MOHAN BABU UNIVERSITY

Sree Sainath Nagar, Tirupati – 517 102

MBU
MOHAN BABU
UNIVERSITY
DREAM. BELIEVE. ACHIEVE

MB SCHOOL OF PHARMACEUTICAL SCIENCES

BACHELOR OF PHARMACY

MBU23 Academic Regulations and Curriculum

(Version 1.0)

(Applicable to B.Pharm Programs offered by MB School of Pharmaceutical Sciences in MBU from 2023-24 onwards)

Choice Based Credit System (CBCS)

MOHAN BABU UNIVERSITY

Vision

To be a globally respected institution with an innovative and entrepreneurial culture that offers transformative education to advance sustainability and societal good.

Mission

- Develop industry-focused professionals with a global perspective.
- Offer academic programs that provide transformative learning experience founded on the spirit of curiosity, innovation, and integrity.
- Create confluence of research, innovation, and ideation to bring aboutsustainable and socially relevant enterprises.
- Uphold high standards of professional ethics leading to harmonious relationship with environment and society.

MB SCHOOL OF PHARMACEUTICAL SCIENCES

Vision

To be a global leader in the field of Pharmaceutical Education and Health Care Management by providing Quality Education, Training, Research and Entrepreneurial Ecosystem.

Mission

- Developing competencies and skills to solve problems in the field of Pharmaceutical Sciences through contemporary Curriculum and congenial learning environment.
- Imbibing ethics and values in students for effective Pharmaceutical practice through curricular, co-curricular and extra-curricular activities.
- Encourage faculty and staff to excel in their respective fields and demonstrate the best of their abilities by way of continuing education, research and consultancy.

PROGRAM EDUCATIONAL OBJECTIVES

After completion of graduation, the graduates of B.Pharmacy will be able to

PEO1. Pursue higher education, learning and research in reputed institutions in the field of Pharmaceutical sciences

PEO2. Accomplished successful professional carrier in manufacturing analysis and marketing of pharmaceuticals

PEO3. Evolve as entrepreneurs by acquiring required skills to develop medicines in the emerging world of pharmaceutical industry

PEO4 Develop novel drug delivery systems using research and solving complex health related problems through lifelong learning and exhibit high ethical attitude in professional practise.

PROGRAM OUTCOMES

On successful completion of the Program, the graduates of B.PharmacyProgram will be able to:

PO1. **Pharmacy knowledge**- possess knowledge and comprehensive of the core & basic knowledge associated profession including pharmaceutical sciences, manufacturing practices & Administrative pharmacy.

PO2. **Analyse** health problems, interpret data and arrive at meaningful conclusions involving scientific inferences

PO3. Design drugs and drug delivery systems to meet desired needs considering **public health and safety,** and the cultural, societal, and environmental considerations.

PO4. Understand and **solve complex problems** in pharmacy by conducting experimental investigations

PO5. Apply appropriate **methods and techniques** and understand utilization of resources appropriately to complex activities in pharmacy.

PO6. Understand the effect of pharmaceutical solutions on legal, cultural, social and public health and safety aspects

PO7. **Develop** sustainable solutions and understand their effect on society and environment

PO8. **Apply ethical** principles & pharmaceutical **regulatory standards** to pharmacy practice professional responsibilities

PO9. Work as an individual and as a member of a team, to plan and to integrate knowledge of various disciplines in pharmacy and to **lead teams in multidisciplinary settings**

PO10. Make effective **oral presentations and communicate** technical ideas to a broad audience using written and oral means

PO11. **Lead and manage** multidisciplinary teams by applying principles of pharmaceutical science and management principles

PO12. **Adopt** to the changes and advancements in technology and engage in independent and **lifelong learning**

PROGRAM SPECIFIC OUTCOMES

On successful completion of the Program, the graduates of B.Pharmacy program will be able to:

PSO1. Apply appropriate tools and techniques for design and development of Pharmaceutical Dosage forms and drug delivery systems.

PSO2. Apply suitable methods to understand the process and analyze the reactions, mechanisms, isolation, method development and validation of natural, semi-synthetic and synthetic drugs.

PSO3. Understand the pharmacological concepts of drugs and apply appropriate tools to evaluate the effect of drugs and their therapeutic outcomes.

PSO4 Create leaders in the pioneer of medicines.

1. Preamble

Modern era students would like to take decisions on their own and plan their future accordingly. Students would like to pursue education as per their pace. On other hand, employers expect multidisciplinary competency, leadership skills and computer literacy along with lifelong learning skills from the students. The conventional learning system has narrow scope with regard to flexibility in choosing courses of their choice to become a well-rounded personality. It is essential that the present education system should address this and provide wide opportunities for students to choose programs and courses of their interest in order to realize their full potential which in turn leads to the nation development. Further, natural resources are depleted globally at a faster rate. Hence, sustainable development has become the agenda for the complete world to preserve natural resources and environment for the sake of future generations. In addition, the world is embracing disruptive technologies to improve the quality of life. Also, students should be nurtured with skills on higher order cognitive capacities, research, innovation, incubation and entrepreneurship; life skills; social consciousness, inclusiveness, equality, culture, languages, literature, ethics and values; basic arts, crafts, humanities, games, sports and fitness.

In this context, Mohan Babu University has taken initiative and brought out Academic Regulations addressing Choice Based Credit System, sustainable development, disruptive technologies, rapid change in knowledge landscape, change in employment landscape, change in global ecosystem and other areas of national and international importance to change country's educational landscape and in turn country's landscape.

MBU23 Academic Regulations embrace Choice Based Credit System, multidisciplinary approach, project based learning, enhanced practical component, etc.

2. Scope

The rules and regulations stated herein shall be called "MBU23 Academic Regulations" in its complete form. MBU23 academic regulations as given in this document are applicable to students admitted in B.Pharm Programs offered under MBU from the academic year 2023-24 onwards. All academic programs under MBU23 shall be decided by the Academic council. MBU23 is applicable for both existing as well as new programs offered by the MBU, until and unless it is explicitly stated.

3. Regulations for UG Programs offered under MBU

These regulations shall be called "The Revised Regulations for the B.Pharm Degree Program (CBCS) of the Pharmacy Council of India, New Delhi". They shall come into effect in the academic year 2023-24. The regulations framed are subject to modifications from time to time by the Pharmacy Council of India. Mohan Babu University (MBU) has adopted the Pharmacy Council of India's Choice Based Credit System (CBCS) regulation and is now being implemented from 2023–24 onwards.

4. Choice Based Credit System (CBCS)

As per the philosophy of Credit Based Semester System, certain quantum of academic work viz. theory classes, tutorial hours, practical classes, etc. are measured in terms of credits. On satisfactory completion of the courses, a candidate earns credits. The amount of credit associated with a course is dependent upon the number of hours of instruction per week in that course. Similarly, the credit associated with any of the other academic, co/extra-curricular activities is dependent upon the quantum of work expected to be put in by the student for each of these activities per week/per activity.

5. Definitions and Nomenclature

'**Degree**' means the academic award conferred upon a student on successful completion of any program of study designed to achieve the defined attributes.

'**Program**' means cohesive arrangement of courses, co-curricular and extracurricular activities to accomplish predetermined objectives leading to the awarding of a degree in a branch or discipline. Some Degree programs also provide options to specialize in a specific domain of interest in a branch or discipline.

'**Course**' means any combination of lecture, tutorial, practical and project based learning sessions of a subject studied in a semester, like Pharmaceutics, Pharmacology, Pharmaceutical Analysis and Chemistry etc.

6. Admission

6.1 Number of Seats:

The number of seats in B. Pharm program for which admission is to be made will be decided by the Board of Management, MBU with approval from Pharmacy Council of India.

6.2 Nationality and Age:

Resident Indian or Non-Resident Indian (NRI), holder of PIO or OCI card issued by Government of India is eligible to apply for the Selection Process.

Note: NRIs, holders of PIO or OCI card issued by Government of India must apply under international student category only.

A student should have attained the age of 17+ years on the 31st December of the year in which he/she is seeking admission.

6.3 Program Eligibility Criteria for B. Pharm Program

Candidate shall have passed 10+2 examination conducted by the respective state/central government authorities recognized as equivalent to 10+2 examination by the Association of Indian Universities (AIU) with English as one of the subjects and Physics, Chemistry, Mathematics (P.C.M) and or Biology (P.C.B / P.C.M.B.) as optional subjects individually. Any other qualification approved by the Pharmacy Council of India as equivalent to any of the above examinations.

6.4 Eligibility Criteria for B. Pharm lateral entry (to third semester)

Student shall have successfully completed D.Pharm. from an institution approved by the Pharmacy Council of India under section 12 of the Pharmacy Act.

6.5 Authority for Admission: Any matter related to admission to any program, the decision of the Admission Committee is final.

If, at any time after admission, it is found that a candidate has not fulfilled the requirements stipulated in the offer of admission, the concerned School Dean may revoke the admission of the candidate and report the matter to the Vice Chancellor.

In Addition to the above, admissions will be based on the rules and regulations of the UGC/Competent authorities in force at the time of admissions.

7. Program offered by MB School of Pharmaceutical Sciences

List of B. Pharm specializations offered by MBU

School	Programs
MB School of Pharmaceutical Sciences	B. Pharmacy
	B. Pharmacy (Lateral Entry)

8. Academic System

8.1 Semester

B. Pharm programs offered by MB School of Pharmaceutical Sciences shall follow the Semester system. There will be two semesters in an academic year.

8.2 Curriculum

The university Academic Regulations shall have 5-digit alpha-numeric representation that refers to University Name followed by last two digits of Calendar Year viz. MBU23 Regulations. Program Curriculum shall have the corresponding Academic Year representation. Students admitted into a program shall adopt a curriculum specified by the Academic Council for that academic year. Unless otherwise stated explicitly by the Academic Council, any curriculum changes will be applicable to the students admitted in the subsequent year and the existing batches continue to follow the curriculum prescribed at the time of their joining the program.

8.3 Course Classification

Courses may be classified as Theory, Practical, Practice school, Industrial Training and Project Work.

8.4 Course Credit Assignment

Credits shall be assigned to each Course with L: T: P: C (Lecture Hours: Tutorial Hours: Practical Hours: Credits) Structure, as defined below:

- ✓ Theory Course: One Lecture Hour (L) per week in a semester: 01 Credit
- ✓ Practical Course: One Practical Hour (P) Per week in a semester: 0.5 Credit
- ✓ Tutorial: One Tutorial Hour (T) Per week in a semester: 01 Credit

The contact periods are not specified for the courses like Practice school, Industrial training and Project work. However, credits assigned are based on the complexity of the work.

8.5 Syllabus

The syllabus of a course provides what the student will learn in the course of study. Each course syllabus document contains course code, course title, L T P C, course description, course outcomes, module-wise topics, duration to cover each module, text books, reference books, video lectures and web resources for additional learning.

8.6 Course Handout

A Course Handout consists of a detailed plan of lectures and its mode of delivery, List of Exercises/Experiential learning, Resources, Evaluation methods, Model Question paper and CO Attainment Targets.

9. Academic Calendar

The academic calendar includes the dates with regard to course registrations, spell of instructions, continuous internal assessment tests, semester-end theory examinations, practical examinations and semester holidays. The Registrar will communicate the Academic calendar to the Departments/ Schools, and the same will be available on the website. The dates and schedules in the academic calendar may change in specific programs due to regulatory and local requirements. In such cases, the concerned School Dean with prior authorization will communicate the changes to the students. The revised academic calendar will also made available on the website.

10. Course Registration

Immediately after joining the University, each student shall be assigned a Mentor by the Department/School concerned. The mentor shall discuss with the student their academic performance semester-wise, periodically, and guide the student on the nature and number of courses to be registered in the ensuing semester, within the framework of that program curriculum.

- Through the course registration process, every semester, it is mandatory for the students to register for the courses specified in the semester as and when notified, with the approval of the mentor.
- The students may be asked to undergo non-credited Bridge Courses for necessary fundamental disciplines as recommended by the program curriculum.
- Students shall not be permitted to register for the courses if the student has any outstanding dues to the University.
- For registering V Semester End Examinations, the student is eligible only if he/she successfully completed all courses till II-Semester as per their program course structure.

10.1 Arrear Examination:

- If a student fails a course, then the student is allowed to register for arrear examinations as and when notified.
- If a student has backlog courses after completion of the program of study, a provision is given to clear the courses by appearing any number of arrear examinations upon the notifications within the stipulated program duration as mentioned in section 19.

11. Attendance Requirements

- A student shall be eligible to appear for semester-end examinations if he acquires a minimum of 80% of attendance in aggregate of all the courses in a semester.
- Condonation of shortage of attendance in aggregate up to 10% (70% and above and below 80%) in each semester may be granted by the School Dean.
- Shortage of attendance below 70% in aggregate shall in no case be condoned.
- Students whose shortage of attendance is not condoned in any semester shall not be eligible to take their semester-end examination and their registration shall stand cancelled.
- Student shall not be promoted to the next semester unless he satisfies the attendance requirements of the semester, as applicable. The student may seek readmission for the semester when offered next. He will not be allowed to register for the courses of the semester while he is in detention.
- Stipulated fee shall be payable to the college towards condonation of shortage of attendance. In the remaining 20% of attendance, the student shall manage medical/personnel/ casual/official absence for organizing events/ seminars/ workshops/ technical/ cultural festivals/ competitions/ participation in co-curricular/ extra-curricular events/NCC/NSS activities or any other reason. However, attendance shall be given at actuals for participating in NCC/NSS activities at National level.

11.1 Academic requirements for promotion/completion of program of study:

- No student shall be permitted to write External Examination unless he/she fulfills the norms given in item No.:11 (Attendance Requirements).
- A student shall not be promoted from second year to third year of program of study if he not PASS all the courses/ subjects pertaining to first year program of study (includes Odd and even semester).
- A student shall not be promoted from Third to Fourth year of program of study if he not PASS all the courses/ subjects pertaining to second year program of study (includes Odd and even semester).
- Lateral entry student shall not be promoted from Third to Fourth year of program of study if he not PASS all the courses/ subjects pertaining to second year program of study.
- If a student detained in any of the semester due to shortage of attendance or not satisfying the academic requirements, then he is eligible for readmission into the same semester when offered next.

12. Evaluation Criteria

12.1 All components in any Program of Study shall be evaluated through Internal Evaluation and/or Semester End Evaluation.

<table>
<tr><th>Course Type</th><th>Marks</th><th colspan="2">Examination and Evaluation</th><th>Scheme of Examination</th></tr>
<tr><td rowspan="4">Theory
(100 Marks)</td><td rowspan="3">25</td><td>15</td><td>Mid Examination
(60 Minutes)</td><td>Two Mid Examinations each for 30 marks shall be conducted and each shall be scaled to 15 marks.
• The question paper for Mid-I & Mid-II shall be of three parts i.e., Part-A, Part-B, and Part-C.
• Part-A shall contain 5 Short answer questions. Each question carries 2 marks [Q. No. 1 (a) to (e)].
• Part-B shall contain Two descriptive questions [from Q. No. 2 to 3)] of which the student must answer one question and shall be evaluated for 10 marks.
• Part-C shall contain Three descriptive questions [from Q. No. 4 to 6)] of which the student must answer two questions and each shall be evaluated for 5 marks.</td></tr>
<tr><td>10</td><td>Continuous Assessment</td><td>The student shall be assessed based on the following parameters two times in a semester.
• Attendance – Max. 4 Marks
Percentage of Attendance – Marks
95 – 100 – 4
90 – 94 – 3
85 – 89 – 2
80 – 84 – 1
• Academic activities – Max. 3 Marks
(Average of any 3 activities Eg. Quiz, Assignment, Open Book Test, Fieldwork, Group Discussion and Seminar)
• Student-Teacher interaction – Max. 3 Marks</td></tr>
<tr><td colspan="3">For a total of 25 Marks, the average of sum of Mid-I & First Continuous Assessment marks and sum of Mid-II & Second Continuous Assessment marks shall be considered.</td></tr>
<tr><td>75</td><td colspan="2">Semester End Examination
(180 Minutes)</td><td>The examination shall be conducted for 75 marks
The question paper shall be of three parts i.e., Part-A, Part-B, and Part-C.
Part-A shall contain ten short-answer questions and each shall be evaluated for 2 marks [Q. No. 1 (a) to (j)].
Part-B shall contain three descriptive questions [from Q. No. 2 to 4)] of which the student must answer two questions and each shall be evaluated for 10 marks.
Part-C shall contain nine descriptive questions [from Q. No. 5 to 13)] of which the student must answer seven questions and each shall be evaluated for 5 marks.</td></tr>
</table>

Course Type	Marks	Examination and Evaluation	Scheme of Examination
Theory (75 Marks)	25	Mid Examination (60 Minutes)	Shall be followed the same mentioned above against Mi Examination and Continuous Assessment.
	50	Semester End Examination (120 Minutes)	The examination shall be conducted for 50 marks The question paper shall be of two parts i.e., Part-A, an Part-B. Part-A shall contain three descriptive questions [from Q. No. 1 to 3)] of which the student must answer two questions and each shall be evaluated for 10 marks. Part-B shall contain eight descriptive questions [from Q. No 4 to 11)] of which the student must answer six question and each shall be evaluated for 5 marks.
Theory (50 Marks)	15	Mid Examination (60 Minutes)	Two Mid Examinations each for 30 marks shall be conducted and each shall be scaled to 15 marks. • The question paper for Mid-I & Mid-II shall be of three parts i.e., Part-A, Part-B, and Part-C. • Part-A shall contain 5 Short answer questions. Each question carries 2 marks [Q. No. 1 (a) to (e)]. • Part-B shall contain Two descriptive questions [from Q No. 2 to 3)] of which the student must answer one question and shall be evaluated for 10 marks. • Part-C shall contain Three descriptive questions [from Q No. 4 to 6)] of which the student must answer two questions and each shall be evaluated for 5 marks.
	35	Semester End Examination (120 Minutes)	The examination shall be conducted for 35 marks The question paper shall be of two parts i.e., Part-A an Part-B. Part-A shall contain two descriptive questions [from Q. No. 1 to 2)] of which the student must answer one question which shall be evaluated for 10 marks. Part-B shall contain seven descriptive questions [from Q. No 3 to 9)] of which the student must answer five question and each shall be evaluated for 5 marks.

12.2

<table>
<tr><th>Course Type</th><th>Marks</th><th colspan="2">Examination and Evaluation</th><th>Scheme of Examination</th></tr>
<tr><td rowspan="3">Practical
(50 Marks)</td><td rowspan="2">15</td><td>5</td><td>Continuous Assessment</td><td>The evaluation shall be on the following parameters.
➢ Attendance – 2 marks
<table><tr><th>Percentage of Attendance</th><th>Marks</th></tr><tr><td>95 – 100</td><td>2</td></tr><tr><td>90 – 94</td><td>1.5</td></tr><tr><td>85 – 89</td><td>1</td></tr><tr><td>80 – 84</td><td>0.5</td></tr><tr><td>Less than 80</td><td>0</td></tr></table>➢ Practical records, regular viva-voce, etc. – 3 marks</td></tr>
<tr><td>10</td><td>Internal Examination
(240 Minutes)</td><td>Two Internal Examinations shall be conducted. Each examination shall be conducted for 40 marks and scaled to 10 marks. The average shall be finalized for a maximum of 10 marks.
• Evaluation shall be on the following parameters.
➢ Synopsis for 10 marks
➢ Major Experiment for 15 marks
➢ Minor experiment for 10 marks
➢ Viva voce for 5 marks.
The distribution of marks may be altered as per the course requirement.</td></tr>
<tr><td>35</td><td colspan="2">Semester End Examination
(240 Minutes)</td><td>• Evaluation shall be on following parameters.
➢ Synopsis for 5 marks
➢ Major Experiment for 15 marks,
➢ Minor experiment for 10 marks
➢ Viva voce for 5 marks.
The distribution of marks may be altered as per the course requirement.</td></tr>
<tr><td colspan="5"></td></tr>
<tr><td rowspan="3">Practical
(25 Marks)</td><td rowspan="2">10</td><td>5</td><td>Continuous Assessment</td><td>The evaluation shall be on the following parameters.
➢ Attendance – 2 marks
<table><tr><th>Percentage of Attendance</th><th>Marks</th></tr><tr><td>95 – 100</td><td>2</td></tr><tr><td>90 – 94</td><td>1.5</td></tr><tr><td>85 – 89</td><td>1</td></tr><tr><td>80 – 84</td><td>0.5</td></tr><tr><td>Less than 80</td><td>0</td></tr></table>Practical records, regular viva-voce, etc. – 3 marks</td></tr>
<tr><td>5</td><td>Internal Examination
(120 Minutes)</td><td>Two Internal Examinations shall be conducted. Each examination shall be conducted for 20 marks and scaled to 5 marks. The average shall be finalized for a maximum of 5 marks.
• Evaluation shall be on the following parameters.
➢ Synopsis for 5 marks
➢ Experiment for 10 marks
➢ Viva voce for 5 marks.
The distribution of marks may be altered as per the course requirement.</td></tr>
<tr><td>15</td><td colspan="2">Semester End Examination
(2 Hours)</td><td>• Evaluation shall be on following parameters.
➢ Synopsis for 3 marks
➢ Experiment for 10 marks,
➢ Viva voce for 2 marks.
The distribution of marks may be altered as per the course requirement.</td></tr>
</table>

<table>
<tr><th>Course Type</th><th>Marks</th><th colspan="2">Examination and Evaluation</th><th>Scheme of Examination</th></tr>
<tr><td rowspan="2">Practice School</td><td rowspan="2">25</td><td>15</td><td>Mid Examination (60 Minutes)</td><td>A student has to select the course module for practice school and shall pursue.

The student must present his understanding in the form of a presentation. The presentation shall be evaluated based on the following parameters
<table><tr><th>Criteria</th><th>Marks</th></tr><tr><td>Topic</td><td>5</td></tr><tr><td>Content</td><td>5</td></tr><tr><td>Presentation</td><td>5</td></tr></table></td></tr>
<tr><td>10</td><td>Continuous Assessment</td><td>The student shall be assessed based on the following parameters two times in a semester.

• Attendance – Max. 4 Marks
<table><tr><th>Percentage of Attendance</th><th>Marks</th></tr><tr><td>95 – 100</td><td>4</td></tr><tr><td>90 – 94</td><td>3</td></tr><tr><td>85 – 89</td><td>2</td></tr><tr><td>80 – 84</td><td>1</td></tr><tr><td>Less than 80</td><td>0</td></tr></table>• Weekly Report – Max. 3 Marks

Student-Teacher interaction – Max. 3 Marks</td></tr>
<tr><td></td><td>125</td><td colspan="2">Semester End Examination

(60 Minutes)</td><td>The complete study shall be presented along with report. The performance shall be evaluated for 125 marks based on the following parameters
<table><tr><th>Criteria</th><th>Marks</th></tr><tr><td>Relevance of Topic</td><td>10</td></tr><tr><td>Content</td><td>25</td></tr><tr><td>Scripting and editing</td><td>25</td></tr><tr><td>Presentation & Slides</td><td>50</td></tr><tr><td>Discussion and Viva</td><td>15</td></tr></table></td></tr>
<tr><td colspan="5"></td></tr>
<tr><td>Project work</td><td>150</td><td colspan="2">Semester End Examination</td><td>Detailed in Section 12.2</td></tr>
<tr><td colspan="5"></td></tr>
<tr><td>Industrial Training</td><td>-</td><td colspan="2">-</td><td>Detailed in Section 12.3</td></tr>
</table>

12.2 Project work

All the students shall undertake a project under the supervision of a teacher and submit a report. The area of the project shall be given any one of the elective subjects opted by the student in semester VIII. The project shall be carried out in group not exceeding 5 in number. The project report shall be submitted in triplicate (typed & bound copy).

The internal and external examiner appointed by the Dean of the school shall evaluate the project at the time of the Practical examinations of other semester(s). Students shall be evaluated in groups for four hours (i.e., about half an hour for a group of five students).

The projects shall be evaluated as per the criteria given below

Evaluation of Dissertation Book

S.No	Name of the heading	Max. marks
1	Objective of the work done	15 marks
2	Methodology adopted	20 marks
3	Results and discussions	20 marks
4	Conclusion and Outcomes	20 marks
	Total	**75 marks**

The 75 marks will be assigned to the dissertation book shall be the same for all the students in a group. However, the 75 marks assigned for the presentation shall be awarded based on the performance of individual students in the given criteria.

Evaluation of Presentation

S.No	Name of the heading	Max. marks
1	Presentation of work	25 marks
2	Communication skills	20 marks
3	Question and answer skills	30 marks
	Total	**75 marks**

12.3 Industrial training

- Students shall undergo Industrial training each with a minimum of 150 hours spread over 4 weeks in a Pharmaceutical Industry/Hospital. It includes the Production unit, Quality Control department, Quality Assurance department, Analytical laboratory, Chemical manufacturing unit, Pharmaceutical R&D, Hospital (Clinical Pharmacy), Clinical Research Organization, Community Pharmacy, etc.
- Students are required to undergo training after Semester – VI and before the commencement of Semester – VII. They should submit their training certificate duly signed by the authority of the training organization to the dean of the school. They will also need to give a presentation to the Institutional Evaluation Committee (IEC) constituted by the Dean.
- The IEC will evaluate the presentation and the training report, with a maximum score of 100 marks.

12.4. Recounting /Revaluation/Personal Verification/ Challenging Evaluation:

Students shall be permitted to apply for Recounting /Revaluation/Personal Verification/ Challenging Evaluation of the Semester End Examination answer scripts within a stipulated period after payment of the prescribed fee. After completion of the process of Recounting/ Revaluation/Personal Verification/ Challenging Evaluation, the records are updated with changes if any, and the student shall be issued a revised grade sheet. If there are no changes, the student shall be intimated the same through a notice.

12.5 Improvement of Internal Assessment

A student shall have the opportunity to improve his/ her performance only once in the mid exam component of internal assessment. The reconduct of mid exam shall be completed before the commencement of end examination of that semester.

13. Course Wise Grading of Students

Each student shall be awarded Letter Grades and Grade Points (GP) based on the aggregate of marks obtained through Internal Evaluation and Semester End Evaluation in a course.

13.1 *Absolute Grading*

Based on the performance, each student shall be awarded a final letter grade at the end of semester for each course. The letter grades and their corresponding grade points are given in table no 4.

Letter Grades and Corresponding Grade Points equivalent to percentage of marks

% of Marks obtained	Letter Grade	Performance	Grade Points (GP)
≥90	O	Outstanding	10
≥80 to <90	A	Excellent	9
≥70 to < 80	B	Good	8
≥ 60 to < 70	C	Fair	7
≥ 50 to < 60	D	Average	6
<50	F	Fail	0
Absent	Ab	Fail	0

A student is considered to have successfully completed a course and earned the credits if he / she secured a letter grade other than "F" or "Ab" in that course. A letter grade "F" or "Ab" in any course implies a failure in that course. The student should reappear for the said examination in the due course.

Pass Marks: In Absolute Grading, a student shall be declared as "PASS" in a course if he/she secures a minimum of 50% of the total marks obtained from Internal assessment and Semester End Evaluation. Otherwise, he/she shall be declared as "FAIL" in that course.

***13.2 Semester Grade Point Average (SGPA*)**: SGPA shall be calculated as given below on a "10 point scale" as an index of the student's performance:

$$SGPA = \frac{\sum(C\ X\ GP)}{\sum C}$$

Where "C" denotes the "credits" assigned to the courses undertaken in that semester and "GP" denotes the "grade points" earned by the student in the respective courses.

Note: SGPA is calculated only for the candidates who appeared in the semester-end regular examinations in a particular semester.

13.3 Cumulative Grade Point Average (CGPA):

The CGPA shall be calculated for a candidate who appeared in the Semester End Examination (including Regular & Arrear) till that semester. The CGPA shall be displayed in the Grade sheet of the Regular Semester-end examinations and also in the consolidated Grade Sheet issued at the end of the program. The CGPA is computed on a 10-point scale as given below:

$$CGPA = \frac{\sum(C\ X\ GP)}{\sum C}$$

Where, C denotes the credits assigned to courses undertaken up to the end of the Program and GP denotes the grade points earned by the student in the respective courses.

Both SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

13.4 Award of Class – The CGPA requirement for the award of class is as follow

CGPA requirement - Awarding of Class

CGPA Secured	Class Awarded
≥ 7.5	First Class with Distinction
≥6.0 and <7.49	First Class
≥5.0 and <5.99	Second Class

14. Grade Sheet

A grade sheet shall be issued to each student indicating the SGPA and CGPA, provided if he passed all the courses registered in the regular semester-end examinations.

15. Consolidated Grade Sheet

After successful completion of the entire Program of study, a Consolidated Grade Sheet indicating the performance in all academic years shall be issued as a final record. Duplicate Consolidated Grade Sheet shall also be issued, if required, after payment of the requisite fee.

16. Withholding of Results

Results may be withheld in a semester, if

- The student has any dues to the Department/ School/ University
- Action arising out of malpractice is pending
- Action arising out of indiscipline is pending

The student whose result was withheld shall not be allowed/promoted to the next higher semester.

17. Credit Transfer

- If a student discontinued in any of the semester and later, he/she wishes to continue in the same program, then he/she shall follow the latest regulations and curriculum that is being implemented during readmission into the same semester. However, the earned credits before discontinued shall be transferred to his credit account and he has to complete his degree within the stipulated program duration as mentioned in section 19.
- A similar procedure shall be adopted for the candidates who are seeking admission from other universities into various eligible programs of the University, subject to the condition that those Universities are recognized and approved for credit transfer by MBU.
- If the other Universities follow a different system, then the program School into which the student is seeking admission/ transfer shall work out on equivalence of credits that are to be transferred with valid supporting documentation.
- The number of credits thus transferred will be considered for the minimum credit requirements of the program, but not considered for the GPA/ CGPA calculations. The credits thus transferred will be indicated as total credits at the bottom of the Consolidated Grade Sheet as 'Total Credits Transferred from (Name of the Institute, place and Country)' and no breakup of courses will be listed.
- Award of degree classification is purely based on the GPA/CGPA calculations considering credits earned during the program of study with the MBU.

18. Program Duration

Minimum Duration: The minimum duration for B. Pharm Program is detailed below

A regular/ lateral entry student is said to be completed the program only if he/she earns required credits, as specified in their program curriculum. However, the degree shall be awarded only upon the completion of minimum duration of the program concerned.

Maximum Duration: if a regular/ lateral entry student has backlog courses even after the completion of the minimum duration limit, an additional grace period equivalent to double the period of minimum duration of the program of study shall be extended. Under no circumstances, the period of study shall be extended beyond the above limit and thereafter his/her studentship stands cancelled automatically. No separate intimation in this regard will be sent to the student.

19. Award of Degree

Eligibility: A student shall be eligible for the B. Pharm award. Degree if he fulfills all the following conditions:

- The minimum credit requirements for the award of a B. Pharm degree can be outlined as follows:

Student background/ optional subjects in 10+2	**No of credits are required for the award of a B. Pharm Degree**
M. Bi. P.C	**214**
Bi. P.C	**216** (he/she shall be offered 2 credits from Remedial mathematics (Theory))
M.P.C	**217** (he/she shall be offered 3 credits from Remedial Biology (Theory & Practical))
From Diploma in Pharmacy (lateral entry student)	**216** (**156 credits** from 3rd sem to 8th sem + transfer of **52 credits** from D. Pharm + **3 credits** by offering communication skills (Theory & Practical) + **4 credits** from Computer applications in Pharmacy (Theory & Practical) and **1 credit** Extracurricular/ Co-curricular activities)

- Successfully acquired the required credits as specified in the curriculum corresponding to the Program of study within the stipulated time.
- Has NO DUES to the University, Hostel, Library, etc., and any other amenities provided by the University.
- No disciplinary action is pending against him.

After successful completion of the program and minimum credit requirements as specified in the program curriculum, a Provisional Certificate will be issued to eligible students. The degree will be conferred on the student during the subsequent Convocation.

20. Amendments to Regulations

The Academic Council headed by the Vice-Chancellor of the University has the right to revise, amend, or change any component of regulations from time to time. In case of any dispute arising in interpreting the rules, the Academic Council's interpretation shall be the final decision.

21. General

The words such as "he", "him", "his" and "her" shall be understood to include all students irrespective of gender connotation.

Note: Failure to read and understand the regulations is not an excuse.

GUIDELINES FOR DISCIPLINARY ACTION FOR MALPRACTICES /

IMPROPER CONDUCT IN EXAMINATIONS

Rule No.	Nature of Malpractices/Improper conduct	Punishment
	If the candidate:	
1. (a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the course of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the course of the examination)	Expulsion from the examination hall and cancellation of the performance in that course only.
(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that course only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the course of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the courses of that Semester. The Hall Ticket of the candidate is to be cancelled.
3.	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred for four consecutive semesters from class work and all Semester-end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. The performance of the original candidate who has been impersonated, shall be cancelled in all the courses of the examination (including labs and project work) already appeared and shall not be allowed to appear for examinations of the remaining courses of that semester. The candidate is also debarred for four consecutive semesters from class work and all Semester-end examinations, if his involvement is established. Otherwise, The candidate is debarred for two consecutive semesters from class work and all Semester-end examinations. The continuation of the course by the candidate is

Rule No.	Nature of Malpractices/Improper conduct	Punishment
	If the candidate:	
		subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
4.	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that course and all the other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester. The candidate is also debarred for two consecutive semesters from class work and all Semester-end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that course only.
6.	Refuses to obey the orders of the Chief Controller of Examinations/Controller of Examinations/any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the Controller of Examinations or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the Controller of Examinations, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that course and all other courses the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the courses of that semester. If the candidate physically assaults the invigilator/Controller of the Examinations, then the candidate is also debarred and forfeits his/her seat. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7.	Leaves the exam hall taking away	Expulsion from the examination hall and cancellation

Rule No.	Nature of Malpractices/Improper conduct	Punishment
	If the candidate:	
	answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	of performance in that course and all the other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester. The candidate is also debarred for two consecutive semesters from class work and all Semester-end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester. The candidate is also debarred and forfeits the seat.

Note: Whenever the performance of a student is cancelled in any course(s) due to Malpractice, Then it shall be treated as failed in that course.

B. Pharmacy

Course Structure

I Semester

S. No.	Course Code	Course Title	Contact Periods per Week				Credits (c)	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total Marks
1.	23PC101001	Human Anatomy and Physiology-I	3	1	-	4	4	25	75	100
2.	23PA101001	Pharmaceutical Analysis	3	1	-	4	4	25	75	100
3.	23PH101001	Pharmaceutics	3	1	-	4	4	25	75	100
4.	23PA101002	Pharmaceutical Inorganic Chemistry	3	1	-	4	4	25	75	100
5.	23PY101001	Communication skills	2	-	-	2	2	15	35	50
6.	23PY101002	Remedial Biology*	2	-	-	2	2	15	35	50
7.	23PY101003	Remedial Mathematics*								
8.	23PC105001	Human Anatomy and Physiology-I Practical	-	-	4	4	2	15	35	50
9.	23PA105001	Pharmaceutical Analysis Practical	-	-	4	4	2	15	35	50
10.	23PH105001	Pharmaceutics Practical	-	-	4	4	2	15	35	50
11.	23PA105002	Pharmaceutical Inorganic Chemistry Practical	-	-	4	4	2	15	35	50
12.	23PY105001	Communication skills Practical	-	-	2	2	1	10	15	25
13.	23PY105002	Remedial Biology Practical*	-	-	2	2	1	10	15	25
		Total	**16**	**4**	**20**	**40**	**30**	**210**	**540**	**750**

* 1. Students who studied Higher Secondary (10+2) with Mathematics, Physics and Chemistry (M.P.C) then he/she mandatorily should study Remedial Biology (Theory) and Remedial Biology (Practical).

2. Students who studied Higher Secondary (10+2) with Biology, Physics and Chemistry (Bi. P.C) in Higher Secondary then he/she mandatorily should study Remedial Mathematics (Theory) only.

3. If a student has studied Mathematics and Biology (M. Bi. P. C) in Higher Secondary, they do not need to select any of the above combinations.

II Semester

S. No.	Course Code	Course Title	Contact Periods per Week				Credits (c)	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total Marks
1.	23PC101002	Human Anatomy and Physiology-II	3	1	-	4	4	25	75	100
2.	23PA101003	Pharmaceutical Organic Chemistry-I	3	1	-	4	4	25	75	100
3.	23PA101004	Biochemistry	3	1	-	4	4	25	75	100
4.	P23PC101003	Pathophysiology	3	1	-	4	4	25	75	100
5.	23PY101004	Computer Applications in Pharmacy*	3	-	-	3	3	25	50	75
6.	23PY101005	Environmental sciences*	3	-	-	3	3	25	50	75
7.	23PC105002	Human Anatomy and Physiology-II Practical	-	-	4	4	2	15	35	50
8.	23PA105003	Pharmaceutical Organic Chemistry-I Practical	-	-	4	4	2	15	35	50
9.	23PA105004	Biochemistry Practical	-	-	4	4	2	15	35	50
10.	23PY105003	Computer Applications in Pharmacy Practical*	-	-	2	2	1	10	15	25
		Total	**18**	**4**	**14**	**36**	**29**	**205**	**520**	**725**

III Semester

S. No.	Course Code	Course Title	Contact Periods per Week				Credits (c)	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total Marks
1.	23PA101005	Pharmaceutical Organic Chemistry-II	3	1	-	4	4	25	75	100
2.	23PH101002	Physical Pharmaceutics-I	3	1	-	4	4	25	75	100
3.	23PH101003	Pharmaceutical Microbiology	3	1	-	4	4	25	75	100
4.	23PH101004	Pharmaceutical Engineering	3	1	-	4	4	25	75	100
5.	23PA105005	Pharmaceutical Organic Chemistry-II Practical	-	-	4	4	2	15	35	50
6.	23PH105002	Physical Pharmaceutics-I Practical	-		4	4	2	15	35	50
7.	23PH105003	Pharmaceutical Microbiology Practical	-	-	4	4	2	15	35	50
8.	23PH105004	Pharmaceutical Engineering Practical	-	-	4	4	2	15	35	50
		Total	**12**	**4**	**16**	**32**	**24**	**160**	**440**	**600**
9.	23PY101001	Communication skills **	2	-	-	2	2	15	35	50
10.	23PY105001	Communication skills Practical **	-	-	2	2	1	10	15	25

** For Lateral Entry Students only.

IV Semester

S. No.	Course Code	Course Title	Contact Periods per Week				Credits (c)	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total Marks
1.	23PA101006	Pharmaceutical Organic Chemistry-III	3	1	-	4	4	25	75	100
2.	23PA101007	Medicinal Chemistry-I	3	1	-	4	4	25	75	100
3.	23PH101005	Physical Pharmaceutics-II	3	1	-	4	4	25	75	100
4.	23PC101004	Pharmacology-I	3	1	-	4	4	25	75	100
5.	23PY101006	Pharmacognosy and Phytochemistry-I	3	1	-	4	4	25	75	100
6.	23PA105006	Medicinal Chemistry-I Practical	-	-	4	4	2	15	35	50
7.	23PH105005	Physical Pharmaceutics-II Practical	-	-	4	4	2	15	35	50
8.	23PC105003	Pharmacology-I Practical	-	-	4	4	2	15	35	50
9.	23PY105004	Pharmacognosy and Phytochemistry-I Practical	-	-	4	4	2	15	35	50
		Total	**15**	**5**	**16**	**36**	**28**	**185**	**515**	**700**
10.	23PY101004	Computer Applications in Pharmacy**	3	-	-	3	3	25	50	75
11.	23PY105003	Computer Applications in Pharmacy Practical**	-	-	2	2	1	10	15	25

** For Lateral Entry Students only.

V Semester

S. No.	Course Code	Course Title	Contact Periods per Week				Credits (c)	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total Marks
1.	23PA101008	Medicinal Chemistry-II	3	1	-	4	4	25	75	100
2.	23PH101006	Industrial Pharmacy-I	3	1	-	4	4	25	75	100
3.	23PC101005	Pharmacology-II	3	1	-	4	4	25	75	100
4.	23PY101007	Pharmacognosy and Phytochemistry-II	3	1	-	4	4	25	75	100
5.	23PH101007	Pharmaceutical Jurisprudence	3	1	-	4	4	25	75	100
6.	23PH105006	Industrial Pharmacy-I Practical	-	-	4	4	2	15	35	50
7.	23PC105004	Pharmacology-II Practical	-	-	4	4	2	15	35	50
8.	23PY105005	Pharmacognosy and Phytochemistry-II Practical	-	-	4	4	2	15	35	50
		Total	**15**	**5**	**12**	**32**	**26**	**170**	**480**	**650**

VI Semester

S. No.	Course Code	Course Title	Contact Periods per Week				Credits (c)	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total Marks
1.	23PA101009	Medicinal Chemistry-III	3	1	-	4	4	25	75	100
2.	23PC101006	Pharmacology-III	3	1	-	4	4	25	75	100
3.	23PY101008	Herbal Drug Technology	3	1	-	4	4	25	75	100
4.	23PH101008	Biopharmaceutics and Pharmacokinetics	3	1	-	4	4	25	75	100
5.	23PH101009	Pharmaceutical Biotechnology	3	1	-	4	4	25	75	100
6.	23PA101010	Quality Assurance	3	1	-	4	4	25	75	100
7.	23PA105007	Medicinal chemistry-III Practical	-	-	4	4	2	15	35	50
8.	23PC105005	Pharmacology-III Practical	-	-	4	4	2	15	35	50
9.	23PY105006	Herbal Drug Technology Practical	-	-	4	4	2	15	35	50
		Total	**18**	**6**	**12**	**36**	**30**	**195**	**555**	**750**

VII Semester

S. No.	Course Code	Course Title	Contact Periods per Week				Credits (c)	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total Marks
1.	23PA101011	Instrumental Methods of Analysis	3	1	-	4	4	25	75	100
2.	23PH101010	Industrial Pharmacy-II	3	1	-	4	4	25	75	100
3.	23PP101001	Pharmacy Practice	3	1	-	4	4	25	75	100
4.	23PH101011	Novel Drug Delivery System	3	1	-	4	4	25	75	100
5.	23PA105008	Instrumental Methods of Analysis Practical	-	-	4	4	2	15	35	50
6.	23PY111001	Practice School	-	-	12	12	6	25	125	150
7.	23PY111002	Industrial Training	-	-	-	-	2	-	100	100
		Total	**12**	**4**	**16**	**32**	**26**	**140**	**560**	**700**

VIII Semester

S. No.	Course Code	Course Title	Contact Periods per Week				Credits (c)	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total Marks
1.	23PY101009	Biostatistics and Research Methodology	3	1	-	4	4	25	75	100
2.	23PC101007	Social and Preventive Pharmacy	3	1	-	4	4	25	75	100
	Elective (Any two courses)									
3.	23PH101012	Pharma Marketing Management	3+3	1+1	-	4 +4	4+4	25 + 25	75 + 75	100+100
4.	23PH101013	Pharmaceutical Regulatory Science								
5.	23PP101002	Pharmacovigilance								
6.	23PY101010	Quality Control and Standardization of Herbals								
7.	23PA101012	Computer Aided Drug Design								
8.	23PH101014	Cell and Molecular Biology								
9.	23PH101015	Cosmetic Science								
10.	23PC101008	Experimental Pharmacology								
11.	23PA101013	Advanced Instrumentation Techniques								
12.	23PH101016	Dietary Supplements and Nutraceuticals								
13.	23PY109001	Project Work			12	12	6		150	150
		Total	**12**	**4**	**12**	**28**	**22**	**100**	**450**	**550**

SEMESTER WISE CREDITS DISTRIBUTION

SEMESTER	CREDIT POINTS
I	**27/29$/30#**
II	**29**
III	**24**
IV	**28**
V	**26**
VI	**30**
VII	**26**
VIII	**22**
Extracurricular/ Co-curricular activities	**01***
Total credit points for the program	**214/216$/217#**

***** The credit points assigned for extracurricular and or co-curricular activities shall be given by the dean of the school. The criteria to acquire this credit point shall be defined by the dean of the school from time to time.

$ Applicable for Bi.P.C. students ONLY.

Applicable for M.P.C. students ONLY.

I SEMESTER

Course Code	Course Title	L	T	P	C
23PC101001	**HUMAN ANATOMY AND PHYSIOLOGY-I**	**3**	**1**	**-**	**4**

Pre-Requisite -
Anti-Requisite -
Co-Requisite -

COURSE DESCRIPTION: Upon completion of this course the student should be able to Understand the gross morphology, structure and functions of various organs of the human body, homeostatic mechanisms and their imbalances. Analyze the various tissues and organs of different systems and special senses of human body.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Comprehend the scope, morphology of cells and tissues. Homeostasis mechanisms of human body.

CO2. Apply appropriate tools to illustrate the structural hierarchy of skin, skeletal muscle and skeletons with functional physiology.

CO3. Understand various components of blood and lymph, homeostatic mechanisms and its disorders.

CO4. Comprehend the structure and functional hierarchy of autonomic nervous system and special senses organs and its disorders.

CO5. Understand the cardiac architecture and physiology; Blood pressure regulation and heart disorders.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	1	-	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	1	-	-	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	1	-	-	-	-	-	-	-	-	-	-	-	-	3	-
CO5	3	1	-	-	-	-	-	-	-	-	-	-	-	-	3	-
Course Correlation Mapping	**3**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**

Correlation Levels: ***3: High;*** ***2: Medium;*** ***1: Low***

COURSE CONTENT

Module 1: INTRODUCTION TO HUMAN BODY AND TISSUES ***(10 Periods)***

Introduction to human body

Definition and scope of anatomy and physiology, levels of structural organization and body systems, basic life processes, homeostasis, basic anatomical terminology.

Cellular level of organization

Structure and functions of cell, transport across cell membrane, cell division, cell junctions. General principles of cell communication, intracellular signaling pathway activation by extracellular signal molecule, Forms of intracellular signaling: a) Contact-dependent b) Paracrine c) Synaptic d) Endocrine

Tissue level of organization

Classification of tissues, structure, location and functions of epithelial, muscular and nervous and connective tissues.

Module 2: SKELETAL SYSTEM AND JOINTS ***(10 Periods)***

Integumentary system

Structure and functions of skin

Skeletal system

Divisions of skeletal system, types of bone, salient features and functions of bones of axial and appendicular skeletal system, Organization of skeletal muscle, physiology of muscle contraction, neuromuscular junction

Joints

Structural and functional classification, types of joints movements and its articulation

Module 3: LYMPHATIC SYSTEM ***(10 Periods)***

Body fluids and blood

Body fluids, composition and functions of blood, hemopoeisis, formation of hemoglobin, anemia, mechanisms of coagulation, blood grouping, Rh factors, transfusion, its significance and disorders of blood, Reticulo endothelial system.

Lymphatic system

Lymphatic organs and tissues, lymphatic vessels, lymph circulation and functions of lymphatic system.

Module 4: PERIPHERAL NERVOUS SYSTEM ***(08 Periods)***

Peripheral nervous system:

Classification of peripheral nervous system: Structure and functions of sympathetic and parasympathetic nervous system.

Origin and functions of spinal and cranial nerves.

Special senses

Structure and functions of eye, ear, nose and tongue and their disorders.

Module 5: CARDIOVASCULAR SYSTEM ***(07 Periods)***

Heart – anatomy of heart, blood circulation, blood vessels, structure and functions of artery, vein and capillaries, elements of conduction system of heart and heartbeat, its regulation by autonomic nervous system, cardiac output, cardiac cycle. Regulation of blood pressure, pulse, electrocardiogram and disorders of heart.

Total Periods: 45

RESOURCES

TEXT BOOKS:

1. Essentials of Medical Physiology by K. Sembulingam and P. Sembulingam. Jaypeebrothers medical publishers, New Delhi.
2. Text book of Medical Physiology- Arthur C, Guyton andJohn.E. Hall. Miamisburg, OH, U.S.A.
3. Principle of Anatomy and Physiology by Tortora Grabowski. Palmetto, GA, U.S.A.
4. Anatomy and Physiology in Health and Illness by Kathleen J.W. Wilson, Churchill, Livingstone, New York.

REFERENCES:

1. Text book of Medical Physiology- Arthur C, Guyton and John. E. Hall. Miamisburg, OH, U.S.A.
2. Human Physiology (vol 1 and 2) by Dr. C.C. Chatterrje, Academic Publishers Kolkata
3. Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co, Riverview, MI USA

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=q6fQf6VLDOY
2. https://www.youtube.com/watch?v=sRMAvOeOy8I
3. https://www.youtube.com/watch?v=q6fX7f3sLaU

WEB RESOURCES:

1. https://westerntc.libguides.com/anatomy/websites
2. https://libguides.wccnet.edu/oer-subjects/anatomy-physiology
3. https://openstax.org/details/books/anatomy-and-physiology

Course Code	Course Title	L	T	P	C
23PA101001	**PHARMACEUTICAL ANALYSIS**	**3**	**1**	**-**	**4**

Pre-Requisite -
Anti-Requisite -
Co-Requisite -

COURSE DESCRIPTION: Upon completion of this course the student should be able to understand the fundamentals of analytical chemistry and principles of electrochemical analysis of drugs.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Demonstrate the fundamentals of pharmaceutical analysis, Sources of impurities, errors and its minimization.

CO2. Demonstrate the theories of acids and bases, volumetric/titrimetric analysis of various pharmaceutical drugs.

CO3. Analyze various pharmaceuticals by applying appropriate electrochemical and gravimetric methods.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	-	2	1	-	-	-	-	-	-	-	-	3	-	-
CO2	3	3	-	-	2	-	-	-	-	-	-	-	-	3	-	-
CO3	3	3	-	-	2	-	-	-	-	-	-	-	-	3	-	-
Course Correlation Mapping	**3**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

Correlation Levels: ***3: High;*** ***2: Medium;*** ***1: Low***

COURSE CONTENT

Module 1: PHARMACEUTICAL ANALYSIS AND ERRORS ***(10 Periods)***

(a) Pharmaceutical analysis: Definition and scope

i) Different techniques of analysis

ii) Methods of expressing concentration

iii) Primary and secondary standards.

iv) Preparation and standardization of various molar and normal solutions- Oxalic acid, sodium hydroxide, hydrochloric acid, sodium thiosulphate, sulphuric acid, potassium permanganate and ceric ammonium sulphate.

(b) Errors: Sources of errors, types of errors, methods of minimizing errors, accuracy, precision and significant figures

(c) Pharmacopoeia, Sources of impurities in medicinal agents, limit tests.

Module 2: ACID BASE AND NON AQUEOUS TITRATIONS ***(10 Periods)***

Acid base titration: Theories of acid base indicators, classification of acid base titrations and theory involved in titrations of strong, weak, and very weak acids and bases, neutralization curves.

Non aqueous titration: Solvents, acidimetry and alkalimetry titration and estimation of Sodium benzoate and Ephedrine HCl.

Module 3: PRECIPITATION AND COMPLEXOMETRIC TITRATIONS ***(10 Periods)***

Precipitation titrations: Mohr's method, Volhard's, Modified Volhard's, Fajans method, estimation of sodium chloride.

Complexometric titration: Classification, metal ion indicators, masking and demasking reagents, estimation of Magnesium sulphate, and calcium gluconate. Basic Principles, methods, and application of diazotisation titration.

Module 4: REDOX TITRATIONS ***(07 Periods)***

Redox titrations

(a) Concepts of oxidation and reduction

(b) Types of redox titrations (Principles and applications)

Cerimetry, Iodimetry, Iodometry, Bromatometry, Dichrometry, Titration with potassium iodate.

Module 5: ELECTROCHEMICAL METHODS OF ANALYSIS ***(08 Periods)***

Electrochemical methods of analysis

Conductometry: Introduction, Conductivity cell, Conductometric titrations, applications.

Potentiometry: Electrochemical cell, construction and working of reference (Standard hydrogen, silver chloride electrode and calomel electrode) and indicator electrodes (metal electrodes and glass electrode), methods to determine end point of potentiometric titration and applications

Polarography: Principle, Ilkovic equation, construction and working of dropping mercury electrode and rotating platinum electrode, applications

Gravimetry: Principle and steps involved in gravimetric analysis. Purity of the precipitate: co-precipitation and post precipitation, Estimation of barium sulphate.

Basic Principles, methods and application of diazotization titration.

Total periods: 45

RESOURCES

TEXT BOOKS:

1. A.I.Vogel, Text Book of Quantitative Inorganic analysis
2. Bentley and Driver's Textbook of Pharmaceutical Chemistry
3. P.GunduRao, Inorganic Pharmaceutical Chemistry

REFERENCES:

1. P. Gundu Rao, Inorganic Pharmaceutical Chemistry
2. John H. Kennedy, Analytical chemistry principles

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=n-UUkKio6Jo
2. https://www.youtube.com/watch?v=zjeG3sa9Lzk
3. https://www.youtube.com/watch?v=uSWYV6x9Dd4

WEB RESOURCES:

1. https://usiu-ke.libguides.com/c.php?g=942908&p=6796727
2. https://www.excedr.com/blog/top-pharma-blogs-websites-for-biopharma/
3. https://www.scilife.io/blog/top-pharmaceutical-websites-blogs

Course Code	Course Title	L	T	P	C
23PH101001	**PHARMACEUTICS**	**3**	**1**	**-**	**4**

Pre-Requisite -
Anti-Requisite -
Co-Requisite -

COURSE DESCRIPTION: This course is designed to impart a fundamental knowledge on the preparatory pharmacy with arts and science of preparing the different conventional dosage forms. Upon completion of this course the student should be able to: Know the history of profession of pharmacy, Understand the basics of different dosage forms, pharmaceutical incompatibilities and pharmaceutical calculations, Understand the professional way of handling the prescription, Preparation of various conventional dosage forms.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Demonstrate the basics of pharmacy, dosage forms, prescription and posology.

CO2. Design and analyse the pharmaceutical dosage forms.

CO3. Design and analyse monophasic and Biphasic liquid dosage forms.

CO4. Design and analyse suppositories and its methods of preparation

CO5. Design of semisolid dosage forms and their evaluation

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	1	-	-	-	-	-	-	-	-	-	-	3	-	-	-
CO2	3	2	2	-	2	-	-	-	-	-	-	-	3	-	-	-
CO3	3	2	2	-	2	-	-	-	-	-	-	-	3	-	-	-
CO4	3	3	2	2	2	-	-	-	-	-	-	-	3	-	-	-
CO5	3	2	2	-	2	-	-	-	-	-	-	-	3	-	-	-
Course Correlation Mapping	3	2	2	2	2	-	-	-	-	-	-	-	3	-	-	-

Correlation Levels: ***3: High;*** ***2: Medium;*** ***1: Low***

COURSE CONTENT

Module 1: DOSAGE FORMS, PRESCRIPTION AND POSOLOGY ***(09 Periods)***

Historical background and development of profession of pharmacy: History of profession of Pharmacy in India in relation to pharmacy education, industry and organization, Pharmacy as a career, Pharmacopoeias: Introduction to IP, BP,USP and Extra Pharmacopoeia.

Dosage forms: Introduction to dosage forms, classification, and definitions

Prescription: Definition, Parts of prescription, handling of Prescription and Errors in prescription.

Posology: Definition, Factors affecting posology. Pediatric dose calculations based on age, body weight and body surface area.

Module 2: PHARMACEUTICAL CALCULATIONS ***(09 Periods)***

Pharmaceutical calculations: Weights and measures – Imperial & Metric system, Calculations involving percentage solutions, alligation, proof spirit and isotonic solutions based on freezing point and molecular weight.

Powders: Definition, classification, advantages and disadvantages, Simple & compound powders–official preparations, dusting powders, effervescent, efflorescent and hygroscopic powders, eutectic mixtures, Geometric dilutions.

Module 3: LIQUID DOSAGE FORMS ***(12 Periods)***

Liquid dosage forms: Advantages and disadvantages of liquid dosage forms. Excipients used in formulation of liquid dosage forms. Solubility enhancement techniques.

Monophasic liquids: Definitions and preparations of Gargles, Mouthwashes, Throat Paint, Eardrops, Nasal drops, Enemas, Syrups, Elixirs, Liniments and Lotions.

Biphasic liquids:

Suspensions: Definition, advantages and disadvantages, classifications, Preparation of suspensions; Flocculated and Deflocculated suspension & stability problems and methods to overcome.

Emulsions: Definition, classification, emulsifying agent, test for the identification of type of Emulsion, Methods of preparation & stability problems and methods to overcome.

Module 4: SUPPOSITORIES AND PHARMACEUTICAL INCOMPATIBILITIES ***(08 Periods)***

Suppositories: Definition, types, advantages and disadvantages, types of bases, methods of preparations. Displacement value & its calculations, evaluation of suppositories.

Pharmaceutical Incompatibilities: Definition, classification, physical, chemical and therapeutic incompatibilities with examples.

Module 5: SEMISOLID DOSAGE FORMS ***(07 Periods)***

Definitions, classification, mechanisms and factors influencing dermal penetration of drugs. Preparation of ointments, pastes, creams and gels. Excipients used in semi solid dosage forms. Evaluation of semi-solid dosages forms.

Total Periods: 45

RESOURCES

TEXTBOOKS:

1. H.C.Anseletal., Pharmaceutical Dosage Form and Drug Delivery System, Lippincott Williams and Walkins, NewDelhi.
2. Carter S.J., Cooper and Gunn's-Dispensing for Pharmaceutical Students, CBS publishers, NewDelhi.
3. M.E. Aulton, Pharmaceutics, The Science & Dosage Form Design, Churchill Livingstonee, Edinburgh.
4. Indian pharmacopoeia.
5. British pharmacopoeia.
6. Lachmann.Theory and Practice of Industrial Pharmacy, Lea & Febiger Publisher, The University of Michigan.
7. Alfonso R. Gennaro Remington. The Science and Practice of Pharmacy, Lippincott Williams, New Delhi.
8. Carter S.J., Cooper and Gunn's. Tutorial Pharmacy,CBS Publications, NewDelhi.
9. E.A.Rawlins,Bentley's TextBook of Pharmaceutics, English Language Book Society, Elsevier Health Sciences,USA.
10. Isaac Ghebre Sellassie: Pharmaceutical Pelletization Technology, MarcelDekker, INC, NewYork.
11. Dilip M.Parikh: Handbook of Pharmaceutical Granulation Technology, Marcel Dekker, INC,NewYork.
12. Francoise Nieloud and Gilberte Marti-Mestres: Pharmaceutical Emulsions and Suspensions, Marcel Dekker, INC,NewYork.

VIDEO LECTURES:

1. https://youtu.be/maIrUdbm3jw
2. https://youtu.be/3OuiWb7jDKI
3. https://youtu.be/O5GWBwowecI
4. https://youtu.be/-weNeW6JfsQ
5. https://youtu.be/js_VZ1pHmCE

WEB RESOURCES:

1. http://www.triphasepharmasolutions.com/Private/USP%201151%20PHARMACEUTICAL%20DOSAGE%20FORMS.pdf
2. http://gputtawar.edu.in/downloads/Monophasic%20Liquid%20Dosage%20Forms.pdf
3. https://uomustansiriyah.edu.iq/media/lectures/4/4_2018_05_19!04_12_49_PM.pdf

Course Code	Course Title	L	T	P	C
23PA101002	**PHARMACEUTICAL INORGANIC CHEMISTRY**	**3**	**1**	**-**	**4**

Pre-Requisite -
Anti-Requisite -
Co-Requisite -

COURSE DESCRIPTION: Upon completion of this course the student should be able to understand the monographs of inorganic drugs and pharmaceuticals.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Demonstrate the source & types of impurities, preparation and analyze limit tests for various ions & heavy metals.

CO2. Demonstrate and analyze the preparation & stability of acid, Bases & Buffers and major extra & Intracellular electrolytes used in replacement therapy.

CO3. Demonstrate the physico-chemical aspects of dental products, Gastro-intestinal agents, Haematinics and Antidotes.

CO4. Acquire Knowledge on radiopharmaceuticals, radioactivity measurements and pharmaceutical applications.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	-	1	-	-	-	-	-	-	-	-	-	3	-	-
CO2	3	3	-	1	-	-	-	-	-	-	-	-	-	3	-	-
CO3	3	3	-	1	-	-	-	-	-	-	-	-	-	3	-	-
CO4	3	3	-	1	-	-	-	1	-	-	-	-	-	1	-	-
Course Correlation Mapping	**3**	**3**	**-**	**1**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

Correlation Levels: ***3: High;*** ***2: Medium;*** ***1: Low***

COURSE CONTENT

Module 1: IMPURITIES IN PHARMACEUTICAL SUBSTANCES ***(10 Periods)***

Impurities in pharmaceutical substances: History of Pharmacopoeia, Sources and types of impurities, principle involved in the limit test for Chloride, Sulphate, Iron, Arsenic, Lead and Heavy metals, modified limit test for Chloride and Sulphate.

General methods of preparation, assay for the compounds superscripted with **asterisk (*),** properties and medicinal uses of inorganic compounds belonging to the following classes.

Module 2: DENTAL PRODUCTS ***(10 Periods)***

Acids, Bases, and Buffers: Buffer equations and buffer capacity in general, buffers in pharmaceutical systems, preparation, stability, buffered isotonic solutions, measurements of tonicity, calculations and methods of adjusting isotonicity.

Major extra and intracellular electrolytes: Functions of major physiological ions, Electrolytes used in the replacement therapy: Sodium chloride*, Potassium chloride, Calcium gluconate* and Oral Rehydration Salt(ORS), Physiological acid base balance.

Dental products: Dentifrices, role of fluoride in the treatment of dental caries, Desensitizing agents, Calcium carbonate, Sodium fluoride, and Zinc eugenol cement.

Module 3: GASTRO INTESTINAL AGENTS ***(10 Periods)***

Acidifiers: Ammonium chloride*and Dil.HCl

Antacid: Ideal properties of antacids, combinations of antacids, Sodium Bicarbonate*, Aluminum hydroxide gel, Magnesium hydroxide mixture

Cathartics: Magnesium sulphate, Sodium orthophosphate, Kaolin and Bentonite

Antimicrobials: Mechanism, classification, Potassium permanganate, Boricacid, Hydrogen peroxide*, Chlorinated lime*, Iodine and its preparations.

Module 4: MISCELLANEOUS COMPOUNDS ***(08 Periods)***

Expectorants: Potassium iodide, Ammonium chloride*.

Emetics: Copper sulphate*, Sodium potassium tartarate.

Haematinics: Ferrous sulphate*, Ferrous gluconate

Poison and Antidote: Sodium thiosulphate*, Activated charcoal, Sodium nitrite.

Astringents: Zinc Sulphate, Potash Alum.

Module 5: RADIOPHARMACEUTICALS ***(07 Periods)***

Radioactivity, Measurement of radioactivity, Properties of α, β, γ radiations, Half-life, radio isotopes and study of radioisotopes-Sodium iodideI^{131}, Storage conditions, precautions & pharmaceutical application of radioactive substances.

Total Periods: 45

Conduct an analysis for the compounds marked with an asterisk (*).

RESOURCES

TEXTBOOKS:

1. Vogel's Qualitative Inorganic Analysis by Svehla, G. and Sivasankar, B. Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), New Delhi.
2. Inorganic Chemistry by Miessler, G.L. and Tarr, D.A., Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), New Delhi.
3. Pharmaceutical Inorganic Chemistry: Theory an d Practic e by Chenchu L aksh m i, N.V., Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), New Delhi.
4. Bentley and Driver's Textbook of Pharmaceutical Chemistry, Oxford University Press, New Delhi
5. Inorganic Pharmaceutical Chemistry by M.L. Schroff, National Book Centre, Kolkata.
6. Inorganic Chemistry by Miessler, G.L. and Tarr, D.A., Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), New Delhi.

VIDEO LECTURES:

1. https://www.smartresultsnow.net/results/your_search
2. http://surl.li/ciksc
3. http://bsppharmacy.classx.co.in
4. https://is.gd/1EhRbH

WEB RESOURCES:

1. https://ytibh.courses.store/394693?ut...
2. https://drive.google.com/file/d/11ZVZ...
3. https://drive.google.com/file/d/1TrGe...

Course Code	Course Title	L	T	P	C
23PY101001	**COMMUNICATION SKILLS**	**2**	**-**	**-**	**2**

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course will prepare the young pharmacy student to interact effectively with doctors, nurses, dentists, physiotherapists and other health workers.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Demonstrate knowledge of Communication Skills, examining and applying Barriers to communication, and Perspectives in Communication.

CO2. Analyze the Elements of Communication and Communication Styles and apply them appropriately to communicate effectively with the community and society.

CO3. Apply Basic Listening Skills and Effective Written Communication for organizing the message.

CO4. Communicate effectively in interviews and during presentations by applying appropriate techniques.

CO5. Communicate effectively in group discussions by applying strategies.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-		2	-	-	-	-	-	-
CO3	3	-	-	-	-	-	-	-		2	-	-	-	-	-	-
CO4	3	-	-	-	2	-	-	-	2	2	-	-	-	-	-	-
CO5	3	-	-	-	2	-	-	-	2	2	-	-	-	-	-	-
Course Correlation Mapping	**3**	**2**	**-**	**-**	**2**	**-**	**-**	**-**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**

Correlation Levels: ***3: High;*** ***2: Medium;*** ***1: Low***

COURSE CONTENT

Module 1: COMMUNICATION SKILLS ***(07 Periods)***

Communication Skills: Introduction, Definition, The Importance of Communication, The Communication Process – Source, Message, Encoding, Channel, Decoding, Receiver, Feedback, Context

Barriers to communication: Physiological Barriers, Physical Barriers, Cultural Barriers, Language Barriers, Gender Barriers, Interpersonal Barriers, Psychological Barriers, Emotional barriers

Perspectives in Communication: Introduction, Visual Perception, Language, Other factors affecting our perspective - Past Experiences, Prejudices, Feelings, Environment.

Module 2: STYLES AND ELEMENTS OF COMMUNICATION ***(07 Periods)***

Elements of Communication: Introduction, Face to Face Communication - Tone of Voice, Body Language (Non-verbal communication), Verbal Communication, Physical Communication.

Communication Styles: Introduction, The Communication Styles Matrix with example for each - Direct Communication Style, Spirited Communication Style, Systematic Communication Style, Considerate Communication Style.

Module 3: BASIC LISTENING SKILLS ***(07 Periods)***

Basic Listening Skills: Introduction, Self-Awareness, Active Listening, Becoming an Active Listener, Listening in Difficult Situations.

Effective Written Communication: Introduction, When and When Not to Use Written Communication - Complexity of the Topic, Amount of Discussion' Required, Shades of Meaning, Formal Communication.

Writing Effectively: Subject Lines, Put the Main Point First, Know Your Audience, Organization of the Message.

Module 4: INTERVIEW AND PRESENTATION SKILLS ***(05 Periods)***

Interview Skills: Purpose of an interview, Do's and Dont's of an interview

Giving Presentations: Dealing with Fears, planning your Presentation, Structuring Your Presentation, Delivering Your Presentation, Techniques of Delivery.

Module 5: GROUP DISCUSSION ***(04 Periods)***

Introduction, Communication skills in group discussion, Do's and Dont's of group discussion.

Total Periods: 30

RESOURCES

TEXTBOOKS:

1. Basic communication skills for Technology, Andreja. J. Ruther Ford, 2nd Edition, Pearson Education, 2011
2. Communication skills, Sanjay Kumar, Pushpalata, 1stEdition, Oxford Press, 2011
3. Organizational Behaviour, Stephen .P. Robbins, 1stEdition, Pearson, 2013
4. Brilliant- Communication skills, Gill Hasson, 1stEdition, Pearson Life, 2011
5. The Ace of Soft Skills: Attitude, Communication and Etiquette for success, Gopala Swamy Ramesh, 5thEdition, Pearson, 2013
6. Developing your influencing skills, Deborah Dalley, Lois Burton, Margaret, Green hall, 1st Edition Universe of Learning LTD, 2010
7. Personality development and soft skills, Barun K Mitra, 1stEdition, Oxford Press, 2011
8. Soft skill for everyone, Butter Field, 1st Edition, Cengage Learning india pvt.ltd, 2011
9. Soft skills and professional communication, Francis Peters SJ, 1stEdition, Mc Graw Hill Education, 2011
10. Effective communication, John Adair, 4thEdition, Pan Mac Millan,2009
11. Bringing out the best in people, Aubrey Daniels, 2ndEdition, Mc Graw Hill, 1999

VIDEO LECTURES:

1. https://youtu.be/hE6I9apUvrk
2. https://youtu.be/fH6YX-QOz7c
3. https://youtu.be/PNZnbMklSA4
4. https://youtu.be/EW4dEzfBst0

WEB RESOURCES:

1. https://www.skillsyouneed.com/ips/communication-skills.html

Course Code	Course Title	L	T	P	C
23PY101002	**REMEDIAL BIOLOGY**	**2**	**-**	**-**	**2**

Pre-Requisite -
Anti-Requisite -
Co-Requisite -

COURSE DESCRIPTION: To learn and understand the components of living world, structure and functional system of plant and animal kingdom.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Demonstrate the diversity of life and Histo-morphological features of flowering plants.
CO2. Understand the basics of Human Anatomy and physiology.
CO3. Analyze the basics of Plant mineral nutrition and Photosynthesis
CO4. Analyze the basics of Plant respiration, Plant cell and tissues.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	1	-	-	2	-	-	-	-	-	-	-	-	-	3	-
CO2	3	1	-	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	-	-	3	-
Course Correlation Mapping	**3**	**2**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**

Correlation Levels: ***3: High;*** ***2: Medium;*** ***1: Low***

COURSE CONTENT

Module 1: LIVING WORLD ***(07 Periods)***

Definition and characters of living organisms. Diversity in the living world. Binomial nomenclature, Five kingdoms of life and basis of classification. Salient features of Monera, Potista, Fungi, Animalia and Plantae, Virus, Morphology of Flowering plants, Morphology of different parts of flowering plants – Root, stem, inflorescence, flower, leaf, fruit, seed. General Anatomy of Root, stem, leaf of monocotyledons & Dicotyledons.

Module 2: BODY FLUIDS AND CIRCULATION ***(07 Periods)***

Composition of blood, blood groups, coagulation of blood, Composition and functions of lymph, Human circulatory system, Structure of human heart and blood vessels, Cardiac cycle, cardiac output and ECG Digestion and Absorption, Human alimentary canal and digestive glands, Role of digestive enzymes, Digestion, absorption and assimilation of digested food Breathing and respiration, Human respiratory system, Mechanism of breathing and its regulation, Exchange of gases, transport of gases and regulation of respiration, Respiratory volumes.

Module 3: EXCRETORY PRODUCTS AND THEIR ELIMINATION ***(07 Periods)***

Modes of excretion, Human excretory system- structure and function, Urine formation, Rennin angiotensin system Neural control and coordination, Definition and classification of nervous system, Structure of a neuron, Generation and conduction of nerve impulse, Structure of brain and spinal cord, Functions of cerebrum, cerebellum, hypothalamus and medulla oblongata Chemical coordination and regulation, Endocrine glands and their secretions, Functions of hormones secreted by endocrine glands Human reproduction, Parts of female reproductive system, Parts of male reproductive system, Spermatogenesis and Oogenesis, Menstrual cycle.

Module 4: PLANTS AND MINERAL NUTRITION ***(05 Periods)***

Essential mineral, macro and micronutrients, Nitrogen metabolism, Nitrogen cycle, biological nitrogen fixation Photosynthesis, Autotrophic nutrition, photosynthesis, Photosynthetic pigments, Factors affecting photosynthesis.

Module 5: PLANT RESPIRATION ***(04 Periods)***

Respiration, glycolysis, fermentation (anaerobic). Plant growth and development, Phases and rate of plant growth, Condition of growth, Introduction to plant growth regulators Cell - The unit of life, Structure and functions of cell and cell organelles. Cell division Tissues, Definition, types of tissues, location, and functions.

Total Periods: 30

RESOURCES

TEXTBOOKS:

1. REMEDIAL-BIOLOGY-Pharmaceutical-Biology-Gokhale-Nirali Prakashan, Pune
2. Text book of Pharmacognosy by C K Kokate, Nirali prakashan.
3. Principles of Anatomy and Physiology by Tortora Grabowski. Palmetto, GA, U.S.A.

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=b4-BcN3sW9s
2. https://www.youtube.com/watch?v=mJPwZcDrsoY
3. https://www.youtube.com/watch?v=EqIwYAc0I1c
4. https://www.youtube.com/watch?v=ZpL6EjmVO-Q

WEB RESOURCES:

1. https://westerntc.libguides.com/anatomy/websites
2. https://libguides.wccnet.edu/oer-subjects/anatomy-physiology
3. https://openstax.org/details/books/anatomy-and-physiology

Course Code	Course Title	L	T	P	C
23PY101003	**REMEDIAL MATHEMATICS**	**2**	**-**	**-**	**2**

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This subject deals with the introduction to Partial fraction, Logarithm, matrices and Determinant, Analytical geometry, Calculus, differential equation and Laplace transform.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Demonstrate the knowledge on Matrices, Determinants, find the solutions of triangles.

CO2. Determine the equation of the straight line, circles, tangent and normal of the circle.

CO3. Determine the limit, continuity, differentiation of different single variable function and partial differentiation.

CO4. Evaluate definite integrals of single variable functions.

CO5. Solve the ordinary differential equation of first and second order.

CO6. Demonstrate the knowledge on Laplace transform of elementary functions, Linear and shifting property.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	-	3	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	3	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	-	3	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	-	3	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	3	-	3	-	-	-	-	-	-	-	-	-	-	-	-
CO6	3	3	-	3	-	-	-	-	-	-	-	-	-	-	-	-
Course Correlation Mapping	**3**	**3**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

Correlation Levels: ***3: High;*** ***2: Medium;*** ***1: Low***

COURSE CONTENT

Module 1: PARTIAL FRACTION, LOGARITHMS, FUNCTIONS, LIMITS AND CONTINUITY. ***(06 Periods)***

Partial fraction

Introduction, Polynomial, Rational fractions, Proper and Improper fractions, Partial fraction , Resolving into Partial fraction, Application of Partial Fraction in Chemical Kinetics and Pharmacokinetics.

Logarithms

Introduction, Definition, Theorems/Properties of logarithms, Common logarithms, Characteristic and Mantissa, worked examples, application of logarithm to solve pharmaceutical problems.

Functions:

Real Valued function, Classification of real valued functions,

Limits and continuity:

Module 2: MATRICES AND DETERMINANT ***(06 Periods)***

Introduction matrices, Types of matrices, Operation on matrices, Transpose of a matrix, Matrix Multiplication, Determinants, Properties of determinants, Product of determinants, Minors and co-Factors, Adjoint or adjugate of a square matrix , Singular and non-singular matrices, Inverse of a matrix, Solution of system of linear of equations using matrix method, Cramer's rule, Characteristic equation and roots of a square matrix, Cayley–Hamilton theorem, Application of Matrices in solving Pharmacokinetic equations.

Module 3: CALCULUS DIFFERENTIATION ***(06 Periods)***

Introductions, Derivative of a function, Derivative of a constant, Derivative of a product of a constant and a function , Derivative of the sum or difference of two functions, Derivative of the product of two functions (product formula), Derivative of the quotient of two functions (Quotient formula) – Without Proof, Derivative of xnw.r.tx, where n is any rational number, Derivative of ex,, Derivative of loge x , Derivative of ax,Derivative of trigonometric functions from first principles (without Proof), Successive Differentiation, Conditions for a function to be a maximum or a minimum at a point.

Module 4: ANALYTICAL GEOMETRY ***(06 Periods)***

Introduction: Signs of the Coordinates, Distance formula,

Straight Line: Slope or gradient of a straight line, Conditions for parallelism and perpendicularity of two lines, Slope of a line joining two points, Slope – intercept form of a straight line.

Integration:

Introduction, Definition, Standard formulae, Rules of integration, Method of substitution, Method of Partial fractions, Integration by parts, definite integrals, application

Module 5: DIFFERENTIAL EQUATIONS AND LAPLACE TRANSFORMS ***(06 Periods)***

Differential Equations: Some basic definitions, Order and degree, Equations in separable form, Homogeneous equations, Linear Differential equations, Exact equations, Application in solving Pharmacokinetic equations

Laplace Transform: Introduction, Definition, Properties of Laplace transform, Laplace Transforms of elementary functions, Inverse Laplace transforms, Laplace transform of derivatives, Application to solve Linear differential equations, Application in solving Chemical kinetics and Pharmacokinetics equations

Total Periods: 30

RESOURCES

TEXTBOOKS:

1. Differential Calculus by Shanthinarayan
2. Pharmaceutical Mathematics with application to Pharmacy by Panchak sharappa Gowda D.H.
3. Integral Calculus by Shanthinarayan
4. Higher Engineering Mathematics by Dr.B.S.Grewal

VIDEO LECTURES:

1. https://youtu.be/hiG6naACUeI?list=PLNKD1qB9ppttrZnL4h6h-WdAOXXCT1VTv
2. https://youtu.be/XJK4lYTIOhk
3. https://youtu.be/A6Ad7VnSlZE?list=PLNKD1qB9ppttx4WuHV0TWRy5dWuVSKEtT
4. https://youtu.be/Re0s1NPZ4ek

WEB RESOURCES:

1. https://youtu.be/bjJZKTrCBNw?list=PLU6SqdYcYsfIuZVt20v-eNZBfFLENrM1F

Course Code	Course Title	L	T	P	C
23PC105001	HUMAN ANATOMY AND PHYSIOLOGY-I PRACTICAL	-	-	4	2

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: Upon completion of this course the student should be able to: Understand the gross morphology, structure and functions of various organs of the human body and analyze numerous hematological variables and record human vital functions.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Identify and analyze the numerous tissues and bones that comprise the human body's systems.

CO2. Apply appropriate tools and analyze numerous hematological variables and record human vital functions.

CO3. Work as an individual and as a member of a team to solve problems with effective communications.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	-	-	2	-	-	-	3	2	-	-	-	-	3	-
CO2	3	3	-	-	3	-	-	-	3	2	-	-	-	-	3	-
CO3	-	-	-	-	-	-	-	-	3	-	-	-	-	-	3	-
Course Correlation Mapping	**3**	**1**	**-**	**-**	**-**	**-**	**-**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**3**	**-**

Correlation Levels: ***3: High;*** ***2: Medium;*** ***1: Low***

COURSE CONTENT

EXPERIMENTS

1. Study of compound microscope.
2. Microscopic study of epithelial and connective tissue
3. Microscopic study of muscular and nervous tissue
4. Identification of axial bones
5. Identification of appendicular bones
6. Introduction to haemocytometry
7. Enumeration of white blood cell (WBC) count
8. Enumeration of total red blood corpuscles (RBC) count
9. Determination of bleeding time
10. Determination of clotting time
11. Estimation of haemoglobin content
12. Determination of blood group
13. Determination of erythrocyte sedimentation rate (ESR).
14. Determination of heart rate and pulse rate
15. Recording of blood pressure.

Course Code	Course Title	L	T	P	C
23PA105001	**PHARMACEUTICAL ANALYSIS PRACTICAL**	**-**	**-**	**4**	**2**

Pre-Requisite -
Anti-Requisite -
Co-Requisite -

COURSE DESCRIPTION: Upon completion of this course the student should be able to understand the fundamentals of analytical chemistry and principles of electrochemical analysis of drugs.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Accomplish knowledge on limit tests of ions, preparation, and standardization of primary and secondary standards.

CO2. Perform and analyze the quantitative estimation by volumetric & electrochemical analysis of diverse pharmaceutical compounds

CO3. Work as an individual and as a member of a team to solve problems with effective communications.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	3	2	3	-	-	-	-	-	-	-	-	-	-	3	-	-
CO3	3	2	3	-	-	-	-	-	-	-	-	-	-	3	-	-
Course Correlation Mapping	**3**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

Correlation Levels: ***3: High;*** ***2: Medium;*** ***1: Low***

COURSE CONTENT

EXPERIMENTS

1. **Limit Test**
   - Chloride
   - Sulphate
   - Iron
   - Arsenic
2. **Preparations and standardizations**
   - Sodium hydroxide
   - Sulphuric acid
   - Sodium thiosulfate
   - Potassium permanganate
   - Ceric ammonium sulphate
3. **Assay along with Standardization of Titrants**
   - Ammonium chloride by acid base titration
   - Ferrous sulphate by Cerimetry
   - Copper sulphate by Iodometry
   - Calcium gluconate by complexometry
   - Hydrogen peroxide by Permanganometry
   - Sodium benzoate by non-aqueous titration
   - Sodium Chloride by precipitation titration
4. Determination of Normality by electro-analytical methods
5. Conductometric titration of strong acid against strong base
6. Conductometric titration of strong acid and weak acid against strong base
7. Potentiometric titration of strong acid against strong base

Course Code	Course Title	L	T	P	C
23PH105001	**PHARMACEUTICS PRACTICAL**	**-**	**-**	**4**	**2**

Pre-Requisite -
Anti-Requisite -
Co-Requisite -

COURSE DESCRIPTION: This course is designed to impart a fundamental knowledge on the preparatory pharmacy with arts and science of preparing the different conventional dosage forms.
Upon completion of this course the student should be able to: Know the history of profession of pharmacy, Understand the basics of different dosage forms, pharmaceutical incompatibilities and pharmaceutical calculations, Understand the professional way of handling the prescription, Preparation of various conventional dosage forms.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Demonstrate the preparation and evaluation of liquid dosages
CO2. Prepare suppository and evaluate its parameters
CO3. Demonstrate different types of powders and its preparation and packing.
CO4. Demonstrate various types of semisolid dosage forms, preparation and evaluation
CO5. Work independently and in teams to solve problems with effective communications

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	-	2	-	-	1	-	-	-	-	3	-	-	-
CO2	3	2	-	-	2	-	-	1	-	-	-	-	3	-	-	-
CO3	3	2	-	-	1	-	-	1	-	-	-	-	3	-	-	-
CO4	3	2	-	-	2	-	-	1	-	-	-	-	3	-	-	-
CO5	-	-	-	-	-	-	-	-	3	3	-	-	-	-	-	-
Course Correlation Mapping	**3**	**2**	**3**	**-**	**2**	**-**	**-**	**1**	**3**	**3**	**-**	**-**	**3**	**-**	**-**	**-**

Correlation Levels: ***3: High;*** ***2: Medium;*** ***1: Low***

COURSE CONTENT

EXPERIMENTS

1. Liquid Dosage Forms

- Syrup IP'66
- Compound syrup of Ferrous Phosphate BPC'68
- Piperazine citrate elixir
- Paracetamol pediatric elixir
- Terpin Hydrate Linctus IP'66
- Iodine Throat Paint (Mandles Paint)
- Strong solution of ammonium acetate
- Cresol with soap solution
- Lugol's solution
- Calamine lotion
- Magnesium Hydroxide mixture
- Aluminimum Hydroxide gel
- Turpentine Liniment
- Liquid paraffin emulsion

2. POWDERS

- ORS powder (WHO)
- Effervescent granules
- Dusting powder
- Divided Powder

3. SUPPOSITORIES

- Glycero gelatin suppository
- Cocoa butter suppository
- Zinc Oxide suppository

4. SEMISOLID DOSAGE FORMS

- Sulphur ointment
- Non-staining-iodine ointment with methyl salicylate
- Carbopal gel

5. DENTAL PRODUCTS

- Iodine gargle
- Chlorhexidine mouthwash

Course Code	Course Title	L	T	P	C
23PA105002	PHARMACEUTICAL INORGANIC CHEMISTRY PRACTICAL	-	-	4	2

Pre-Requisite -
Anti-Requisite -
Co-Requisite -

COURSE DESCRIPTION: The course is intended to introduce the students to pharmaceutical chemistry. It will also help them to understand the identification of different anions, cations and different inoganic pharmaceuticals.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Accomplish knowledge on limit tests of ions and identification tests of diverse inorganic compounds

CO2. Perform and analyze the preparation & test of purity of diverse pharmaceutical compounds.

CO3. Prepare a few Inorganic Pharmaceutical Substances and carry out Pharmacopoeial tests.

CO-PO-PSO Mapping Table:

Course Outcome	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	1	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	3	2	1	-	-	-	-	-	-	-	-	-	-	3	-	-
CO3	3	2	1	-	-	-	-	-	-	-	-	-	-	3	-	-
Course Correlation Mapping	**3**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

Correlation Levels: ***3: High;*** ***2: Medium;*** ***1: Low***

COURSE CONTENT

EXPERIMENTS

1. Limit tests

- Limit test for Chlorides and Sulphates
- Modified limit test for Chlorides and Sulphates
- Limit test for Iron
- Limit test for Heavy metals
- Limit test for Lead
- Limit test for Arsenic

2. Identification tests

- Magnesium hydroxide
- Ferrous sulphate
- Sodium bicarbonate
- Calcium gluconate
- Copper sulphate

3. Test for purity

- Swelling power of Bentonite
- Neutralizing capacity of Aluminium hydroxide gel
- Determination of potassium iodate and iodine in potassium Iodide

4. Preparation of inorganic pharmaceuticals

- Boric acid
- Potash alum
- Ferrous sulphate

Course Code	Course Title	L	T	P	C
23PY105001	**COMMUNICATION SKILLS PRACTICAL**	**-**	**-**	**2**	**1**

Pre-Requisite -
Anti-Requisite -
Co-Requisite -

COURSE DESCRIPTION: Students will develop theoretical knowledge and practical skills related to group development, leadership, preparing and running meetings, decision-making.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Demonstrate knowledge of Basic communication through communicative functions.

CO2. Analyze Phonetics by examining and applying sounds of English through Phonetics.

CO3. Apply appropriate Listening Comprehension / Direct and Indirect Speech, Figures of Speech, and Effective Communication.

CO4. Function effectively as an individual and as a member in diverse teams examining and applying writing skills.

CO5. Communicate effectively by applying appropriate Interview Handling Skills, E-Mail etiquette, and Presentation Skills.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-		-	-	-	-	2	-	-	-	-	-	-
CO2	3	2	-	-		-	-	-	-	2	-	-	-	-	-	-
CO3	3	-	-	-		-	-	-	-	2	-	-	-	-	-	-
CO4	3	-	-	-	2	-	-	-	2	2	-	-	-	-	-	-
CO5	3	-	-	-	2	-	-	-	2	2	-	-	-	-	-	-
Course Correlation Mapping	**3**	**2**	**-**	**-**	**2**	**-**	**-**	**-**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**

Correlation Levels: ***3: High;*** ***2: Medium;*** ***1: Low***

COURSE CONTENT

EXPERIMENTS

1. Basic communication covering the following topics

- Meeting People
- Asking Questions
- Making Friends
- What did you do?
- Do's and Dont's

2. Pronunciations covering the following topics

- Pronunciation (Consonant Sounds)
- Pronunciation and Nouns
- Pronunciation (Vowel Sounds)

3. Advanced Learning

- Listening Comprehension / Direct and Indirect Speech
- Figures of Speech
- Effective Communication
- Writing Skills
- Effective Writing
- Interview Handling Skills
- E-Mail etiquette
- Presentation Skill

Course Code	Course Title	L	T	P	C
23PY105002	**REMEDIAL BIOLOGY PRACTICAL**	**-**	**-**	**2**	**1**

Pre-Requisite -
Anti-Requisite -
Co-Requisite -

COURSE DESCRIPTION: Upon completion of this course the student should be able to: Understand the gross morphology, structure and functions of various parts of the plant and anatomy and physiology of animals.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Demonstrate the histochemical reactions of parts of the plant using microscope.

CO2. Demonstrate the fundamentals of plant Cell and modifications of Stem, Root, and Leaf.

CO3. Analyze the anatomy and physiology of frog using simulations

CO4. Analyze the animal tissues and organs

CO5. Work independently and in teams to solve problems with effective communication

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	-	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	1	-	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	-	-	3	-
CO5	-	-	-	-	-	-	-	-	3	3	-	-	-	-	3	-
Course Correlation Mapping	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**-**	**-**	**-**	**-**	**3**	**-**

Correlation Levels: ***3: High;*** ***2: Medium;*** ***1: Low***

COURSE CONTENT

EXPERIMENTS

1. Introduction to experiments in biology.
   a) Study of Microscope
   b) Section cutting techniques
   c) Mounting and staining
   d) Permanent slide preparation
2. Study of cell and its inclusions
3. Study of Stem, Root, Leaf, and its modifications
4. Detailed study of frog by using computer models
5. Microscopic study and identification of tissues
6. Identification of bones
7. Determination of blood group
8. Determination of blood pressure
9. Determination of tidal volume

II SEMESTER

Course Code	Course Title	L	T	P	C
23PC101002	**HUMAN ANATOMY AND PHYSIOLOGY-II**	**3**	**1**	**-**	**4**

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: Upon completion of this course the student should be able to understandthe gross morphology, structure and functions of various systems of the human body, homeostatic mechanisms.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Comprehend the structure and functional hierarchy of central nervous system.

CO2. Understand the structure and functions of digestive system and energy metabolism.

CO3. Understand the structure and functions of respiratory & urinary system.

CO4. Comprehend the structure and functions of all endocrine glands.

CO5. Describe the anatomy of male and female reproductive system and genetics of human body.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	1	-	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	1	-	-	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	1	-	-	-	-	-	-	-	-	-	-	-	-	3	-
CO5	3	1	-	-	-	-	-	-	-	-	-	-	-	-	3	-
Course Correlation Mapping	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**

Correlation Levels: ***3: High;*** ***2: Medium;*** ***1: Low***

COURSE CONTENT

Module 1: NERVOUS SYSTEM ***(10 Periods)***

Organization of nervous system, neuron, neuroglia, classification and properties of nerve fibre, electrophysiology, action potential, nerve impulse, receptors, synapse, neurotransmitters. Central nervous system: Meninges, ventricles of brain and cerebrospinal fluid. Structure and functions of brain (cerebrum, brain stem, cerebellum), spinal cord (gross structure, functions of afferent and efferent nerve tracts, reflex activity).

Module 2: DIGESTIVE SYSTEM AND ENERGETICS ***(06 Periods)***

Digestive system

Anatomy of GI Tract with special reference to anatomy and functions of stomach, (Acid production in the stomach, regulation of acid production through parasympathetic nervous system, pepsin role in protein digestion) small intestine and large intestine, anatomy and functions of salivary glands, pancreas and liver, movements of GIT, digestion and absorption of nutrients and disorders of GIT.

Energetics

Formation and role of ATP, Creatinine Phosphate and BMR.

Module 3: RESPIRATORY AND URINARY SYSTEM ***(10 Periods)***

Respiratory system

Anatomy of respiratory system with special reference to anatomy of lungs, mechanism of respiration, regulation of respiration Lung Volumes and capacities transport of respiratory gases, artificial respiration and resuscitation methods.

Urinary system

Anatomy of urinary tract with special reference to anatomy of kidney and nephrons, functions of kidney and urinary tract, physiology of urine formation, micturition reflex and role of kidneys in acid base balance, role of RAS in kidney and disorders of kidney.

Module 4: ENDOCRINE SYSTEM ***(10 Periods)***

Classification of hormones, mechanism of hormone action, structure and functions of pituitary gland, thyroid gland, parathyroid gland, adrenal gland, pancreas, pineal gland, thymus and their disorders.

Module 5: REPRODUCTIVE SYSTEM AND GENETICS ***(09 Periods)***

Reproductive system

Anatomy of male and female reproductive system, Functions of male and female reproductive system, sex hormones, physiology of menstruation, fertilization, spermatogenesis, oogenesis, pregnancy and parturition.

Introduction to genetics

Chromosomes, genes and DNA, protein synthesis, genetic pattern of inheritance.

Total Periods: 45

RESOURCES

TEXTBOOKS:

1. Essentials of Medical Physiology by K. Sembulingam and P. Sembulingam. Jaypee brothers medical publishers, New Delhi.
2. Text book of Medical Physiology- Arthur C, Guyton and John.E. Hall. Miamisburg, OH, U.S.A.
3. Principle of Anatomy and Physiology by Tortora Grabowski. Palmetto, GA, U.S.A.
4. Anatomy and Physiology in Health and Illness by Kathleen J.W. Wilson, Churchill Livingstone, New York.

VIDEO LECTURES:

1. https://youtu.be/hE6I9apUvrk
2. https://youtu.be/fH6YX-QOz7c
3. https://youtu.be/PNZnbMklSA4

WEB RESOURCES:

1. https://westerntc.libguides.com/anatomy/websites
2. https://libguides.wccnet.edu/oer-subjects/anatomy-physiology
3. https://openstax.org/details/books/anatomy-and-physiology

Course Code	Course Title	L	T	P	C
23PA101003	**PHARMACEUTICAL ORGANIC CHEMISTRY –I**	**3**	**1**	**-**	**4**

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: Upon completion of this course the student should be able to understand the classification and nomenclature of simple organic compounds, structural isomerism, intermediates forming in reactions, important physical properties, reactions and methods of preparation of these compounds, mechanisms and orientation of reactions.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Attain knowledge of nomenclature of diverse class of organic compounds.

CO2. Comprehend elimination reactions with stereo chemical aspects.

CO3. Emphasize on, substitution reactions and qualitative analysis of official organic compounds related to some alkyl halides and alcohols.

CO4. Comprehend on addition, redox reactions: Named reactions and qualitative analysis, uses of some carbonyl organic compounds.

CO5. Emphasize on properties of carboxylic acids, amides, esters and qualitative analysis, uses of some carboxylic acid derivatives.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	1	-	-	-	-	-	-	-	-	-	1	-	3	-	-
CO2	3	1	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO3	3	-	-	-	-	-	-	-	-	-	-	1	-	3	-	-
CO4	3	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO5	3	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-
Course Correlation Mapping	**3**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**3**	**-**	**-**

Correlation Levels: ***3: High;*** ***2: Medium;*** ***1: Low***

COURSE CONTENT

Module 1: NOMENCLATURE OF ORGANIC COMPOUNDS ***(07 Periods)***

Classification, nomenclature, and isomerism Classification of Organic Compounds Common and IUPAC systems of nomenclature of organic compounds (up to 10 Carbons open chain and carbocyclic compounds) Structural isomerisms in organic compounds.

Module 2: ALKANES AND ALKENES ***(10 Periods)***

Alkanes*, Alkenes* and Conjugated dienes* SP3 hybridization in alkanes, Halogenation of alkanes, uses of paraffins. Stabilities of alkenes, SP2 hybridization in alkenes E1 and E2 reactions – kinetics, order of reactivity of alkyl halides, rearrangement of carbocations, Saytzeffs orientation and evidences. E1 verses E2 reactions, Factors affecting E1 and E2 reactions. Ozonolysis, electrophilic addition reactions of alkenes, Markownikoff's orientation, free radical addition reactions of alkenes, Anti Markownikoff's orientation. Stability of conjugated dienes, Diel-Alder, electrophilic addition, free radical addition reactions of conjugated dienes, allylic rearrangement.

Module 3: SN^1 AND SN^2 REACTIONS ***(10 Periods)***

Alkyl halides* SN1 and SN2 reactions - kinetics, order of reactivity of alkyl halides, stereochemistry and rearrangement of carbocations. SN1 versus SN2 reactions, Factors affecting SN1 and SN2 reactions Structure and uses of ethylchloride, Chloroform, trichloroethylene, tetrachloroethylene, dichloromethane, tetrachloromethane and iodoform. Alcohols*- Qualitative tests, Structure and uses of Ethyl alcohol, Methyl alcohol, chlorobutanol, Cetosteryl alcohol, Benzyl alcohol, Glycerol, Propylene glycol.

Module 4: ALDEHYDES AND KETONES ***(10 Periods)***

Carbonyl compounds* (Aldehydes and ketones) Nucleophilic addition, Electromeric effect, aldol condensation, Crossed Aldol condensation, Cannizzaro reaction, Crossed Cannizzaro reaction, Benzoin condensation, Perkin condensation, qualitative tests, Structure and uses of Formaldehyde, Paraldehyde, Acetone, Chloral hydrate, Hexamine, Benzaldehyde, Vanilin, Cinnamaldehyde.

Module 5: CARBOXYLIC ACIDS ***(08 Periods)***

Acidity of carboxylic acids, effect of substituents on acidity, inductive effect and qualitative tests for carboxylic acids, amide and ester Structure and Uses of Acetic acid, Lactic acid, Tartaric acid, Citric acid, Succinic acid. Oxalic acid, Salicylic acid, Benzoic acid, Benzyl benzoate, Dimethyl phthalate, Methyl salicylate and Acetyl salicylic acid • Aliphatic amines* - Basicity, effect of substituent on Basicity. Qualitative test, Structure and uses of Ethanolamine, Ethylenediamine, Amphetamine.

Total Periods: 45

General methods of preparation and reactions of compounds superscripted with asterisk (*) to be explained to emphasize on definition, types, classification, principles/ mechanisms, applications, examples, and differences.

RESOURCES

TEXTBOOKS:

1. Text book of pharmaceutical organic chemistry by V Alagarsamy
2. Text book of pharmaceutical organic chemistry by mohammed Ali.
3. Textbook of Organic Chemistry by B.S. Bahl & Arun Ba
4. Reaction and reaction mechanism by Ahluwaliah/Chatwal

VIDEO LECTURES:

1. https://solotutes.com/hi//videos?v=eJAWvjszRjI
2. https://www.khanacademy.org/science/organic-chemistry
3. https://onlinecourses.swayam2.ac.in/cec23_cy03/preview

WEB RESOURCES:

1. https://global.oup.com/uk/orc/pharmacy/
2. https://www.himpub.com/BookDetail.aspx?BookId=1619&NB=&Book_TitleM=Pharmaceutical%20Organic%20Chemistry%20-%20I
3. https://onlinelibrary.wiley.com/series/2231

Course Code	Course Title	L	T	P	C
23PA101004	**BIOCHEMISTRY**	**3**	**1**	**-**	**4**

Pre-Requisite -
Anti-Requisite -
Co-Requisite -

COURSE DESCRIPTION: Upon completion of this course the student should be able to understand molecular levels of the chemical process associated with living cells, metabolism of nutrient molecules in physiological and pathological conditions.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Comprehend the biological significance and metabolism of Biomolecules & Bioenergetics.

CO2. Demonstrate the biosynthesis, their significance and metabolism of Lipids and Nucleic acids.

CO3. Illustrate the genetic organization of mammalian genome and functions of DNA in the synthesis of RNAs, proteins and Catabolism of purine nucleotides, Hyperuricemia, Gout disease.

CO4. Understand the catalytic role of enzymes, importance of enzyme inhibitors in design of new drugs, therapeutic and diagnostic applications of enzymes.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO3	3	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO4	3	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-
Course Correlation Mapping	**3**	**2**	-	-	-	-	-	-	-	-	-	-	-	**3**	-	-

Correlation Levels: ***3: High;*** ***2: Medium;*** ***1: Low***

COURSE CONTENT

Module 1: BIOMOLECULES INTRODUCTION ***(08 Periods)***

Biomolecules Introduction, classification, chemical nature and biological role of carbohydrate, lipids, nucleic acids, amino acids and proteins. • Bioenergetics Concept of free energy, endergonic and exergonic reaction, Relationship between free energy, enthalpy and entropy; Redox potential. Energy rich compounds; classification; biological significances of ATP and cyclic AMP.

Module 2: CARBOHYDRATE METABOLISM ***(10 Periods)***

Carbohydrate metabolism Glycolysis – Pathway, energetics and significance Citric acid cycle-Pathway, energetics and significance HMP shunt and its significance; Glucose-6-Phosphate dehydrogenase (G6PD) deficiency Glycogen metabolism Pathways and glycogen storage diseases (GSD) Gluconeogenesis- Pathway and its significance Hormonal regulation of blood glucose level and Diabetes mellitus • Biological oxidation Electron transport chain (ETC) and its mechanism. Oxidative phosphorylation & its mechanism and substrate phosphorylation Inhibitors ETC and oxidative phosphorylation/Uncouplers level.

Module 3: LIPID METABOLISM ***(10 Periods)***

Lipid metabolism β-Oxidation of saturated fatty acid (Palmitic acid) 61 Formation and utilization of ketone bodies; ketoacidosis De novo synthesis of fatty acids (Palmitic acid) Biological significance of cholesterol and conversion of cholesterol into bile acids, steroid hormone and vitamin D Disorders of lipid metabolism: Hypercholesterolemia, atherosclerosis, fatty liver and obesity. • Amino acid metabolism General reactions of amino acid metabolism: Transamination, deamination & decarboxylation, urea cycle and its disorders Catabolism of phenylalanine and tyrosine and their metabolic disorders (Phenylketonuria, Albinism, alkeptonuria, tyrosinemia) Synthesis and significance of biological substances; 5-HT, melatonin, dopamine, noradrenaline, adrenaline Catabolism of heme; hyperbilirubinemia and jaundice.

Module 4: NUCLEIC ACID METABOLISM ***(10 Periods)***

Nucleic acid metabolism and genetic information transfer Biosynthesis of purine and pyrimidine nucleotides Catabolism of purine nucleotides and Hyperuricemia and Gout disease Organization of mammalian genome Structure of DNA and RNA and their functions DNA replication (semi conservative model) Transcription or RNA synthesis Genetic code, Translation or Protein synthesis and inhibitors.

Module 5: ENZYMES INTRODUCTION ***(07 Periods)***

Enzymes Introduction, properties, nomenclature and IUB classification of enzymes Enzyme kinetics (Michaelis plot, Line Weaver Burke plot) Enzyme inhibitors with examples Regulation of enzymes: enzyme induction and repression, allosteric enzymes regulation Therapeutic and diagnostic applications of enzymes and isoenzymes Coenzymes –Structure and biochemical functions.

Total Periods: 45

RESOURCES

TEXTBOOKS:

1. Textbook of Biochemistry by Rama Rao.
2. Textbook of Biochemistry by Deb.
3. Biochemistry by Stryer
4. Outlines of Biochemistry by Conn and Stumpf

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=tpBAmzQ_pUE
2. https://www.pexels.com/search/videos/biochemistry/
3. https://ocw.mit.edu/courses/7-05-general-biochemistry-spring-2020/video_galleries/video-lectures/

WEB RESOURCES:

1. https://biochem.oregonstate.edu/undergraduate/educational-resources
2. https://guides.lib.utexas.edu/biochemistry
3. https://www.biochim.ro/web-resources/

Course Code	Course Title	L	T	P	C
23PC101003	**PATHOPHYSIOLOGY**	**3**	**1**	**-**	**4**

Pre-Requisite -
Anti-Requisite -
Co-Requisite -

COURSE DESCRIPTION: Upon completion of this course the student should be able to analyse the abnormal morphological structure and functions of various diseases in human body.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Comprehend the principles of cell injury and basic mechanism involved in inflammation.
CO2. Comprehend the clinical characteristics and complications of cardiovascular system, Respiratory system and Renal system.
CO3. comprehend the etiopathogenesis, clinical characteristics and complications of Hematological disease. Disease associated with Endocrine system, Nervous system and GI system.
CO4. comprehend the etiopathogenesis, clinical characteristics and complications of cancer, Disease associated with joints and Bones, Hepatitis.
CO5. comprehend the etiopathogenesis, clinical characteristics and complications of infectious disease.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	1	-	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	1	-	-	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	1	-	-	-	-	-	-	-	-	-	-	-	-	3	-
CO5	3	1	-	-	-	-	-	-	-	-	-	-	-	-	3	-
Course Correlation Mapping	**3**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**

Correlation Levels: ***3: High;*** ***2: Medium;*** ***1: Low***

COURSE CONTENT

Module 1: CELL INJURY AND INFLAMMATION ***(10 Periods)***

Basic principles of Cell injury and Adaptation:

Introduction, definitions, Homeostasis, Components and Types of Feedback systems, Causes of cellular injury**,** Pathogenesis (Cell membrane damage, Mitochondrial damage, Ribosome damage, Nuclear damage)**,** Morphology of cell injury – Adaptive changes (Atrophy, Hypertrophy, hyperplasia, Metaplasia, Dysplasia)**,** Cell swelling, Intra cellular accumulation, Calcification, Enzyme leakage and Cell Death Acidosis & Alkalosis, Electrolyte imbalance

Basic mechanism involved in the process of inflammation and repair:

Introduction, Clinical signs of inflammation, Different types of Inflammation, Mechanism of Inflammation – Alteration in vascular permeability and blood flow, migration of WBC's, Mediators of inflammation, Basic principles of wound healing in the skin, Pathophysiology of Atherosclerosis.

Module 2: CARDIOVASCULAR SYSTEM, RESPIRATORY SYSTEM AND RENAL SYSTEM ***(10 Periods)***

Cardiovascular System:

Hypertension, congestive heart failure, ischemic heart disease (angina, myocardial infarction, atherosclerosis, and arteriosclerosis)

Respiratory system: Asthma, Chronic obstructive airways diseases.

Renal system: Acute and chronic renal failure.

Module 3: PATHOPHYSIOLOGY OF BLOOD, GIT, ENDOCRINE AND NERVOUS SYSTEM. ***(10 Periods)***

Haematological Diseases:

Iron deficiency, megaloblastic anemia (Vit B12 and folic acid), sickle cell anemia, thalasemia, hereditary acquired anemia, hemophilia

Endocrine system: Diabetes, thyroid diseases, disorders of sex hormones

Nervous system: Epilepsy, Parkinson's disease, stroke, psychiatric disorders:

Depression, schizophrenia and Alzheimer's disease.

Gastrointestinal system: Peptic Ulcer

Module 4: PATHOPHYSIOLOGY OF BONES, JOINTS, AND CANCER. ***(08 Periods)***

Inflammatory bowel diseases, jaundice, hepatitis (A, B,C,D,E,F) alcoholic liver disease.

Disease of bones and joints: Rheumatoid arthritis, osteoporosis and gout

Principles of cancer: classification, etiology and pathogenesis of cancer

Diseases of bones and joints: Rheumatoid Arthritis, Osteoporosis, Gout

Principles of Cancer: Classification, etiology and pathogenesis of Cancer.

Module 5: PATHOPHYSIOLOGY OF INFECTIOUS AND SEXUALLY TRANSMITTED DISEASES. ***(07 Periods)***

Infectious diseases: Meningitis, Typhoid, Leprosy, Tuberculosis

Urinary tract infections

Sexually transmitted diseases: AIDS, Syphilis, Gonorrhea

Total Periods: 45

RESOURCES

TEXTBOOKS:

1. Vinay Kumar, Abul K. Abas, Jon C. Aster; Robbins &Cotran Pathologic Basis of Disease; South Asia edition; India; Elsevier; 2014.
2. HarshMohan; Text book of Pathology; 6th edition; India; Jaypee Publications; 2010.
3. Laurence B, Bruce C, Bjorn K. ; Goodman Gilman's The Pharmacological Basis of Therapeutics; 12th edition; New York; McGraw-Hill; 2011.

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=5wt5_mzkfrY
2. https://www.youtube.com/playlist?list=PLQrdx7rRsKfVmhC2RWJapeCJ3C73ZgffH
3. https://cosmolearning.org/courses/pathophysiology-lessons-from-armando/video-lectures

WEB RESOURCES:

1. https://libguides.nwpolytech.ca/patho/web
2. https://libguides.norquest.ca/pathophysiology
3. https://www.researchgate.net/post/Best_resource_Website_to_learn_the_pathology_of_any_disease

Course Code	Course Title	L	T	P	C
23PY101004	**COMPUTER APPLICATIONS IN PHARMACY**	**3**	**-**	**-**	**3**

Pre-Requisite -
Anti-Requisite -
Co-Requisite -

COURSE DESCRIPTION: This subject deals with the introduction Database, Database Management system, computer application in clinical studies and use of data bases.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Demonstrate knowledge on the Concepts of Number Systems, Information Systems, Web Technologies, and Databases used in Computing.

CO2. Apply the concepts of computing in Drug design and Drug dispensing system.

CO3. Demonstrate knowledge in Bio-informatics.

CO4. Apply computing system software for data analysis in Preclinical development.

CO5. Work independently to solve problems with effective communication.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	-	-	-	-	-	-	-	-	-	-		-	-	-	-
CO5	-	-		-	-	-	-	-	-	3	3	-	-	-	-	-
Course Correlation Mapping	**3**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**-**	**-**	**-**	**-**	**-**

Correlation Levels: ***3: High;*** ***2: Medium;*** ***1: Low***

COURSE CONTENT

Module 1: NUMBER SYSTEM AND CONCEPT OF INFORMATION SYSTEMS AND SOFTWARE. ***(06 Periods)***

Number system: Binary number system, Decimal number system, Octal number system, Hexadecimal number systems, conversion decimal to binary, binary to decimal, octal to binary etc, binary addition, binary subtraction – One's complement, Two's complement method, binary multiplication, binary division.

Concept of Information Systems and Software: Information gathering, requirement and feasibility analysis, data flow diagrams, process specifications, input/output design, process lifecycle, planning and managing the project.

Module 2: WEB TECHNOLOGIES ***(06 Periods)***

Introduction to HTML, XML, CSS and Programming languages, introduction to web servers and Server Products.

Introduction to databases, MYSQL, MS ACCESS, Pharmacy Drug database.

Module 3: APPLICATION OF COMPUTERS IN PHARMACY. ***(06 Periods)***

Application of computers in Pharmacy – Drug information storage and retrieval, Pharmacokinetics, Mathematical model in Drug design, Hospital and Clinical Pharmacy, Electronic Prescribing and discharge (EP) systems, barcode medicine identification and automated dispensing of drugs, mobile technology and adherence monitoring.

Diagnostic System, Lab-diagnostic System, Patient Monitoring System, Pharma Information System.

Module 4: BIOINFORMATICS. ***(06 Periods)***

Introduction, Objective of Bioinformatics, Bioinformatics Databases, Concept of Bioinformatics, Impact of Bioinformatics in Vaccine Discovery.

Module 5: COMPUTERS AS DATA ANALYSIS IN PRECLINICAL DEVELOPMENT ***(06 Periods)***

Chromatographic dada analysis (CDS), Laboratory Information management System (LIMS) and Text Information Management System (TIMS).

Total Periods: 30

RESOURCES

TEXTBOOKS:

1. Computer Application in Pharmacy – William E. Fassett –Lea and Febiger, 600 South Washington Square, USA, (215) 922-1330.
2. Computer Application in Pharmaceutical Research and Development – Sean Ekins – Wiley - Interscience, A John Willey and Sons, INC., Publication, USA
3. Bioinformatics (Concept, Skills and Applications) - S.C.Rastogi – CBS Publishers and Distributors, 4596/1-A, 11 Darya Gani, New-Delhi –110 002 (INDIA).

VIDEO LECTURES:

1. https://youtu.be/JDtXkqYQNtM
2. https://youtu.be/xIKCZCHFH1Q
3. https://youtu.be/cD69m7rJI_o
4. https://youtu.be/_U51pQLOIUI
5. https://youtu.be/QQEMb7m4MzM

WEB RESOURCES:

1. https://sist.sathyabama.ac.in/sist_coursematerial/uploads/BP205T.pdf
2. https://www.studocu.com/in/document/gla-university/computer-applications-in-pharmacy/computer-applications-in-pharmacy-notes/4078962

Course Code	Course Title	L	T	P	C
23PY101005	**ENVIRONMENTAL SCIENCES**	**3**	**-**	**-**	**3**

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: Environmental Sciences is the scientific study of the environmental system and the status of its inherent or induced changes on organisms. It includes not only the study of physical and biological characters of the environment but also the social and cultural factors and the impact of man on environment.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Understand the basics of various natural resources and environmental problems.

CO2. Understand the concept of an ecosystem, protection and improvement of various ecosystems.

CO3. Understand the concepts of air, water and soil pollutions.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	2	-	-	-	-	1	**-**	**-**	**-**
CO2	3	1	-	-	-	-	2	-	-	-	-	1	**-**	**-**	**-**
CO3	3	1	-	-	-	-	2	-	-	-	-	1	**-**	**-**	**-**
Course Correlation Mapping	**3**	**1**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**

Correlation Levels: ***3: High;*** ***2: Medium;*** ***1: Low***

COURSE CONTENT

Module 1: The Multidisciplinary nature of environmental studies. ***(10 Periods)***

Natural Resources,

Renewable and non-renewable resources:

Natural resources and associated problems

a) Forest resources; b) Water resources; c) Mineral resources; d) Food resources; e) Energy resources; f) Land resources: Role of an individual in conservation of natural resources.

Module 2: Ecosystems ***(10 Periods)***

- Concept of an ecosystem.
- Structure and function of an ecosystem.
- Introduction, types, characteristic features, structure and function of the ecosystems: Forest ecosystem; Grassland ecosystem; Desert ecosystem; Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

Module 3: Environmental Pollution ***(10 Periods)***

Air pollution; Water pollution; Soil pollution

Total Periods: 30

RESOURCES

TEXTBOOKS:

1. Y.K. Sing, Environmental Science, New Age International Pvt, Publishers,Bangalore.
2. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
3. Bharucha Erach, The Biodiversity of India, Mapin Pu blishing Pvt. Ltd., Ahmedabad – 380 013, Indi.,
4. Clark R.S., Marine Pollution, Clanderson Press Oxford.

VIDEO LECTURES:

1. https://sciencequery.com/desert-ecosystem-types-and-components/
2. https://youtu.be/ryaEocaxMwc

WEB RESOURCES:

1. https://www.google.co.in/books/edition/Pollution_5th_Edition/vzQfAgAAQBAJ?hl=en&gbpv=1&dq=air+pollution+causes&printsec=frontcover
2. https://www.britannica.com/science/water-pollution.
3. https://www.britannica.com/science/ecosystem

Course Code	Course Title	L	T	P	C
23PC105002	HUMAN ANATOMY AND PHYSIOLOGY-II PRACTICAL	-	-	4	2

Pre-Requisite -
Anti-Requisite -
Co-Requisite -

COURSE DESCRIPTION: Upon completion of this course the student should be able to Understand the gross morphology, structure and functions of various organs of the human body and perform the various experiments related to nerve, eye, lung, tongue, temperature and homeostatic mechanisms of the human body.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Comprehend the structure and functions of special sense organs, nervous system, digestive system, respiratory system, cardiovascular systems, urinary system and reproductive systems and endocrine system.

CO2. Perform the various experiments related to nerve, eye, lung, tongue, temperature and homeostatic mechanisms of the human body.

CO3. Work as an individual and as a member of a team to solve problems with effective communications.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	-	-	2	-	-	-	3	2	-	-	-	-	3	-
CO2	3	3	-	-	3	-	-	-	3	2	-	-	-	-	3	-
CO3	-	-	-	-	-	-	-	1	3	-	-	-	-	-	3	-
Course Correlation Mapping	**3**	**1**	**-**	**-**	**-**	**-**	**-**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**3**	**-**

Correlation Levels: ***3: High;*** ***2: Medium;*** ***1: Low***

COURSE CONTENT

EXPERIMENTS

1.
- To study the integumentary and special senses using specimen, models, etc.,
- To study the nervous system using specimen, models, etc.
- To study the endocrine system using specimen, models, etc

2.
- To demonstrate the general neurological examination
- To demonstrate the function of olfactory nerve
- To examine the different types of taste.
- To demonstrate the visual acuity
- To demonstrate the reflex activity
- Recording of body temperature
- To demonstrate positive and negative feedback mechanism.
- Determination of tidal volume and vital capacity.
- Study of digestive, respiratory, cardiovascular systems, urinary and reproductive systems with the help of models, charts and specimens.
- Recording of basal mass index.
- Study of family planning devices and pregnancy diagnosis test.
- Demonstration of total blood count by cell analyzer.
- Permanent slides of vital organs and gonads.

Course Code	Course Title	L	T	P	C
23PA105003	**PHARMACEUTICAL ORGANIC CHEMISTRY–I PRACTICAL**	**-**	**-**	**4**	**2**

Pre-Requisite -
Anti-Requisite -
Co-Requisite -

COURSE DESCRIPTION: Upon completion of the course, the student shall be able to Analyze a minimum of 5 unknown organic molecules and prepare a few solid derivatives from organic substances

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Accomplish knowledge on synthesis of compounds with pharmaceutical importance.
CO2. Perform qualitative analysis of compounds with diverse functional groups.
CO3. Work as an individual and as a member of a team to solve problems with effective communications.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	1	2	2	-	-	-	3	2	-	-	-	3	-	-
CO2	3	3	1	-	2	-	-	-	3	2	-	-	-	3	-	-
CO3	-	-	-	-	-	-	-	-	3	-	-	-	-	3	-	-
Course Correlation Mapping	**3**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

Correlation Levels: ***3: High;*** ***2: Medium;*** ***1: Low***

COURSE CONTENT

EXPERIMENTS

1. Systematic qualitative analysis of unknown organic compounds like

a. Preliminary test: Color, odour, aliphatic/aromatic compounds, saturation and unsaturation, etc.
b. Detection of elements like Nitrogen, Sulphur and Halogen by Lassaigne's test
c. Solubility test
d. Functional group test like Phenols, Amides/Urea, Carbohydrates, Amines, Carboxylic acids, Aldehydes and Ketones, Alcohols, Esters, Aromatic and Halogenated Hydrocarbons, Nitro compounds and Anilides.
e. Melting point/ Boiling point of organic compounds
f. Identification of the unknown compound from the literature using melting point/ boiling point.
g. Preparation of the derivatives and confirmation of the unknown compound by melting point/ boiling point.
h. Minimum 5 unknown organic compounds to be analysed systematically.

2. Preparation of suitable solid derivatives from organic compounds.

3. Construction of molecular models.

Course Code	Course Title	L	T	P	C
23PA105004	**BIOCHEMISTRY PRACTICAL**	**-**	**-**	**4**	**2**

Pre-Requisite -
Anti-Requisite -
Co-Requisite -

COURSE DESCRIPTION: Biochemistry Practical course makes the students to understand the importance of different biochemical tests and their clinical applications.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Perform qualitative analysis of various biochemical parameters present in blood and urine and to interpret the clinical relevance based on observation.

CO2. Perform quantitative analysis of various biochemical parameters present in blood and urine and to interpret the clinical conditions based on the results.

CO3. Carry out experiments to study the factors affecting enzyme activity.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	1	-	2	-	-	-	3	2	-	-	-	3	-	-
CO2	3	2	1	-	3	-	-	-	3	2	-	-	-	3	-	-
CO3	-	-	-	-	-	-	-	-	3	-	-	-	-	3	-	-
Course Correlation Mapping	**3**	**1**	**1**	**-**	**2**	**-**	**-**	**-**	**3**	**2**	**-**	**-**	**-**	**3**	**-**	**-**

Correlation Levels: ***3: High;*** ***2: Medium;*** ***1: Low***

COURSE CONTENT

EXPERIMENTS

1. Qualitative analysis of carbohydrates (Glucose, Fructose, Lactose, Maltose, Sucrose and starch)
2. Identification tests for Proteins (albumin and Casein)
3. Quantitative analysis of reducing sugars (DNSA method) and Proteins (Biuret method)
4. Qualitative analysis of urine for abnormal constituents
5. Determination of blood creatinine
6. Determination of blood sugar
7. Determination of serum total cholesterol
8. Preparation of buffer solution and measurement of Ph
9. Study of enzymatic hydrolysis of starch
10. Determination of Salivary amylase activity
11. Study the effect of Temperature on Salivary amylase activity.

Course Code	Course Title	L	T	P	C
23PY105003	COMPUTER APPLICATIONS IN PHARMACY PRACTICAL	-	-	2	1

Pre-Requisite -
Anti-Requisite -
Co-Requisite -

COURSE DESCRIPTION: This subject deals with the introduction Database, Database Management system, computer application in clinical studies and use of databases.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Demonstrate knowledge on the Concepts of Number Systems, Information Systems, Web Technologies, and Databases used in Computing.

CO2. Work independently to solve problems with effective communication.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	1	-	-	-	-	-	-	-	-	-		-	-	-	-
CO2	-	-	-	-	-	-	-	-	-	-	3	3	-	-	-	-
Course Correlation Mapping	3	1	-	-	-	-	-	-	-	-	2	2	-	-	-	-

Correlation Levels: ***3: High;*** ***2: Medium;*** ***1: Low***

COURSE CONTENT

EXPERIMENTS

1. Design a questionnaire using a word processing package to gather information about a particular disease.
2. Create a HTML webpage to show personal information.
3. Retrieve the information of a drug and its adverse effects using online tools.
4. Creating mailing labels Using Label Wizard, generating label in MSWORD.
5. Create a data base in MS Access to store the patient information with the required fields Using access.
6. Design a form in MS Access to view, add, delete and modify the patient record in the database.
7. Generating report and printing the report from patient database.
8. Creating invoice table using–MS Access.
9. Drug information storage and retrieval using MS Access
10. Creating and working with queries in MS Access.
11. Exporting Tables, Queries, Forms and Reports to webpages.

III SEMESTER

Course Code	PHARMACEUTICAL ORGANIC CHEMISTRY-II	L	T	P	C
23PA101005		3	1	-	4

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION:

This subject deals with the classification and nomenclature of simple organic compounds, structural isomerism, intermediates forming in reactions, important physical properties, reactions, and methods of preparation of these compounds. The syllabus also emphasizes on mechanisms and orientation of reactions.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1.	Shall be able to write the structure, name, synthesis, and reactions of aromatic benzene, naphthalene, anthracene, and cycloalkanes (cyclopropane and cyclobutane).
CO2.	Able to compare the reactivity of organic compounds.
CO3.	Understand the concept of resonance
CO4.	Chemistry of fats and oils is also included and students will understand analytical constants' applications like acid value, saponification value, and ester value useful in the quality assurance of oils and fats.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	3	-	2	-	-	-	-	-	-	-	-	-	-	3	-	-
CO3	3	-	-	-	-	1	-	-	-	-	-	-	-	3	-	-
CO4	3	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-
Course Correlation Mapping																

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1 Benzene and its derivatives (10 Periods)

- Analytical, synthetic, and other evidence in the derivation of the structure of benzene, Orbital picture, resonance in benzene, characters, and Huckel's rule.
- Reactions of benzene - nitration, sulphonation, halogenation-reactivity, Friedel crafts alkylation- reactivity, limitations, Friedel crafts acylation.
- Substituents, the effect of substituents on reactivity and orientation of mono-substituted benzene compounds towards electrophilic substitution reaction
- Structure and uses of DDT, Saccharin, BHC, and Chloramine.

Module 2 Phenols, Aromatic amines and Aromatic acids (10 Periods)

- **Phenols:** The acidity of phenols, the effect of substituents on acidity, qualitative tests, Structure and uses of phenol, cresols, resorcinol, and naphthols.
- **Aromatic Amines*** - Basicity of amines, the effect of substituents on basicity, and synthetic uses of aryl diazonium salts
- **Aromatic Acids*** –Acidity, the effect of substituents on acidity, and important reactions of benzoic acid.

Module 3 Fats and Oils (10 Periods)

- Fatty acids – reactions.
- Hydrolysis, Hydrogenation, Saponification and Rancidity of oils, Drying oils.
- Analytical constants – Acid value, Saponification value, Ester value, Iodine value, Acetyl value, Reichert Meissl (RM) value – significance and principle involved in their determination.

Module 4 Polynuclear hydrocarbons: (08 Periods)

- Synthesis, reactions
- Structure and medicinal uses of Naphthalene, Phenanthrene, Anthracene, Diphenylmethane, Triphenylmethane, and their derivatives.

Module 5 Cyclo alkanes* (07 Periods)

- stabilities – Baeyer's strain theory, limitation of Baeyer's strain theory, Coulson and Moffitt's modification, Sachse Mohr's theory (Theory of strainless rings), reactions of cyclopropane and cyclobutane only.

Total 45 periods

General methods of preparation and reactions of compounds superscripted with asterisk (*) to be explained to emphasize on definition, types, classification, principles/mechanisms, applications, examples, and differences.

RESOURCES

REFERENCES:

1. Bahl, B.S. & Bahl, Arun. (Title: "Textbook of Organic Chemistry")
2. Finar, I.L. (Title: "Organic Chemistry, Volume-I")
3. Mann, A. & Saunders, D.R. (Title: "Practical Organic Chemistry")
4. Morrison, R.T. & Boyd, R.N. (Title: "Organic Chemistry")
5. Soni, P.L. (Title: "Organic Chemistry")
6. Vogel, A.I. (Title: "Vogel's Textbook of Practical Organic Chemistry")

VIDEO LECTURES:

1 https://youtu.be/d86lQloVCf0?si=4lbEm72pQ5eeddou
2 https://youtu.be/w0cPN1KuuSk?si=RDfiD10weVGIy4IR
3 https://youtu.be/brs2nMubr84?si=At1gJEmC7ODbxDlH

WEB RESOURCES:

1 https://courseware.cutm.ac.in/wp-content/uploads/2020/06/AromaticAcids-and-Effect-of-substitution-on-aromaticity.pdf
2 https://www.researchgate.net/publication/325737820_UNIT-II_Phenols_Acidity_of_phenols_effect_of_substituents_on_acidity_qualitative_tests_Structure_and_uses_of_phenol_cresols_resorcinol_naphthols_Dr_Sumanta_Mondal_Lecture_Notes_Pharmaceutical_Organic_
3 https://egyankosh.ac.in/bitstream/123456789/59581/1/Unit11.pdf
4 https://www.studocu.com/in/document/maulana-abul-kalam-azad-university-of-technology/pharmaceutical-organic-chemistry-ii/baeyers-stain-theory-with-limitations-coulson-moffits-modification-sachse-mohr-theory/43533280
5 https://www.abcam.com/pathways/fatty-acid-oxidation

Course Code	Course Title	L	T	P	C
23PH101002	**PHYSICAL PHARMACEUTICS-I**	**3**	**1**	**-**	**4**

Pre-Requisite -
Anti-Requisite -
Co-Requisite -

COURSE DESCRIPTION: the course deals with the various physical and physicochemical properties, and principles involved in dosage forms/formulations. Theory and practical components of the subject help the student to get a better insight into various areas of formulation research and development, and stability studies of pharmaceutical dosage forms.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Understand various physicochemical properties of drug molecules in the designing the dosage forms

CO2. Know the principles of chemical kinetics & to use them for stability testing and determination of expiry date of formulations

CO3. Describe the concept of complexation and protein binding. Analyze the chemical stability tests of various drug products

CO4. Demonstrate use of physicochemical properties in the formulation development and evaluation of dosage forms.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	-	-	1	2	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	1	2	-	-	-	-	-	-	-	-	-	-	-
CO3	3	-	-	1	2	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-		1	-	-	-	-	-	-	-	-	-	-	-
Course Correlation Mapping	**3**	**2**		**1**	**2**								**-**	**-**	**-**	

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1 Solubility of drugs (10 Periods)

Solubility expressions, mechanisms of solute solvent interactions, ideal solubility parameters, solvation & association, quantitative approach to the factors influencing solubility of drugs, diffusion principles in biological systems. Solubility of gas in liquids, solubility of liquids in liquids, (Binary solutions, ideal solutions) Raoult's law, real solutions. Partially miscible liquids, Critical solution temperature, and applications. Distribution law, its limitations and applications.

Module 2 States of Matter and properties of matter (10 Periods)

State of matter, changes in the state of matter, latent heats, vapour pressure, sublimation critical point, eutectic mixtures, gases, aerosols – inhalers, relative humidity, liquid complexes, liquid crystals, glassy states, solid crystalline, amorphous & polymorphism.

Physicochemical properties of drug molecules:

Refractive index, optical rotation, dielectric constant, dipole moment, dissociation constant, determinations and applications

Module 3 Surface and interfacial phenomenon (10 Periods)

Liquid interface, surface & interfacial tensions, surface free energy, measurement of surface & interfacial tensions, spreading coefficient, adsorption at liquid interfaces, surface active agents, HLB Scale, solubilisation, detergency, adsorption at solid interface.

Module 4 Complexation and protein binding (08 Periods)

Introduction, Classification of Complexation, Applications, methods of analysis, protein binding, Complexation and drug action, crystalline structures of complexes, and thermodynamic treatment of stability constants.

Module 5 pH, buffers, and Isotonic solutions (07 Periods)

Sorensen's pH scale, pH determination (electrometric and calorimetric), applications of buffers, buffer equation, buffer capacity, buffers in pharmaceutical and biological systems, and buffered isotonic solutions.

Total 45 Periods

RESOURCES
REFERENCES:

1. Cooper, J., & Gunn, C. (Title: "Tutorial Pharmacy")
2. Liberman, H.A., Lachman, L., (Year). Pharmaceutical Dosage Forms: Tablets, Volumes 1-3. Marcel Dekkar Inc.
3. Martin, Alfred. (Title: "Physical Pharmacy")
4. Ramasamy, C., & Manavalan, R. (Title: "Physical Pharmaceutics")
5. Subramanyam, C.V.S. (Title: "Physical Pharmaceutics")

VIDEO LECTURES:

1. https://youtu.be/p4XBX2XZFzo
2. https://youtu.be/pWdpCqXeNBo
3. https://youtu.be/MxEbggL08FM
4. https://youtu.be/G7U7vt9bGy8
5. https://youtu.be/x_5GGBtsugE
6. https://youtu.be/dlXyPtEgzI8

WEB RESOURCES:

1. https://www.iptsalipur.org/wpcontent/uploads/2020/08/BP302T_PYP_UNIT_I.pdf
2. https://www.slideshare.net/JILSHA123/states-of-matter-and-properties-of-matter-238444571
3. https://www.slideshare.net/MahewashPathan/physicochemical-properties-of-drug-molecules-238140887
4. https://www.slideshare.net/RahulPals/surface-and-interfacial-phenomenon
5. https://www.iptsalipur.org/wpcontent/uploads/2020/08/BP302T_PYP_UNIT_IV.pdf

Course Code	Course Title	L	T	P	C
23PH101003	**PHARMACEUTICAL MICROBIOLOGY**	**3**	**1**	**0**	**4**

Pre-Requisite -
Anti-Requisite -
Co-Requisite -

COURSE DESCRIPTION: Study of all categories of microorganisims especially for the production of alcohol, antibiotics, vaccines, vitamins enzymes etc

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. To understand methods of identification, cultivation and preservation of various microorganisms.
CO2. To understand the importance and implementation of sterilization in pharmaceutical processing and industry.
CO3. To learn sterility testing of pharmaceutical products.
CO4. To understand the cell culture technology and its applications in pharmaceutical industries.
CO5. To learn and carry out the microbiological standardization of Pharmaceuticals.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	2	-	3	-	2	2	-	-	-	-	-	2	-	3	3
CO2	2	2	-	3	-	2	2	-	-	-	-	-	1	-	2	2
CO3	2	2	-	3	-	2	2	-	-	-	-	-	2	-	3	3
CO4	2	2	-	3	-	2	2	-	-	-	-	-	2	-	2	2
CO5	2	2	-	3	-	2	2	-	-	-	-	-	1	-	3	3
Course Correlation Mapping	**3**	**1**	**-**	**3**	**-**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**3**	**3**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1 Introduction to microbes (10 Periods)

Introduction, history of microbiology, its branches, scope and its importance. Introduction to Prokaryotes and Eukaryotes, Study of ultra-structure and morphological classification of bacteria, nutritional requirements, raw materials used for culture media and physical parameters for growth, growth curve, isolation and preservation methods for pure cultures, cultivation of anaerobes, quantitative measurement of bacterial growth (total & viable count). Study of different types of phase constrast microscopy, dark field microscopy and electron microscopy.

Module 2 Identification of microbes (10 Periods)

Identification of bacteria using staining techniques (simple, Gram's & Acid-fast staining) and biochemical tests (IMViC). Study of principle, procedure, merits, demerits and applications of physical, chemical gaseous, radiation and mechanical method of sterilization. Evaluation of the efficiency of sterilization methods. Equipments employed in large scale sterilization. Sterility indicators.

Module 3 Growth and study of antibiotics (10 Periods)

Growth of animal cells in culture, general procedure for cell culture, primary, established and transformed cell cultures. Study of morphology, classification, reproduction/replication and cultivation of Fungi and Viruses. Classification and mode of action of disinfectants. Factors influencing disinfection, antiseptics and their evaluation. For bacteriostatic and bactericidal actions. Evaluation of bactericidal & Bacteriostatic. Sterility testing of products (solids, liquids, ophthalmic and other sterile products) according to IP, BP and USP.

Module 4 Sources of contamination and Microbiological Assay (08 Periods)

Designing of aseptic area, laminar flow equipments; study of different sources of contamination in an aseptic area and methods of prevention, clean area classification. Principles and methods of different microbiological assay. Methods for standardization of antibiotics, vitamins and amino acids. Assessment of a new antibiotic.

Module 5 Protecting Pharmaceutical Products (07Periods)

- Types of spoilage, factors affecting the microbial spoilage of pharmaceutical products, sources and types of microbial contaminants, assessment of microbial contamination and spoilage.
- Preservation of pharmaceutical products using antimicrobial agents, evaluation of microbial stability of formulations.
- Application of cell cultures in pharmaceutical industry and research

Total 45 Periods

RESOURCES

REFERENCES:

1. Harris, M. "Pharmaceutical Microbiology". Balliere Tindall and Cox.
2. Hugo, W.B., & Russel, A.D. "Pharmaceutical Microbiology". Blackwell Scientific Publications.
3. Pelczar, M.J., Chan, E.C.S., & Krieg, N.R. "Microbiology". Tata McGraw Hill.
4. Prescott, S.C., & Dunn, C.G. "Industrial Microbiology", 4th edition. CBS Publishers & Distributors.

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=1HeW32AoxoA
2. https://www.youtube.com/playlist?list=PLGi86CfCcpDYboTdCH5nXuAPQYf37iMVC
3. https://youtu.be/YwdYf4Yd3DE?si=67LegCfhzDGG5qO-

WEB RESOURCES:

1. Malcolm Harris, Balliere Tindall and Cox: Pharmaceutical Microbiology.
2. Rose: Industrial Microbiology.
3. Cooper and Gunn's: Tutorial Pharmacy, CBS Publisher and Distribution.
4. Probisher, Hinsdill et al: Fundamentals of Microbiology, 9th ed. Japan

Course Code	Course Title	L	T	P	C
23PH101004	Pharmaceutical Engineering	3	1	-	4

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course is designed to impart a fundamental knowledge on the art and science of various unit operations that are applicable in pharmaceutical industry.

COURSE OUTCOMES: After successful completion of the course, students will be able:

To know various unit operations used in pharmaceutical industries

CO2. To understand the material handling techniques

CO3. To perform various processes involved in pharmaceutical manufacturing process.

CO4. To carry out various test to prevent environmental pollution.

CO5. To appreciate and comprehend significance of plant lay out design for optimum use of resources.

CO6. To appreciate the various preventive methods used for corrosion control in Pharmaceutical industries

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	2	-	-	2	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	2	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	2	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	2	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	2	-	-	-	-	-	-	-	-	-	-	-
CO6	3	2	-	-	2	-	-	-	-	-	-	-	-	-	-	-
Course Correlation Mapping	**3**	**2**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1 Flow of fluids, Size reduction and Size separation (10 Periods)

Flow of fluids: Types of manometers, Reynolds number and its significance, Bernoulli's theorem and its applications, Energy losses, Orifice meter, Venturimeter, Pitot tube and Rotometer.
Size Reduction: Objectives, Mechanisms & Laws governing size reduction, factors affecting size reduction, principles, construction, working, uses, merits and demerits of Hammer mill, ball mill, fluid energy mill, Edge runner mill & end runner mill.
Size Separation: Objectives, applications & mechanism of size separation, official standards of powders, sieves, size separation Principles, construction, working, uses, merits and demerits of Sieve shaker, cyclone separator, Airseparator, Bag filter & elutriation tank.

Module 2 Heat transfer, Evaporation and Distillation (10 Periods)

Heat Transfer: Objectives, applications & Heat transfer mechanisms. Fourier's law, Heat transfer by conduction, convection & radiation. Heat interchangers & heat exchangers.
Evaporation: Objectives, applications and factors influencing evaporation, differences between evaporation and other heat process. principles, construction, working, uses, merits and demerits of Steam jacketed kettle, horizontal tube evaporator, climbing film evaporator, forced circulation evaporator, multiple effect evaporator& Economy of multiple effect evaporator.
Distillation: Basic Principles and methodology of simple distillation, flash distillation, fractional distillation, distillation under reduced pressure, steam distillation & molecular distillation

Module 3 Drying and Mixing (10 Periods)

Drying: Objectives, applications & mechanism of drying process, measurements & applications of Equilibrium Moisture content, rate of drying curve. principles, construction, working, uses, merits and demerits of Tray dryer, drum dryer spray dryer, fluidized bed dryer, vacuum dryer, freeze dryer.
Mixing: Objectives, applications & factors affecting mixing, Difference between solid and liquid mixing, mechanism of solid mixing, liquids mixing and semisolids mixing. Principles, Construction, Working, uses, Merits and Demerits of Double cone blender, twin shell blender, ribbon blender, Sigma blade mixer, planetary mixers, Propellers, Turbines, Paddles & Silverson Emulsifier.

Module 4 Filtration and Centrifugation (08 Periods)

Filtration: Objectives, applications, Theories & Factors influencing filtration, filter aids, filter medias. Principle, Construction, Working, Uses, Merits and demerits of plate & frame filter, filter leaf, rotary drum filter, Meta filter & Cartridge filter, membrane filters and Seidtz filter.
Centrifugation: Objectives, principle & applications of Centrifugation, principles, construction, working, uses, merits and demerits of Perforated basket centrifuge, Non-perforated basket centrifuge, semi continuous centrifuge & super centrifuge.

Module 5 Corrosion and prevention (07 Periods)

Materials of pharmaceutical plant construction, Corrosion and its prevention: Factors affecting during materials selected for Pharmaceutical plant construction, Theories of corrosion, types of corrosion and there prevention. Ferrous and nonferrous metals, inorganic and organic non metals, basic of material handling systems.

Total 45

Periods

RESOURCES

REFERENCES:

1. Badger, W.L., & Banchero, J. "Introduction to Chemical Engineering".
2. Carter, S.J. "Cooper and Gunn's Tutorial Pharmacy".
3. Lachman, L., Lieberman, H.A., & Kanig, J.L. "Theory and Practice of Industrial Pharmacy".
4. Martin, A. "Remington Practice of Pharmacy".
5. McCabe, W.L., Smith, J.C., & Harriott, P. "Unit Operations of Chemical Engineering".
6. Simpson, N.J.K. "Solid Phase Extraction: Principles, Techniques, and Applications".
7. Subrahmanyam, C.V.S., et al. "Pharmaceutical Engineering: Principles and Practices".
8. Subrahmanyam, C.V.S., et al. "Physical Pharmaceutics".

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=3fKUqLEu1w0
2. https://www.youtube.com/watch?v=KuxPhDfTTJQ
3. https://www.youtube.com/watch?v=q984-ewU5Bw

WEB RESOURCES:

1. https://www.pharmaguideline.com/2007/02/size-separation-objectives-applications-machanism-of-size-separation.html
2. https://www.pharmaguideline.com/2007/02/objectives-principle-and-applications-of-centrifugation.html

Course Code	Course Title	L	T	P	C
23PH105002	PHYSICAL PHARMACEUTICS–I PRACTICAL	-	-	4	2

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: The components of the course help the student to get a better insight into various areas of formulation research and development, and stability studies of pharmaceutical dosage forms.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Explain the solubility of drugs at different temperatures and interpret scientific data, represent the data in a tabular and/or graphical form.

CO2. Determine the effect of temperature, pH, solvent, and co-solvent on solubility

CO3. Calculate critical solution temperature & effect of addition of electrolyte on CST of Phenol-water system, solubility, partition coefficient, molecular weight, heat of solution of given compounds

CO4. Determine the stability constant.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	-	-	2	1	-	-	-	-	-	-	-	2	-	-	-
CO2	3	-	-	2	1	-	-	-	-	-	-	-	2	-	-	-
CO3	3	-	-	2	1	-	-	-	-	-	-	-	2	-	-	-
CO4	3	-	-	2	1	-	-	-	-	-	-	-	2	-	-	-
Course Correlation Mapping	**3**	**-**	**-**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**-**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

EXPERIMENTAL LEARNING	
1	Determination of the solubility of the drug at room temperature
2	Determination of pKa value by Half Neutralization/ Henderson Hasselbalch
3	Determination of Partition co-efficient of benzoic acid in benzene and water
4	Determination of Partition co-efficient of Iodine in CCl4 and water
5	Determination of % composition of NaCl in a solution using phenol-water system by CST method
6	Determination of surface tension of given liquids by drop count and drop weight method
7	Determination of the HLB number of a surfactant by saponification method
8	Determination of Freundlich and Langmuir constants using activated charcoal
9	Determination of critical micellar concentration of surfactants
10	Determination of stability constants and donor-acceptor ratio of PABA-Caffeine complex by solubility method
11	Determination of stability constants and donor-acceptor ratio of Cupric-Glycine complex by pH titration method

Course Code	COURSE TITLE	L	T	P	C
23PH105003	PHARMACEUTICAL MICROBIOLOGY PRACTICAL	-	-	4	2
Pre-Requisite	-				
Anti-Requisite	-				
Co-Requisite	-				
COURSE DESCRIPTION:					
COURSE OUTCOMES: After successful completion of the course, students will be able to:					

CO1. Understand methods of identification, cultivation and preservation of various microorganisms

CO2. To understand the importance and implementation of sterlization in pharmaceutical processing and industry

CO3. Understand the cell culture technology and its applications in pharmaceutical industries.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	2	-	2	-	-	-	-	-	-	-	-	2	2	-	2
CO2	3	2	-	2	-	-	-	-	-	-	-	-	2	2	-	1
CO3	3	2	-	2	-	-	-	-	-	-	-	-	1	2	-	2
Course Correlation Mapping	**3**	**2**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**-**	**2**

Correlation Levels: 3: High; 2: Medium; 1: Low

Course Content

EXPERIMENTAL LEARNING

1. Introduction and study of different equipment and processing, e.g., B.O.D. incubator, laminar flow, aseptic hood, autoclave, hot air sterilizer, deep freezer, refrigerator, and microscopes used in experimental microbiology.
2. Sterilization of glassware, preparation, and sterilization of media.
3. Subculturing of bacteria and fungus. Nutrient stabs and slants preparations.
4. Staining methods- Simple, Grams staining and acid-fast staining (Demonstration with practical).
5. Isolation of pure culture of micro-organisms by multiple streak plate techniques and other techniques.
6. Microbiological assay of antibiotics by cup plate method and other methods
7. Motility determination by Hanging drop method.
8. Sterility testing of pharmaceuticals
9. Bacteriological analysis of water
10. Biochemical test.

Course Code	COURSE TITLE	L	T	P	C
23PH105004	PHARMACEUTICAL ENGINEERING PRACTICAL	-	-	4	2
Pre-Requisite	-				
Anti-Requisite	-				
Co-Requisite	-				
COURSE DESCRIPTION:					
COURSE OUTCOMES: After successful completion of the course, students will be able to:					

CO1. To understand the material handling techniques
CO2. To know various unit operations used in pharmaceutical industries
CO3. To perform various processes involved in the pharmaceutical manufacturing process

CO-PO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	-	-	-	-	-	-	-	-	-	-	2	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	2	-	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	2	-	-	-
Course Correlation Mapping	3	3	-	-	-	-	-	-	-	-	-	-	2	-	-	-

Correlation Levels: 3: High; 2: Medium; 1: Low

Course Content

EXPERIMENTAL LEARNING

1 Determination of radiation constant of brass, iron, unpainted, and painted
2 Steam distillation – To calculate the efficiency of steam distillation.
3 To determine the overall heat transfer coefficient by heat exchanger
4 Construction of drying curves (for calcium carbonate and starch).
5 Determination of moisture content and loss on drying
6 Determination of humidity of air – i) From wet and dry bulb temperatures – use of
Dew point method.
7 Description of Construction working and application of Pharmaceutical Machinery such as rotary tablet machine, fluidized bed coater, fluid energy mill,
and dehumidifier.
8 Size analysis by sieving – To evaluate the size distribution of tablet granulations –
Construction of various size frequency curves including arithmetic
And logarithmic probability plots.
9 Size reduction: To verify the laws of size reduction using a ball mill and determining Kicks, Rittinger's, Bond's coefficients, power requirement and the critical speed of the Ball Mill.
10 Demonstration of colloid mill, planetary mixer, fluidized bed dryer, freeze dryer
and such other major equipment
11 Factors affecting Rate of Filtration and Evaporation (Surface area, Concentration
and Thickness/ Viscosity.
12 To study the effect of time on the Rate of Crystallization.
13 To calculate the uniformity Index for a given sample by using Double Cone Blender.

IV SEMESTER

Course Code	Course Title	L	T	P	C
23PA101006	PHARMACEUTICAL ORGANIC CHEMISTRY-III	3	1	-	4

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This subject imparts knowledge on stereo-chemical aspects of organic compounds and organic reactions, important named reactions, chemistry of important heterocyclic compounds. It also emphasizes medicinal and other uses of organic compounds.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Understand the methods of preparation and properties of organic compounds.
CO2. Explain the stereo-chemical aspects of organic compounds and stereo-chemical Reactions.
CO3. Know the medicinal uses and other applications of organic compounds.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	2	-	2	2	-	-	-	-	-	1	-	2	-	3	-	-
CO2	2	-	2	2	-	-	-	-	-	1	-	1	-	3	-	-
CO3	2	-	2	2	-	-	-	-	-	1	-	1	-	2	-	-
Course Correlation Mapping	2	-	2	2	-	-	-	-	-	1	-	2	-	3	-	-

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1 Stereo isomerism (10 Periods)

Optical isomerism – Optical activity, enantiomerism, diastereoisomerism, meso compounds Elements of symmetry, chiral and achiral molecules DL system of nomenclature of optical isomers, sequence rules, RS system of nomenclature of optical isomers Reactions of chiral molecules Racemic modification and resolution of racemic mixture. Asymmetric synthesis: partial and absolute.

Module 2 Geometrical isomerism (10 Periods)

Nomenclature of geometrical isomers (Cis Trans, EZ, Syn Anti systems) Methods of determination of configuration of geometrical isomers. Conformational isomerism in Ethane, n-Butane, and Cyclohexane. Stereo isomerism in biphenyl compounds (Atropisomerism) and conditions for optical activity. Stereospecific and stereoselective reactions.

Module 3 Heterocyclic compounds (10 Periods)

Nomenclature and classification Synthesis, reactions, and medicinal uses of following compounds/derivatives - Pyrrole, Furan, and Thiophene Relative aromaticity and reactivity of Pyrrole, Furan, and Thiophene.

Module 4 Synthesis, reactions, and medicinal uses of Heterocyclic compounds (08 Periods)

Synthesis, reactions, and medicinal uses of the following compounds/derivatives - Pyrazole, Imidazole, Oxazole, and Thiazole. Pyridine, Quinoline, Isoquinoline, Acridine and Indole. Basicity of pyridine Synthesis and medicinal uses of Pyrimidine, Purine, azepines, and their derivatives.

Module 5 Reactions of Synthetic Importance (07 Periods)

Metal hydride reduction (NaBH4 and LiAlH4), Clemmensen reduction, Birch reduction, Wolff Kishner reduction. Oppenauer-oxidation and Dakin reaction. Beckmann rearrangement and Schmidt rearrangement. Claisen-Schmidt condensation.

Total 45 periods

RESOURCES

TEXTBOOKS:	
1.	Bahl, Arun, & Bahl, B.S. "A Textbook of Organic Chemistry".
2.	Bansal, R.K. "Heterocyclic Chemistry".
3.	Finar, I.L. "Organic Chemistry, Volume-I".
4.	Finar, I.L. "Organic Chemistry, Volume-II".
5.	Gilchrist, T.L. "Heterocyclic Chemistry".

VIDEO LECTURES:	
1.	https://solotutes.com/hi//videos?v=eJAWvjszRjI
2.	https://www.khanacademy.org/science/organic-chemistry
3.	https://onlinecourses.swayam2.ac.in/cec23_cy03/preview
WEB RESOURCES:	
1.	https://global.oup.com/uk/orc/pharmacy/
2.	https://www.himpub.com/BookDetail.aspx?BookId=1619&NB=&Book_TitleM=Pharmaceutical%20Organic%20Chemistry%20-%20I
3.	https://onlinelibrary.wiley.com/series/2231

Course Code	Course Title	L	T	P	C
23PA101007	MEDICINAL CHEMISTRY-I	3	1	-	4

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This subject is designed to impart fundamental knowledge on the structure, chemistry, and therapeutic value of drugs. The subject emphasizes on structure-activity relationships of drugs, the importance of physicochemical properties, and the metabolism of drugs. The syllabus also emphasizes on chemical synthesis of important drugs under each class.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Understand the chemistry of drugs concerning their pharmacological activity

CO2. Understand the drug metabolic pathways, adverse effects, and therapeutic value of drugs

CO3. Know the Structural Activity Relationship (SAR) of different classes of drugs and write the chemical synthesis of some drugs.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	2	1	-	-	-	-	-	-	-	-	-	-	-	2	-	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-
CO3	2	-	-	2	-	-	-	-	-	-	-	-	-	2	-	-
Course Correlation Mapping	2	-	-	2	-	-	-	-	-	-	-	-	-	2	-	-

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1 Introduction to Medicinal Chemistry (10 Periods)

Introduction to Medicinal Chemistry: History and development of medicinal chemistry Physicochemical properties about biological action Ionization, Solubility, Partition Coefficient, Hydrogen bonding, Protein binding, Chelation, Bioisosterism, Optical and Geometrical isomerism.
Drug metabolism: Drug metabolism principles- Phase I and Phase II.
Factors affecting drug metabolism include stereochemical aspects.

Module 2 Drugs acting on Autonomic Nervous System (10 Periods)
Adrenergic Neurotransmitters

Biosynthesis and catabolism of catecholamine. Adrenergic receptors (Alpha & Beta) and their distribution.
Sympathomimetic agents: SAR of Sympathomimetic agents Direct acting: Nor epinephrine, Epinephrine, Phenylephrine*, Dopamine, Methyldopa, Clonidine, Dobutamine, Isoproterenol, Terbutaline, Salbutamol*, Bitolterol, Naphazoline, Oxymetazoline, and Xylometazoline. Indirect-acting agents: Hydroxy amphetamine, Pseudoephedrine, Propylhexedrine. Agents with mixed mechanism: Ephedrine, Metaraminol.
Adrenergic Antagonists:
Alpha-adrenergic blockers: Tolazoline*, Phentolamine, Phenoxybenzamine, Prazosin, Dihydroergotamine, Methysergide.
Beta-adrenergic blockers: SAR of beta blockers, Propranolol*, Metibranolol, Atenolol, Betazolol, Bisoprolol, Esmolol, Metoprolol, Labetalol, Carvedilol.

Module 3 Cholinergic neurotransmitters: (10Periods)
Biosynthesis and catabolism of acetylcholine. Cholinergic receptors (Muscarinic & Nicotinic) and their distribution.
Parasympathomimetic agents: SAR of Parasympathomimetic agents
Direct-acting agents: Acetylcholine, Carbachol*, Bethanechol, Methacholine, Pilocarpine.
Indirect acting/ Cholinesterase inhibitors (Reversible & Irreversible): Physostigmine, Neostigmine*, Pyridostigmine, Edrophonium chloride, Tacrine hydrochloride, Ambenonium chloride, Isofluorphate, Echothiophate iodide, Parathione, Malathion.
Cholinesterase reactivator: Pralidoxime chloride.
Cholinergic Blocking Agents: SAR of cholinolytic agents
Solanaceous alkaloids and analogs: Atropine sulfate, Hyoscyamine sulfate, Scopolamine hydrobromide, Homatropine hydrobromide, Ipratropium bromide*.
Synthetic cholinergic blocking agents: Tropicamide, Cyclopentolate hydrochloride, Clidinium bromide, Dicyclomine hydrochloride*, Glycopyrrolate, Methantheline bromide, Propantheline bromide, Benztropine mesylate, Orphenadrine citrate, Biperidine hydrochloride, Procyclidine hydrochloride*, Tridihexethyl chloride, Isopropamide iodide, Ethopropazine hydrochloride.

Module 4 Drugs acting on Central Nervous System (08 Periods)

A. Sedatives and Hypnotics:

- **Benzodiazepines:** SAR of Benzodiazepines, Chlordiazepoxide, Diazepam*, Oxazepam, Chlorazepate, Lorazepam, Alprazolam, Zolpidem
- **Barbiturtes:** SAR of barbiturates, Barbital*, Phenobarbital, Mephobarbital, Amobarbital, Butabarbital, Pentobarbital, Secobarbital
- **Miscellaneous:**
  Amides & imides: Glutethmide. Alcohol & their carbamate derivatives: Meprobomate, Ethchlorvynol.
  Aldehyde & their derivatives: Triclofos sodium, Paraldehyde.

B. Antipsychotics

- **Phenothiazines:** SAR of Phenothiazines - Promazine hydrochloride, Chlorpromazine hydrochloride*, Triflupromazine, Thioridazine hydrochloride, Piperacetazine hydrochloride, Prochlorperazine maleate, Trifluoperazine hydrochloride.
- **Ring Analogues of Phenothiazines:** Chlorprothixene, Thiothixene, Loxapine succinate, Clozapine.
- **Fluro butyrophenones:** Haloperidol, Droperidol, Risperidone.
- **Beta amino ketones:** Molindone hydrochloride.
- **Benzamides:** Sulpieride.

C. Anticonvulsants: SAR of Anticonvulsants**,** mechanism of anticonvulsant action

- **Barbiturates**: Phenobarbitone, Methabarbital.
- **Hydantoins:** Phenytoin*, Mephenytoin, Ethotoin
- **Oxazolidine diones:** Trimethadione, Paramethadione
- **Succinimides:** Phensuximide, Methsuximide, Ethosuximide*
- **Urea and monoacylureas**: Phenacemide, Carbamazepine*
- **Benzodiazepines**: Clonazepam
- **Miscellaneous:** Primidone, Valproic acid, Gabapentin, Felbamate

Module 5 Drugs acting on Central Nervous System General anesthetics (07 Periods)

Inhalation anesthetics: Halothane*, Methoxyflurane, Enflurane, Sevoflurane, Isoflurane, Desflurane.
Ultra short-acting barbiturates: Methohexital sodium*, Thiamylal sodium, Thiopental sodium.
Dissociative anesthetics: Ketamine hydrochloride. *
Narcotic and non-narcotic analgesics
Morphine and related drugs: SAR of Morphine analogs, Morphine sulfate, Codeine, Meperidine hydrochloride, Anilerdine hydrochloride, Diphenoxylate hydrochloride, Loperamide hydrochloride, Fentanyl citrate*, Methadone hydrochloride*, Propoxyphene hydrochloride, Pentazocine,
Levorphanol tartarate.
Narcotic antagonists: Nalorphine hydrochloride, Levallorphan tartarate, Naloxone hydrochloride.
Anti-inflammatory agents: Sodium salicylate, Aspirin, Mefenamic acid*, Meclofenamate, Indomethacin, Sulindac, Tolmetin, Zomepriac, Diclofenac, Ketorolac, Ibuprofen*, Naproxen, Piroxicam, Phenacetin, Acetaminophen, Antipyrine, Phenylbutazone.

Total 45 periods

Study of the development of the following classes of drugs, Classification, mechanism of action, uses of drugs mentioned in the course, Structure-activity relationship of the selective class of drugs as specified in the course, and synthesis of drugs superscripted (*).

RESOURCES

TEXTBOOKS:	
1.	Burger, A. "Burger's Medicinal Chemistry, Volume I to IV".
2.	Finar, I.L. "Organic Chemistry, Volume II".
3.	Lednicer, D. "The Organic Chemistry of Drug Synthesis, Volume 1 to 5".
4.	Martindale, W. "Martindale's Extra Pharmacopoeia".
5.	Smith, J., & Williams, A. "Introduction to Principles of Drug Design".
6.	"Remington's Pharmaceutical Sciences".

VIDEO LECTURES:	
1.	https://youtu.be/_nH_RodthIg?si=63cZYwf6lC0FMkhc
2.	https://youtu.be/5bFrMjh-Arw?si=6Rsa14zogT4eXPFN
3.	https://youtu.be/A0RLVlYNF84?si=NMRv1Dly5Bckeh65
4.	https://youtu.be/b7iR8pgOEYs?si=9jfaXHM05-nxroZ1
5.	https://youtu.be/jC5hjHMP4og?si=odcp46eUr0V5NBqY
WEB RESOURCES:	
1.	https://global.oup.com/uk/orc/pharmacy/
2.	https://www.himpub.com/BookDetail.aspx?BookId=1619&NB=&Book_TitleM=Pharmaceutical%20Organic%20Chemistry%20-%20I
3.	https://onlinelibrary.wiley.com/series/2231

Course Code	Course Title	L	T	P	C
23PH101005	Physical Pharmaceutics-II	3	1	-	4

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION:

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Understand various physicochemical properties of drug molecules in designing the dosage forms.

CO2. Know the principles of chemical kinetics & to use them for stability testing and determination of expiry date of formulations.

CO3. Demonstrate use of physicochemical properties in the formulation development and evaluation of dosage forms.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	1	-	-	2	-	-	-	-	-	-	-	3	-	-	-
CO2	3	2	3	1	2	-	1	1	-	-	-	-	3	-	-	-
CO3	3	3	3	-	2	-	-	-	-	-	-	-	3	-	-	-
Course Correlation Mapping	3	2	3	1	2	-	1	1	-	-	-	-	3	-	-	-

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1 Colloidal dispersions (10 Periods)

Classification of dispersed systems & their general characteristics, size & shapes of colloidal particles, classification of colloids & comparative account of their general properties. Optical, kinetic & electrical properties. Effect of electrolytes, coacervation, peptization& protective action.

Module 2 Rheology (10 Periods)

Rheology: Newtonian systems, law of flow, kinematic viscosity, effect of temperature, non-Newtonian systems, pseudoplastic, dilatant, plastic, thixotropy, thixotropy in formulation, determination of viscosity, capillary, falling Sphere, rotational viscometers

Deformation of solids: Plastic and elastic deformation, Heckel equation, Stress, Strain, Elastic Modulus

Module 3 Coarse dispersion (10 Periods)

Suspension, interfacial properties of suspended particles, settling in suspensions, formulation of flocculated and deflocculated suspensions. Emulsions and theories of emulsification, microemulsion, and multiple emulsions; Stability of emulsions, preservation of emulsions, rheological properties of emulsions, and emulsion formulation by HLB method

Module 4 Micromeretics (08 Periods)

Particle size and distribution, mean particle size, number and weight distribution, particle number, methods for determining particle size by different methods, counting and separation method, particle shape, specific surface, methods for determining surface area, permeability, adsorption, derived properties of powders, porosity, packing arrangement, densities, bulkiness & flow properties

Module 5 Drug stability (07 Periods)

Reaction kinetics: zero, pseudo-zero, first & second order, units of basic rate constants, determination of reaction order. Physical and chemical factors influencing the chemical degradation of pharmaceutical products: temperature, solvent, ionic strength, dielectric constant, specific & general acid-base catalysis, and Simple numerical problems. Stabilization of medicinal agents against common reactions like hydrolysis & oxidation. Accelerated stability testing in expiration dating of pharmaceutical dosage forms. Photolytic degradation and its prevention

Total 45

Periods

RESOURCES

REFERENCES:

1. Cooper, J., & Gunn, C. "Tutorial Pharmacy".
2. Glbaldi, M., & Donald, R. "Pharmacokinetics". Mercel Dekker Inc.
3. Liberman, H.A., & Lachman, C. "Pharmaceutical Dosage Forms: Tablets, Volumes 1-3". Marcel Dekker Inc.
4. Martin, A. "Physical Pharmacy", Sixth Edition.
5. Parrott, E.L. "Experimental Pharmaceutics".
6. Ramasamy, C., & Manavalan, R. "Physical Pharmaceutics".
7. Stocklosam, J. "Pharmaceutical Calculations". Lea & Febiger.

VIDEO LECTURES:

1. https://youtu.be/D3qUQNDNaIw
2. https://youtu.be/xP7ijJbyb9Q
3. https://youtu.be/mT9QBh8cbT0

WEB RESOURCES:

1. https://innocentbalti.files.wordpress.com/2015/01/martins-physical-pharmacy-6th-ed-2011-dr-murtadha-alshareifi.pdf
2. https://drive.google.com/file/d/1fnxS3grWDoYDgvnJteIiXHHsjjFpfWow/view?usp=drivesdk
3. https://drive.google.com/file/d/1uQyrQF_84rkbBTcMAbenkThi3VSi8a07/view?usp=drivesdk
4. https://drive.google.com/file/d/1I5rTyYYZald7ris9erPmFakZLuyKw8T5/view?usp=drivesdk
5. https://drive.google.com/file/d/1iRxxpiek4fQ419lS3bFy2td9gSl6ft0H/view?usp=drivesdk

Course Code	Course Title	L	T	P	C
23PC101004	PHARMACOLOGY-I	3	1	-	4

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: The main purpose of the subject is to understand what drugs do to living organisms and how they are explored in the treatment of diseases. The subject covers information about the drugs such as the mechanism of action (Pharmacodynamics), as well as absorption, distribution, metabolism, and excretion (Pharmacokinetics) along with side effects and clinical applications.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Comprehend the scope of pharmacology, sources of drugs, and routes of administration of drugs.
CO2. Explain the mechanisms of drug action at the cellular & organ system levels.
CO3. Understand the pharmacological actions of different categories of drugs.
CO4. To study the pharmacology of various neurotransmitters and drugs with relevant treatment of diseases.
CO5. Apply the basic pharmacological knowledge in the prevention and treatment of various diseases.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	-	1	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	-	1	-	-	-	-	1	-	-	-	-	-	-	3	-
CO3	3	1	-	-	-	-	-	-	-	-	-	3	-	-	3	-
CO4	3	1	-	-	-	-	-	-	-	-	-	3	-	-	3	-
CO5	3	2	-	-	-	-	-	-	-	-	-	3	-	-	3	-
Course Correlation Mapping	**3**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**	**3**	**-**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1 General Pharmacology (08 Periods)

a. Introduction to Pharmacology- Definition, historical landmarks and scope of pharmacology, nature and source of drugs, essential drugs concept and routes of drug administration, Agonists, antagonists (competitive and non-competitive), spare receptors, addiction, tolerance, dependence, tachyphylaxis, idiosyncrasy, allergy.
b. Pharmacokinetics- Membrane transport, absorption, distribution, metabolism and excretion of drugs. Enzyme induction, enzyme inhibition, kinetics of elimination

Module 2 Pharmacodynamics (12 Periods)

a. Pharmacodynamics- Principles and mechanisms of drug action. Receptor theories and classification of receptors, regulation of receptors. drug receptors interactions signal transduction mechanisms, G-protein–coupled receptors, ion channel receptors, transmembrane enzyme-linked receptors, transmembrane JAK-STAT binding receptors and receptors that regulate transcription factors, dose-response relationship, therapeutic index, combined effects of drugs and factors modifying drug action.
b. Adverse drug reactions.
c. Drug interactions (pharmacokinetic and pharmacodynamic)
d. Drug discovery and clinical evaluation of new drugs -Drug discovery phase, preclinical evaluation phase, clinical trial phase, phases of clinical trials, and pharmacovigilance.

Module 3 Pharmacology of drugs acting on the peripheral nervous system (10 Periods)

a. Organization and function of ANS.
b. Neurohumoral transmission, co-transmission, and classification of neurotransmitters.
c. Parasympathomimetics, Parasympatholytics, Sympathomimetics, sympatholytics.
d. Neuromuscular blocking agents and skeletal muscle relaxants (peripheral).
e. Local anesthetic agents.
f. Drugs used in myasthenia gravis and glaucoma

Module 4 Pharmacology of drugs acting on the central nervous system (08 Periods)

a. Neurohumoral transmission in the C.N.S. special emphasis on the importance of various neurotransmitters like GABA, Glutamate, Glycine, serotonin, and dopamine.
b. General anesthetics and pre-anesthetics**.**
c. Sedatives, hypnotics, and centrally acting muscle relaxants.
d. Anti-epileptics
e. Alcohols and disulfiram

Module 5 Pharmacology of drugs acting on central nervous system (07 Periods)

a. Psychopharmacological agents: Antipsychotics, antidepressants, anti-anxiety agents, anti-manics and hallucinogens.
b. Drugs used in Parkinsons disease and Alzheimer's disease.
c. CNS stimulants and nootropics.
d. Opioid analgesics and antagonists
e. Drug addiction, drug abuse, tolerance and dependence.

Total 45 periods

RESOURCES

TEXTBOOKS:	
1.	Goodman, L.S., & Gilman, A.G. "Goodman and Gilman's: The Pharmacological Basis of Therapeutics".
2.	Sharma, H.L., & Sharma, K.K. "Principles of Pharmacology". Paras Medical Publisher.
3.	Tripathi, K.D. "Essentials of Medical Pharmacology". JAYPEE Brothers Medical Publishers (P) Ltd, New Delhi.

VIDEO LECTURES:	
1.	https://www.youtube.com/watch?v=e2pM930x9xw
2.	https://www.youtube.com/watch?v=ECEJrTjwgNw
3.	https://www.youtube.com/watch?v=NchhDVZHGKs
WEB RESOURCES:	
1.	http://www2.hsc.wvu.edu/som/physio/classes/pcol260/pdf/about_pcol260.pdf
2.	https://study.com/academy/lesson/pharmacy-drug-databases-web-resources.html

Course Code	COURSE CORE Course Title	L	T	P	C
23PY101006	PHARMACOGNOSY AND PHYTOCHEMISTRY-I	3	1	-	4

Pre-Requisite	-
Anti-Requisite	-
Co-Requisite	-

COURSE DESCRIPTION: This course provides a comprehensive introduction to Pharmacognosy, exploring the sources, classification, cultivation, and conservation of medicinal plants. It covers quality control, plant tissue culture, and the role of Pharmacognosy in various medical systems. Students will gain insight into primary and secondary metabolites, as well as novel marine drugs.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Define and describe the fundamentals, history, scope, and development of Pharmacognosy, including sources of drugs and their classifications.

CO2. Classify and evaluate drugs of natural origin using various classification systems and quality control methods.

CO3. Explain the cultivation, collection, processing, and conservation of medicinal plants, and the applications of plant hormones and genetic techniques.

CO4. Apply plant tissue culture techniques in pharmacognosy, including understanding nutritional requirements, maintenance, and applications such as edible vaccines.

CO5. Integrate the role of Pharmacognosy in allopathic and traditional medicine systems, identifying and classifying secondary metabolites and their properties.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes										Program Specific Outcomes			
	PO1	PO2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO 9	PO10	PSO 1	PSO 2	PSO3	PSO4
CO1	3	1	1	-	3	-	2	2	-	-	-	3	-	-
CO2	3	3	1	-	2	-	-		-	-	-	3	-	-
CO3	3	3	2	-		-	-		-	-	-	3	-	-
CO4	3	3	1	-	3	-	-	2	-	-	-	3	-	-
CO5	3	3	1	-	3	-	-	2	-	-	-	3	-	-
Course Correlation Mapping	**3**	**3**	**-**	**3**	**3**	**-**	**2**	**2**	-	-	**–**	**3**	**-**	**-**

Correlation Levels: ***3: High;*** ***2: Medium;*** ***1: Low***

COURSE CONTENT

Module 1 Introduction to Pharmacognosy (10 Periods)

Introduction to Pharmacognosy:

a. Definition, history, scope, and Development of Pharmacognosy
b. Sources of Drugs – Plants, Animals, Marine & Tissue Culture
c. Organized drugs, unorganized drugs (dried latex, dried juices, dried extracts, gums, mucilages, oleoresins, and oleo- gum -resins).

Classification of drugs:

Alphabetical, morphological, taxonomical, chemical, pharmacological, chemo, and sero-taxonomical classification of drugs

Quality control of Drugs of Natural Origin:

a. Adulteration of drugs of natural origin. Evaluation by organoleptic, microscopic, physical, chemical, and biological methods and properties.
b. Quantitative microscopy of crude drugs including lycopodium spore method, leaf constants, camera lucida, and diagrams of microscopic objects to scale with camera lucida.

Module 2 Cultivation, Collection, Processing, and storage of drugs of natural origin (10 Periods)

Cultivation, Collection, Processing, and storage of drugs of natural origin:

a. Cultivation and Collection of Drugs of natural origin Factors influencing the cultivation of medicinal plants.
b. Plant hormones and their applications.
c. Polyploidy, mutation, and hybridization with reference to medicinal plants

Conservation of medicinal plants.

Module 3 Plant tissue culture (07 Periods)

- Historical development of plant tissue culture, types of cultures, Nutritional requirements, growth, and their maintenance.
- Applications of plant tissue culture in pharmacognosy.
- Edible vaccines.

Module 4 Pharmacognosy in various systems of medicine (10 Periods)

Pharmacognosy in various systems of medicine:

Role of Pharmacognosy in allopathy and traditional systems of medicine namely, Ayurveda, Unani, Siddha, Homeopathy, and Chinese systems of medicine.

Introduction to secondary metabolites:

Definition, classification, properties, and test for identification of Alkaloids, Glycosides, Flavonoids, Tannins, Volatile oil, and Resins.

Module 5 Study of biological source, chemical nature, and uses of drugs of natural origin containing the following drugs. (08 Periods)

Plant Products:

a. Fibers - Cotton, Jute, Hemp
b. Hallucinogens, Teratogens, Natural allergens

Primary metabolites:

General introduction, detailed study concerning chemistry, sources, preparation, evaluation, preservation, storage, therapeutic uses, and commercial utility as

Pharmaceutical Aids and/or Medicines for the following Primary metabolites:
Carbohydrates: Acacia, Agar, Tragacanth, Honey
Proteins and Enzymes: Gelatin, casein, proteolytic enzymes (Papain, bromelain, serratiopeptidase, urokinase, streptokinase, pepsin).
Lipids (Waxes, fats, fixed oils): Castor oil, Chaulmoogra oil, Wool Fat, Bees Wax
Marine Drugs:
Novel medicinal agents from marine sources.

Total 45 Periods

RESOURCES

TEXTBOOKS:	
1.	Ali, M. "Pharmacognosy and Phytochemistry". CBS Publishers & Distribution.
2.	Ansari, S.H. "Essentials of Pharmacognosy". Birla Publications.
3.	Bobbers, J., KS, M., & Tylor, V.E. "Pharmacognosy & Pharmacobiotechnology".
4.	Choudhary, R.D. "Herbal Drug Industry". Eastern Publisher.
5.	Evans, W.C. "Trease and Evans Pharmacognosy". W.B. Sounders & Co.
6.	Kalia, A.N. "Textbook of Industrial Pharmacognosy". CBS Publishers.
7.	Kokate, C.K., Purohit, A.P., & Gokhale, S.B. "Textbook of Pharmacognosy". Nirali Prakashan.
8.	Pande, H. "Herbal Cosmetics". Asia Pacific Business Press, Inc.
9.	Endress, R. "Plant Cell Biotechnology". Springer-Verlag.
10.	Dubey, R.C. "Textbook of Biotechnology".
11.	Vyas, S.P., & Dixit, V. "Textbook of Biotechnology".
12.	"The Formulation and Preparation of Cosmetics, Fragrances, and Flavors".
13.	"Remington's Pharmaceutical Sciences".

VIDEO LECTURES:	
1.	https://www.youtube.com/watch?v=wYB04tuFNnI
2.	https://www.youtube.com/watch?v=NpukQtaAIls
3.	https://youtu.be/HR9KHW-e0pY
4.	https://rb.gy/tswn3x
5.	https://rb.gy/2nzq18
WEB RESOURCES:	
1.	http://docs.neu.edu.tr/staff/ali.mericli/1a-Carbohydrates_4.pdf
2.	https://shorturl.at/AHXY3

Course Code	Course Title	L	T	P	C
23PA105006	Medicinal chemistry-I Practical	-	-	4	2

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: Upon completion of this course the student should be able to understand the classification and nomenclature of simple organic compounds, structural isomerism, intermediates forming in reactions, important physical properties, reactions and methods of preparation of these compounds, mechanisms and orientation of reactions

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Accomplish knowledge of the synthesis of compounds with pharmaceutical importance.
CO2. Perform qualitative analysis of compounds with diverse functional groups.
CO3. Work as an individual and as a member of a team to solve problems with effective communication.
CO4. Comprehend on addition, redox reactions: Named reactions and qualitative analysis, usesof some carbonyl organic compounds.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	-	-	2	-	-	-	-	-	-	-	3	-	3	-	-
CO2	3	-	-	-	-	-	-	-	-	2	-	3	-	3	-	-
CO3	3	-	-	2	-	-	-	-	-	-	-	3	-	3	-	-
CO4	3	-	-	-	-	-	-	-	-	1	-	-	-	3	-	-
Course Correlation Mapping	3	-	-	2	-	-	-	-	-	2	-	3	-	3	-	-

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

EXPERIMENTS	
I	**Preparation of drugs/ intermediates**
	1,3-pyrazole
	1,3-oxazole
	Benzimidazole
	Benztriazole
	2,3- diphenyl quinoxaline
	Benzocaine
	Phenytoin
	Phenothiazine
	Barbiturate
II	**Assay of drugs**
	Chlorpromazine
	Phenobarbitone
	Atropine
	Ibuprofen
	Aspirin
	Furosemide
III	**Determination of the Partition coefficient for any two drugs**

Course Code	Course Title	L	T	P	C
23PH105005	Physical Pharmaceutics-II Practical	-	-	4	2
Pre-Requisite	-				
Anti-Requisite	-				
Co-Requisite	-				

COURSE DESCRIPTION:

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Demonstrate the various methods to determine derived properties of powders and particle size.
CO2. Design and apply skills to evaluate flow behavior of fluids and study the deformation of solids.
CO3. Demonstrate preparation and evaluation of pharmaceutical suspensions, emulsions, and colloids.
CO4. Acquire skills in conducting accelerated stability testing and analyze the chemical kinetics of drugs.
CO5. Work independently and in teams to solve problems with effective communications.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes										Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PSO1	PSO2	PSO3	PSO4
CO1	2	3	3	-	-	-	-	-	-	-	3	-	-	-
CO2	2	3	3	-	1	-	-	-	-	-	3	-	-	-
CO3	2	3	3	-	1	-	-	-	-	-	3	-	-	-
CO4	2	3	3	3	1	1	1	1	-	-	3	-	-	-
CO5	-	-	-	-	-	-	-	-	3	3	3	-	-	-
Course Correlation Mapping	**3**	**3**	**3**	**3**	**1**	**1**	**1**	**1**	**3**	**3**	**3**	**-**	**-**	**-**

Correlation Levels: 3: High; 2: Medium; 1: Low

Course Content

EXPERIMENTAL LEARNING

1 Determination of particle size, particle size distribution using sieving method.

2 Determination of particle size, particle size distribution using microscopic method.

3 Determination of bulk density, true density and porosity.

4 Determine the angle of repose and influence of lubricant on angle of repose.

5 Determination of viscosity of liquid using Ostwald's viscometer.

6 Determination sedimentation volume with effect of different suspending agent.

7 Determination sedimentation volume with effect of different concentration ofsingle suspending agent.

8 Determination of viscosity of semisolid by using Brookfield viscometer.

9 Determination of reaction rate constant first order.

10 Determination of reaction rate constant second order.

11 Accelerated stability studies.

Course Code	Course Title	L	T	P	S	C
23PC105003	**PHARMACOLOGY-I PRACTICAL**	-	-	4	-	2
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: The practical experiments are complementary to the topics discussed in theory. These experiments also help the students to learn the principles of screening methods in drug development. The students will also learn to use computer-assisted learning techniques as alternatives to animal models.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1: Understand the ethical considerations governing animal experiments, general instruments, handling, dosing of animals and CPCSEA guidelines, etc.

CO2: Employ computer-assisted learning and simulated experiments as alternatives to animal experimentation for studying drug effects.

Course Outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	1	-	-	1	-	-	1	-	-	-	-	-	-	3
CO2	3	2	2	1	-	-	-	1	-	-	-	-	-	-	3
Course Correlation Mapping	**3**	**1**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**3**

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

EXPERIMENTS

1. Introduction to experimental pharmacology.
2. Commonly used instruments in experimental pharmacology.
3. Study of common laboratory animals.
4. Maintenance of laboratory animals as per CPCSEA guidelines.
5. Common laboratory techniques. Blood withdrawal, serum, and plasma separation, anesthetics, and euthanasia are used for animal studies.
6. Study of different routes of drug administration in mice/rats.
7. Study of the effect of hepatic microsomal enzyme inducers on the phenobarbitone sleeping time in mice.
8. Effect of drugs on ciliary motility of frog esophagus
9. Effect of drugs on rabbit eye.
10. Effects of skeletal muscle relaxants using rota-rod apparatus.
11. Effect of drugs on locomotor activity using actophotometer.
12. Anticonvulsant effect of drugs by MES and PTZ method.
13. Study of stereotype and anti-catatonic activity of drugs on rats/mice.
14. Study of the effect of hepatic microsomal enzyme inducers on the phenobarbitone sleeping time in mice.
15. Effect of drugs on ciliary motility of frog oesophagus.

Course Code	Course Title	L	T	P	C
23PY105004	PHARMACOGNOSY AND PHYTOCHEMISTRY-I Practical	-	-	4	2

Pre-Requisite -
Anti-Requisite -
Co-Requisite -

COURSE DESCRIPTION: The subject involves the fundamentals of Pharmacognosy like crude drugs, their identification and evaluation, the phytochemicals present in them, and their medicinal properties.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Accomplish knowledge on identification of unorganized drugs.
CO2. Learn to perform various quantitative microscopical studies.
CO3. Gain knowledge on quality control parameters for herbal drugs.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO5	PO 6	PO7	PO8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	2	3	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	3	2	3	-	-	-	-	-	-	-	-	-	-	3	-	-
CO3	3	2	3	-	-	-	-	-	-	-	-	-	-	3	-	-
Course Correlation Mapping	**3**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

Correlation Levels: ***3: High;*** ***2: Medium;*** ***1: Low***

COURSE CONTENT

EXPERIMENTS

1. Analysis of crude drugs by chemical tests: (i)Tragacanth (ii) Acacia (iii) Agar (iv) Gelatin (v) starch (vi) Honey (vii) Castor oil
2. Determination of stomatal number and index
3. Determination of vein islet number, vein islet termination, and palisade ratio.
4. Determination of size of starch grains, and calcium oxalate crystals by eyepiece micrometer
5. Determination of Fiber length and width
6. Determination of the number of starch grains by the Lycopodium spore method
7. Determination of Ash value
8. Determination of Extractive values of crude drugs
9. Determination of moisture content of crude drugs
10. Determination of swelling index and foaming

V SEMESTER

Course Code	Course Title	L	T	P	C
23PA101008	**MEDICINAL CHEMISTRY – II**	3	1	-	4
Pre-Requisite	-				
Anti-Requisite	-				
Co-Requisite	-				

COURSE DESCRIPTION: This subject is designed to impart fundamental knowledge on the structure, chemistry and therapeutic value of drugs. The subject emphasizes on structure activity relationships of drugs, importance of physicochemical properties and metabolism of drugs. The syllabus also emphasizes on chemical synthesis of important drugs under each class.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1	Understand the chemistry of drugs with respect to their pharmacological activity.
CO2	Understand the drug metabolic pathways, adverse effect and therapeutic value of drugs.
CO3	Know the Structural Activity Relationship of different class of drugs.
CO4	Study the chemical synthesis of selected drugs.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific outcomes			
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**
CO1	2	-	-	-	-	-	-	-	-	2	-	2	-	-	-	-
CO2	2	-	2	2	-	-	-	-	-	1	-	1	-	-	-	-
CO3	2	-	-	-	-	-	-	-	-	2	-	2	-	-	-	-
CO4	2	-	-	2	-	-	-	-	-	2	-	2	-	-	-	-
Course Correlation Mapping	**2**	**-**	1	**2**	-	-	-	**-**	-	**2**	-	2	**-**	**-**	**-**	**-**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1	**Antihistaminic agents**	**(10 Periods)**

- **Antihistaminic agents:** Histamine, receptors and their distribution in the humanbody
- **H1–antagonists:** Diphenhydramine hydrochloride*, Dimenhydrinate, Doxylamines cuccinate, Clemastine fumarate, Diphenylphyraline hydrochloride, Tripelenamine hydrochloride, Chlorcyclizine hydrochloride, Meclizine hydrochloride, Buclizine hydrochloride, Chlorpheniramine maleate, Triprolidine hydrochloride*, Phenidamine tartarate, Promethazine hydrochloride*, Trimeprazine tartrate, Cyproheptadine hydrochloride, Azatidine maleate, Astemizole, Loratadine, Cetirizine, Levocetrazine Cromolyn sodium
- **H2-antagonists:** Cimetidine*, Famotidine, Ranitidin.
- **Gastric Proton pump inhibitors:** Omeprazole, Lansoprazole, Rabeprazole, Pantoprazole
- **Anti-neoplastic agents:**
- **Alkylating agents:** Meclorethamine*, Cyclophosphamide, Melphalan,Chlorambucil, Busulfan, Thiotepa.
- **Antimetabolites:** Mercaptopurine*, Thioguanine, Fluorouracil, Floxuridine,Cytarabine, Methotrexate*, Azathioprine
- **Antibiotics:** Dactinomycin, Daunorubicin, Doxorubicin, Bleomycin
- **Plant products:** Etoposide, Vinblastin sulphate, Vincristin sulphate

Module 2	**Anti-anginal**	**(10 Periods)**

- **Anti-anginal:**

  Vasodilators: Amyl nitrite, Nitroglycerin*, Pentaerythritol tetranitrate, Isosorbide

  dinitrite*, Dipyridamole.
- **Calcium channel blockers:** Verapamil, Bepridil hydrochloride, Diltiazem hydrochloride, Nifedipine, Amlodipine, Felodipine, Nicardipine, Nimodipine.
- **Diuretics:**

  Carbonic anhydrase inhibitors: Acetazolamide*, Methazolamide, Dichlorphenamide.

  Thiazides: Chlorthiazide*, Hydrochlorothiazide, Hydroflumethiazide, Cyclothiazide,

  Loop diuretics: Furosemide*, Bumetanide, Ethacrynic acid.

  Potassium sparing Diuretics: Spironolactone, Triamterene, Amiloride.

  Osmotic Diuretics: Mannitol
- **Anti-hypertensive Agents:** Timolol, Captopril, Lisinopril, Enalapril, Benazepril hydrochloride, Quinapril hydrochloride, Methyldopate hydrochloride,* Clonidine hydrochloride, Guanethidine monosulphate, Guanabenz acetate, Sodium nitroprusside, Diazoxide,Minoxidil, Reserpine, Hydralazine hydrochloride.

Module 3	**Anti-arrhythmic Drugs**:	**(10 Periods)**

- **Anti-arrhythmic Drugs:** Quinidine sulphate, Procainamide hydrochloride, Disopyramide phosphate*, Phenytoin sodium, Lidocaine hydrochloride, Tocainide hydrochloride, Mexiletine hydrochloride, Lorcainide hydrochloride, Amiodarone, Sotalol.
- **Anti-hyperlipidemic agents:** Clofibrate, Lovastatin, Cholesteramine and Cholestipol
- **Coagulant & Anticoagulants:** Menadione, Acetomenadione, Warfarin*, Anisindione, clopidogrel
- **Drugs used in Congestive Heart Failure:** Digoxin, Digitoxin, Nesiritide, 0Bosentan, Tezosentan.

Module 4	**Drugs acting on Endocrine system**	**(08 Periods)**

- **Drugs acting on Endocrine system**
  Nomenclature, Stereochemistry and metabolism of steroids
- **Sex hormones:** Testosterone, Nandralone, Progestrones, Oestriol, Oestradiol, Oestrione, Diethyl stilbestrol.
- **Drugs for erectile dysfunction:** Sildenafil, Tadalafil.
- **Oral contraceptives**: Mifepristone, Norgestril, Levonorgestrol
- **Corticosteroids:** Cortisone, Hydrocortisone, Prednisolone, Betamethasone, Dexamethasone
- **Thyroid and antithyroid drugs**: L-Thyroxine, L-Thyronine, Propylthiouracil, Methimazole

Module 5	**Antidiabetic agents:**	**(07 Periods)**

- **Antidiabetic agents:**
  Insulin and its preparations
  Sulfonyl ureas: Tolbutamide*, Chlorpropamide, Glipizide, Glimepiride.
  Biguanides: Metformin.
  Thiazolidinediones: Pioglitazone, Rosiglitazone.
  Meglitinides: Repaglinide, Nateglinide.
  Glucosidase inhibitors: Acrabose, Voglibose.
- **Local Anesthetics:** SAR of Local anesthetics
- **Benzoic Acid derivatives**; Cocaine, Hexylcaine, Meprylcaine, Cyclomethycaine,
  Piperocaine.
- **Amino Benzoic acid derivatives**: Benzocaine*, Butamben, Procaine*, Butacaine,
  Propoxycaine, Tetracaine, Benoxinate.

• **Lidocaine/Anilide derivatives**: Lignocaine, Mepivacaine, Prilocaine, Etidocaine. • **Miscellaneous**: Phenacaine, Diperodon, Dibucaine.*
Total 45 periods
Study of the development of the following classes of drugs, Classification, mechanism of action, uses of drugs mentioned in the course, Structure-activity relationship of the selective class of drugs as specified in the course, and synthesis of drugs superscripted (*).

RESOURCES

REFERENCES:	
1	Burger's Medicinal Chemistry, Vol I
2	Burger's Medicinal Chemistry, Vol II
3	Burger's Medicinal Chemistry, Vol III
4	Burger's Medicinal Chemistry, Vol IV
5	Organic Chemistry by I.L. Finar, Vol. II
6	API Textbook of Medicine (2 Volumes)
VIDEO LECTURES:	
1.	https://youtu.be/MVOdb9GXfQI?si=Jhttps://youtu.be/MVOdb9GXfQI?si=J-k0uG6a2F9TMiPM-k0uG6a2F9TMiPM
2.	https://youtu.be/CmuLSpMJOZE?si=_wGxrY4yw-Wx1w8V
3.	https://youtu.be/KATUSkOn2aU?si=XbEBipM3nWNHTWMv
4.	https://youtu.be/aR1AKcCYn_o?si=JAGdhbIpIGUD_0Ip
WEB RESOURCES:	
1.	https://global.oup.com/uk/orc/pharmacy/
2.	https://www.himpub.com/BookDetail.aspx?BookId=1619&NB=&Book_TitleM=Pharmaceutical%20Organic%20Chemistry%20-%20I
3.	https://www.himpub.com/BookDetail.aspx?BookId=1619&NB=&Book_TitleM=Pharmaceutical%20Organic%20Chemistry%20-%20I

Course Code	Course Title	L	T	P	C
23PH101006	**INDUSTRIAL PHARMACY-I**	**3**	**1**	**-**	**4**

Pre-Requisite	-
Anti-Requisite	-
Co-Requisite	-

COURSE DESCRIPTION: Course enables the student to understand and appreciate the influence of pharmaceutical additives and various pharmaceutical dosage forms on the performance of the drug product.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

	Evaluate and apply physic-chemical properties of a chemical moiety in the development of its dosage forms.
CO2.	Know various considerations in the development of pharmaceutical dosage forms.
CO3.	Formulate different solid dosage forms.
CO4.	Evaluate the solid dosage forms according to both official and nonofficial methods.
CO5.	Design a desired dosage form of a "new drugs".

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	1	2	-	-	-	-	-	-	-	-	-	3	-	-	-
CO2	3	2	2	-	-	-	-	-	-	-	-	-	3	-	-	-
CO3	3	1	1	-	-	-	-	-	-	-	-	-	3	-	-	-
CO4	3	1	1	-	-	-	-	-	-	-	-	-	3	-	-	-
CO5	3	1	2	-	-	-	-	-	-	-	-	-	3	-	-	-
Course Correlation Mapping	3	1	2	-	-	-	-	-	-	-	-	-	3	-	-	-

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1	Preformulation Studies	(07 Periods)
Introduction to preformulation, goals and objectives, study of physicochemical characteristics of drug substances. **a. Physical properties:** Physical form (crystal & amorphous), particle size, shape, flow properties, solubility profile (pKa, pH, partition coefficient), polymorphism **b. Chemical Properties:** Hydrolysis, oxidation, reduction, racemisation, polymerization BCS classification of drugs & its significant Application of preformulation considerations in the development of solid, liquid oral and parenteral dosage forms and its impact on stability of dosage forms.		

Module 2	Tablets	(10 Periods)
a. **Introduction,** ideal characteristics of tablets, classification of tablets. Excipients, Formulation of tablets, granulation methods, compression and processing problems. Equipments and tablet tooling. **b. Tablet coating:** Types of coating, coating materials, formulation of coating composition, methods of coating, equipment employed and defects in coating. **c. Quality control tests:** In process and finished product tests. **Liquid orals:** Formulation and manufacturing consideration of syrups and elixirs suspensions and emulsions; Filling and packaging; evaluation of liquid orals official in pharmacopoeia.		

Module 3	Capsules	(08 Periods)
a. Hard gelatin capsules: Introduction, Production of hard gelatin capsule shells. size of capsules, Filling, finishing and special techniques of formulation of hard gelatin capsules, manufacturing defects. In process and final product quality control tests for capsules. **b. Soft gelatin capsules:** Nature of shell and capsule content, size of capsules, importance of base adsorption and minim/gram factors, production, in process and final product quality control tests. Packing, storage and stability testing of soft gelatin capsules and their applications. **Pellets:** Introduction, formulation requirements, pelletization process, equipments for manufacture of pellets.		

Module 4	Parenteral Products	(10 Periods)
a. Definition, types, advantages and limitations. Preformulation factors and essential requirements, vehicles, additives, importance of isotonicity b. Production procedure, production facilities and controls, aseptic processing c. Formulation of injections, sterile powders, large volume parenterals and lyophilized products. d. Containers and closures selection, filling and sealing of ampoules, vials and infusion fluids. Quality control tests of parenteral products. **Ophthalmic Preparations:** Introduction, formulation considerations; formulation of eye drops, eye ointments and eye lotions; methods of preparation; labeling, containers; evaluation of ophthalmic preparations.		

Module 5	Cosmetics	(10 Periods)
Cosmetics: Formulation and preparation of the following cosmetic preparations: lipsticks, shampoos, cold cream and vanishing cream, tooth pastes, hair dyes and sunscreens. **Pharmaceutical Aerosols:** Definition, propellants, containers, valves, types of aerosol systems; formulation and manufacture of aerosols; Evaluation of aerosols; Quality control and stability studies. **Packaging Materials Science:** Materials used for packaging of pharmaceutical products, factors		

influencing choice of containers, legal and official requirements for containers, stability aspects of packaging materials, quality control tests.
Total 45 Periods

RESOURCES

References:

1. Modern Pharmaceutics by Gilbert S. Banker & C.T. Rhodes. United Kingdom: CRC Press, 2002.
2. Pharmaceutics: The Science of Dosage Form Design by Aulton. Netherlands: Churchill Livingstone, 2002.
3. Ansel, Howard C.. Introduction to Pharmaceutical Dosage Forms. United States: Lippincott Williams & Wilkins, 1985.
4. Lachman, Leon., Lieberman, Herbert A.., Kanig, Joseph L.. The Theory and Practice of Industrial Pharmacy. India: Lippincott Williams & Wilkins, 1986.

VIDEO LECTURES:

1. s https://www.youtube.com/watch?v=t9oAlE6rVsk
2. https://www.youtube.com/watch?v=MHmTg-g0oQ4
3. https://www.youtube.com/watch?v=0i4TkJSsh08
4. https://www.youtube.com/watch?v=NKd4sjxHhoo

WEB RESOURCES:

https://www.roquette.com/media-center/news/2016-10-18pharma-2016-parenteral-preparations

https://www.pharmfdainfo.com/2023/01/Pelletization-Process.html

https://thepharmapedia.com/type-of-packaging-pharmaceutics/pharmacy-notes/

https://onlinecourses.swayam2.ac.in/cec22_lb02/preview

Course Code	Course Title	L	T	P	C
23PC101005	PHARMACOLOGY-II	3	1	-	4

Pre-Requisite		-
Anti-Requisite		-
Co-Requisite		-

COURSE DESCRIPTION: This subject imparts fundamental knowledge on various aspects (classification, mechanism of action, therapeutic effects, clinical uses, side effects, and contraindications) of drugs acting on different systems of the body and in addition, emphasis on the basic concepts of bioassay.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1	Understand the concept and pharmacology of drugs acting on the cardiovascular system.
CO2.	Correlate the pharmacology of drugs acting on Haematinics and the urinary system.
CO3.	Understand the pharmacological actions of different categories of autocoids and drugs used to treat various diseases.
CO4.	Determine the fundamental knowledge of various aspects (classification, mechanism of action, therapeutic effects, clinical uses, side effects, and contraindications) of drugs acting on the endocrine system.
CO5.	Understand the basic concept and applications of Bioassays.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	2	-	-	-	-	-	-	-	-	-	3	-	-	3	-
CO2	3	1	-	-	-	-	-	-	-	-	-	3	-	-	3	-
CO3	3	2	-	-	-	-	-	-	-	-	-	3	-	-	3	-
CO4	3	2	-	-	-	-	-	-	-	-	-	3	-	-	3	-
CO5	3	1	-	-	-	-	-	-	-	-	-	3	-	-	3	-
Course Correlation Mapping	**3**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**	**3**	**-**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1 Pharmacology of drugs acting on the Cardiovascular system (10 Periods)

a. Introduction to hemodynamic and electrophysiology of the heart.
b. Drugs used in congestive heart failure
c. Anti-hypertensive drugs.
d. Anti-anginal drugs.
e. Anti-arrhythmic drugs.
f. Anti-hyperlipidaemic drugs.

Module 2 Pharmacology of drugs acting on CVS & Urinary system (10Periods)

1. Pharmacology of drugs acting on the cardiovascular system

a. Drugs used in the therapy of shock.
b. Haematinics, coagulants and anticoagulants.
c. Fibrinolytic and anti-platelet drugs
d. Plasma volume expanders

2. Pharmacology of drugs acting on the urinary system

a. Diuretics
b. Anti-diuretics.

Module 3 Autocoids and related drugs (10 Periods)

a. Introduction to autacoids and classification
b. Histamine, 5-HT, and their antagonists.
c. Prostaglandins, Thromboxanes and Leukotrienes.
d. Angiotensin, Bradykinin, and Substance P.
e. Non-steroidal anti-inflammatory agents
f. Anti-gout drugs
g. Antirheumatic drugs

Module 4 Pharmacology of drugs acting on the endocrine system (08Periods)

a. Basic concepts in endocrine pharmacology.
b. Anterior Pituitary hormones- analogues and their inhibitors.
c. Thyroid hormones- analogues and their inhibitors.
d. Hormones regulating plasma calcium level- Parathormone, Calcitonin, and Vitamin-D.
d. Insulin, Oral Hypoglycemic agents, and glucagon.
e. ACTH and corticosteroids.

Module 5 Pharmacology of drugs acting on the endocrine system (07Periods)

Pharmacology of drugs acting on endocrine system

a. Androgens and Anabolic steroids.
b. Estrogens, progesterone, and oral contraceptives.
c. Drugs acting on the uterus.

Bioassay

a. Principles and applications of bioassay.
b. Types of bioassays
c. Bioassay of insulin, oxytocin, vasopressin, ACTH, d-tubocurarine, digitalis, histamine and 5-HT.

Total 45 Periods

RESOURCES

REFERENCES:

1. K.D. Tripathi. Essentials of Medical Pharmacology, JAYPEE Brothers Medical Publishers (P) Ltd, New Delhi.
2. Sharma H. L., Sharma K. K., Principles of Pharmacology, Paras medical publisher.
3. Goodman and Gilman's, The Pharmacological Basis of Therapeutics.

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=e2pM930x9xw
2. https://www.youtube.com/watch?v=ECEJrTjwgNw
3. https://www.youtube.com/watch?v=NchhDVZHGKs

WEB RESOURCES:

1. http://www2.hsc.wvu.edu/som/physio/classes/pcol260/pdf/about_pcol260.pdf
2. https://study.com/academy/lesson/pharmacy-drug-databases-web-resources.html
3. https://study.com/academy/lesson/pharmacy-drug-databases-web-resources.html

Course Code	Course Title	L	T	P	C
23PY101007	**Pharmacognosy and Phytochemistry-II**	3	1	-	4
Pre-Requisite	-				
Anti-Requisite	-				
Co-Requisite	-				

COURSE DESCRIPTION: This course deals with the isolation and identification of secondary metabolites of crude drugs. the study of phytochemicals through plant tissue culture, drug interactions, and basic principles of traditional systems of medicine.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1.	Understand the concepts of basic metabolic pathways and the use of radioactive isotopes in the production and investigation of secondary metabolite.
CO2.	Know about the chemistry and commercial/ therapeutic uses of crude drugs.
CO3.	Understand the various aspects of isolation, identification, and analysis of therapeutically important phytoconstituents.
CO4.	Know about the industrial production, estimation, and utilization of various phytoconstituents.
CO5.	Understand various methods of extraction procedures and applications of the latest techniques like spectroscopy, chromatography, and electrophoresis in the isolation, purification, and identification of active constituents in crude drugs.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes										Program Specific Outcomes			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	-	3	-	-	-	-	-	-	-	3	-	-
CO2	3	3	-	3	-	-	-	-	-	-	-	3	-	-
CO3	3	3	-	3	-	-	-	-	-	-	-	3	-	-
CO4	3	3	-	3	-	-	-	-	-	-	-	3	-	-
CO5	3	3	-	3	-	-	-	-	-	-	-	3	-	-
Course Correlation Mapping	**3**	**3**	**-**	**3**	**-**	**-**	-	-	**-**	**-**	–	**3**	**-**	**-**

Correlation Levels: ***3: High;*** ***2: Medium;*** ***1: Low***

COURSE CONTENT

Module 1:	**Metabolic pathways in higher plants and their determination.**	***(07 Periods)***
a) Brief study of basic metabolic pathways and formation of different secondary metabolites through these pathways- Shikimic acid pathway, Acetate pathway, and Isoprenoid pathway. b) Study of utilization of radioactive isotopes in the investigation of Biogenetic studies.		
Module 2:	**General introduction, composition, chemistry & chemical classes, biosources, therapeutic uses, and commercial applications of the following secondary metabolites:**	***(14 Periods)***
• **Alkaloids:** Vinca, Rauwolfia, Belladonna, Opium, • **Phenylpropanoids and Flavonoids:** Lignans, Tea, Ruta • **Steroids, Cardiac glycosides & Triterpenoids:** Liquorice, Dioscorea, Digitalis • **Volatile oils:** Mentha, Clove, Cinnamon, Fennel, Coriander • **Tannins:** Catechu, Pterocarpus • **Resins:** Benzoin, Guggul, Ginger, Asafoetida, Myrrh, Colophony • **Glycosides:** Senna, Aloes, Bitter Almond • **Iridoids, Other terpenoids & Naphthaquinones:** Gentian, Artemisia, Taxus, Carotenoids.		
Module 3:	**Isolation, Identification and Analysis of Phytoconstituents.**	***(06 Periods)***
• **Terpenoids:** Menthol, Citral, Artemisin • **Glycosides:** Glycyrrhetinic acid and rutin • **Alkaloids:** Atropine, Quinine, Reserpine, Caffeine		
Module 4:	**Industrial production, estimation, and utilization of the following phytoconstituents**	***(10 Periods)***
Forskolin, Sennoside, Artemisinin, Diosgenin, Digoxin, Atropine, Podophyllotoxin, Caffeine, Taxol, Vincristine and Vinblastine.		
Module 5:	**Fundamentals of Phytochemistry**	***(08 Periods)***
Modern methods of extraction, and application of the latest techniques like spectroscopy, chromatography, and electrophoresis in the isolation, purification, and identification of crude drugs.		
		Total 45 Periods

RESOURCES

VIDEO LECTURES:	
TEXTBOOKS:	
6.	Evans, W.C. Trease, and Evans Pharmacognosy. 16th edition. London: W.B. Sounders & Co., 2009.
7.	Ali, Mohammad. Pharmacognosy and Phytochemistry. New Delhi: CBS Publishers & Distribution.
8.	Kokate, C.K., Purohit, A.P., Gokhale, S.B. Textbook of Pharmacognosy. 37th Edition. New Delhi: Nirali Prakashan, 2007.
9.	Choudhary, R.D. Herbal Drug Industry. 1st Edition. New Delhi: Eastern Publisher, 1996.
10.	Ansari, Dr. S.H. Essentials of Pharmacognosy. 2nd edition. New Delhi: Birla Publications, 2007.
11.	Pande, H. Herbal Cosmetics. New Delhi: Asia Pacific Business Press, Inc.
12.	Kalia, A.N. Textbook of Industrial Pharmacognosy. New Delhi: CBS Publishers, 2005.
13.	Endress, R. Plant Cell Biotechnology. Berlin: Springer-Verlag, 1994.
14.	Bobbers, James, KS, Marilyn, Tylor, VE. Pharmacognosy & Pharmacobiotechnology.
15.	The Formulation and Preparation of Cosmetics, Fragrances, and Flavors.
16.	Remington's Pharmaceutical Sciences.
17.	Vyas, Text Book of Biotechnology. Dixit, Text Book of Biotechnology. Dubey, R.C.
18.	Evans, W.C. Trease and Evans Pharmacognosy. 16th edition. London: W.B. Sounders & Co., 2009.

5.	https://www.youtube.com/watch?v=tC1WyivzS-8
6.	https://www.youtube.com/results?search_query=acetate+pathway
7.	https://www.youtube.com/watch?v=WsigAEO4kR8
8.	https://www.youtube.com/watch?v=SZrXbt7e1EU
9.	https://www.youtube.com/watch?v=GU2TB6mNz5s
10.	https://www.youtube.com/watch?v=beAZS_b9P8o
WEB RESOURCES:	
2.	https://www.phytojournal.com/
3.	https://www.rroij.com/pharmacognosy-and-phytochemistry.php

Course Code	Course Title	L	T	P	C
23PH101007	PHARMACEUTICAL JURISPRUDENCE	3	1	-	4

Pre-Requisite		-
Anti-Requisite		-
Co-Requisite		-

COURSE DESCRIPTION: The course deals with pharmaceutical legislations and their implications in the development and marketing of pharmaceuticals, various Indian pharmaceutical acts and laws and the code of ethics during the pharmaceutical practice.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1	To recall the pharmaceutical legislations, ethics, right to information, medical termination of pregnancy and intellectual property rights
CO2.	To relate the significance of Drugs and cosmetics act 1940 and its rules 1945 in relation to import and manufacture of drugs.
CO3.	To apply the knowledge on schedules pertaining to Drugs and cosmetics act 1940 and its rules 1945 and also administration of the act and rules.
CO4.	To understand the functions of pharmacy councils and implementation of education regulations in pharmacy.
CO5.	To appraise the importance of medicinal and toilet preparations act and narcotic drugs and psychotropic substances act and rules.
CO6.	To discuss the salient features of drugs and magic remedies act, prevention of cruelty to animal act and drugs price control order

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	-	-	-	-	1	-	2	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	1	-	2	-	-	-	-	-	-	-	-
CO3	3	-	-	-	-	1	-	2	-	-	-	-	-	-	-	-
CO4	3	-	-	-	-	1	-	2	-	-	-	-	-	-	-	-
CO5	3	-	-	-	-	1	-	2	-	-	-	-	-	-	-	-
CO6	3	-	-	-	-	1	-	2	-	-	-	-	-	-	-	-
Course Correlation Mapping	**3**	**-**	**-**	**-**	**-**	**1**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1 Introduction and manufacturing of drugs (10 Periods)

Objectives, Definitions, Legal definitions of schedules to the Act and Rules Import of drugs – Classes of drugs and cosmetics prohibited from import, Import under license or permit. Offences and penalties**.**

Manufacture of drugs – Prohibition of manufacture and sale of certain drugs, conditions for grant of license and conditions of license for manufacture of drugs, Manufacture of drugs for test, examination and analysis, manufacture of new drug, loan license and repacking license.

Module 2 Drugs and Cosmetics Act, 1940 and rules 1945 (10Periods)

Detailed study of Schedule G, H, M, N, P, T, U, V, X, Y, Part XII B, Sch F & DMR (OA) Sale of Drugs – Wholesale, Retail sale and Restricted license. Offences and penalties Labeling & Packing of drugs- General labeling requirements and specimen labels for drugs and cosmetics, List of permitted colors. Offences and penalties. Administration of the Act and Rules – Drugs Technical Advisory Board, Central drugs Laboratory, Drugs Consultative Committee, Government drug analysts, licensing authorities, controlling authorities, Drugs Inspectors

Module 3 Pharmacy Act, Toilet preparations Act and Narcotic drugs Act (10Periods)

Pharmacy Act, 1948: Objectives, Definitions, Pharmacy Council of India; its constitution and functions, Education Regulations, State and Joint state pharmacy councils; constitution and functions, Registration of Pharmacists, Offences and Penalties.

Medicinal and Toilet Preparation Act –1955:

Objectives, Definitions, Licensing, Manufacture In bond and Outside bond, Export of alcoholic preparations, Manufacture of Ayurvedic, Homeopathic, Patent & Proprietary Preparations. Offences and Penalties.

Narcotic Drugs and Psychotropic substances Act-1985 and Rules: Objectives, Definitions, Authorities and Officers, Constitution and Functions of narcotic & Psychotropic Consultative Committee, National Fund for Controlling the Drug Abuse, Prohibition, Control and Regulation, opium poppy cultivation and production of poppy straw, manufacture, sale and export of opium, Offences and Penalties

Module 4 Magic remedies, cruelty to animals and Price control Acts (08Periods)

Drugs and magic Remedies Act: Objectives, Definitions, Prohibition of certain advertisements, Classes of Exempted advertisements, Offences and Penalties

Prevention of Cruelty to animals Act-1960: Objectives, Definitions, Institutional Animal Ethics Committee, CPCSEA guidelines for Breeding and Stocking of Animals, Performance of Experiments, Transfer and acquisition of animals for experiment, Records, Power to suspend or revoke registration, Offences and Penalties

National Pharmaceutical Pricing Authority: Drugs Price Control Order (DPCO)- 2013. Objectives, Definitions, Sale prices of bulk drugs, Retail price of formulations, Retail price and ceiling price of scheduled formulations, National List of Essential Medicines (NLEM)

Module 5 Pharmaceutical Legislations (07Periods)

A brief review, Introduction, Study of drugs enquiry committee, Health survey and development committee, Hathi committee and Mudaliar committee.

Code of Pharmaceutical ethics Definition, Pharmacist in relation to his job, trade, medical profession and his profession, Pharmacist's oath

Medical Termination of Pregnancy Act

Right to Information Act

Introduction to Intellectual Property Rights (IPR)

Total 45 Periods

RESOURCES

REFERENCES:

1. Mehra, M. L. The Handbook of Drug Laws: An Encyclopaedia of Drugs and Cosmetics Act, Rules, Case Law, Drugs (Price Control) Orders, 1995 India: University Book Agency, 1997.
2. The Medicinal and Toilet Preparations (Excise Duties Act, 1955. N.p.: Universal Law Publishing, (n.d.).
3. Magazine, Ranjan. Drugs and Cosmetics Act, 1940 and Rules 1945. India: CBS Publishers & Distributors, 2019.
4. Mithal, M.. Textbook of Forensic Pharmacy. India: Current Distributors, 1988.
5. Jain, N. K.. Textbook of Forensic Pharmacy. India: Vallabh Prakashan, 2003.

VIDEO LECTURES:

1. https://youtu.be/OWH72T4wALU
2. https://youtu.be/SDA6CaVzeVY
3. https://youtu.be/Rj3S95mrzMw
4. https://youtu.be/LZQXKL07jVU
5. https://youtu.be/LZQXKL07jVU

WEB RESOURCES:

1. https://www.iptsalipur.org/wp-content/uploads/2020/08/BP505T-PJ-UNIT_III.pdf
2. https://www.iptsalipur.org/wp-content/uploads/2020/08/BP505T-PJ-UNIT_IV.pdf
3. https://www.iptsalipur.org/wp-content/uploads/2020/08/BP505T-PJ-UNIT_V.pdf
4. https://www.iptsalipur.org/wp-content/uploads/2020/08/BP505T-PJ-UNIT_I.pdf

Course Code	Course Title	L	T	P	C
23PH105006	**INDUSTRIAL PHARMACY-I PRACTICAL**	**-**	**-**	**4**	**2**

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION:

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Outline the principles and procedure for the Preformulation studies, preparation and evaluations of solid dosage formulations like tablets, granules listed in the course.

CO2. Apply the formulation concepts and principles in quality assurance of glass ampoules, marketed tablets and capsules and to conclude experiments with inference based on data generated & on their observations.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	-	2	-	-	-	-	-	-	-	3	-	-	-
CO2	3	2	-	-	2	-	-	-	-	-	-	-	3	-	-	-
Course Correlation Mapping	3	2	-	-	2	-	-	-	-	-	-	-	3	-	-	

Correlation Levels: ***3: High;*** ***2: Medium;*** ***1: Low***

COURSE CONTENT

1. Preformulation studies on paracetamol/aspirin/or any other drug (2 expt)
2. Preparation and evaluation of Paracetamol tablets (2 expt)
3. Preparation and evaluation of Aspirin tablets (2 expt)
4. Coating of tablets- film coating of tables/granules (2 expt)
5. Preparation and evaluation of Tetracycline capsules (2 expt)
6. Preparation of Calcium Gluconate injection
7. Preparation of Ascorbic Acid injection
8. Quality control test of (as per IP) marketed tablets and capsules
9. Preparation of Eye drops/ and Eye ointments
10. Preparation of Creams (cold / vanishing cream)
11. Evaluation of Glass containers (as per IP)

RESOURCES

Recommended Books:

1. Pharmaceutical dosage forms - Tablets, volume 1 -3 by H.A. Liberman, Leon Lachman & J.B.Schwartz.
2. Pharmaceutical dosage form - Parenteral medication vol- 1 & 2 by Liberman & Lachman.
3. Pharmaceutical dosage form disperse system VOL-1 by Liberman & Lachman
4. Modern Pharmaceutics by Gilbert S. Banker & C.T. Rhodes, 3rd Edition.

WEBLINKS:

1. https://www.scribd.com/document/285321520/Industrial-Practicals-Manual
2. https://www.coursehero.com/file/217751827/IndustrialpharmacylabManualpdf/

Course Code	Course Title	L	T	P	C
23PC105004	PHARMACOLOGY LAB-II	-	-	4	2

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: With these experiments, students will learn to apply pharmacodynamic principles in the quantification of drug responses in in-vivo and in-vitro models. The students will also learn to use computer-assisted learning techniques as alternatives to animal experimentation.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. s Understand the design and interpretation of preclinical evaluation techniques for screening various drugs by using simulation on different models.

CO2. Employ simulated experiments as alternatives to animal experimentation for studying drug effects.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	-	1	-	-	1	-	-	-	-	-	-	3	3
CO2	3	-	-	-	1	-	-	1	-	-	-	-	-	-	3	3
Course Correlation Mapping	**3**	**1**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

EXPERIMENTS

Group – I

1. s Introduction to in-vitro pharmacology and physiological salt solutions.
2. Effect of drugs on isolated frog heart.
3. Effect of drugs on blood pressure and heart rate of dog.
4. Study of diuretic activity of drugs using rats/mice.

Group – II

1. DRC of acetylcholine using frog rectus abdominis muscle.
2. Effect of physostigmine and atropine on DRC of acetylcholine using frog rectus abdominis muscle and rat ileum respectively.
3. Bioassay of histamine using guinea pig ileum by matching method.
4. Bioassay of oxytocin using rat uterine horn by interpolation method.
5. Bioassay of serotonin using rat fundus strip by three-point bioassay.
6. Bioassay of acetylcholine using rat ileum/colon by four-point bioassay.
7. Determination of PA2 value of prazosin using rat anococcygeal muscle (by Schilds plot method).
8. Determination of PD2 value using guinea pig ileum.
9. Effect of spasmogens and spasmolytics using rabbit jejunum.
10. Anti-inflammatory activity of drugs using carrageenan-induced paw-edema model.
11. Analgesic activity of drug using central and peripheral methods.

Course Code	Course Title	L	T	P	C
23PY105005	Pharmacognosy and Phytochemistry II (practical)	-	-	4	2
Pre-Requisite	-				
Anti-Requisite	-				
Co-Requisite	-				

COURSE DESCRIPTION: This course is designed to impart to the students knowledge of crude drugs, isolation of phytoconstituents, and their identification.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1.	Understand the macroscopy, microscopy, and chromatographic techniques for the identification of phytoconstituents and crude drugs.
CO2.	Understand the knowledge of isolation and identification of phytoconstituents.
CO3.	Relate the significance of the identification of unorganized drugs.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes										Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
CO1	3	3	-	3	-	-	-	-	-	-	-	3	-	-
CO2	3	3	-	3	-	-	-	-	-	-	-	3	-	-
CO3	3	3	-	3	-	-	-	-	-	-	-	3	-	-
Course Correlation Mapping	**3**	**3**	**-**	**3**	**-**	**-**	-	-	**-**	**-**	–	**3**	**-**	**-**

Correlation Levels: ***3: High;*** ***2: Medium;*** ***1: Low***

COURSE CONTENT

EXPERIMENTS	
8.	Morphology, histology, and powder characteristics & extraction & detection of Cinchona, Cinnamon, Senna, Clove, Ephedra, Fennel and Coriander.
9.	Exercise involving isolation & detection of active principles a. Caffeine - from tea dust. b. Diosgenin from Dioscorea c. Atropine from Belladonna d. Sennosides from Senna
10.	Separation of sugars by Paper chromatography
11.	TLC of herbal extract
12.	Distillation of volatile oils and detection of phytoconstituents by TLC
13.	Analysis of crude drugs by chemical tests: **(**i) Asafoetida (ii) Benzoin (iii) Colophony (iv) Aloes (v) Myrrh

VI SEMESTER

Course Code	Course Title	L	T	P	C
23PA101009	MEDICINAL CHEMISTRY – III (Theory)	3	1	-	4

Pre-Requisite -
Anti-Requisite -
Co-Requisite -

COURSE DESCRIPTION: This subject is designed to impart fundamental knowledge on the structure, chemistry and therapeutic value of drugs. The subject emphasis on modern techniques o fractional drug design like quantitative structure activity relationship (QSAR), Prodrug concept, combinatorial chemistry and Computer aided drug design (CADD). The subject also emphasizes on the chemistry, mechanism of action, metabolism, adverse effects,
Structure Activity Relationships (SAR), therapeutic uses and synthesis of important drugs.

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

CO1. Understand the importance of drug design and different techniques of drug design.

CO2. Understand the chemistry of drugs with respect to their biological activity.

CO3. Know the metabolism, adverse effects and therapeutic value of drugs.

CO4. Know the importance of SAR of drugs

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO5	PO 6	PO7	PO8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	PSO 4
CO1	2	1	-	-	-	-	-	-	-	-	-	-	2	1	-	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-
CO3	2	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-
CO4	1	-	-	2	-	-	-	-	-	-	-	-	1	-	-	2
Course Correlation Mapping	**2**	**1**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**1**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: Antibiotics ***(10Periods)***

- **Antibiotics**
  Historical background, Nomenclature, Stereochemistry, Structure activity relationship, Chemical degradation classification and important products of the following classes.
- **β-Lactam antibiotics:** Penicillin, Cepholosporins, β- Lactamase inhibitors, Monobactams
- **Aminoglycosides:** Streptomycin, Neomycin, Kanamycin
- **Tetracyclines:** Tetracycline,Oxytetracycline, Chlortetracycline, Minocycline, Doxycycline.

Module 2: Antibiotics ***(10 Periods)***

- **Antibiotics**
  Historical background, Nomenclature, Stereochemistry, Structure activity relationship, Chemical degradation classification and important products of the following classes.
  Macrolide: Erythromycin Clarithromycin, Azithromycin.
- **Miscellaneous:** Chloramphenicol*, Clindamycin.
- **Prodrugs:** Basic concepts and application of prodrugs design.
- **Antimalarials:** Etiology of malaria.
- **Quinolines:** SAR, Quinine sulphate, Chloroquine*, Amodiaquine, Primaquine phosphate, Pamaquine*, Quinacrine hydrochloride, Mefloquine.
- **Biguanides and dihydro triazines:** Cycloguanil pamoate, Proguanil.
- **Miscellaneous:** Pyrimethamine, Artesunete, Artemether, Atovoquone.

Module 3: Anti-tubercular Agents ***(10 Periods)***

- **Anti-tubercular Agents**
- **Synthetic anti tubercular agents:** Isoniozid*, Ethionamide, Ethambutol, Pyrazinamide, Para amino salicylic acid.*
- **Anti tubercular antibiotics:** Rifampicin, Rifabutin, Cycloserine Streptomycine, Capreomycin sulphate.
- **Urinary tract anti-infective agents**
- **Quinolones:** SAR of quinolones, Nalidixic Acid,Norfloxacin, Enoxacin, Ciprofloxacin*, Ofloxacin, Lomefloxacin, Sparfloxacin, Gatifloxacin, Moxifloxacin
- **Miscellaneous:** Furazolidine, Nitrofurantoin*, Methanamine.
- **Antiviral agents:**
  Amantadine hydrochloride, Rimantadine hydrochloride, Idoxuridine trifluoride, Acyclovir*, Gancyclovir, Zidovudine, Didanosine, Zalcitabine, Lamivudine, Loviride, Delavirding, Ribavirin, Saquinavir, Indinavir,Ritonavir.

Module 4: Antifungal agents: ***(08 Periods)***

- **Antifungal agents:**
- **Antifungal antibiotics:** Amphotericin-B, Nystatin, Natamycin, Griseofulvin.
- **Synthetic Antifungal agents:** Clotrimazole, Econazole, Butoconazole, Oxiconazole Tioconozole, Miconazole*, Ketoconazole, Terconazole, Itraconazole, Fluconazole, Naftifine hydrochloride, Tolnaftate*.
- **Anti-protozoal Agents:** Metronidazole*, Tinidazole, Ornidazole, Diloxanide, Iodoquinol, Pentamidine Isethionate, Atovaquone, Eflornithine.
- **Anthelmintics:** Diethylcarbamazine citrate*, Thiabendazole, Mebendazole*, Albendazole, Niclosamide, Oxamniquine, Praziquantal, Ivermectin.

Module 5: Introduction to Drug Design ***(07 Periods)***

- **Introduction to Drug Design**
  Various approaches used in drug design.
  Physicochemical parameters used in quantitative structure activity relationship (QSAR) such as partition coefficient, Hammet's electronic parameter, Tafts steric parameter and Hansch analysis.
  Pharmacophore modeling and docking techniques.
- **Combinatorial Chemistry:** Concept and applications
  Chemistry of combinatorial: solid phase and solution phase synthesis.

Total Periods: 45

Study of the development of the following classes of drugs, Classification, mechanism of action, uses of drugs mentioned in the course, Structure-activity relationship of the selective class of drugs as specified in the course, and synthesis of drugs superscripted by (*).

RESOURCES

TEXT BOOKS:

1. Wilson and Giswold's Organic medicinal and Pharmaceutical Chemistry.
2. Foye's Principles of Medicinal Chemistry
3. Burger's Medicinal Chemistry, Vol I to IV
4. The Organic Chemistry of Drug Synthesis by Lednicer, Vol. 1-5.

REFERENCES:

1 https://drive.google.com/file/d/10DyG..
2. http://on-app.in/app/home?orgCode=ytibh
3. https://ytibh.courses.store/191940?ut...

VIDEO LECTURES:

1. https://youtu.be/ewERE8gpqBU?si=vAMoH4qZ_CXx9VKZ
2. https://youtu.be/geslVzMgm3s?si=LofVS8EH_Z0ACkge
3. https://youtu.be/ZIkIMVJ4ni0?si=hi8EDMczRq4bxEOn

WEB RESOURCES:

1. https://drive.google.com/file/d/10DyG...
2. http://on-app.in/app/home?orgCode=ytibh
3. https://ytibh.courses.store/191940?ut...

Course Code	Course Title	L	T	P	C
23PC101006	PHARMACOLOGY-III	3	1	-	4

Pre-Requisite		-
Anti-Requisite		-
Co-Requisite		-

COURSE DESCRIPTION

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1.		Understand the mechanism of drug action and its relevance in the treatment of different infectious diseases.
CO2.		Comprehend the principles of toxicology and chrono pharmacology and treatment of various poisonings.
CO3.		Understand the correlation of pharmacology with related medical sciences.
CO4.		understand the therapeutic applications and adverse effects of drugs including the molecular basis of the mechanisms of action, guiding principles of prescribing practices etc.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	-	-	-	-	-	-	-	-	1	-	-	3	-
CO2	3	3	-	-	-	-	-	-	-	-	-	1	-	-	3	-
CO3	3	2	-	-	-	-	-	-	-	-	-	1	-	-	3	-
CO4	3	2	-	-	-	-	-	-	-	-	-	1	-	-	3	-
Course Correlation Mapping	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**3**	**-**

C1rrelation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1 Pharmacology of drugs acting on Respiratory system (10 Periods)

a. Anti -asthmatic drugs
b. Drugs used in the management of COPD
c. Expectorants and antitussive.
d. Nasal decongestants
e. Respiratory stimulants

Pharmacology of drugs acting on the Gastrointestinal Tract

a. Antiulcer agents.
b. Drugs for constipation and diarrhoea.
c. Appetite stimulants and suppressants.
d. Digestants and carminatives.
e. Emetics and anti-emetics.

Module 2 Chemotherapy I (10 Periods)

3. Chemotherapy

a. General principles of chemotherapy.
b. Sulfonamides and cotrimoxazole.
c. Antibiotics- Penicillins, cephalosporins, chloramphenicol, macrolides,
d. quinolones and fluoroquinolins, tetracycline and aminoglycoside

Module 3 Chemotherapy II (10 Periods)

Chemotherapy

a. Antitubercular agents
b. Antileprotic agents
c. Antifungal agents
d. Antiviral drugs
e. Anthelmintics
f. Antimalarial drugs
g. Antiamoebic agents

Module4 Chemotherapy III (08 Periods)

Chemotherapy

a. Urinary tract infections and sexually transmitted diseases.
b. Chemotherapy of malignancy.

Immunopharmacology

a. Immunostimulants
b. Immunosuppressants
c. Protein drugs, monoclonal antibodies, target drugs to antigen, biosimilars

Module 5 Toxicology (07 Periods)

Principles of toxicology

a. Definition and basic knowledge of acute, subacute, and chronic toxicity.

b. Definition and basic knowledge of genotoxicity, carcinogenicity, teratogenicity, and mutagenicity

c. General principles of treatment of poisoning

d. Clinical symptoms and management of barbiturates, morphine, organophosphosphorus compound lead, mercury, and arsenic poisoning.

Chrono pharmacology

a. Definition of rhythm and cycles.

b. Biological clock and their significance leading to chronotherapy.

Total 45 Periods

RESOURCES

REFERENCES:	
1.	Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Rang and Dale's Pharmacology, Churchill Livingstone Elsevier
2.	Katzung B. G., Masters S. B., Trevor A. J., Basic and Clinical Pharmacology, Tata McGraw-Hill
3.	Goodman and Gilman's, The Pharmacological Basis of Therapeutics
4.	Marry Anne K. K., Lloyd Yee Y., Brian K. A., Robbin L.C., Joseph G. B., Wayne A. K., Bradley R.W., Applied Therapeutics: The Clinical Use of Drugs, Lippincott Williams & Wilkins
5.	Mycek M.J., Gelnet S.B., Perper M.M., Lippincott's Illustrated Reviews-Pharmacology
6.	K.D. Tripathi, Essentials of Medical Pharmacology, JAYPEE Brothers Medical Publishers (P) Ltd, New Delhi
7.	Sharma H. L., Sharma K. K., Principles of Pharmacology, Paras Medical Publisher
8.	Modern Pharmacology with Clinical Applications, by Charles R. Craig & Robert N. Udupa and P.D. Gupta, Concepts in Chronopharmacology.

VIDEO LECTURES:	
1.	https://www.youtube.com/watch?v=3BLC0h8nyng
2.	https://www.youtube.com/watch?v=lkrTOSUTvAg
3.	https://www.youtube.com/watch?v=sPJAWl9xV-o
4.	https://www.youtube.com/watch?v=sYB0j3-Fi3M
5.	https://www.youtube.com/watch?v=MykplrrIgBo

WEB RESOURCES:	
1.	https://www.nigms.nih.gov/education/fact-sheets/Pages/circadian-rhythms.aspx
2.	https://www.webpages.uidaho.edu/etox/lectures/lecture10/slides_tera.pdf
3.	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2482845/pdf/postmedj00413-0038.pdf

Course Code	Course Title	L	T	P	C
23PY101008	Herbal Drug Technology	3	1	-	4
Pre-Requisite	-				
Anti-Requisite	-				
Co-Requisite	-				

COURSE DESCRIPTION: This course gives knowledge of the herbal drug industry, raw material quality, standards for the quality of herbal medications, herbal cosmetics, natural sweeteners, nutraceuticals, etc. It also emphasizes GMP, patenting, and regulatory issues of herbal drugs.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1.	Understand the definitions of herbs and their preparations, GACP, and various systems of medicine.
CO2.	Relate the significance of herbal-drug/herbal-food interactions and the use of nutraceuticals for the treatment of various diseases.
CO3.	Understand the raw materials and excipients used for the preparation of herbal cosmetics and herbal formulations.
CO4.	Learn about the evaluation of drugs as per WHO and ICH guidelines. Patenting and regulatory requirements of natural products and regulatory issues.
CO5.	Understand the herbal industry and GMP of the Indian system of medicines.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes										Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
CO1	3	3	-	3	-	-	-	-	-	-	-	3	-	-
CO2	3	3	-	3	-	-	-	-	-	-	-	3	-	-
CO3	3	3	-	3	-	-	-	-	-	-	-	3	-	-
CO4	3	3	-	3	-	-	-	-	-	-	-	3	-	-
CO5	3	3	-	3	-	-	-	-	-	-	-	3	-	-
Course Correlation Mapping	**3**	**3**	**-**	**3**	**-**	**-**	-	-	**-**	**-**	**–**	**3**	**-**	**-**

Correlation Levels: ***3: High;*** ***2: Medium;*** ***1: Low***

COURSE CONTENT

Module 1:	Indian Systems of Medicine	*(07 Periods)*

Herbs as raw materials
Definition of herb, herbal medicine, herbal medicinal product, herbal drug preparation Source of Herbs Selection, identification, and authentication of herbal materials Processing of herbal raw material.

Biodynamic Agriculture
Good agricultural practices in the cultivation of medicinal plants including Organic farming. Pest and Pest management in medicinal plants: Biopesticides/Bioinsecticides.

Indian Systems of Medicine

- Basic principles involved in Ayurveda, Siddha, Unani, and Homeopathy
- Preparation and standardization of Ayurvedic formulations viz Aristas and Asawas, Ghutika, Churna, Lehya, and Bhasma.

Module 2:	Nutraceuticals	*(14 Periods)*

Nutraceuticals
General aspects, Market, growth, scope, and types of products available in the market. Health benefits and role of Nutraceuticals in ailments like Diabetes, CVS diseases, Cancer, Irritable bowel syndrome, and various Gastrointestinal diseases.

Study of the following herbs as health food: Alfalfa, Chicory, Ginger, Fenugreek, Garlic, Honey, Amla, Ginseng, Ashwagandha, and Spirulina.

Herbal-Drug and Herb-Food Interactions: General introduction to interaction and classification. Study of the following drugs and their possible side effects and interactions: Hypercium, kava-kava, Ginkgo Biloba, Ginseng, Garlic, Pepper & Ephedra.

Module 3:	Herbal Cosmetics	*(06 Periods)*

Herbal Cosmetics:
Sources and description of raw materials of herbal origin used via, fixed oils, waxes, gums colors, perfumes, protective agents, bleaching agents, and antioxidants in products such as skin care, hair care, and oral hygiene products.

Herbal excipients:
Herbal Excipients – Significance of substances of natural origin as excipients – colorants, sweeteners, binders, diluents, viscosity builders, disintegrants, flavors & perfumes.

Herbal formulations:
Conventional herbal formulations like syrups, mixtures, and tablets and Novel dosage forms like phytosomes.

Module 4:	Evaluation of Herbal Drugs	*(10 Periods)*

Evaluation of Drugs: WHO & ICH guidelines for the assessment of herbal drugs Stability testing of herbal drugs. **Patenting and Regulatory requirements of natural products:**

- Definition of the terms: Patent, IPR, Farmer's right, Breeder's rights, Bioprospecting and Biopiracy.
- Patenting aspects of Traditional Knowledge and Natural Products. Case study of Curcuma & Neem.

Regulatory Issues: Regulations in India (ASU DTAB, ASU DCC), Regulation of manufacture of ASU drugs - Schedule Z of Drugs & Cosmetics Act for ASU drugs.

Module 5:	**Good Manufacturing Practice of Indian systems of medicine.**	***(08 Periods)***

General Introduction to the Herbal Industry

- Herbal drugs industry: Present scope and prospects.
- A brief account of plant-based industries and institutions involved in work on medicinal and aromatic plants in India.

Schedule T – Good Manufacturing Practice of Indian systems of medicine

- Components of GMP (Schedule – T) and its objectives
- Infrastructural requirements, working space, storage area, machinery and equipment, standard operating procedures, health and hygiene, documentation, and records.

Total 45 Periods

RESOURCES

TEXTBOOKS:	
1.	Textbook of Pharmacognosy by Trease & Evans.
2.	Textbook of Pharmacognosy by Tyler, Brady & Robber.
3.	Pharmacognosy by Kokate, Purohit, and Gokhale.
4.	Essentials of Pharmacognosy by Dr. S. H. Ansari.
5.	Pharmacognosy & Phytochemistry by V.D. Rangari.
6.	Pharmacopoeial Standards for Ayurvedic Formulation (Council of Research in Indian Medicine & Homeopathy).
7.	Mukherjee, P.W. Quality Control of Herbal Drugs: An Approach to Evaluation of Botanicals. Business Horizons Publishers, New Delhi, India, 2002.

VIDEO LECTURES:	
1.	https://youtu.be/NS1uZoyZR_8?si=wM2BFEAMSsij-Hng
2.	https://youtu.be/yLPr2rRSJwM?si=WAN2abBoPHj_HWaR
3.	https://youtu.be/nnFbVPHe7eM?si=hXiBmGxWkXc2QHqP
4.	https://youtu.be/tj3BbDW_ZC0?si=4EqgcORn1yrJqt8s
WEB RESOURCES:	
1.	https://pharmacyinfoline.com/herbal-drug-technology-theory/

Course Code	Course Title	L	T	P	C
23PH101008	Biopharmaceutics and Pharmacokinetics	3	1	-	4
Pre-Requisite	-				
Anti-Requisite	-				
Co-Requisite	-				

COURSE DESCRIPTION: The course helps in exploring pharmaceutical sciences about how drugs interact with body, it also examines the factors influencing drug absorption, distribution, metabolism and excretion, focusing on drug formulation and delivery systems. The course makes the student to understand the importance of optimizing drug therapy, from understanding drug behavior to enhance effective ness of drug and safety profile, ultimately contributing to advancements in patient care and drug development.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1	Understand the basics of Biopharmaceutics processes & factors.
CO2.	Understand the pharmacokinetic model analysis of drugs& multiple dosage regimen
CO3.	Acquire knowledge on BA & BE studies & their assessment

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	2	-	-	-	-	-	-	-	3	-	-	-
CO2	3	2	2	-	1	-	-	1	-	-	-	-	3	-	-	-
CO3	3	-	3	-	1	1	-	1	-	-	-	-	3	-	-	-
Course Correlation Mapping	**3**	**2**	**3**	**-**	**1**	**1**	**-**	**1**	**-**	**-**	**-**	**-**	**3**	**-**	**-**	**-**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1 Drug Absorption (07 Periods)

Absorption; Mechanisms of drug absorption through GIT, factors influencing drug absorption though GIT, absorption of drug from Non per oral extra-vascular routes

Module 2 Drug Distribution and Elimination (06 Periods)

Distribution Tissue permeability of drugs, binding of drugs, apparent, volume of drug distribution, plasma and tissue protein binding of drugs, factors affecting protein-drug binding. Kinetics of protein binding, Clinical significance of protein binding of drugs

Elimination: Drug metabolism and basic understanding metabolic pathways renal excretion of drugs, factors affecting renal excretion of drugs, renal clearance, Non renal routes of drug excretion of drugs

Module 3 Bioavailability and Bioequivalence (07 Periods)

Definition and Objectives of bioavailability, absolute and relative bioavailability, measurement of bioavailability, *in-vitro* drug dissolution models, *in-vitro-in-vivo* correlations, bioequivalence studies, methods to enhance the dissolution rates and bioavailability of poorly soluble drugs

Module 4 Pharmacokinetics (10 Periods)

Definition and introduction to Pharmacokinetics, Compartment models, Non compartment models, physiological models, One compartment open model. (a). Intravenous Injection (Bolus) (b). Intravenous infusion and (c) Extra vascular administrations. Pharmacokinetics parameters - K_E, t1/2, Vd, AUC, Ka, Cl_T and CL_R- definitions methods of eliminations, understanding of their significance and application

Module 5 *Multicompartment models* (08 Periods)

Two compartment open model. IV bolus Kinetics of multiple dosing, steady state drug levels, calculation of loading and maintenance doses and their significance in clinical settings

Module 6 Nonlinear Pharmacokinetics (07 Periods)

: a. Introduction, b. Factors causing non-linearity. C. Michaelis-menton method of estimating parameters, Explanation with example ofdrugs.

Total 45 Periods

RESOURCES

REFERENCES:

1. Gibaldi, Milo. Biopharmaceutics and clinical pharmacokinetics. United Kingdom: Lippincott Williams & Wilkins, 1977.
2. Brahankar DM, Jaiswal SB. Biopharmaceutics and Pharmacokinetics: A treatise. Vallabh Prakashan; 2009.
3. Robert F Notari, Biopharmaceutics and Clinical Pharmacokinetics: An Introduction, Fourth Edition. United Kingdom: CRC Press, 2017.
4. Rowland, Malcolm., Tozer, Thomas N.. Clinical Pharmacokinetics: Concepts and Applications. United Kingdom: Williams & Wilkins, 1995.

VIDEO LECTURES:

1. https://youtu.be/3S20pnv28ys
2. https://youtu.be/x3dYISmnk5U
3. https://youtu.be/3S20pnv28ys

WEB RESOURCES:

1. https://www.sciencedirect.com/topics/engineering/pharmacokinetic-model#:~:text=A%20pharmacokinetic%20model%20describes%20the, have%20three%20or%20fewer% 20 compartments.

Course Code	Course Title	L	T	P	C
23PH101009	**Pharmaceutical Biotechnology**	**3**	**1**	**-**	**4**

Pre-Requisite		-
Anti-Requisite		-
Co-Requisite		-

COURSE DESCRIPTION:

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1.		Understanding the importance of Immobilized enzymes in Pharmaceutical Industries
CO2.		Understand applications of Genetic engineering in relation to production of pharmaceuticals
CO3.		Understand the concept of immunity and preparation of vaccine.
CO4.		Understand the use of microorganisms in fermentation technology

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Course Correlation Mapping	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1 Basics principles of Pharmaceutical Biotechnology (10 Periods)

a) Brief introduction to Biotechnology with reference to Pharmaceutical Sciences.
b) Enzyme Biotechnology- Methods of enzyme immobilization and applications.
c) Biosensors- Working and applications of biosensors in Pharmaceutical Industries.
d) Brief introduction to Protein Engineering.
e) Use of microbes in industry. Production of Enzymes- General consideration - Amylase, Catalase, Peroxidase, Lipase, Protease, Penicillinase.
f) Basic principles of genetic engineering.

Module 2 DNA technology (10 Periods)

a) Study of cloning vectors, restriction endonucleases and DNA ligase.
b) Recombinant DNA technology. Application of genetic engineering in medicine.
c) Application of r DNA technology and genetic engineering in the production of: i) Interferon ii) Vaccines- hepatitis- B iii) Hormones-Insulin.
d) Brief introduction to PCR

Module 3 Immunity and Vaccines (10 Periods)

Types of immunity- humoral immunity, cellular immunity
a) Structure of Immunoglobulins
b) Structure and Function of MHC
c) Hypersensitivity reactions, Immune stimulation and Immune suppressions.
d) General method of the preparation of bacterial vaccines, toxoids, viral vaccine, antitoxins, serum-immune blood derivatives and other products relative to immunity.
e) Storage conditions and stability of official vaccines
f) Hybridoma technology- Production, Purification and Applications.

Module 4 Biotransformation and Mutation (08 Periods)

a) Introduction to Microbial biotransformation and applications
b) Mutation: Types of mutation/mutants.
c) Immuno blotting techniques- ELISA, Western blotting, Southern blotting.
d) Genetic organization of Eukaryotes and Prokaryotes
e) Microbial genetics including transformation, transduction, conjugation, plasmids and transposons.

Module 5 Fermentation and Blood Products (07 Periods)

a) Fermentation methods and general requirements, study of media, equipments, sterilization methods, aeration process, stirring.
b) Large scale production fermenter design and its various controls.
c) Study of the production of - penicillins, citric acid, Vitamin B12, Glutamic acid, Griseofulvin.
d) Blood products: Collection, Processing and storage of Whole human Blood, Dried Human Plasma and Plasma substitutes

Total 45 Periods

RESOURCES

REFERENCES:	
1.	Bellanti J, editor. Immunology. Springer Science & Business Media; 2013.
2.	Glick BR, Patten CL. Molecular biotechnology: principles and applications of recombinant DNA. John Wiley & Sons; 2022 .
3.	Goding, James W.. Monoclonal Antibodies: Principles and Practice. Switzerland: Elsevier Science, 1996.
4.	Gingold EB, Walker JM, editors. Molecular biology and biotechnology. Royal Society of Chemistry; 1988.
5.	Zaborsky, Oskar R.. Immobilized Enzymes. United States: CRC Press, 1973.
6.	Primrose, S. B.. Molecular Biotechnology. India: Wiley, 1991.
7.	Stanbury, Peter F., Whitaker, Allan., Hall, Stephen J. Principles of Fermentation Technology. Netherlands: Elsevier Science, 2016.
VIDEO LECTURES:	
1.	https://www.youtube.com/watch?v=xM0bozu8Q6Q
2.	https://www.youtube.com/watch?v=SqJ5FKP4-pM
3.	https://www.youtube.com/watch?v=V6UdZq7k3Tk
4.	https://www.youtube.com/watch?v=WGCgYKYv2mI&list=PLlCSanxO4a9ExMMUj09ViNjRjZSPDYmy1
WEB RESOURCES:	
1.	https://www.cdc.gov/vaccines/vac-gen/immunity-types.htm
2.	https://www.who.int/news-room/feature-stories/detail/how-are-vaccines-developed
3.	https://www.lifeblood.com.au/health-professionals/clinical-practice/use-of-blood-components

Course Code	Course Title	L	T	P	C
23PA101010	QUALITY ASSURANCE	3	1	-	4
Pre-Requisite					
Anti-Requisite					
Co-Requisite					

COURSE DESCRIPTION: This course deals with the various aspects of quality control and quality assurance aspects of the pharmaceutical industries. It deals with important aspects like cGMP, QC tests, documentation, quality certifications, and regulatory affairs.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1.	understand the cGMP aspects in the pharmaceutical industry.
CO2.	Correlate the importance of documentation
CO3.	Understand the scope of quality certifications applicable to pharmaceutical industries
CO4.	Understand the responsibilities of QA & QC departments

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	3	2	-	-	-	-	-	-	-	3	3	-	-
Course Correlation Mapping	**3**	**2**	**-**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**-**	**-**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1 Quality Assurance and Quality Management concepts (10 Periods)

- **Quality Assurance and Quality Management concepts:** Definition and concept of Quality control, Quality assurance and GMP
- **Total Quality Management (TQM):** Definition, elements, philosophies
- **ICH Guidelines:** purpose, participants, process of harmonization, Brief overview of QSEM, with special emphasis on Q-series guidelines, ICH stability testing guidelines
- **Quality by design (QbD):** Definition, overview, elements of QbD program, tools.
- **ISO 9000 & ISO14000**: Overview, Benefits, Elements, steps for registration.
- **NABL accreditation:** Principles and procedures.

Module 2 Organization and personnel (10Periods)

- **Organization and personnel:** Personnel responsibilities, training, hygiene and personal records.
- **Premises:** Design, construction and plant layout, maintenance, sanitation, environmental control, utilities and maintenance of sterile areas, control of contamination.
- **Equipment and raw materials:** Equipment selection, purchase specifications, maintenance, purchase specifications, and maintenance of stores for raw materials.

Module 3 Quality Control (10 Periods)

- **Quality Control:** Quality control test for containers, rubber closures, and secondary packing materials.
- **Good Laboratory Practices:** General Provisions, Organization and Personnel, Facilities, Equipment, Testing Facilities Operation, Test and Control Articles, Protocol for Conduct of a Nonclinical Laboratory Study, Records and Reports, Disqualification of Testing Facilities.

Module 4 Document maintenance in the pharmaceutical industry (08 Periods)

- **Complaints:** Complaints and evaluation of complaints, Handling of returned goods, recalling, and waste disposal.
- **Document maintenance in the pharmaceutical industry:** Batch Formula Record, Master Formula Record, SOP, Quality audit, Quality Review and Quality documentation, Reports and documents, and distribution records.

Module 5 Calibration and Validation (07Periods)

- **Calibration and Validation:** Introduction, definition, and general principles of calibration, qualification and validation, importance and scope of validation, types of validation, and validation master plan. Calibration of pH meter, Qualification of UV-visible spectrophotometer, General principles of Analytical method Validation.
- **Warehousing:** Good warehousing practice, materials management

Total 45 Periods

RESOURCES

REFERENCES:

1. "Quality Assurance Guide" by Organization of Pharmaceutical Products of India.
2. "Good Laboratory Practice Regulations, 2nd Edition" by Sandy Weinberg, Vol. 69.
3. "Quality Assurance of Pharmaceuticals - A Compendium of Guidelines and Related Materials, Vol I" by WHO Publications.
4. "A Guide to Total Quality Management" by Kaushik Maitra and Sedhan K. Ghosh.
5. "How to Practice GMPs" by P. P. Sharma.
6. "ISO 9000 and Total Quality Management" by Sadhan K. Ghosh.
7. "The International Pharmacopoeia" - Vol I, II, III, IV - General Methods of Analysis and Quality Specification for Pharmaceutical Substances, Excipients, and Dosage Forms.
8. "Good Laboratory Practices" - Marcel Dekker Series.
9. ICH guidelines, ISO 9000, and 14000 guidelines.

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=bcCkQ1IiaKA
2. https://t.me/GracefulPharma/79
3. https://chat.whatsapp.com/Graceful_ph...

WEB RESOURCES:

1. https://www.youtube.com/watch?v=HKgr8L3DlM4&list=PLGaz8McLWyIynMtzSNKFj0gDXQguRKHB1
2. https://kclpharmacy.com/
3. https://www.youtube.com/watch?v=PI3qYoC3xi4&list=PLFpCrsN3l3fCU-M_reaMJP9uD8MIyhnuD

Course Code	Course Title	L	T	P	C
23PA105007	**MEDICINAL CHEMISTRY- III (Practical)**	**-**	**-**	**4**	**2**

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This subject is designed to impart fundamental knowledge on the structure, chemistry, and therapeutic value of drugs. The subject emphasizes on modern techniques o fractional drug design like quantitative structure activity relationship (QSAR), Prodrug concept, combinatorial chemistry and Computer-aided drug design (CADD). The subject also emphasizes on the chemistry, mechanism of action, metabolism, adverse effects, Structure Activity Relationships (SAR), therapeutic uses and synthesis of important drugs.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Make use of preparation methods of some important organic compounds.

CO2. perform the qualitative analysis for important organic compounds.

CO3. Build the knowledge on construction of molecular models.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO 9	PO10	PO1 1	PO1 2	PSO 1	PSO 2	PSO3	PSO 4
CO1	2	3	-	-	-	-	1	-	-	-	-	-	-	-	3	-
CO2	3	3	-	-	2	-	1	-	-	-	-	-	-	-	3	-
CO3	2	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-
Course Correlation Mapping	**3**	**3**	**-**	**-**	**3**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**

Correlation Levels: ***3: High;*** ***2: Medium;*** ***1: Low***

COURSE CONTENT

EXPERIMENTS

1. **I Preparation of drugs and intermediates**
   1 Sulphanilamide
   2 7-Hydroxy, 4-methyl coumarin
   3 Chlorobutanol
   4 Triphenyl imidazole
   5 Tolbutamide
   6 Hexamine

2. **II Assay of drugs**
   1 Isonicotinic acid hydrazide
   2 Chloroquine
   3 Metronidazole
   4 Dapsone
   5 Chlorpheniramine maleate
   6 Benzyl penicillin

3. Preparation of medicinally important compounds or intermediates by Microwave irradiation technique

4. Drawing structures and reactions using chem draw

5. Determination of physicochemical properties such as logP, clogP, MR, Molecular weight, Hydrogen bond donors and acceptors for class of drugs course content using drug design software Drug likeliness screening (Lipinskies RO5)

Course Code	Course Title	L	T	P	C
23PC105005	PHARMACOLOGY-III	-	-	4	2
Pre-Requisite	-				
Anti-Requisite	-				
Co-Requisite	-				

COURSE DESCRIPTION:

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1: Demonstrate the dose calculation, and agonist and antagonist effects of drugs on simulated experiments.

CO2: Evaluate the toxicity aspects of drugs and related products based on simulated experiments.

CO3: Calculate and evaluate the pharmacological effect through the calculation of pharmacokinetic parameters using biostatistics methods.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes										Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO10	PSO 1	PSO2	PSO 3	PSO4
CO1	3	2	-	-	-	-	-	-	1	-	-	-	2	-
CO2	3	2	-	-	-	-	-	-	1	-	-	-	2	-
CO3	3	2	-	-	-	-	-	-	1	-	-	-	2	-
Course Correlation Mapping	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**2**	**-**

Correlation Levels: 3: High; 2: Medium; 1: Low

Course Content

EXPERIMENTAL LEARNING	
1	Dose calculation in pharmacological experiments
2	Antiallergic activity by mast cell stabilization assay
3	Study of anti-ulcer activity of a drug using pylorus ligand (SHAY) rat model and NSAIDS induced ulcer model.
4	Study of the effect of drugs on gastrointestinal motility
5	Effect of agonist and antagonists on guinea pig ileum
6	Estimation of serum biochemical parameters by using a semi-autoanalyzer
7	Effect of saline purgative on frog intestine
8	Insulin hypoglycemic effect in rabbit
9	Test for pyrogens (rabbit method)
10	Determination of acute oral toxicity (LD50) of a drug from a given data
11	Determination of acute skin irritation/corrosion of a test substance
12	Determination of acute eye irritation/corrosion of a test substance
13	Calculation of pharmacokinetic parameters from a given data
14	Biostatistics methods in experimental pharmacology (student's t-test, ANOVA)
15	Biostatistics methods in experimental pharmacology (Chi-square test, Wilcoxon Signed Rank test)

Course Code	Course Title	L	T	P	C
23PY105006	Herbal Drug Technology Practical	-	-	4	2
Pre-Requisite	-				
Anti-Requisite	-				
Co-Requisite	-				

COURSE DESCRIPTION: This course gives the knowledge of basic understanding of herbal drug formulations and preliminary phytochemical screening.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1.	Understand the knowledge on preparation and evaluation of various herbal formulations.
CO2.	Understand the evaluation of excipients used in herbal preparations
CO3.	Acquire knowledge on preliminary phytochemical screening and monographic analysis of herbal drugs.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes										Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
CO1	3	3	-	3	-	-	-	-	-	-	-	3	-	-
CO2	3	3	-	3	-	-	-	-	-	-	-	3	-	-
CO3	3	3	-	3	-	-	-	-	-	-	-	3	-	-
Course Correlation Mapping	**3**	**3**	**-**	**3**	**-**	**-**	-	-	**-**	**-**	–	**3**	**-**	**-**

Correlation Levels: ***3: High;*** ***2: Medium;*** ***1: Low***

COURSE CONTENT

EXPERIMENTS	
1.	To perform preliminary phytochemical screening of crude drugs.
2.	Determination of the alcohol content of Asava and Arista.
3.	Evaluation of excipients of natural origin.
4.	Incorporation of prepared and standardized extract in cosmetic formulations like creams, lotions, shampoos and their evaluation.
5.	Incorporation of prepared and standardized extract in formulations like syrups, mixtures and tablets and their evaluation as per Pharmacopoeial requirements
6.	Monograph analysis of herbal drugs from recent Pharmacopoeias
7.	Determination of Aldehyde content
8.	Determination of Phenol content
9.	Determination of total alkaloids

VII SEMESTER

Course Code	Course Title	L	T	P	C
23PA101011	**INSTRUMENTAL METHODS OF ANALYSIS**	**3**	**1**	**-**	**4**

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This subject deals with the application of instrumental methods in qualitative and quantitative analysis of drugs. This subject is designed to impart a fundamental knowledge on the principles and instrumentation of spectroscopic and chromatographic technique. This also emphasizes on theoretical and practical knowledge on modern analytical instruments that are used for drug testing.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

Understand the interaction of matter with electromagnetic radiations and its applications in drug analysis.

CO2. Understand the chromatographic separation and analysis of drugs.

CO3. Perform quantitative & qualitative analysis of drugs using various analytical instruments.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Course Correlation Mapping	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**	**-**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1 **UV-Visible Spectroscopy and Fluorimetry** **(10 Periods)**

UV Visible spectroscopy - Electronic transitions, chromophores, auxochromes, spectral shifts, solvent effect on absorption spectra, Beer and Lambert's law, Derivation and deviations. Instrumentation - Sources of radiation, wavelength selectors, sample cells, detectors- Photo tube, Photomultiplier tube, Photo voltaic cell, Silicon Photodiode. Applications - Spectrophotometric titrations, Single component and multi-component analysis

Fluorimetry - Theory, Concepts of singlet, doublet and triplet electronic states, internal and external conversions, factors affecting fluorescence, quenching, instrumentation and applications.

Module 2 **IR and Atomic Absorption Spectrophotometry.** **(10 Periods)**

IR spectroscopy-Introduction, fundamental modes of vibrations in poly atomic molecules, sample handling, factors affecting vibrations. Instrumentation - Sources of radiation, wavelength selectors, detectors - Golay cell, Bolometer, Thermocouple, Thermistor, Pyroelectric detector and applications
Flame Photometry-Principle, interferences, instrumentation and applications
Atomic absorption spectroscopy- Principle, interferences, instrumentation and applications
Nepheloturbidometry- Principle, instrumentation and applications

Module 3 **Chromatography I** **(10 Periods)**

Introduction to chromatography
Adsorption and partition column chromatography-Methodology, advantages, disadvantages,, and applications.
Thin layer chromatography- Introduction, Principle, Methodology, Rf values, advantages, disadvantages,, and applications.
Paper chromatography- Introduction, methodology, development techniques, advantages, disadvantages, and applications
Electrophoresis– Introduction, factors affecting electrophoretic mobility, Techniques of paper, gel, capillary electrophoresis, applications

Module 4 **Chromatography II** **(08 Periods)**

Gas chromatography: Introduction, theory, instrumentation, derivatization, temperature programming, advantages, disadvantages and applications
High performance liquid chromatography (HPLC): Introduction, theory, instrumentation, advantages, and applications.

Module 5 **Advanced Chromatographic Techniques** **(07 Periods)**

Ion exchange chromatography- Introduction, classification, ion exchange resins, properties, mechanism of the ion exchange process, factors affecting ion exchange, methodology, and applications
Gel chromatography- Introduction, theory, instrumentation, and applications
Affinity chromatography- Introduction, theory, instrumentation, and applications

Total Periods 45

RESOURCES

REFERENCES:

1. Connors, K.A. "Textbook of Pharmaceutical Analysis".
2. Sharma, B.K. "Instrumental Methods of Chemical Analysis".
3. Sharma, Y.R. "Organic Spectroscopy".
4. Vogel, A.I. "Vogel's Textbook of Quantitative Chemical Analysis".

VIDEO LECTURES:

1. https://youtu.be/PGhcv8ZYkBA?si=XGxQ-EkoOz4-LKXy
2. https://youtu.be/Wap9pQEN4gE?si=w3FQ7MK7HbMXk0VB
3. https://youtu.be/SnbXQTTHGs4?si=IPHWBd7ckAz1nf39
4. https://youtu.be/EOJrRnpiq5s?si=5Aqm8JJ7L9eSbf9K
5. https://youtu.be/p3_WtEYIhTo?si=1HVwMcoylnvAi5QS

WEB RESOURCES:

1. https://www.carewellpharma.in/bpharmacy/notes/7th-sem/instrumental-methods-of-analysis/unit-1
2. https://pharmaedu.in/b-pharmacy-7th-semester-instrumental-methods-of-analysis-notes-2022/
3. https://www.youtube.com/watch?v=mVj8lBPTyis.

Course Code	Course Title	L	T	P	C
23PH101010	**INDUSTRIAL PHARMACY-II**	**3**	**1**	**-**	**4**

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: Upon completion of the course, the student shall be able to: Know the process of pilot plant and scale up of pharmaceutical dosage forms Understand the process of technology transfer from lab scale to commercial batch know different Laws and Acts that regulate pharmaceutical industry understand the approval process and regulatory requirements for drug products

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO4. know the process of pilot plant and scale up of pharmaceutical dosage forms
CO5. understand the process of technology transfer from lab scale to commercial batch
CO6. Know different Laws and Acts that regulate pharmaceutical industry
CO7. understand the approval process and regulatory requirements for drug products.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	-	-	-	2	-	-	2	-	-	-	-	3	-	-	-
CO2	3	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-
CO3	2	-	-	-	-	-	-	3	-	-	-	-	3	-	-	-
CO4	2	-	-	-	-	-	-	3	-	-	-	-	2	-	-	-
Course Correlation Mapping	**3**	**1**	**-**	**-**	**2**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**3**	**-**	**-**	**-**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1 Pilot plant scale up techniques (10 Periods)

General considerations - including significance of personnel requirements, space requirements, raw materials, Pilot plant scaleup considerations for solids, liquid orals, semi solids and relevant documentation, SUPAC guidelines, Introduction to platform technology.

Module 2 Technology development and transfer (10Periods)

WHO guidelines for Technology Transfer(TT): Terminology, Technology transfer protocol, Quality risk management, Transfer from R & D to production (Process, packaging and cleaning), Granularity of TT Process (API, excipients, finished products, packaging materials) Documentation, Premises and equipments, qualification and validation, quality control, analytical method transfer, Approved regulatory bodies and agencies, Commercialization - practical aspects and problems (case studies), TT agencies in India - APCTD, NRDC, TIFAC, BCIL, TBSE / SIDBI; TT related documentation - confidentiality agreement, licensing, MoUs, legal issues.

Module 3 Regulatory affairs (10Periods)

Introduction, Historical overview of Regulatory Affairs, Regulatory authorities, Role of Regulatory affairs department, Responsibility of Regulatory Affairs Professionals.

Regulatory requirements for drug approval: Drug Development Teams, Non-Clinical Drug Development, Pharmacology, Drug Metabolism and Toxicology, General considerations of Investigational New Drug (IND) Application, Investigator's Brochure (IB) and New Drug Application (NDA), Clinical research / BE studies, Clinical Research Protocols, Biostatistics in Pharmaceutical Product Development, Data Presentation for FDA Submissions, Management of Clinical Studies.

Module 4 Quality management systems (08Periods)

Quality management & Certifications: Concept of Quality, Total Quality Management, Quality by Design (QbD), Six Sigma concept, Out of Specifications (OOS), Change control, Introduction to ISO 9000 series of quality systems standards, ISO 14000, NABL, GLP

Module 5 Indian Regulatory Requirements (07Periods)

Central Drug Standard Control Organization (CDSCO) and State Licensing Authority: Organization, Responsibilities, Certificate of Pharmaceutical Product (COPP), Regulatory requirements and approval procedures for New Drugs.

Total 45 Periods

RESOURCES

REFERENCES:

Douglas J. Pisano and David S. Mantus. "Textbook of FDA Regulatory Affairs: A Guide for Prescription Drugs, Medical Devices, and Biologics", Second Edition.

2. International Regulatory Affairs Updates. Available at: http://www.iraup.com/about.php
3. Regulatory Affairs from Wikipedia, the free encyclopedia. Modified on 7th April. Available at: http://en.wikipedia.org/wiki/Regulatory_Affairs
4. Regulatory Affairs brought by Learning Plus, Inc. Available at: http://www.cgmp.com/ra.htm

VIDEO LECTURES:

1. https://youtu.be/dMkj4YWKOOU
2. https://youtu.be/U9L1NM43HVs
3. https://youtu.be/4I3_N9Gbh4g
4. https://youtu.be/VBiwC-BanRY
5. https://youtu.be/6HVYX8FRSGA
6. https://youtu.be/wNj57CA9TMA

WEB RESOURCES:

1. https://www.iptsalipur.org/wp-content/uploads/2020/08/BP702T_IP_I.pdf
2. https://www.iptsalipur.org/wpcontent/uploads/2020/08/BP702T_IP_II.pdf
3. https://www.iptsalipur.org/wp content/uploads/2020/08/BP702T_IP_III.pdf
4. https://www.icao.int/NACC/Documents/Meetings/2016/AIMQMS/QMSFPLAIMQualityManagementSystemsGuide.pdf
5. https://www.iptsalipur.org/wp-content/uploads/2020/08/BP702T_IP_V.pdf

Course Code	Course Title	L	T	P	C
23PP101001	PHARMACY PRACTICE	3	1	0	4

Pre-Requisite		-
Anti-Requisite		-
Co-Requisite		-

COURSE DESCRIPTION: The course deals with teaching various skills like drug distribution, drug information, and therapeutic drug monitoring for improved patient care. In community pharmacy, students will be learning various skills such as dispensing of drugs, responding to minor ailments by providing suitable safe medication, patient counselling for improved patient care in the community set

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1.		Understand various drug distribution methods in hospital and appreciate the pharmacy stores management and inventory control.
CO2.		Monitor drug therapy of patient through medication chart review and clinical review and obtain medication history interview and counsel the patients
CO3.		Identify drug related problems and detect and assess adverse drug reactions
CO4.		Interpret selected laboratory results (as monitoring parameters in therapeutics) of specific disease states and know pharmaceutical care services.
CO5.		Cnduct patient counseling in community pharmacy and appreciate the concept of rational drug therapy.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Course Correlation Mapping	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1	Hospital and its Organization	(10 Periods)

Hospital and it's organization

Definition, Classification of hospital- Primary, Secondary and Tertiary hospitals, Classification based on clinical and non- clinical basis, Organization Structure of a Hospital, and Medical staffs involved in the hospital and their functions.

b) Hospital pharmacy and its organization - Definition, functions of hospital pharmacy, Organization structure, Location, Layout and staff requirements, and Responsibilities and functions of hospital pharmacists.

c) Adverse drug reaction- Classifications - Excessive pharmacological effects, secondary pharmacological effects, idiosyncrasy, allergic drug reactions, genetically determined toxicity, toxicity

following sudden withdrawal of drugs, Drug interaction- beneficial interactions, adverse interactions, and pharmacokinetic drug interactions, Methods for detecting. drug interactions, spontaneous case reports and record linkage studies, and Adverse, drug reaction reporting and management.

d) **Community Pharmacy**

Organization and structure of retail and wholesale drug store, types and design, Legal requirements for establishment and maintenance of a drug store, Dispensing of proprietary products, maintenance of records of retail and wholesale drug store.

Module 2	Drug Distribution and other policies	(10 Periods)

a) Drug distribution system in a hospital - Dispensing of drugs to inpatients, types of drug distribution systems, charging policy and labelling, dispensing of drugs to ambulatory patients, and dispensing of controlled drugs.

b) Hospital formulary - Definition, contents of hospital formulary, Differentiation of hospital formulary and Drug list, preparation and revision, and addition and deletion of drug from hospital formulary.

c) Therapeutic drug monitoring- Need for Therapeutic Drug Monitoring, Factors to be considered during the Therapeutic Drug Monitoring, and Indian scenario for Therapeutic Drug Monitoring.

d) Medication adherence - Causes of medication non-adherence, pharmacist role in the medication adherence, and monitoring of patient medication adherence.

e) Patient medication history interview- Need for the patient medication history interview, medication interview forms.

f) Community pharmacy management - Financial, materials, staff, and infrastructure requirements.

Module 3		(10 Periods)

a) Pharmacy and therapeutic committee - Organization, functions, Policies of the pharmacy and therapeutic committee in including drugs into formulary, inpatient and outpatient prescription, automatic stop order, and emergency drug list preparation.

b) Drug information services- Drug and Poison information centre, Sources of drug information, Computerised services, and storage and retrieval of information.

c) Patient Counselling-Definition of patient counselling; steps involved in patient counselling, and Special cases that require the pharmacist

d) Education and training program in the hospital- Role of pharmacist in the education and training program, Internal and external training program, Services to the nursing homes/clinics, Code of ethics for community pharmacy, and Role of pharmacist in the interdepartmental communication and community health education.

e) Prescribed medication order and communication skills- Prescribed medication order-interpretation and legal requirements, and Communication skills- communication with prescribers and patients

Module 4		**(08 Periods)**
a) Budget preparation and implementation- Budget preparation and implementation **b) Clinical Pharmacy -**Introduction to Clinical Pharmacy, Concept of clinical pharmacy, functions and responsibilities of clinical pharmacist, Drug therapy monitoring - medication chart review, clinical review, pharmacist intervention, Ward round participation, Medication history and Pharmaceutical care. Dosing pattern and drug therapy based on Pharmacokinetic & disease pattern. **c) Over the counter (OTC) sales-** Introduction and sale of over the counter, and Rational use of common over the counter medications.		
Module 5		**(07 Periods)**
a) Drug store management and inventory control- Organisation of drug store, types of materials stocked and storage conditions, Purchase and inventory control: principles, purchase procedure, purchase order, procurement and stocking, Economic order quantity, Reorder quantity level, and Methods used for the analysis of the drug expenditure **b) Investigational use of drugs-** Description, principles involved, classification, control, identification, role of hospital pharmacist, advisory committee. **c) Interpretation of Clinical Laboratory Tests-** Blood chemistry, hematology, and urine analysis		
		Total 45 Periods

RESOURCES

REFERENCES:

1. Hassan, W.E. "Hospital Pharmacy", 5th ed. Philadelphia: Lea & Febiger.
2. LT, Scott. "Basic Skills in Interpreting Laboratory Data", 4th ed. American Society of Health System Pharmacists Inc.
3. Merchant, S.H., & Quadry, J.S. "A Textbook of Hospital Pharmacy", 4th ed. Ahmadabad: B.S. Shah Prakakshan.
4. Parthasarathi, G., Nyfort-Hansen, K., & Nahata, M.C. "A Textbook of Clinical Pharmacy Practice: Essential Concepts and Skills", 1st ed. Chennai: Orient Longman Private Limited.
5. Parmar, N.S. "Health Education and Community Pharmacy", 18th ed. India: CBS Publishers & Distributors.
6. Tipnis, Bajaj. "Hospital Pharmacy", 1st ed. Maharashtra: Career Publications.

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=l6Nzmd7oZlM
2. https://www.youtube.com/watch?v=Nlv90fKQqVg
3. https://www.youtube.com/watch?v=PbJhx5_mc48

WEB RESOURCES:

1. American journal of health system pharmacy. ISSN: 1535-2900 (online)
2. https://journals.lww.com/drug-monitoring/pages/default.aspx
3. https://journals.sagepub.com/home/jpp
4. https://www.pharmacytimes.com/

Course Code		L	T	P	C
23PH101011	**NOVEL DRUG DELIVERY SYSTEMS**	**3**	**1**	**0**	**4**

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This subject is designed to impart basic knowledge on the area of novel drug delivery systems.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. To get the basic knowledge and understand various approaches for development of Controlled drug delivery systems.

CO2. To understand the criteria for selection of drugs and polymers for the development of Novel drug delivery systems through Cavities of head

CO3. To understand the formulation parameters of drugs for the development of Novel drug delivery system through GIT and Lungs

CO4. To understand the advantages, dis advantages and applications of Novel Drug delivery systems through skin, tissues and uterus

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	2	2	3	-	-	-	-	-	-	-	-	2	-	-	3
CO2	2	2	2	3	-	-	-	-	-	-	-	-	2	-	-	3
CO3	2	2	2	3	-	-	-	-	-	-	-	-	2	-	-	3
CO4	2	2	2	3	-	-	-	-	-	-	-	-	2	-	-	3
Course Correlation Mapping	**2**	**2**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1	**Concept and Techniques of NDDS**	**10 Periods)**
Introduction, terminology/definitions and rationale, advantages, disadvantages, selection of drug candidates. Approaches to design-controlled release formulations based on diffusion, dissolution and ion exchange principles. Physicochemical and biological properties of drugs relevant to controlled release Formulations **Polymers:** Introduction, classification, properties, advantages and application of polymers in formulation of controlled release drug delivery systems. **Microencapsulation:** Definition, advantages and disadvantages, microspheres /microcapsules, microparticles, methods of microencapsulation, applications.		
Module 2	**Mucosal and Ocular**	**(10 Periods)**
Mucosal Drug Delivery system: Introduction, Principles of bio adhesion / mucoadhesion, concepts, advantages and disadvantages, transmucosal permeability and formulation considerations of buccal delivery systems. **Ocular Drug Delivery Systems:** Introduction, intra ocular barriers and methods to overcome –Preliminary study, ocular formulations and occuserts		
Module 3	**GRDDS & Naso Pulmonary**	**(10 periods)**
Gastro retentive drug delivery systems: Introduction, advantages, disadvantages, approaches for GRDDS – Floating, high-density systems, inflatable and gastro adhesive systems and their applications **Naso pulmonary drug delivery system:** Introduction to Nasal and Pulmonary routes of drug delivery, Formulation of Inhalers (dry powder and metered dose), nasal sprays, nebulizers		
Module 4	**Targeted & Implantable Drug Delivery systems**	**(07 periods)**
Targeted drug Delivery: Concepts and approaches advantages and disadvantages, Introduction to liposomes, niosomes, nanoparticles, monoclonal antibodies and their applications **Implantable Drug Delivery Systems:** Introduction, advantages and disadvantages, concept of implants and osmotic pump		
Module 5	**Intrauterine and transdermal**	**(08 periods)**
Intrauterine Drug Delivery Systems: Introduction, advantages and disadvantages, development of intra uterine devices (IUDs) and applications **Transdermal Drug Delivery Systems:** Introduction, Permeation through skin, factors affecting permeation, permeation enhancers, basic components of TDDS, formulation approaches		
		Total 45 periods

RESOURCES

REFERENCES:

1. Chien, Y.W. "Novel Drug Delivery Systems", 2nd edition, revised and expanded. Marcel Dekker, Inc., New York.
2. Encyclopedia of Controlled Delivery. Mathiowitz, E. Published by Wiley Interscience Publication, John Wiley and Sons, Inc., New York. Chichester/Weinheim.
3. Jain, N.K. "Controlled and Novel Drug Delivery", CBS Publishers & Distributors, New Delhi, First edition 1997 (reprint in 2001).
4. Robinson, J.R., & Lee, V.H.L. "Controlled Drug Delivery Systems". Marcel Dekker, Inc., New York.
5. Vyas, S.P., & Khar, R.K. "Controlled Drug Delivery - Concepts and Advances". Vallabh Prakashan, New Delhi.

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=kQNxETJgBHA
2. https://www.youtube.com/watch?v=udAoWpfWM7g
3. https://www.youtube.com/watch?v=H0D-ERVh7LY

WEB RESOURCES:

1. Indian Journal of Pharmaceutical Sciences (IPA)
2. Indian Drugs (IDMA)
3. Journal of Controlled Release (Elsevier Sciences)
4. Drug Development and Industrial Pharmacy (Marcel & Decker)
5. International Journal of Pharmaceutics (Elsevier Sciences)

Course Code	Course Title	L	T	P	C
23PA105008	INSTRUMENTAL METHODS OF ANALYSIS PRACTICAL	-	-	4	2

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course emphasizes on theoretical and practical knowledge on modern analytical instruments that are used for drug testing.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1 Practical skills for the analysis of drugs and excipients using various instrumentation techniques.

CO2 To make accurate analysis and report the results in defined formats & learn documentation and express the observations with clarity.

CO3 To understand the professional and safety responsibilities for working in the analysis laboratory

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Course Correlation Mapping	3	2	-	3	2	-	-	-	-	-	-	-	3	3	-	-

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

1. Determination of absorption maxima and effect of solvents on absorption maxima of organic compounds
2. Estimation of dextrose by colorimetry
3. Estimation of sulfanilamide by colorimetry
4. Simultaneous estimation of ibuprofen and paracetamol by UV spectroscopy
5. Assay of paracetamol by UV- Spectrophotometry
6. Estimation of quinine sulfate by fluorimetry
7. Study of quenching of fluorescence
8. Determination of sodium by flame photometry
9. Determination of potassium by flame photometry
10. Determination of chlorides and sulphates by nephelo turbidometry
11. Separation of amino acids by paper chromatography
12. Separation of sugars by thin layer chromatography
13. Separation of plant pigments by column chromatography
14. Demonstration experiment on HPLC
15. Demonstration experiment on Gas Chromatography

RESOURCES

REFERENCES:

1. Finar, I.L. "Organic Chemistry".
2. Garrett, D.C. "Quantitative Analysis of Drugs".
3. Kemp, W. "Organic Spectroscopy".
4. Sethi, P.D. "Quantitative Analysis of Drugs in Pharmaceutical Formulations".
5. Silverstein, Silverstein. "Spectrophotometric Identification of Organic Compounds".

VIDEO LECTURES:

1. https://www.carewellpharma.in/B_Pharm...
2. https://www.carewellpharma.in
3. https://telegram.me/carewellpharma.

WEB RESOURCES:

1. https://www.carewellpharma.in/quiz/carewell.
2. https://www.carewellpharma.in/B_Pharm...
3. https://www.youtube.com/watch?v=mVj8lBPTyis.

VIII SEMESTER

COURSE CORE

Course Code	Course Title	L	T	P	C
23PY101009	**Biostatistics and Research Methodology**	3	1	-	4

Pre-Requisite -
Anti-Requisite -
Co-Requisite -

COURSE DESCRIPTION: To understand the applications of Biostatics in Pharmacy. This subject deals with descriptive statistics, Graphics, Correlation, Regression, logistic regression Probability theory, Sampling technique, Parametric tests, Non Parametric tests, ANOVA, Introduction to Design of Experiments, Phases of Clinical trials and Observational and Experimental studies.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Understand the concepts of Frequency distribution, Measures of central tendency, Measures of dispersion and Correlation.

CO2. Learn about the Regression, Probability and Parametric tests.
CO3. Understand the various non-parametric tests, Introduction to Research, Graphs and Designing the methodology.
CO4. Learn about the Regression modeling, Introduction to Practical components of Industrial and Clinical Trials Problems.
CO5. Understand various methods of Design and Analysis of experiments, Factorial Design and Response Surface methodology.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes										Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
CO1	3	3	-	3	-	-	-	-	-	-	-	3	-	-
CO2	3	3	-	3	-	-	-	-	-	-	-	3	-	-
CO3	3	3	-	3	-	-	-	-	-	-	-	3	-	-
CO4	3	3	-	3	-	-	-	-	-	-	-	3	-	-
CO5	3	3	-	3	-	-	-	-	-	-	-	3	-	-
Course Correlation Mapping	**3**	**3**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

Correlation Levels: ***3: High;*** ***2: Medium;*** ***1: Low***

COURSE CONTENT

Module 1: Measures of central tendency, Measures of dispersion and Correlation. ***(10 Periods)***

Introduction: Statistics, Biostatistics, Frequency distribution
Measures of central tendency: Mean, Median, Mode- Pharmaceutical examples
Measures of dispersion: Dispersion, Range, standard deviation, Pharmaceutical problems
Correlation: Definition, Karl Pearson's coefficient of correlation, Multiple correlation -

Module 2: Regression, Probability and Parametric tests ***(10 Periods)***

Regression: Curve fitting by the method of least squares, fitting the lines y= a + bx and x = a + by, Multiple regression, standard error of regression– Pharmaceutical Examples
Probability: Definition of probability, Binomial distribution, Normal distribution, Poisson's distribution, properties - problems Sample, Population, large sample, small sample, Null hypothesis, alternative hypothesis, sampling, essence of sampling, types of sampling, Error-I type, Error-II type, Standard error of mean (SEM) - Pharmaceutical examples
Parametric test: t-test(Sample, Pooled or Unpaired and Paired) , ANOVA, (One way and Two way), Least Significance difference

Module 3: Non-Parametric tests, Introduction to Research, Graphs and Designing the methodology ***(10 Periods)***

Non Parametric tests: Wilcoxon Rank Sum Test, Mann-Whitney U test, Kruskal-Wallis test, Friedman Test
Introduction to Research: Need for research, Need for design of Experiments, Experiential Design Technique, plagiarism
Graphs: Histogram, Pie Chart, Cubic Graph, response surface plot, Counter Plot graph
Designing the methodology: Sample size determination and Power of a study, Report writing and presentation of data, Protocol, Cohorts studies, Observational studies, Experimental studies, Designing clinical trial, various phases.

Module 4: Regression modeling and Introduction to Practical components of Industrial and Clinical Trials Problems ***(08 Periods)***

Blocking and confounding system for Two-level factorials
Regression modeling: Hypothesis testing in Simple and Multiple regressionmodels
Introduction to Practical components of Industrial and Clinical Trials Problems: Statistical Analysis Using Excel, SPSS, MINITAB ® , DESIGN OF EXPERIMENTS, R - Online Statistical Software's to Industrial and Clinical trial approach

Module 5: Design and Analysis of Experiments ***(07 Periods)***

Factorial Design: Definition, 2^2, 2^3 design. Advantage of factorial design

Response Surface methodology: Central composite design, Historical design, Optimization Techniques

RESOURCES

TEXTBOOKS:	
1.	Bolton, S. "Pharmaceutical Statistics: Practical and Clinical Applications". Marcel Dekker Inc., New York.
2.	Guptha, S.C. "Fundamentals of Statistics". Himalaya Publishing House.
3.	Montgomery, D., & Douglas, C. "Design and Analysis of Experiments". Wiley Students Edition.
4.	Pannerselvam, R. "Design and Analysis of Experiments". PHI Learning Private Limited.

VIDEO LECTURES:	
1.	https://www.youtube.com/watch?v=tC1WyivzS-8
2.	https://www.youtube.com/watch?v=ZkjP5RJLQF4
3.	https://www.youtube.com/watch?v=ztxHObo5gnU
4.	https://www.youtube.com/watch?v=0m-rs2M7K-Y
WEB RESOURCES:	
1.	https://experimentaldesign.online/
2.	https://digitalfirst.bfwpub.com/stats_applet/stats_applet_5_correg.html

Course Code	Course Title	L	T	P	C
23PC101007	**SOCIAL AND PREVENTIVE PHARMACY**	**3**	**1**	**-**	**4**

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: The purpose of this course is to introduce to students a number of health issues and their challenges. The course also introduced a number of national health programmes. The roles of pharmacist in these contexts are also discussed

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Acquire high consciousness/realization of current issues related to health and pharmaceutical problems within the country and worldwide.

CO2. Have a critical way of thinking based on current healthcare development.

CO3. Evaluate alternative ways of solving problems related to health and pharmaceutical issues

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	2	3	-	-	-	2	-	-	-	-	-	-	-	-	-	-
CO2	3	1	-	-	-	2	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	2	-	-	-	-	-	-	-	-	-	-
Course Correlation Mapping	**3**	**2**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1 Concept of health and disease (10 Periods)

Definition, concepts and evaluation of public health.
Understanding the concept of prevention and control of disease, social causes of diseases and social problems of the sick.
Social and health education: Food in relation to nutrition and health, Balanced diet, Nutritional deficiencies, Vitamin deficiencies, Malnutrition and its prevention.
Sociology and health: Socio cultural factors related to health and disease, Impact of urbanization on health and disease, Poverty and health
Hygiene and health: personal hygiene and health care; avoidable habits.

Module 2 Preventive medicine (10Periods)

General principles of prevention and control of diseases such as cholera, SARS, Ebola virus, influenza, acute respiratory infections, malaria, chicken guinea, dengue, lymphatic filariasis, pneumonia, hypertension, diabetes mellitus, cancer, drug addiction-drug substance abuse.

Module 3 National health programs (10Periods)

National health programs, its objectives, functioning and outcome of the following: HIV AND AIDS control Programme, TB, Integrated disease surveillance program (IDSP), National leprosy control programme, National mental health program, National programme for prevention and control of deafness, Universal immunization programme, National programme for control of blindness, Pulse polio programme.

Module 4 National Health intervention programme (08Periods)

National health intervention programme for mother and child, National family welfare programme, National tobacco control programme, National Malaria Prevention Program, National programme for the health care for the elderly, Social health programme; role of WHO in Indian national program

Module 5 Community services (07Periods)

Community services in rural, urban and school health: Functions of PHC, Improvement in rural sanitation, national urban health mission, Health promotion and education in school.

Total 45 Periods

RESOURCES

REFERENCES:

1. Adepu, R. "Community Pharmacy Practice". BSP Publishers, Hyderabad.
2. Hiremath, Lalita D., & Hiremath, Dhananjaya A. "Essentials of Community Medicine—A Practical Approach". JAYPEE Publications.
3. Jain, Vivek. "Review of Preventive and Social Medicine (Including Biostatistics)". JAYPEE Publications.
4. Mahajan, and Gupta (Edited by Roy Rabindra Nath, Saha Indranil). "Textbook of Preventive and Social Medicine". 4th Edition. JAYPEE Publications.
5. Park, K. "Park Textbook of Preventive and Social Medicine". 21st Edition. BANARSIDAS BHANOT PUBLISHERS.
6. Prabhakara, GN. "Short Textbook of Preventive and Social Medicine". 2nd Edition. JAYPEE Publications.

VIDEO LECTURES:

1. https://youtu.be/KbFRlyNhXwc
2. https://youtu.be/_pw8n-M8FQE
3. https://youtu.be/2E2oC620Hh8
4. https://youtu.be/TXkCePq55D0
5. https://youtu.be/pjKLePZwwSI

WEB RESOURCES:

1. https://www.himsr.co.in/wp-content/uploads/2020/03/Concept Prevention-of-Disease.-Dr.Meely-Panda.pdf
2. https://www.upstate.edu/publichealth/pdf/handbook.pdf
3. https://pharmacyinfoline.com/national-health-programs/

Course Code	Course Title	L	T	P	C
23PH101012	PHARMA MARKETING MANAGEMENT	3	1	-	4

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION:
The pharmaceutical industry not only needs highly qualified researchers, chemists and, technical people, but also requires skilled managers who can take the industry forward by managing and taking the complex decisions which are imperative for the growth of the industry.

COURSE OUTCOMES: After successful completion of the course, students will be able to:
CO1. Understand marketing concepts and techniques**.**

CO2. Provide their applications in the pharmaceutical industry.
CO3. Provide Knowledge and know-how of marketing management groom the people for taking a challenging role in Sales and Product management

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Course Correlation Mapping	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1 Marketing (10 Periods)

Definition, general concepts and scope of marketing; Distinction between marketing & selling; Marketing environment; Industry and competitive analysis; Analyzing consumer buying behavior; industrial buying behavior.

Pharmaceutical marketing:

Quantitative and qualitative aspects; size and composition of the market; demographic descriptions and socio-psychological characteristics of the consumer; market segmentation& targeting. Consumer profile; Motivation and prescribing habits of the physician; patients' choice of physician and retail pharmacist. Analyzing the Market; Role of market research.

Module 2 Product decision (10 Periods)

Classification, product line and product mix decisions, product life cycle, product portfolio analysis; product positioning; New product decisions; Product branding, packaging and labeling decisions, Product management in pharmaceutical industry.

Module 3 Product Promotion (10Periods)

Methods, determinants of promotional mix, promotional budget; An overview of personal selling, advertising, direct mail, journals, sampling, retailing, medical exhibition, public relations, online promotional techniques for OTC Products.

Module 4 Pharmaceutical marketing channels. (08 Periods)

Designing channel, channel members, selecting the appropriate channel, conflict in channels, physical distribution management: Strategic importance, tasks in physical distribution management.

Professional sales representative (PSR):

Duties of PSR, purpose of detailing, selection and training, supervising, norms for customer calls, motivating, evaluating, compensation and future prospects of the PSR.

Module 5 Pricing (07 Periods)

Meaning, importance, objectives, determinants of price; pricing methods and strategies, issues in price management in pharmaceutical industry. An overview of DPCO (Drug Price Control Order) and NPPA (National Pharmaceutical Pricing Authority).

Emerging concepts in marketing:

Vertical & Horizontal Marketing; Rural Marketing; Consumerism; Industrial Marketing; Global Marketing.

Total 45 periods

RESOURCES

REFERENCES:

1. Grewal, D., & Levy, M. "Marketing". Tata McGraw-Hill.
2. Kotler, P., & Keller, K.L. "Marketing Management". Prentice Hall of India.
3. Kumar, A., & Menakshi, N. "Marketing Management". Vikas Publishing, India.
4. Ramaswamy, U.S., & Nanakamari, S. "Marketing Management: Global Perspective, Indian Context". Macmilan India.
5. Saxena, R. "Marketing Management". Tata McGraw-Hill (India Edition).
6. Walker, J.R., Boyd, H.W., & Larreche, J.C. "Marketing Strategy: Planning and Implementation". Tata McGraw-Hill.

VIDEO LECTURES:

1 https://www.youtube.com/watch?v=zHxgdXQyHoA

2 https://youtu.be/dGUgsPE7Auo?si=ipgBQMv78i_yt_Nj

3 https://youtu.be/SLub8Br9tHw?si=xkYtWMCpkM-ayvva

WEB RESOURCES:

1 https://pathofscience.org/Library/MMPh_Part_II.pdf

2 https://pharmaedu.in/b-pharm-pharma-marketing-management-notes-pdf/

Course Code		L	T	P	C
23PH101013	**PHAMACEUTICAL REGULATORY SCIENCE**	**3**	**1**	**0**	**4**

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course is designed to impart the fundamental knowledge on the regulatory requirements for approval of new drugs, and drug products in regulated markets of India & other countries like US, EU, Japan, Australia, UK etc. It prepares the students to learn in detail on the regulatory requirements, documentation requirements, and registration procedures for marketing the drug products.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO4. To impart the fundamental knowledge on the regulatory requirements for approval of new drugs, and drug products in regulated markets of India & other countries like US, EU, Japan, Australia, UK etc.

CO5. To know about the process of drug discovery and development

CO6. To know the regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals

CO7. To know the regulatory approval process and their registration in Indian and international markets

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	2	2	2	2	-	-	-	3	-	-	-	-	3	3	-	-
CO2	2	2	2	3	-	-	-	3	-	-	-	-	3	2	-	-
CO3	2	3	2	3	-	-	-	2	-	-	-	-	3	2	-	-
CO4	2	3	2	3	-	-	-	3	-	-	-	-	2	3	-	-
Course Correlation Mapping	**2**	**3**	**2**	**3**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**3**	**3**	**-**	**-**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1 New Drug Discovery and development (10Periods)

Stages of drug discovery, Drug development process, pre-clinical studies, non-clinical activities, clinical studies, Innovator and generics, Concept of generics, Generic drug product development.

Module 2 Regulatory Authorities and Approvals Process (08 Periods)

Regulatory Approval Process

Approval processes and timelines involved in Investigational New Drug (IND), New Drug Application (NDA), Abbreviated New Drug Application (ANDA). Changes to an approved NDA / ANDA.

Regulatory authorities and agencies

Overview of regulatory authorities of India, United States, European Union, Australia, Japan, Canada (Organization structure and types of applications)

Module 3 Registration of Indian drug product in overseas market (10Periods)

Procedure for export of pharmaceutical products, technical documentation, Drug Master Files (DMF), Common Technical Document (CTD), electronic Common Technical Document (eCTD), ASEAN Common Technical Document (ACTD)research.

Module 4 Clinical trails (10 Periods)

Developing clinical trial protocols, Institutional Review Board / Independent Ethics committee - formation and working procedures, Informed consent process and procedures, GCP obligations of Investigators, sponsors & Monitors, Managing and Monitoring clinical trials, Pharmacovigilance – safety monitoring in clinical trials

Module 5 Regulatory Concepts (07Periods)

Basic terminology, guidance, guidelines, regulations, Laws and Acts, Orange book, Federal Register, Code of Federal Regulatory, Purple book

(45 PERIODS)

RESOURCES

REFERENCES:

1. Berry, I.R., & Martin, R.P. (Eds.). "The Pharmaceutical Regulatory Process", Second Edition. Drugs and the Pharmaceutical Sciences, Vol. 185. Informa Healthcare Publishers.
2. Guarino, R.A. "New Drug Approval Process: Accelerating Global Registrations", 5th edition. Drugs and the Pharmaceutical Sciences, Vol. 190.
3. Itkar, S., & Vyawahare, N.S. "Drug Regulatory Affairs". Nirali Prakashan.
4. Pisano, D.J., & Mantus, D. (Eds.). "FDA Regulatory Affairs: A Guide for Prescription Drugs, Medical Devices, and Biologics".
5. Rozovsky, F.A., & Adams, R.K. "Clinical Trials and Human Research: A Practical Guide to Regulatory Compliance".
6. Weinberg, S. "Guidebook for Drug Regulatory Submissions". John Wiley & Sons, Inc.

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=8Q_Um-v9j_o
2. https://www.youtube.com/watch?v=DLNA5EuBTmM
3. https://www.youtube.com/playlist?list=PLpGHT1n4-mAtmt8CC6Fteo5oaNT7h8gAs
4. https://www.youtube.com/watch?v=i07PKRKpi0c

WEB RESOURCES:

1. https://www.youtube.com/watch?v=i07PKRKpi0c
2. https://www.ecfr.gov/
3. https://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfcfr/CFRSearch.cfm?CFRPart=820

COURSE CORE

Course Code	Course Title	L	T	P	C
23PP101002	**PHARMACOVIGILANCE**	3	1	-	4

Pre-Requisite -
Anti-Requisite -
Co-Requisite -

COURSE DESCRIPTION: This paper will provide an opportunity for the student to learn about the development of pharmacovigilance as a science, basic terminologies used in pharmacovigilance, the global scenario of Pharmacovigilance, train students on establishing pharmacovigilance Programme in an organization, various methods that can be used to generate safety data and signal detection. This paper also develops the skills of classifying drugs, diseases, and adverse drug reactions.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Know the importance of drug safety monitoring, the History and development of pharmacovigilance, and National and international scenarios of
CO2. Understand dictionaries, coding, and terminologies used in pharmacovigilance, international standards for the classification of diseases and drugs, information resources, and establishing of pharmacovigilance program.
CO3. Learn about vaccine safety surveillance, pharmacovigilance methods, and effective communication in pharmacovigilance.
CO4. Understand the safety data generation, ICH guidelines for ICSR, PSUR, expedited reporting, and pharmacovigilance planning.
CO5. Pharmacogenomics of adverse reactions, drug safety evaluation in special populations, CIOMS, CDSCO, and Pharmacovigilance.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes										Program Specific Outcomes			
	PO1	PO2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO 9	PO10	PSO 1	PSO 2	PSO3	PSO4
CO1	3	3	-	3	-	-	-	-	-	-	2	-	-	-
CO2	3	3	-	3	-	-	-	-	-	-	2	-	-	-
CO3	3	3	-	3	-	-	-	-	-	-	2	-	-	-
CO4	3	3	-	3	-	-	-	-	-	-	2	-	-	-
CO5	3	3	-	3	-	-	-	-	-	-	2	-	-	-
Course Correlation Mapping	**3**	**3**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**-**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: Introduction ***(10 Periods)***

Introduction to Pharmacovigilance - History and development of Pharmacovigilance, Importance of safety monitoring of Medicine, WHO International Drug Monitoring Programme, Pharmacovigilance Program of India (PvPI)

Introduction to adverse drug reactions - Definitions and classification of ADRs, Detection and reporting, Methods in Causality assessment, Severity and seriousness assessment, Predictability and preventability assessment, Management of adverse drug reactions

Basic terminologies used in pharmacovigilance - Terminologies of adverse medication-related events, Regulatory terminologies

Module 2: Drug and disease classification ***(10 Periods)***

Drug and disease classification - Anatomical, therapeutic, and chemical classification of drugs, International classification of diseases, Daily defined doses, International non-proprietary names for drugs

Drug dictionaries and coding in pharmacovigilance - WHO adverse reaction terminologies - MedDRA and standardized MedDRA queries, WHO drug dictionary - Eudravigilance medicinal product dictionary,

Information resources in pharmacovigilance - Basic drug information resources, Specialized resources for ADRs

Establishing pharmacovigilance program - Establishing in a hospital, Establishment & operation of a drug safety department in industry, Contract research organizations, Establishing a national program

Module 3: Vaccine Safety Surveillance ***(10 Periods)***

Vaccine safety surveillance - Vaccine Pharmacovigilance, Vaccination failure, Adverse events following immunization

Pharmacovigilance methods- Passive surveillance – Spontaneous reports and case series, Stimulated reporting, Active surveillance – Sentinel sites, drug event monitoring, and registries, Comparative observational studies – Cross-sectional study, case-control study, and cohort study, Targeted clinical investigations

Communication in pharmacovigilance - Effective communication in Pharmacovigilance, Communication in Drug Safety Crisis management, Communicating with Regulatory Agencies, Business Partners, Healthcare facilities & Media

Module 4: Safety data generation ***(08 Periods)***

Safety data generation - Pre-clinical phase, Clinical phase, Post-approval phase (PMS)

ICH Guidelines for Pharmacovigilance - Organization and objectives of ICH, Expedited reporting, Individual case safety reports, Periodic safety update reports, Post approval expedited reporting, Pharmacovigilance planning, Good clinical practice in pharmacovigilance studies.

Module 5: Pharmacogenomics ***(07 Periods)***

Pharmacogenomics of adverse drug reactions - Genetics-related ADR with example focusing PK parameters.

Drug safety evaluation in special population – Paediatrics, Pregnancy and lactation, Geriatrics

CIOMS - CIOMS Working Groups, CIOMS Form

CDSCO (India) and Pharmacovigilance - D&C Act and Schedule Y, Differences in Indian and global pharmacovigilance requirements

RESOURCES

TEXTBOOKS:	
1.	Andrews, E.B., & Nicholas. "Mann's Pharmacovigilance". Wiley Publishers.
2.	Barton, Cobert. "Cobert's Manual of Drug Safety and Pharmacovigilance". Jones & Bartlett Publishers.
3.	Cobert, Barton., Biron, P. "Practical Drug Safety from A to Z". Jones and Bartlett Publishers.
4.	Gupta, S.K. "Textbook of Pharmacovigilance". Jaypee Brothers, Medical Publishers.
5.	Mohanta, G.P., & Manna, P.K. "Textbook of Pharmacovigilance: Concept and Practice".
6.	Munjal, Y. "Textbook of Medicine".
7.	Parthasarathi, G., Nyfort-Hansen, K., & Nahata, M.C. "A Textbook of Clinical Pharmacy Practice: Essential Concepts and Skills".
8.	Strom, B.L., Kimmel, S.E., & Hennessy, S. (Eds.). "Textbook of Pharmacoepidemiology". Wiley Publishers.
9.	Talbot, J., & Walle, P. "Stephens' Detection of New Adverse Drug Reactions". Wiley Publishers.
10.	Waller, P. "An Introduction to Pharmacovigilance". Wiley Publishers.
11.	National Formulary of India.

VIDEO LECTURES:	
1.	https://youtu.be/1LKA7EpfruE?feature=shared
2.	https://youtu.be/1PATE6c4Dso?feature=shared
3.	https://youtu.be/1LKA7EpfruE?feature=shared
4.	https://youtu.be/RXmrUhSSSlo?feature=shared
WEB RESOURCES:	
1.	https://pharmacyinfoline.com/pharmacovigilance-theory/

COURSE CORE

Course Code	Course Title	L	T	P	C
23PY101010	**QUALITY CONTROL AND STANDARDIZATION OF HERBALS**	3	1	-	4

Pre-Requisite -
Anti-Requisite -
Co-Requisite -

COURSE DESCRIPTION: In this subject, the student learns about the various methods and guidelines for the evaluation and standardization of herbs and herbal drugs. The subject also provides an opportunity for the student to learn cGMP, GAP, and GLP in traditional systems of medicine.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO6. know WHO guidelines for quality control of herbal drugs.
CO7. learn about Quality assurance in the herbal drug industry.
CO8. know the regulatory approval process and their registration in Indian and international markets.
CO9. Learn about EU and ICH guidelines for quality control of herbal drugs.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes										Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
CO1	3	3	-	3	-	-	-	-	-	-	-	3	-	-
CO2	3	3	-	3	-	-	-	-	-	-	-	3	-	-
CO3	3	3	-	3	-	-	-	-	-	-	-	3	-	-
CO4	3	3	-	3	-	-	-	-	-	-	-	3	-	-
Course Correlation Mapping	**3**	**3**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

Correlation Levels: ***3: High;*** ***2: Medium;*** ***1: Low***

COURSE CONTENT

Module 1: Basic Test and WHO guidelines ***(10 Periods)***

a. Basic tests for drugs – Pharmaceutical substances, Medicinal plant materials, and dosage forms.
b. WHO guidelines for quality control of herbal drugs.
C. Evaluation of commercial crude drugs intended for use.

Module 2: Quality Assurance ***(10 Periods)***

a. Quality assurance in the herbal drug industry of cGMP, GAP, GMP, and GLP in traditional systems of medicine.
b. WHO Guidelines on Current Good Manufacturing Practices (cGMP) for Herbal Medicines.
c. WHO Guidelines on GACP for Medicinal Plants.

Module 3: ICH Guidelines ***(10 Periods)***

a. EU and ICH guidelines for quality control of herbal drugs.
b. Research Guidelines for Evaluating the Safety and Efficacy of Herbal Medicines.

Module 4: Stability Testing ***(08 Periods)***

a. Stability testing of herbal medicines. Application of various chromatographic techniques in the standardization of herbal products.
b. Preparation of documents for new drug application and export registration GMP requirements and Drugs & Cosmetics Act provisions.

Module 5: Regulatory Requirements ***(07 Periods)***

a. Regulatory requirements for herbal medicines.
b. WHO guidelines on safety monitoring of herbal medicines in pharmacovigilance systems Comparison of various Herbal Pharmacopoeias.
c. Role of chemical and biological markers in standardization of herbal products.

RESOURCES

TEXTBOOKS:	
1.	Agrawal, S.S. "Herbal Drug Technology". Universities Press.
2.	EMEA. "Guidelines on Quality of Herbal Medicinal Products/Traditional Medicinal Products".
3.	Mukherjee, P.W. "Quality Control of Herbal Drugs: An Approach to Evaluation of Botanicals". Business Horizons Publishers, New Delhi, India.
4.	Rangari, V.D. "Textbook of Pharmacognosy and Phytochemistry", Vol. I. Carrier Publishing.
5.	Shinde, M.V., Dhalwal, K., Potdar, K., Mahadik, K. "Application of Quality Control Principles to Herbal Drugs". International Journal of Phytomedicine.
6.	Trease, G.E., & Evans, W.C. "Pharmacognosy".
7.	WHO. "Quality Control Methods for Medicinal Plant Materials".
8.	WHO. "Guidelines for the Appropriate Use of Herbal Medicines".
9.	WHO. "The International Pharmacopeia", Vol. 2: Quality Specifications, 3rd edn.
10.	WHO. "WHO Global Atlas of Traditional, Complementary and Alternative Medicine", 2 vol. set.
11.	WHO. "Guidelines on Good Agricultural and Collection Practices (GACP) for Medicinal Plants".
12.	Agrawal, S.S. "Herbal Drug Technology". Universities Press.

VIDEO LECTURES:	
1.	https://youtu.be/QxEq3H5WGI0?feature=shared
2.	https://youtu.be/XWEeegHxDcc?feature=shared
3.	https://youtu.be/iH1sCf1lLdM?feature=shared
4.	https://youtu.be/8sSJ6odDzz4?feature=shared
WEB RESOURCES:	
1.	https://pharmacyinfoline.com/quality-control-and-standardization-of-herbals-theory/

Course Code	Course Title	L	T	P	C
23PA101012	**COMPUTER AIDED DRUG DESIGN**				

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This subject is designed to provide detailed knowledge of rational drug design process and various techniques used in rational drug design process.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Design and discovery of lead molecules
CO2. The role of drug design in drug discovery process
CO3. The concept of QSAR and docking
CO4. Various strategies to develop new drug like molecules
CO5. The design of new drug molecules using molecular modeling software

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Course Correlation Mapping	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1 Introduction to Drug Discovery and Development **(10 Periods)**

Introduction to Drug Discovery and Development - Stages of drug discovery and development

Lead discovery and Analog Based Drug Design - Rational approaches to lead discovery based on traditional medicine, Random screening, Non-random screening, serendipitous drug discovery, lead discovery based on drug metabolism, lead discovery based on clinical observation.

Analog Based Drug Design: Bioisosterism, Classification, Bioisosteric replacement. Any three case studies.

Module 2 Quantitative Structure Activity Relationship **(10 Periods)**

Quantitative Structure Activity Relationship (QSAR) - SAR versus QSAR, History and development of QSAR, Types of physicochemical parameters, experimental and theoretical approaches for the determination of physicochemical parameters such as Partition coefficient, Hammet's substituent constant and Tafts steric constant. Hansch analysis, Free Wilson analysis, 3D-QSAR approaches like COMFA and COMSIA.

Module 3 Virtual Screening techniques **(10 Periods)**

Virtual Screening techniques: Drug likeness screening, Concept of pharmacophore mapping and pharmacophore based Screening.

Molecular docking: Rigid docking, flexible docking, manual docking, Docking based screening. *De novo* drug design.

Module 4 Introduction to Bioinformatics **(08 Periods)**

Informatics & Methods in drug design- Introduction to Bioinformatics, chemoinformatics. ADME databases, chemical, biochemical and pharmaceutical databases

Module 5 Molecular Modelling **(07 Periods)**

Molecular Modelling: Introduction to molecular mechanics and quantum mechanics. Energy Minimization methods and Conformational Analysis, global conformational minima determination.

Total 45 Periods

RESOURCES

REFERENCES:

1. Delgado, J.N., & Remers, W.A. (Eds.). "Wilson & Gisvolds's Textbook of Organic Medicinal & Pharmaceutical Chemistry". Lippincott, New York.
2. Foye, W.O. "Principles of Medicinal Chemistry". Lea & Febiger.
3. Graham, L.P. "An Introduction to Medicinal Chemistry". Oxford University Press.
4. GCK, R. (Ed.). "Drug Action at the Molecular Level". University Park Press, Baltimore.
5. Korolkovas, A., & Burckhalter, J.H. "Essentials of Medicinal Chemistry". Wiley Interscience.
6. Martin, Y.C. "Quantitative Drug Design". Dekker, New York.
7. Silverman, R.B. "The Organic Chemistry of Drug Design and Drug Action". Academic Press, New York.
8. Smith, H.J., & Williams, H. (Eds.). "Introduction to the Principles of Drug Design". Wright, Boston.
9. Wolf, M.E. (Ed.). "The Basis of Medicinal Chemistry, Burger's Medicinal Chemistry". John Wiley & Sons, New York.

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=3uY5N3rgoLE
2. https://www.youtube.com/watch?v=W-Ov2cUaYQY
3. https://www.youtube.com/watch?v=fMbVB_huh28

WEB RESOURCES:

1. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4443793/#:~:text=In%20virtual%20screening%2C%20large%20libraries,tested%20%5B1%2C%202%5D.
2. https://www.precisionmed.ch/en/what-is-molecular-modelling/
3. https://collegedunia.com/exams/bioinformatics-biology-articleid-1454

Course Code	Course Title	L	T	P	C
23PH101014	**Cell and Molecular Biology**	**3**	**1**	**-**	**4**

Pre-Requisite		-
Anti-Requisite		-
Co-Requisite		-

COURSE DESCRIPTION: Cell biology deals with physiological properties of cells, their structure, organelles they contain, interactions with their life cycle, division, death and cell function. Cell biology research encompasses single-celled and multicellular organisms.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO6.		Summarize history of cell and molecular biology, cellular functioning and composition
CO7.		Describe the chemical foundations of cell biology, properties of DNA and protein
CO8.		Know the cellular membrane structure and function, cell cycle and genetics.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	2	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	2	-	-	-
Course Correlation Mapping	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**	**-**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1 Cell and Molecular Biology (10 Periods)

a) Cell and Molecular Biology: Definitions theory and basics and Applications.
b) Cell and Molecular Biology: History and Summation.
c) Properties of cells and cell membrane.
d) Prokaryotic versus Eukaryotic
e) Cellular Reproduction
f) Chemical Foundations – an Introduction and Reactions (Types)

Module 2 Cell molecular mechanism (10 Periods)

a) DNA and the Flow of Molecular Information
b) DNA Functioning
c) DNA and RNA
d) Types of RNA
e) Transcription and Translation

Module 3 Proteins & amino acids (10 Periods)

a) Proteins: Defined and Amino Acids
b) Protein Structure
c) Regularities in Protein Pathways
d) Cellular Processes
e) Positive Control and significance of Protein Synthesis

Module 4 Genetics (08 Periods)

a) Science of Genetics
b) Transgenics and Genomic Analysis
c) Cell Cycle analysis
d) Mitosis and Meiosis
e) Cellular Activities and Checkpoints

Module 5 Cell signaling (07 Periods)

a) Cell Signals: Introduction
b) Receptors for Cell Signals
c) Signaling Pathways: Overview
d) Misregulation of Signaling Pathways
e) Protein-Kinases: Functioning

RESOURCES

REFERENCES:

1. Bergey's Manual of Systematic Bacteriology. Williams and Wilkins - A Waverly Company.
2. Cooper, and Gunn. "Tutorial Pharmacy". CBS Publisher and Distribution.
3. Pharmaceutical Microbiology. Blackwell Scientific Publications, Oxford London.

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=HpH1qhcb8gQ
2. https://www.youtube.com/watch?v=jFNlMxHWRHk
3. https://www.youtube.com/watch?v=6tp7oiWRK0s

WEB RESOURCES:

1. https://www.mustafaaltinisik.org.uk/s-molecularcellbiology.pdf
2. https://www.academia.edu/44422597/THE_CELL_Molecular_Biology_of_Sixth_Edition
3. http://www.bio-nica.info/Biblioteca/Bolsover2004CellBiology.pdf

Course Code	Course Title	L	T	P	C
23PH101015	**COSMETIC SCIENCE**	**3**	**1**	**-**	**4**

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: The course teaches students to study about various problems in oral cavity, on skin and for hair. It also teaches few cosmetics that can help in overcoming these problems. It also teaches about regulatory requirements for cosmetics and cosmeceuticals.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Know the concepts of cosmetics, cosmeceuticals and its classification

CO2. To know key building blocks for various cosmetic formulations

CO3. Know about importance of herbal products in cosmetics excipients

CO4. Understand the formulation and evaluation of different cosmetic product

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	3	2	-	-	-	-	-	-	-	3	3	-	-
Course Correlation Mapping	**3**	**2**	**-**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**-**	**-**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1 Introduction to Cosmetics and Cosmeceuticals (07 Periods)

Classification of cosmetic and cosmeceutical products, Definition of cosmetics as per Indian and EU regulations, Evolution of cosmeceuticals, from cosmetics, cosmetics as quasi and OTC drugs
Cosmetic excipients: Surfactants, rheology modifiers, humectants, emollients, preservatives. Classification and application. **Skin:** Basic structure and function of skin. **Hair:** Basic structure of hair. Hair growth cycle. **Oral Cavity:** Common problem associated with teeth and gums**.**

Module 2 Formulation and building blocks (10 Periods)

Principles of formulation and building blocks of skin care products: Face wash, Moisturizing cream, Cold Cream, Vanishing cream and their advantages and disadvantages. Application of these products in formulation of cosmeceuticals.
Antiprespirants & deodorants- Actives & mechanism of action.
Principles of formulation and building blocks of Hair care products: Conditioning shampoo, Hair conditioner, anti-dandruff shampoo. Hair oils. Chemistry and formulation of Paraphenylene diamine based hair dye.
Principles of formulation and building blocks of oral care products: Toothpaste for bleeding gums, sensitive teeth. Teeth whitening, Mouthwash.

Module 3 Role of Herbs in Cosmetics (10 Periods)

Skin Care: Aloe and turmeric, **Hair care:** Henna and amla. **Oral care:** Neem and clove.
Analytical cosmetics: BIS specification and analytical methods for shampoo, skin cream and toothpaste**.**
Sun protection, Classification of Sunscreens and SPF.

Module 4 Cosmetic Evaluation (10 Periods)

Principles of Cosmetic Evaluation: Principles of sebumeter, corneometer. Measurement of TEWL, Skin color, Hair tensile strength, Hair combing properties Soaps, and syndet bars. Evolution and skin benefits

Module 5 Cosmetic Problems (08 Periods)

Oily and dry skin, causes leading to dry skin, skin moisturisation. Basic understanding of the terms Comedogenic, dermatitis. Problems associated with skin: blemishes, wrinkles, acne, prickly heat and body odor.
Cosmetic problems associated with Hair and scalp: Dandruff, Hair fall causes.

Total 45

Periods

RESOURCES

REFERENCES:

1. Nanda, S., & Khar, R.K. "Textbook of Cosmeticology". Tata Publishers.
2. Sharma, P.P. "Cosmetics – Formulations, Manufacturing and Quality Control", 4th Edition. Vandana Publications Pvt. Ltd., Delhi.
3. Wilkinson, Moore. "Harry's Cosmeticology", Seventh Edition. George Godwin.

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=bcCkQ1IiaKA
2. https://www.youtube.com/watch?v=K077QLu-YCM
3. https://www.youtube.com/watch?v=EUkPz51MoaM

WEB RESOURCES:

1. https://skyntox.com/blogs/skincare/introduction-to-skincare-in-detail
2. https://www.prodigia-cosmetics.com/cosmetic-evaluation-what-is-it/?lang=en
3. https://www.daburdentalcare.com/dental-cosmetics/pages/default.aspx

Course Code	Course Title	L	T	P	C
23PC101008	PHARMACOLOGICAL SCREENINGMETHODS	3	1	-	4

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This subject is designed to impart the basic knowledge of preclinical studies in experimental animals including design, conduct and interpretations of results

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. To know the applications of various commonly used laboratory animals.

CO2. Appreciate & demonstrate the various screening methods used in preclinical research.

CO3. Design & execute a research hypothesis independently.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Course Correlation Mapping	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**	**-**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1 Laboratory Animals: (10 Periods)

Study of CPCSEA and OECD guidelines for maintenance, breeding and conduct of experiments on laboratory animals, Common lab animals: Description and applications of different species and strains
of animals. Popular transgenic and mutant animals.
Techniques for collection of blood and common routes of drug administration in laboratory animals, Techniques of blood collection and euthanasia.

Module 2 Preclinical screening models - Introduction (10 Periods)

a. Introduction: Dose selection, calculation and conversions, preparation of drug solution/suspensions, grouping of animals and importance of sham negative and positive control groups.
Rationale for selection of animal species and sex for the study.
b. **Study of screening animal models for** Diuretics, nootropics, anti-Parkinson's,antiasthmatics,

Module 3 Preclinical screening models for ANS, CVS and CVS (15 Periods)

Preclinical screening models: for ANS activity, sympathomimetics, sympatholytics, parasympathomimetics, parasympatholytics, skeletal muscle relaxants, drugs acting on eye, local anaethetics
Preclinical screening models: for CNS activity- analgesic, antipyretic,anti-inflammatory, general anaesthetics, sedative and hypnotics, antipsychotic, antidepressant, antiepileptic, antiparkinsonism, alzheimer's disease.
Preclinical screening models: for CVS activity- antihypertensives, diuretics, antiarrhythmic, antidyslepidemic, anti-aggregatory, coagulants, and anticoagulants.
Preclinical screening models for other important drugs like antiulcer, antidiabetic, anticancer and antiasthmatics.

Module 4 Research methodology and Bio-statistics (10 Periods)

Selection of research topic, review of literature, research hypothesis and study design Pre-clinical data analysis and interpretation using Students 't' test and One-way ANOVA. Graphical representation of data

RESOURCES

REFERENCES:

1. Kulkarni, S.K. "Handbook of Experimental Pharmacology".
2. Rao, P.S.S., & Richard, J. "Introduction to Biostatistics and Research Methods".
3. Vogel, H.G. "Drug Discovery and Evaluation".

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=uN7gxxA_I7A
2. https://www.youtube.com/watch?v=q0Ebb4UZ0OI
3. https://www.youtube.com/watch?v=B8s69atm9bE

WEB RESOURCES:

1. https://www.scribd.com/document/196385476/General-Principles-of-Preclinical-Screening
2. herman-et-al-2012-screening-for-preclinical-disease-test-and-disease-characteristics-1.pdf

Course Code	Course Title	L	T	P	C
23PA101013	**ADVANCED INSTRUMENTATION TECHNIQUES**	**3**	**1**	**-**	**4**

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This subject deals with the application of instrumental methods in qualitative and quantitative analysis of drugs. This subject is designed to impart advanced knowledge on the principles and instrumentation of spectroscopic and chromatographic hyphenated techniques. This also emphasizes on theoretical and practical knowledge on modern analytical instruments that are used for drug testing.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Understand the interaction of matter with electromagnetic radiations and its applications in drug analysis.

CO2. Understand the chromatographic separation and analysis of drugs..

CO3. Perform quantitative & qualitative analysis of drugs using various analytical instruments.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Course Correlation Mapping	**3**	**2**	**-**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**-**	**-**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1 **Nuclear Magnetic Resonance spectroscopy** **(10 Periods)**

Principles of H-NMR and C-NMR, chemical shift, factors affecting chemical shift, coupling constant, Spin - spin coupling, relaxation, instrumentation and applications

Mass Spectrometry- Principles, Fragmentation, Ionization techniques – Electron impact, chemical ionization, MALDI, FAB, Analyzers-Time of flight and Quadrupole, instrumentation, application

Module 2 **Thermal Analysis and X-Ray Diffraction** **(10 Periods)**

Thermal Methods of Analysis: Principles, instrumentation and applications of ThermogravimetricAnalysis (TGA), Differential Thermal Analysis (DTA), Differential Scanning Calorimetry (DSC)

X- **Ray Diffraction Methods:** Origin of X-rays, basic aspects of crystals, X- ray Crystallography, rotating crystal technique, single crystal diffraction,powder diffraction, structural elucidation and applications.

Module 3 Calibration and Validation **(10 Periods)**

Calibration and validation-as per ICH and USFDA guidelines

Calibration of following Instruments - Electronic balance, UV-Visible spectrophotometer, IR spectrophotometer, Fluorimeter, Flame Photometer, HPLC and GC

Module 4 **Radio immune assay** **(08 Periods)**

Radio immune assay: Importance, various components, Principle, different methods, Limitation and Applications of Radio immuno assay

Extraction techniques: General principle and procedure involved in the solid phase extraction and liquid-liquid extraction

Module 5 **Hyphenated Techniques** **(07 Periods)**

Hyphenated techniques-LC-MS/MS, GC-MS/MS, HPTLC-MS

Total 45

Periods

RESOURCES

REFERENCES:

1. Beckett, A.H., & Stenlake, J.B. "Practical Pharmaceutical Chemistry".
2. Connors, K.A. "Textbook of Pharmaceutical Analysis".
3. Finar, I.L. "Organic Chemistry".
4. Garrett, D.C. "Quantitative Analysis of Drugs".
5. Kemp, W. "Organic Spectroscopy".
6. Sharma, B.K. "Instrumental Methods of Chemical Analysis".
7. Sharma, Y.R. "Organic Spectroscopy".
8. Vogel, A.I. "Vogel's Textbook of Quantitative Chemical Analysis".

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=CH-4TtZSvY0
2. https://www.youtube.com/watch?v=kaNVahNGDnQ
3. https://www.youtube.com/watch?v=QHMzFUo0NL8

WEB RESOURCES:

1. https://www.colby.edu/chemistry/NMR/NMR.html
2. https://en.wikipedia.org/wiki/Liquid_chromatography%E2%80%93mass_spectrometry
3. https://www.lecturenotes.net/home/m_courses_page2_lecturenotes/advanced-pharmaceutical-instrumental-analysis/1708/

COURSE CORE

Course Code	Course Title	L	T	P	C
23PH101016	**DIETARY SUPPLEMENTS AND NUTRACEUTICALS**	3	1	-	4

Pre-Requisite -
Anti-Requisite -
Co-Requisite -

COURSE DESCRIPTION: This subject covers the foundational topics that are important for understanding the needs and requirements of dietary supplements for the various population groups.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Understand the need for supplements by different groups of people to maintain a healthy life.
CO2. Understand the outcome of deficiencies in dietary supplements.
CO3. Appreciate the components in dietary supplements and their application.
CO4. Appreciate the regulatory and commercial aspects of dietary supplements including health claims.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes										Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
CO1	3	3	-	3	-	-	-	-	-	-	-	3	-	-
CO2	3	3	-	3	-	-	-	-	-	-	-	3	-	-
CO3	3	3	-	3	-	-	-	-	-	-	-	3	-	-
CO4	3	3	-	3	-	-	-	-	-	-	-	3	-	-
Course Correlation Mapping	**3**	**3**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

Correlation Levels: ***3: High;*** ***2: Medium;*** ***1: Low***

COURSE CONTENT

Module 1: INTRODUCTION ***(07 Periods)***

a. Definitions of Functional foods, Nutraceuticals, and Dietary supplements. Classification of Nutraceuticals, Health problems and diseases that can be prevented or cured by Nutraceuticals i.e. weight control, diabetes, cancer, heart disease, stress, osteoarthritis, hypertension, etc.

b. Public health nutrition, maternal and child nutrition, nutrition and aging, nutrition education in the community.

c. Source, Name of marker compounds and their chemical nature, Medicinal uses and health benefits of following used as nutraceuticals/functional foods: Spirulina, Soybean, Ginseng, Garlic, Broccoli, Gingko, Flaxseeds

Module 2: Phytochemicals as Nutraceuticals ***(15 Periods)***

Phytochemicals as nutraceuticals: Occurrence and characteristic features (chemical nature medicinal benefits) of following

a) Carotenoids- α and β-Carotene, Lycopene, Xanthophylls, leutin
b) Sulfides: Diallyl sulfides, Allyl trisulfide.
c) Polyphenolics: Reservetrol
d) Flavonoids- Rutin, Naringin, Quercitin, Anthocyanidins, catechins, Flavones
e) Prebiotics / Probiotics.: Fructo oligosaccharides, Lactobacillus
f) Phyto estrogens: Isoflavones, daidzein, Geebustin, lignans
g) Tocopherols
h) Proteins, vitamins, minerals, cereal, vegetables, and beverages as functional foods: oats, wheat bran, rice bran, seafood, coffee, tea, etc.

Module 3: Role of freeradicals ***(07 Periods)***

a) Introduction to free radicals: Free radicals, reactive oxygen species, production of free radicals in cells, damaging reactions of free radicals on lipids, proteins, Carbohydrates, nucleic acids.
b) Free radicals in Diabetes mellitus, Inflammation, Ischemic reperfusion injury, Cancer, Atherosclerosis, Free radicals in brain metabolism and pathology, kidney damage, muscle damage. Free radicals involvement in other disorders. Free radicals theory of ageing.
c) Dietary fibres and complex carbohydrates as functional food ingredients

Module 4: ***(10 Periods)***

a) Antioxidants: Endogenous antioxidants – enzymatic and nonenzymatic antioxidant defense, Superoxide dismutase, catalase, Glutathione peroxidase, Glutathione Vitamin C, Vitamin E, α- Lipoic acid, melatonin

Synthetic antioxidants: Butylated hydroxy Toluene, Butylated hydroxy Anisole.

b) Functional foods for chronic disease prevention.

Module 5: ***(06 Periods)***

a) Effect of processing, storage and interactions of various environmental factors on the potential of nutraceuticals.

b) Regulatory Aspects; FSSAI, FDA, FPO, MPO, AGMARK. HACCP and GMPs on Food Safety. Adulteration of foods.

c) Pharmacopoeial Specifications for dietary supplements and nutraceuticals.

RESOURCES

TEXTBOOKS:	
1.	Agusti, K.T., & Faizal, P. "Role of Dietary Fibers and Neutraceuticals in Preventing Diseases". BSPublication.
2.	Balch, J.F., & Balch, P.A. "Prescription for Nutritional Healing", 2nd Edn. Avery Publishing Group, NY.
3.	Carper, J. "The Food Pharmacy". Simon & Schuster, UK Ltd.
4.	Cooper, K.A. "Advanced Nutritional Therapies".
5.	Gibson, G., & Williams, C. (Eds.). "Functional Foods". Woodhead Publishing Co., London.
6.	Goldberg, I. "Functional Foods". Chapman and Hall, New York.
7.	Lakshmi, Sri. "Dietetics".
8.	Labuza, T.P. "Functional Foods and Dietary Supplements: Safety, Good Manufacturing Practice (GMPs) and Shelf-Life Testing" in "Essentials of Functional Foods", M.K. Sachmidl and T.P. Labuza (Eds.). Aspen Press.
9.	Shils, M.E., Olson, J.A., & Shike, M. "Modern Nutrition in Health and Disease", Eighth edition. Lea and Febiger.

VIDEO LECTURES:	
1.	https://youtu.be/dRiHWvLdmvE?feature=shared
2.	https://youtu.be/CP1Lzx1wQX8?feature=shared
3.	https://youtu.be/kd4eJsgABWA?feature=shared
4.	https://youtu.be/Y_j079-vi9c?feature=shared
WEB RESOURCES:	
1.	https://rxpharma-edu.com/notes-sharing/rx-pharma-notes/semester-8-notes/