Raghavendra Institute of Pharmaceutical Education and Research (RIPER)

(Conferred Autonomous status from the academic year 2016-17)
Accorded under Sections 2 (f) and 12 (B) of UGC act 1956 and Accredited by National Board of Accreditation (NBA) and National Assessment & Accreditation Council (NAAC)
Approved by PCI and AICTE, New Delhi

Academic Regulations, Program structure
&
Syllabus

Effective from ACY 2016-2017

BACHELOR OF PHARMACY

(Applicable for the students admitted from 2016 -2017)

: Awarding University:
Jawaharlal Nehru Technological University Anantapur (JNTUA)

KR Palli Cross, Near SKU University, Anantapuramu, Andhra Pradesh, India - 515 721
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Academic Regulations, Program Structure & Syllabus

Bachelor of Pharmacy
Effective from ACY 2016-2017

Index

1. Academic Council Proceedings

Up on recommendation from Board of studies of this institution, regarding the approval of the document "Academic regulations, Program structure & Syllabus" for Bachelor of Pharmacy Program, the academic council approved the same during the 2nd academic council meeting held on 09.07.2016 at Board room of Raghavendra Institute of Pharmaceutical Education and Research (RIPER), Anantapuramu, Andhra Pradesh, India.

S.NO	Category as per UGC	Name	Signature
1	The Principal (Chairman)	Dr. Y. Padmanabha Reddy	
2	Heads department	Dr. P. Ramalingam	
		Dr. S. Jaffar sadiq	
		Dr. B. Srinath	
3	Four teachers of College	Dr. K. Ramakrishna Reddy	
		Dr. M.V. Jyothi	
		Dr. K. Somasekhar Reddy	
		Mr. S. Nagarjuna	
4	Four experts from outside the college	Dr. S. Kannan, Physician, RDT Hospitals, Bathalapalli, Anantapur (dist))	
		Mr. K. Anand , Industrialist and President, chemist and druggist association. Anantapur District	
		Dr. Hari Hara Theja Drug Inspector, Drug control department, Govt. of Andhra Pradesh	
		Dr. M. Kiran Kumar (Pharmaceutical Scientists from Industry)	
5	Three Nominees of the University	Prof. A. Ananda Rao (Ex-officio member), JNTUA	
		Prof. K. Rama Naidu ((Ex-officio member), JNTUA	
		Pro. N. Devanna (Member) JNTUA	— ABSENT —
6	Faculty member (Member secretary)	Dr. C. Sowmya	

2. Program Outcomes

After successful completion of the program the graduate will be able to

1. Use the knowledge of pharmaceutical science and Life Science in health care sectors.
2. Demonstrate to participate in design of pharmaceutical process and quality control and other related technique.
3. Acquire knowledge to conduct, analyze and interpret data of experiments in production, analytical and clinical aspects.
4. Contribute the acquired skills in multifaceted health sectors such as pharmaceutical industry, hospital, and technical organizations.
5. Adapt technical knowledge to visualize and work on laboratory and multidisciplinary tasks.
6. Translate skills to use modern Pharmaceutical tools, software and equipment to analyze and solve problems.
7. Appraise the knowledge of professional and ethical responsibilities liable to the profession and society
8. Assess and implement the professional knowledge in a research team and or alone in multidisciplinary tasks.
9. Illustrate the impact of Pharmaceutical sciences on the society and also will be aware of modern issues.
10. Develop confidence for self education and ability for life-long learning and to conduct research.
11. Modify knowledge in management skills and leadership qualities.

3. Introduction to the Document

The guidelines published in this document are official guidelines by the Academic council and Board of studies (BoS) of Raghavendra Institute of Pharmaceutical Education and Research (RIPER) (An Autonomous institution) sponsored by Raghavendra Educational and Rural Development Society (RERDS) – Anantapuramu, Andhra Pradesh. The document is a fusion product based on

a. Recommendations and guidelines stipulated for syllabus structure by UGC, AICTE, PCI, New Delhi.

b. Academic regulations stipulated by Jawaharlal Nehru Technological University Anantapur (JNTUA), Ananthapuramu, Andhra Pradesh.

c. Experts opinion from the Academic Council approved Advisory boards members includes both academicians and researchers from reputed organizations at national and international levels.

d. Suggestions and inputs from members of academic council and Board of studies.

e. Recommendations based on feedback from alumni, employers, faculty, students, parents and other experts from allied area.

This ***academic regulations, Program structure & Syllabus document*** has been prepared to ensure quality system in teaching and learning process, examination, assessment, and functioning of other academic related matters to the satisfaction of stakeholders, such as students, parents, alumni, employers, faculty, etc. This document provides core principles of academic regulations duly approved by academic council and board of studies of this institution. The Implementation of these academic regulations shall lead to be considered in the institute and thereby enrich the quality of education and research in the field of pharmaceutical sciences. The guidelines shall aid the transparency and accountability in the administration set up. The list of objectives for implementing academic regulations and course structure through these guidelines are listed below,

- to improve the academic regulations and course structure.
- to strengthen the Industry-Institute interaction.
- to comply with rules and regulations of regulatory bodies like JNTUA, PCI, AICTE etc.,
- to meet the requirements of accreditation council and board.
- to enhance the quality of teaching-learning process and assessments.
- to provide career support programs, training for enhancing quality in placements and

higher education.

- to place improved systems for feedback, self-appraisal of faculty and staff.
- to create bench marking with other institutes of repute.

4. Preamble

Title, application, and the authorities to interpret, clarify, modify and to amend

a) The regulations stated herein below shall be called as a document of "**Academic regulations, Program structure & syllabus"** for Raghavendra Institute of Pharmaceutical Education and Research (RIPER).

b) These regulations shall be in force from the batch admitted from 2016 -2017 by the date of ratification by the Academic council and Board of studies (BoS) of the college after the conferment of autonomous status by UGC.

c) In the event of any doubt about the interpretation of these regulations, the matter shall be referred to Academic council and Board of studies (BoS) and their decision shall be final.

d) The Academic council and Board of studies (BoS) shall have the authority to modify, amend and repeal any of the provisions of these regulations from time to time.

Definitions

In this document, unless there is anything repugnant to the subject or context

i. "***College***" means "Raghavendra Institute of Pharmaceutical Education & Research (RIPER) (An Autonomous Institution), Anantapuramu, Andhra Pradesh".

ii. "***Student***" means a candidate who has taken admission into Ph.D. / M. Pharm / B.Pharm / Pharm.D / D. Pharm course of this college as per the guidelines stipulated from time to time by the regulations of State Government of Andhra Pradesh and the Government of India for admissions into various courses of study and the affiliating university, i.e., Jawaharlal Nehru Technological University, Anantapur (JNTUA), Ananthapuramu, Andhra Pradesh.

iii. "***Academic Council***" means the Academic council constituted as per the guidelines of UGC.

iv. "***Board of Studies***" means Board of Studies constituted in each department as per the guidelines of UGC.

v. ***"Principal"*** means the Head of the institution

vi. ***"Head of the Department"*** means the Head of an Academic Department of the College.

vii. ***"Faculty member"*** means the teacher (Assistant/Associate/Professor) working on regular or adhoc basis in any of the Academic Departments of the College.

viii. *"**Program"*** means a candidate who has chosen to avail degree of Ph.D. / M. Pharm /B. Pharm / Pharm.D and diploma of D. Pharm of this college as per the marks/ rank awarded by the National/ University/ State common entrance tests, India.

ix. *"**Course**" individual subjects described with content for instructions to the students.*

x. ***"Specialization"*** means a candidate who has chosen into a specialty of the program such as "Pharmaceutical Analysis & Quality Assurance/ Pharmaceutics/Pharmacology/ Pharmacy Practice".

xi. *"**Assessment"*** means evaluation process for the outcome and grading in term of the marks.

xii. ***"Credit"*** means a weight to the time requirements of the academic course in the institute.

5. Academic Regulations – 2016

Raghavendra Institute of Pharmaceutical Education and Research (RIPER)

(An Autonomous Institution under JNT University Anantapur, JNTUA)

(Effective for the students admitted into I year from the Academic Year 2016-2017 onwards)

Program	Bachelor of Pharmacy (B. Pharm)
Recommended by	Board of Studies (BOS)
Effective from	Students admitted from AY 2016-17

As per the Academic council of the Raghavendra Institute of Pharmaceutical Education and Research, (Autonomous Institution) and as directed by the University grant commission (UGC), the Jawaharlal Nehru technological University, Anantapur (JNTUA), shall confer the undergraduate degree in Bachelor of Pharmacy (B. Pharm) with the fulfillment of all the requirements for the award of the degree.

1. Eligibility:

Admission to this programme shall be made subject to the eligibility and qualifications prescribed by the awarding university (JNTUA), State government of Andhra Pradesh/Govt. of India and as per regulatory bodies like All India Council for Technical Education (AICTE) and Pharmacy Council of India (PCI), New Delhi, from time to time.

The admission is based on EAMCET/PIOFN/management categories and is subjected reservation policy of the government from time to time.

2. Program details

Duration	4 years
Semesters	8 semesters (each semester will be not less than 20 week, including examinations provided the academic calendar structured to fulfil 90 instruction days excluding examinations.
Mode	Full-time
Total credits	200
Maximum duration	Period equal to twice the prescribed duration (8 years)

3. Attendance Requirements:

i. A student shall be eligible to appear for end examinations if has acquired a minimum of 75% of attendance in aggregate of all the courses.

ii. Condonation of shortage of attendance in aggregate up to 10 % (65% and above and below 75%) in each semester. Condonation may be fixed by examination / academic committee.

iii. A student will not be promoted to the next semester unless he satisfies the attendance requirement of 65 %, as applicable to all subjects. If any students fail to record 65 % in an individual Course, even he/she put 75% as aggregate, she/he should not be allowed for the particular course and the rest of the course may be allowed to register. He/she may register for the next semester/offered next.

iv. Shortage of aggregate attendance below 65% shall in NO case be condoned and will not be promoted. Students whose shortage of attendance are not condoned in any semester are not eligible to take their end examination of that class and their registration shall stand cancelled and need to register as regular.

4. Distribution and Weightage of Marks:

i. The performance of a student in each semester shall be evaluated course-wise with a maximum of 100 marks for theory and 100 marks for practical subject. In addition assignment, seminar and Project work shall be evaluated.

ii. For theory subjects the distribution shall be 30 marks for Continuous assessment (Class test, midterm exam, assignment) and 70 marks for the End assessment (End-Examination).

iii. For theory subjects, during the semester there shall be 2 class tests, which include both objective and descriptive questions for a duration of 45 minutes. One class test should be conducted at pre-midterm and one should be as post midterm tests. The test may be conducted for 20 marks and best score need to be converted to 10 for continuous assessment.

iv. For theory subject, the midterm examination shall be conducted after the 8^{th} week of instruction. There will be one midterm theory examinations should be conducted for 30 marks. It has to be converted to 15 for continuous assessment. The midterm examination shall be conducted once in the middle of the semester provided that the schedule should be indicated in the academic calendar, to avoid student absenteeism.

v. For theory subject, there will be one or two assignments in relevance to course outcome, need to be evaluated as per standard rubrics and documented. Final score may be included in the continuous assessment as indicated in individual course syllabi.

vi. For practical subjects there shall be a continuous day to day evaluation based on lab work / record (10 marks), participation based on portfolio and attendance (5 marks) and there will be a midterm examination along with midterm theory examinations. The midterm practical examinations should be conducted for 30 marks. It has to be converted to 15 for continuous assessment.

vii. Laboratory marks and the sessional marks awarded by the instructors are not final. They are subject to scrutiny and scaling by the chief controller of examinations, wherever felt desirable. In such conditions, the sessional and laboratory marks awarded by the College will be referred to a Committee. The Committee will arrive at a scaling factor and the marks will be scaled as per the scaling factor. The recommendations of the Committee are final and binding. The laboratory records and internal test papers shall be preserved in the respective departments as per the University norms and shall be produced to the Committees of the University/regulatory bodies as and when they ask for.

viii. There shall be an audit pass course with no external examination. However, attendance in the audit course shall be considered while calculating aggregate attendance and student shall be declared pass in the audit course only when he/she secures 40 % or more in the internal examinations.

ix. There shall be an Industrial visit as an audit course during 3rd year 2nd semester summer vacation. The student shall submit a technical report to the department and present a seminar on the visit. The report and the presentation shall be evaluated by the departmental committee consisting of the Head of the Department and two senior faculty members. There shall be no external examination. The student shall be declared pass only when he secures 40 % or more in the internal examinations.

x. Out of a total of 200 marks for the project work, 60 marks shall be for Internal Evaluation and 140 marks for the End Semester Examination (Viva-voce). The Viva-Voce shall be conducted by a committee consisting of HOD, Project Supervisor and an External Examiner nominated by the University**.** Project work shall start in 4th year 1st semester and shall continue in the semester break. The evaluation of project work shall be conducted at the end of the 4th year 2nd semester. The Internal Evaluation shall be made by the

departmental committee, on the basis of two seminars given by each student on the topic of his/her project.

xi. In case, the student does not secure the minimum academic requirement in any course (i.e. 40 % in end examination and 50 % aggregate of the overall subject in the semester), he/she has to reappear for the End examination, either in supplementary or regular in that particular course, or repeat the course when next offered. However, the continuous assessment marks remain same.

NOTE: In case any candidates continue assessment is low only if due to absenteeism to attend mid -term examination, he/she shall submit the application with appropriate reason to Principal. Then trueness of the application may be evaluated by the examination committee including controller of examination. In such cases, if the committee fails to allow, a prescribed fee is paid to the examination section, to undertake a midterm examination, scheduled by the Controller of examinations.

5. Minimum Academic Requirements

The following academic requirements have to be satisfied in addition to the attendance requirements:

i. A candidate shall be deemed to have secured the minimum academic requirement in a course if he /she secures not less than 40% of marks in the end examinations (assessment) and the minimum aggregate of 50% of the total marks of all courses (together end examinations and continuous assessment). There is no minimum requirement on continuous assessment marks.

ii. A student shall be promoted from 2^{nd} to 3^{rd} year only if he/she fulfills the academic requirement of securing 50 credits of the courses that have been studied up to 2^{nd} year 2^{nd} semester.

iii. A student shall obtain a course completion / register for higher studies only if he/she acquires 200 credits. Marks obtained in all courses (200 credits) shall be considered in the calculation of aggregate percentage of marks / pass class / CGPA.

iv. Students who fail to earn 200 credits as indicated in the course structure within eight academic years from the year of their admission shall forfeit their seat in B. Pharm programme and their admission shall stand cancelled.

6. Award of B. Pharm. Degree

A student will be declared eligible for the award of the B. Pharmacy degree if he/she fulfills the following academic regulations:

i. Pursues a course of study of not less than four academic years and in not more than eight academic years.

ii. Registers for 200 credits and secure all 200 credits.

7. Transitory Regulations:

Discontinued, detained, or failed candidates are eligible for readmission as and when the semester is offered after fulfillment of academic regulations. Candidates who have been detained for want of attendance or not fulfilled academic requirements or who have failed after having undergone the course in earlier regulations or have discontinued and wish to continue the course are eligible for admission into the unfinished semester from the date of commencement of class work with the same or equivalent subjects as and when subjects are offered, subject to Section 2 and they will be in the academic regulations into which they get readmitted.

8. Withholding of results:

If the candidate has any dues not paid to the university or if any case of indiscipline or malpractice is pending against him, the result of the candidate shall be withheld and he will not be allowed / promoted into the next higher semester. The issue of awarding a degree is liable to be withheld in such cases.

9. Award of Class:

After a student has satisfied the requirements prescribed for the completion of the program and is eligible for the award of B. Pharm. Degree he shall be placed in one of the following four classes:

Class Awarded	% Aggregate to be secured	
First Class with Distinction	70% and above	From the aggregate marks secured from 200 credits and audit courses.
First Class	Below 70% but not less than 60%	
Second Class	Below 60% but not less than 50%	

(The marks in internal evaluation and end examination shall be shown separately in the marks memorandum)

However, while awarding the degree, rounding of percentages is permitted to the extent of 0.5% to effect change of class from pass close to Second class, Second class in First class, First class to First class with Distinction for all the courses being offered or to be offered by the University without adding any marks to the original marks secured by the students.

10. General:

i. The academic regulations should be read as a whole for the purpose of any interpretation.
ii. Malpractices rules- nature and punishments are appended.
iii. Where the words "he", "him", "his", occur in the regulations, they also include "she", "her", "hers", respectively.
iv. In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Vice-Chancellor is final.
v. The University may change or amend the academic regulations at any time and the changes or amendments shall be made applicable to all the students on rolls with effect from the dates notified by the University.

Academic Regulations – 2016

Raghavendra Institute of Pharmaceutical Education and Research (RIPER)

An Autonomous Institution under JNT University Anantapur (JNTUA)

(LATERAL ENTRY SCHEME)

(Effective for the students admitted in II year from the Academic Year 2016-2017 onwards)

Program	Bachelor of Pharmacy (B. Pharm)
Approved by	Academic Council
Effective from	Students admitted from AY 2016-17

As per the Academic council of the Raghavendra Institute of Pharmaceutical Education and Research, (Autonomous Institution) and as directed by the University grant commission (UGC), the Jawaharlal Nehru technological University, Anantapur (JNTUA), shall confer the undergraduate degree in Bachelor of Pharmacy (B. Pharm) with the fulfillment of all the requirements for the award of the degree.

1. Eligibility:

Admission to this programme shall be made subject to the eligibility and qualifications prescribed by the awarding university (JNTUA), State government of Andhra Pradesh/Govt. of India and as per regulatory bodies like All India Council for Technical Education (AICTE) and Pharmacy council of India (PCI), New Delhi, from time to time.

The admission is based on ECET/PIOFN/management categories and is subjected reservation policy of the government from time to time.

2. Program details

Duration	3 years
Semesters	6 semesters (each semester will be not less than 20 week, including examinations provided the academic calendar structured to fulfil 90 instruction days excluding examinations
Mode	Full-time
Total credits	150
Maximum duration	Period equal to twice the prescribed duration (6 years)

3. Attendance Requirements:

i. A student shall be eligible to appear for end examinations if has acquired a minimum of 75% of attendance in aggregate of all the courses.

ii. Condonation of shortage of attendance in aggregate up to 10 % (65% and above and below 75%) in each semester. Condonation may be fixed by examination / academic committee.

iii. A student will not be promoted to the next semester unless he satisfies the attendance requirement of 65 %, as applicable to all subjects. If any students fail to record 65 % in an individual Course, even he/she put 75% as aggregate, she/he should not be allowed for the particular course and the rest of the course may be allowed to register. He/she may register for the next semester/offered next.

iv. Shortage of aggregate attendance below 65% shall in NO case be condoned and will not be promoted. Students whose shortage of attendance are not condoned in any semester are not eligible to take their end examination of that class and their registration shall stand cancelled and need to register as regular.

4. Distribution and Weightage of Marks:

i. The performance of a student in each semester shall be evaluated course-wise with a maximum of 100 marks for theory and 100 marks for practical subject. In addition assignment, seminar and Project work shall be evaluated.

ii. For theory subjects the distribution shall be 30 marks for Continuous assessment (Class test, midterm exam, assignment) and 70 marks for the End assessment (End-Examination).

iii. For theory subjects, during the semester there shall be 2 class tests, which include both objective and descriptive questions for a duration of 45 minutes. One class test should be conducted at pre-midterm and one should be as post midterm tests. The test may be conducted for 20 marks and best score need to be converted to 10 for continuous assessment.

iv. For theory subject, the midterm examination shall be conducted after the 8th week of instruction. There will be one midterm theory examinations should be conducted for 30 marks. It has to be converted to 15 for continuous assessment. The midterm examination shall be conducted once in the middle of the semester provided that the schedule should be indicated in the academic calendar, to avoid student absenteeism.

v. For theory subject, there will be one or two assignments in relevance to course outcome, need to be evaluated as per standard rubrics and documented. Final score may be included in the continuous assessment as indicated in individual course syllabi.

vi. For practical subjects there shall be a continuous day to day evaluation based on lab work / record (10 marks), participation based on portfolio and attendance (5 marks) and there will be a midterm examination along with midterm theory examinations. The midterm practical examinations should be conducted for 30 marks. It has to be converted to 15 for continuous assessment

vii. Laboratory marks and the sessional marks awarded by the instructors are not final. They are subject to scrutiny and scaling by the chief controller of examinations, wherever felt desirable. In such conditions, the sessions and laboratory marks awarded by the College will be referred to a Committee. The Committee will arrive at a scaling factor and the marks will be scaled as per the scaling factor. The recommendations of the Committee are final and binding. The laboratory records and internal test papers shall be preserved in the respective departments as per the University norms and shall be produced to the Committees of the University/regulatory bodies as and when they ask for.

viii. There shall be an audit pass course with no external examination. However, attendance in the audit course shall be considered while calculating aggregate attendance and student shall be declared pass in the audit course only when he/she secures 40 % or more in the internal examinations.

ix. There shall be an Industrial visit as an audit course during 3rd year 2nd semester summer vacation. The student shall submit a technical report to the department and present a seminar on the visit. The report and the presentation shall be evaluated by the departmental committee consisting of the Head of the Department and two senior faculty members. There shall be no external examination. The student shall be declared pass only when he secures 40 % or more in the internal examinations.

x. Out of a total of 200 marks for the project work, 60 marks shall be for Internal Evaluation and 140 marks for the End Semester Examination (Viva-voce). The Viva-Voce shall be conducted by a committee consisting of HOD, Project Supervisor and an External Examiner nominated by the University**.** Project work shall start in 4th year 1st semester and shall continue in the semester break. The evaluation of project work shall be conducted at the end of the 4th year 2nd semester. The Internal Evaluation shall be

made by the departmental committee, on the basis of two seminars given by each student on the topic of his/her project.

xi. In case, the student does not secure the minimum academic requirement in any course (i.e. 40 % in end examination and 50 % aggregate of the overall subject in the semester), he/she has to reappear for the End examination, either in supplementary or regular in that particular course, or repeat the course when next offered. However, the continuous assessment marks remain same.

NOTE: In case any candidates continue assessment is low only if due to absenteeism to attend mid -term examination, he/she shall submit the application with appropriate reason to Principal. Then trueness of the application may be evaluated by the examination committee including controller of examination. In such cases, if the committee fails to allow, a prescribed fee is paid to the examination section, to undertake a midterm examination, scheduled by the Controller of examinations.

6. Minimum Academic Requirements

The following academic requirements have to be satisfied in addition to the attendance requirements:

i. A candidate shall be deemed to have secured the minimum academic requirement in a course if he /she secures not less than 40% of marks in the end examinations (assessment) and the minimum aggregate of 50% of the total marks of all courses (together end examinations and continuous assessment). There is no minimum requirement on continuous assessment marks.

ii. A student shall be promoted from 2^{nd} to 3^{rd} year only if he/she fulfills the academic requirement of securing 25 credits of the courses that have been studied up to 2^{nd} year 2^{nd} semester.

iii. A student shall obtain a course completion / register for higher studies only if he/she acquires 150 credits. Marks obtained in all courses (150 credits) shall be considered in the calculation of aggregate percentage of marks / pass class / CGPA.

iv. Students who fail to earn 150 credits as indicated in the course structure within eight academic years from the year of their admission shall forfeit their seat in B. Pharm course and their admission shall stand cancelled.

7. Award of B. Pharm. Degree

A student will be declared eligible for the award of the B. Pharmacy degree if he/she fulfills the following academic regulations:

i. Pursues a course of study for not less than three academic years and in not more than six academic years.

ii. Registers for 150 credits and secure all 150 credits.

11. Transitory Regulations:

Discontinued, detained, or failed candidates are eligible for readmission as and when the semester is offered after fulfilment of academic regulations. Candidates who have been detained for want of attendance or not fulfilled academic requirements or who have failed after having undergone the course in earlier regulations or have discontinued and wish to continue the course are eligible for admission into the unfinished semester from the date of commencement of class work with the same or equivalent subjects as and when subjects are offered, subject to Section 2 and they will be in the academic regulations into which they get readmitted.

12. Withholding of results:

If the candidate has any dues not paid to the university or if any case of indiscipline or malpractice is pending against him, the result of the candidate shall be withheld and he will not be allowed / promoted into the next higher semester. The issue of awarding a degree is liable to be withheld in such cases.

13. Award of Class:

After a student has satisfied the requirements prescribed for the completion of the program and is eligible for the award of B. Pharm. Degree he shall be placed in one of the following four classes:

Class Awarded	% of marks to be secured	
First Class with Distinction	70% and above	From the aggregate marks secured from 150 credits and audit courses.
First Class	Below 70% but not less than 60%	
Second Class	Below 60% but not less than 50%	

(The marks in internal evaluation and end examination shall be shown separately in the marks memorandum)

However, while awarding the degree, rounding of percentages is permitted to the extent of 0.5% to effect change of class from pass close to Second class, Second class in First class, First class to First class with Distinction for all the courses being offered or to be offered by the University without adding any marks to the original marks secured by the students.

14. General:

i. The academic regulations should be read as a whole for the purpose of any interpretation.
ii. Malpractices rules- nature and punishments are appended.
iii. Where the words "he", "him", "his", occur in the regulations, they also include "she", "her", "hers", respectively.
iv. In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Vice-Chancellor is final.

The University may change or amend the academic regulations at any time and the changes or amendments shall be made applicable to all the students on rolls with effect from the dates notified by the University.

Assessment tools /Evaluation

The following assessment tools may be adapted in the evaluation process.

Type of assessment	**Assessment tool for evaluation**
Continuous assessment	Class test, Midterm examination, Assignment, Seminar, VIVA, Participation, Lab work/Field work.
End assessment	Descriptive theory examination, Practical examinations, VIVA, Presentation. Comprehensive online examination

6. Program Structure & Syllabus

B. PHARM; YEAR 1; SEMESTER 1

Course code	Paper	Name of the course	Hrs /week	Credits
16BPH101	Theory	Remedial Mathematics (for Bi.P.C Stream)	4	4
16BPH102	Theory	Biology (for M.P.C Stream)	2	2
16BPH107	Practical	Biology Practical (for M.P.C Stream)	4	2
16BPH103	Theory	Communicative English	3	3
16BPH104	Theory	Pharmaceutical Inorganic chemistry	4	4
16BPH105	Theory	Pharmaceutical organic chemistry-I	4	4
16BPH106	Theory	Human anatomy & Physiology – I	4	4
16BPH108	Practical	Pharmaceutical Inorganic chemistry Practical	4	2
16BPH109	Practical	Pharmaceutical organic chemistry-I Practical	4	2
16BPH110	Practical	Human anatomy & Physiology – I Practical	4	2
TOTAL			31/33	25

B. PHARM; YEAR 1; SEMESTER 2

Course code	Paper	Name of the course	Hrs /week	Credits
16BPH201	Theory	Pharmaceutical organic chemistry-II	4	4
16BPH202	Theory	Environmental science	3	3
16BPH203	Theory	General Pharmacy & Dosage forms	4	4
16BPH204	Theory	Human anatomy & physiology-II	3	3
16BPH205	Theory	Pharmacognosy –I	3	3
16BPH206	Practical	Pharmaceutical organic chemistry-II Practical	4	2
16BPH207	Practical	General Pharmacy & Dosage forms Practical	4	2
16BPH208	Practical	Human anatomy & physiology-II Practical	4	2
16BPH209	Practical	Pharmacognosy –I Practical	4	2
TOTAL			33	25

B. PHARM; YEAR 2; SEMESTER 1

Course code	Paper	Name of the course	Hrs /week	Credits
16BPH301	Theory	Physical pharmacy –I	4	4
16BPH302	Theory	Pharmaceutical engineering	4	4
16BPH303	Theory	Pharmaceutical analysis	4	4
16BPH304	Theory	Bio Statistics & computer applications	3	3
16BPH305	Practical	Physical pharmacy –I Practical	4	2
16BPH306	Practical	Pharmaceutical engineering-practical	4	2
16BPH307	Practical	Pharmaceutical analysis Practical	4	2
16BPH308	Practical	Bio Statistics & computer applications Practical	4	2
16BPH309		Comphrensive online examination	-	2
TOTAL			31	25

B. PHARM; YEAR 2; SEMESTER 2

Course code	Paper	Name of the course	Hrs /week	Credits
16BPH401	Theory	Physical pharmacy-II	4	4
16BPH402	Theory	Pathophysiology & Health education	4	4
16BPH403	Theory	Pharmaceutical microbiology	4	4
16BPH404	Theory	Pharmacognosy-II	4	4
16BPH405	Practical	Physical pharmacy-II Practical	4	2
16BPH406	Practical	Pharmaceutical microbiology Practical	4	2
16BPH407	Practical	Pharmacognosy-II Practical	4	2
16BPH408		Comphrensive online examination	-	2
16BPH409	Audit course	Human values & professional ethics	2	1
TOTAL			30	25

B. PHARM; YEAR 3; SEMESTER 1

Course code	Paper	Name of the course	Hrs /week	Credits
16BPH501	Theory	Medicinal chemistry-I	3	3
16BPH502	Theory	Pharmacology-I	3	3
16BPH503	Theory	Pharmaceutical Biochemistry	3	3
16BPH504	Theory	Pharmaceutical technology-I	3	3
16BPH505	Theory	Advances in alternative medicine	3	3
16BPH506	Practical	Medicinal chemistry-I Practical	4	2
16BPH507	Practical	Biochemistry Practical	4	2
16BPH508	Practical	Pharmaceutical technology-I Practical	4	2
16BPH509		Comphrensive online examination	-	2
16BPH510 **16BPH511**	Elective	1. Pharmacoinformatics 2. Pharmacoeconomics	2	2
TOTAL			29	25

B. PHARM; YEAR 3; SEMESTER 2

Course code	Paper	Name of the course	Hrs /week	Credits
16BPH601	Theory	Medicinal chemistry-II	3	3
16BPH602	Theory	Pharmaceutical Jurisprudence	2	2
16BPH603	Theory	Pharmacology-II	3	3
16BPH604	Theory	Pharmaceutical technology-II	3	3
16BPH605	Theory	Modern analytical techniques	3	3
16BPH606	Practical	Medicinal chemistry-II Practical	4	2
16BPH607	Practical	Pharmacology-II Practical	4	2
16BPH608	Practical	Pharmaceutical technology-II Practical	4	2
16BPH609	Practical	Modern analytical techniques Practical	4	2
16BPH610		Comphrensive online examination	-	2
16BPH611	Audit	Advanced communication skills Lab	2	1
TOTAL			30	25

B. PHARM; YEAR 4; SEMESTER 1

Course code	Paper	Name of the course	Hrs /week	Credits
16BPH701	Theory	Pharmaceutical biotechnology	3	3
16BPH702	Theory	Biopharmaceutics & Pharmacokinetics	3	3
16BPH703	Theory	Pharmacology-III	3	3
16BPH704	Theory	Medicinal chemistry –III	4	4
16BPH705	Practical	Pharmaceutical Biotechnology Practical	4	2
16BPH706	Practical	Biopharmaceutics & Pharmacokinetics Practical	4	2
16BPH707	Practical	Pharmacology-III Practical	4	2
16BPH708	Practical	Medicinal chemistry –III Practical	4	2
16BPH709		Comphrensive online examination	-	2
16BPH710 **16BPH711**	Elective	**1.** Pharmacological Screening methods **2.** Fundamentals of Drug regulatory affairs	2	2
TOTAL			31	25

B. PHARM; YEAR 4; SEMESTER 2

Course code	Paper	Name of the course	Hrs /week	Credits
16BPH801	Theory	Novel drug delivery systems	3	3
16BPH802	Theory	Pharmaceutical management & quality Assurance	2	2
16BPH803	Theory	Hospital & Clinical pharmacy	2	2
16BPH804	Theory	Chemistry of natural drugs	3	3
16BPH805	Practical	Novel drug delivery systems Practical	4	2
16BPH806	Practical	Chemistry of natural drugs Practical	4	2
16BPH807	Theory	MOOC on Intellectual Property Rights	--	2
16BPH808	Seminar	Presentation	--	1
16BPH809	Research	Project	3	8
TOTAL			21	25

Program	**B.Pharmacy**
Year	**First year /1st semester**
Name of the course	**Remedial Mathematics**
Course Code	**16BPH101**
Credits	**4**
Hours /week	**4 hours (lectures)**
Pre / co-requisite/s	**Nil**

Course Description: This is an introductory course in mathematics. This subject deals with the introduction to Algebra, trigonometry, Co-Ordinate geometry, differential calculus, integral calculus, differential equations, Laplace transform.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO 1: Define Algebra, Trigonometry, Co-Ordinate geometry, Differential calculus, Integral Calculus, Differential equation, Laplace transform and their applications;

CO 2: Solve the problems of different types by applying theory

CO 3: Appreciate the important applications of mathematics in pharmacy.

Theory Course: Contents

S.no	Topics
I (2 weeks)	**Algebra :** Arithmetic Progression –Geometric Progression, Logarithms: Logarithm of a real number to an arbitrary base, theorems on Logarithms, application of logarithms in Pharmaceutical computations and Partial fractions
II (2weeks)	**Trigonometry:** Trigonometric ratios and the relations between them, Sin (A+B), Cos (A+B),Tan(A+B) formulae only, Trigonometric ratios of multiple and sub multiple angles.
III (2 weeks)	**Co-Ordinate Geometry** Distance between points, Area of a Triangle, Co-Ordinates of a point dividing a given line segment in a given ratio, equation to a straight line in different forms.
IV (2weeks)	**Differential calculus:** Limit of a function differentiation, derivatives of trigonometric functions, logarithmic and partial differentiation, Maxima and minima (elementary).
V (2weeks)	**Integration:** Definition of integration, indefinite of integrals, standard integrals, fundamental rules of Integration, Integration by substitution, integration by parts and definite Integrals, properties of definite Integrals.
VI (2weeks)	**Differential Equations:** Order and degree, formation of the differential equation, solutions of the first order and first degree differential equations (variable separable).

VII	Applications of first order and first degree differential equation: law of natural growth and decay, Newton's law of cooling.
VIII (2weeks)	**Laplace transforms:** Definition, elementary functions, Properties of linearity and shifting, transforms of multiplication by t^n.

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Class test	5%
	Assignments	5 %
	Sessional Examination	20%
End Assessment	End theory examination	70 %
	TOTAL	**100%**

Note: Class tests to be conducted at 4th and 14th Week; Mid-semester to be conducted after 8th week

Textbooks:

1. Intermediate first and second year mathematics text books printed and published by Telugu Academy.
2. P.Seshagiri Rao. A Text book of Remedial Mathematics. Pharma med press; 2008.

Program	B. Pharm
Year /Semester	First year / 1st semester
Name of the course	Biology
Course Code	16BPH102
Credits	2
Hours /week	2 hours (lectures)
Pre / co-requisite/s	Nil

Course Description: The Biology course is aimed to study of history, development and scope of botany and zoology, Plant and animal cell detailed structure. Types and functions of Chromosomes. Structure, types and functions of nucleic acids. Cell cycle and its regulators. Mitosis, meiosis, different types of tissues and their functions. Salient features and classification of plants, animal kingdom, and the course will emphasize the identification, uses, and histological features of root, stem, bark, wood, leaf, flower, inflorescence, fruit and seed. Modifications of root stem and leaf. Study of parasites their diseases, control and life history of insects

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO 1: State the importance of Remedial biology, zoology

CO2: Explain the plant cell, animal cell structure and their features

CO3: Describe parasites, insects and their disease and control

CO4: Describe the histological features and modification that belongs to Root, Stem and Leaf

Theory Course: Contents

Unit	Topics
I (2 weeks)	Plant and animal cell: Detailed structure,types and functions of Chromosomes.
	Structure, types and functions of Nucleic acids. Cell cycle and its regulators.
II (2 weeks)	Mitosis, Meiosis, different types of Tissues and their functions.
III (2weeks)	Salient features and classification of plants into major groups- Algae, Fungi, Bryophytes, Pteridophytes,
	Gymnosperms and Angiosperms.
IV	Classification of animal kingdom and salient features of each Phylum. Simple

(2weeks)	and compound microscopes used in biology, section cutting; staining and mounting of sections.
V (2weeks)	Morphology and Histology of Root, Stem, Bark, Wood, Leaf, Flower, Inflorescence, Fruit and Seed. Modifications of Root, Stem and Leaf. Some important plant drugs their active constituents and uses
VI (2 weeks)	Study of Structure and life history of parasites: Amoeba, Entamoeba, Trypanosoma, Plasmodium,
VII (2 weeks)	Taenia, Ascaris, Schistosoma, Oxyuris and Ancylostoma.
VIII (2 weeks)	General structure and life history of Insects like Cockroach, Mosquito and Housefly. Comparative gross Anatomical features of Frog, Rat and Rabbit.

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Class test	10%
	Assignments	5 %
	Mid-semester Examination	15%
End Assessment	End theory examination	70 %
	TOTAL	**100%**

Note: Class tests to be conducted at 4th and 14th Week; Mid-semester to be conducted after 8th week

Learning Resources/Recommended Texts/Reference books/web resources

TEXT BOOKS

1. Gokhale S B, Kokate C K, Bidarkar D S. Pharmaceutical biology. 1st ed. Nirali Prakashan Publications: Pune;1998.
2. Punam K, Singh. Remedial Biology. 1st ed. SChand Publications: New Delhi; 2012.
3. Nair PKG,Achar KP, Prabhu SG. Remedial Biology. 1st ed. Himalaya Publication
4. R .Berg. A Text book of Botony. Indian ed. Linda publishing house: Mumbai; 2008.
5. Peter V J, Russel, Stephen Wolfe, Paul E Hertz, Cecie starr, Beverly MC Milan. Cell and Molecular Biology. Indian ed. Neilson education: Canada;2009.
6. Sivarama KrishnaG, Sree Ramulu K. Babu rao V. Intermediate second year botany. 3rd ed.Telugu academi: Hyderabad; 2006.
7. Dutta AC. A class book of Botany. 16th ed. Singh HD Publication: Kolkata; 1986.
8. Pandey BP. Botony.5th ed. Rajendra Publications: New Delhi; 2007.
9. KrishnanandanY, Ramajoga roa G. Subbaroa K. Babu roa V. Intermediate first year, 4th ed Telugu Academi: Hyderabad; 2007.

Program	**B. Pharm**
Year /Semester	**First year / 1st semester**
Name of the course	**Communicative English**
Course Code	**16BPH103**
Credits	**3**
Hours /week	**3 hours (lectures)**
Pre / co-requisite/s	**Nil**

Course Description: The Functional English I course is aimed to present fundamental in functional English compounds. It emphasize on specific language needs of students.. The course will emphasize the needs analysis revealed that although all the students continue to find communication in English a necessary like their counterpart a decade ago, their specific needs have changed. The importance of this functional English course fine it necessary to communicate in a highly technically advanced milieu about the changing environment, changing workplaces, changing outdated teaching is becoming increasingly ineffective. There is a strong need to produce new language teaching materials that are more 'in sync' with the needs of the present generation of learners. The course helps students to communicate their ideas effectively to their target audience. Although there are specializations and variations in language teaching , differently designated as General English , Technical English , Academic English and English for specific purposes, all these variations share a single objective ,namely to make the learner a more effective and efficient communicator.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO 1: Communicate their ideas effectively to their target audience.
CO 2. Acquire ability to participate effectively in group discussions.
CO 3. Develop ability in writing in various contexts.
CO 4. Acquire a proper level of competence for employability.

Course: Contents

Unit	Topics
I (2weeks)	Tenses, Paragraph writing, writing letters, Essay Writing. Poetry: Ode to Autumn Prose: Green Cover
II (2weeks)	Compound nouns, writing instructions role play, prefixes, suffies Prose: Solar Thermal Power Poetry: Song 36 from Githanjali.
III (2weeks)	Types of interviews, if conditional, Vocabulary, telephone skills, Topic: Advantages and Disadvantages of Travel Poetry: The Unknown Citizen

IV (2weeks)	Group discussion, double consonants , curriculum vitae, direct and indirect speec. Topic: Nuclear Energy Poetry: The Road Not Taken
V (2weeks)	Writing reports, compound nouns, prepositions Topic: Importance of History, Poetry: The Unknown Citizen
VI (2weeks)	Topics: Phrasal verb, reading graphs,Adverb,Note making Text: Tourism, Poetry: Insensibility
VII (2weeks)	Accent, Degree of comparision,Vocabulary. ,types of interviews,, Text: Is Progress Real? Pollution
VIII (2weeks)	Active and Passive ,phonitics , double consonants,reading graphs. Text: cloud computer

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Class test	10%
	Assignments	5 %
	Mid-semester Examination	15%
End Assessment	End theory examination	70 %
	TOTAL	**100%**

Learning Resources/Recommended Texts/Reference books/web resources

1. *MINDSCAPES*: English for Technologists and Engineers, Orient Blackswan, 2014.
2. Effective Tech Communication, Rizvi,Tata McGraw-Hill Education, 2007.
3. Technical Communication, Meenakshi Raman, Oxford University Press.
4. English Conversations Prcatice, Grant Taylor, Tata Mc GrawHill publications, 2013.
5. Practical English Grammar. Thomson and Martinet, OUP, 2010.

Program /Year/Sem	B. Pharm
Year /Semester	First year / 1st semester
Name of the course	Pharmaceutical Inorganic Chemistry
Course Code	16BPH104
Credits	4
Hours /week	4 hours (lectures)
Pre / co-requisite/s	Nil

Course Description: Pharmaceutical Inorganic chemistry course mainly deals with fundamentals of chemical composition, preparation methods, properties, identification tests, storage, assay & uses of various inorganic pharmaceuticals according to their monographs mentioned in the various pharmacopoeias. This course also provides basic principles, applications of volumetric titrations and importance of inorganic metals and heavy metal poisoning.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO 1: State the concept & content of specifications mentioned in monograph for various categories of inorganic pharmaceuticals.

CO 2: Demonstrate the knowledge of various types of errors and various sources of impurities in the pharmaceuticals.

CO 3: Apply the suitable principles in determination of purity by limit tests and percentage purity by assay methods as per the pharmacopoeias (Indian pharmacopeia, British pharmacopoeia, United states pharmacopoeia)

Theory Course: Contents

Unit	Topics
I (2 weeks)	**Introduction to volumetric titrations**: Concept and understanding of titration, titrate, titrant, indicator, standardization, primary standard, secondary standard, concentration expressions.
	Concept of figures, errors, precision, accuracy and sources of impurities in pharmaceuticals.
II (2 weeks)	**Aqueous titration:** Acid-base concept, Acidimetry, Alkalimetry and applications. **Non-aqueous titration:** Theory, solvents used, types and its applications.
	Redox titrations: Concept of oxidation, reduction, oxidizing agent, reducing agent, redox reaction, indicators, types and its applications. Basic principle involved in Permanganomerty, ceriometry, iodometry, iodimetry.
III (2 weeks)	**Precipitation titrations:** General principles, methods, indicators and applications.
	Gravimetric analysis: Basic concept, steps involved in precipitation technique, co-prercipitation, post-precipitation and its applications.
IV (2 weeks)	**Complexometric titration:** Theory, types, indicators used, masking and demasking and their applications.
	Diazotization titration: Principle, dead-stop end point technique and applications.

V (2 weeks)	**Basic concepts of Pharmaceutical inorganic chemistry:** Introduction to Indian pharmacopoeia (IP). Concept and content of monograph and definition of various specifications under monograph. Molecular formula, symbol & uses of some important (Minimum 4) Monovalent, divalent and trivalent metals. Heavy metals & its poisoning.
	Concept of limit test, Limit tests for arsenic, heavy metals, lead, iron, chloride and sulphate.
VI (2 weeks)	**Eletrolytes used for replacement therapy:** Sodium chloride*, Potassium chloride, calcium chloride, calcium gluconate* **Electrolytes used in acid-base therapy:** Acid-base balance, Sodium acetate, sodium citrate*, sodium lactate & Potassium bicarbonate.
	Electrolyte Combination therapy: Compound sodium chloride solution (Ringer's solution), ORS. **Haematinics:** Ferrous sulphate*, Ferrous fumarate, ferrous gluconate, ferric ammonium citrate*, iron & dextrose injection.
VII (2 weeks)	**Topical Agents:** Zinc sulphate, calcium hydroxide*, zinc oxide*, calamine, zinc stearate, talc, heavy kaolin and light kaolin (only uses), activated dimethicone, hydrogen peroxide solution*, potassium permanganate, silver nitrate (silver protein), iodine (solutions of iodine, povidone iodine), boric acid*.
	Dental Products - Anti-caries agents: Role of fluoride, Sodium fluoride*, stannous fluoride. **Dentifries:** calcium carbonate, dibasic calcium phosphate*, calcium phosphate.
VIII (2 weeks)	**Acidifiers:** Dilute hydrochloric acid, sodium acid phosphate **Antacids:** sodium bicarbonate*, aluminium hydroxide gel*, dried aluminium hydroxide gel, magnesium hydroxide mixture.
	Expectorants: Ammonium chloride* and potassium iodide. **Emetics:** Potassium antimony tartarate & copper sulphate*. **Antidotes:** Sodium nitrite, sodium thiosulphate*, Activated charcoal.

Note: Definition, structure, formulae, Preparation*, Properties, uses identification test* and principle behind Assays* of the compounds mentioned in Unit VI to Unit VII (*ONLY FOR SPECIFIED COMPOUNDS)

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Class test	10%
	Assignments	5 %
	Mid-semester Examination	15%
End Assessment	End theory examination	70 %
	TOTAL	**100%**

Note: Class tests to be conducted at 4th and 14th Week; Mid-semester to be conducted after 8th week

Learning Resources/Recommended Texts/Reference books/web resources

Text Books:

1. A.H.Beckett and J.B.Stenlake. Practical pharmaceutical chemistry. Part-I. The Athtone press: University of London; 1968.
2. J.H Block, E.Roche, T.O Soine and C.O. Wilson. Inorganic Medical and Pharmaceutical Chemistry. Lea & Febiger Philadelphia PA; 1974.
3. G.R. Chatwal. Pharmaceutical Chemistry – Inorganic. 5th edition. Himalaya Publishing House: Mumbai, India; 2014.

4. A.A. Napoleon. Pharmaceutical Titrimetric Analysis Theory and Practical. 2nd ed. Kalaimani Publishers & Distributers: Kanchipuram; 2013.
5. J. Mendham, R.C. Denney, J. D. Barnes and M.J.K. Thomas. Vogel's Quantitative Chemical Analysis. 6th edition. Pearson education Delhi; 2000.

References:

1. Gary L. Miessler, Paul J. Fischer and Donald A. Tarr. Inorganic chemistry. 5th edition. Pearson education New Delhi; 2014.
2. P. Gundu Rao. Pharmaceutical and Medicinal Inorganic Chemistry. 1st edition. Vallabh Prakashan Delhi; 2008.
3. G.D. Tuli, R.D. Madan, S.K. Basu and Satya Prakash. Advanced Inorganic Chemistry. Volume 1. Published by S. Chand & Company Ltd; 2014.
4. William L. Jolly. Modern Inorganic Chemistry. 2nd edition. Mc Graw-Hill: New York; 1984.
5. A.H.Beckett and J.B.Stenlake.Textbook of Pharm. Analysis. CBS Publishers, Delhi.
6. J. Mendham, R.C. Denney, J.D. Barnes and M.J.K. Thomas. Vogel's Textbook of Quantitative Chemical Analysis. 6th edition. Pearson Education Pvt. Ltd: New Delhi; 2003.
7. Indian Pharmacopoeia.

Program	B. Pharmacy
Year /Semester	First year / I Semester
Name of the course	Pharmaceutical Organic chemistry – I
Course Code	16BPH105
Credits	4
Hours /week	4 hours (lectures)
Pre / co-requisites	Nil

Course Description: The pharmaceutical organic chemistry-I course is aimed to present fundamental in chemistry of organic compounds. It emphasizes on basic nomenclature, physical and chemical properties of various organic compounds. The course will describe the pharmaceutical importance of these functional groups, isomerism and their molecular structures and properties in chemistry of drug substances. This also deals with various mechanisms involved in synthesis and reaction of chemical compounds.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO1: Define the nomenclature, physical and chemical properties of a molecule in relation to the structure of organic compounds.

CO2: Demonstrate the possible mechanism and the intermediate product involved in a chemical reaction.

CO3: Apply the appropriate substrate, catalyst and reaction conditions in the design of chemical reaction.

CO4: Analyze the fundamentals on behavior of chemical compounds in design of beneficial, economic and safe reaction for a new chemical entity.

Theory Course: Contents

Unit	Topics
I (2 weeks)	Concept on shapes of organic molecules, valency (C, H, O, N, S, P, X, Si), hybridization SP_3, SP_2, SP.
	Different bonds, bond lengths, bond angles, bond dissociation energies, molecular weight calculations. Impact of structure on BP, MP and solubility.
II (2 weeks)	**Electronic effects in organic molecules:** Inductive effect, electromeric, mesomeric effect, hyper conjugation, concept of resonance and stability.
	Types of organic reagents and reactions. **Reactive intermediates**- Carbocations, carbanions, carbenes and nitrenes;
III (2 weeks)	Polarity of molecules, Dipole moments, Inter and intra molecular forces. Bonding and Anti-bonding orbitals.

	Aliphatic/Alicyclic Hydrocarbons: Nomenclature, isomerism (Chain, Conformational and geometrical), optical isomerism, relative stabilities (heat of combustion and hydrogenation).
	Alkenes: Electrophilic addition reactions of alkenes, Markovnikow's rule, anti-Markovnikow's rule, Karasch effect, Bayer's oxidation (Cis-hydroxylation, polymerization).
IV (2 weeks)	**Alkadienes:** Stability of conjugated dienes, 1, 2 and 1, 4 - addition reactions of conjugated dienes. **Alkynes:** Acidity of 1-alkynes, formation of metal acetylides, stereo specific reduction of alkynes, addition of hydrogen halide, addition of water and keto-enol tautomerism.
	Halogen compounds-Aliphatic: Nomenclature, general methods of preparation, characteristic nucleophilic substitution reactions, factors that play role **in** S_N1 and S_N2, Walden inversion, elimination reaction and Saytzeff's rule.
V (2 weeks)	**Alcohols:** Nomenclature, classification, general methods of preparation, physical properties, hydrogen bonding, characteristic nucleophilic substitution reactions (replacement of -OH by -Cl).
	Elimination reactions and relative reactivities of primary, secondary and tertiary alcohols. Meerwein Pondorff Verley reduction. **Ethers:** Nomenclature, Williamson's synthesis, action of hydro iodic acid on ethers (Ziesel's method).
VI (2 weeks)	**Carbonyl compounds**: Nomenclature of aldehyde and ketone, properties, Preparation, Reactions that differentiate aldehyde and ketone. Relative reactivities of carbonyl compounds.
	Nucleophilic addition and addition elimination reactions, Oxidation-reduction reactions, aldol condensation, Cannizzaro reaction, benzoin condensation, Perkins reactions, Reformatsky reaction and Oppenauer oxidation.
VII (2 weeks)	**Carboxylic acids**: Nomenclature, intermolecular association, stability of carboxylate anion, two important methods of preparation, decarboxylation, functional group reactions and reduction of carboxylic acids.
	Acid derivatives: (Acid chlorides, anhydrides, esters and amides): Nomenclature, reactions like hydrolysis, reduction of esters and amides, Hofmann's degradation of amides. Brief account of preparation and properties of malonic and acetoacetic esters and their importance in organic synthesis.
VIII (2weeks)	**Nitro compounds**: Nomenclature, acidity of nitro compounds containing α-hydrogens, reductive reactions of aromatic nitro compounds. **Amines**: Nomenclature, classification, basicity of amines, relative reactivity, Hinsberg method of separation.
	Amines: Acylation reactions. Diazotisation and reactions of diazonium salts. **Nitriles and isonitriles**: Nomenclature, two methods of synthesis, reactivity and functional reactions.

Assessment methods and weightage

Assessment type	Assessment tool	Distribution
Continuous Assessment	Class test	10%
	Assignments	5 %
	Mid-semester Examination	15%
End Assessment	End theory examination	70 %
	TOTAL	**100%**

Note: Class tests to be conducted at 4th and 14th Week; Mid-semester to be conducted after 8th week.

Learning Resources/Recommended Texts/Reference books/web resources

1. Allyn, Bacon. Morrison and Boyd*:* Organic Chemistry. 7thEd. Pearson education; New Delhi: 2011.
2. T.W. Solomons. Organic Chemistry. 8thEd. University of South Florida, John Wiley & Sons, Inc; New York: 2004.
3. Arun Bahl, B.S. Bahl. Advanced Organic Chemistry. S.Chand and limited; New Delhi: 2010.
4. I.L. Finar. Organic Chemistry. Longman, Scientific & Technical. 5thEd. Co published in USA with John Wiley & Sons, Inc; New York: 2004.
5. Zimmerman and Zimmerman. *Elements of Organic Chemistry*. 2ndEd. Collier Macmillan Publishers; London: 1983.
6. O. P Agarwal. Organic chemistry Reaction and Reagents. 26th Ed. Goel Publishing House. New Delhi: 1996.

Program	B. Pharm
Year /Semester	First year / 1st semester
Name of the course	Human Anatomy & Physiology – I
Course Code	16BPH106
Credits	4
Hours /week	4 hours (lectures)
Pre / co-requisite/s	Nil

Course Description: This course is aimed to provide fundamental knowledge on the structure and functions of the human body. This course emphasizes both homeostasis mechanisms and homeostatic imbalances of various body systems. This course also describes the structure and functions of various organ systems of the human body like haemopoietic, lymphatic,osseous, urinary and cardiovascular systems.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO 1: Define anatomy and physiology, basic terminologies used in this course.

CO2: Describe the structure and functions of various organs of the human body.

CO 3: Explain the various homeostatic mechanisms and their imbalances of various systems.

Theory Course: Contents

Unit	Topics
I (2 weeks)	**Cell:** Scope of anatomy and physiology, basic terminology used in this subject. Body fluids, homeostasis.
	Structure of cell, its components and their functions.
II (2 weeks)	**Tissues:** Elementary tissues of the human body: epithelial and connective tissues, their sub types and functions.
	Muscular and nervous tissues, their sub types and functions.
III (2 weeks)	**Haemopoietic system:** Composition and functions of blood, Types of blood cells, Blood groups and their significance.
	Mechanism of coagulation of blood. Types of anaemia, Disorders related to blood components (Definitions only)
IV (2 weeks)	**Lymph and Lymphatic System:** Composition, formation and circulation of lymph.
	Anatomy & physiology of lymph node and spleen. Disorders related to lymphatic system (Definitions only)
V (2 weeks)	**Cardiovascular system:** Basic anatomy and physiology of heart and blood vessels, circulation (Systemic, pulmonary, coronary). Conducting system of the heart. Cardiac cycle, Heart sounds.
	Electrocardiogram and its significance. Blood pressure and its regulation. Disorders related to CVS (Definitions only)
VI	**Osseous system:** Structure, composition and functions of bone. Functions of

(2 weeks)	skeleton.
	Joints, classification of joints and types of movements of synovial joints.
VII (2 weeks)	**Skeletal muscles:** Histology of skeletal muscle, Physiology of Muscle contraction.
	Physiological properties of skeletal muscle and their disorders (definitions only)
VIII (2 weeks)	**Urinary system:** Various parts, structure & functions of the urinary tract. Physiology of urine formation.
	Acid – base balance, Renin angiotensin aldosterone(RAA) system, Disorders related to Urinary system (Definitions only)

Assessment methods and weightage

Assessment type	Assessment tool	Distribution
Continuous Assessment	Class test	10%
	Assignments	5 %
	Mid-semester Examination	15%
End Assessment	End theory examination	70 %
	TOTAL	**100%**

Note: Class tests to be conducted at 4th and 14th Week; Mid-semester to be conducted after 8th week

Learning Resources/Recommended Texts/Reference books/web resources

1. Tortora Gerard J, Derrikson Bryan. Principles of anatomy and physiology. 11th ed. Wiley: 2006.
2. Wilson K J W. Ross and Wilson's foundations of anatomy and physiology. 5th ed. Churchill Livingstone: Edinburg; 1981.
3. Guyton arthur C. Physiology of human body. 6 th ed. Brooks coole Publisher: 1983.
4. Chatterjee C C. Human physiology. Volume I & II. Medical allied agency: Calcutta; 2004.
5. Anne Waugh and Alon Grant. Ross and Wilson Anatomy & Physiology. 11th ed. Churchill Livingstone: 2010.
6. Guyton Arthur C. Text book of Medical Physiology. 10 th ed. Harcot Publishers: Singapore; 2000.

Program	B. Pharm
Year /Semester	First year / 1st semester
Name of the course	Biology Practical
Course Code	16BPH107
Credits	2
Hours /week	4 hours (Practical)
Pre / co-requisite/s	Nil

Course Description: The Biology laboratory course is aimed to train the students Care and uses of microscope, Gross identification of permanent slides of structure and life cycle of plants/animals, this course also deals with wet laboratory based experiments on identification of plants, this course also provides the laboratory skills Study of various morphological characters of plant parts. Preparation, Microscopic Examination of Stem, Root and Leaf of Mono and Dicot leaves. Structure of human parasites and insects mentioned in the theory with the help of specimen. Anatomical features of different organs of frog and rabbit using charts.
Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO 1: Describe the plant cell, animal cell, and their features

CO 2: Demonstrate the skills on identification, histology of plants

CO3: State morphological identification of plants.

CO 4: List the parasites, insects and their disease

Practical Course: Contents

Week	Topics
1.	Introduction to laboratory safety techniques and the use of class wares and chemicals.
2.	Study of microscope.
3.	Gross identification of permanent slides of structure and life cycle of plants/animals mentioned in the theory syllabus.
4.	Morphology of plant parts indicated in theory
5.	Preparation, Microscopic Examination of monocot stem
6.	Preparation, Microscopic Examination of dicot stem
7.	Preparation, Microscopic Examination of monocot root
8.	Preparation, Microscopic Examination of dicot root
9.	Preparation, Microscopic Examination of monocot leaf

10.	Preparation, Microscopic Examination of dicot leaf
11.	Structure of human parasites and insects mentioned in the theory with the help of specimen.
12.	Anatomical features of different organs of frog and rabbit using charts.
13.	**Revision**

Demo/Workshop:
Dissection of Cockroach Mouth Parts, observation of different phases of Mitotic division in Onion Root tips.

Seminar/Assignment/Group discussion:
Preparation of Herbarium of plant parts indicated in theory and study of salient features for identification.

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Participation	5 %
	Lab work (day to day)	10 %
	Mid-semester Examination	15%
End Assessment	End Practical examination	70 %
	TOTAL	**100%**

Mid - semester to be conducted after 8th week.

Learning Resources/Recommended Texts/Reference books/web resources

1. Kokate CK, Gokhale SB. Practical Pharmacognosy. 5th ed. Nirali Prakashan: Delhi; 2003.
2. Khandelwal KR, Vrunda Sethi. Practical Pharmacognosy. 25th ed. Nirali Prakashan: Delhi; 2015.
3. Iyangar MA. Study of crude drugs. 12th ed. Manipal Press Limited: Manipal; 2004.
4. Biren N Shafi, Nayak BS. Experimental Pharmacognosy. 1st ed. S Vikas & Co; 2009.
5. Iyangar MA, Nayak SK. Anatomy of Crude drugs. 12th ed. Manipal Press Limited: Manipal; 2011.
6. Gokhale S B, Kokate C K, Bidarkar D S. Pharmaceutical biology. 1st ed. Nirali Prakashan Publications: Pune;1998.

Program /Year/Sem	B. Pharm
Year /Semester	First year / 1st semester
Name of the course	Pharmaceutical Inorganic Chemistry Practical
Course Code	16BPH108
Credits	2
Hours /week	4 hours (Practical)
Pre / co-requisite/s	Nil

Course Description: Pharmaceutical inorganic chemistry laboratory course is aimed to train the students on experimental techniques for the determination of impurities and their limits as per the pharmacopoeias. This course also deals with identification of various cations & anions of inorganic compounds by their chemical tests. This course also provide laboratory skills related to calibration and percentage purity analysis by volumetric titrations as per monographs specified in various pharmacopoeias.

Course Learning Outcomes:

Upon successful completion of this course, the student should be able to:

CO 1: Demonstrate the skills on calibration of glasswares and standardization of solutions.

CO 2: Differentiate various cations and anions by chemical tests.

CO 3: Perform the limit tests and assay methods to know the impurities limit and percentage purity of the pharmaceuticals.

Practical Course: Contents

Week	Topics
1.	Introduction & Calibration of balances and weighing
2.	Calibration of Pipette and Burette
3.	Limit test for Chlorides & Modifications in Limit test for chlorides in coloured compound as per IP 2010
4.	Limit test for Sulphates & Modifications in Limit test for sulphates in coloured compound as per IP 2010
5.	Limit test for Iron as per IP 2014
6.	Limit test for Arsenic as per IP 2014
7.	Preparation and standardization of Hydrochloric acid solution (0.1N)
8.	Preparation and standardization of Potassium permanganate solution (0.1N)
9.	Assay of Boric acid by acid-base titration as per IP 2010
10.	Assay of Copper Sulphate by redox titration as per IP 2010
11.	Assay of Sodium benzoate by non-aqueous titration as per BP 2009
12.	Assay of Sodium chloride by precipitation titration as per IP 2010
13.	Assay of Calcium gluconate by complexometric titration as per IP 2010
14.	Identification tests for cations & anions for compounds - KCl, $NaHCO_3$ and $FeSO_4$
15.	Problem based exercise

Assessment methods and weightage

Assessment type	Assessment tool	Distribution
Continuous Assessment	Participation	5 %
	Lab work (day to day)	10 %
	Mid-semester Examination	15%
End Assessment	End Practical examination	70 %
	TOTAL	**100%**

Mid-semester to be conducted after 8th week.

Learning Resources/Recommended Texts/Reference books/web resources

1. A.H.Beckett and J.B.Stenlake. Practical pharmaceutical chemistry. Part-I. The Athtone press: University of London; 1968.
2. Gary L. Miessler, Paul J. Fischer and Donald A. Tarr. Inorganic chemistry. 5th edition. Pearson education New Delhi; 2014.
3. P. Gundu Rao. Pharmaceutical and Medicinal Inorganic Chemistry. 1st edition. Vallabh Prakashan Delhi; 2008.
4. G.D. Tuli, R.D. Madan, S.K. Basu and Satya Prakash. Advanced Inorganic Chemistry. Volume 1. Published by S. Chand & Company Ltd; 2014.
5. William L. Jolly. Modern Inorganic Chemistry. 2nd edition. Mc Graw-Hill: New York; 1984.
6. Indian Pharmacopoeia 2007, 2010 and 2014.
7. British Pharmacopoeia 2009.

Program	B. Pharmacy
Year /Semester	First year / I semester
Name of the course	Pharmaceutical Organic chemistry – I Practical
Course Code	16BPH109
Credits	2
Hours /week	4 hours (Practical)
Pre / co-requisite/s	Nil

Course Description: The pharmaceutical organic chemistry I laboratory course is aimed to train the students on experimental techniques for the determination of physical constants of organic compounds. This course also deals with wet laboratory based experiments on identification of various chemical classes of organic compounds using basic principle of organic chemistry. This course also provides the laboratory skills related to reaction design, chemical synthesis and purification process for few organic medicinal compounds.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO1: Demonstrate the skills on determination of various physical properties of organic molecules.

CO2: Differentiate various classes of organic compounds by experimental techniques.

CO3: Perform chemical reaction and purification of organic compounds of pharmaceutical interest.

CO4: Analyze the identification of the organic compounds with different functional groups.

Practical Course : Contents

Week	Topics
	Name of the experiments
1.	Introduction to Equipment and glassware
2.	Introduction to atomic models
3.	Experiment on melting point
4.	Experiments on boiling point
5.	N-Acetylation : Preparation of Acetanilide from Aniline
6.	O-Acetylation : Preparation of Aspirin from Salicylic acid
7.	Benzoylation : Synthesis of benzanilide from aniline

8.	Hydrolysis : Preparation of Benzoic acid from Benzamide
9.	Esterification: Preparation of Phenyl benzoate from Phenol.
10.	Condensation : Preparation of Benzoin from Benzaldehyde.
11.	Bromination : Preparation of p-Bromoacetanilide from Acetanilide
12.	Nitration : Preparation of Picric acid from phenol
13.	Oxidation : Preparation of 9,10-Anthraquinone
14.	Reduction: Reduction of anthraquinone to anthrene
15.	Revision

Note: Bromination and nitration are carried out as demonstration experiments because of irritant and carcinogenic effect.

Workshop: Correlation of structure with nomenclature (Working exercise in two labs)

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Participation	5 %
	Lab work (day to day)	10 %
	Mid-semester Examination	15%
End Assessment	End Practical examination	70 %
	TOTAL	**100%**

Mid-semester is to be conducted after 8th week.

Learning Resources/Recommended Texts/Reference books/web resources

1. Vogel, A.I, Tatchell A.R, Furnis B.S, Hannaford A.J, Smith P.W.G. Practical Organic Chemistry. 5th Ed. Pearson Publishers Prentice Hall; New Delhi: 1996.
2. R.K. Bansal, Laboratory Manual of Organic Chemistry, 5th Ed. New Age International; New Delhi 2007.
3. O.P. Agarwal, Advanced Practical Organic Chemistry, 3rd Ed. Goel Publication; Meerut: 2011
4. F.G.Mann & B.C. Saunders, Practical Organic Chemistry, 4th Ed. Chaman enterprises; New Delhi: 2004.

Program	**B. Pharm**
Year /Semester	**First year / 1st semester**
Name of the course	**Human Anatomy & Physiology – I Practical**
Course Code	**16BPH110**
Credits	**2**
Hours /week	**4 hours (Practical)**
Pre / co-requisite/s	**Nil**

Course Description: This course is aimed to train the students on experimental techniques for the determination of various hematological parameters & physiological parameters. This course also aimed to expertise the students on identification of various types of tissues & bones of the human body.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO 1: Record various physiological parameters, and perform hematological tests.

CO 2: Identify various types of tissues and bones of the human body.

CO 3: Estimate haemoglobin content of blood.

Practical Course: Contents

Week	Topics
1.	Introduction to laboratory safety techniques
2.	Study of compound microscope
3.	Microscopic study of different tissues – Epithelial tissue, Muscular tissue
4.	Microscopic study of different tissues – Connective tissue, Nervous tissue
5.	Study of human skeleton- Axial skeleton system
6.	Study of human skeleton- Appendicular skeleton system
7.	Determination of Blood group
8.	Estimation of Haemoglobin in blood
9.	Determination of bleeding time
10.	Determination of clotting time
11.	Determination of ESR
12.	Recording of body temperature
13.	Recording of pulse rate
14.	Recording of Blood pressure.
15.	**Revision**

Assessment methods and weightage

Assessment type	Assessment tool	Distribution
Continuous Assessment	Participation	5 %
	Lab work (day to day)	10 %
	Mid-semester Examination	15%
End Assessment	End Practical examination	70 %
	TOTAL	**100%**

Mid-semester to be conducted after 8th week.

Learning Resources/Recommended Texts/Reference books/web resources

1. Tortora Gerard J, Derrikson Bryan. Principles of anatomy and physiology. 11th ed. Wiley: 2006.
2. Wilson K J W. Ross and Wilson's foundations of anatomy and physiology. 5th ed. Churchill Livingstone: Edinburg; 1981.
3. Guyton arthur C. Physiology of human body. 6 th ed. Brooks coole Publisher: 1983.
4. Chatterjee C C. Human physiology. Volume I & II. Medical allied agency: Calcutta; 2004.
5. Anne Waugh and Alon Grant. Ross and Wilson Anatomy & Physiology. 11th ed. Churchill Livingstone: 2010.
6. Guyton Arthur C. Text book of Medical Physiology. 10 th ed. Harcot Publishers: Singapore; 2000.
7. Kale S R,Kale R R.practical human anatomy and physiology.19 th ed. Pune. Nirali prakashan;2009.
8. Goyal R K, Natvar M P, Shah S A. Practical anatomy, Physiology and biochemistry,1st ed. Publisher: B S Shah Publisher: Ahmadabad; 1988.

Program	**B. Pharmacy**
Year /Semester	**First year / 2nd Semester**
Name of the course	**Pharmaceutical Organic chemistry – II**
Course Code	**16BPH201**
Credits	**4**
Hours /week	**4 hours (lectures)**
Pre / co-requisite/s	**Nil**

Course Description: The pharmaceutical organic chemistry I1 course is aimed to present fundamental in chemistry of organic compounds. It emphasize on basic nomenclature, physical and chemical properties of various organic compounds. The course will emphasize the pharmaceutical importance of these functional groups, in chemistry of drug substances. The course demonstrates various mechanisms involved in synthesis and reaction of chemical compounds.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO1: Define the nomenclature, physical and chemical properties, aromaticity of a molecule in relation to the structure of carbocyclic and heterocyclic compounds.

CO2: Demonstrate the possible mechanism and the intermediate product involved in a chemical reaction.

CO3: Apply the appropriate substrate, catalyst and reaction conditions in the design of chemical reaction.

CO4: Analyze the fundamentals on behavior of chemical compounds.

NOTE: Definition, nomenclature, structure, aromaticity, reactivity, synthesis (Two important methods) acidity-basicity and characteristic reactions of one heterocyclic compound from each class. Few examples of drugs which contain the cited ring system.

Theory Course: Contents

Unit	Topics
I (2 weeks)	**Aromatic hydrocarbons:** Kekule structure of benzene, bond length, heat of hydrogenation, stability, molecular orbital picture of benzene, aromaticity, Huckel's rule, nomenclature of benzene derivatives.
	Characteristic reactions of benzene, theory of reactivity and orientation in mono substituted benzene.
II (2weeks)	**Aromatic halogen compounds:** Nomenclature, low reactivity of halo benzenes towards nucleophilic substitution, arenes, benzyne ion concept.

	Polynuclear aromatic hydrocarbons: Nomenclature, structure and aromatic character of naphthalene, resonance structures, electron density and reactivity, electrophilic substitution, oxidation and reduction reactions.
III (2 weeks)	**Phenols**: Nomenclature, general methods of preparation, physical properties, acidity of phenols, stability of phenoxide ion.
	Reactions of phenols, Kolbe-Schmidt reaction, Fries rearrangement, and Reimer-Tiemann Reaction.
IV (2weeks)	**Heterocyclic chemistry:** Introduction to heterocyclic ring system. Nomenclature of heterocyclic compounds
	Five membered ring systems: Furan, pyrrole, thiophene, pyrazole, imidazole, oxazole, isoxazole and thiazole.
V (2 weeks)	**Six membered ring systems:** *pyridine, pyrazine,* pyrimidine and pyridazine. **Seven membered ring systems:** Azepine
	Fused ring systems: *Indole, quinoline, Iso-quinoline, acridine, benzimidazole, phenothiazine and purines.
VI (2 weeks)	**Stereochemistry of Carbon compounds -** Optical rotation, plane polarized light, optical activity, chirality, elements of symmetry, notations (assignment of configuration).
	Relative configuration (Fischer DL configuration), absolute configuration (R & S), sequence rules (with examples). Concept of E & Z, cis & trans, syn & anti configurations.
VII (2 weeks)	Stereo selective, stereo specific and pericyclic reactions. Optical activity of biphenyl compounds.
	Beckmann rearrangement, Hoffmann rearrangement, Bayer-villager reaction, Benzilic acid rearrangement.
VIII (2 weeks)	Birch reduction, Mannich reaction, Michael addition reaction, Curtius rearrangement.
	Schmidt reaction, neighbouring group effects and reduction by transition metal complexes.
	Revision

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Class test	10%
	Assignments	5 %
	Mid-semester Examination	15%
End Assessment	End theory examination	70 %
	TOTAL	**100%**

Note: Class tests to be conducted at 4th and 14th Week; Mid-semester to be conducted after 8th week

Learning Resources/Recommended Texts/Reference books/web resources

1. Allyn, Bacon. Morrison and Boyd: Organic Chemistry. 7thEd. Pearson education; New Delhi: 2011.
2. T.W. Solomons. Organic Chemistry. 8thEd. University of South Florida, John Wiley & Sons, Inc; New York: 2004.
3. Arun Bahl, B.S. Bahl. Advanced Organic Chemistry. S.Chand and limited; New Delhi: 2010.
4. I.L. Finar. Organic Chemistry. Longman, Scientific & Technical. 5thEd. Co published in USA with John Wiley & Sons, Inc; New York: 2004.
5. Zimmerman and Zimmerman. Elements of Organic Chemistry. 2ndEd. Collier Macmillan Publishers; London: 1983.
6. O. P Agarwal. Organic chemistry Reaction and Reagents. 26th Ed. Goel Publishing House. New Delhi: 1996.

Program /Year/Sem	B. Pharm
Year /Semester	First year / 2nd Semester
Name of the course	Environmental Science
Course Code	16BPH202
Credits	3
Hours /week	3 hours (lectures)
Pre / co-requisite/s	Nil

Course Description: Environmental Science course mainly deals with various natural resources, effects of various kinds of pollution, conservation of resources. It also deals with problems & case studies related to population and loss of biodiversity. It describes the importance of several acts and ethics related to the environmental protection. This course also emphasizes on social issues related to resettlement and rehabilitation of people.

Course Learning Outcomes:

Upon successful completion of this course, the student should be able to:

CO 1: Define the concept of environment protection.

CO 2: Apply the several methods for enhancement of bio-diversity.

CO 3: Analyze the possible advantages & disadvantages of conservation of natural resources.

Theory Course: Contents

UNIT	Topics
I (2 weeks)	**The Multidisciplinary nature of environmental studies:** Definition, scope and importance
II (2 weeks)	**Natural Resources:** **a.** ***Forest resources****:* Use and over-exploitation, deforestation, case studies. **b.** ***Water resources****:* Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. **c.** ***Mineral resources***: Use and exploitation, case studies. **d.** ***Food resources****:* World food problems, effects of modern agriculture, fertilizer- pesticide related problems, case studies.
	e. ***Energy resources****:* Growing energy needs, renewable and non-renewable energy sources use of alternate energy sources. **f.** ***Land resources***: Land as a resource, land degradation, soil erosion and desertification.
III (2 weeks)	**Conservation of natural resources**: Role of an individual in conservation of natural resources.
	Equitable use of resources for sustainable lifestyles.
IV (2 weeks)	**Ecosystems:** Concept of an ecosystem. Structure and function of an ecosystem. Producers, consumers and decomposers. Energy flow in the ecosystem. Food chains, food webs and ecological pyramids.
	Introduction, types, characteristic features, structure and function of the

	following ecosystem: a) Forest ecosystem b) Desert ecosystem, c) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)
V (2 weeks)	**Biodiversity and its conservation:** Introduction, definition: genetic species and ecosystem diversity. **Biogeographical, classification of India. Value of biodiversity**: consumptive use and productive use. India as a mega diversity nation. Hot spots of biodiversity.
	Threats to biodiversity: Habitat loss, poaching of wildlife, man-wildlife conflicts. Endangered and endemic species of India. **Conservation of biodiversity:** In-situ conservation of biodiversity
VI (2 weeks)	**Environmental Pollution:** *Definition, causes, effects and control measures of:* a) Air pollution, b) Water pollution - Biological oxygen demand (BOD) c) Soil pollution, d) Marine pollution and e) Nuclear hazards.
	Solid waste Management: Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies. **Disaster management:** Floods, earthquake, cyclone and landslides.
VII (2 weeks)	**Social Issues and the Environment:** From unsustainable to sustainable development. Urban problems related to energy. Water conservation, rain water harvesting, watershed management Resettlement and rehabilitation of people; its problems and concerns.*Case studies*
	Ethics related to environmental protection: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear Accidents and holocaust.
VIII (2 weeks)	**Environment protection Act.** The air (prevention and control of pollution) act 1981. The Water (prevention and control of pollution) act 1974.
	The wildlife protection Act 1972. The Forest conservation Act 1980. Issues involved in enforcement of environmental legislation. Public awareness.

Assessment methods and weightage

Assessment type	Assessment tool	Distribution
Continuous Assessment	Class test	10%
	Assignments	5 %
	Mid-semester Examination	15%
End Assessment	End theory examination	70 %
TOTAL		**100%**

Note: Class tests to be conducted at 4th and 14th Week; Mid-semester to be conducted after 8th week

Learning Resources/Recommended Texts/Reference books/web resources:

TEXT BOOKS:

1. K. Mukkanti. Environmental studies. New Delhi: S. Chand; 2010.
2. R. J. Ranjit Daniel, Jagadhish Krishnaswamy. Environmental studies. India Pvt. Ltd: Wiley; 2009.
3. M. Anji Reddy. Text Book of Environmental Sciences & Technology. Hyderabad [India]: BS Publications; 2010.
4. Connell. Basic Concepts of Environmental Chemistry, 2nd ed. American Society of Agronomy, Madison: CRC Press; 2005.
5. D.K Asthana and Meera. Text book of Environmental studies. New Delhi: S. Chand & Company Ltd; 2009.
6. Y. Anjaneyulu. Introduction to Environmental Science, ed. Hyderabad: B.S. Publication; 2004.
7. C. Manohar Chary, P Jayram Reddy. Principles of Environmental Studies. india: Pharma book syndicate.

REFERENCE

BOOKS:

1. William P. Cunningham & Mary Ann Cunningham. 4th ed. : Mc Graw – Hill; 2010.
2. W. P. Cooper& et al. Environmental Encyclopedia. Mumbai: Jaico Publishing House; 2008.
3. K. C. Agarwal. Environmental Biology. Bikaner: Nidi Publishers Ltd; 2001.
4. R.Rajagopalan. Environmental Studies. Oxford University Press; 2005.

Program	B. Pharm
Year /Semester	First year / II Semester
Name of the course	General Pharmacy and Dosage forms
Course Code	16BPH203
Credits	4
Hours /week	4 hours (lectures)
Pre / co-requisite/s	Nil

Course Description: The General Pharmacy and Dosage forms course includes an introduction to the history of pharmacy, Prescription, medical and Pharmaceutical terminology, systems of measurement and Pharmaceutical calculations which are essential in compounding and utilisation of dosage forms. This course will emphasize on principles and procedures adopted in formulation of different types of dosage forms.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO 1: Define various medical and Pharmaceutical terms.

CO 2: Explain various principles and procedures involved in formulation of different types of dosage forms.

CO 3: Calculate different Pharmaceutical calculations involved in formulation.

Theory Course: Contents

Unit	Topics
I (2 weeks)	**Origin and History** Development of Pharmacy, Evolution of Pharmacy education &Industry in India, Scope of Pharmacy
	Origin and development of the Pharmacopoeias, Salient features of I.P, B.P, U.S.P.
II (2 weeks)	**Introduction to Drug and Dosage forms** Drug - Definition, Essential characteristics. Dosage form – Definition
	Classification, Advantages and disadvantages of various dosage forms.
III (2 weeks)	**Medical and Pharmaceutical terminology** Definitions of Analgesic, Antacid, Anthelmintic, Antifungal, Antimicrobial, Antiseptic, Astringent, Antipruritic, Counter irritant, Carminative, Diuretic, Diaphoretic
	Emollient, Expectorant, Keratolytic, laxative, Pharyngitis, Purgative, Rubefacient, Topical protectant.
IV (2 weeks)	**Prescription** Parts of prescription, handling of prescription, fundamental operations in compounding

	Source of errors in prescription and care required in handling of Prescription, labeling of dosage forms.
V (2 weeks)	**Pharmaceutical calculations** Weights and Measures, introduction to Latin terms, Percentage calculations, alligation method, Proof spirit calculations, displacement value
	Calculations of Isotonicity adjustment. Posology-factors affecting selection of dose & dosage form and calculations of doses.
VI (2 weeks)	**i) Monophasic Liquids** Principles and procedures adopted in formulation of Syrups, Elixirs, gargles, mouthwashes, Lotions, Liniments
	ii) Biphasic Liquids- Suspension, Emulsion
VII (2 weeks)	**i) Solid Dosage forms:** Principles and procedures adopted in formulation of Powders Simple and compound powders, insufflations, dusting powders.
	Eutectic mixtures, potent powders, effervescent powders and effervescent granules. **ii) Semisolid Dosage forms:** ointments
VIII (2 weeks)	**Incompatibilities** Introduction, classification.
	Methods to overcome incompatibility.

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Class test	10%
	Assignments	5 %
	Mid-semester Examination	15%
End Assessment	End theory examination	70 %
	TOTAL	**100%**

Note: Class tests to be conducted at 4th and 14th Week; Mid-semester to be conducted after 8th week

Learning Resources/Recommended Texts/Reference books/web resources

1. Carter S.J. Cooper & Gunns Dispensing for Pharmaceutical students. 12th ed. New Delhi: CBS Publication; 2008.
2. Metha R.M. Dispensing Pharmacy. New Delhi: Vallabh Publication; 2006.
3. Rawlins EA. Text Book of Pharmaceutics. 8th ed. New Delhi: ELBS Publications; 2004.
4. Gaud R.S. Modern dispensing Pharmacy. 3rd ed. Maharastra: career publication; 2009.
5. Medical Dictionary.

Program	**B. Pharm**
Year /Semester	**First year / 2nd semester**
Name of the course	**Human Anatomy & Physiology – II**
Course Code	**16BPH204**
Credits	**3**
Hours /week	**3 hours (lectures)**
Pre / co-requisite/s	**Nil**

Course Description: This course aimed to provide fundamental knowledge on the structure and functions of the human body. This course deals with the role of hormones and its regulation. This course describes the structure and functions of various organ systems of the human body like CNS, ANS, reproductive, endocrine, respiratory and digestive systems. This course also deals with the structure and functions of sense organs.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:
CO 1: Describe the structure and functions of various organs of the human body.
CO 2: Discuss disorders related to various organ systems.
CO 3: Explain the various hormones and their imbalances.

Theory Course: Contents

Unit	Topics
I (2 weeks)	**Central Nervous System**: Functions of different parts of brain and spinal cord. Structure of blood brain barrier and its importance. Neurochemical transmission in the central nervous system
	Electroencephalogram, cranial nerves and their functions. Disorders related to CNS (Definitions only)
II (2 weeks)	**Autonomic Nervous System**: Sympathetic nervous system & parasympathetic nervous system. Physiology of autonomic nervous system.
	Action potential, Synapse, Mechanism of neurohumoral transmission in the ANS.
III (2 weeks)	**Reproductive System:** Male and Female reproductive organs and their hormones, physiology of menstruation, and fertilization.
	Sex differentiation, coitus, spermatogenesis & oogenesis.
IV (2 weeks)	**Endocrine System I:** Anatomy &Physiology of Pituitary gland, Adrenal gland.
	Thyroid, Parathyroid gland, Calcitonin & maintenance of calcium levels in blood.
V (2 weeks)	**Endocrine System II:** Pancreas & maintenance of glucose levels in blood.
	Physiology of Oxytocin, Prolactin& Sex hormones.
VI (2 weeks)	**Respiratory System*:*** Various parts of respiratory tract and their functions. Respiratory volumes and vital capacity.
	Mechanism and regulation of respiration, Disorders related to respiratory system (Definitions only)
VII	**Digestive *System:*** Gross anatomy & Physiology of the gastro-intestinal tract,

(2 weeks)	Stomach, liver, pancreas and gall bladder.
	Role of gastro intestinal secretions in digestion & absorption. Disorders related to GIT (definitions only)
VIII (2 weeks)	**Study of sense organs:** Structure and detailed functions of eye, nose & tongue
	Structure and detailed functions of ear & skin

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Class test	10%
	Assignments	5 %
	Mid-semester Examination	15%
End Assessment	End theory examination	70 %
	TOTAL	**100%**

Note: Class tests to be conducted at 4th and 14th Week; Mid-semester to be conducted after 8th week

Learning Resources/Recommended Texts/Reference books/web resources

1. Tortora Gerard J, Derrikson Bryan. Principles of anatomy and physiology. 11th ed. Wiley: 2006.
2. Wilson K J W. Ross and Wilson's foundations of anatomy and physiology. 5th ed. Churchill Livingstone: Edinburg; 1981.
3. Guyton arthur C. Physiology of human body. 6 th ed. Brooks coole Publisher: 1983.
4. Chatterjee C C. Human physiology. Volume I & II. Medical allied agency: Calcutta; 2004.
5. Anne Waugh and Alon Grant. Ross and Wilson Anatomy & Physiology. 11th ed. Churchill Livingstone: 2010.
6. Guyton Arthur C. Text book of Medical Physiology. 10 th ed. Harcot Publishers: Singapore; 2000.

Program	**B. Pharm**
Year /Semester	**First year / 2nd semester**
Name of the course	**Pharmacognosy – I**
Course Code	**16BPH205**
Credits	**3**
Hours /week	**3 hours (lectures)**
Pre / co-requisite/s	**Nil**

Course Description: The Pharmacognosy I course is aimed to study history, development and scope of Pharmacognosy. Brief introduction to natural sources of drugs with examples: plants, animals, minerals, marine and microorganisms. Classification of drugs from natural origin: Alphabetical, Morphological, Taxonomical, Chemotaxonomic, Pharmacological and Chemical Classification with suitable examples. The course will emphasize the Cultivation, collection, processing, drying, and storage of medicinal plants. This course also provides study of crude drugs belongs to the category of Carbohydrates, Lipids, and Tannins.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO 1: List the importance of Pharmacognosy
CO2: Explain the Cultivation, collection, processing, drying, and storage of medicinal plants.
CO3: State importance of Natural sources of drugs, scientific names, active constituents, uses of drugs
CO4: Recognize the importantce of crude drugs belong to Carbohydrates, Lipids and Tannins category

Theory Course: Contents

Unit	Topics
I (2 weeks)	Definition, History, Development and Scope of Pharmacognosy
	Brief introduction to natural sources of drugs with examples: Plants, Animals, Minerals, Marine and Microorganisms
I I (2 weeks)	Classification of drugs of natural origin: Alphabetical, Morphological, Taxonomical classification
	Chemotaxonomical, Pharmacological and Chemical classification with suitable examples
III (2 weeks)	Methods of Cultivation, Collection, Processing, Drying and Storage of Medicinal plants
	Factors influencing cultivation of medicinal plants. Plant hormones and their applications
IV (2 weeks)	Introduction, Definition, Classification, Different Chemical tests for Carbohydrates

V (2 weeks)	Biological source, Active constituents, Chemistry, Identification test and Uses of the following Carbohydrates: Acacia, Tragacanth, Agar, Starch, Guar gum, Bael
	Pectin, Isabgol, Gum ghatti, Locust bean gum and Honey.
VI (2 weeks)	Definition, Classification and Properties of Tannins. Biological source, Active constituents, Chemistry, Identification test and Uses of Pale catechu, Black catechu, Galls, Myrobalan, Amla, Ashoka and Arjuna.
VII (2 weeks)	Introduction, Definition, Classification, Extraction methods, Chemistry and Analysis of Lipids.
VIII (2 weeks)	Biological source, Active constituents, Chemistry and Uses of Castor oil, Cod liver oil, Shark liver oil, Linseed oil, Cocoa butter, Wool fat
	Rice bran oil, Arachis oil, Lard, Olive oil and Chaulmoogra oil

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Class test	10%
	Assignments	5 %
	Mid-semester Examination	15%
End Assessment	End theory examination	70 %
	TOTAL	**100%**

Note: Class tests to be conducted at 4th and 14th Week; Mid-semester to be conducted after 8th week

Learning Resources/Recommended Texts/Reference books/web resources

1. Kokate CK, Purohit AP, Gokhale SB. Pharmacognosy. 44th ed. Nirali Prakashan: New Delhi; 2009.
2. Handa SS, Kapoor VK. Text book of Pharmacognosy. 1st ed. Vallabh Prakashan: Delhi; 2001.
3. James E Robbers, Varro E Tyler. Pharmacognosy and Pharmacobiotechnology. 9th ed. Williams & Wilkins: USA; 1988.
4. WHO guidelines on Good Agricultural and Collection Practices (GACP). WHO, Geneva; 2003.
5. Wallies TE. Text book of Pharmacognosy. 5th ed. CBS Publishers & Distributors: Delhi; 1999.
6. Evans WC, Trease. Pharmacognosy. 15th ed. Elsevier: Delhi; 2009.
7. Anasuya R Kashi, Ramachandran, Bindi Sukumaran. Text book of Industrial Pharmacognosy. 1st ed. Universitites Press: Hyderabad; 2012.
8. Farooqui AA, Sreeramu BS. Cultivation and Utilization of Medicinal and Aromatic Crops. 1st ed. Universitites Press: Hyderabad; 2010.
9. Vinod D Rangari. Text book of Pharmacognosy and Phytochemistry. 1st ed. Volume I & II; Career Publications; 2004.
10. Kokate CK. Gokhale AS, Gokhale SB. Cultivation of medicinal plants. 4th ed. Nirali Prakashan: Pune; 2007

Program	B. Pharmacy
Year /Semester	First year / II Semester
Name of the course	Pharmaceutical Organic chemistry –II Practical
Course Code	16BPH206
Credits	2
Hours /week	4 hours (Practical)
Pre / co-requisite/s	Nil

Course Description: The pharmaceutical organic chemistry I laboratory course is aimed to train the students on experimental techniques for the determination of physical constants of organic compounds. This course also deals with wet laboratory based experiments on identification of various chemical classes of organic compounds using basic principle of organic chemistry. This course also provides the laboratory skills related to reaction design, chemical synthesis and purification process for few organic medicinal compounds.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO1: Demonstrate the skills on determination of various physical properties of organic molecules.

CO2: Differentiate various classes of organic compounds by experimental techniques.

CO3: Perform chemical reaction and purification of organic compounds of pharmaceutical interest.

CO4: Analyze the identification of the organic compounds with different functional groups.

Week	Topics
	Name of the Experiments:
	Identification of the following organic compounds by Systematic qualitative analysis including acidic/basic/neutral character, aromatic/aliphatic, saturated/unsaturated, test for special elements and functional group identification tests.
01	Phenols
02	Amines
03	Anilides and nitro compounds
04	Amides
05	Carboxylic Acids

06	Aldehydes & Ketones
07	Alcohols
08	Esters
	A. Quantitative determination of organic compounds via functional groups
09	Phenolic groups by bromination method.
10	Alcoholic group by acetylation method
	B. Synthesis/preparation involving more than one step
11	Benzimidazole from o-phenylene diamine
12	Preparation of 2-phenylindole from Phenyl hydrazine by Fischer's method.
13	Phenothiazine from diphenyl amine
14	Condensation: Benzoin from benzaldehyde.
15	**Revision**

Practical Course : Contents

Workshop: Correlation of structure with nomenclature (Working exercise in two labs)

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Participation	5 %
	Lab work (day to day)	10 %
	Mid-semester Examination	15%
End Assessment	End Practical examination	70 %
	TOTAL	**100%**

Mid-Semester has to be conducted after 8th week.

Learning Resources/Recommended Texts/Reference books/web resources

1. Vogel, A.I, Tatchell A.R, Furnis B.S, Hannaford A.J, Smith P.W.G. Practical Organic Chemistry. 5th Ed. Pearson Publishers Prentice Hall; New Delhi: 1996.
2. R.K. Bansal, Laboratory Manual of Organic Chemistry, 5th Ed. New Age International; New Delhi 2007.
3. O.P. Agarwal, Advanced Practical Organic Chemistry, 3rd Ed. Goel Publication; Meerut: 2011.
4. F.G.Mann & B.C. Saunders, Practical Organic Chemistry, 4th Ed. Chaman enterprises; New
5. Delhi: 2004.

Program	**B. Pharm**
Year /Semester	**First year / 2nd semester**
Name of the course	**General Pharmacy and Dosage form Practical**
Course Code	**16BPH207**
Credits	**2**
Hours /week	**4 hours (Practical)**
Pre / co-requisite/s	**Nil**

Course Description: The General Pharmacy and Dosage forms practical course is aimed to train the students on formulation of different types of dosage forms. This course also deals with Pharmaceutical calculations which are essential in compounding and utilisation of dosage forms. This course also provides the skills to identify various incompatibilities in handling of Prescriptions.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO 1: Identify various incompatibilities in handling of Prescriptions

CO 2: Calculate different Pharmaceutical calculations involved in formulation.

CO 3: Formulate different types of dosage forms.

Practical Course : Contents

Week	Topics
1	Preparation of Simple syrup and Orange syrup
2	Preparation of Aqueous Iodine solution
3	Preparation of Strong ammonium acetate solution
4	Preparation of Castor oil emulsion
5	Preparation of Liquid Paraffin castor oil emulsion
6	Preparation of Calamine lotion
7	Preparation of Magnesium hydroxide mixture
8	Preparation of Camphor liniment and turpentine liniment
9	Preparation of Eutectic powder
10	Preparation of dusting powder
11	Preparation of Simple ointment
12	Preparation of Sulphur ointment

13	Dispensing procedures involving pharmaceutical calculations, and dosage calculations for paediatric and geriatric patients
14	Identification of physical, chemical and therapeutic incompatibilities in a prescription, and dispensing of such prescriptions
15	Problem based exercise
16	**Revision**

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Participation	5 %
	Lab work (day to day)	10 %
	Mid-semester Examination	15%
End Assessment	End Practical examination	70 %
	TOTAL	**100%**

Mid-semester to be conducted after 8th week.

Learning Resources/Recommended Texts/Reference books/web resources

1. Subrahmanyam C.V.S. Laboratory manual of Pharmaceutics. Delhi: vallabh publications; 2006.
2. Carter S.J. Cooper & Gunns Dispensing for Pharmaceutical students. 12th ed. New Delhi: CBS Publication; 2008.
3. Metha R.M. Dispensing Pharmacy. New Delhi: Vallabh Publication; 2006.

Program	**B. Pharm**
Year /Semester	**First year / 2nd semester**
Name of the course	**Human Anatomy & Physiology – II Practical**
Course Code	**16BPH208**
Credits	**2**
Hours /week	**4 hours (Practical)**
Pre / co-requisite/s	**Nil**

Course Description: This course aimed to train the students on experimental techniques for the estimation of RBC, WBC, and DLC. This course deals with the experiments on Spirometry like determination of vital capacity. This course also provides basic knowledge of ECG-PQRST waves and their significance.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:
CO 1: Describe various organ systems.

CO 2: Explain different family planning methods.

CO 3: Estimate RBC, WBC, and DLC.

Practical Course: Contents

Week	Topics
1	Study of Male Reproductive system with help of charts &models
2	Study of Female Reproductive system with help of charts &models
3	Study of neubauers chamber
4	Estimation of R.B.C. count
5	Estimation of W.B.C count
6	Estimation of D.L.C.
7	Study of Digestive system with help of charts &models
8	Study of CNS with help of charts &models
9	Study of ANS with help of charts &models
10	Study of Respiratory system with help of charts &models
11	Determination of vital capacity
12	Study of ECG: Basic understanding of ECG - PQRST waves and their significance.

13	Study of different family planning appliances.
14	Study of Urinary system with help of charts &models
15	**Revision**
16	**Revision**

Assessment methods and weightage

Assessment type	Assessment tool	Distribution
Continuous Assessment	Participation	5 %
	Lab work (day to day)	10 %
	Mid-semester Examination	15%
End Assessment	End Practical examination	70 %
	TOTAL	**100%**

Mid-semester to be conducted after 8th week.

Learning Resources/Recommended Texts/Reference books/web resources

1. Tortora Gerard J, Derrikson Bryan. Principles of anatomy and physiology. 11th ed. Wiley: 2006.
2. Wilson K J W. Ross and Wilson's foundations of anatomy and physiology. 5th ed. Churchill Livingstone: Edinburg; 1981.
3. Guyton arthur C. Physiology of human body. 6 th ed. Brooks coole Publisher: 1983.
4. Chatterjee C C. Human physiology. Volume I & II. Medical allied agency: Calcutta; 2004.
5. Anne Waugh and Alon Grant. Ross and Wilson Anatomy & Physiology. 11th ed. Churchill Livingstone: 2010.
6. Guyton Arthur C. Text book of Medical Physiology. 10 th ed. Harcot Publishers: Singapore; 2000.
7. Kale S R,Kale R R.practical human anatomy and physiology.19 th ed. Pune. Nirali prakashan;2009.
8. Goyal R K, Natvar M P, Shah S A. Practical anatomy, Physiology and biochemistry, 3 rd ed. Publisher: B S Shah Publisher: Ahmadabad; 1988.

Program	B. Pharm
Year /Semester	First year / 2nd semester
Name of the course	Pharmacognosy – I Practcal
Course Code	16BPH209
Credits	2
Hours /week	4 hours (Practical)
Pre / co-requisite/s	Nil

Course Description: The Pharmacognosy I laboratory course is aimed to train the students that collection and preparation of herbarium of natural drugs. This course provides the laboratory skills of various morphological characters and chemical test of the drugs mentioned in theory under lipids, carbohydrates and tannins. This course also deals with laboratory based experiments on identification of drugs by swelling factor.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO 1: Demonstrate the skills on Collection and preparation of herbarium of natural drugs.

CO 2: Illustrate morphological charecters of crude drugs.

CO 3. Evaluate crude drugs by chemical test.

Practical Course: Contents

Week	Topics
1.	Introduction to laboratory safety techniques and the use of glass wares and chemicals.
2.	Study of microscope.
3.	Collection and preparation of herbarium/ laminated photos/ specimens of natural drugs.
4.	Study of various morphological characters of carbohydrates
5.	Study of various morphological characters of lipids
6.	Study of various morphological characters of tannins
7.	Chemical tests for Acacia, Tragacanth, Agar
8.	Chemical tests for Starch, Guar gum and Honey
9.	Chemical tests for Pale catechu, Black catechu
10.	Chemical tests for Castor oil, Cod liver oil, Shark liver oil and Linseed oil
11.	Chemical tests for Cocoa butter, Wool fat, Rice bran oil and Arachis oil
12.	Chemical tests for Lard, Olive oil and Chaulmoogra oil
13.	Determination of swelling factor of mucilage containing herbal drug.
14.	**Revision**

Assessment methods and weightage

Assessment type	Assessment tool	Distribution
Continuous Assessment	Participation	5 %
	Lab work (day to day)	10 %
	Mid-semester Examination	15%
End Assessment	End Practical examination	70 %
	TOTAL	**100%**

Mid - semester to be conducted after 8th week.

Learning Resources/Recommended Texts/Reference books/web resources

1. Kokate CK, Gokhale SB. Practical Pharmacognosy. 5th ed. Nirali Prakashan: Delhi; 2003.
2. Khandelwal KR, Vrunda Sethi. Practical Pharmacognosy. 25th ed. Nirali Prakashan: Delhi; 2015.
3. Iyangar MA. Study of crude drugs. 12th ed. Manipal Press Limited: Manipal; 2004.
4. Biren N Shafi, Nayak BS. Experimental Pharmacognosy. 1st ed. S Vikas & Co: Pune; 2009.
5. Iyangar MA, Nayak SK. Anatomy of Crude drugs. 12th ed. Manipal Press Limited: Manipal; 2011.

Program	B. Pharm
Year /Semester	Second year / Ist Semester
Name of the course	Physical Pharmacy – I
Course Code	16BPH301
Credits	4
Hours /week	4 hours (lectures)
Pre / co-requisite/s	Nil

Course Description: The Physical Pharmacy – I course is aimed to describe the fundamental aspects of intermolecular forces, thermodynamics, solubilization of electrolytes & non-electrolytes, pH & tonicity that govern the *In-vivo* & *In-vitro* actions of pharmaceutical products. This course also provides the skills related to determination of various physical & colligative properties.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO 1: Define the different states of matter, laws of physical pharmacy.

CO2: Describe the theories of solution of electrolytes & ionic equilibria.

CO3: Apply the appropriate principles in determining the physical properties of drug molecules.

CO4: Calculate acidity constants, pH and tonicity to convert paratonic solutions to isotonic solutions.

Theory Course: Contents

Unit	Topics
I (2 weeks)	Intermolecular forces : Binding forces between molecules. States of matter: the gaseous state
	The liquid state, Solid state & liquid crystalline state
II (2 weeks)	Phase rule: Definition and explanation. One component (water system),
	Reduced phase rule equation, two compartment system (Phenol - water system & TEA - Water system).
III (2 weeks)	Thermodynamics: The zeroth, first law of thermodynamics.
	The second, third law of thermodynamics. Limitation so laws, Free energy functions (gibbs, Helmholtz) and applications, entropy of mixing.
IV (2 weeks)	Physical properties of drug molecules: refractive index and molar refraction, Dielectric constant.
	Induced polarization, dipole moment and optical rotatory dispersion.

V (2 weeks)	Solutions of Non electrolytes: ideal and real solutions, colligative Properties. lowering of vapour pressure,
	Depression in freezing point, elevation of boiling point and Osmotic pressure, their molecular weight determinations.
VI (2 weeks)	Solutions of Electrolytes: The Arrhenius theory of electrolyte dissociation. Properties of solutions of electrolytes.
	The modern theory of strong electrolytes (activity & Activity co-efficient, ionic strength), and other coefficients for expressing colligative properties.
VII (2 weeks)	Ionic equilibria: Modern theories of acids, bases and salts,
	Sorensen's pH scale, calculation of pH and acidity constants.
VIII (2 weeks)	Buffers and isotonic systems: The Henderson-hasselbalch equation, buffer capacity, buffers in pharmaceutical and biological systems, isotonic solutions, methods of adjusting tonicity and pH (Relevant numerical problems).
	Revision

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Class test	10%
	Assignments	5 %
	Mid-semester Examination	15%
End Assessment	End theory examination	70 %
	TOTAL	**100%**

Note: Class tests to be conducted at 4th and 14th Week; Mid-semester to be conducted after 8th week.

Learning Resources/Recommended Texts/Reference books/web resources

1. Sinko P.J. Martin's Physical Pharmacy and Pharmaceutical Sciences. 5th ed. New Delhi: Wolters Kluwer Health Pvt.Ltd.,; 2007.
2. Subramanyam C.V.S. Essentials of Physical Pharmacy. 1st ed. Delhi: Vallabh Prakashan; 2008.
3. Manavalan. R, Ramaswamy. C. Physical pharmaceutics. 2nd ed. Tamilnadu: Vignesh publisher; 2008.
4. http://www.e-booksdirectory.com
5. http://www.jblearning.com
6. http://pharmacyebook.blogspot.in

Program	**B. Pharm**
Year /Semester	**Second/ 1st semester**
Name of the course	**Pharmaceutical Engineering**
Course Code	**16BPH302**
Credits	**4**
Hours /week	**4 hours (lectures)**
Pre / co-requisite/s	**Nil**

Course Description: The Pharmaceutical Engineering course is designed to impart a fundamental knowledge on the art and science of various machines and their handling in pharmaceutical industry. This course focuses on various topics like fluid flow, material handling, Size reduction, Size separation, mixing, distillation, filtration, crystallization, evaporation and drying. This course also focuses on construction, working and various applications of machinery related to above specified techniques. This course emphasizes pharmaceutical importance of different equipment's with merits and demerits.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO 1: Define various unit operations used in Pharmaceutical Industries.
CO 2: Describe different material handling techniques.
CO 3: Demonstrate various processes involved in Pharmaceutical manufacturing process.

Theory Course: Contents

Unit	Topics
I (2 weeks)	Introductory concepts and Fluid Flow: Unit operation / Unit processes, material and energy balance, Equilibrium state, rate process, steady and unsteady states. Types of flow, Reynold's number, bernoulli's equation, manometers- Simple, differential, Inclined
	Material handling systems a. Liquid handling - Study of different types of pumps such as Reciprocating pumps, centrifugal pumps b. Gas handling - various types of fans, blowers. c. Solid handling – Conveyor - Belt, Screw, Pneumatic
II (2 weeks)	Humidity control: Definitions. Psychrometric charts and measurement of humidity, application of humidity measurement.
	Distillation: Theory of distillation, azeotropic distillation, steam distillation, Fractional distillation and molecular distillation.
III (2 weeks)	Filtration: Theory of filtration, Types of filtration- Surface, depth filtration. Factors affecting filtration, filter aids, filter media, industrial filters including filter press, rotary filter, edge filter.

	Centrifugation: Principles of centrifugation, industrial centrifugal filters - perforated basket centrifuge, semi continuous centrifuge filters, centrifugal sedimenters - super centrifuge, conical disc centrifuge, optimum cleaning cycle in batch filters.
IV (2 weeks)	Crystallization: Characteristics of crystals, Solubility curves, Supersaturation theory and its limitations, crystal growth. Study of various types of crystallizers such as Swenson walker crystalizer, vacuum crystalizer, Krystal crystallizer. Caking of crystals and its prevention
	Evaporation: Definition and theory of evaporation, factors affecting evaporation, evaporators-film evaporators.
V (2 weeks)	Drying: Moisture content and theory of drying, rate of drying and time of drying calculations, drying curves. Concept of loss on drying and its importance.
	Classification and types of dryers, dryers used in pharmaceutical industries- tray dryer, Fluid bed dryer, spray dryer, freeze-dryer, vacuum dryer.
VI (2 weeks)	Size Reduction: Definition, theory and applications of size reduction, factors affecting size reduction, laws governing energy requirements of a mill.
	A brief study of ball mill, hammer mill, fluid energy mill.
VII (2 weeks)	Size Separation: Different techniques of size separation, sieves, sieve shakers.
	Continuous sedimentation tank, cyclone separators, bag filters.
VIII (2 weeks)	Mixing: Theory of mixing, solid-solid, solid-liquid and liquid-liquid mixing equipments-double cone, twin-shell, silverson mixer, colloid mill.
	sigma blade mixer, planetary mixer, propeller mixer and turbine mixer. Homogenizer, triple roller mill.

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Class test	10%
	Assignments	5 %
	Mid-semester Examination	15%
End Assessment	End theory examination	70 %
	TOTAL	**100%**

Note: Class tests to be conducted at 4th and 14th Week; Mid-semester to be conducted after 8th week

Learning Resources/Recommended Texts/Reference books/web resources

1. Carter S.J. Cooper and Gunn's Tutorial Pharmacy. 6th ed. Delhi: CBS publisher; 2005.
2. Subramanayam C.V.S. Pharmaceutial engineering principles and practices. Delhi: Vallabh Prakashan; 2005.
3. Samba Murthy K. Pharmaceutical Engineering. New Delhi: New Age International Publishers Ltd; 2008.
4. Girish k. jani. Pharmaceutical engineering-I. 5th ed. Ahmedabad: B.S. Shah prakashan; 2007-2008.
5. Girish k. jani. Pharmaceutical engineering-II. 5th ed. Ahmedabad: B.S. Shah prakashan; 2007-2008.
6. Rawlins EA. Text Book of Pharmaceutics. 8th ed. New Delhi: ELBS Publications; 2004.

Programme	**B. Pharm**
Year /Semester	**Second year / 1st semester**
Name of the course	**Pharmaceutical Analysis**
Course Code	**16BPH303**
Credits	**4**
Hours /week	**4 hours (Lectures)**
Pre / co-requisite/s	**Nil**

Course Description:

The pharmaceutical analysis course provides the knowledge of basic principles in quantitative pharmaceutical analysis and aid opportunity to develop awareness of drug quality and it's control. It also covers different analytical techniques like refractometry, polarimetry, conductometry, polarography, amperometry, ORD, XRD, RIA, ELISA, exothermic and endothermic reactions and chromatographic techniques like column chromatography, paper chromatography, thin layer chromatography.

Course Learning Outcomes:

Upon successful completion of this course, the student should be able to:

CO 1: Choose the analytical technique depending upon the drug substance/ drug product.

CO 2: Analyze the physical/chemical property of the drug in a reproducible manner.

CO 3: Adapt chromatographic techniques to isolate/separate the mixture of compounds.

Theory Course: Contents

Unit	Topics
I (2 Weeks)	Introduction to Pharmaceutical analysis, quality control and quality assurance, Classification of analytical methods, Introduction to qualitative and quantitative analysis and its significance, Importance of quality control and quality assurance in pharmacy.
	Principle, instrumentation and applications of i) Refractometry, ii) Polarimetry
II (2 Weeks)	Potentiometry: Introduction to EMF, electrochemical cells and half cells, Electrodes, measurement of potential, pH curve, EMF curve, derivative curve in application to end point determination.
	Conductometric titrations: Basic concepts, conductivity cell, different types of conductometric titrations.
III (2 Weeks)	Polarography: Basic concepts, apparatus and principles, different currents, polarographic maxima, general polarographic analysis, applications in identification and quantification of metals
	Amperometric titrations with one polarized electrode, general procedure, titration curves, applications in pharmaceutical analysis.
IV (2 Weeks)	Physical and chemical methods of determination of moisture content (including Karl-Fisher method, LOD, IR balance).
	Basic Principles (exothermic and endothermic reactions) and applications of differential thermal analysis (DTA), thermo gravimetric analysis (TGA)

	and differential scanning colorimetry (DSC)
V (2 Weeks)	Principle of optical activity, optical purity, concept of Optical Rotatory dispersion (ORD), Cotton effect, Octant Rule, Circular dichroism Vs ORD.
	XRD: production X-ray, types, Braggs law, XRD pattern in identification and comparison of polymorphs with examples.
VI (2 Weeks)	Radio Immuno Assay & Enzyme Linked Immuno Sorbate Assay: principle, types of RIA and ELISA tests and their applications in diagnosis.
	Basic Chromatography: Introduction to chromatography as an analytical tool. Chromatographic separation methods
VII (2 Weeks)	Basic Chromatography: Concepts for selection of Mobile Phase and Stationary Phase. Retention time, Retention volume, resolution.
	Column chromatography: Adsorption and partition theory, adsorbents used, preparation, procedure and methods of detection and applications.
VIII (2 weeks)	Thin layer chromatography: Principle, 1D and 2D techniques, preparation of plates, and detection techniques and applications. HPTLC: Principle, instrumentation and applications
	Paper Chromatography: Theory, different techniques employed, filter papers used, qualitative and quantitative detection.

Assessment methods and weightage

Assessment type	Assessment tool	Distribution
Continuous Assessment	Class test	10%
	Assignments	5 %
	Mid-semester Examination	15%
End Assessment	End theory examination	70 %
	TOTAL	**100%**

Note: Class tests to be conducted at 4th and 14th Week; Mid-semester to be conducted after 8th week.

Learning Resources/Recommended Texts/Reference books/web resources

1. Vogel AI. Text book of quantitative chemical analysis. 5th ed. Newyork: Longman Scientific & Technical; 1989. ISBN 0582446937
2. Indian pharmacopeia. (2014). Government of India, Ministry of health and family welfare. Vol 1, 2, 3. Ghaziabad: Published by Indian pharmacopeial commission.
3. The British Pharmacopoeia. (2014).The commission of human medicines pursuant to the medicines act 1968, Vol 1 to 5, London: Published by stationery office on behalf of the medicines and health care products regulatory agency (MHRA).
4. The United states pharmacopoeia-National formulary. (USP 37-NF 32). Rockville: Published by the united states pharmacopoeial convention.

5. The European pharmacopoeia. (2008). 6th ed., Strasbourg: Published by the council of Europe.
6. The Japanese Pharmacopoeia. (2006). 13th ed., Japan: Published by the society of Japanese Pharmacopoeia, under the supervision of the R & D division, Pharmaceutical affairs bureau, Ministry of health & welfare.
7. Skoog DA, James HF, Crouch SR. Principles of Instrumental Analysis. 6th ed. India: Cengage Learning; 2007. ISBN-13: 978-0495012016, ISBN-10: 0495012017.
8. Connors KA. A textbook of Pharmaceutical Analysis. 3rd ed. India: Wiley India Pvt. Ltd; 1982. ISBN: 8LGYW9TY5P8.
9. Napoleon AA. Pharmaceutical titrimetric analysis, India: Kalaimani publishers and distributors; 2013.

Program /Year/Sem	B. Pharm
Year /Semester	Second year / Ist Semester
Name of the course	Biostatistics and Computer Applications
Course Code	16BPH304
Credits	3
Hours /week	3 hours (lectures)
Pre / co-requisite/s	Nil

Course Description:

Statistical methods and Computer applications course that provides an integrated presentation of Statistical methods and Computer applications. Information about each method is presented to explain the processes involved in Computer knowledge and statistical methods so that students will develop an understanding of the usage of the methods in Pharmaceutical clinical studies. Students are able to interpret testing of Statistical methods and Computer applications in Pharmaceutical clinical studies.

In this subject there are different Computer science technologies and Statistical methods in pharmacy field considered. Multidisciplinary approach allows facilitating the understanding of interrelations between Computer science technologies, Statistical methods and applications and improves the education at Pharmaceutical clinical studies.

Course Learning Outcomes: Upon successful completion of this course, the students should be able to:

CO1: Define basics of statistics, correlation coefficient and regression, ANOVA and MS-Office applications
CO2: Perform the operating system of computer and its applications in pharmacy.
CO3: Analyze the statistical quality control of *X*-bar chart, *R* chart, *c* chart, *p* chart.

Theory Course: Contents

Unit	Topics
I (2 weeks)	Basics of Statistics Types of data, collection of data, variables and variation, sample, population, statistic and parameter
	Measures of central tendency of dispersion, coefficient of variation graphical representation of data
II (2 weeks)	Histogram, semilogarithmic plots, bar, pie, diagrams, binomial, poison and normal distributions, kurtosis and skewness.
	Correlation and Regression Correlation spearman coefficient of correlation, pearson's rank correlation, regression analysis, linear regression.
III (2 weeks)	Statistical Inference Basics of testing hypothesis, null hypothesis, alternate hypothesis, level of significance

	Statistical Inference Confidence interval standard errors, parametric and non-parametric tests used in pharmaceutical experiments.
IV (2 weeks)	ANOVA One way and two way analysis, CRD, RBD, latin square designs, SQC, applications of statistical concepts in pharmaceutical sciences.
	MS-Office MS-Word, MS-Excel, MS-Powerpoint.
V (2 weeks)	Information technology Internet and world wide web, Search strategies.
	Introduction to Computers Components of computer, computer languages, use of computers
VI (2 weeks)	Introduction to Computers Introduction to Operation System.
	Introduction to Computers MS-DOS, MS-Windows, LINUX.
VII (2 weeks)	Computer applications in pharmaceutical clinical studies, computer validation-introduction
	Work study Basic procedure involved in method study and work Measurement
VIII (2 weeks)	Statistical Quality Control: *X*-bar chart, *R* chart, *c* chart, *p* chart, (Simple Problems), Acceptance Sampling, Deming's contribution to quality.
	Revision

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Class test	10%
	Assignments	5 %
	Mid-semester Examination	15%
End Assessment	End theory examination	70 %
	TOTAL	**100%**

Note: Class tests to be conducted at 4th and 14th Week; Mid-semester to be conducted after 8th week

Learning Resources/Recommended Texts/Reference books/web resources

1. Shukla RS, Chandel PS. Cytogenetic, Evolution, Biostatics and Plant Breeding. India: S. Chand & company limited; 2009. ISBN:10: 8121929067 / ISBN 13: 9788121929066.
2. Pranab K. Introduction to Biostatistics: A Textbook of Biometry. India: S. Chand & company limited; 2007. ISBN-10: 8121923298, ISBN-13: 978-812192329.
3. Khan, Khanum. Fundamentals of Biostatistics. India: Ukaaz Publications; 1994. ISBN-10: 8190044109 / ISBN-13: 978-8190044103.
4. Sanford Bolton, Charles Bon. Pharmaceutical Statistics. 5th ed. Florida: CRC Press; 2009. ISBN-13: 978-1420074222 / ISBN-10: 1420074229.
5. Ron Mansfiled. Working in Microsoft office. Noida: Tata McGraw-Hill Education Pvt. Ltd; 2004.

Program	**B. Pharm**
Year /Semester	**Second year / Ist Semester**
Name of the course	**Physical Pharmacy – I Practical**
Course Code	**16BPH305**
Credits	**2**
Hours /week	**4 hours (Practical)**
Pre / co-requisite/s	**Nil**

Course Description: The Physical Pharmacy – I laboratory course is aimed to train the students on experimental techniques for the determination of physico-chemical properties. This course also deals with wet laboratory based experiments on identification critical solution temperatures of binary phase systems. This course also provides the laboratory skills related to determination of pH, physical & colligative properties.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO 1: Demonstrate the skills on determination of various physical properties of drug molecules.

CO2: Operate equipments like pH meter, Refractometer etc.,

CO 3: Calculate the buffer capacities of pharmaceutical buffers by experimental techniques.

Practical Course : Contents

Week	Topics
1.	Introduction to laboratory safety techniques and the use of glass wares and chemicals.
2.	Determination of CST for Phenol- water system.
3.	Determination of effect of impurities (1% NaCl) on Phenol water system.
4.	Determination of LCT for TEA (Tri Ethyl Amine)- Water system.
5.	Construction of Ternary phase diagram.
6.	Determination of refractive index of liquids.
7.	Determination of percent composition of glycerine by Capillary Flow method.
8.	Determination of molecular weight by Rast camphor method.
9.	Estimation of pKa by Half Neturalization Method.
10.	Calibration of pH Meter using standard buffers

11.	Estimation of pH using pH meter.
12.	Preparation of phosphate Buffers
13.	Determination of Buffer Capacity.
14.	Demonstration on Polarimeter.
15.	Problem based exercise
16.	**Revision**

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Participation	5 %
	Lab work (day to day)	10 %
	Mid-semester Examination	15%
End Assessment	End Practical examination	70 %
	TOTAL	**100%**

Mid-semester to be conducted after 8th week.

Learning Resources/Recommended Texts/Reference books/web resources

1. Subramanyam. C.V.S., Vasanthraju. S.G. Laboratory manual of physical pharmacy. 2nd ed. New Delhi: Vallabh Prakashan; 2009.
2. Guru Prasad mohanta, Prabal kumar manna. Physical pharmacy practical text. 1st ed. Hyderabad: Pharma Med Press; 2008.
3. Gaud. R.S., Gupta. G.D. Practical physical pharmacy. 1st ed. New Delhi: CBS Publishers; 2005.
4. www.Pharmamedpress.com

Program	**B. Pharm**
Year /Semester	**Second / 1st Semester**
Name of the course	**Pharmaceutical Engineering Practical**
Course Code	**16BPH306**
Credits	**2**
Hours /week	**4 hours (Practical)**
Pre / co-requisite/s	**Nil**

Course Description: The Pharmaceutical Engineering Practical course is aimed to train the students on handling of equipments related to size reduction, size separation and mixing. This course also deals with determination of humidity using thermometers, rate of drying, rate of filtration, extraction by distillation and rate of evaporation.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO 1: Demonstrate the techniques of filtration, distillation and size reduction.
CO 2: Perform and illustrate different mixing techniques.
CO3: Measure humidity at different environments using dry bulb and wet bulb thermometers.

Practical Course : Contents

Week	Topics
1	Study of factors (effect of solid concentration, viscosity, surface area) affecting rate of filtration.
2	Effect of filter aid and filter media on rate of filtration.
3	Estimation of sedimentation time for suspensions by centrifugation.
4	Determination of particle size distribution of powder by sieving method.
5	Experiment to illustrate size reduction using Ball mill.
6	Determination of mixing index using double cone blender.
7	Determination of mixing efficiency of soluble solids in liquids using propeller blade.
8	Determination of humidity by Dew point method.
9	Determination of humidity by Psychrometric charts.
10	Effect of surface area on rate of evaporation.
11	Determination of rate of drying.
12	Determination of Loss on drying.
13	Extraction of volatile oil by steam distillation.

Assessment methods and weightage

Assessment type	Assessment tool	Distribution
Continuous Assessment	Participation	5 %
	Lab work (day to day)	10 %
	Mid-semester Examination	15%
End Assessment	End Practical examination	70 %
TOTAL		**100%**

Mid-semester to be conducted after 8th week.

II. DEMO/ WORKSHOP

Determination of type of flow (Reynolds experiment)
Double cone blender, homogenizer, tray dryer.

III. SEMINAR/ASSIGNMENT/GROUP DISCUSSION

Symbols used in flow sheets for drawing equipment.

Learning Resources/Recommended Texts/Reference books/web resources

1. Subrahmanyam CVS. Laboratory manual of Pharmaceutical Engineering (Unit operations). New delhi: vallabh publications; 2006.
2. Venkateshwara Rao T. Pharmaceutical engineering (unit operations) Practical manual. Hyderabad: Tarus publishers; 2014.
3. Sudhakara reddy. Pharmaceutical engineering (unit operations) Practical manual. Hyderabad: Pharma book syndicate; 2007.
4. Goti. Pharmaceutical engineering (unit operations). Jalandhar: Vikas Publications; 2006.

Programme	**B. Pharm**
Year /Semester	**Second year / 1st semester**
Name of the course	**Pharmaceutical Analysis Practical**
Course Code	**16BPH307**
Credits	**2**
Hours /week	**4 hours (Practical)**
Pre / co-requisite/s	**Nil**

Course Description:

The pharmaceutical analysis course describes the fundamental skills of non-instrumental pharmaceutical techniques and their applications. It provides the significant skills up on the practical handling techniques of glass wares, solvents and others. It also provides the awareness of determinate and indeterminate errors while performing the analysis like potentiometry, conductometry, refractometry, polarimetry and chromatographic analysis like ascending paper chromatography, radial paper chromatography and thin layer chromatography.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO 1: Perform quantative analysis for drug substance/drug product with in electrochemical techniques.

CO 2: Adapt various electrochemical techniques to identify/quantify the API or in matrix.

CO 3: Demonstrate skill in separation techniques and moisture content determination.

Practical Course: Contents

Week	Name of the experiments
1	Determination of strength of hydrochloric acid by potentiometry.
2	Assay of metronidazole by potentiometry as per IP 2010.
3	Assay of furosemide by potentiometry as per BP 2014.
4	Determination of strength of potassium chloride by conductometry.
5	Determination of pKa using pH meter.
6	Determination of refractive index of various sample by Abbe's refractometer.
7	Determination of optical rotation for sucrose/dextrose by polarimeter.
8	Determination of loss on drying (LOD) of paracetamol as per IP 2010.
9	Identification of amino acids/sugars by ascending paper chromatography.
10	Identification of amino acids/sugars by radial paper chromatography.
11	Identification of amino acids/sugars/essential oils/fixed oils by thin layer chromatography.
12	Identification of related substances present in Paracetamol by TLC as per (IP-2007)
13	Determination of moisture content by Karl Fischer titration (Demo).
14	Column chromatographic separation of phytocompounds (Demo).
15	Revision
16	Assignment/ Work shop

Assessment methods and weightage

Assessment type	Assessment tool	Distribution
Continuous Assessment	Participation	5 %
	Lab work (day to day)	10 %
	Mid-semester Examination	15%
End Assessment	End Practical examination	70 %
	TOTAL	**100%**

Mid-semester to be conducted after 8th week.

Learning Resources/Recommended Texts/Reference books/web resources

1. Vogel AI. Text book of quantitative chemical analysis. 5th ed. Newyork: Longman Scientific & Technical; 1989. ISBN 0582446937
2. Indian pharmacopeia. (2014). Government of India, Ministry of health and family welfare. Vol 1, 2, 3. Ghaziabad: Published by Indian pharmacopeial commission.
3. The British Pharmacopoeia. (2014).The commission of human medicines pursuant to the medicines act 1968, Vol 1 to 5, London: Published by stationery office on behalf of the medicines and health care products regulatory agency (MHRA).
4. The United states pharmacopoeia-National formulary. (USP 37-NF 32). Rockville: Published by the united states pharmacopoeial convention.
5. The European pharmacopoeia. (2008). 6th ed., Strasbourg: Published by the council of Europe.
6. The Japanese Pharmacopoeia. (2006). 13th ed., Japan: Published by the society of Japanese Pharmacopoeia, under the supervision of the R & D division, Pharmaceutical affairs bureau, Ministry of health & welfare.
7. Skoog DA, James HF, Crouch SR. Principles of Instrumental Analysis. 6th ed. India: Cengage Learning; 2007. ISBN-13: 978-0495012016, ISBN-10: 0495012017.
8. Connors KA. A textbook of Pharmaceutical Analysis. 3rd ed. India: Wiley India Pvt. Ltd; 1982. ISBN: 8LGYW9TY5P8.
9. Napoleon AA. Pharmaceutical titrimetric analysis, India: Kalaimani publishers and distributors; 2013.

Program /Year/Sem	**B. Pharm**
Year /Semester	**Second year / Ist Semester**
Name of the course	**Biostastistics and Computer Applications Practical**
Course Code	**16BPH308**
Credits	**2**
Hours /week	**4 hours (Practical)**
Pre / co-requisite/s	**Nil**

Course Description: Statistical Methods and Computer Applications course that provides an integrated presentation of Statistical Methods and Computer Applications. Information about each method is presented to explain the processes involved in Computer knowledge and Statistical methods so that students will develop an understanding of the usage of the methods in pharmaceutical clinical studies. Students are able to interpret testing of Statistical methods and Computer applications in pharmaceutical clinical studies. In this Subject there are different Computer science technologies and statistical methods in pharmacy field considered. Multidisciplinary approach allows facilitating the understanding of interrelations between computer science technologies, Statistical methods and applications and improves the education at Pharmaceutical clinical studies.

Course Learning Outcomes: Upon successful completion of this course, the students should be able to:

CO1: Define basics of statistics, correlation coefficient and regression, ANOVA and MS-Office applications
CO2: Perform the operating system of computer and its applications in pharmacy.
CO3: Analyze the statistical quality control of *X*-bar chart, *R* chart, *c* chart, *p* chart.
CO4: Adapt various charts like construction of x-chart and R-chart.

Practical Course : Contents

Week	Topics
1.	Computation of Mean, S.D and Coefficient of variation
2.	Computation of Correlation
3.	Equations of Regression lines
4.	Fitting a Straight line
5.	Student t-test
6.	Chi-square test
7.	ANOVA-one way
8.	ANOVA-two way
9.	CRD Experimentation

10.	Randomized Block Design
11.	Latin Square Design
12.	Construction of x-chart
13.	Construction of R-chart
14.	MS-WORD Experiment
15.	MS-Excel and Powerpoint Experiment
16.	**Revision**

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Participation	5 %
	Lab work (day to day)	10 %
	Mid-semester Examination	15%
End Assessment	End Practical examination	70 %
	TOTAL	**100%**

Mid-semester to be conducted after the 8th week.

Learning Resources/Recommended Texts/Reference books/web resources

1. Shukla RS, Chandel PS. Cytogenetic, Evolution, Biostatics and Plant Breeding. India: S. Chand & company limited; 2009. ISBN:10: 8121929067 / ISBN 13: 9788121929066.
2. Pranab K. Introduction to Biostatistics: A Textbook of Biometry. India: S. Chand & company limited; 2007. ISBN-10: 8121923298, ISBN-13: 978-812192329.
3. Khan, Khanum. Fundamentals of Biostatistics. India: Ukaaz Publications; 1994. ISBN-10: 8190044109 / ISBN-13: 978-8190044103.
4. Sanford Bolton, Charles Bon. Pharmaceutical Statistics. 5th ed. Florida: CRC Press; 2009. ISBN-13: 978-1420074222 / ISBN-10: 1420074229.
5. Ron Mansfiled. Working in Microsoft office. Noida: Tata McGraw-Hill Education Pvt. Ltd; 2004.

Program	B. Pharm
Year /Semester	Second year / 2nd Semester
Name of the course	Physical Pharmacy- II
Course Code	16BPH401
Credits	4
Hours /week	4 hours (lectures)
Pre / co-requisite/s	Nil

Course Description: The Physical Pharmacy- II course is aimed to apply physico -chemical principles in the delivery of drug and the design of pharmaceutical dosage forms. The course will emphasize the pharmaceutical importance of complexation in improving solubility. This also deals with drug decomposition & kinetics. This course provides the skills required in pharmaceutics and physical pharmacy.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO 1: Define the fundamental aspects of solubility, distribution, flow of liquids & solids.

CO2: Recognize the importance of micromeretics, rheology & interfacial phenomenon in manufacturing of dosage form.

CO 3: Apply the principles of diffusion and complexation in formulations.

CO 4: Test the drug decomposition kinetics & stability of dispersed systems.

Theory Course: Contents

Unit	Topics
I (2 weeks)	Solubility and distribution law: Solvent-solute interaction, solubility of gases in liquids, solubility of liquids in liquids,
	Solubility of solids in liquids, distribution of solutes in immiscible solvents-effect of association & dissociation, applications. Introduction to phenomena of diffusion: Fick's first law and second law.
II (2 weeks)	Complexation: Classification, mechanism of complex formation, Metal complexes, organic molecular complexes, inclusion complexes,
	advantages of complexation, methods of analysis.
III (2 weeks)	Kinetics: Introduction to the concept of kinetics and their application in pharmacy. Concept of zero order, first order, and pseudo order reactions. Determination of reaction order.
	Half life period ($t_{1/2}$), shelf life period (t_{90}) and their usefulness. Influence of temperature and Arrhenious theory. Decomposition and stabilization of medicinal agents, accelerated stability testing of drugs and determination of shelf life period.

IV (2 weeks)	Interfacial Phenomena: Liquid interfaces, measurement of surface and interfacial tensions, adsorption at liquid interfaces.
	Adsorption isotherms only (freundlich's isotherms and Langmuir's isotherm's). Surface-active agents and HLB scale. Parachor, Adsorption at solid interfaces. Electrical properties of interfaces.
V (2 weeks)	Micromeritics: Particle size distribution, average particle size, number and weight distribution,
	Particle number, methods for determining particle volume, surface area, particle size, derived properties of powders.
VI (2 weeks)	Rheology: Newtons law of flow, Newtonian systems, non-Newtonian systems,
	Thixotropy, measurement and applications in formulations. Determination of viscosity and its applications.
VII (2 weeks)	Colloids: Introduction, types of colloidal systems, Stability of colloids,
	Optical Properties, kinetic properties, electrical properties and Donnan Membrane equilibrium, gold number.
VIII (2 weeks)	Coarse Dispersions: *Suspensions*: Types and theories of suspensions, interfacial properties of suspended particles, stability evaluation, settling in suspensions and formulation of suspensions.
	Emulsions: Theories of emulsification, physical stability of emulsions, preservation of emulsions, Rheological properties of emulsions and suspensions.
	Revision

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Class test	10%
	Assignments	5 %
	Mid-semester Examination	15%
End Assessment	End theory examination	70 %
	TOTAL	**100%**

Note: Class tests to be conducted at 4th and 14th Week; Mid-semester to be conducted after 8th week

Learning Resources/Recommended Texts/Reference books/web resources

1. Sinko.P.J. Martin's Physical Pharmacy and Pharmaceutical Sciences. 5th ed. New Delhi: Wolters Kluwer Health Pvt.Ltd.,; 2007.
2. Subhramanyam. CVS. Textbook of Physical Pharmacy. 2nd ed. Delhi: Vallabh prakashan; 2014.
3. Manavalan. R, Ramaswamy. C. Physical pharmaceutics. 2nd ed. Tamilnadu: Vignesh publisher; 2008.
4. http://www.e-booksdirectory.com
5. http://www.jblearning.com
6. http://pharmacyebook.blogspot.in

Program	B. Pharm
Year /Semester	Second Year / 2nd Semester
Name of the course	Pathophysiology and Health Education
Course Code	16BPH402
Credits	4
Hours /week	4 hours (lectures)
Pre / co-requisite/s	Nil

Course Description: This course aimed to provide knowledge on altered physiological and biochemical functions of the body in pathological states. This course also describes about preventive and control measures for common diseases and overall health importance in life.#

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO1: Describe the Pathophysiological mechanisms for common diseases

CO2: Interpret the disease status by diagnostic tools include biochemical and instrumental methods

CO3: Evaluate the rational Pharmacotherapeutics interventions related to diseases

CO4: Explain the principles of first aid, family planning methods and knowledge related to common communicable diseases

Theory Course: Contents

Unit	Topics
I (2 weeks)	**Basic Principles of Cell Injury, Adaptation:** a. Causes of cellular injury, pathogenesis, and morphology of cell injury.
	b.Cellular adaptations, atrophy and hypertrophy.
II (2 weeks)	**Inflammation:** a.Acute and chronic inflammation
	b.Mediators of inflammation, brief outline of the process of repair
III (2 weeks)	**Cancer** a.Classification of tumours, difference between benign and malignant tumours
	b.Etiology and pathogenesis of cancer, invasions and metastasis.
IV (2 weeks)	**Pathophysiology of common diseases I** a Epilepsy and Psychosis
	b.Depression and Mania
V (2 weeks)	**Pathophysiology of common diseases II** a. Hypertension, Angina, Congestive cardiac failure, Atherosclerosis and Myocardial infarction.
	b.Rheumatoid arthritis, Gout, Peptic ulcer, Asthma, Jaundice, T.B, UTIs and AIDS.

VI (2 weeks)	**Concepts of health & disease:** Disease causing agents and prevention of disease. Balanced diet and nutritional deficiency disorders. **First Aid:** Emergency treatment of Shock, Snakebites, Burns, Poisoning and Resuscitation methods.
	Demography and family planning: Demography cycle, population problem, family planning and various contraceptive methods.
VII (2 weeks)	**Brief outline of communicable diseases I** a.Causative agents, modes of transmission and prevention of the following diseases- Chicken pox, Measles, Influenza, Diphtheria and whooping cough.
	b.Tuberculosis, Poliomyelitis, Hepatitis, cholera and Typhoid
VIII (2 weeks)	**Brief outline of communicable diseases II** a.Food poisoning, Helminthiasis, Malaria, Filariasis and Rabies
	b.Trachoma, Tetanus, Leprosy and STDs

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Class test	10%
	Assignments	5 %
	Mid-semester Examination	15%
End Assessment	End theory examination	70 %
	TOTAL	**100%**

Note: Class tests to be conducted at 4th and 14th Week; Mid-semester to be conducted after 8th week

Learning Resources/Recommended Texts/Reference books/web resources

REFERENCES

1. Praveen Kumar and Michael Clark. Clinical medicine.7 th ed.UK: Saunders Elsevier; 2005.
2. Roger Walker and Clive Edwards. Clinical Pharmacy and Therapeutics.3 rd ed.UK: Churchill Livingstone; 2003.
3. Guyton. A and Hall J.E. Textbook of Medical Physiology.11 th ed. Philadelphia: Saunders Elsevier; 2006.
4. Joseph T. DiPiro, Robert L. Talbert, Gary C. Yee, Gary R. Matzke , Barbara G. Wells and L. Michael Posey .L. Pharmacotherapy: A Pathophysiologic Approach.7 th ed. New York: McGraw-Hill Companies; 2008.
5. Parmar N.S. Health Education and Community Pharmacy.1st ed. New Delhi: CBS Publisher; 2008.
6. Vinay kumar, Abul k. abbas and Nelson fausto, Robbins and cotran. Pathologic basis of disease.7th ed. Philadelphia: Saunders Elsevier; 2005.
7. Harsh Mohan. Text book of pathology.7 th ed. New Delhi: Jaypee Brothers Medical Publishers (P) Ltd; 2010.

Program	B. Pharm
Year /Semester	Second year / 2nd semester
Name of the course	Pharmaceutical Microbiology
Course Code	16BPH403
Credits	4
Hours /week	4 hours (lectures)
Pre / co-requisite/s	Pharmaceutical Biochemistry

Course Description: This course deals with history of microbiology, various aspects of microorganisms, its classification, morphology, laboratory cultivation identification and maintenance. This course discusses the various steps involved in control of microorganisms. This course further emphasizes on epidimeology of diseases.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO 1: Demonstrate the importance of pharmaceutical microbiology by acquiring knowledge of microorganisms and diseases caused by them and their application in pharmaceutical industry and human health.
CO 2: Apply the techniques of sterilization, identification, growth of microorganisms along with analytical aspects.
CO 3: Illustrates the application of microbiology in Pharmaceutical industry.
CO 4: Identifies different diseases caused by microorganisms.

Theory Course: Contents

Unit	Topics
I (2 weeks)	**Introduction to Microbiology:** Origin, scope and discovery of spontanesous generations theory,
	contributions of Antony von Lewvonhock, Pasteur, Koch and Lister.
II (2 weeks)	**Diversity of Microorganisms:** Prokaryotes versus eukaryotes – eukaryotic and prokaryotic cell structure, three domains of life (bacteria, archaea and eurkaryotics)
	Pharmaceutical significance of protozoa, algae, fungi, bacteria and viruses. Characterisation and identification of microorganisms.
III (2 weeks)	**Nutrition and Growth of Microbes:** Nutritional requirements, Types of Nutrient media and growth conditions and Nutritional types based on energy source.
	Isolation, cultivation (aerobic & anaerobic) and preservation of microorganisms, physiology of growth, bacterial growth curve
IV (2 weeks)	**Introduction to Microbiology of water, air and Milk**. Methods of Quantitative evaluation of microbial contamination.
	Microbial limit test official in IP

V (2 weeks)	**Control of Microorganisms:** General Concepts, Inhibition of growth and killing, sterilization and disinfection, antisepsis and sanitation, mode of action application & limitation of physical agents (moist and dry heat, radiation and filtration), chemical agents.
	Various types of disinfectants, factors affecting sterilization and disinfection, evaluation of antimicrobial activity. Chemotherapeutic agents, mode of action and applications, drug resistance. Official methods of sterility testing of pharmaceuticals and biosafety measures.
VI (2 weeks)	**Bacterial Genetics:** Genetic recombination in bacteria, DNA replication, transcription and translation. Gene regulation (lac operon and tryptophan operon).
	Mutations, Mutagenesis, chemical and physical mutagens, isolation and antibiotic resistant mutants.
VII (2 weeks)	**Epidimeology of Diseases:** Study of etiology, diagnois, source of infection, mode of transmission, immunization methods, prevention and control of the following diseases.
	Bacillary dysentery, diphtheria, tuberculosis, leprosy, cholera, typhoid, syphilis, gonerrhoea, tetanus, food poisioning and infective hepatitis
VIII (2Weeks)	**Application of Microbes in Pharmaceutical Industry** a. ***Microbiological Assays:*** Principles and Methods involved in Assay of Antibiotics, Vitamins, Amino acids & Bio-Sensors in Analysis. b. ***Microbial Source & applications of various pharmaproducts*** like Antibiotics,vitamins. amino acids, solvents, enzymes & genetic engineered products etc.
	Revision

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Class test	10%
	Assignments	5 %
	Mid-semester Examination	15%
End Assessment	End theory examination	70 %
	TOTAL	**100%**

Note: Class tests to be conducted at 4th and 14th Week; Mid-semester to be conducted after 8th week

Learning Resources/Recommended Texts/Reference books/web resources

1. Prescott. Microbiology, 8th ed. UK: McGraw Hill Education; 2013.
2. Pelczar Jr MJ, Chan ECS,Krieg NR. Microbiology, 5th ed. UK: Tata McGraw Hill; 2004.
3. AnanthaNarayan, JayramPanikar. Text Book of Microbiology, 7th ed. India: Orient Blackswan; 2005.
4. Dubey RC. A Textbook of Microbiology, 1st ed. India: S. Chand& Company Ltd; 2000.
5. Kishore Namdeorao Gujar , Suhasini Bhatnagar**.** Pharmaceutical Microbiology Theory, 1st ed. India: Himalaya Publishing House; 2010.

6. EugeneWN, MarthaTN, C.Evans Roberts, Denise Jr.GA, NancyN P. Student Study Guide to Accompany Microbiology: A Human Perspective, 3rd ed. UK: McGraw-Hill Higher Education; 2001.
7. Stephen P, Norman AH, Sean PG, Brendan FG. Hugo and Russell's Pharmaceutical Microbiology, 8th ed.UK: Wiley Publications; 2011.
8. Tortora GJ,Funke BR, Case CL. Microbiology: An Introduction. 12th ed. UK: Benjamin-Cummings Publishing Company; 2014.
9. Prescott SC,Gordon Dunn C. Industrial Microbiology, 1st ed. UK: Mc.Graww Hill; 1940.
10. Chandrakant RK. Pharmaceutical Microbiology Principles and Applications. 6th ed. India: Nirali Prakashan; 2008.

Program	B. Pharm
Year /Semester	Second year / 2nd semester
Name of the course	Pharmacognosy – II
Course Code	16BPH404
Credits	4
Hours /week	4 hours (lectures)
Pre / co-requisite/s	NIL

Course Description: The pharmacognosy II course is aimed to present introduction and study of crude drugs belongs to the category of glycosides like saponin glycosides, cardiac glycosides, anthraquinone glycosides and bitter glycosides, alkaloids like pyridine, tropane, quinoline, isoquinoline, indole, imidazole, amino, steroidal, purine and quinozoline alkaloids, volatile oils containing alcohol, aldehyde, ketone, oxide, phenyl ether and resins.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO 1: List the important aspects of crude drugs belongs to category of alkaloids, glycosides

CO2: State the important aspects of crude drugs belongs to category of Volatile oils and Resins.

CO3: Describe the biological source, chemical constituents, uses of alkaloids, glycosides, volatile oils and resins

Theory Course: Contents

Unit	Topics
I (2 Weeks)	Definition, Classification of Glycosides. Synonyms, Biological source, Active constituents, Chemistry, Identification test and Uses following glycosides containing drugs.
	Saponin glycosides- Glycyrrhiza, Ginseng, Dioscorea, Senega, Sarsaparilla
II (2 weeks)	Cardioactive glycosides- Digitalis, Squill, Strophanthus, Thevetia Anthraquinone glycosides- Aloe, Senna, Rhubarb, Cascara Bitter Glycosides- Psoralea, Gentian, Chirata
III (2 Weeks)	Definition, Classification of Alkaloids. Synonyms, Biological source, Active constituents, Chemistry, Identification test and Uses following alkaloid containing drugs. Pyridine- Piperidine alkaloids- Tobacco, Lobelia Tropane- Belladonna, Hyoscyamus, Datura, Coca.
IV (2 Weeks)	Indole- Ergot, Rauwolfia, Vinca, Nux Vomica Imidazole- Pilocarpus Steroid- Kurchi, veratrum,Aswagandha

V (2 weeks)	Quinoline, Isoquinoline- Cinchona, Ipecac, Opium Alkaloidal amine- Ephedra, Colchicum Glycoalkaloid- Solanum Purine- Coffee, Tea
VI (2 weeks)	Definition, Classification of Volatile oils Synonyms, Biological source, Active constituents, Chemistry and Uses of Clove, Cinnamon, Fennel, Mentha, Coriander
VII (2 weeks)	Synonyms, Biological source, Active constituents, Chemistry and Uses of Nutmeg, Eucalyptus, Cardamom, Lemon Grass and Dill
VIII (2 weeks)	Definition, classification and properties of resins. Synonyms, Biological source, Active constituents, Chemistry, Identification test and Uses following Resin containing drugs- Asafoetida, Balsam of tolu and Podophyllum.

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Class test	10%
	Assignments	5 %
	Mid-semester Examination	15%
End Assessment	End theory examination	70 %
	TOTAL	**100%**

Note: Class tests to be conducted at 4th and 14th Week; Mid-semester to be conducted after 8th week

Learning Resources/Recommended Texts/Reference books/web resources

1. Kokate CK, Purohit AP, Gokhale SB. Pharmacognosy. 44th ed. Nirali Prakashan: New Delhi; 2009.
2. Handa SS, Kapoor VK. Text book of Pharmacognosy. 1st ed. Vallabh Prakashan: Delhi; 2001.
3. James E Robbers, Varro E Tyler. Pharmacognosy and Pharmacobiotechnology. 9th ed. Williams & Wilkins: USA; 1988.
4. WHO guidelines on Good Agricultural and Collection Practices (GACP). WHO, Geneva; 2003.
5. Wallies TE. Text book of Pharmacognosy. 5th ed. CBS Publishers & Distributors: Delhi; 1999.
6. Evans WC, Trease. Pharmacognosy. 15th ed. Elsevier: Delhi; 2009.
7. Vinod D Rangari. Text book of Pharmacognosy and Phytochemistry. 1st ed. Volume I & II; Career Publications; 2004.

Program	B. Pharm
Year /Semester	Second year / 2nd Semester
Name of the course	Physical Pharmacy- II Practical
Course Code	16BPH405
Credits	2
Hours /week	4 hours (Practical)
Pre / co-requisite/s	Nil

Course Description: The Physical Pharmacy- II laboratory course is aimed to train the students on experimental techniques for the determination of physico –chemical properties of substances. This course also deals with wet laboratory that determines order of kinetics, flow of solids & liquids. This course also provides the laboratory skills related to solubility, partition & evaluation of dispersed systems.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO 1: Demonstrate the skills on determination of physico –chemical properties.

CO2: Analyze the stability of dispersed systems by experimental techniques.

CO 3: Interpret the scientific data from graphical presentations.

Practical Course : Contents

Week	Topics
1.	Introduction to laboratory safety techniques and the use of glass wares and chemicals.
2.	Determination of bulk density, true density and percentage porosity.
3.	Determination of effect of particle size and glidant on angle of repose.
4.	Calibration of eye-piece micrometer
5.	Determination of particle size distribution by optical microscopy
6.	Determination of globule size by optical microscopy.
7.	Determination of sedimentation volume and degree of flocculation.
8.	Determination of viscosity by Ostwald Viscometer.
9.	Determination of surface tension using Stalagmometer.
10.	Determination of CMC of a surfactant.
11.	Determination of effect of addition of Salt/pH/cosolvent on the solubility
12.	Determination of partition coefficient of Benzoic acid between benzene and water.

13.	Determination of Order of reaction – First order.(acid hydrolysis of methyl acetate)
14.	Determination of effect of temperature on first order kinetics and energy of activation.
15.	Problem based exercise
16.	**Revision**

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Participation	5 %
	Lab work (day to day)	10 %
	Mid-semester Examination	15%
End Assessment	End Practical examination	70 %
	TOTAL	**100%**

Mid-semester to be conducted after 8th week.

Learning Resources/Recommended Texts/Reference books/web resources

1. Subramanyam. C.V.S, Thimma Setty. J. Laboratory manual of physical pharmaceutics. 1st ed. New Delhi: Vallabh Prakashan; 2009.
2. Guru Prasad mohanta, Prabal kumar manna. Physical pharmacy practical text. 1st ed. Hyderabad: Pharma Med Press; 2008.
3. Gaud. R.S, Gupta. G.D. Practical physical pharmacy. 1st ed. New Delhi: CBS Publishers; 2005.
4. www.Pharmamedpress.com

Program	B. Pharm
Year /Semester	Second year / 2nd Semester
Name of the course	Pharmaceutical Microbiology Practical
Course Code	16BPH406
Credits	2
Hours /week	4 hours (Practical)
Pre / co-requisite/s	Nil

Course Description: This course describes the anatomy, identification, growth factors and sterilization of microorganisms. This course proposes the mode of transmission of diseases and applications of microorganisms in pharmaceutical field. This course also illustrates different techniques involved evaluation of antimicrobials.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO 1: Proposes different types nutritional medias required for growth of microorganisms.
CO2: Examine microorganisms, identify the source and to do cultivation, microorganisms in the laboratory.
CO3: Differentiate antibiotics based on their sensitivity and resistance to various microorganism's by experimental techniques.

Practical Course: Contents

Week	Topics
1.	Introduction to equipment and glassware used in microbiology laboratory.
2.	Preparation of various culture media.
3.	Sterilization techniques and their validations.
4.	Aseptic transfer of culture into different types of media.
5.	Characterization of microbes by staining methods (simple gram's, acid fast and negative staining and spore staining) and motility testing by hanging drop method.
6.	Enumeration of bacteria by pour plate/spread plate technique
7.	Enumeration of bacteria by direct microscopic count. (Neubauer's chamber)
8.	Isolation of pure cultures by streak plate, spread plate and pour plate. Evaluation of antiseptics and disinfectants by phenol coefficient method(R/w), sterility test for bulk powders and water for injection (IP).
9.	Observation of colony/culture characters
10.	Bio chemical reactions: i) Indole test. ii) Methyl red test. iii) Voges proskauer test. iv) Starch hydrolysis test. v) Fermentation of carbohydrates and gelatin liquefaction.
11.	Construction of bacterial growth curve for *E. coli*.

12.	Anti-microbial assay by cup and plate method and turbidometric method
13.	Revision

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Participation	5 %
	Lab work (day to day)	10 %
	Mid-semester Examination	15%
End Assessment	End Practical examination	70 %
	TOTAL	**100%**

Mid-semester to be conducted after 8th week.

Learning Resources/Recommended Texts/Reference books/web resources

1. Cappuccino J G, Natalie Sherman. Microbiology- a Laboratory Manual, 7th ed. India: Pearson Education; 2005.
2. Dubey RC, Maheswari DK. Practical Microbiology, 2nd ed. India: S.Chand& Company Ltd; 2006.
3. Gaud RS, Gupta GD. Practical Microbiology, ISBN8185790310. India: Nirali Prakashan; 2008.

Program	B. Pharm
Year /Semester	Second year / 2nd Semester
Name of the course	Pharmacognosy – II Practical
Course Code	16BPH407
Credits	2
Hours /week	4 hours (Practical)
Pre / co-requisite/s	NIL

Course Description: The pharmacognosy II laboratory course is aimed to train the students on experimental pharmacognosy for the evaluation of crude drugs belongs to category of alkaloids, glycosides, volatile oils and resins by their morphological and microscopic characters. This course emphasise identification of crude drugs by chemical test. This course also deals with chemomicroscopic examination of crude drugs.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:
CO 1: Inspect the crude drugs by their macroscopic characters

CO2: Evaluate the crude drugs by their microscopic characters

CO3: Examine the crude drugs by chemical test

Practical Course: Contents

Week	Topics
1.	Introduction to Pharmacognosy laboratory and experiments
2.	Study of various morphological characters of alkaloids
3.	Study of various morphological characters of glycosides.
4.	Study of various morphological characters of Volatile oils
5.	Study of various morphological characters of Resins
6.	Microscopy (Transverse section & powder) of Senna
7.	Microscopy (Transverse section & powder) of Cinchona
8.	Microscopy (Transverse section & powder) of Ephedra
9.	Microscopy (Transverse section & powder) of Nux vomica
10.	Microscopy (Transverse section & powder) of Rauwolfia
11.	Microscopy (Transverse section & powder) of Datura
12.	Microscopy (Transverse section & powder) of Cinnamon
13.	Microscopy (Transverse section & powder) of Coriander

14.	Microscopy (Transverse section & powder) of Fennel
15.	Chemical test for aloes
16.	**Revision**

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Participation	5 %
	Lab work (day to day)	10 %
	Mid-semester Examination	15%
End Assessment	End Practical examination	70 %
	TOTAL	**100%**

Mid-semester to be conducted after 8th week

Learning Resources/Recommended Texts/Reference books/web resources

1. Kokate CK, Gokhale SB. Practical Pharmacognosy. 5th ed. Nirali Prakashan: Delhi; 2003.
2. Khandelwal KR, Vrunda Sethi. Practical Pharmacognosy. 25th ed. Nirali Prakashan: Delhi; 2015.
3. Iyangar MA. Study of crude drugs. 12th ed. Manipal Press Limited: Manipal; 2004.
4. Biren N Shafi, Nayak BS. Experimental Pharmacognosy. 1st ed. S Vikas & Co; 2009.
5. Iyangar MA, Nayak SK. Anatomy of Crude drugs. 12th ed. Manipal Press Limited: Manipal; 2011.

Program /Year/Sem	**B. Pharm**
Year /Semester	**Second year / 2nd semester**
Name of the course	**Human values & Professional ethics (Audit Course)**
Course Code	**16BPH409**
Credits	**1**
Hours /week	**2 hours (lectures)**
Pre / co-requisite/s	**Nil**

Course Description: This course is universally adaptable, involving a systematic and rational study of the human being vis-a-vis the rest of existence. It is free from any dogma or value prescriptions. It is a process of self-investigation and self-exploration, and not or giving sermons. Whatever is found as truth or reality is stated as proposal and the students are facilitated to verify it in their right based on their Natural Acceptance and Experiential Validation. This process of self-exploration takes the form of a dialogue between the teacher and the students to begin with, and within the student himself/herself finally. This self-exploration also enables them to evaluate their pre-conditionings and present beliefs.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO 1: Help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.

CO2: Facilitate the development of a Holistic perspective among students towards life, profession and happiness, based on a correct understanding of the Human reality and the rest of Existance. Such a holistic perspective forms the basis of Value based living in a natural way

CO 3: Highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually satisfying human behaviour and mutually enriching interaction with Nature.

Theory Course: Contents

Unit	Topics
I (2 weeks)	**Introduction –Need, Basic Guidelines and Content** 1. Understanding the need, basic guidelines, content and process for value Education 2. Self-Exploration – What is it? – its content and process: 'Natural Acceptance' and Experiential Validation – as the mechanism for self-explanation 3. Continuous Happiness and Prosperity – A look at basic Human Aspirations
II (2 weeks)	**Process for Value Education** **1.** Right Understanding, Relationship and Physical Facilities – basic requirements for fulfillment of aspirations of every human being with their correct priority

	2. Understanding Happiness and prosperity correctly – A critical appraisal of the current scenario 3. Method to fulfill the above human aspirations; understanding and living in harmony at various levels
III (2 weeks)	**Understanding Harmony in the Human Being** – 1. Understanding human being as a co-existence of the sentient 'I' and the material 'Body' 2. Understanding the needs of Self ('I') and 'Body' – Sukh and Suvidha 3. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
IV (2 weeks)	**Harmony in Myself** 1**.** Understanding the characteristics and activities of 'I' and harmony in 'I' 2. Understanding the harmony of I with the Body: Sanyam and Swasthya: correct appraisal of Physical needs, meaning of Prosperity in detail 3. Programs to ensure Sanyam and Swasthya – practice exercises and Case Studies will be taken up in Practice Sessions
V (2 weeks)	**Understanding Harmony in the Family and Society – harmony in Human - Human Relationship** 1.Understanding harmony in the family – the basic unit of human interaction 2.Understanding values in human relationship; meaning of Nyaya and Program for its fulfillment to ensure Ubhay-tripti
VI (2 weeks)	**Trust (Vishwas) and Respect (Samman) as the foundational values of relationship.** Understanding the meaning of Vishwas; Difference between intention and competence. Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship. Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sah-astiva as comprehensive Human Goals. Visualizing a universal harmonious order in society - Undivided Society (Akhand Samaj), Universal Order (Sarvabhaum Vyawastha) - from family to world family!
VII (2 weeks)	**Understanding Harmony in the nature and Existence - Whole existence as Co-existence:** Understanding the harmony in the Nature. Interconnectedness and mutual fulfillment among the four orders of nature - recyclability and self-regulation in nature. Understanding Existence as Co-existence (Sah-astiva) of mutually interacting units in all-pervasive space. Holistic perception of harmony at all levels of existence.
VIII (2 weeks)	Implications of the above Holistic Understanding of Harmony on Professional Ethics: Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basic for Humanistic Education, Humanistic Constitution and Humanistic Universal Order. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order, b. Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.

Assessment methods and weightage

Assessment type	Assessment tool	Distribution
Continuous Assessment	Class test	10%
	Assignments	5 %
	Mid-semester Examination	15%
End Assessment	End theory examination	70 %
TOTAL		**100%**

Note: Class tests to be conducted at 4th and 14th Week; Mid-semester to be conducted after 8th week

Learning Resources/Recommended Texts/Reference books/web resources

Text Books

1. R R Gaur, R,Sangal, G.P Bagaria, A Foundation Course in Value Education(English), 2009.
2. R R Gaur, R Sangal G P Bagaria, Teacher's Manual (English), 2009.

Reference Books

1. Ivan IIIich, Energy& Equity, The Trinity Press, Worcester, and harper Collins, USA, 1974.
2.. Schumacher E.F, Small is Beautiful; a study of economics as if people mattered, Blond & Briggs, Bratain, 1973.
3. Nagraj A, Jeevan vidya to Na Prayanam, Hyderabad, 1998.
4. Pradeep Kumar R., Jeevan Vidya to Na Prayanam, Hyderabad, 2013.
5. Sussan George, How the other half Dies, Penguin Press, Peprinted 1986, 1991.
6. Dhar PL, Gaur RR, Science and Humanism, common wealth publishers, 1990.
7. A.N. Tripathy, Human values, New Age International Publishers, 2003.
8. Subhas Palekar, How to practice natural Farming, Pracheen (Vaidik) Krishi tantra shodh, Amravati, 2000.
9. Donella H. Meadows, Dennis L. Meadows,Jorgen Randers, William W. B1ehrens III, Limits to Growth – club of Rome's report, universe Books, 1972.
10. E.G. Seebauer & Robert, L BERRY, Foundationals of Ethics for Scientists & Engineers, Oxford University Press, 2000.
11. Govindrajran M., Natrajan S & Senthi Kumar V.S., Engineering Ethics (including human Values), Eastern Economy Edition, Prentice hall of India Ltd.
12. Banerjee B P, Foundations of Ethics and Management, Excel books, 2005.
13. B.L. Bajpai, Indian Ethos and Modern Management, New Royal book Co; Lucknow, 2004.

Program	B. Pharm
Year /Semester	Third year / 1st semester
Name of the course	Medicinal chemistry – I
Course Code	16BPH501
Credits	3
Hours /week	3 hours (lectures)
Pre / co-requisite/s	Nil

Course Description: The Medicinal chemistry I course explores role of organic chemistry in the design and action of drugs, it is helpful for discussing principles of drug discovery, drug development, drug receptor interactions and structure activity relationships and to understand the relationship between the biological, chemical physical properties of medicinal compounds, it covers various components like mechanism, chemistry belongs to ANS, CNS drugs.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO 1: Define the drug targets and molecular mechanism action.
CO 2: Encourage the development of problem – solving skills and knowledge related to chemotherapy which is necessary to provide pharmaceutical care.
CO 3: Build a knowledge base of chemotherapy principles for various disease states.

Theory Course: Contents

Unit	Topics
I (2 weeks)	**Physico chemical properties of drug molecules in relation to biological activity** – Solubility, partition-coefficient, Receptors: Types of receptors, Types of forces involved in drug receptor Interaction, Bioisosterism and steric features of drugs, drug distribution and protein binding.
II (2 weeks)	**Mechanisms of Drug action**: Introduction, Enzyme stimulation, Enzyme inhibition. Theories of drug action (Ferguson's, Dale's, perturbation, Rate theory and occupation). concept of soft and hard drug, Introduction, metabolism: Introduction to Biotransformation, phase I & II (With one drug example).
III (2 weeks)	**Drugs acting on ANS:** **Adrenergic and antiadrenergic agents:** Adrenergic agonist: Chemistry and metabolism of neurotransmitters, Dopamine, Epinephrine, Ephedrine*, Phenylephrine, Isoprenaline*, Naphazoline, Oxymetazoline*, Salbutamol* Adrenergic antagonist: Classification, Phenoxy benzamine*, Prazosin*, , Propranolol, Atenolol*, Metaprolol, Labetolol, Esmolol. SAR of Sympathomimetics (Catecholamines)
IV (2 weeks)	**Cholinergic and anti-cholinergic agents:** Cholinergic receptor and neuro chemistry and concept of neuro muscular blocking agents. Succinylcholine*, Methacholine, carbachol, pilocarpine*, Physostigmine, pyridostigmine, Neostigmine, Malathion, Nicotine, Dicyclomine*, Biperiden*, SAR- Cholinergic agonists, Anti-cholinergics, Neuro muscular blockers.

V (2 weeks)	**CNS system Depressants and Central dopaminergic signalling agents Anxiolytics, Sedatives and Hypnotics:** Benzodiazepines (Diazepam*, Oxazepam, Nitrazepam, Clonazepam, Midozolam, Alprazolam*), Barbiturates (Phenobarbital*, Amobarbital, Pentobarbital, Secobarbital), Glutethimide*, Meprobamate*, methocarbamol, Methyprylon. SAR-Benzodiazepines, Barbiturates.
VI (2 weeks)	**Anti-Psychotics**: Phenothiazines (Chlorpromazine*, Thioridazine, Fluphenazine), thioxanthines (Thiothixene*), Butyrophenones (Haloperidol*, Droperidol, resperidone, penfluridol), Miscellaneous- Lithium salts, Clozapine and Olanzapine. SAR- Phenothiazines, Butyrophenones.
	Anti-convulsants: Phenytoin*, Valproic acid, Carbamazepine*, Primidone, Ethosuximide*, SAR- Hydantoins, Oxazolidinediones, Succinimides. **Anti-parkinsonism**: Levodopa*-Carbidopa, Amantidine*, Selegiline, Apomorphine, Ropinirole, Entacapone, Tolcapone
VII (2 weeks)	**Analeptics**: Picrotoxin, Doxapram*, Methyl xanthines (Caffeine, Theophylline, Theobromine) **Psychomotor stimulant:** Dextro amphetamine*, Methamphetamine, Phenfluramine,.
	Anti-depressants: Types, Phenelzine, Tranylcypromine*, Tricyclic anti-depressants: Imipramine*, Desipramine, Amytriptyline*, Doxepin*, Fluoxetine*, Sertraline, **Newer agents:** Venlafaxine, Buspirone, Mirtazapine and Bupropion. SAR- Tricyclic antidepressants, MAOIs.
VIII (2 weeks)	**Anaesthetics:** **General anaesthetics**: Chemical classification, Inhaled and Injectable, Meyer-Overton theory, Halothane*, Isoflurane, Sevoflurane, Triflurane, Propofol, Ketamine, Etomidate, Thiopental sodium*.
	Local anaesthetics: Cocaine, Lignocaine*, Procaine*, benzocaine, Ropivacaine, Bupivacaine, Articaine. Adjuvant to local anaesthetics. SAR- Esters and amides. Anaesthetic activity in relation to the partition coefficiency.

Note:Introduction, definition, chemical classification with structure, nomenclature, synthesis(only for * marked drugs), Mechanism of action, SAR including metabolites and therapeutic uses of following classes of drugs from Unit III to Unit VIII.

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Class test	10%
	Assignments	5 %
	Mid-semester Examination	15%
End Assessment	End theory examination	70 %
	TOTAL	**100%**

Note: Class tests to be conducted at 4th and 14th Week; Mid-semester to be conducted after 8th week

Learning Resources/Recommended Texts/Reference books/web resources

1. William O. Foye, Textbook of Medicinal Chemistry, Lea Febiger, Philadelphia.
2. Graham. L. Patrick, an Introduction to Medicinal Chemistry, Oxford University publishers.
3. JH Block & JM Beale (Eds), Wilson & Griswold's Text book of organic Medicinal Chemistry and pharmaceutical chemistry, 11th Ed, Lipcolt, Raven, Philadelphia, 2004
4. Rama Rao Nadendla, Medicinal Chemistry, Mc Millan Publishers.
5. Hansch, Comprehensive medicinal chemistry, Vol 1 – 6 Elsevier pergmon press, Oxford.
6. D. Abraham (Ed), Burger Medicinal chemistry and Drug discovery, Vol. 1 & 2, , 6th Ed, John Wiley & Sons, New York 2003.
7. M. Atherden, Bentley and Driver's Textbook of Pharmaceutical Chemistry Ed: l. Oxford University Press, Delhi.
8. Daniel lednicer, Strategies for Organic Drug Synthesis and Design, John Wiley, N. Y. 1998.
9. D. Lednicer, Organic drug synthesis, Vol, 1 – 6, J. Wiley N.Y.

Program	B. Pharm
Year /Semester	Third Year / 1st semester
Name of the course	Pharmacology- I
Course Code	16BPH502
Credits	3
Hours /week	3 hours (lectures)
Pre / co-requisite/s	Nil

Course Description: This course aimed to provide basic knowledge on principles of general pharmacology such as sources of drug, drug development phases, routes of drug administration, mechanism of drug action and pharmacokinetic aspects like drug absorption, distribution, metabolism and excretion. Subsequently, this course also covers about the drugs acting on central and peripheral nervous system.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO1: Review the principles of drug discovery and development

CO2:Analyze the various advantages and disadvantages of different routes of drug administration

CO3: Explain the fundamental molecular mechanisms of drug action

CO4:Illustrate the various pharmacological aspects like mechanism of action, pharmacokinetics, side effects, drug interactions, contraindications and indications of drugs falling under below mentioned chapters.

Theory Course: Contents

Unit	Topics
I (2 weeks)	**General Pharmacology:** a. Introduction- Definition, Historical development and scope of pharmacology. Sources of drugs and routes of drug administration. Principles of drug discovery and development, phases of clinical trials. b. Pharmacodynamics Mechanism of drug action with special emphasis on receptors, drug-receptor interaction theories, factors modifying drug action. c. Pharmacokinetics Drug absorption, distribution, metabolism and excretion. Factors affecting/modifying pharmacokinetic parameters.
II (2 weeks)	**Pharmacology of drugs acting on Peripheral Nervous System-I** a.Neurohumoral transmission (autonomic and somatic nervous system)

	b.Cholinergic receptors and adrenergic receptors.
III (2 weeks)	**Pharmacology of drugs acting on Peripheral Nervous System-II** a. Parasympathomimetics, Parasympatholytics, Sympathomimetics and Sympatholytics.
	b. Neuromuscular blocking agents and local anesthetic agents.
IV (2 weeks)	**Pharmacology of drugs acting on Central Nervous System- I** a. Neurohumoral transmission in the C.N.S with special emphasis on dopamine, GABA and 5-HT neurotransmission.
	b. General anesthetics, sedatives, hypnotics and anti-anxiety agents.
V (2 weeks)	**Pharmacology of drugs acting on Central Nervous System- II** a. Pharmacology of drugs used in affective/mood disorders like depression and mania.
	b. Pharmacology of drugs used in behavioral disorders like psychosis.
VI (2 weeks)	**Pharmacology of drugs acting on Central Nervous System- III** a. Pharmacology of drugs used in neurodegenerative disorders like parkinsonism and Alzheimer's disease.
	b. Pharmacology of drugs used in epilepsy
VII (2 weeks)	**Pharmacology of drugs acting on Central Nervous System-IV** a.Narcotic analgesics and antagonists
	b.CNS stimulants and Centrally acting muscle relaxants. c.Alcohols and disulfiram. Drug addiction, abuse and dependence.
VIII (2 weeks)	a. Peripherally acting Analgesics and Antipyretics
	b. Anti-inflammatory drugs and Anti-gout drugs

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Class test	10%
	Assignments	5 %
	Mid-semester Examination	15%
End Assessment	End theory examination	70 %
	TOTAL	**100%**

Note: Class tests to be conducted at 4th and 14th Week; Mid-semester to be conducted after 8th week

Learning Resources/Recommended Texts/Reference books/web resources

1. Tripathi KD. Essentials of Medical Pharmacology. 7 th ed. New Delhi: Jaypee Brothers; 2014.
2. Rang H.P, Dale M.M and Ritter J.M.Pharmacology. 8 th ed .Edinburgh: Elsevier Churchill living stone;2016.
3. David E.Golan, Armen H.Tashjian and April W. Armstrong. Principles of pharmacology: the pathophysiological basis of drug therapy.2 nd ed. Philadelphia: Lippincott Williams & Wilkins; 2008.
4. Bertram. G. Katzung. Basic and clinical pharmacology. 11 th ed. New York: Mc Graw-Hill; 2010.
5. Satoskar RS, Bhandarkar SD and Nirmala N.Rege. Pharmacology and Pharmacotherapeutics.19th ed. Mumbai: Popular prakashan.2005.
6. Hardman J.G , Lee E. Limbard, Good Man & Gilmans. The Pharmacological basis of therapeutics. 11 th ed.USA: Mc Grawhill; 2006.

Program	B. Pharmacy
Year /Semester	Third year / 1st semester
Name of the course	Pharmaceutical Biochemistry
Course Code	16BPH503
Credits	3
Hours /week	3 hours (lectures)
Pre / co-requisite/s	Nil

Course Description: The pharmaceutical Biochemistry course is aimed to present knowledge about transport mechanisms of compounds and drugs across the membrane. It emphasize the importance of electron transport chain, oxidative phosphorylation. The course deals with enzymes definition, mechanism, classification, enzyme inhibition, activation and diagnostic uses of enzymes. It also provides information about classification, uses and metabolism of biomolecules and their metabolic disorders. It provides the knowledge about clinical chemistry estimation of some constituents present in urine and in blood and their abnormal values in diagnosis. It gives the information about kidney function tests and liver function tests.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO 1: Define enzymes, transport mechanisms, electron transport chain and oxidative phosphorylation.

CO2: Explain the chemistry, classification, uses and metabolism of carbohydrates, proteins, lipids and nucleic acids.

CO 3: Discuss the metabolic disorders of carbohydrates, proteins, lipids and nucleic acids.

CO4: Analyze the constituents present in urine and serum.

Theory Course: Contents

Unit	Topics
I (2weeks)	Cell Processes, Bioenergetic and Cellular Reactions Bio chemical organization of the cell, molecular constituents of membrane.
	Active & passive transport process, sodium and potassium pumps, osmoregulation and hemostasis.
II (2Weeks)	The concept of free energy, determination of change in free energy from equilibrium constant & reduction potential. Production of ATP and its biological significance, Redox reactions and redox potential.
	The respiratory chain & its role in energy capture & its control. Oxidative phosphorylation, its energetics & E.T.C mechanism.
III	Introduction to Bio-Molecules: Structure, classification, biological functions of

(2 weeks)	carbohydrates, proteins, lipids, nucleic acids (DNA & RNA) vitamins & minerals.
IV (2weeks)	Enzymes & Co-Enzymes: Classification, Structure, mechanism of action, properties, factors affecting enzyme action, enzyme kinetics and enzyme inhibitions.
	Repressions with reference to drug action, Isoenzymes, Coenzymes from Vitamins, Nucleotides and non-nucleotides. Clinical importance of enzymes in treatment and diagnosis.
V (2 weeks)	Metabolism of carbohydrates: Introduction to metabolism, Metabolic pathway, regulation and significance of the following pathways and cycles: Glycolysis (aerobic and anaerobic) glycogenolysis.
	Gluconeogenesis, Krebs's cycle, HMP & uronic acid pathways, Cori cycle and disorders of carbohydrate metabolism.
VI (2 weeks)	Metabolism of Lipids : Alpha, Beta, Gama & Omega oxidations of fatty acids, bio-synthesis of fatty acids, cholesterol and ketogenesis.
	Utilization of ketone bodies, regulation, energetics of Lipid metabolism and disorders of lipid metabolism.
VII (2weeks)	Metabolism of Proteins: Structure, classification of protein. Classification of amino acids, concept of essential and nonessential amino acids and their importance in deamination, Trans-amination, de-carboxylation, Urea cycle , Metabolism of Valine, cystine, cysteine, tryptophan, tyrosine and methionine
	Metabolic disorders of protein metabolism. Nucleic acid metabolism: Synthesis of purines, pyrimidines and their degradation, protein synthesis and genetic code.
VIII (2 weeks)	Clinical Biochemistry Introduction to clinical biochemistry, Normal values of various biochemical parameters (Blood / or Urine: Glucose, VLDL, LDL etc. total proteins, urea, Minerals, Hormones… etc.) and their abnormal values in diagnosis
	Liver function test and kidney function test and OGTT.

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Class test	10%
	Assignments	5 %
	Mid-semester Examination	15%
End Assessment	End theory examination	70 %
	TOTAL	**100%**

Note: Class tests to be conducted at 4th and 14th Week; Mid-semester to be conducted after 8th week

Learning Resources/Recommended Texts/Reference books/web resources

1. Satyanarayana U. *Textbook of Biochemistry*, 4th ed. New Delhi: ELSEVIER a Division of Reed Elsevier India Pvt Ltd; 2013.

2. Lehninger. *Principles of Biochemistry*, 5th ed. New York: M/s worth Publishers; 1978.

3. Robert K. Murray, Daryl K. Granner, Peter A. Mayes, Victor W. Rodwell. *Harper's Biochemistry*, 5th ed.: Mc Graw Hill Medical; 2013.

4. Jain J. L., Sunjay Jain, Nitin Jain. *Fundamentals of Biochemistry*, 6th ed.: Chand Company & Company Ltd.
5. Powar C. B. & Chatwal G. R. *Biochemistry*, 5th ed.: Himalaya Publishing House; 1989.
6. Stryer L. *Textbook of Biochemistry,* 6th ed.: W.H.Freemann & Co Ltd; 2012.
7. Conn E. E. & Stump P. K. *Outline of Biochemistry*, 5th ed.: John Wiley and sons, New York; 2010.

Program	B. Pharm
Year /Semester	Third year / 1st semester
Name of the course	Pharmaceutical Technology-I
Course Code	16BPH504
Credits	3
Hours /week	3 hours (lectures)
Pre / co-requisite/s	Nil

Course Description: The pharmaceutical technology I course is aimed to present fundamentals and importance of preformulation studies and the effect of physico chemical properties of drug on formulations. It emphasize on several additives used to formulate the dosage forms. The course also deals with the cosmetic preparations for skin, hair and baby care products. It describes about the formulation of ophthalmic products and aerosols. This course also provides the laboratory skills related to identify the type of emulsions.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO 1: Define the various additives used in the formulation of pharmaceutical dosage forms.

CO2: Demonstrate the possible modes of degradation of drugs.

CO 3: Apply the appropriate excipients used to formulate the drug products.

CO4: Analyze the fundamentals of cosmetic science in formulation of cosmetics preparations.

Theory Course: Contents

Unit	Topics
I (2 weeks)	**Preformulation**: Goals, Physicochemical properties like physical form, particle size, shape, density, wetting, solubility, dissolution, partition coefficient, hydrolysis, oxidation-reduction, racemization, polymerization, etc and their effect on formulation.
	Drug-excipient incompatability studies,. Introduction to Stability testing of finished products as per ICH guidelines
II (2 weeks)	**Liquid dosage forms:** Introduction, types of additives used in formulations.
	Vehicles, stabilizers. Intra ocular irrigating solutions
III (2 weeks)	**Semisolid dosage forms:** Definitions, types, mechanisms of drug penetration, factors influencing penetration, semisolid bases and their selection.
	General formulation of semi solids, clear gels manufacturing procedure, evaluation and packaging

IV (2 weeks)	**Suppositories:** Ideal requirements of bases, Different types of bases
	Manufacturing procedure packing and evaluation, Problems in formulating suppositories
V (2 weeks)	**Pharmaceutical aerosols:** Definition, propellants general formulation, manufacturing and packaging methods.
	Pharmaceutical applications, Quality control tests for aerosols ,Metered dose inhalers
VI (2 weeks)	**Cosmeticology and Cosmetic Preparations-I:** Fundamentals of cosmetic science. Formulation, preparation and packaging of cosmetics for skin like face powders, compact face powders.
	Body powders, cleansing lotions, emollient lotions and sunscreen lotions.
VII (2 weeks)	**Cosmetic Preparations-II:** Formulation, preparation and packaging of cosmetics for hair (shampoos, hair colorants, epilatories and depilatories)
	Formulation, preparation and packaging of manicure preparations like nail polish, lipsticks, eye lashes, baby care products etc.
VIII (2 weeks)	**Herbal Cosmetics :** Introduction,definition,Classification of herbal cosmetics
	Cosmeceutical importance of Soapnut,Amla,Henna,Aloe vera,Turmeric as herbal drugs.

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Class test	10%
	Assignments	5 %
	Mid-semester Examination	15%
End Assessment	End theory examination	70 %
	TOTAL	**100%**

Note: Class tests to be conducted at 4th and 14th Week; Mid-semester to be conducted after 8th week

Learning Resources/Recommended Texts/Reference books/web resources

Text Books:

1. Lachman L, Lieberman HA, Kanig JL. Theory & Practice of industrial pharmacy.3rd ed. Philadelphia: Lea & Febieger; 1990.
2. Allen LV, Popovich NG, Ansel HC.pharmaceutical dosage forms and drug delivery systems. 8th ed.Lippincott Williams & Wilkins; 2005.
3. Aulton Pharmaceutics ME. The science of dosage form design .2nd ed. Churchill-Livingstone; 2002.
4. Mithal B.M . A text book of pharmaceutical formulations. 6thed.Delhi: vallabh prakashan;2010.
5. Mithal BM ,Saha RN. A hand book of cosmetics. Isted.Delhi: vallabh prakashan; 2004.
6. Sagarin, MS Balsam .Cosmetics Sciences &Technology.2nd ed. Vol.1, 2 & 3 Wiley India Pvt. Ltd;2008.
7. Banker and Rhodes. Modern pharmaceutics. marcel dekker series.
8. Shobharani R Hiremath. Text book of industrial pharmacy. universities press; 2008.
9. Lippincott Williams, Wilkin Remington.The science and practice of pharmacy.21st ed. New delhi:Wolters kluwer Health pvt ltd; 2006.

Program	B. Pharm
Year /Semester	Third year / 1st semester
Name of the course	Advances in Alternative Medicine
Course Code	16BPH505
Credits	3
Hours /week	3 hours (lectures)
Pre / co-requisite/s	Pharmacognosy I & Pharmacognosy II

Course Description: The Advances in Alternative Medicine course is aimed to present the study of alternative systems used like ayurveda, unani, siddha, homeopathy and chineese system of medicine. This course emphasise formulation of churna, lehya, asava and arista and their evaluation as per global and national regulatory requirements. This course provide knowledge on traditional drugs.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO 1: Recognise importance of the traditional systems of medicine.

CO2: Illustrate evaluation methods of crude drugs.

CO 3: Explain herbal formulations and their evaluation.

CO 4: Understand the biogenesis of secondary metabolites.

Theory Course: Contents

Unit	Topics
I (2 weeks)	General introduction to Alternative Systems of Medicine like Ayurveda, Siddha, Unani
	Homeopathy and Chinese system of medicine
II (2 weeks)	Formulation and evaluation of Churnas, Lehyas
	Asavas and Aristas with suitable examples
III (2 weeks)	Study of traditional drugs-Common and Vernacular names, Sources, Chemical constituents and Uses of Kantakari, Malkanguni, Shatavari, Tylophora, Bilva, Kalijeeri, Rasna, Aparmarga
	Gokhuru, Guduchi, Bach, Amla, Guggul, Kalimusali, Punarnava, Chirata and Brahmi
IV (2 weeks)	Adulteration: Definition and methods of adulteration with examples
	Evaluation: Definition, methods of drug evaluation by Macroscopic, Microscopic, physical, Chemical and biological.
V (2 weeks)	Standardization of herbal formulations with suitable examples- principles and methods of standardization of herbal formulations like macroscopic, microscopic, physical, chemical and biological evaluation
VI (2 weeks)	WHO guidelines on quality control of crude drugs- Introduction, principles for assessing safety of herbal medicines with reference to contaminants and residues, Recommended analytical methods.
VII (2 weeks)	Brief introduction to the organizations and institutions associated with natural product research like AYUSH, CIMAP, IICT

	CCMB, NISCAIR and NBRI
VIII (2 weeks)	Biogenesis: General techniques of biosynthetic studies, Basic metabolic pathways (HMP and Shikimic acid pathway).
	Biogenesis of secondary metabolites like Atropine, Morphine, Quinine, Digitoxin, Digoxin, Isoprenoids and cholesterol.

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Class test	10%
	Assignments	5 %
	Mid-semester Examination	15%
End Assessment	End theory examination	70 %
	TOTAL	**100%**

Note: Class tests to be conducted at 4th and 14th Week; Mid-semester to be conducted after 8th week

Learning Resources/Recommended Texts/Reference books/web resources

1. Kokate CK, Purohit AP, Gokhale SB. Pharmacognosy. 44th ed. Nirali Prakashan: New Delhi; 2009.
2. Handa SS, Kapoor VK. Text book of Pharmacognosy. 1st ed. Vallabh Prakashan: Delhi; 2001.
3. Vinod D Rangari. Text book of Pharmacognosy and Phytochemistry. 1st ed. Volume I & II; Career Publications; 2004.
4. Gupta Sharma. Text book of Pharmacognosy. Volume II. 1st ed. Pragathi Prakashan; 2007.
5. Harborne JB. Phytochemical methods. 3rd ed. Rajkamal electronic press: Delhi; 2005.
6. Pulok K Mukharjee. Quality control of herbal drugs. 1st ed. Business Horizons pharmaceutical publishers; 1999.

Program	B. Pharm
Year /Semester	Third year / 1st Semester
Name of the course	Pharmacoinformatics (Choice based Elective)
Course Code	16BPH510
Credits	2
Hours /week	2 hours (lectures)
Pre / co-requisite/s	Computer basics

Course Description: Bioinformatics is the science concerned with the development and application of computer hardware and software for the acquisition, storage, analysis and visualization of biological information.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO 1: Expresses the knowledge of interlink of pharmaceutical sciences with bioinformatics.

CO 2: Expertise their skills for bioinformatics concepts, tools and analytical techniques.

CO3: Development of database for an efficient storage, access and management of the large corpse of various biological information's.

CO4:Manage new algorithms and statistics for assessing the relationships among large sets of biological data e. g. DNA sequence data.

Theory Course: Contents

Unit	Topics
I (2 weeks)	**Computer fundamentals**: Introduction, Computer system hardware, computer memory, input and out put devices, basics of operating systems, algorithms.
II (2 weeks)	**Introduction to Bioinformatics** : Components, Necessity, Skills required for a Successful Bioinformatician.,
	Types of Sequences used in Bioinformatics., Historical aspects, Symbols used in Databases, Nomenclature of DNA, Sequences, Nomenclature of Protein Sequences,
III (2 weeks)	**Databases** Symbols, objectives, properties and classifications of Databases. Format and Annotation: Conventions for databases indexing and specification of search terms;
	Common sequence file formats; Files for multiple sequence alignment; Files for structural data; Annotated sequence databases - primary sequence databases; Subsidiary data storage unfinished genomic sequence data, organism's specific

	databases;
IV (2 weeks)	**Protein sequence and structure databases**; List of Gateways, RNAi databases, Data – Access, Retrieval and Submission: Data Access - standard search engines; Data retrieval; Software for data building; Submission of new and revised data. NCBI resource; Databases-EXProt, NCBI Protein, PIR, Swiss-prot, TrEMBL and UniProt
V (2 weeks)	**Hard-Link Relationships** : between Databases, Locus link, Sequence Retrieval System (SRS), ENTREZ, Data Retrieval Tools.
VI (2 weeks)	**PHYLOGENY**: bioinformatics tools, Classification of tools, applications in prediction, construction, understanding of genes. Study of genes related diseases.
	Definition, Molecular Phylogenetic, Phylogenetic analysis, Various types of trees, Methods of Construction
VII (2 weeks)	**Introduction to Prediction of Protein structure**, Visualization of structure using Rasmol or SPDB Viewer or CHIME
	Molecular Dynamics, molecular modeling and simulations, molecular docking
VIII (2Weeks)	**Current advances in Bioinformatics**: Computer aided drug designing (CADD), Chemoinformatics, Immunoinformatics.
	Revision.

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Class test	10%
	Assignments	5 %
	Mid-semester Examination	15%
End Assessment	End theory examination	70 %
	TOTAL	**100%**

Note: Class tests to be conducted at 4th and 14th Week; Mid-semester to be conducted after the 8th week

Learning Resources/Recommended Texts/Reference books/web resources

1. Attwood TK, Parry Smith DJ. Introduction to Bioinformatics, 2nd ed. India:Pearson Education;1999.
2. Jean-Michel Claverie, Cedric Notredame. Bioinformatics, 1st ed. USA: Dummies; 2007.
3. Lesk A M. Introduction to Bioinformatics, 4th ed.UK: OUP Oxford; 2013.
4. Rastogi RS. Bioinformatics: Concepts, skills & Applications, 2nd ed.India: CBS; 2009.

Program	B. Pharm
Year /Semester	Third year /1st semester
Name of the course	Pharmacoeconomics (Choice based Elective)
Course Code	16BPH511
Credits	2
Hours /week	2 hours (lectures)
Pre / co-requisite/s	Nil

Course Description: The Pharmacoeconomics course is designed to impart basic knowledge on various Pharmacoeconomic tools and its applications. This course is designed to provide an understanding of the economics of pharmaceuticals in health care systems, and the skills required to apply economic analysis to the evaluation of products and the broad policy issues affecting the industry. The course gives information about various Pharmacoeconomic evaluation types and how to employ them in making various decisions. It gives a brief idea on role of Pharmacoeconomics in evaluation of research outcome and formulary management.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO 1: Recognize the various Pharmacoeconomic variables and outcomes.

CO 2: Relate the Pharmacoeconomics in various health care systems.

CO 3: Interpret Pharmacoeconomic data and define how various pharmacoeconomical evaluation tools used to set drug prices and control drug budgets.

CO 4: Apply the Pharmacoeconomic in designing and managing formulary, taking decisions on various disorders and in evaluating drug literature and drug research.

Theory Course: Contents

Unit	Topics
I (2 weeks)	**Pharmacoeconomics:** Definition, history, needs of Pharmacoeconomics evaluations
II (2 weeks)	**Health care system of the world and Pharmacoeconomics emphasizing on U.S., U.K., Australia, India.**
III (2 weeks)	**Variables in Pharmacoeconomics:** Introduction to the variables, relationship between outcomes and variables. **Pharmacoeconomics variables:** Clinical Variable, Humanistic variable, Perspective variable, Factors affecting Pharmacoeconomics measures.

IV (2 weeks)	**Pharmacoeconomics evaluation** Outcome assessment and types of evaluation Includes theoretical aspects of various methods and practical study of various methods with the help of case studies for individual methods: Cost – minimization, Cost- benefit, Cost – effectiveness, Cost utility
V (2 weeks)	**Principles and Pharmacoeconomics of Drug Literature Evaluation**
VI (2 weeks)	**Pharmacoeconomics evaluation of Drug Research Outcome;** Evaluation of Qualification of author, title, abstract, study methodology, results, discussion, sponsorship and conclusion.
VII (2 weeks)	**Application of Pharmacoeconomics and decision analysis in** GIT disorders, Cardiovascular Disorders, Respiratory Disorders and their disease managements.
VIII (2 weeks)	**Applications of Pharmacoeconomics in general** Software and case studies, Role in formulary management decisions Revision

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Class test	10%
	Assignments	5 %
	Mid-semester Examination	15%
End Assessment	End theory examination	70 %
	TOTAL	**100%**

Note: Class tests to be conducted at 4th and 14th Week; Mid-semester to be conducted after 8th week

Learning Resources/Recommended Texts/Reference books/web resources

1. F. Randy Vogenberg, Introduction to Applied Pharmacoeconomics, McGraw Hill, 2001.
2. Health care, Cost, Quality and Outcomes: ISPOR book of terms, ISPOR, 2003.
3. Essentials of Pharmacoeconomics by Karen L. Rascati
4. Pharmacoeconomics: http://www.ispor.org/

Program	B. Pharm
Year /Semester	Third year / 1st semester
Name of the course	Medicinal chemistry – I Practicals
Course Code	16BPH506
Credits	2
Hours /week	4 hours (Practical)
Pre / co-requisite/s	Nil

Course Description: The Medicinal chemistry I laboratory course is aimed to train the students on experimental techniques for the determination and Synthesis of different biologically active compound libraries and evaluation of their biological activity using cytotoxicity assays. Analysis of structure activity relationships using the data generated. This course also provides the laboratory skills related to reaction design, chemical synthesis and purification process for few medicinal compounds.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO 1:Demonstrate the skills on determination of various physical properties of organic molecules related to biological activity.

CO 2:Perform chemical reaction and purification of medicinal compounds of pharmaceutical interest.

CO 3:Differentiate various classes of medicinal compounds by experimental design.

Practical Course: Contents

Week	Name of the experiment
01	Synthesis of Barbituric acid from Diethyl Malonate
02	Synthesis of Phenytion from Benzoin or Benzil
03	Synthesis of Diphenyl quinaoxaline from o-phenylene diamine and benzil
04	Synthesis of phenothiazine from o-phenylene diamine
05	Synthesis of Benzocaine from Para amino benzoic acid
06	Synthesis of Dibromo succinic acid from malic acid
07	Synthesis of Benzoxazine from Anthranilic acid
08	Monograph analysis of Caffeine (bulk drug) as per IP 2014.
09	Monograph analysis of Phenytoin (bulk drug or tablets) as per IP 2014.
10	Monograph analysis of Phenobarbital sodium tablets as per BP 2008.
11	Monograph analysis of Benzocaine (bulk drug or tablets) as per IP 2014.
12	**Workshop:** Correlation of the structure with the chemical name

(Literature, Journal reported lead compounds synthesis relevant to theory can also be included)	
	Revision

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Participation	5 %
	Lab work (day to day)	10 %
	Mid-semester Examination	15%
End Assessment	End Practical examination	70 %
	TOTAL	**100%**

Mid-semester to be conducted after 8th week.

Learning Resources/Recommended Texts/Reference books/web resources

1. A.I. Vogel, Text Book of Practical Organic Chemistry, 5th Edition. Pearson Prentice Hall.
2. F.G. Mann & B.C. Saunders, Practical Organic Chemistry, 4th Edition. Pearson Publishers.
3.Indian Pharmacopoeia
4.British Pharmacopoeia

Program	B. Pharmacy
Year /Semester	Third year / 1st semester
Name of the course	Pharmaceutical Biochemistry Practical
Course Code	16BPH507
Credits	2
Hours /week	4 hours (Practical)
Pre / co-requisite/s	Nil

Course Description: The pharmaceutical Biochemistry laboratory course is aimed to train the students on experimental techniques for the identification of carbohydrates, proteins, amino acids and lipids. This course also deals with experiments on estimation of constituents in urine and blood and their significance in diagnosis of various diseases.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO 1: Identify the carbohydrates proteins and lipids based upon chemical tests.

CO2: Perform paper chromatography/Thin layer chromatography for identification of amino acids.

CO 3. Demonstrate the skills on determination of various constituents present in urine and serum.

Practical Course: Contents

Week	Topics
1.	Identification of carbohydrates mono, di and polysaccharides.
2.	Identification of amino acids
3.	Identification of lipids
4.	Identification of amino acids using paper chromatography/TLC
5.	Estimation of glucose in urine by Benedict's quantitative reagent method.
6.	Estimation of creatinine in urine by jaffe's method
7.	Estimation of blood sugar by folin-wu tube method.
8.	Estimation of Urea in Blood by DAM method
9.	Estimation of serum cholesterol by Libermann-burchard method
10.	Estimation of Serum protein using biuret reagent.

11.	Estimation of serum bilirubin using vonder bergh reagent.
12.	Estimation of sodium in serum by Flame photometry
13.	Estimation of SGOT in serum
14.	Estimation of SGPT in serum
15.	Effect of temperature on the activity of alpha-amylase
16.	Estimation of chlorides in urine by Volhard's method
17.	DEMO: Different diagnostic methods in diagnostic lab, Blood glucose estimation by Glucometer.

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Participation	5 %
	Lab work (day to day)	10 %
	Mid-semester Examination	15%
End Assessment	End Practical examination	70 %
	TOTAL	**100%**

Mid-semester to be conducted after 8th week.

Learning Resources/Recommended Texts/Reference books/web resources

1. David T. Plummer. *Introduction to Practical Biochemistry*, 3rd ed.: Tata Mc Graw-Hill Education Pvt Ltd; 1988.
2. Pattabhiraman. *Practical Biochemistry*, 4th ed.: All India Pub (New Delhi); 2004

Program	B. Pharmacy
Year /Semester	Third year /Ist semester
Name of the course	Pharmaceutical Technology – I Practical
Course Code	16BPH508
Credits	2
Hours /week	4 hours (Practical)
Pre / co-requisite/s	Nil

Course Description: The pharmaceutical technology I laboratory course is aimed to train the students on experimental techniques for the preparation of pharmaceutical dosage forms.. This course also deals with formulation of suppositories and ophthalmic preparations. This course also provides the laboratory skills related to formulation of cosmetic preparations

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO 1: Demonstrate the skills on usage of additives in the dosage forms

CO2: Differentiate the type of emulsions.

CO 3: Formulate different cosmetics and baby care products.

Practical Course : Contents

Week	Topics
1.	Preparation and packaging of Paracetamol syrup
2.	Preparation and packaging of codeine phosphate linctus
3.	Preparation, evaluation and packaging of milk of magnesia
4.	Identification tests for emulsions
5.	Preparation and packaging of Benzoic acid ointment
6.	Preparation and packaging of Boric acid suppositories
7.	Preparation of Zinc sulphate eye drops
8.	Preparation of Atropine sulphate eye ointment
9.	Preparation of cetrimide cream
10.	Formulation of Lipsticks
11.	Formulation of Toothpowder and toothpaste
12.	Preparation of Shampoo

13.	Preparation of Cold cream and vanishing cream
14.	Preparation of diclofenac gel
15.	Formulation of baby powder, lotion
16.	**Revision**

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Participation	5 %
	Lab work (day to day)	10 %
	Mid-semester Examination	15%
End Assessment	End Practical examination	70 %
	TOTAL	**100%**

Mid-semester to be conducted after 8th week.

Learning Resources/Recommended Texts/Reference books/web resources

1. Lachman L, Lieberman HA, Kanig JL. Theory & Practice of industrial pharmacy.3rd edition. Philadelphia: Lea & Febieger;1990.
2. Allen LV, Popovich NG, Ansel HC.pharmaceutical dosage forms and drug delivery systems. Lippincott Williams & Wilkins; 2005.
3. Aulton Pharmaceutics ME.The science of dosage form design. 2nd ed. Churchill-Livingstone; 2002.
4. Mithal BM. A text book of pharmaceutical formulations.6thed.Delhi: vallabh prakashan;2010.
5. Mithal BM,Saha RN. A hand book of cosmetics. Ist ed.Delhi:vallabh prakashan; 2004.
6. Sagarin, MS Balsam Cosmetics Sciences &Technology.2nd ed. Vol.1, 2 & 3 Wiley India Pvt. Ltd;2008.
7. Shobharani R Hiremath. Text book of industrial pharmacy. universities press; 2008.
8. Lippincott Williams and Wilkin Remington..The science and practice of pharmacy.21st ed: New delhi:Wolters kluwer Health pvt ltd; 2006.

Program	B. Pharmacy
Year /Semester	Third year /2nd semester
Name of the course	Medicinal chemistry - II
Course Code	16BPH601
Credits	3
Hours /week	3 hours (lectures)
Pre / co-requisite/s	Nil

Course Description: Medicinal chemistry II course is aimed to present chemistry of medicinal compounds. It emphasize on nomenclature and Structure and activity relationship (SAR) of various class of drugs. The course will emphasize the pharmaceutical importance of these medicinal compounds. This course also deals with stereochemistry, mechanism of action, metabolism and their therapeutic uses. This also deals with various methods for the synthesis of Drug substances. It also gives information about adverse drug reactions of drugs.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO1: Define the nomenclature and structure of various class of drugs.

CO2: Explain the SAR, stereochemistry and mechanism of action of the drugs.

CO3: Describe therapeutic uses and metabolism of drugs which includes phase I and Phase II reactions.

CO4: Apply appropriate methods to synthesize some drugs.

Theory Course: Contents

NOTE: Introduction, definition, chemical classification with structure, nomenclature, synthesis (only for * marked drugs), mechanism of action, SAR including stereo chemical aspects, metabolites (including its Adverse drug reactions) and therapeutic uses of the following classes of drugs from UNIT I to UNIT VIII.

Unit	Topics
I (2 weeks)	**Drugs acting on renal system Renin-Angiotensin system inhibitors**: Captopril*, Lisinopril, Enalapril*, Ramipril, Benzapril, Losartan*, Candesartan, Telmisartan, Valsartan, Aliskiren.
	Diuretics: Acetazolamide*, Methazolamide, Dichlorphenamide, Hydrochlorthiazide*, Benzthiazide, Furosemide*, bumetanide, Newer- Piretanide, Ethacrynic acid*, Indacrinone, Spironolactone, Aldosterone, Amiloride, Triamterene and Mannitol. SAR- Carbonic anhydrase inhibitors, Thiazides, Loop diuretics.

II (2weeks)	**Anti anginal agents & vasodilators:** Nitroglycerin, Isosorbide dinitrate, Erithrityl tetra nitrate*, pentaerythritol tetra nitrate. Ion channel blockers- Verapamil, Diltiazem, Nifedipine, Amlodipine*, Felodipine, Nicardipine, Bepridil, Ranolazine
	Antithrombotic agents- Aspirin, Dipyridamole, Clopidogrel* and Ticlopidine **Antiarrhythmic drugs**: Quinidine, Procainamide*, Disopyramide, Lidocaine, Mexiletine*, Propafenone, Amiodarone, Bretylium, Sotalol.
III (2weeks)	**Antihypertensive agents**: classification, Reserpine, Guanethidine, Prazosin, Terazosin, Methyldopa, Clonidine, Hydralazine, Sodium nitroprusside, Sildenafil citrate, Minoxidil, Amrinone, Milrinone. SAR- beta-blockers.
	Antihyperlipidemic agents: Clofibrate, Fenofibrate*, Dextrothyroxine, Cholestyramine resin, Colestipol, Nicotinic acid, ß-Sitosterol, Probucol, Ezetimibe, Simvastatin, Lovastatin, Pravastatin, Fluvastatin, Atorvastatin, Rosuvastatin. SAR-HMG CO-A inhibitors.
IV (2 week)	**Synthetic hypoglycemic agents**: Tolbutamide*, Tolazamide, Chlorpropamide, Acetohexamide, Glipizide, Glyburide, Glimepiride, Gliclazide.
	Repaglinide, Pioglitazone, Metformin*, Acarbose, Miglitol. **Thyroid and antithyroid drugs**: Levothyroxine, Liothyronine, Propylthiouracil, Methimazole.
V (2weeks)	**Opioids**: Morphine, Levorphanol, Pentazocine, Meperidine*, Loperamide, Fentanyl, Methadone, Tramadol*, Butorphanol, Buprenorphine **Opioid antagonist**: Naltrexone, Naloxone, Methylnaltrexone.SAR of morphine and its analogs.
	NSAIDs: A note on prostaglandins and leukotrienes. Aspirin, Indomethacin, Sulindac*, Tolmetin, Ketorolac, Ibuprofen*, Naproxen, Fenoprofen, Mefenamic acid, Diclofenac*, Lumiracoxib, Piroxicam, Meloxicam, Celecoxib, Paracetamol*.
VI (2weeks)	**Management of Gout and Hyperuricemia**: Colchicine, Allopurinol*, Probenecid, Sulfinpyrazole. **Antimigraine drugs**: Sumatriptan, Zolmitriptan. SAR – Salicylates, Aryl propionic acids, oxicams.
	Anticoagulants: Factors, Warfarin sodium*, Dicumarol, Anisindione
VII (2weeks)	**Antibiotics β- Lactams:** Penicillin G, Penicillin V, Methicillin, Oxacillin, Cloxacillin*, Dicloxacillin, Ampicillin*, Amoxicillin, piperacillin. **β- Lactamase inhibitors**: Clavulanate potassium, Sulbactam, Tazobactam, Newer-Meropenem, Biapenem,
	Cephalosporins: Cephalexin*, Cefadroxil, Cefazolin, Cefaclor, Cefuroxime, Cefixime, Cefotaxime, Ceftriaxone, Cefepime. SAR-Penicillins and Cephalosporins.
VIII (2weeks)	**Aminoglycosides and Tetracyclines:** Streptomycin, Neomycin, Kanamycin, Amikacin, Gentamicin, Tobramycin, Tetracycline, Chlortetracycline, oxytetracycline, Doxycycline, Minocycline. SAR- Aminoglycosides and tetracyclines.
	Macrolides and Lincomycins: Erythromycin, Clarithromycin, Azithromycin Lincomycin, Clindamycin. **Miscellaneous**: Vancomycin, Bacitracin, Polymyxin B, Chloramphenicol, Novobiocin, Aztreonam, Ertapenem

Assessment methods and weightage

Assessment type	Assessment tool	Distribution
Continuous Assessment	Class test	10%
	Assignments	5 %
	Mid-semester Examination	15%
End Assessment	End theory examination	70 %
	TOTAL	**100%**

Note: Class tests to be conducted at 4th and 14th Week; Mid-semester to be conducted after 8th week

Learning Resources/Recommended Texts/Reference books/web resources

1. William O. Foye. *Principle of medicinal chemistry*, 5th Ed. New Delhi: Wolter's Kluwer health (India) Pvt Ltd.; 2008.
2. Block JH & Beale JM. *Wilson & Gisvold's Textbook of Organic Medicinal and Pharmaceutical Chemistry*, 12th ed. Philadelphia: Wolter's Kluwer health (India) Pvt Ltd.; 2011.
3. Abraham D. *Burger, Medicinal Chemistry and Drug Discovery*, 6th Ed. New York: John Wiley & Sons. 2007.
4. Graham L. Patrick. *An Introduction to Medicinal Chemistry*, 1st ed. U K: Oxford University Publishers; 2002.
5. Rama Rao Nadendla. *Medicinal Chemistry*: Mc Millan Publishers; 2007.
6. Hansch. *Comprehensive Medicinal Chemistry*, Vol 1-6 ed. Oxford: Elsevier pergmon press.

Program	B. Pharm
Year /Semester	Third Year / 2nd semester
Name of the course	Pharmaceutical Jurisprudence
Course Code	16BPH602
Credits	2
Hours /week	2 hours (lectures)
Pre / co-requisite/s	Nil

Course Description: The pharmaceutical jurisprudence course is aimed to present fundamentals in various acts like pharmacy act 1948, drugs and cosmetics act 1940 and rule 1945, narcotics and psychotropic substance act 1985 and rules 1986 etc. It also emphasizes the responsibilities of pharmacist and also ethics to be followed in pharmacy profession.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO 1: List various schedules and their applications in pharmacy

CO 2: Discuss the significance and relevance of pharmaceutical laws in India and role of ethics in pharmacy profession.

CO 3: Explain the components of schedule M and schedule Y related to manufacturing and clinical trials respectively.

CO 4: Appraise the requirements of manufacturing, labeling, and packaging of formulations as per the guidelines of various regulatory agencies.

Theory Course: Contents

Unit	Topics
I (2 weeks)	**Pharmaceutical ethics & policy:** Pharmacist in relation to his job and trade.
	Pharmacist in relation to his profession, medical profession, pharmacist oath.
II (2 weeks)	**Pharmacy Act 1948:** Pharmacy council of India(PCI), educational regulations,
	Composition and functions of state and joint state pharmacy councils, first and subsequent registers.
III (2 weeks)	**Drugs and Cosmetics Act 1940 and Rules 1945:** Schedules, administration of the act and rules, manufacture.
	Labeling, sale of drugs, offences and penalities.
IV (2 weeks)	**Narcotic Drugs & Psychotropic Substances Act 1985 and Rules 1986:** Definitions, prohibition control and regulation, offences and penalties.
	Cultivation of opium poppy and production of opium or poppy straw, manufacture sale and export of opium.

V (2 weeks)	**Drugs and Magic Remedies (Objectionable Advertisements) Act 1954 and Rules 1955:** Definitions, prohibited advertisements, exempted advertisements.
	Advertisements exempted conditionally, offences and penalties, schedule J diseases.
VI (2 weeks)	**Medical termination of pregnancy act 1970 and rules 1975:** Definations, provisions of the act, offences and penalities.
	AP State Shops & Establishments Act 1988 & Rules 1990: Definations, registration of establishments, hours of work, opening and closing of shops, leave, offences and penalities.
VII (2 weeks)	**Medicinal & Toilet Preparations (Excise Duties) Act 1955:**Definitions, licensing, manufacture In-bond.
	Manufacture Out-bond, offences and penalties.
VIII (2 weeks)	**Prevention of Cruelty to animals Act 1960:** Definations, Objectives, Experimentation on animals, Prohibition of Experimentation.
	Drugs (Prices Control) Order 1995: Definations, objectives, calculation of retail price of formulations, price and price list, maintenance of records and power of entry search and seizure, penalities.

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Class test	10%
	Assignments	5 %
	Mid-semester Examination	15%
End Assessment	End theory examination	70 %
	TOTAL	**100%**

Note: Class tests to be conducted at 4th and 14th Week; Mid-semester to be conducted after 8th week

Learning Resources/Recommended Texts/Reference books/web resources

1. Mithal B.M. Text Book of Forensic Pharmacy, 10 ed. New Delhi: Vallabh Prakashan; 2016.
2. Kokate C.K, Gokhale S.B. Text Book of Forensic Pharmacy, 1st ed. Hyderabad: Pharma Book Syndicate; 2006.
3. Jain N.K. Text Book of Forensic Pharmacy, 8th ed. New Delhi: Vallabh Prakashan; 2016.
4. Agarwal S.P, Rajesh Khanna. Pharmaceutical Jurisprudence and Ethics, 5th ed. New Delhi: Birla Publications; 2014.

Program	B. Pharm
Year /Semester	Third Year / 2nd semester
Name of the course	Pharmacology- II
Course Code	16BPH603
Credits	3
Hours /week	3 hours (lectures)
Pre / co-requisite/s	Nil

Course Description: This course aimed to provide knowledge on mechanism of action, adverse effects, drug interactions, contraindications and therapeutic uses of drugs acting on cardiovascular system, hematopoietic system, renal system, Gastro intestinal tract and respiratory system.This course also describes about drugs related to Hormones and their antagonists.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO 1:Describe various pharmacological aspects of drugs falling under below mentioned chapters.

CO2:Apply the drug information for the management of disorders falling under below mentioned chapters.

CO3: Analyze the drug related problems pertaining to the below mentioned chapters

CO4: Describe the Pathophysiological basis about the below mentioned chapters

Theory Course: Contents

Unit	Topics
I (2 weeks)	**Pharmacology of Drugs acting on cardiovascular System-I** a.Pharmacology of drugs used in hypertension
	b.Pharmacology of drugs used in congestive heart failure
II (2 weeks)	**Pharmacology of Drugs acting on cardiovascular System-II** a.Pharmacology of drugs used in coronary artery diseases (Atherosclerosis)
	b.Pharmacology of drugs used in coronary artery diseases (Angina pectoris and MI)
III (2 weeks)	**Pharmacology of Drugs acting on cardiovascular System-III** a.Types of cardiac arrhythmias and reasons for cardiac arrhythmias.Electrocardiogram.
	b.Pharmacology of drugs used in arrhythmias
IV (2 weeks)	**Pharmacology of Drugs acting on urinary system** a.Fluid and Electrolyte balance
	b.Diuretics and Anti-diuretics
V (2 weeks)	**Pharmacology of Drugs acting on hematopoietic system** a. Coagulants, anticoagulants

	b.Fibrinolytics, Antifibrinolytics, Antiplatelet drugs c. Hematinics
VI (2 weeks)	**Pharmacology of Drugs acting on the gastrointestinal tract** a. Anti-ulcer Drugs
	b. Laxatives and antidiarrhoeal drugs c. Emetics and anti-emetics
VII (2 weeks)	**Hormones and their antagonists** a. Insulin, Oral hypoglycemic agents b. Thyroid and anti-thyroid drugs
	c. Adrenocortical steroids and their analogues d. Uterine stimulants and relaxants
VIII (2 weeks)	**Pharmacology of Drugs Acting on the Respiratory System** a.Anti-asthmatic drugs
	b.Anti-tussives and expectorants c.Respiratory stimulants

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Class test	10%
	Assignments	5 %
	Mid-semester Examination	15%
End Assessment	End theory examination	70 %
	TOTAL	**100%**

Note: Class tests to be conducted at 4th and 14th Week; Mid-semester to be conducted after 8th week

Learning Resources/Recommended Texts/Reference books/web resources

1. Tripathi KD. Essentials of Medical Pharmacology. 7 th ed. New Delhi: Jaypee Brothers; 2014.
2. Rang H.P, Dale M.M and Ritter J.M.Pharmacology. 8 th ed .Edinburgh: Elsevier Churchill living stone;2016.
3. David E.Golan, Armen H.Tashjian and April W. Armstrong. Principles of pharmacology: the pathophysiological basis of drug therapy.2 nd ed. Philadelphia: Lippincott Williams & Wilkins; 2008.
4. Bertram. G. Katzung. Basic and clinical pharmacology. 11 th ed. New York: Mc Graw-Hill; 2010.
5. Satoskar RS, Bhandarkar SD and Nirmala N.Rege. Pharmacology and Pharmacotherapeutics.19th ed. Mumbai: Popular prakashan.2005.
6. Hardman J.G , Lee E. Limbard, Good Man & Gilmans. The Pharmacological basis of therapeutics. 11 th ed.USA: Mc Grawhill; 2006.

Program	B. Pharm
Year /Semester	Third year / 2nd semester
Name of the course	Pharmaceutical technology - II
Course Code	16BPH604
Credits	3
Hours /week	3 hours (lectures)
Pre / co-requisite/s	Nil

Course Description: The pharmaceutical technology II course is aimed to present fundamentals of various techniques in the development of tablets, capsules and parenterals . It emphasize on basic principles involved in the microencapsulation and pharmaceutical importance of the microencapsulation techniques The course also deals with the formulation, filling methods of parenterals on large scale. It also describes about the packaging components and their specifications. This course also provides the laboratory skills related to evaluation of various dosage forms.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO 1: Define the different types of tablets.
CO2: Demonstrate the various techniques used in tablet coating.
CO 3: Propose the appropriate packaging system for the drug products.
CO4: Analyze the fundamentals in designing of parenteral formulations.

Theory Course: Contents

Unit	Topics
I (2 weeks)	**Tablets:** Introduction to different types of tablets, Formulation of tablets, Reasons for granulation, Granulation properties, Granulation technology on large-scale by various techniques and equipments.
	Tablet processing problems and their remedy. Physics of tablet making. Types of tablet compression machinery and the equipments employed and evaluation of tablets.
II (2 weeks)	**Coating of Tablets:** Types of coating**,** Reasons for coating coating materials and their selection, formulation of coating solution, equipment for coating
	Coating processes, evaluation of coated tablets. Tablet coating defects and their remedy
III (2 weeks)	**Capsules:** Advantages and disadvantages of capsule dosage forms, material for production of hard and soft gelatin capsules, sizes of capsules, Rationale for the selection of soft gels as dosage forms**.** capsule filling, processing problems in capsule manufacturing,
	Importance of base absorption and minimum/gm factors in soft capsules, quality control, stability testing and storage of capsule dosage forms..
IV (2 weeks)	**Microencapsulation:** Types of microencapsulation and importance of microencapsulation in pharmacy, microencapsulation by coacervation phase seperation, multi orifice centrifugal separation.

	Spray drying, spray congealing, polymerization complex emulsion, air suspension technique, and pan coating techniques, evaluation of microcapsules
V (2 weeks)	**Parenterals-I** Preformulation factors, water for injection, treatment of apyrogenicity, Formulation details, containers, closures and their selection. Prefilling treatment.
	washing and sterilization of containers and closures, preparation of solutions and suspensions, filling and closing of ampoules, vials, infusion fluids,
VI (2 weeks)	**Parenterals-II:** Lyophillization, preparation of sterile powders, evaluation of parenteral products. Aseptic techniques,
	Sources of contamination and methods of prevention. Design of aseptic area, laminar flow benches, Environmental control monitoring
VII (2 weeks)	**Packaging Materials :**Packaging components, types, specifications, Factors influencing choice of containers
	Methods of evaluation of packaging materials as per I.P.
VIII (2 weeks)	**Packaging of Pharmaceutical products:** Methods of packing of solids, liquids and semi-solid dosage forms,
	Legal and other official requirements for containers, stability aspects of packaging.

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Class test	10%
	Assignments	5 %
	Mid-semester Examination	15%
End Assessment	End theory examination	70 %
	TOTAL	**100%**

Note: Class tests to be conducted at 4th and 14th Week; Mid-semester to be conducted after 8th week

Learning Resources/Recommended Texts/Reference books/web resources

1. Lachman L, Lieberman H A, Kanig JL. Theory & Practice of industrial pharmacy. 3rd ed. Philadelphia: Lea & Febieger;1990.
2. Allen LV, Popovich NG, Ansel H C. Pharmaceutical dosage forms and drug delivery systems. 8th ed. Lippincott Williams & Wilkins; 2005.
3. Aulton Pharmaceutics ME.The science of dosage form design. 2nd ed. Churchill Livingstone; 2002.
4. Mithal BM. A text book of pharmaceutical formulations. 6th ed. Delhi: vallabh prakashan; 2010.
5. Jain U K, Goupale D C, Nayak S. Pharmaceutical packing technology. 1st ed.pharmamed press; 2009.
6. Lippincott Williams and Wilkin.The science and practice of pharmacy. 21st ed. New delhi: Wolters kluwer Health pvt ltd;2006.
7. Jain NK. Pharmaceutical product development. 1st ed.Delhi: CBS publishers; 2008.

Programme	**B. Pharm**
Year /Semester	**Third year / 2nd semester**
Name of the course	**Modern Analytical Techniques**
Course Code	**16BPH605**
Credits	**3**
Hours /week	**3 hours (Lectures)**
Pre / co-requisite/s	**Nil**

Course Description:

The modern analytical techniques course delivers the basic principles of modern instrumental techniques include spectroscopy and chromatography and it provides the significant knowledge upon the qualitative and quantitative estimation of the drug. The course covers the theory of operation, instrument design and methodology, and applications of spectroscopic techniques like UV/VIS, Fluorescence, IR, AAS, Flame Photometry, Nephelo-turbidimetry, MS, and NMR and chromatographic methods that includes HPLC, GC and explains a brief note it on ELISA, RIA, ORD, and XRD.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO 1: Demonstrate the knowledge of various instrumental techniques for qualitative and quantitative estimation of drug substance/ drug product.

CO 2: Employ the suitable analytical technique for the qualitative and quantitative estimation of drug substance/ drug product.

CO 3: Choose different analytical techniques such as spectroscopy, chromatography and electrophoresis based upon the drug substance/ drug product.

Theory Course: Contents

Unit	Topics
I (2 Weeks)	UV-Visible Spectroscopy: EMR, Molecular energy, types of electronic transition during UV Visible light absorption, derivation of combined equation of lambert's-beer law and deviations of beer's law, chromophores, Auxochromes, isobestic point
	UV and Visible Spectroscopy: instrumentation – Construction of single beam and double beam spectrophotometers, Woodward Fiesher rule for calculation of λ- max, quantitative applications (calibration method, A1%cm, single and double point standardization, simultaneous equation method) to dosage forms.
II (2 Weeks)	IR Spectroscopy: Vibrational energy in bond, types of vibrations, Hook's law, sample preparation, instrumentation – FT- IR (single and double beam)
	IR Spectroscopy: ATR, Determination of functional group by IR spectra, Application of IR spectra in monograph analysis as per IP.
III (2 Weeks)	H^1-NMR spectroscopy: Principle, theory, spin-quantum number, energy levels, relaxation process, chemical shift and NMR spectrum, shielding and de-shielding, spin-spin coupling

	H^1-NMR spectroscopy: J – value, Instrumentation, applications, ESR Vs NMR (comparison of principle and application).
IV (2 Weeks)	Mass Spectrometry: Basic principle, types of peaks in mass spectrum, fragmentation pattern,
	Instrumentation (single and double focusing), ionization techniques, Nitrogen rule, unsaturation index (formula). Importance of Mass spectroscopy in the structural elucidation.
V (2 Weeks)	Fluorimetry: Theory, Fluorescence and chemical structure, stokes and anti-stokes, quantum efficiency, factors affecting the intensity of fluorescence, Instrumentation (double beam), Applications in Pharmaceutical analysis. Note on Phosphorescence.
	Flame Emission photometry and Atomic absorption spectroscopy: Emission spectra, Absorption spectra, line spectra, principle of absorption / emission of UV light by elements, instrumentation, applications in pharmaceutical analysis. Focus on interference.
VI (2 Weeks)	Nephelo-turbidimetry: Introduction, principle, instrumentation of Nephelo-turbidimeter, pharmaceutical application as specified in IP, determination chlorides and sulphates.
	Electrophoresis techniques involving Moving boundary electrophoresis, zone electrophoresis, continuous electrophoresis (preparative) and applications.
VII (2 Weeks)	Gas Chromatography: Principle, adsorption isotherm and its relation to tailing and fronting, Instrumentation - carrier gas, flow regulators, injectors columns, detectors.
	Gas Chromatography: Various parameters used in GC analysis. Brief note on GC-MS.
VIII (2 Weeks)	HPLC: Principle, Vandeemter equation, Instrumentation - mobile phase, degassing, pumps, injectors, columns, detectors. Isocratic and gradient elution in RP-HPLC.
	Various parameters in chromatogram of HPLC, Comparisons between HPTLC Vs HPLC and HPLC Vs GC. Brief note on LC-MS, LC-MS/MS.

Assessment methods and weightage

Assessment type	Assessment tool	Distribution
Continuous Assessment	Class test	10%
	Assignments	5 %
	Mid-semester Examination	15%
End Assessment	End theory examination	70 %
	TOTAL	**100%**

Note: Class tests to be conducted at 4th and 14th Week; Mid-semester to be conducted after 8th week

Learning Resources/Recommended Texts/Reference books/web resources

1. Willard HH, Merritt LL, Dean JA, Settle FA. Instrumental Methods of Analysis. 7th ed. India: CBS Publishers and Distributors; 2004. ISBN: 9788123909431.
2. Settle AF. Handbook of Instrumental Techniques for Analytical Chemistry. Har/Cdr ed. New Jersey: Prentice Hall; 1997. ISBN-10: 0131773380, ISBN-13: 978-0131773387.
3. Skoog DA, Holler FJ, Crouch SR. Principles of Instrumental Analysis. 6th ed. India: Cengage Learning; 2006. ISBN-10: 0495012017, ISBN 13: 9780495012016
4. Watson DG. Pharmaceutical Analysis. 3rd ed. London: Churchill Livingstone; 2012. ISBN-13: 978-0702046216
5. Sethi PD. Quantitative analysis of drugs in pharmaceutical formulations. 3rd ed. India: CBS Publishers; 2007. ISBN-10: 8123905602, ISBN-13: 978-8123905600
6. Connors KA. A textbook of Pharmaceutical Analysis. 3rd ed. India: Wiley India Pvt. Ltd; 1982. ISBN: 8LGYW9TY5P8.
7. Sharma BK. Instrumental chemical analysis, 28th ed. India: Goel publishing house; 2014. ISBN: 9788182830998.
8. Silverstein RM, Webster FX, Kiemle DJ, Bryce DL. Spectrometric identification of organic compounds. 8th ed. New Jersey: John Wiley & Sons; 2004. ISBN: 9780470914014.
9. Kemp W. Organic spectroscopy. 3rd ed. London: Palgrave Macmillan; 1991. ISBN-10: 033351954X, ISBN-13: 9780333519547.

Program	B. Pharmacy
Year /Semester	Third year /2nd semester
Name of the course	Medicinal chemistry – II Practical
Course Code	16BPH606
Credits	2
Hours /week	4 hours (Practical)
Pre / co-requisite/s	Nil

Course Description: Medicinal chemistry-II laboratory course is aimed to train the students in synthesis of medicinal compounds. This course also deals with identification of drugs using chemical tests and by various spectroscopic methods as per IP procedures. This course also provides the laboratory skills related to identification of impurities present in drug substances, chemical synthesis and purification process for few medicinal compounds and the skills related to the identification of functional groups

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO1: Identify the functional groups present in drug substances

CO2: Perform quantitative estimations to determine the purity of drug substances.

CO3: Demonstrate the skills in synthesis of various medicinal compounds.

CO4: Analyze various medicinal compounds by identification tests.

Practical Course: Contents

Week	Topics
1.	Synthesis of Paracetamol from p-amino phenol
2.	Synthesis of Cinnamic acid from Benzaldehyde
3.	Synthesis of Benzotriazole from o-phenylene diamine
4.	Synthesis of 1-phenyl-3-methyl-5-pyrazolone from hydrazine hydrate
5.	Synthesis of 7-Hydroxy-4-methyl coumarin from resorcinol and ethyl acetoacetate
6.	Synthesis of Salicylaldehyde from phenol
7.	Synthesis of Aspirin from salicylic acid
8.	Identification and test for purity for Aspirin tablet as per IP
9.	Identification and test for purity for Acetazolamide tablet as per IP

10.	Identification and test for purity for propranolol tablet as per IP
11.	Identification and test for purity for Diclofenac sodium tablet as per IP
12.	Identification and test for purity for Paracetamol tablet as per IP
13.	DEMO/WORKSHOP: Microwave assisted organic synthesis,
14.	DEMO/WORKSHOP Purification of synthesized compounds (Column chromatography)
15.	WORKSHOP: Nomenclature of medicinal compounds
16.	DEMO: Rotary vacuum evaporator

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Participation	5 %
	Lab work (day to day)	10 %
	Mid-semester Examination	15%
End Assessment	End Practical examination	70 %
	TOTAL	**100%**

Mid-semester to be conducted after 8th week.

Learning Resources/Recommended Texts/Reference books/web resources

1. Vogel A. L. *Vogel's Textbook of Practical Organic Chemistry*, 5th ed. Pearson Prentice Hall: Dorling. Kindersley (India) Pvt, Ltd; 2007.
2. Mann F. G. & Saunders B. C. *Practical Organic Chemistry*, 4th ed.: Pearson Publishers; 2007.
3. Indian pharmacopoeia 2007/2010.

Program	B. Pharm
Year /Semester	Third year / 2nd semester
Name of the course	Pharmacology – II Practical
Course Code	16BPH607
Credits	2
Hours /week	4 hours (Practical)
Pre / co-requisite/s	Nil

Course Description: This course aimed to expertise the students on Basic needs of Pharmacology like handling of animals, Routes of drug administration, Collection of blood samples by various techniques. This course also describe about different preclinical screening models employed in drug discovery and development.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO 1:Demonstrate the Basic needs and skills required for pharmacology laboratory.

CO2: Perform the *insitu* experiments on isolated living Tissues

CO3: Evaluate the Preclinical drug screening experiments on intact animals

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Practical Course: Contents

Week	Topics
1	Introduction to Experimental Pharmacology
2	Study of laboratory animals and their handling (a. Frogs, b. Mice, c. Rats, d. Guinea pigs, e. Rabbits).
3	Study of different routes of drug administration in animals
4	Collection of blood samples from animals
5	Study of laboratory appliances used in experimental pharmacology.
6	Study of physiological salt solutions used in experimental pharmacology
7	To record the dose response curve of Ach using isolated rat ileum/frog rectus abdominis muscle preparation.
8	To record the dose response curve of Ach using isolated rat ileum preparation in the presence of physostigmine/Neostigmine.
9	To record the dose response curve of Ach using isolated rat ileum preparation in the presence of Atropine
10	Study of Mydriatic and Miotics on rabbit eye
11	Study of Local anesthetics on rabbit eye
12	Study of muscle relaxant activity by using Rotarod apparatus
13	Study of Antianxiety activity by using Elevated plus maze

14	Study of spontaneous motor activity and Locomotor activity by using Actophotometer
15	DEMO
16	**Revision**

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Participation	5 %
	Lab work (day to day)	10 %
	Mid-semester Examination	15%
End Assessment	End Practical examination	70 %
	TOTAL	**100%**

Mid-semester to be conducted after 8th week.

Learning Resources/Recommended Texts/Reference books/web resources

1. Ramesh k.Goyal, Natvar M.Patel, Prabhakar MC, Rajendra V.Bhatt and Anitha A.Mehta. Practicals in pharmacology.8 th ed.Ahmendabad:B.S.Shah Prakashan; 2009.
2. Kulakarni SK. Handbook of Experimental Pharmacology.4 th ed. New Delhi: vallabh Prakashan; 2012
3. Ghosh MN. Fundamentals of Experimental pharmacology.6 th ed.Kolkata: Hilton& company; 2008.
4. Parmar NS, Shiv Prakash. Screening Methods in Pharmacology. New Delhi: Narosa Publishing House; 2011.#

Program	**B. Pharm**
Year /Semester	**Third year / 2nd semester**
Name of the course	**Pharmaceutical Technology – II Practical**
Course Code	**16BPH608**
Credits	**2**
Hours /week	**4 hours (laboratory)**
Pre / co-requisite/s	**Nil**

Course Description: The pharmaceutical technology II laboratory course is aimed to train the students on various techniques for the preparation of tablets . This course also deals with the quality control tests to be performed on tablets, capsules and parenterals .This course also provides the laboratory skills related to handling of different equipments.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO 1: Demonstrate the skills in handling of different equipments

CO2: Demonstrate the skills in preparing the tablets

CO 3: Evaluate the tests on tablets ,Parenterals and capsules

Practical Course : Contents

Week	Topics
1	Preparation of tablets by wet granulation method
2	Preparation of chewable tablets
3	Preparation of tablets by direct compression method
4	Preparation of effervescent tablets
5	Weight variation test for uncoated tablets
6	Friability test for uncoated tablets
7	Hardness test for uncoated tablets
8	Disintegration test for uncoated tablets
9	Dissolution test for uncoated tablets
10	Disintegration test for enteric coated tablets
11	Preparation and filling of hard gelatin capsules
12	Weight variation test for hard gelatin capsules

13	Disintegration test for hard & soft gelatin capsules
14	Preparation of Sodium chloride intravenous infusion
15	Ampoule sealing (pull sealing & Tip sealing)
16	Clarity test, leaking test for parenterals

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Participation	5 %
	Lab work (day to day)	10 %
	Mid-semester Examination	15%
End Assessment	End Practical examination	70 %
	TOTAL	**100%**

Mid-semester to be conducted after 8th week.

Learning Resources/Recommended Texts/Reference books/web resources

1. Lachman L, Lieberman HA , Kanig JL. Theory & Practice of industrial pharmacy.3rd ed. Philadelphia: Lea & Febieger;1990.
2.Allen LV, Popovich N G, Ansel H C. pharmaceutical dosage forms and drug delivery systems.8th edition. Lippincott Williams & Wilkins; 2005.
3. Aulton Pharmaceutics M. E..The science of dosage form design.2nd ed. Churchill-Livingstone; 2002.
4. Mithal BM. A text book of pharmaceutical formulations. 6thed. Delhi:vallabh prakashan; 2010.
5. Lippincott Williams and Wilkin.The science and practice of pharmacy.21st ed. New Delhi:Wolters kluwer Health pvt ltd; 2006
6. Jain NK.Pharmaceutical product development,1st ed. Delhi:CBS publishers;2008.

Programme	**B. Pharm**
Year /Semester	**Third year / 2nd semester**
Name of the course	**Modern analytical techniques Practical**
Course Code	**16BPH609**
Credits	**2**
Hours /week	**4 hours (laboratory)**
Pre / co-requisite/s	**Nil**

Course Description:

The modern analytical techniques course describes the fundamentals of instrumental techniques and their applications. It provides the significant skills on the handling of instruments and equipments such as UV, IR and HPLC. It emphasize the knowledge of procedures in analyzing drug substance/drug product as per monographs of IP/BP/USP/EP/JP/Others.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO 1: Analyze to carry out the handling of instrument and equipment independently

CO 2: Design and deepen their practical skills so as to be capable of solving practically associated problems

CO 3: Judge the result outcome of the drug analysis performed by self with monographs.

Practical Course: Contents

Week	Name of the experiments
1	Determination of λmax of ibuprofen/paracetamol/amlodipine.
2	Determination of isobestic point of diclofenac and paracetamol.
3	Estimation of amlodipine by UV spectrophotometry (calibrative curve method).
4	Assay of ibuprofen by UV spectrophotometry (calibrative curve method).
5	Assay of furosemide by UVspectrophotometry-A (1%,1cm) method.
6	Estimation of riboflavin by fluorimetry (calibrative curve method).
7	Study of chemical quenching effect of quinine sulphate by fluorimetry.
8	Spectrophotometric estimation of ciprofloxacin in the ciprofloxacin injection by colorimetry (calibrative curve method).
9	Estimation of $Na^+/K^+/Ca^{++}$ ion concentration by flame photometry.
10	Limit test of sulphate in calcium gluconate by nephelo-turbidimetric method as per USP 29.
11	Excise the woodward fisher rule for calculation of λ_{max} calculation.
12	Interpretation of IR Spectra.
13	Demonstration of HPLC instrumentation for the analysis of APIs.
14	Demonstration of the preparation of potassium bromide (KBr) pellet and record the IR spectrum.
15	Excise on various system suitability parameters of HPLC.
16	Revision

Assessment methods and weightage

Assessment type	Assessment tool	Distribution
Continuous Assessment	Participation	5 %
	Lab work (day to day)	10 %
	Mid-semester Examination	15%
End Assessment	End Practical examination	70 %
	TOTAL	**100%**

Mid-semester to be conducted after 8th week.

Learning Resources/Recommended Texts/Reference books/web resources

1. Indian pharmacopeia. (2014). Government of India, Ministry of health and family welfare. Vol 1, 2, 3. Ghaziabad: Published by Indian pharmacopeial commission.
2. The British Pharmacopoeia. (2014).The commission of human medicines pursuant to the medicines act 1968, Vol 1 to 5, London: Published by stationery office on behalf of the medicines and health care products regulatory agency (MHRA).
3. The United states pharmacopoeia-National formulary. (USP 37-NF 32). Rockville: Published by the united states pharmacopoeial convention.
4. The European pharmacopoeia. (2008). 6th ed., Strasbourg: Published by the council of Europe.
5. The Japanese Pharmacopoeia. (2006). 13th ed., Japan: Published by the society of Japanese Pharmacopoeia, under the supervision of the R & D division, Pharmaceutical affairs bureau, Ministry of health & welfare.
6. Martindale- The extra pharmacopoeia. 35th ed., London: Published by the royal pharmaceutical society.
7. Analytical profiles of drug substances. Vol. 1 to Vol. 20. Edited by Klaus Florey. United States of America: Published by Academic Press, Inc. ISBN: 978-0-12-260820-9
8. Analytical profiles of drug substances. Vol. 21 to Vol. 30. Edited by Harry G Brittain. United States of America: Published by Academic Press, Inc.
9. A Series of Analytical chemistry by open learning. Edited by David J. Ando.India: Published by Wiley India.

Program	**B. Pharm**
Year /Semester	**Third year / 2nd semester**
Name of the course	**Advanced communication skills Practical (Audit Course)**
Course Code	**16BPH611**
Credits	**1**
Hours /week	**2 hours (Practical)**
Pre / co-requisite/s	**Nil**

Course Description: This Advanced Communication Skills course is suitable for anyone who is responsible for building and managing influential relationships, particularly where polished communication and interpersonal skills really count. Ideally delegates will approach the course with some theoretical or practical understanding of interpersonal communication.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO 1: Apply the skills necessary for communication excellence
CO 2: Develop your communication style to increase rapport with others
CO 3: Apply the art and science of influence: body language and listening
CO 4: Identify different thinking styles to be more persuasive

Course: Contents

	Topics
I (2weeks)	Communicative competency: 1.Reading comprehension 2.Listening comprehension
II (2weeks)	Technical Writing 1.Report Writing 2.Curriculum Vitae
III (2weeks)	Presentation skills 1.Oral presentation. 2.Powerpoint Presentation
IV (2weeks)	Phonetics Telephone skills
V (2weeks)	1.Group discussion 2.Interview skills
VI (2weeks)	1.Covering letter 2.Email writing
VII (2weeks)	1.Eye contact 2.Vocabulary for competitive purpose
VIII (2weeks)	1.Body postures 2.Gestures

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Participation	5 %
	Lab work (day to day)	10 %
	Mid-semester Examination	15%
End Assessment	End Practical examination	70 %
	TOTAL	**100%**

Program	**B. Pharm**
Year /Semester	**Fourth year / 1st semester**
Name of the course	**Pharmaceutical Biotechnology**
Course Code	**16BPH701**
Credits	**3**
Hours /week	**3 hours (lectures)**
Pre / co-requisite/s	**Pharmaceutical Microbiology**

Course Description: This course is dealing with the basic techniques of fermentation technology, rDNA technology, Enzyme immobilization, biotechnological based drugs. This course discusses basics of proteomics, genomics, bioinformatics and their related software and applications.This course will focus on the new developments in the production of biopharmaceuticals by rDNA technology.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO 1:Compare the knowledge of interlink of pharmaceutical sciences, with bio technology by using living organisms their products applying rDNA technology and software's for human health.
CO2: Expertise their skills for biotechnology concepts, tools and analytical techniques.
CO3: Prepare, Standardise and Storage of Vaccines.
CO4: Compare and contrast different tools used in bioinformatics.

Theory Course: Contents

	Topics
I (2 weeks)	**Fermentation Technology:** Isolation, Selection, Screening of Industrial important microbes, Strain improvement. Types, design & operation of Bioreactor. Types of fermentations, optimization of fermentation process
	Principle and Procedure involving in downstream process and effluent treatment.
II (2 weeks)	**Specific Fermentations:** Selection of organism, fermentation & purification of various antibiotics like penicillin, streptomycin, tetracycline, erythromycin,
	vitamins like riboflavin and cyanocobalamin,
	organic acids like lactic acid, alcohol, acetone etc.
III (2 weeks)	**Microbial Transformations:** Types, Methods of bioconversions
	Application in Pharma Industry, Steroidal transformation
IV (2 weeks)	**Recombinant DNA Technology:** Introduction to r-dna technology and genetic engineering, steps involved isolation of enzymes, vectors, recombination and cloning of genes.
	Production of bio technology derived therapeutic proteins like humulin, humatrop, activase, intron a, monoclonal antibodies by hybridoma technique,

	recombivax HB (hepatitis b).
V (2 weeks)	**Immunology & Immunological Preparations:** Principles of Immunity, Humoral imm y, cell mediated immunity.
	Antigen – antibody reactions, hypersensitivity and its applications. Active & passive immunizations vaccine preparation, Standardization & storage of BCG, cholera, smallpox, polio, typhus, tetanus toxoid, immuno serum & diagnostic agents.
VI (2 weeks)	**Enzyme Technology** :Techniques of immobilization of enzymes, factors affecting enzyme kinetics, advantages of immobilization over isolated enzymes.
	Study of enzymes such as hyaluronidase, penicillinase, streptokinase, streptodornase, amylase, protease etc. immobilization of bacteria & plant cells.
VII (2 weeks)	**Blood and Blodd products** :Introduction, role, collection, process & storage of blood products, plasma substitutes and sutures & ligatures like whole human blood, human normal ig, dextran, catgut etc.
	plasma substitutes and sutures & ligatures like whole human blood, human normal ig, dextran, catgut etc.
VIII (2Weeks)	**Genome :** Introductory study & applications of bioinformatics, proteomics and genomics.
	Revision

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Class test	10%
	Assignments	5 %
	Mid-semester Examination	15%
End Assessment	End theory examination	70 %
	TOTAL	**100%**

Note: Class tests to be conducted at 4th and 14th Week; Mid-semester to be conducted after 8th week

Learning Resources/Recommended Texts/Reference books/web resources

1. Stanbury PF, WhitakerA, Hall SJ. Principles of Fermentation Technology, 2nd ed. USA: Elsevier; 2013.
2. Prescott SC, Dunn CG. Industrial Microbiology,1st ed. UK: Mc.Graww Hill;1940.
3. Vyas SP, Dixit VK. Pharmaceutical Biotechnology, 1sted. India:CBS Publishers;1998.
4. Kori SS, Halkai MA. Pharmaceutical Biotechnology, 3rded. India:Vallabh Prakashan;2016.
5. Singh BD. Biotechnology, 1st ed. India:Kalyani Publishers;2004.
6. Gupta PK. Genetics, 3rd ed. India: Rastogi Publications; 2005.
7. Kumaresan V. Biotechnology, 1sted. India: Saras Publications; 2005.

Program	B. Pharm
Year /Semester	Fourth year / 1st semester
Name of the course	Biopharmaceutics & Pharmacokinetics
Course Code	16BPH702
Credits	3
Hours /week	3 hours (lectures)
Pre / co-requisite/s	Nil

Course Description: This course emphasize the mechanisms of drug absorption and study of the physicochemical, physiological, pathological and pharmaceutical factors affecting the absorption, distribution and elimination of drugs from the body. The course also includes the protein binding, pharmacokinetic compartment models and nonlinear kinetics. It describes the bioavailability study protocol and bioequivalence. The course also deals with mechanisms of renal clearance, clinical pharmacokinetics, pharmacokinetic drug interactions.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO 1: Underline the concept of biopharmaceutics and pharmacokinetics in formulation development

CO2: Describe the mechanisms of drug absorption.

CO 3: Differentiate between compartmental and non-compartmental analysis.

CO4: Estimate the basic pharmacokinetic parameters that describe drug absorption and disposition.

Theory Course: Contents

	Topics
I (2 weeks)	**Biopharmaceutics** **Introduction** to Biopharmaceutics and Pharmacokinetics and their role in formulation development and clinical setting.
	Passage of drugs across biological barrier (passive diffusion, active transport, facilitated diffusion and pinocytosis)
II (2 weeks)	**Factors influencing absorption** – physiochemical factors
	Physiological and pharmaceutical factors. Biopharmaceutical Classification System (BCS) and its significance
III (2 weeks)	**Drug distribution & protein binding:** Drug distribution in the body, Factors influencing distribution.
	Plasma protein binding, binding sites, factors influencing protein binding. Significance of protein binding.

IV (2 weeks)	**Pharmacokinetics**: Significance of plasma drug concentration measurement. **Compartment model:** Definition and scope. Pharmacokinetics of drug absorption – Zero order and first order absorption rate constant using Wagner Nelson method Volume of distribution
	Comparative kinetics: One compartment and Determination of Pharmacokinetic parameters from plasma and urine data after drug administration by oral and parenteral routes. Curve fitting (Method of Residuals) Clearance concept.
V (2 weeks)	**Clearance & Non-linear pharmacoknietics:** Mechanism of Renal clearance, clearance ratio, determination of renal clearance.
	Non-linear pharmacoknietics with special reference to one compartment model after I.V.Drug administration, Michealis Menten Equation, detection of non-linearity (Saturation mechanism). Determination of Km and Vm
VI (2 weeks)	**Clinical pharmacokinetics** Definition and scope. Dosage adjustment in patients with renal and hepatic failure. Pharmacokinetic drug interactions and its significance in combination therapy.
	Design of dosage regimen, Individualization of therapy, Drug accumulation during multiple dosing
VII (2 weeks)	**Bioavailability and bioequivalence.** Measures of bioavailability, C-max, T-max and Area Under the Curve (AUC). Design of single dose bioequivalence study. Overview of regulatory requirements for conduction of bio-equivalence studies.
	Bioavailability testing protocol and procedures. *In vivo* methods of evaluation – statistical treatment
VIII (2 weeks)	**Dissolution studies:** . *In vitro* dissolution studies for solid dosage forms methods, interpretation of dissolution data *invitro-invivo* correlations
	Comparison of dissolution profiles. Factors affecting dissolution, Methods to enhance bioavailability

Assessment methods and weightage

Assessment type	Assessment tool	Distribution
Continuous Assessment	Class test	10%
	Assignments	5 %
	Mid-semester Examination	15%
End Assessment	End theory examination	70 %
	TOTAL	**100%**

Note: Class tests to be conducted at 4th and 14th Week; Mid-semester to be conducted after 8th week

Learning Resources/Recommended Texts/Reference books/web resources

1. Shargel L. Text book of applied Biopharmaceutics and Pharmacokinetics. 4th edn. Connecticut :Appleton centuary crofts; 2004.
2. Venkateswarlu. Fundamentals of Biopharmaceutics and Pharmacokinetics. Pharma Book Syndicate;2004.
3. Milo Gibaldi. Biopharmaceutics and clinical pharmacokinetics. 4th ed. Hyderabad: Pharma Book Syndicate;2005.
4. Brahmankar DM, Jaiswal SB. Biophamaceutics and pharmacokinetics- a treatise.2nd edition. Delhi:vallabh prakashan; 2009.
5. Madan PL. Biopharmaceutics and Pharmacokinetics. 1st ed. Jaypee Bros;2010.

Program	B. Pharm
Year /Semester	Fourth Year / 1st semester
Name of the course	Pharmacology- III
Course Code	16BPH703
Credits	3
Hours /week	3 hours (lectures)
Pre / co-requisite/s	Nil

Course Description: This course aimed to provide knowledge on pharmacological aspects like mechanism of action, pharmacokinetics, side effects, drug interactions, contraindications and indications of various chemotherapeutic agents. This course describes about general principles of chemotherapy with special focus on mechanism of drug resistance.This course also emphasises about toxicity studies,treatment of specific poisoning conditions and Bioassays.
Course Learning Outcomes: Upon successful completion of this course, the student should be able to:
CO 1: Illustrates the general principles of chemotherapy

CO 3: Apply the knowledge of chemotherapeutic agents for the management of infectious diseases

C0 4: Describe the principles of animal toxicology and human toxicology

C05: Explain the principles of various bioassays and their role in drug discovery.

Theory Course: Contents

	Topics
I (2 weeks)	**Chemotherapeutic agents -I** a. General principles of chemotherapy.
	b. Sulphonamides, co-trimoxazole and β-lactam antibiotics
II (2 weeks)	**Chemotherapeutic agents -II** a.Tetracyclines, Amino glycosides, Chloramphenicol, Macrolides
	b. Quinolones, Fluoroquinolones and polypeptide antibiotics
III (2 weeks)	**Chemotherapeutic agents -III** a.Chemotherapy of Tuberculosis
	b.Chemotherapy of Leprosy
IV (2 weeks)	**Chemotherapeutic agents -IV** a.Chemotherapy of Malignancy
	b.Chemotherapy of Fungal and Viral diseases
V (2 weeks)	**Chemotherapeutic agents –IV** a.Chemotherapy of Protozoal diseases
	b.Chemotherapy of Helmintic infections

VI (2 weeks)	**Autacoids and their antagonists** a. Amine autacoids- Histamine, 5-HT. Antagonists including Antihistamines and Serotonin blockers
	b. Lipid derived autacoids-Prostaglandins, Thromboxanes and Leukotrienes c. Peptide autacoids- Angiotensin, Bradykinin
VII (2 weeks)	**Principles of toxicology** a**.** Definition of Poison, General principles of treatment of poisoning. b. Treatment of Barbiturate, Opioid, Organophosphorus and Atropine poisoning. c.$LD_{50,}ED_{50}$ and therapeutic index
	Principles of Animal toxicology: Acute, sub acute and chronic toxicity studies.
VIII (2 weeks)	**Bioassays** a. Principles of bioassays and errors in bioassays.
	b. Study of bioassay methods for the following drugs i. Digitalis ii. D-Tubocurarine iii. Oxytocin iv. Insulin

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Class test	10%
	Assignments	5 %
	Mid-semester Examination	15%
End Assessment	End theory examination	70 %
	TOTAL	**100%**

Note: Class tests to be conducted at 4th and 14th Week; Mid-semester to be conducted after 8th week

Learning Resources/Recommended Texts/Reference books/web resources

1. Tripathi KD. Essentials of Medical Pharmacology. 6 th ed. New Delhi: Jaypee Brothers; 2009.
2. Rang H.P, Dale M. M and Ritter J.M.Pharmacology.6 th ed .Edinburgh: Churchill living stone;2003.
3. David E.Golan, Armen H.Tashjian and April W. Armstrong. Principles of pharmacology: the pathophysiological basis of drug therapy.2 nd ed. Philadelphia: Lippincott Williams & Wilkins; 2008.
4. Bertram. G. Katzung. Basic and clinical pharmacology. 10 th ed. New York: Mc Graw-Hill; 2006.
5. Satoskar RS, Bhandarkar SD and Nirmala N.Rege. Pharmacology and Pharmacotherapeutics.19th ed. Mumbai: Popular prakashan.2005.
6. Hardman J.G , Lee E. Limbard, Good Man & Gilmans. The Pharmacological basis of therapeutics. 11 th ed.USA: Mc Grawhill; 2006.

Program	**B. Pharmacy**
Year /Semester	**Fourth year / Ist Semester**
Name of the course	**Medicinal Chemistry– III**
Course Code	**16BPH704**
Credits	**4**
Hours /week	**4 hours (lectures)**
Pre / co-requisite/s	**Nil**

Course Description: Medicinal chemistry-III course is aimed to present fundamental in chemistry of medicinal compounds. The course will emphasize the pharmaceutical importance of functional groups, nomenclature, SAR and therapeutic uses of various medicinal compounds. This also deals with various methods for the synthesis of Drug substances. This also provides various mechanisms involved in synthesis and reactions of chemical compounds.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO1: Define the nomenclature, structure of a molecule in relation to the classification of organic compounds.

CO2: Demonstrate the possible mechanism and therapeutic uses of medicinally important compounds.

CO3: Apply the appropriate substrate, catalyst and reaction conditions in the design of chemical synthesis.

CO4: Analyze the fundamentals on behavior of chemical compounds in the synthesis of medicinal compounds.

NOTE: Introduction, definition, chemical classification with structure, nomenclature, synthesis (only for * marked drugs), mechanism of action, SAR including stereo chemical aspects, metabolites (including its ADR) and therapeutic uses of the following classes of drugs.

Theory Course: Contents

Unit	Topics
I (2 weeks)	**Histamine and Antihistaminic agents:** H1-Antagonists: Chlorpheniramine*, Triprolidine, phenindamine, diphenhydramine*, doxylamine succinate, tripelennamine, antazoline phosphate,cyclizine, meclizine*, buclizine, promethazine*, methdilazine, cyproheptadine, azatadine maleate,fexofenadine, loratadine, desloratadine, cetrizine, acrivastin.
	H2 Antagonists: Cimetidine,famotidine, ranitidine*, omeprazole*, esomeprazole, lansoprazole, pantoprazole, rabeprazole, sucralfate, misoprostol. Note on H3-agonist and antagonists. SAR – H1 and H2 receptor antagonists.

II (2 weeks)	**Introduction of antibiotics :** Different types of antibiotics like penicillin, **Antibiotics:** Cephalosporins, aminoglycosides, tetracyclines.
	Synthetic antibacterials and antifungal agents: Sulphonamides and quinolones: cotrimaxazole,sulphacetamide*, sulphaquanidine, sulfiisoxazole*, sulfadoxime, trisulfapyrimidines, triple sulfa, norfloxacin, ciprofloxacin, ofloxacin*, levofloxacin.sar- sulphonamides, fluroquinolones.
III (2 weeks)	**Urinary antiseptics:** Nitrofurantoin*, furazolidine, nitrofurazole, methenamine.antifungal agents: clotrimazole*, itraconazole, ketoconazole, miconazole*, fluconazole,amphotericin b, nystatin, griseofulvin*. SAR- azoles.
	Anti-paracytic and antimycobacterial agents: A. Antimalarials: life cycle, chloroquine*, amodiaquine, primaquine, quinacrine*, artemisinin, pyrimethamine, atovaquone and proguanil. SAR – 4 -aminoquinolines, aminoacridines.
IV (2 weeks)	**Antiamoebics and anthelmentics:** Metronidazole, tinidazole*, dilaxanide, iodoquinol, dec*, thiabendazole, piperazine, mebendazole*, albendazole, dimercaprol, niclosamide, pyrantel pamoate, ivermectin.
	Antimycobacterials: Isoniazid*, ethambutol*, pyrazinamide, rifampicin, thioacetazone, cycloserins, dapsone*, clofazimine.
V (2 weeks)	**Antivirals:** Viral replication, amantidine*, acyclovir*, oseltamivir, idoxuridine, zidovudine*, lamivudine, stavudine, efavirenz, didanosine, tenofovir, zalcitabine, emitricitabine, nevirapine,ritonavir, saquinavir. SAR- RTIs, NNRTIs.
	Antineoplastics: Chlorambucil*, Cyclophosphamide, ifosamide, thiatepa, lomustine, busulfan, carmustine*, cisplatin, procarbazine, streptazocin, methotrexate, 5-FU, cytarabine, 6-Mp.
VI (2weeks)	**Antineoplastics:** Thioguanine, Vidarabine, tamoxifen. chemistry of anticancer antibiotics, A note on Newer agents, SAR – Alkylating agents, nitroso ureas.
	Physico chemical properties of drug molecules in relation to biological activity – Solubility, lipophilicity, partition-coefficient, Ionization, hydrogen bonding.
VII (2 weeks)	Physico chemical properties of drug molecules in relation to biological activity – Chelation, redox potential and surface activity, Bioisosterism and steric features of drugs, drug distribution and protein binding.
	Mechanisms of Drug action: Introduction, Enzyme stimulation, Enzyme inhibition. Theories of drug action (Ferguson's, Dale's, perturbation and occupation).
VII (2 weeks)	Drug metabolism: Introduction to Biotransformation, concept of soft and hard drug, phase I & II (With one drug example).
	Introduction, basic concepts and clinical importance of Prodrug and criteria for drug latentiation approach.
	Revision

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Class test	10%
	Assignments	5 %
	Mid-semester Examination	15%
End Assessment	End theory examination	70 %
TOTAL		**100%**

Note: Class tests to be conducted at 4th and 14th Week; Mid-semester to be conducted after 8th week

Learning Resources/Recommended Texts/Reference books/web resources

Text Books:

1. J.H Block, J.M Beale . Wilson *& Gisvold's* Text book of organic Medicinal Chemistry and pharmaceutical chemistry. 12th Ed. Lipcolt, Raven ; Philadelphia: 2011.
2. William O. Foye, Thomas L.lemke, David.A, Roche. Textbook of Medicinal Chemistry. 6th Ed. Lipincort Williams & willkins; Philadelphia: 2008.
3. Graham. L. Patrick. An Introduction to Medicinal Chemistry. 1stEd. Bios scientific publishers limited. Oxford University publishers ;U.K: 2002.
4. Rama Rao Nadendla. Medicinal Chemistry.1stEd. Pharma book syndicate; Hyderabad: 2007.
5. M.P.S.Ishan, Abdul Faruk. Synthesis of organic medicinal compounds.1st Ed. Narosha publishing house ; New Delhi: 2006.
6. J.Dharuman. Chemistry of synthetic drugs. 12th Ed. AITBS publishers limited; New Delhi: 2008.

Reference Books:

1.Hansch.C, sammes.P.G,Taylor. Comprehensive medicinal chemistry. 1stEd. Vol:1–6 Elsevier pergmon press. Oxford; Newyork: 1990.
2. D. Abraham. Burger Medicinal chemistry and Drug discovery. 6th Ed. Vol. 1 & 2. John Wiley & Sons; New York : 2003.
3. M. Atherden. Bentley and Driver's Textbook of Pharmaceutical Chemistry. 8thEd. Oxford University Press ; Delhi: 2000.
4. Daniel lednicer . Strategies for Organic Drug Synthesis and Design . 1stEd. John Wiley; Newyork: 1998.
5. D. Lednicer, L.A.Mitsher. Organic drug synthesis. J.Wiley&son; Newyork: 1984.

Program	B. Pharm
Year /Semester	Fourth year /Ist semester
Name of the course	Pharmaceutical Biotechnology Practical
Course Code	16BPH705
Credits	2
Hours /week	4 hours (Practical)
Pre / co-requisite/s	Nil

Course Description: The pharmaceutical Biotechnology laboratory course is aimed to train the students on experimental techniques for the isolation of antibiotic producing microorganisms from soil, immobilization of enzymes. This course also deals with wet laboratory based experiments on identification of Minimum inhibitory concentrations of antibiotics. This course also provides the laboratory skills related to fermentation process, extraction of DNA, electrophoresis, bioassays.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO 1: Demonstrate the skills on handling of various equipment based physical methods of Sterilization, Incubation,Fermentor.

CO2: Differentiate antibiotics based on their sensitivity and resistance to various microorganism's by experimental techniques.

CO 3: Estimate different biomolecules by bioanalytical techniques.

Practical Course: Contents

Week	Topics
1.	Introduction to laboratory safety techniques and the use of class wares and chemicals. Basic rules and requirements for laboratory, Study of equipments and Glassware's used in Biotechnology laboratory.
2.	Preparation and Sterilization of Nutrient Agar medium.
3.	Isolation of antibiotic producing microorganisms from soil.
4.	Preparation and Sterilization of liquid MS media
5.	Development of Callus culture from carrot explants.
6.	Immobilization of Enzymes by calcium alginate
7.	Test for antibiotic sensitivity by filter paper or cup plate method.
8.	Test for sterility testing as per IP for injectable.
9.	Isolation of DNA from Onions.

10.	Demonstration of precipitation reaction based on immune-diffusion test.
11.	Microbiological assay of VitaminB12
12.	Entrapment of plant cell in alginate gel
13.	Agarose gel electrophoresis of Bovine serum albumin
14.	Fermentation techniques
15.	Extraction of bacterial DNA and RNA and their estimations by colorimetry.
16.	**Revision**

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Participation	5 %
	Lab work (day to day)	10 %
	Mid-semester Examination	15%
End Assessment	End Practical examination	70 %
	TOTAL	**100%**

Mid-semester to be conducted after 8th week.

Learning Resources/Recommended Texts/Reference books/web resources

1. Rana SVS. Biotechniques, 1st ed. India: Rastogi Publications;2005.
2. Kokate, Jalalpure, Hurakadle. Pharmaceutical Biotechnology, 1sted.India: Elsevier; 2011.
3. Dubey RC, Maheswari DK. Practical Microbiology, 2nd ed. India: S.Chand& Company Ltd; 2006.

Program	B. Pharm
Year /Semester	Fourth year / 1st semester
Name of the course	Biopharmaceutics & Pharmacokinetics Practical
Course Code	16BPH706
Credits	2
Hours /week	4 hours (Practical)
Pre / co-requisite/s	Nil

Course Description: The Biopharmaceutics and Pharmacokinetics laboratory course is designed to provide the students on laboratory skill for the demonstration of instrumentation based on principles of dissolution of solid dosage forms. This course also deals with experiments on dissolution enhancement, protein binding . This course also provides the skills for interpretation of plasma and urine drug concentration data obtained after various routes of administration to determine necessary pharmacokinetic parameters.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO 1: Demonstrate the skills on instrumentation related to dissolution and protein binding

CO2: Demonstrate the relative bioavailability

CO 3: Estimate various pharmacokinetic parameters of drugs following various compartment models with different routes of administration.

Practical Course : Contents

Week	Topics
1	Determination of relative bioavailability
2	Determination of pharmacokinetic parameters from plasma data
3	Estimation of pharmacokinetic parameters of one compartment model by i.v. bolus administration
4	Estimation of pharmacokinetic parameters of one compartment model by i.v. infusion administration
5	Preparation & evaluation of diclofenac sodium gel
6	Estimation of absorption rate constant by method of residuals
7	Estimation of absorption rate constant by wagner nelson method
8	Estimation of pharmacokinetic parameters from urinary data by rate of excretion method
9	In-vitro dissolution study for the tablets
10	Determination of level of significance by ANOVA

11	Determination of level of significance by t-test
12	Estimation of pharmacokinetic parameters from urinary data by sigma minus method
13	Determination of protein binding
14	Preparation of solid dispersions
15	**Revision**

Learning Resources/Recommended Texts/Reference books/web resources

1.Shargel L. Text book of applied Biopharmaceutics and Pharmacokinetics. 4th ed. Connecticut :Appleton centuary crofts; 2004.

2.Venkateswarlu. Fundamentals of Biopharmaceutics and Pharmacokinetics. Pharma Book Syndicate;2004.

3.Milo Gibaldi. Biopharmaceutics and clinical pharmacokinetics. 4th ed. Hyderabad: Pharma Book Syndicate;2005.

4.Brahmankar DM, Jaiswal SB. Biophamaceutics and pharmacokinetics- a treatise.2nd ed. Delhi:vallabh prakashan; 2009.

5. Madan PL. Biopharmaceutics and Pharmacokinetics. 1st ed. Jaypee Bros;2010.

Program	**B. Pharm**
Year /Semester	**Fourth year /1st semester**
Name of the course	**Pharmacology – III Practical**
Course Code	**16BPH707**
Credits	**2**
Hours /week	**4 hours (laboratory)**
Pre / co-requisite/s	**Nil**

Course Description: This course aimed to provide skill for the students on various aspects of bioassay experiments. This course also provide an idea about the calculations of pA2 value for antagonists.This course also expertise the students on drug screening methods by using intact animals.#

Course Learning Outcomes:
Upon successful completion of this course, the student should be able to:
CO 1: Perform the Bioassays of drugs by using suitable isolated organ or tissue preparation.

CO2: Calculate the pA_2 value of Different antagonists by using suitable organ or tissue preparation.

CO 3: Perform the Experiments on intact animals related to screening of different categories of drugs .

Practical Course: Contents

Week	Topics
1.	Introduction to Bioassays
2.	Carry out Bioassay of Ach using isolated rat ileum/ frog rectus abdominis muscle preparation by interpolation Method.
3.	Carry out Bioassay of Ach using isolated rat ileum/ frog rectus abdominis muscle preparation by matching/ bracketing Method.
4.	Carry out Bioassay of Ach using isolated rat ileum/ frog rectus abdominis muscle preparation by three point method.
5.	Carry out Bioassay of Ach using isolated rat ileum/ frog rectus abdominis muscle preparation by four point method.
6.	Calculate the pA_2 value of Atropine using acetylcholine as an agonist on rat ileum preparation
7.	Study of drug induced Catatonia in rats
8.	Study of antipsychotic activity by using Pole climb response apparatus
9.	Study of analgesic activity by using Analgesiometer
10.	Study of anti-inflammatory activity by using Plethysmometer
11.	Study of antidepressant activity by using Forced Swim test & Tail suspension test

12.	Study of anticonvulsant activity by using Electroconvulsio meter
13.	Study of Apomorphine induced compulsive behavior in rat.
14.	DEMO 1
15.	DEMO 2
16.	**Revision**

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Participation	5 %
	Lab work (day to day)	10 %
	Mid-semester Examination	15%
End Assessment	End Practical examination	70 %
	TOTAL	**100%**

Mid-semester to be conducted after 8th week.

Learning Resources/Recommended Texts/Reference books/web resources

1. Ramesh k.Goyal, Natvar M.Patel, Prabhakar MC, Rajendra V.Bhatt and Anitha A.Mehta. Practicals in pharmacology.8 th ed.Ahmendabad:B.S.Shah Prakashan; 2009.
2. Kulakarni SK. Handbook of Experimental Pharmacology.4 th ed. New Delhi: vallabh Prakashan; 2012.
3. Ghosh MN. Fundamentals of Experimental pharmacology.6 th ed.Kolkata: Hilton& company; 2008.
4. Parmar NS, Shiv Prakash. Screening Methods in Pharmacology. New Delhi: Narosa Publishing House; 2011.

Program	**B. Pharmacy**
Year /Semester	**Fourth year / Ist semester**
Name of the course	**Medicinal chemistry –III Practical**
Course Code	**16BPH708**
Credits	**2**
Hours /week	**4 hours (Practical)**
Pre / co-requisite/s	**Nil**

Course Description: The Medicinal chemistry-III laboratory course is aimed to train the students on experimental techniques for the synthesis of medicinal compounds. This course also deals with monograph analysis and determination of medicinal compounds. This course also provides the laboratory skills related to reaction design, chemical synthesis and purification process for few organic medicinal compounds.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO1: Demonstrate the skills on assay of various drugs from different categories.

CO2: Differentiate various methods of assays for medicinal compounds by experimental techniques.

CO3: Perform the percentage purity of medicinal compounds.

Practical Course: Contents

Week	Topics
01	Synthesis of Hydrazones of benzoic acid
02	Synthesis of Eosin from Fluoroscein
03	Synthesis of Benzilic acid from benzyl
04	Synthesis of Sulphanilamide
05	Synthesis of 1,4- Napthaquinone from naphthalene
06	Synthesis of Ortho iodo benzoic acid from anthranilic acid
07	Synthesis of Diazo amino benzene from aniline
08	Synthesis of Acid hydrazides from Salicylic acid
09	Synthesis of Chalcones

10	Assay of Sulpha methoxazole (anti bacterial)
11	Assay of Glibenclamide (hypoglycaemic agent)
12	Assay of Metronidazole (antiprotozoal)
13	Assay of Isoniazid (anti tubercular)
	Revision

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Participation	5 %
	Lab work (day to day)	10 %
	Mid-semester Examination	15%
End Assessment	End Practical examination	70 %
TOTAL		**100%**

Mid-Semester to be conducted after 8th week.

Workshop: Correlation of structure with nomenclature
Demo: Preparative TLC

Learning Resources/Recommended Texts/Reference books/web resources

1. Vogel, A.I, Tatchell A.R, Furnis B.S, Hannaford A.J, Smith P.W.G. Practical Organic Chemistry. 5th Ed. Pearson Publishers Prentice Hall; New Delhi: 1996.
2. F.G. Mann , B.C. Saunders. Practical Organic Chemistry. 4th Ed. Chaman enterprises; New Delhi: 2004.
3. O.P. Agarwal. Advanced Practical Organic Chemistry. 3rd Ed. Goel Publication; Meerut: 2008.
4. Ghajiabad. Indian Pharmacopoeia. Indian Pharmacopoeia commission: Ministry of health and family welfare : 2007.
5. P.D.Sethi, Quantitative analysis of drugs in pharmaceutical formulations. 3rd Ed. CBS publications; New Delhi : 2008. London. British pharmacopoeia. 5th Ed. Modern Humanities Research association (MHRA): 2007.

Program	B. Pharmacy
Year /Semester	Fourth/ 1st Semester
Name of the course	Pharmacological Screening methods (Choice based Elective)
Course Code	16BPH710
Credits	2
Hours /week	2 HOURS (Lectures)
Pre / co-requisite/s	Nil

Course Description: This course is designed to impart knowledge and skill necessary for research and drug development process. This course covers briefly basic principle of drug discovery process, bioassays of some important products, determination of toxicity studies and various preclinical screenings models. This course also emphasizes about alternative to animal screening procedures.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO 1: Enumerate the preclinical models employed in the screening of new drugs.

CO2: Describe the basic principles of bioassays and biological standardization of vaccines and hormones

CO 3: Summarize the principles of toxicity evaluation and determination of LD_{50} value

CO4: Explain Alternatives to animal screening procedures

Theory: Course Contents

Unit	Topics
I (2weeks)	**Drug discovery process:** Principles, techniques and strategies used in new drug discovery.
	Regulations for laboratory animal care and ethical requirements.
II (2weeks)	**Bioassays:** Basic principles of bioassays, advantages and disadvantages of bioassays. Biological standardization of vasopressin, digitalis, oxytocin.
	Biological standardization of acetylcholine, adrenaline, insulin and d-tubocurarine.
III (2weeks)	**Preclinical models employed in the screening of new drugs belonging to following categories-I:** Sympathomimetics, parasympathomimetics, sedatives, hypnotics.
	Anti-arrhythmic agents, Antihypertensives, Cardiotonics, myocardial infarction, Bronchodilators.
IV	**Preclinical models employed in the screening of new drugs belonging to**

(2weeks)	**following categories-II**: Anti-psychotic agents, anti-anxiety agents, nootropic drugs, antidepressant drugs; antiparkinsonian agents, anti-epileptics.
	Analgesics, anti-inflammatory agents, antiulcer agents and hepatoprotectives.
V (2weeks)	**Preclinical models employed in the screening of new drugs belonging to following categories-III:** Antimalarials, anti-helmintics and anti-diabetics.
	Models for Rheumatoid arthritis, Urolithiasis and status epilepticus.
VI (2weeks)	**Alternatives to animal screening procedures:** Cell-line, patch –clamp technique
	In-vitro models, molecular biology techniques.
VII (2weeks)	**Principles of toxicity evaluations:** ED50, LD50 and TD values
	International guidelines(ICH recommendations)
VIII (2weeks)	**Drug development process:** Clinical trials, WHO and Drugs control authorities, preparation of IND/NDAs
	Statistical design in clinical trials, data analysis technique and presentation skills

Recommended Texts/Reference books:

1. Gerhard Vogel H, Wolfgang H. Vogel, Bernward A. Scholkens, Jurgen Sandow and gunter Muller. Drug Discovery and Evaluation: Pharmacological Assays. 3rd ed. New York: Spinger-Verlag Berlin Heidelberg; 2008.

2. Parmar N. S and Shiv Prakash. Screening Methods in Pharmacology. 2nd ed. Oxford U K: Alpha science international; 2015.

3. Robert Arnold Turner. Screening Methods in Pharmacology two volumes. 2nd ed. New York: Academic press; 2009.

4. Gupta S K. Drug Screening Methods.2nd ed. New Delhi: Jaypee brothers medical publishers; 2009.

5. Avanapu Srinivasa Rao and Namburi Bhagya Lakshmi. Pharmacological Screening Methods and Toxicology.1st ed. Hyberabad: PharmaMed press; 2014.

Program	B. Pharm
Year /Semester	Fourth year / 1st semester
Name of the course	Fundamentals of Drug regulatory affairs (Choice based Elective)
Course Code	16BPH711
Credits	2
Hours /week	2 hours (lectures)
Pre / co-requisite/s	Nil

Course Description: Drug regulatory affairs is aimed to increase the knowledge of students in total quality management, GMP and ICH. It emphasizes the discussions on Regulatory requirements for conducting pre clinical and clinical studies, Regulatory guidance's and guidelines for filing and approval process –API, NDA, ANDA. It also enlightens the students with the documentation process in the industry. This increases the knowledge of students in various quality control &regulatory aspects.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:
CO 1: Define basic framework of regulatory affairs.
CO 2: Identify the various regulatory requirements for filing process of IND, NDA and ANDA
CO 3: Demonstrate the various quality control aspects of different regulatory bodies as per their requirements throughout the world

Theory Course: Contents

Unit	Topics
I (2 weeks)	Concept of Quality, Total Quality Management. Quality by design, six sigma concept.
II (2 weeks)	Regulatory Affairs : Indian context – requirements and guidelines of GMP Drugs and Cosmetics Act 1940 and Rules 1945 with reference to Schedule N ,U & Y.
III (2 weeks)	Drug regulatory and accrediting agencies of the world USFDA and WHO
IV (2 weeks)	Regulatory Considerations for Pre-clinical Regulatory Considerations Clinical Evaluation
V (2 weeks)	Globalization of drug industry, present status scope of pharmaceutical industry in India.
VI (2 weeks)	ICH guidelines for manufacturing and quality assurance of drug formulation Stability testing: ICH and WHO guidelines, Photostability studies
VII (2 weeks)	Documentation in pharmaceutical industry: Batch Formula Record, Master Formula Record

	Documentation in pharmaceutical industry: Distribution records, Drug Master Files
VIII (2 weeks)	Regulatory requirements for product approvals: Active Pharmaceutical Ingredients, Biologics.
	Regulatory requirements for product approvals: Novel therapies obtaining New Drug Application (NDA), Abbreviated New Drug Application (ANDA) for generic drugs

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Class test	10%
	Assignments	5 %
	Mid-semester Examination	15%
End Assessment	End theory examination	70 %
	TOTAL	**100%**

Note: Class tests to be conducted at 4th and 14th Week; Mid-semester to be conducted after 8th week

Learning Resources/Recommended Texts/Reference books/web resources

1. A Guide to Total Quality Management by Kaushik Maitra and Sedhan K. Ghosh.
2. Quality assurance and quality management in pharmaceutical industry by Y.Anjaneyulu and Marayya
3. Generic Drug Product Development, Solid Oral Dosage forms, Leon Shargel and Isader Kaufer, Marcel Dekker series, Vol.143
4. Current good manufacturing practices for pharmaceuticals by Manohar A. Potdar
5. The Pharmaceutical Regulatory Process, Second Edition Edited by Ira R. Berry and Robert P. Martin, Drugs and the Pharmaceutical Sciences,Vol.185, Informa Health care Publishers.
6. New Drug Approval Process: Accelerating Global Registrations By Richard A Guarino, MD, 5th edition, Drugs and the Pharmaceutical Sciences,Vol.190.
7. Guidebook for drug regulatory submissions / Sandy Weinberg. By John Wiley & Sons. Inc.

Program	**B. Pharm**
Year /Semester	**Fourth year / 2nd semester**
Name of the course	**Novel Drug Delivery Systems**
Course Code	**16BPH801**
Credits	**3**
Hours /week	**3 hours (lectures)**
Pre / co-requisite/s	**Nil**

Course Description: course is designed to provide students with the knowledge of the principle, strategies, and materials used adopted in development of novel drug delivery systems including oral controlled, targeted drug delivery systems, mucoadhesive systems, liposomes, resealed erythrocytes and microspheres. This course also emphasizes the study of various formulation and evaluation parameters involved in development of the above mentioned drug delivery systems.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:
CO 1: Define the concepts and applications of novel drug delivery systems such as controlled, sustained drug delivery systems, liposomes, resealed erythrocytes, etc.
CO2: Apply the knowledge in developing various novel formulations as required by regulatory specifications and patience compliance.
CO 3: Appraise the quality of various dosage forms as per stipulated evaluation parameters for oral, parenteral, topical etc. drug delivery systems.

Theory Course: Contents

	Topics
I (2 weeks)	**Fundamentals of Controlled Drug Delivery System**: Concepts of controlled release, sustained release, extended release, timed release and delayed release. Rationale behind the design of above delivery systems.
	Factors influencing the design and performance of sustained and controlled release dosage forms.
II (2 weeks)	**Polymers:** Classification, biodegradable polymers.
	Pharmaceutical applications of Polymers.
III (2 weeks)	**Oral Control Drug Delivery Systems**: Fundamentals, Dissolution Controlled, Diffusion Controlled, Ion Exchange Resins.
	Osmotic based systems, pH Independent Systems , altered density systems .
IV (2 weeks)	**Transdermal Drug Delivery Systems:** Fundamentals, permeation of drugs across the skin.
	Types of TDDS, Materials employed and Evaluation of TDDS.

V (2 weeks)	**Targeted Drug Delivery Systems:** Fundamentals and applications, formulation and evaluation of nano particles.
	Formulation and evaluation of resealed erythrocytes and liposomes.
VI (2 weeks)	**Miscellaneous delivery systems:** Introduction, Principle and applications of Floating drug delivery, and Ocular drug delivery.
	Principle and applications of Ocular drug delivery.
VII (2 weeks)	**Mucoadhesive Delivery Systems:** Mechanism of bioadhesion, mucoadhesive materials.
	Formulation and evaluation of ocular and buccal delivery systems.
VIII (2 weeks)	**Prodrugs:** Introduction, classification basing on structural association and site of conversion.
	Applications, limitations of prodrugs.

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Class test	10%
	Assignments	5 %
	Mid-semester Examination	15%
End Assessment	End theory examination	70 %
	TOTAL	**100%**

Note: Class tests to be conducted at 4th and 14th Week; Mid-semester to be conducted after 8th week

Learning Resources/Recommended Texts/Reference books/web resources

1. Jain NK. Controlled and Novel Drug Delivery, 1st ed. New Delhi: CBS Publishers; 2012.
2. Lachman, Liberman's. Theory and Practice of Industrial Pharmacy, 4th ed. New Delhi: CBS Publishers; 2015.
3. Yie W. Chien. Novel Drug Delivery Systems, 2nd ed. New York: Informa Health Care; 2011.
4. Vyas S.P, Khar R.K. Targeted and Controlled Drug Delivery System, 1st ed. New Delhi: CBS Publishers; 2010.

Programme	**B. Pharm**
Year /Semester	**Fourth year / 2nd semester**
Name of the course	**Pharmaceutical management and quality assurance**
Course Code	**16BPH802**
Credits	**2**
Hours /week	**2 hours (Lectures)**
Pre / co-requisite/s	**Nil**

Course Description:

The pharmaceutical management and quality assurance course provides a significant knowledge about the Pharmaceutical industry setup and their quality process in the industry. It also gains knowledge upon the rules and regulations all over the world for the approval of the drug into the market. It covers various topics such as features of business organisations and new economic environment, manufacturing management, organisation of distribution and marketing, pharma industry, audits in pharma industry, good manufacturing practices, regulatory agencies, various types of validation and role of quality assurance department in pharma industry.

Course Learning Outcomes:

Upon successful completion of this course, the student should be able to:

CO 1: State the principle, structure and functions of business organizations.

CO 2: Explain the status of pharma company and its growth and related guidelines like cGMP, cGLP, export and import trade.

CO 3: Demonstrate the knowledge of regulatory agencies in pharmaceuticals.

Theory Course: Contents

Unit	Topics
I (2 Weeks)	Features of Business Organisations & New Economic Environment: Characteristic features of Business, Features and evaluation of Sole Proprietorship, Partnership
	Features of Business Organisations & New Economic Environment: Joint Stock Company, Public Enterprises and their types, Changing Business Environment in Post Liberalisation scenario.
II (2 Weeks)	Manufacturing Management: Goals of Production Management and Organisation – Production, Planning and Control – Plant location -
	Manufacturing Management: Principles and Types of Plant Layout-Methods of production (Job, batch and Mass Production), New Product Development.
III (2 Weeks)	Organisation of Distribution and Marketing: Functions of Marketing, Marketing Mix, Marketing Strategies based on Product Life Cycle.,
	Organisation of Distribution and Marketing: Channels of distribution – Factors influencing channels of distribution, sales organization and sales promotion.

IV (2 Weeks)	Pharma Industry: Growth of Pharma Industry in India–current status and its role in building national economy and national health – Structure of Pharma Industry in India–PSUs in Pharma Industry – Progress in the manufacture of basic drugs
	synthetic and drugs of vegetable origin. Export and import of drugs and pharmaceuticals – Export and import Trade.
V (2 Weeks)	Audits in pharma industry: Various types of audits and insurance.
	Introduction to Good Manufacturing Practices: Schedule – M (India), CFR 21 Part 210 and 211 of US FDA, CGMP, GLP
VI (2 Weeks)	Introduction Drug Regulatory Agencies: Indian CDSCO, US FDA, EMEA, Canadian HPFBI, and Australian TGA.
	Introduction to NDA, ANDA, IND, ICH, patent law and ISO.
VII (2 Weeks)	Introduction to quality assurance, quality control, Process validation (prospective, retrospective & concurrent),
	cleaning validation (sampling procedure and acceptance criteria), analytical method validation,
VIII (2 Weeks)	Equipments validation (DQ,IQ,OQ,PQ), SOP and STP. Types of documents in Quality assurance.
	Role of Quality Assurance department in the industry, QA Documentation procedure in Industry

Assessment methods and weightage

Assessment type	Assessment tool	Distribution
Continuous Assessment	Class test	10%
	Assignments	5 %
	Mid-semester Examination	15%
End Assessment	End theory examination	70 %
	TOTAL	**100%**

Note: Class tests to be conducted at 4th and 14th Week; Mid-semester to be conducted after 8th week

Learning Resources/Recommended Texts/Reference books/web resources

1. Aryasri, Subbarao. Pharmaceutical Administration, TMH.
2. Smarta RB. Strategic Pharma Marketing. India: A.H. Wheeler Publishing Co Ltd; 1996. ISBN-10: 8185814996, ISBN-13: 9788185814995
3. Vidyasagar G. Pharmaceutical Industrial Management. India: Pharma book syndicate; 2005. ISBN-10: 8188449121, ISBN-13: 978-8188449125
4. Jain NK. Pharmaceutical product development. India: CBS Publishers & Distributors; 2007. ISBN-10: 8123913214, ISBN-13: 978-8123913216
5. Subbarao C. Pharmaceutal Marketing in India – Concepts and Strategy Cases. Hyderabad: Pharma Book Syndicate; 2007. ISBN 10: 8188449253 ISBN 13: 9788188449255
6. Khanna OP. Industrial engineering and management. New Delhi: Dhanpat Rai Publishing Company; 2010. ISBN-10: 818992835X, ISBN-13: 9788189928353.

Program	B. Pharm
Year /Semester	Fourth year / 2nd semester
Name of the course	Hospital and Clinical Pharmacy
Course Code	16BPH803
Credits	2
Hours /week	2 hours (Lectures)
Pre / co-requisite/s	Nil

Course Description: The hospital and clinical pharmacy course is designed to impart basic knowledge and skills of various aspects of hospital and clinical pharmacy. The topics of hospital pharmacy discusses about the organization of hospital and hospital pharmacy, role of hospital pharmacist, roles and responsibilities of various hospital committees, drug procurement inventory management further emphasize on central sterile pharmaceutical preparations. The topics under clinical pharmacy outlines the various functions of clinical pharmacist, application of biochemical tests in diagnosis of the disease. The information regarding Pharmacovigilance helps the learner to acquire knowledge about assessing, reporting and managing adverse drug reactions. The course also helps the learner to recognize the importance of developing professional communication skills.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO 1: Define the professional practice like drug distribution and management skills in hospital pharmacy and clinical pharmacy in association with respect to various committees of the hospitals.

CO 2: Assess the drug therapy of patient through drug therapy chart review; recognize and manage drug related problems effectively.

CO 3: Equip unbiased drug and poison information.

CO 4: Interpret the laboratory investigations of specific diseased states.

Theory Course: Contents

Unit	Topics
I (2 weeks)	Organization of Hospital and Hospital Pharmacy: •Classification of hospitals along with Medical, Nursing, Pharmacy staff and non medical staff. •Definition of hospital pharmacy, its organization, structure, staff, layout, responsibilities and functions, policy and planning, finance, infrastructure and work load. •The role of hospital pharmacy department in relation with other hospital departments and staff.

II (2 weeks)	Constitution, roles, responsibilities, merits and demerits of Hospital committee's: •Pharmacy and Therapeutics committee (PTC) •Drugs Committee •Infection control Committee •Institutional Review committee(IRC)/ Institutional Review Board(IRB)/Institutional Ethical committee(IEC)
III (2 weeks)	Hospital Pharmacy Services: •Drug Distribution -Ward stock, Floor stock, Unit dose, Individual patient, Outpatient and Ambulatory care. -Distribution of Narcotics and controlled substances •Drug Procurement and Ware housing •Inventory Control– Definition, Methods (EOQ, Buffer stock, Lead time, ABC, VED etc.,) •Hospital formulary and Communication Newsletters.
IV (2 weeks)	Central Sterile Pharmaceutical preparations and supply: •Sterile formulation : Large and small volume parentrals •Unit dose preparations, including semisolid and powder preparations •Central sterile supply services.
V (2 weeks)	Introduction of Clinical Pharmacy: •Functions and responsibilities of clinical pharmacist •Drug therapy chart review- Pharmacist Analysis (SOAP, FARM) •Ward round participation •Drug and Poison information •Patient counseling •Rational drug use and Essential drug concept
VI (2 weeks)	Clinical evaluation of diseases: •Biochemical tests as a diagnosing tool in diseases like renal failure, hepatic failure, cardiac complications, endocrine disorders, pulmonary diseases, infectious diseases, fluid dysbalance and hematological conditions.
VII (2 weeks)	Pharmacovigilance: •Aim, scope and definition of Pharmacovigilance •Adverse drug reactions classification, mechanism, predisposing factors, causality assessment. •Reporting, evaluation, preventing and management of adverse drug reactions •Role of pharmacist in Pharmacovigilance
VIII (2 weeks)	Pharmacist Communications: •Continuous Medical Education (CME), Continuous Nursing Education (CNE), Continuous Pharmacy Education (CPE) •Principles and elements involved in communication •Barriers involved in communication •Listening skills, questioning skills, problem solving skills •Social awareness programs like AIDS awareness programs, Smoking Cessation, Alcohol Cessation, family planning etc., Revision

Assessment methods and weightage

Assessment type	Assessment tool	Distribution
Continuous Assessment	Class test	10%
	Assignments	5 %
	Mid-semester Examination	15%
End Assessment	End theory examination	70 %
	TOTAL	**100%**

Note: Class tests to be conducted at 4th and 14th Week; Mid-semester to be conducted after 8th week

Learning Resources/Recommended Texts/Reference books/web resources

1. William E Hassan. Hospital Pharmacy – 5th ed. Phialdelphia: Lea and Febiger.
2. Merchant and Qadry's: Dr. J.S.Qadry. A textbook of Hospital Pharmacy 10th ed. B.S.Shah Prakashan.
3. David H Lawson, R Michael E. Richards. Clinical Pharmacy and Hospital Drug Management – 1982. Champan and Hall.
4. Dr. H.P.Tipnis, Dr. Amrita Bajaj. Clinical Pharmacy – 1st ed. Career Publications.
5. Dr. G. Parthasarathi, Karin Nyfort-Hansen, Milap C Nahata. A textbook of Clinical Pharmacy Practice- essential concepts and skills – 2nd ed. University Press.
6. S. J. Carter. Cooper and Gunn's. Dispensing for Pharmaceutical students – 12th ed. CBS Publishers and Distributors.
7. Mary Lee. Basic skills in interpreting laboratory data – 5th ed. American Society of Health System Pharmacist®.
8. Susan Foran. Australian drug information - Procedure manual – 1996. Society of Hospital Pharmacists of Australia.

Program	B. Pharm
Year /Semester	Fourth year / 2nd semester
Name of the course	Chemistry of Natural Drugs
Course Code	16BPH804
Credits	3
Hours /week	3 hours (lectures)
Pre / co-requisite/s	Pharmacognosy I, Pharmacognosy II and Medicinal Chemistry

Course Description: The chemistry of natural drugs course is aimed to present information and knowledge on phytochemical aspects of natural compounds like alkaloids, terpenoids, steroids and vitamins. The course emphasizes on the phytochemical nature of the natural compounds like their chemistry, properties, structural elucidations and their SAR. The course also focuses on the phytopharmacological nature of the steroids.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO 1: Record phytochemical aspects of natural compounds like alkaloids, terpenoids, steroids and vitamins

CO2: List the phytochemical nature of the natural compounds like their chemistry, properties, structural elucidations and their SAR.

CO 3: Recall the phytopharmacological nature of the steroids.

Theory Course: Contents

Unit	Topics
I (2 weeks)	General structural elucidation of natural products General extraction procedure for various phytoconstituents, techniques in identification for alkaloids, glycosides, steroids, terpenes, flavonoids, phenols, lignans, resins, carbohydrate and proteins. Chemical methods for determination of active hydrogen, methoxy, hydroxyl, N-methyl and degradation (Hoffmann, Edmann etc). Techniques for the determination of ring size. Structural elucidation of Ephedrine, Atropine, Morphine and Papavarine.
II (2 weeks)	Alkaloids Definition of alkaloids, pseudoalkaloids and protoalkaloids. General methods of extraction, isolation, Properties and tests for alkaloids. Opium alkaloids: Structural features of Morphine molecule – Peripheral groups. Modification of structure and effect on analgesic activity – SAR of morphine and morphine-like analgesics. Narcotic antagonists: Nalorphine, Levallorphan. Anti-tussive agents: Noscapine, Dextromethorphan. Smooth muscle relaxants: Papaverine and related compounds like ethaverine, Dioxyline. Structures and uses of these compounds.
III (2 weeks)	Tropane alkaloids: Structures of Atropine/hyoscyamine, Hyoscine, Hydrolytic products of these Tropine and Scopine. Relationship between tropine & pseudotropine. Biological

	actions and uses of tropane alkaloids. Homatropine. Rauwolfia alkaloids: Structures and uses of Reserpine, Rescinnamine, Deserpidine, ajmaline, syrosingapine. Hydrolysis of reserpine and rescinnamine. Mechanism of action of reserpine. Ergot alkaloids: Classification, structures, hydrolytic products, pharmacological actions, therapeutic uses and toxicity. Synthetic derivatives: Methyl ergonovine (Methyl ergometrine), LSD, Ethysergide
IV (2 weeks)	Terpenes & Terpenoids: Introduction to Volatile oils, terpene vs terpenoids, Classification, isoprene, special isoprene and gem- dialkyl rules. Sources and structures (Including isomerism), general extraction procedure and Pharmaceutical uses for Citral, citral-a (Geranial), citral-b (Neral). Alpha-terpeniol, Carvone, Chemical transformation and interconversion of citral to citronellal, citronellol, geraniol, nerol, geranic acid, p-cymene, alfa-terpeneol and ionones. Conversion and interconversion of camphor into camphoric acid, camphoronic acids, p-cymene, Borneol, isoborneol. Menthol, Menthone, 1, 8- Cineole, Camphor.
V (2 weeks)	Steroids: Introduction, nomenculature and classification of steroids. Stereochemistry of Cholesterol. Structure and uses of Bile acids, steroidal hormones. Different Sources of steroidal drugs like diosgenin, cholesterol, stigmasterol and ergosterol. Synthesis of progesterone and testosterone.
VI (2 weeks)	Synthetic oestrogens like diethyl stilbosterol, hexosterol, 17-alpha ethinyl oestradiol, Interconversions of Estrone, Estriol, Estradiol. Chemistry of keto and non keto adreno corticoids. A note on anabolic steroids (Structures and uses).
VII (2 weeks)	Cardiac Glycosides: Structures of cardiac glycosides from Digitalis, Strophanthus, Squill and Bufa. Enzymatic and acid hydrolytic reactions of the glycosides. Mechanism of action, SAR, therapeutic uses and toxicity.
VIII (2 weeks)	Vitamins: Classification, structure and related function in enzyme and physiological activity. Chemistry of thiamine, riboflavin, Niacin, Pyridoxine, Vitamin A, D, E, K. Structural elucidation of Riboflavin, Vitamin D. Conversions of vitamins

Assessment methods and weightage:

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Class test	10%
	Assignments	5 %
	Mid-semester Examination	15%
End Assessment	End theory examination	70 %
	TOTAL	**100%**

Note: Class tests to be conducted at 4th and 14th Week; Mid-semester to be conducted after 8th week

Learning Resources/Recommended Texts/Reference books/web resources

1. Harborn JB. Phytochemical methods. 3rd ed. Spinger; Delhi; 1998.
2. Finar IL. Organic Chemistry. 6th ed. Addison Wesley Longman Private limited; Delhi; 2001.
3. Agarwal OP. Chemistry of organic natural products. 31st ed. Krishna Prakashan India limited; Meerut; 2005.
4. Robert Thornton Morrison, Robert Neilson Boyd. Organic chemistry. 7th ed. Dorling Kindersly India private limited; Delhi; 2009.

5. Donald j Abraham. Burger's Medicinal chemistry and drug discovery. 6th ed; Volume I; Wiley Interscience; Delhi; 2007.
6. Mann FG, Saunders BC. Practical organic chemistry. 4th ed. India Binding house; noida; 2007.

Program	B. Pharmacy
Year /Semester	Fourth year / 2nd semester
Name of the course	Novel Drug Delivery Systems Practical
Course Code	16BPH805
Credits	2
Hours /week	4 hours (Practical)
Pre / co-requisite/s	Nil

Course Description: Course is designed to provide students with the knowledge of formulating various novel drug delivery systems using different polymers and their evaluations. This course also emphasizes the comparative study of various marketed and prepared formulations. To provide skills in operation of various instruments like tablet compression machine, disintegration, dissolution, etc.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO 1: Practice the formulation of various dosage forms.
CO 2: Analyze dosage forms by using different instruments like dissolution, disintegration apparatus.
CO 3: Compare drug release profiles of marketed and prepared formulations..

Practical Course : Contents

Week	Topics
1	Formualtion of Matrix Tablets
2	Evaluation of Matrix Tablets
3	Formualtion of Film Coated Tablets.
4	Evaluation of Film Coated Tablets.
5	Formualtion of Enteric Coated Tablets.
6	Evaluation of Enteric Coated Tablets.
7	Formulation of Transdermal Drug Delivery Systems
8	Evaluation of Transdermal Drug Delivery Systems
9	Formulation of Mucoadhesive Delivery Systems
10	Evaluation of Mucoadhesive Delivery Systems
11	Evaluation of Market Sustained Release Formualtions.
12	Preparation and evaluation of microspheres.
13	Floating drug delivery system.(Demo)

14	Advances in novel drug delivery.(Seminar/ Assignment/group discussion)
15	Revision
16	Revision

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Participation	5 %
	Lab work (day to day)	10 %
	Mid-semester Examination	15%
End Assessment	End Practical examination	70 %
	TOTAL	**100%**

Mid-semester to be conducted after 8th week

Learning Resources/Recommended Texts/Reference books/web resources

1. Jain NK. Controlled and Novel Drug Delivery, 1st ed. New Delhi: CBS Publishers; 2012.
2. Lachman, Liberman's. Theory and Practice of Industrial Pharmacy, 4th ed. New Delhi: CBS Publishers; 2015.
3. Yie W. Chien. Novel Drug Delivery Systems, 2nd ed. New York: Informa Health Care; 2011.
4. Vyas S.P, Khar R.K. Targeted and Controlled Drug Delivery System, 1st ed. New Delhi: CBS Publishers; 2010.

Program	B. Pharm
Year /Semester	Fourth year / 2nd semester
Name of the course	Chemistry of Natural Drugs Practical
Course Code	16BPH806
Credits	2
Hours /week	4 hours (Practical)
Pre / co-requisite/s	NIL

Course Description: The chemistry of natural drugs laboratory course is aimed to train the students on evaluation of various alkaloid containing drugs by commonly used alkaloid reagents. This course also deals with extraction and thin layer chromatographic evaluation of herbal drugs. This course also provides the laboratory skills on identification of the phytochemical nature of the crude drugs.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO 1: Demonstrate the skills on evaluation of various alkaloid containing drugs by commonly used alkaloid reagents

CO2: Illustrate skill on extraction and thin layer chromatographic evaluation of herbal drugs.

CO 3: Identify the phytochemical nature of the crude drugs.

Practical Course: Contents

Week	Topics
1.	Introduction to laboratory and experiments
2.	Preparation of different alkaloidal reagents, like Dragendroff, Mayer, Wagner's, Hager's etc and testing of some alkaloids and plant extracts using these reagents. Identification of alkaloids by specific colour tests.
3.	Tests for steroids, steroidal glycosides, cardiac glycosides.
4.	Test for flavonoids and their glycosides.
5.	Tests for anthraquinones, saponin glycosides.
6.	TLC of strychnine in extract of Nux vomica.
7.	TLC of Menthol in mentha oil.
8.	TLC of Digoxin in extract of digitalis.
9.	TLC of quercetin in plant extracts.
10.	Extraction and isolation of caffeine from tea leaves.

11.	Extraction and isolation of piperine from black pepper.
12.	Extraction of nicotine from tobacco.
13.	Extraction of Atropine from Datura.
14.	Estimation of phenolic content in plant extract (Demonstration only)
15.	**Revision**

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Participation	5 %
	Lab work (day to day)	10 %
	Mid-semester Examination	15%
End Assessment	End Practical examination	70 %
	TOTAL	**100%**

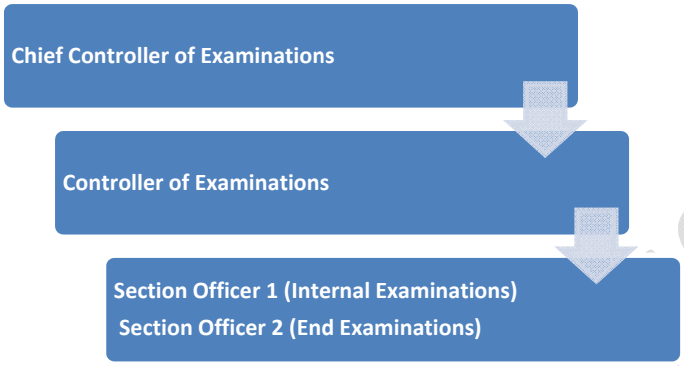
Mid-semester to be conducted after 8th week

Learning Resources/Recommended Texts/Reference books/web resources

1. Kokate CK, Gokhale SB. Practical Pharmacognosy. 5th ed. Nirali Prakashan: Delhi; 2003.
2. Khandelwal KR, Vrunda Sethi. Practical Pharmacognosy. 25th ed. Nirali Prakashan: Delhi; 2015.
3. Iyangar MA. Study of crude drugs. 12th ed. Manipal Press Limited: Manipal; 2004.
4. Indian Pharmacopoeia, 2014.
5. Herbal Pharmacopoeia, Indian Drugs Manufacturers Association, India.
6. Harborne JB. Phytochemical methods. 3rd ed. Rajkamal electronic press: Delhi; 2005.
7. Pulok K Mukharjee. Quality control of herbal drugs. 1st ed. Business Horizons pharmaceutical publishers; 1999.

7. Examination Cell – Structure, Rules and regulations

a) Organization structure



b) Infra-structure / Security / confidential zone

- Single entry with complete partitions for various sections of examinations Under CCTV survillence
- Single door entry & exit
- Confidential room attached to Controller of examinations
- Separate strong room for Used and Un-used examination material
- Evaluation Hall with toilet facility / water facility etc.
- Repo-graphic area
- Office section

c) Assurance of confidentiality

- Free entry is restricted in the premises.
- Question paper selection and Question paper moderation will be done just 30 minutes before the examination commencement. During moderation electronic gadgets including mobiles and internet facility will not be entertained during question paper moderation.
- Question paper setting from Outside the University with minimum PG or preferably Ph.D. having five years of teaching experience in relevant subject. The obtained sets of question paper will be under the custody of controller of examinations.
- Question paper moderation will be done if required after consultation with the Chief controller of examination & after receiving inputs from of HOD's of concerned departments in CE chamber.
- All the experts involed in the moderation will be asked to be present in the chamber till the examination commences.
- Question papers will be carried in sealed covers by CE and will be handed over to Invigilators ten minutes before commencement examination.

d) **Eligibility criteria for experts in examination and evaluation.**

NOTE:
*Double Evaluation for M.Pharm, if there is a discrepancy of 15 % deviation between two evaluations, there will be third evaluation.

Challenge valuation will be adapted for end examinations results of all programs as per awarding university.

End Examinations	B.Pharm	M.Pharm*	Pharm.D
Theory Paper Evaluator	M. Pharm with 3 Years of Experience	Ph.D with 2 years of Experience	M. Pharm with 3 Years of Experience / Pharm. D with two years of Experience
Q. Paper Setter	M. Pharm with 10 Year of Experience / Ph.D with 2 years	Ph.D with 5 years of Experience	M. Pharm with 10 Years of Experience / Pharm. D with three years of Experience / Ph.D with 2 years
Practical Examiner Internal	M. Pharm with 2 Years of Experience	M. Pharm with 5 Years of Experience	M. Pharm with 2 Years of Experience / Pharm. D with one year of Experience
Practical Examiner External	M. Pharm with 3 Years of Experience	Ph.D with 2 years of Experience	M. Pharm with 3 Years of Experience / Pharm. D with two years of Experience
Project Evaluators	Ph.D with 2 years of Experience	Ph.D with 5 years of Experience / equivalent with industrial experience	M. Pharm with 10 Years of Experience / Pharm. D with three years of Experience / Ph.D with 2 years

e) **Recommended assessment tools**

Note: Class tests to be conducted at 4th and 14th Week; Mid-semester to be conducted after 8th week

B.Pharm	M.Pharm	Pharm. D
Class tests	Class tests	Class tests
Assignment	Assignment	Assignment
Seminar	Seminar	Seminar
Mid - Examination	Mid – Examination	Mid - Examination
End Examinations	End Examinations	End Examinations
Comprehensive exam (Quiz)	Journal club Participation	Presentations
MOOCs	PBL Assignment	Clerkship
Research Project / VIVA	Research Project / VIVA	Research Project / Internship
Participation	Participation	Participation

1. Annexure-I: Class test rubrics / Question Paper model

Raghavendra Institute of Pharmaceutical Education and Research (Autonomous)
Awarding University: JNT University, Anantapur (JNTUA)

Cousre Name: Cousre Code:
Date of Examination: Total Marks: 20 M

Section-A

I. Multiple Choice Questions (MCQ's) 1× 10 = 10 M

Section-B

II. Answer any TWO out of THREE questions 2× 5 = 10 M

2. Annexure - II: Rubrics for Assignment Assessment

Assignment - Evaluation / Marking Schemes (10 Marks)

Parameter	Very good (2)	Good (1)	Satisfactory (0.5)	Not satisfactory (0)
Relevance of content to Topic (2)				
Reliable resources used (2)				
Presentation of content (2)				
Similarity Index (2)				
Total				
Total (8)				
Submission Date	Before Due date (2)		After due date (1)	

3. Annexure - III: Mid – Term examinations

a) Mid – Examination Rubrics (Theory)

Raghavendra Institute of Pharmaceutical Education and Research (Autonomous)
Awarding University: JNT University, Anantapur (JNTUA)

Course Name: Course Code:
Date of Examination: Total Marks: 30 M

Section-A

I. Short answer questions (All Compulsory) 2× 5 = 10 M

Section-B

II. Answer any TWO out of THREE questions 2× 10 = 20 M

b) Mid – Examination Rubrics (Practical)

Raghavendra Institute of Pharmaceutical Education and Research (Autonomous)
Awarding University: JNT University, Anantapur (JNTUA)

Practical question paper pattern

Course Name: *Course Code:*
Date of Examination: *Total Marks: 30 M*

I. Synopsis *5 M*
II. Experiment *15 M*
III. Viva voce and Record *10 M*

4. Annexure-IV:

a) End Examinations - Theory question paper rubrics

Raghavendra Institute of Pharmaceutical Education and Research(Autonomous)
Awarding University: JNT University, Anantapur (JNTUA)

Course Name: *Course Code:*
Date of Examination: *Total Marks: 70 M*

Section-A

I. Answer the following questions *8 × 2 = 16 M*

Section-B

II. Answer any SIX out of EIGHT questions *6 × 9 = 54 M*

b) End examinations - Practical question paper rubrics

Raghavendra Institute of Pharmaceutical Education and Research (Autonomous)
Awarding University: JNT University, Anantapur (JNTUA)

Practical question paper pattern

Subject Name: *Subject Code:*
Date of Examination: *Total Marks: 70 M*

I. Synopsis	*10 M*
II. Major Experiment	*25 M*
III. Minor Experiment	*20 M*
IV. Viva voce and Record	*15 M*

5. Annexure – V: Grading and ranking

- Semester Grade point Average (SGPA) and Cumulative Grade point average (CGPA) as per awarding university.
- Gold medal and ranking will be declared for those students who have passed all semesters in single attempt only.

6. Annexure VI: Malpractices / Punishments

- As per the regulations and guidelines of awarding university from time to time.