Foye's Principles of Medicinal Chemistry	6 th Ed	Lippincott Williams and Wilkins.

James E.F. Reynolds	Martindale, The Extra Pharmacopoeia	29 th Ed	Pharmaceutical Press, England
sLednicer and Mitscher	Organic Drug Synthesis	--	John wiley and sons
A.I. Vogel, A.R. Tatchell, B.S. Furnis, A.J. Hannaford, P.W.G. Smith	Vogel's Text Book of Practical Organic Chemistry	5 th Ed	Pearson Education
Corwin Hansch	Comprehensive Medicinal Chemistry by Hansch series	Vol 1-6	Elisever Press.
Becket A.H. and Stanlake	Practical Pharmaceutical Chemistry, Vol.I & II		CBS Publishers.
C.Oliver Kappe, Doris Dallinger and S.Shaun Murphree	Practical Microwave Synthesis for Organic Chemists: Strategies, Instruments and Protocols	2009	Wiley-VCH Verlag GmbH & Co. KGaA, Weinheim.ISBN 978-527-32097-4
Surendranath Pandeya	Text Book of Medicinal Chemistry Vol. I & II	--	S.G.Publisher, Varanasi

Name of the Course: Advanced Pharmaceutics (Theory & Practical)		
Course code: 3.8.2		Semester: VIII
Duration: Theory 45 hours & Practical 45hrs		Maximum Marks: 100
Teaching Scheme:		Examination Scheme
Theory:	03 hrs/week	Sessional Exam: 20 Marks
Tutorial:	01 hr /week	End Semester Exam: 80 Marks
Practical:	06 hrs/week	
Objective:-		
S.No		
1.	The students shall have an understanding of the concept, design and evaluation of various sustained and controlled release dosage forms.	
2.	To train the students to formulate advanced drug delivery systems	
Pre- Requisite:-		
1	Basic knowledge about manufacturing aspects and biopharmaceutics is essential	
Units		
	Contents	Hrs/week
Unit-1	Quality Assurance: Organization and personnel: Responsibilities, Training and Hygiene.	04
Unit-2	Manufacturing documents, Standard operating procedures, Master formula records, Batch Manufacturing record.	04
Unit-3	Design and Study on process validation and equipment validation of autoclave and dissolution apparatus.	05
Unit-4	Controlled Drug Delivery System: Dissolution, Diffusion, Combination of dissolution and diffusion controlled, Osmotic controlled, Hydrodynamically balanced systems and Ion Exchange controlled systems.	09
Unit-5	Microencapsulation: Methods, kinetics of drug release from microcapsules technology and applications.	04
Unit-6	Transdermal Drug Delivery Systems: Theory, formulation designs and evaluation.	04
Unit-7	Advances in drug delivery systems: Definition, advantages, disadvantages, types, components and applications to Buccal, Nasal and Ocular delivery.	05
Unit-8	Oral site specific drug delivery systems: Gastroretentive drug delivery systems, Colon specific drug delivery systems, pH controlled.	04
Unit-9	Concept, method and application of drug targeting for Nanoparticles, Liposomes and Erythrocytes.	06

3.8.2	Advanced Pharmaceutics (Practicals)	90 Hours 06 hrs/ week	
1	Preparation and evaluation of microcapsules by different microencapsulation techniques.		
2.	Preparation and evaluation of matrix tablets by using various polymers		
3.	Preparation and Evaluation of Transdermal patches (suitable drug) by solvent casting method.		
4.	Study of In-Vitro dissolution of various sustained release formulations of marketed products.		
5.	Preparation & characteristics of slightly soluble drugs using various solid dispersion techniques by melting/ solvent evaporation method		
6.	Formulation and Evaluation of Ophthalmic <i>In-Situ</i> gel using carbopol.		
7.	Preparation and Evaluation of Buccal films using Hydrophilic polymers by solvent casting method		
8.	Preparation of Standard operating procedures (SOP) of equipments used in manufacture of Tablets and Parenterals.		
9.	Validation of Dissolution apparatus		
10.	To prepare documentation of house keeping		
11.	To Prepare documentation of personal training record		
12.	To prepare documentation of Master formula record		
13.	To prepare documentation of Batch Manufacturing record		
Text Books			
Sl.No	Name of the Book	Author	Publisher
01	Good Laboratory Practice Regulations	S. Weinberg	Marcel and Dekker, New York.
02	Validation of Aseptic Pharmaceutical Processes	F.J Carleton & J.P Agalloco	Marcel and Dekker, New York.
03	Pharmaceutical Process Validation.	J.R. Berry and R.A. Nash	Marcel and Dekker, New York.
04	Understanding ISO 9000 and Implementing the basics to Quality.	D.H. Stamatis	Marcel and Dekker, New York.
05	“How to practice GMPs”	P.P. Sharma	Vandana Publications, New Delhi.
06	Pharmaceutical Quality Assurance.	Manohar A. Potdar	Nirali Prakashan, Mumbai.
07	Introduction to ISO 9000 and Total Quality Management	Shdhan K. G	Oxford Publications, Calcutta.
08	SOP Guidelines, 2nd Ed.	D. H. Shah	Business Horizon.
09	Novel Drug Delivery Systems	Yie W. Chien	Marcel Dekker Inc., New York.
10	Controlled Drug Delivery Systems	J.R Robinson & Vincent H. Lee	Marcel Dekker Inc., New York.

11	Sustained & Controlled Drug Delivery Systems	J.R Robinson	Marcel Dekker Inc., New York.
12	Advances in Controlled & Novel Drug Delivery Systems	N.K.Jain	Vallabh Prakashan, New Delhi.
13	Microencapsulation	J.R Nixon	Marcel Dekker Inc., New York.

Name of the Course: Pharmacotherapeutics (Theory)		
Course code: 3.8.3	Semester: VIII	
Duration: Theory 60 hours	Maximum Marks: 100	
Teaching Scheme:	Examination Scheme	
Theory: 04 hrs/week	Sessional Exam: 20 Marks	
Tutorial: 01 hr /week	End Semester Exam: 80 Marks	
Practical: -- hrs/week		
Objective:-		
S.No		
1.	To understand the importance of rational prescribing of drugs and concept of essential drugs.	
2.	To know the etiology, clinical manifestations, investigations, complications, diagnosis of disease and drug treatment including pharmacotherapy and non-pharmacotherapy	
Pre- Requisite:-		
1	Basic knowledge about pharmacology ADME and drugs information.	
Units	Contents	Hrs/week
Unit-1	Basic Principles of Pharmacotherapy Individualization of drug therapy Pharmacokinetic consideration Pharmacodynamic consideration Other factors that affect therapeutic outcomes Approach to individualization therapy Drug regulation and development Adverse drug reactions and drug toxicity Factors affecting drug therapy outcomes	10
Unit-2	Drug induced diseases	02
Unit-3	Brief introduction, definition, classification (type), epidemiology, etiology, clinical manifestations, investigations, complications, diagnosis of disease and drug treatment includes pharmacotherapy and non-pharmacotherapy such as desired outcomes, overall goal of the therapy, treatment algorithm, first line treatment, treatment in concomitant conditions liked renal failure, asthma, dislipidemia, anemia, clinical monitoring and patient care (patient education and life style modification) of the following system/diseases: <ul style="list-style-type: none"> i. Cardiovascular System: Hyperlipidemias, hypertension, congestive heart failure, ischemic heart diseases, cardiac arrhythmias. ii. Neuropsychiatry: CNS Disorders: Epilepsy, Parkinsonism. iii. Pulmonary disorders: Asthma, COPD. iv. Endocrine disorders: Diabetes mellitus, Thyroid disease 	06 03 03

	v. Infectious Diseases: Tuberculosis, Malaria, Urinary tract infections, Gastroenteritis, Pneumonia, upper respiratory tract infections.	04 09	
	vi. Joint and musculoskeletal: Rheumatic arthritis, SLE.		
	vii. Hematological disorders: Anemia, drug induced hematological disorders.	03 04	
	ix. Neoplasm: Acute leukemia and Hodgkin's disease.	03	
	x. GIT: Peptic ulcer and ulcerative colitis.	03	
	xi. Liver: Hepatitis, Cirrhosis.	02	
	xii. Dermatological Disorders: Acne, Psoriasis, Eczema.	03	
	xiii. Common ocular disorders and infections. Glaucoma	01	
	xiv. Immunology: HIV	02	
	xv. Nutrition: Enteral nutrition, Parenteral nutrition	02	
Text Books: Latest edition			
Sl.No	Name of the Book	Author	Publisher
01	Clinical Pharmacy and Therapeutics	Editors: Roger Walker and Clive Edwards	M/s Churchill Living stone, Edinburgh
02	Hand Book of Applied Therapeutics	Mary Anne Koda-Kimble, Lloyd Young, Wayne AK, B.Joseph Guglieolmo.	M/s Lippincott Williams and Wilkins.
03	Pharmacotherapy: A Pathophysiological Approach.	Joseph T Dipiro, Robert L Talbert, Gray Cyee, Gary R Matzke, Barbara G Wells, Michael Fosey.	M/s Appleton and Lange
04	Clinical Pharmacy and Therapeutics	Eric T Herfindal and Dick R, Gourley	Linda Lloyd Hart. M/s Williams and Wilkins.
05	Clinical Pharmacy	Dr Tipnis and Dr Amrita Bajaj.	M/s Career publisher, Nasik. Maharashtra.
06	Pharmacology and Pharmacotherapeutics	Satoskar RS, Bhandarkar SD, Nirmal N Rage	Popular Prakashan, Mumbai.
07	Goodman and Gilman's The Pharmacological basis of therapeutics	A Goodman Gilman, T.W. Rall, ALS. Nies, P. Taylor	McGraw – Hill, New Delhi.
08	Encyclopedia of Clinical Pharmacy	Joseph T Dipiro	Marcel Dekkar Inc. USA

Name of the Course: Regulatory Affairs (Theory)		
Course code: 3.8.4		Semester: VIII
Duration: Theory 45 hours		Maximum Marks: 100
Teaching Scheme:		Examination Scheme
Theory:	03 hrs/week	Sessional Exam: 20 Marks
Tutorial:	01 hr /week	End Semester Exam: 80 Marks
Assignment:	-- hrs/week	
Objective:-		
S.No		
1.	To know the regulatory compliance with the manufacturing aspects	
Pre- Requisite:-		
1	Basic knowledge about manufacturing aspects, SOP/BMR documentation is essential	
Units	Contents	Hrs/week
Unit-1	Intellectual property rights: Strategy in bioinformatics.	03
Unit-2	Patents: Patent search, process of patent, economic theories, cost and benefits of patents.	08
Unit-3	TRIPS and pharmaceutical industry: its issues and prospects.	04
Unit-4	GMP and regulations: cGMP, Indian GMP regulations, International GMP regulations (ICH and WHO guidelines on GMP)	10
Unit-5	Regulatory Compliance: India, USA, Other countries.	05
Unit-6	Formatting, assembling and submitting the new drug application(NDA) -FDA guidelines -Assembling applications for submission -NDA contents -The NDA in CTD (Common Technical Document) format.	03
Unit-7	Generic drug approval -Approval and marketing of OTC Human drugs	02
Unit-8	Pharma legislation: A background -import and export of licence and drugs	05
Unit-9	Pharmacovigilance in EU, USA, INDIA	02
Unit-10	Regulatory affairs in relation to other professions -RA : an emerging profession -Development of profession -Responsibilities, qualification, skills, abilities of RA professionals -relationship of RA to other professions -advantages of certification.	03

Text Books			
S.No	Titles of the Book	Name of Authors	Name of the Publisher
01	The pharmaceutical regulatory process	I. R. Berry	Marcel Dekker
02	The Patent Act 1970 and its Latest amendments		The Gazettes of India
03	The complete patent book: Everything you need to know to obtain your patent	J. L. Rogers	Sphinx Publishing
04	Good laboratory practice: guidance on archiving		MHRA guidelines
05	Good Laboratory Practice Regulations, fourth edition	Sandy Weinberg	Informa Healthcare
06	Good laboratory practice (GLP): quality practices for regulated non-clinical research and development - 2 nd edition	M.J. Stoklosa and H.C. Ansel	World Health Organization.
07	Generic drug product development solid oral dosage forms	L. Shargel, I. Kanfer	Marcel Dekker

Name of the Course: Nanopharmaceuticals/ Nanomedicine (Theory) (Optional subjects)			
Course code: 3.8.5		Semester: VIII	
Duration: Theory 45 hours		Maximum Marks: 100	
Teaching Scheme:		Examination Scheme	
Theory:	03 hrs/week	Sessional Exam: 20 Marks	
Tutorial:	01 hr /week	End Semester Exam: 80 Marks	
Practical:	-- hrs/week		
Objective:-			
S.No			
1.	To study the concept and application of drug targeting by Nanotechnology		
2.	To know the different methodology in Nanotechnology		
Pre- Requisite:-			
1	Basic knowledge about drug delivery system is essential		
Units	Contents		Hrs/week
Unit-1	Introduction to Nanoscience, history, milestones, Nanotechnology, concepts, techniques and applications of Nanoscience.		06
Unit-2	Overview of different available nanomaterials such as nanoparticles, nanowires, fullness nanotubes, nanocomposites, medical applications of nanomaterials, introduction to nanomedicine, applications and challenges of nanomedicine, overview of nanomedicine markets and business aspects.		12
Unit-3	Nanopharmaceuticals: Fundamentals and applications of Nanoparticles for gene therapy, drug delivery and drug targeting, cancer treatment, drug tracking systems.		08
Unit-4	Therapeutic action of nanoparticles and nanodevices targeted, non-targeted delivery: controlled drug release: theranostics (simultaneous diagnosis and drug delivery).		08
Unit-5	Nanoparticles: Pharmaceutical production, quality assurance and regulations.		07
Unit-6	Health and safety issues, ethical, social and policy issues involved in production and commercialization of nanomedicine.		04
Text Books			
Name of Authors	Titles of the Book	Edition	Name of the Publisher
Yie W. Chien	Novel Drug Delivery Systems		Marcel Dekker Inc., New York.
J.R Robinson & Vincent H. Lee	Controlled Drug Delivery Systems		Marcel Dekker Inc., New York.
J.R Robinson	Sustained & Controlled Drug Delivery Systems		Marcel Dekker Inc., New York.
N.K.Jain	Advances in Controlled & Novel Drug Delivery Systems		Vallabh Prakashan, New Delhi.

Name of the Course: Clinical Trials and Research Methodology (Theory) (Optional subjects)			
Course code: 3.8.5		Semester: VIII	
Duration: Theory 45 hours		Maximum Marks: 100	
Teaching Scheme:		Examination Scheme	
Theory:	03 hrs/week	Sessional Exam: 20 Marks	
Tutorial:	01 hr /week	End Semester Exam: 80 Marks	
Practical:	-- hrs/week		
Objective:-			
S.No			
1.	To imbibe the concept of Schedule Y guidelines		
2.	To know the features of clinical trials and principle of sponsors, investigators		
Pre- Requisite:-			
1	Knowledge of basic pharmacology and therapeutics		
Units	Contents		Hrs/week
Unit-1	Clinical trials: Introduction Historical perspective, Different phases of clinical trials		04
Unit-2	Ethical issues in clinical research – IRB/IEC, Schedule Y guidelines		04
Unit-3	Features of clinical trials		05
Unit-4	Outcome measures in clinical research		03
Unit-5	Responsibilities of principle investigators, sponsors and study documents		08
Unit-6	Monitoring of clinical research,		04
Unit-7	Data analysis and interpretation		06
Unit-8	Reports, publications and critical review		04
Unit-9	Reviews, meta-analysis and practice		04
Unit-10	Review of Literature (MEDLINE, Cochrane collaboration)		03
Text Books			
Name of Authors	Titles of the Book	Edition	Name of the Publisher
Julia Lloyd and Ann Raven Ed.	Handbook of clinical research.		Churchill Livingstone c.
Giovanna di Ignazio, Di Giovanna and Haynes.	Principles of Clinical Research		
David Machin, Simon Day and Sylvan Green, March 2005,	Textbook of Clinical Trials		John Wiley and Sons.
	Central Drugs Standard Control		New Delhi: Ministry of

	Organization. Good Clinical Practices-Guidelines for Clinical Trials on Pharmaceutical Products in India.		Health; 2001.
	International Conference on Harmonization of Technical requirements for registration of Pharmaceuticals for human use. ICH Harmonized		Tripartite Guideline. Guideline for Good Clinical Practice.E6; May 1996.
	Ethical Guidelines for Biomedical Research on Human Subjects 2000.		Indian Council of Medical Research, New Delhi.

Name of the Course: Standardization and Quality control of Herbal Drugs (Theory) (Optional subjects)		
Course code: 3.8.5	Semester: VIII	
Duration:45	Maximum Marks: 100	
Teaching Scheme:	Examination Scheme	
Theory: 03 hrs/week	Sessional Exam: 20 Marks	
Tutorial: 01 hr /week	End Semester Exam: 80 Marks	
Practical: -- hrs/week		
Objective:-		
S.No		
1.	To develop the concept of value addition to herbal drugs in terms of quality standards and standardization of herbal drugs.	
2	To make learners aware about the regulatory aspects of intellectual properties related to the Herbs	
Pre- Requisite:-		
1	Basic knowledge of Industrial Pharmacognosy is essential	
Units	Contents	Hrs/week
Unit-1	Introduction: Factors affecting quality of crude drugs, methods for documentation and preservation of crude drugs and their products, detection of common adulterants, microbial contamination, toxic metals, pesticides, insecticides and insect infestation in whole and powdered drugs.	7
Unit-2	Role of biomarkers in standardization of phytopharmaceuticals Study of following biomarkers a. Berberin b. Curcuminoids c. Strychnin d. Hyoscyamin e. Forskolin	8
Unit-3	Analytical profile of following medicinal plants a. <i>Adhatoda vasaka</i> b. <i>Andrographis paniculata</i> c. <i>Centalla asiatica</i> d. <i>Withania somnifera</i> e. <i>Glycyrrhiza glabra</i> f. <i>Curcuma longa</i> g. <i>Acorus calamus</i> h. <i>Phyllanthus amarus</i> i. <i>Berberis aristata</i> j. <i>Piper longum</i>	10
Unit-4	Pharmacological screening of herbal drugs, Need and new strategies for pharmacological screening a. Hepatoprotective b. Diuretic	8

	<ul style="list-style-type: none"> c. Anti ulcer d. Anti oxidant e. CNS agents 	
Unit-5	Standardization and evaluation of Ayurvedic formulations as per Ayurvedic Pharmacopoeia <ul style="list-style-type: none"> a. Asava & Arista b. Churna c. Bhasma d. Ghutika e. Taila 	5
Unit-6	Stability study of phytopharmaceuticals as per ICH guidelines	2
Unit-7	<ul style="list-style-type: none"> a. Role of HPLC and HPTLC in evaluation of herbal drugs b. Role of Spectroscopic analysis in evaluation of herbal drugs 	5

Text Books

Name of Authors	Titles of the Book	Edition	Name of the Publisher
Text Book of Pharmacognosy	Kokate C.K., Purohit A.P and Gokhale S.P	35 th	Nirali Prakashan, Pune
Trease and Evans,	Pharmacognosy	15 th	W.B.Saunders, New York
V.E., Tylor, L.R. Brady and S.B., Robbers	Pharmacognosy	9 th	K.M. Varghese Co. Bombay.
Wallis T.E.	Textbook Of Pharmacognosy	4 th	CBS, Delhi
Iyengar M.A and Nayak S.G.K.	Anatomy of Crude Drugs	12 th	Manipal power press, Manipal.
Kokate C.K	.Practical Pharmacognosy	12 th	Vallabh Prakashan, Delhi.
Harborne J.B.	Phytochemical Methods	.3 rd	Chapman and Hall, International Edition, London
Brain K.R and Turner T.D.	The Practical Evaluation of Phytopharmaceuticals	1975	Wright-Sciotechnica, Bristol.
Raphael Ikan	Natural Products – A Laboratory Guide	2 nd	Academic Press, New York, USA.
Wagner H., Bladt S., Zagajski E.M.	Plant Drug Analysis	2 nd	Springer-Verlag, Berlin, London.
Pulok K, Mukherjee	Quality control methods of Herbal drugs	1 st	Business Horizons, New Delhi.
WHO	Quality control methods for medicinal plant materials	3 rd	WHO, Geneva
Smith P. M.	The Chemotaxonomy of Plants	2009	Edinburgh

Name of the Course: Pharmaceutical Manufacturing Management (Theory)		
(Optional subjects)		
Course code: 3.8.5	Semester: VIII	
Duration:45	Maximum Marks: 100	
Teaching Scheme:	Examination Scheme	
Theory: 03 hrs/week	Sessional Exam: 20 Marks	
Tutorial: 01 hr /week	End Semester Exam: 80 Marks	
Practical: -- hrs/week		
Objective:-		
S.No		
1.	Facilitate the needs of pharmaceutical industry.	
2.	Work in F&D/R&D departments for the formulation development.	
3.	Know safety guidelines which prevent industrial hazards.	
Pre- Requisite:- Nil		
1	Basic requirements of Pharmaceutical manufacturing and technology is essential	
Units	Contents	Hrs/week
Unit-1	Production Area Design: Pharmaceutical Industry Profile, Facility Planning, Mechanical Utilities, High Purity Water, Oral Solid Dosage Facilities, Sterile Manufacturing layout, facilities and control, Packaging/Warehousing	08
Unit-2	Product management and Documentation: ISO 9000 series, Total quality management, guide to pharmaceutical manufacturing facilities, Productivity, GMP considerations, Quality assurance and process control, stress on documentation practices.	08
Unit-3	INDUSTRIAL SAFETY: Industrial hazards due to fire accidents, mechanical and electrical equipments, chemical and pharmaceutical. Monitoring and prevention systems. Industrial effluent testing and treatment. Discussion on industrial accident case studies, environment and pollution acts.	05
Unit-4	Inventory management: Costs in inventory, inventory categories-special considerations, selective inventory control, reorder quantity methods and EOQ, inventory models, safety stock-stock out, lead time-reorder time methods, modern inventory management systems, inventory evaluation.	04
Unit-5	MATERIAL MANAGEMENT AND HUMAN RESOURCE DEVELOPMENT: Materials-quality and quantity, value analysis, purchasing-centralized and decentralized, vendor development, buying techniques, purchasing cycle and procedures, stores management salvaging and disposal of scrap and surplus, Human resource development- Personnel training, job specification. Job enlargement and enrichment, blue and white-collar jobs. Labor welfare.	08

Unit-6	Team building and Leadership: Communication skills: Significance of communication, measures for effective communication (oral and written), barriers of communication. Team building activities and its significance, Professional Manager (Team leader)-tasks, responsibilities and skills needed. Leadership styles, decision making-types, procedures, evaluation and selection of alternatives, decision making under various situations.	08	
Unit-7	Contract Management: Definition, Principles of contract management, contract production and Analysis, Arrangement for contract manufacture, Contract giver, responsibilities, Contract acceptor, Facility requirements, cGMP considerations	04	
Text Books			
Name of Authors	Titles of the Book	Edition	Name of the Publisher
Leon Lachman, Herbert. A. Lieberman, Joseph. L. Kanig,	The theory and practice of Industrial Pharmacy	Special edition 2009	Varghese Publishing House, Hind Rajasthan Building, Dadar, Bombay-400014.
Gilbert. S. Banker, Christopher. T. Rhodes,	Modern Pharmaceutics	4 th edition	.Marcel Decker, Inc., 270 Madison Avenue, New York
Herbert. A. Lieberman, Leon Lachman, Joseph. B. Schwartz,	Pharmaceutical Dosage Forms-Tablets, Volumes 1, 2, 3	.	Marcel Decker, Inc., 270 Madison Avenue, New York
Kenneth, E. Avis, Leon Lachman, Herbert. A. Lieberman,	Pharmaceutical Dosage Forms- Parenteral Medications, Volumes 1 & 2	.	Marcel Dekker, Inc., 270 Madison Avenue, New York
Mark Gibson	Pharmaceutical Preformulation and formulation	1 st edition	Interpharm/CRC
E.A. Rawlins,	Bentley's textbook of Pharmaceutics	8 th edition	Baillere Tindall, London.
Heniz Weirich, Harold Kanootz,	Management- A Global Perspective	10 th Edition	McGraw-Hill International Edition, 1994.
Peter F. Drucker	Management, Tasks, Responsibilities, Practices,		Allied Publishers Ltd. Reprinted 1998