

K L COLLEGE OF PHARMACY

B.PHARMACY

HANDBOOK 2017-18

1. Vision and Mission of the Department

VISION-Lead the future of global healthcare and well-being of the communities we serve.

MISSION-The Department of Pharmacy is committed to:

- 1. Education:** Provide the most comprehensive and highest quality education for pharmaceutical sciences in a learning environment that embraces diversity, equity, integrity, ethics, moral courage and accountability.
- 2. Community service:** Conduct health education programs to the community to prevent disease and improve public health and well-ness by fostering an environment that promotes the safe, efficacious, and cost-effective use of medications.
- 3. Research:** Develop a passion for discovery and innovations with multidisciplinary collaborative research and engage in creative partnerships locally and globally to advance health education, research, and practice.
- 4. Entrepreneurship:** Encourage and support resourcefulness, originality, imagination, ingenuity, and vision in our students, faculty, and staff. Foster the development of entrepreneurs who have the ability to dream, inspire and innovate and courage to envisage the commercial success and socio economic productivity of innovations.

2. Program Educational Objectives (PEOs)

| S.No | PROGRAMME EDUCATION OBJECTIVES (PEOs) |
|------|---|
| 1 | To produce pharmacist workforce competent for the society. |
| 2 | To produce pharmacy graduates with employable skills and high technical competence in pharmaceutical industry and health care sectors |
| 3 | To inculcate research activity and develop passion for discovery and innovations |
| 4 | To develop entrepreneurship qualities that support growth of pharmaceutical intellectual property and contribute for economic development throughout the world. |

3. Program Outcomes(POs)

| S.No | PROGRAMME OUTCOME (PO) |
|--|---|
| 1 Pharmacy Knowledge | Provide basic knowledge for understanding the principles and their applications in the area of Pharmaceutical Sciences and Technology. |
| 2 Technical Skills | Develop an ability to use various instrument and equipment with an in depth knowledge on standard operating procedures for the same. |
| 3 Modern tool usage | Develop/apply appropriate techniques, resources, and IT tools including prediction and modeling to complex health issues and medicine effect with an understanding of the limitations. |
| 4 Research and Development | To demonstrate knowledge of identifying a problem, critical thinking, analysis and provide rational solutions in different disciplines of Pharmaceutical Sciences and Technology. |
| 5 Lifelong Learning | Develop an aptitude for continuous learning and professional development with ability to engage in pharmacy practice and health education programs. |
| 6 Communication | Communicate effectively on health care activities with the medical community and with society at large, to comprehend drug regulations, write health reports and provide drug information. |
| 7 The Pharmacist and Society | Apply reasoning informed by the contextual knowledge to comprehend medical prescription, perform patient counselling and issue or receive clear instructions on drug safety and the consequent responsibilities relevant to the professional pharmacy practice. |
| 8 Ethics | Follow the code of ethics and commit to professional values and responsibilities and norms of the pharmacy practice. |
| PSO 1 Pharmaceutical product development | To apply the knowledge of manufacturing, formulation and quality control of various pharmaceutical and cosmetic products in the form of powders, tablets. capsules, parenteral, solutions, suspensions, emulsions, creams, lotions and aerosols etc. |
| PSO 2 Invention and Entrepreneurship | Find the application of modern tools to integrate health care systems, design an effective product with commercial advantage and societal benefit, perform risk analysis and become entrepreneur. |

4. Mapping of PEOs and POs

| | PEO1 | PEO2 | PEO3 | PEO4 | PEO5 |
|------|------|------|------|------|------|
| PO1 | √ | √ | | | |
| PO2 | | √ | √ | | |
| PO3 | | √ | | √ | |
| PO4 | | | √ | √ | |
| PO5 | √ | | | | √ |
| PO6 | √ | | | | √ |
| PO7 | | √ | | | √ |
| PO8 | | | | | |
| PSO1 | | √ | √ | | |
| PSO2 | | | √ | √ | |

5. Academic Regulations

Short Title and Commencement

These regulations shall be called as “The Regulations for the B. Pharm. Degree Program (CBCS) of the K L College of Pharmacy, K L University, Vaddeswaram, Andhra Pradesh, India. They shall come into effect from the Academic Year 2017-18. The regulations framed are subject to modifications from time to time by K L University to comply with the rules and regulations of Pharmacy Council of India (PCI), the statutory body for the Pharmacy Course in India.

2. Minimum qualification for admission

2.1 First year B. Pharm:

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.

2.2. B. Pharm lateral entry (to third semester):

A pass in D. Pharm. course from an institution approved by the Pharmacy Council of India under section 12 of the Pharmacy Act.

3. Duration of the program

The course of study for B.Pharm shall extend over a period of eight semesters (four academic years) and six semesters (three academic years) for lateral entry students. The curricula and syllabi for the program shall be prescribed from time to time by K L University in harmony with Pharmacy Council of India, New Delhi.

4. Medium of instruction and examinations

Medium of instruction and examination shall be in English.

5. Working days in each semester

Each semester shall consist of not less than 100 working days. The odd semesters shall be conducted from the month of June/July to November/December and the even semesters shall be conducted from December/January to May/June in every calendar year.

6. Attendance and progress

A candidate is required to put in at least 80% attendance in individual courses considering theory and practical separately. The candidate shall complete the prescribed course satisfactorily to be eligible to appear for the respective examinations.

7. Program/Course credit structure

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 for each of these activities per week.

7.1. Credit assignment

7.1.1. Theory and Laboratory courses

Courses are broadly classified as Theory and Practical. Theory courses consist of lecture (L) and /or tutorial (T) hours, and Practical (P) courses consist of hours spent in the laboratory. Credits (C) for a course is dependent on the number of hours of instruction per week in that course, and is obtained by using a multiplier of one (1) for lecture and tutorial hours, and a multiplier of half (1/2) for practical (laboratory) hours. Thus, for example, a theory course having three lectures and one tutorial per week throughout the semester carries a credit of 4. Similarly, a practical having four laboratory hours per week throughout semester carries a credit of 2.

7.2. Minimum credit requirements

The minimum credit points required for award of a B. Pharm. degree is 208. These credits are divided into Theory courses, Tutorials, Practical, Practice School and Project over the duration of eight semesters. The credits are distributed semester-wise as shown in Table IX. Courses generally progress in sequences, building competencies and their positioning indicates certain academic maturity on the part of the learners. Learners are expected to follow the semester-wise schedule of courses given in the syllabus.

The lateral entry students shall get 52 credit points transferred from their D. Pharm program. Such students shall take up additional remedial courses of 'Communication Skills' (Theory and Practical) and 'Computer Applications in Pharmacy' (Theory and Practical) equivalent to 3 and 4 credit points respectively, a total of 7 credit points to attain 59 credit points, the maximum of I and II semesters.

8. Academic work

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

9. Course of study

The course of study for B. Pharm shall include Semester Wise Theory & Practical as given in Table – I to VIII. The number of hours to be devoted to each theory, tutorial and practical course in any semester shall not be less than that shown in Table – I to VIII.

CHAPTER- II: B.PHRAM. COURSE STRUCTURE

Table-I: Course of study for semester I

| Course code | Name of the course | No. of Hours | | | Total Credits |
|-----------------------------|---|--------------|-------------------------------------|---------------------------------------|---------------|
| | | L | T | P | |
| 17PH1101 | Human Anatomy and Physiology I | 3 | 1 | 4 | 6 |
| 17PH1102 | Pharmaceutical Analysis I | 3 | 1 | 4 | 6 |
| 17PH1103 | Pharmaceutics I | 3 | 1 | 4 | 6 |
| 17PH1104 | Pharmaceutical Inorganic Chemistry | 3 | 1 | 4 | 6 |
| 17PH1105 | Communication skills | 2 | - | 2 | 3 |
| 17PH1106RB*/ 17PH1106RM* | #Remedial Biology / \$Remedial Mathematics | 3 | - | 2 | 4 |
| | | | 1 | - | 4 |
| Total | | 16 | 4^{\$}/5[#] | 18^{\$}/20[#] | 31 |

[#]Applicable ONLY for the students who have studied Mathematics / Physics / Chemistry at HSC and appearing for Remedial Biology (RB) course.

^{\$}Applicable ONLY for the students who have studied Physics / Chemistry / Botany / Zoology at HSC and appearing for Remedial Mathematics (RM) course.

* Non University Examination (NUE)

Table-II: Course of study for semester II

| Course code | Name of the course | No. of Hours | | | Total Credits |
|--------------|------------------------------------|--------------|----------|-----------|---------------|
| | | L | T | P | |
| 17PH1207 | Human Anatomy and Physiology II | 3 | 1 | 4 | 6 |
| 17PH1208 | Pharmaceutical Organic Chemistry I | 3 | 1 | 4 | 6 |
| 17PH1209 | Biochemistry | 3 | 1 | 4 | 6 |
| 17PH1210 | Pathophysiology | 3 | 1 | - | 4 |
| 17PH1211 | Computer Applications in Pharmacy | 3 | - | 2 | 4 |
| 17PH1212 | Environmental sciences | 3 | - | - | 3 |
| Total | | 18 | 4 | 14 | 29 |

Table-III: Course of study for semester III

| Course code | Name of the course | No. of Hours | | | Total Credits |
|--------------|-------------------------------------|--------------|----------|-----------|---------------|
| | | L | T | P | |
| 17PH2113 | Pharmaceutical Organic Chemistry II | 3 | 1 | 4 | 6 |
| 17PH2114 | Physical Pharmaceutics I | 3 | 1 | 4 | 6 |
| 17PH2115 | Pharmaceutical Microbiology | 3 | 1 | 4 | 6 |
| 17PH2116 | Pharmaceutical Engineering | 3 | 1 | 4 | 6 |
| Total | | 12 | 4 | 16 | 24 |

Table-IV: Course of study for semester IV

| Course code | Name of the course | No. of Hours | | | Total Credits |
|-------------|--------------------------------------|--------------|----------|-----------|---------------|
| | | L | T | P | |
| 17PH2217 | Pharmaceutical Organic Chemistry III | 3 | 1 | - | 4 |
| 17PH2218 | Medicinal Chemistry I | 3 | 1 | 4 | 6 |
| 17PH2219 | Physical Pharmaceutics II | 3 | 1 | 4 | 6 |
| 17PH2220 | Pharmacology I | 3 | 1 | 4 | 6 |
| 17PH2221 | Pharmacognosy and Phytochemistry I | 3 | 1 | 4 | 6 |
| | Total | 15 | 5 | 16 | 28 |

Table-V: Course of study for semester V

| Course code | Name of the course | No. of Hours | | | Total Credits |
|-------------|-------------------------------------|--------------|----------|-----------|---------------|
| | | L | T | P | |
| 17PH3122 | Medicinal Chemistry II | 3 | 1 | - | 4 |
| 17PH3123 | Industrial Pharmacy I | 3 | 1 | 4 | 6 |
| 17PH3124 | Pharmacology II | 3 | 1 | 4 | 6 |
| 17PH3125 | Pharmacognosy and Phytochemistry II | 3 | 1 | 4 | 6 |
| 17PH3126 | Pharmaceutical Jurisprudence | 3 | 1 | - | 4 |
| | Total | 15 | 5 | 12 | 26 |

Table-VI: Course of study for semester VI

| Course code | Name of the course | No. of Hours | | | Total Credits |
|-------------|---------------------------------------|--------------|----------|-----------|---------------|
| | | L | T | P | |
| 17PH3227 | Medicinal Chemistry III | 3 | 1 | 4 | 6 |
| 17PH3228 | Pharmacology III | 3 | 1 | 4 | 6 |
| 17PH3229 | Herbal Drug Technology | 3 | 1 | 4 | 6 |
| 17PH3230 | Biopharmaceutics and Pharmacokinetics | 3 | 1 | - | 4 |
| 17PH3231 | Pharmaceutical Biotechnology | 3 | 1 | - | 4 |
| 17PH3232 | Quality Assurance | 3 | 1 | - | 4 |
| | Total | 18 | 6 | 12 | 30 |

Table-VII: Course of study for semester VII

| Course code | Name of the course | No. of Hours | | | Total Credits |
|-------------|----------------------------------|--------------|----------|----------|---------------|
| | | L | T | P | |
| 17PH4133 | Instrumental Methods of Analysis | 3 | 1 | 4 | 6 |
| 17PH4134 | Industrial Pharmacy II | 3 | 1 | - | 4 |
| 17PH4135 | Pharmacy Practice | 3 | 1 | - | 4 |
| 17PH4136 | Novel Drug Delivery System | 3 | 1 | - | 4 |
| 17PH4137 | Practice School* | 12 | - | - | 6 |
| | Total | 28 | 5 | 4 | 24 |

*Non University Examination (NUE)

Table-VIII: Course of study for semester VIII

| Course code | Name of the course | No. of Hours | | | Total Credits |
|-------------|--|--------------|----------|----------|---------------|
| | | L | T | P | |
| 17PH4238 | Biostatistics and Research Methodology | 3 | 1 | | 4 |
| 17PH4239 | Social and Preventive Pharmacy | 3 | 1 | | 4 |
| 17PH4240ET | Pharma Marketing Management | 3 + 3 | 1 + 1 | | 4 + 4 = 8 |
| 17PH4241ET | Pharmaceutical Regulatory Science | | | | |
| 17PH4242ET | Pharmacovigilance | | | | |
| 17PH4243ET | Quality Control and Standardization of Herbals | | | | |
| 17PH4244ET | Computer Aided Drug Design | | | | |
| 17PH4245ET | Cell and Molecular Biology | | | | |
| 17PH4246ET | Cosmetic Science | | | | |
| 17PH4247ET | Experimental Pharmacology | | | | |
| 17PH4248ET | Advanced Instrumentation Techniques | | | | |
| 17PH4249ET | Dietary Supplements and Nutraceuticals | | | | |
| 17PH4250PW | Project Work | 12 | | | 6 |
| | | 24 | 4 | 0 | 22 |

Table-IX: Semester wise credits distribution

| Semester | Credit Points |
|--|---------------|
| I | 31 |
| II | 29 |
| III | 24 |
| IV | 28 |
| V | 26 |
| VI | 30 |
| VII | 24 |
| VIII | 22 |
| Extracurricular/ Co-curricular activities | 01* |
| Total credit points for the program | 215 |

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

10. Program Committee

1. The B. Pharm. program shall have a Program Committee constituted by the Head of the institution in consultation with all the Heads of the departments.
2. The composition of the Program Committee shall be as follows:

A senior teacher shall be the Chairperson; One Teacher from each department handling B.Pharm courses; and four student representatives of the program (one from each academic year), nominated by the Head of the institution.

3. Duties of the Program Committee:
 - i. Periodically reviewing the progress of the classes.
 - ii. Discussing the problems concerning curriculum, syllabus and the conduct of classes.
 - iii. Discussing with the course teachers on the nature and scope of assessment for the course and the same shall be announced to the students at the beginning of respective semesters.
 - iv. Communicating its recommendation to the Head of the institution on academic matters.
 - v. The Program Committee shall meet at least thrice in a semester preferably at the end of each Sessionalexam (Internal Assessment) and before the end semester exam.

11. Examinations/Assessments

The scheme for internal assessment and end semester examinations is given in Table – X.

11.1. End semester examinations

The End Semester Examinations for each theory and practical course through semesters I to VIII shall be conducted by the university except for the subjects with asterix symbol (*) in table I and II for which examinations shall be conducted by the subject experts at college level and the marks/grades shall be submitted to the university.

11.2. Internal assessment: Continuous mode

The marks allocated for Continuous mode of Internal Assessment shall be awarded as per the scheme given below.

Table-XI:Scheme for awarding internal assessment: Continuous mode

| Theory | | |
|---|---------------|----------|
| Criteria | Maximum Marks | |
| Attendance (Refer Table – XII) | 4 | 2 |
| Academic activities (Average of any 3 activities e.g. quiz, assignment, open book test, field work, group discussion and seminar) | 3 | 1.5 |
| Student – Teacher interaction | 3 | 1.5 |
| Total | 10 | 5 |
| Practical | | |
| Attendance (Refer Table – XII) | 2 | |
| Based on Practical Records, Regular viva voce, etc. | 3 | |
| Total | 5 | |

Table- XII: Guidelines for the allotment of marks for attendance

| Percentage of Attendance | Theory | Practical |
|---------------------------------|---------------|------------------|
| 95 – 100 | 4 | 2 |
| 90 – 94 | 3 | 1.5 |
| 85 – 89 | 2 | 1 |
| 80 – 84 | 1 | 0.5 |
| Less than 80 | 0 | 0 |

11.2.1. Sessional Exams

Two Sessional exams shall be conducted for each theory / practical course as per the schedule fixed by the college(s). The scheme of question paper for theory and practical Sessional examinations is given below. The average marks of two Sessional exams shall be computed for internal assessment as per the requirements given in tables –X.

Sessional exam shall be conducted for 30 marks for theory and shall be computed for 15 marks. Similarly Sessional exam for practical shall be conducted for 40 marks and shall be computed for 10 marks.

Question paper pattern for theory Sessional examinations

For subjects having University examination

| | | |
|--|---|-------------|
| I. Multiple Choice Questions (MCQs) | = | 10 x 1 = 10 |
| OR | | OR |
| Objective Type Questions (5 x 2) (Answer all the questions) | = | 05 x 2 = 10 |
| I. Long Answers (Answer 1 out of 2) | = | 1 x 10 = 10 |
| II. Short Answers (Answer 2 out of 3) | = | 2 x 5 = 10 |
| | | ----- |
| Total | = | 30 marks |

For subjects having Non University Examination

| | | |
|---------------------------------------|---|-------------|
| I. Long Answers (Answer 1 out of 2) | = | 1 x 10 = 10 |
| II. Short Answers (Answer 4 out of 6) | = | 4 x 5 = 20 |
| | | ----- |
| Total | = | 30 marks |
| | | ----- |

Question paper pattern for practical sessional examinations

| | | |
|-----------------|---|----------|
| I. Synopsis | = | 10 |
| II. Experiments | = | 25 |
| III. Viva voce | = | 05 |
| | | ----- |
| Total | = | 40 marks |
| | | ----- |

12. Promotion and award of grades

A student shall be declared PASS and eligible for getting grade in a course of B.Pharm. program if he/she secures at least 50% marks in that particular course including internal assessment. For example, to be declared as PASS and to get grade, the student has to secure a minimum of 50 marks for the total of 100 including continuous mode of assessment and end semester theory examination and has to secure a minimum of 25 marks for the total 50 including internal assessment and end semester practical examination.

13. Carry forward of marks

In case a student fails to secure the minimum 50% in any Theory or Practical course as specified in 12, then he/she shall reappear for the end semester examination of that course. However his/her marks of the Internal Assessments shall be carried over and he/she shall be entitled for grade obtained by him/her on passing.

14. Improvement of internal assessment

A student shall have the opportunity to improve his/her performance only once in the Sessional exam component of the internal assessment. The re-conduct of the Sessional exam shall be completed before the commencement of next end semester theory examinations.

15. Re-examination of end semester examinations

Re-examination of end semester examinations shall be conducted as per the schedule given in table XIII. The exact dates of examinations shall be notified from time to time.

Table-XIII: Tentative schedule of end semester examinations

| Semester | For Regular Candidates | For Failed Candidates |
|---------------------|------------------------|-----------------------|
| I, III, V and VII | November / December | May / June |
| II, IV, VI and VIII | May / June | November / December |

Question paper pattern for end semester theory examinations

For 75 marks paper

| | | | | |
|--|---|--------|---|----------|
| I. Multiple Choice Questions (MCQs) | = | 20 x 1 | = | 20 |
| OR | | OR | | |
| Objective Type Questions (10 x 2) | = | 10 x 2 | = | 20 |
| (Answer all the questions) | | | | |
| II. Long Answers (Answer 2 out of 3) | = | 2 x 10 | = | 20 |
| III. Short Answers (Answer 7 out of 9) | = | 7 x 5 | = | 35 |
| | | | | ----- |
| Total | = | | | 75 marks |
| | | | | ----- |

For 50 marks paper

I. Long Answers (Answer 2 out of 3) = 2 x 10 = 20

II. Short Answers (Answer 6 out of 8) = 6 x 5 = 30

Total = 50 marks

For 35 marks paper

I. Long Answers (Answer 1 out of 2) = 1 x 10 = 10

II. Short Answers (Answer 5 out of 7) = 5 x 5 = 25

Total = 35 marks

Question paper pattern for end semester practical examinations

I. Synopsis = 5

II. Experiments = 25

III. Viva voce = 5

Total = 35 marks

16. Academic Progression:

No student shall be admitted to any examination unless he/she fulfills the norms given in 6. Academic progression rules are applicable as follows:

A student shall be eligible to carry forward all the courses of I, II and III semesters till the IV semester examinations. However, he/she shall not be eligible to attend the courses of V semester until all the courses of I and II semesters are successfully completed.

A student shall be eligible to carry forward all the courses of III, IV and V semesters till the VI semester examinations. However, he/she shall not be eligible to attend the courses of VII semester until all the courses of I, II, III and IV semesters are successfully completed.

A student shall be eligible to carry forward all the courses of V, VI and VII semesters till the VIII semester examinations. However, he/she shall not be eligible to get the course completion certificate until all the courses of I, II, III, IV, V and VI semesters are successfully completed.

A student shall be eligible to get his/her CGPA upon successful completion of the courses of I to VIII semesters within the stipulated time period as per the norms specified in 26.

A lateral entry student shall be eligible to carry forward all the courses of III, IV and V semesters till the VI semester examinations. However, he/she shall not be eligible to attend the courses of VII semester until all the courses of III and IV semesters are successfully completed.

A lateral entry student shall be eligible to carry forward all the courses of V, VI and VII semesters till the VIII semester examinations. However, he/she shall not be eligible to get the course completion certificate until all the courses of III, IV, V and VI semesters are successfully completed.

A lateral entry student shall be eligible to get his/her CGPA upon successful completion of the courses of III to VIII semesters within the stipulated time period as per the norms specified in 26.

Any student who has given more than 4 chances for successful completion of I / III semester courses and more than 3 chances for successful completion of II / IV semester courses shall be permitted to attend V / VII semester classes ONLY during the subsequent academic year as the case may be. In simpler terms there shall NOT be any ODD BATCH for any semester.

Note: Grade AB should be considered as failed and treated as one head for deciding academic progression. Such rules are also applicable for those students who fail to register for examination(s) of any course in any semester.

17. Grading of performances

17.1. Letter grades and grade points allocations:

Based on the performances, each student shall be awarded a final letter grade at the end of the semester for each course. The letter grades and their corresponding grade points are given in Table – XII.

Table – XII: Letter grades and grade points equivalent to Percentage of marks and performances

| Percentage of Marks Obtained | Letter Grade | Grade Point | Performance |
|------------------------------|--------------|-------------|-------------|
| 90.00 – 100 | O | 10 | Outstanding |
| 80.00 – 89.99 | A | 9 | Excellent |
| 70.00 – 79.99 | B | 8 | Good |
| 60.00 – 69.99 | C | 7 | Fair |
| 50.00 – 59.99 | D | 6 | Average |
| Less than 50 | F | 0 | Fail |
| Absent | AB | 0 | Fail |

A learner who remains absent for any end semester examination shall be assigned a letter grade of AB and a corresponding grade point of zero. He/she should reappear for the said evaluation/examination in due course.

18. The Semester grade point average (SGPA)

The performance of a student in a semester is indicated by a number called ‘Semester Grade Point Average’ (SGPA). The SGPA is the weighted average of the grade points obtained in all the courses by the student during the semester. For example, if a student takes five courses (Theory/Practical) in a semester with credits C₁, C₂, C₃, C₄ and C₅ and the student’s grade points in these courses are G₁, G₂, G₃, G₄ and G₅, respectively, and then students’ SGPA is equal to:

$$\text{SGPA} = \frac{C_1G_1 + C_2G_2 + C_3G_3 + C_4G_4 + C_5G_5}{C_1 + C_2 + C_3 + C_4 + C_5}$$

The SGPA is calculated to two decimal points. It should be noted that, the SGPA for any semester shall take into consideration the F and ABS grade awarded in that semester. For example if a learner has a F or ABS grade in course 4, the SGPA shall then be computed as:

$$\text{SGPA} = \frac{C_1G_1 + C_2G_2 + C_3G_3 + C_4* \text{ZERO} + C_5G_5}{C_1 + C_2 + C_3 + C_4 + C_5}$$

19. Cumulative Grade Point Average (CGPA)

The CGPA is calculated with the SGPA of all the VIII semesters to two decimal points and is indicated in final grade report card/final transcript showing the grades of all VIII semesters and their courses. The CGPA shall reflect the failed status in case of F grade(s), till the course(s) is/are passed. When the course(s) is/are passed by obtaining a pass grade on subsequent examination(s) the CGPA shall only reflect the new grade and not the fail grades earned earlier. The CGPA is calculated as:

$$\text{CGPA} = \frac{C_1S_1 + C_2S_2 + C_3S_3 + C_4S_4 + C_5S_5 + C_6S_6 + C_7S_7 + C_8S_8}{C_1 + C_2 + C_3 + C_4 + C_5 + C_6 + C_7 + C_8}$$

where C₁, C₂, C₃,... is the total number of credits for semester I, II, III,.... and S₁, S₂, S₃,... is the SGPA of semester I, II, III,....

20. Declaration of class

The class shall be awarded on the basis of CGPA as follows:

- First Class with Distinction = CGPA of 7.50 and above
- First Class = CGPA of 6.00 to 7.49
- Second Class = CGPA of 5.00 to 5.99

21. 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 directly relate any one of the elective subject 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 not less than 25 pages).

The internal and external examiner appointed by the University 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:

| | |
|-------------------------------|----------|
| Objective(s) of the work done | 15 Marks |
| Methodology adopted | 20 Marks |
| Results and Discussions | 20 Marks |
| Conclusions and Outcomes | 20 Marks |

| | |
|--------------|-----------------|
| Total | 75 Marks |
|--------------|-----------------|

Evaluation of Presentation:

| | |
|----------------------------|----------|
| Presentation of work | 25 Marks |
| Communication skills | 20 Marks |
| Question and answer skills | 30 Marks |

| | |
|--------------|-----------------|
| Total | 75 Marks |
|--------------|-----------------|

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

22. Industrial training (Desirable)

Every candidate shall be required to work for at least 150 hours spread over four weeks in a Pharmaceutical Industry/Hospital. It includes 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. After the Semester – VI and before the commencement of Semester – VII, and shall submit satisfactory report of such work and certificate duly signed by the authority of training organization to the head of the institute.

23. Practice School

In the VII semester, every candidate shall undergo practice school for a period of 150 hours evenly distributed throughout the semester. The student shall opt any one of the domains for practice school declared by the program committee from time to time.

At the end of the practice school, every student shall submit a printed report (in triplicate) on the practice school he/she attended (not more than 25 pages). Along with the exams of semester VII, the report submitted by the student, knowledge and skills acquired by the student through practice school shall be evaluated by the subject experts at college level and grade point shall be awarded.

24. Award of Ranks

Ranks and Medals shall be awarded on the basis of final CGPA. However, candidates who fail in one or more courses during the B.Pharm program shall not be eligible for award of ranks. Moreover, the candidates should have completed the B. Pharm program in minimum prescribed number of years, (four years) for the award of Ranks.

25. Award of degree

Candidates who fulfill the requirements mentioned above shall be eligible for award of degree during the ensuing convocation.

26. Duration for completion of the program of study

The duration for the completion of the program shall be fixed as double the actual duration of the program and the students have to pass within the said period, otherwise they have to get fresh Registration.

27. Re-admission after break of study

Candidate who seeks re-admission to the program after break of study has to get the approval from the university by paying a condonation fee.

No condonation is allowed for the candidate who has more than 2 years of break up period and he/she has to rejoin the program by paying the required fees.

6. Course Structure which contains mapping of POs

| S.No | COURSE CODE | COURSE NAME | LTP | CR | PRE REQ. | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|--------------------|-------------|--------------------------------------|-------|----|----------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|
| SEMESTER-I | | | | | | | | | | | | | | | |
| 1 | 17PH1101 | HUMAN ANATOMY AND PHYSIOLOGY-I | 3-1-4 | 6 | – | 2 | 2 | | 1 | | | | | | |
| 2 | 17PH1102 | PHARMACEUTICAL ANALYSIS | 3-1-4 | 6 | – | 2 | 2 | | | | | | | | |
| 3 | 17PH1103 | PHARMACEUTICS- I | 3-1-4 | 6 | – | 3 | 3 | | | | | 2 | | | |
| 4 | 17PH1104 | PHARMACEUTICAL INORGANIC CHEMISTRY | 3-1-4 | 6 | – | 2 | 2 | | 1 | | | | | | |
| 5 | 17PH1105 | COMMUNICATION SKILLS | 2-0-2 | 3 | – | | | | | | 3 | 2 | | | |
| 6 | 17PH1106RM | REMEDIAL BIOLOGY | 3-0-2 | 4 | – | 1 | | | | | | | | | |
| 7 | 17PH1106RB | REMEDIAL MATHEMATICS | 3-1-0 | 4 | – | 1 | | | | | | | | | |
| 8 | 17PH1107 | HUMAN ANATOMY AND PHYSIOLOGY-II | 3-1-4 | 6 | – | 2 | 2 | | 1 | | | | | | |
| SEMESTER-II | | | | | | | | | | | | | | | |
| 9 | 17PH1208 | PHARMACEUTICAL ORGANIC CHEMISTRY –I | 3-1-4 | 6 | – | | 3 | | | | | | | 2 | |
| 10 | 17PH1209 | BIOCHEMISTRY | 3-1-4 | 6 | – | 2 | 2 | | 1 | | | | | | |
| 11 | 17PH1210 | PATHOPHYSIOLOGY | 3-1-0 | 4 | – | 2 | | | | | | 1 | | | |
| 12 | 17PH1211 | COMPUTER APPLICATIONS IN PHARMACY | 3-0-2 | 4 | – | | | 3 | | | 3 | | | | 1 |
| 13 | 17PH1212 | ENVIRONMENTAL SCIENCES | 3-0-0 | 3 | – | | | | 1 | | | 2 | 3 | | |
| SEMESTER-II | | | | | | | | | | | | | | | |
| 14 | 17PH2113 | PHARMACEUTICAL ORGANIC CHEMISTRY –II | 3-1-4 | 6 | – | | 3 | | | | | | | 2 | |
| 15 | 17PH2114 | PHYSICAL PHARMACEUTICS-I | 3-1-4 | 6 | – | 3 | 2 | | | | | | | | |
| 16 | 17PH2115 | PHARMACEUTICAL MICROBIOLOGY | 3-1-4 | 6 | – | 2 | 2 | | 1 | | | | | | |
| 17 | 17PH2116 | PHARMACEUTICAL ENGINEERING | 3-1-4 | 6 | – | 3 | 2 | | 1 | | | | | | |

| | | | | | | | | | | | | | | | | |
|----------------------|------------|--|-----------------|-----|---|---|---|---|---|---|---|---|---|---|---|---|
| 36 | 17PH4135 | PHARMACY PRACTICE | 3-1-4 | 6 | - | | | | | 2 | | 3 | | | | |
| 37 | 17PH4136 | NOVEL DRUG DELIVERY SYSTEMS | 3-1-4 | 6 | - | | 3 | | | | | | 3 | 2 | | |
| 38 | 17PH4137 | PRACTICE SCHOOL | 12-0-0 | 6 | - | | 2 | | | | | | 3 | | | |
| SEMESTER-VIII | | | | | | | | | | | | | | | | |
| 39 | 17PH4238 | BIOSTATISTICS AND RESEARCH METHODOLOGY | 3-1-0 | 6 | - | | | | 3 | 1 | | | | | | |
| 40 | 17PH4239 | SOCIAL AND PREVENTIVE PHARMACY | 3-1-0 | 4 | - | | | | | | 3 | 2 | | | | |
| 41 | 17PH4240ET | PHARMA MARKETING MANAGEMENT | 2 X 3-1-0 | 2X4 | - | | | | | | 3 | | | 2 | | |
| 42 | 17PH4241ET | PHARMACEUTICAL REGULATORY SCIENCE | | | - | 3 | | | | | | | | | 2 | |
| 43 | 17PH4242ET | PHARMACOVIGILANCE | | | - | | | | | | | 3 | | | | 2 |
| 44 | 17PH4243ET | QUALITY CONTROL AND STANDARDIZATION OF HERBALS | | | - | | 3 | | | | | | | | 2 | |
| 45 | 17PH4244ET | COMPUTER AIDED DRUG DESIGN | | | - | | | 3 | | | | | | | | 2 |
| 46 | 17PH4245ET | CELL AND MOLECULAR BIOLOGY | | | - | | 2 | | 3 | | | | | | | |
| 47 | 17PH4246ET | COSMETIC SCIENCE | | | - | | | | | | | | | | 3 | 2 |
| 48 | 17PH4247ET | EXPERIMENTAL PHARMACOLOGY | | | - | | 2 | | 3 | | | | | | | |
| 49 | 17PH4248ET | ADVANCED INSTRUMENTATION TECHNIQUES | | | - | | 3 | | 2 | | | | | | | |
| 50 | 17PH4249ET | DIETARY SUPPLEMENTS AND NUTRACEUTICALS | | | - | | | | | | | | | | 3 | 2 |
| 51 | 17PH4250 | PROJECT WORK | 12-0-0 | 6 | - | | 2 | | 3 | | | | 1 | 1 | | |

***ET-Elective**

7. Syllabus

| COURSE | CO | Course Outcome's | PO/PSO | BTL |
|--|-----|--|--------|-----|
| 17PH1101: HUMAN ANATOMY AND PHYSIOLOGY-I | CO1 | Explain the gross morphology, structure and functions of various organs of the human body. | 1,4 | 1,2 |
| | CO2 | Describe the various homeostatic mechanisms and their imbalances. | 1,4 | 1,2 |
| | CO3 | Identify the various tissues and organs of different systems of human body. | 1,4 | 1,2 |
| | CO4 | Understand the organ functions | 1,4 | 1,2 |
| | CO5 | Perform the various experiments related to physiology and health. | 1,2 | 2,3 |
| <p>•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.</p> <p>•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</p> <p>•Tissue level of organization Classification of tissues, structure, location and functions of epithelial, muscular and nervous and connective tissues.</p> <p>•Integumentary system Structure and functions of skin</p> <p>•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</p> <p>•Joints Structural and functional classification, types of joints movements and its articulation</p> <p>•Body fluids and blood •Body fluids, composition and functions of blood, hemopoiesis, formation of hemoglobin, anemia, mechanisms of coagulation, blood grouping, Rh factors, transfusion, its significance and disorders of blood, Reticulo endothelial system.</p> <p>•Lymphatic system Lymphatic organs and tissues, lymphatic vessels, lymph circulation and functions of lymphatic system</p> <p>•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.</p> <p>•Special senses Structure and functions of eye, ear, nose and tongue and their disorders.</p> <p>•Cardiovascular system Heart – anatomy of heart, blood circulation, blood vessels, structure and functions of artery, vein and capillaries, elements of conduction system of heart and heart beat, its regulation by autonomic nervous system, cardiac output, cardiac cycle. Regulation of blood pressure, pulse, electrocardiogram and disorders of heart.</p> <p>17PH1101P. HUMAN ANATOMY AND PHYSIOLOGY (Practical)</p> <p>1.Study of compound microscope. 2.Microscopic study of epithelial and connective tissue 3.Microscopic study of muscular and nervous tissue</p> | | | | |

4. Identification of axial bones
5. Identification of appendicular bones
6. Introduction to hemocytometry.
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 hemoglobin 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 | CO | Course Outcome's | PO/PSO | BTL |
|---|-----|---|--------|-----|
| 17PH1102: PHARMACEUTICAL ANALYSIS | CO1 | understand the principles of volumetric and electro chemical analysis | 1,2 | 1,2 |
| | CO2 | carryout various volumetric and electrochemical titrations | 1,2 | 1,2 |
| | CO3 | develop analytical skills | 1,2 | 1,2 |
| | CO4 | Reporting analytical result and data integrity | 1,2 | 1,2 |
| | CO5 | Perform various analytical experiments | 1,2 | 2,3 |

- (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.
- 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
 - Precipitation titrations: Mohr's method, Volhard's, Modified Volhard's, Fajans method, estimation of sodium chloride.
 - Gravimetry: Principle and steps involved in gravimetric analysis. Purity of the precipitate: co-precipitation and post precipitation, Estimation of barium sulphate.
 - 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.
- 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
- 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

17PH1102P. PHARMACEUTICAL ANALYSIS (Practical)

I Limit Test of the following

(1) Chloride

(2) Sulphate

(3) Iron

(4) Arsenic

II Preparation and standardization of

(1) Sodium hydroxide

(2) Sulphuric acid

(3) Sodium thiosulfate

(4) Potassium permanganate

(5) Ceric ammonium sulphate

III Assay of the following compounds along with Standardization of Titrant

(1) Ammonium chloride by acid base titration

(2) Ferrous sulphate by Cerimetry

(3) Copper sulphate by Iodometry

(4) Calcium gluconate by complexometry

(5) Hydrogen peroxide by Permanganometry

(6) Sodium benzoate by non-aqueous titration

(7) Sodium Chloride by precipitation titration

IV Determination of Normality by electro-analytical methods

(1) Conductometric titration of strong acid against strong base

(2) Conductometric titration of strong acid and weak acid against strong base

(3) Potentiometric titration of strong acid against strong base

| COURSE | CO | Course Outcome's | PO/PSO | BTL |
|-------------------------------|-----|---|--------|-----|
| 17PH1103: PHARMACEUTICS- I | CO1 | Know the history of profession of pharmacy | 1,7 | 1,2 |
| | CO2 | Understand the basics of different dosage forms | 1,7 | 1,2 |
| | CO3 | Understand the pharmaceutical incompatibilities and pharmaceutical calculations | 1,7 | 1,2 |
| | CO4 | Understand the professional way of handling the prescription | 1,7 | 1,2 |
| | CO5 | Apply the knowledge to prepare various conventional dosage forms | 2,PSO1 | 2,3 |

•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.

•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.

•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.
- 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.
- Semisolid dosage forms: 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

17PH1103P. PHARMACEUTICS I (Practical)

1 . Syrups

- a) Syrup IP'66
- b) Compound syrup of Ferrous Phosphate BPC'68

2. Elixirs

- a) Piperazine citrate elixir
- b) Paracetamol pediatric elixir

3. Linctus

- a) Terpin Hydrate Linctus IP'66
- b) Iodine Throat Paint (Mandles Paint)

4. Solutions

- a) Strong solution of ammonium acetate
- b) Cresol with soap solution
- c) Lugol's solution

5. Suspensions

- a) Calamine lotion
- b) Magnesium Hydroxide mixture
- c) Aluminium Hydroxide gel

6. Emulsions

- a) Turpentine Liniment
- b) Liquid paraffin emulsion

7. Powders and Granules

- a) ORS powder (WHO)
- b) Effervescent granules c) Dusting powder d) Divided powders

8. Suppositories

- a) Glycero gelatin suppository
- b) Cocoa butter suppository
- c) Zinc Oxide suppository

8. Semisolids

- a) Sulphur ointment
- b) Non staining-iodine ointment with methyl salicylate
- c) Carbopal gel

9. Gargles and Mouthwashes

- a) Iodine gargle
- b) Chlorhexidine mouthwash

| COURSE | CO | Course Outcome's | PO/PSO | BTL |
|-----------------------------|-----|---|--------|-----|
| 17PH1104: PHARMACEUTICAL | CO1 | know the sources of impurities and methods to determine the impurities in inorganic drugs and | 1,4 | 1,2 |

| | | | | |
|---------------------|-----|---|-----|-----|
| INORGANIC CHEMISTRY | | pharmaceuticals | | |
| | CO2 | understand the medicinal and pharmaceutical importance of inorganic compounds | 1,4 | 1,2 |
| | CO3 | Know the preparation and analysis of inorganic medicinal compounds | 1,4 | 1,2 |
| | CO4 | Know their diagnostic applications | 1,4 | 1,2 |
| | CO5 | Apply the knowledge to prepare various inorganic pharmaceuticals | 1,2 | 2,3 |

•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

•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.

•Gastrointestinal agents

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, Boric acid, Hydrogen peroxide*, Chlorinated lime*, Iodine and its preparations

•Miscellaneous compounds

Expectorants: Potassium iodide, Ammonium chloride*. Emetics: Copper sulphate*, Sodium potassium tartarate Haematinics: Ferrous sulphate*, Ferrous gluconate

Poison and Antidote: Sodium thiosulphate*, Activated charcoal, Sodium nitrite³³³

Astringents: Zinc Sulphate, Potash Alum

•Radiopharmaceuticals: Radio activity, Measurement of radioactivity, Properties of α , β , γ radiations, Half life, radio isotopes and study of radio isotopes - Sodium iodide I131, Storage conditions, precautions & pharmaceutical application of radioactive substances.

17PH1104P. PHARMACEUTICAL INORGANIC CHEMISTRY (Practical)

I Limit tests for following ions

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 II Identification test

Magnesium hydroxide Ferrous sulphate Sodium bicarbonate Calcium gluconate Copper sulphate

III Test for purity

Swelling power of Bentonite

Neutralizing capacity of aluminum hydroxide gel

Determination of potassium iodate and iodine in potassium Iodide

IV Preparation of inorganic pharmaceuticals

Boric acid Potash alum Ferrous sulphate

| COURSE | CO | Course Outcome's | PO/PSO | BTL |
|----------------------|-----|--|--------|-----|
| 17PH1105:COMMUNICATI | CO1 | Understand the behavioral needs for a Pharmacist to function effectively in the areas of | 6,7 | 2,3 |

| | | | | |
|-----------|-----|---|-----|-----|
| ON SKILLS | | pharmaceutical operation | | |
| | CO2 | Communicate effectively (Verbal and Non Verbal) | 6,7 | 2,3 |
| | CO3 | Effectively manage the team as a team player | 6,7 | 2,3 |
| | CO4 | Develop interview skills | 6,7 | 2,3 |
| | CO5 | Demonstrate communicative skills. | 1,2 | 2,3 |

- 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
- 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
- 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
- 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
- Group Discussion: Introduction, Communication skills in group discussion, Do's and Dont's of group discussion

17PH1105P.COMMUNICATION SKILLS (Practical)

The following learning modules are to be conducted using wordsworth® English language lab software

Basic communication covering the following topics

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

Pronunciations covering the following topics Pronunciation (Consonant Sounds) Pronunciation and Nouns

Pronunciation (Vowel Sounds)

Advanced Learning

Listening Comprehension / Direct and Indirect Speech Figures of Speech

Effective Communication Writing Skills

Effective Writing Interview Handling Skills E-Mail etiquette Presentation Skills

| COURSE | CO | Course Outcome's | PO/PSO | BTL |
|------------------------------|-----|---|--------|-----|
| 17PH1106RB: REMEDIAL BIOLOGY | CO1 | Introduce biology to non biology students | 1 | 1,2 |
| | CO2 | know the classification and salient features of five kingdoms of life | 1 | 1,2 |
| | CO3 | understand the basic components of anatomy & physiology of plant | 1 | 1,2 |
| | CO4 | know understand the basic components of anatomy & physiology animal with special reference to human | 1 | 1,2 |
| | CO5 | Perform various biology experiments | 1,2 | 2,3 |

Living world:

- 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, Protista, 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.
- Body fluids and circulation
 - 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
- Excretory products and their elimination
 - Modes of excretion
 - Human excretory system- structure and function
 - Urine formation
 - Renin 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
- Plants and mineral nutrition:
 - Essential mineral, macro and micronutrients
 - Nitrogen metabolism, Nitrogen cycle, biological nitrogen fixation
- Photosynthesis
 - Autotrophic nutrition, photosynthesis, Photosynthetic pigments, Factors affecting photosynthesis.
- Plant respiration: 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.

17PH1106RBP.REMEDIAL BIOLOGY (Practical)

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, seed, fruit, flower and their modifications
4. Detailed study of frog by using computer models
5. Microscopic study and identification of tissues pertinent to Stem, Root Leaf, seed, fruit and flower
6. Identification of bones
7. Determination of blood group
8. Determination of blood pressure
9. Determination of tidal volume

| COURSE | CO | Course Outcome's | PO/PSO | BTL |
|----------------------------------|-----|---|--------|-----|
| 17PH1106RM: REMEDIAL MATHEMATICS | CO1 | Introduce essential of mathematics to biology students | 1 | 1,2 |
| | CO2 | Know the theory and their application in Pharmacy | 1 | 1,2 |
| | CO3 | Solve the different types of problems by applying theory | 1 | 1,2 |
| | CO4 | Appreciate the important application of mathematics in Pharmacy | 1 | 1,2 |

•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.

•Function:

Real Valued function, Classification of real valued functions,

•Limits and continuity :

Introduction , Limit of a function, Definition of limit of a function ($\lim_{x \rightarrow a} f(x) = L$ - ϵ - δ definition) , $\lim_{x \rightarrow a} \frac{x - a}{x - a} = na^{n-1}$, $\lim_{\theta \rightarrow 0} \frac{\sin \theta}{\theta} = 1$,

$$\lim_{x \rightarrow a} \frac{x - a}{x - a} = na^{n-1} , \quad \lim_{\theta \rightarrow 0} \frac{\sin \theta}{\theta} = 1,$$

•Matrices and Determinant:

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

•Calculus

Differentiation : 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 x^n w.r.tx, where n is any rational number, Derivative of

ex,, Derivative of $\log_e x$, 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. Application

•Analytical Geometry

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.

•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

| COURSE | CO | Course Outcome's | PO/PSO | BTL |
|---|-----|--|--------|-----|
| 17PH1207: HUMAN ANATOMY AND PHYSIOLOGY-II | CO1 | Explain the gross morphology, structure and functions of various organs of the human body. | 1,4 | 1,2 |
| | CO2 | Describe the various homeostatic mechanisms and their imbalances. | 1,4 | 1,2 |
| | CO3 | Identify the various tissues and organs of different systems of human body. | 1,4 | 1,2 |
| | CO4 | Perform the hematological tests like blood cell counts, haemoglobin estimation, bleeding/clotting time etc and also record blood pressure, heart rate, pulse and respiratory volume. | 1,4 | 1,2 |
| | CO5 | Apply the knowledge to perform various physiology experiments | 1,2 | 2,3 |

•Nervous system

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)

•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.

•Respiratory system 12 hours

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.

•Endocrine system

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.

•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

17PH1207 P. HUMAN ANATOMY AND PHYSIOLOGY (Practical)

- 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
- 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 analyser
- Permanent slides of vital organs and gonads.

| COURSE | CO | Course Outcome's | PO/PSO | BTL |
|---|-----|---|--------|-----|
| 17PH1208: PHARMACEUTICAL ORGANIC CHEMISTRY –I | CO1 | write the structure, name and the type of isomerism of the organic compound | 2,PSO1 | 1,2 |
| | CO2 | write the reaction, name the reaction and orientation of reactions | 2,PSO1 | 1,2 |
| | CO3 | account for reactivity/stability of compounds, | 2,PSO1 | 1,2 |
| | CO4 | identify/confirm the identification of organic compound | 2,PSO1 | 1,2 |
| | CO5 | Apply the knowledge to synthesize various organic compounds | 2,PSO1 | 2,3 |

•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

•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

•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

•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.

•Carboxylic acids*

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

17PH1208P. PHARMACEUTICAL ORGANIC CHEMISTRY -I (Practical)

1. Systematic qualitative analysis of unknown organic compounds like
 1. Preliminary test: Color, odour, aliphatic/aromatic compounds, saturation and unsaturation, etc.
 2. Detection of elements like Nitrogen, Sulphur and Halogen by Lassaigne's test
 3. Solubility test
 4. Functional group test like Phenols, Amides/ Urea, Carbohydrates, Amines, Carboxylic acids, Aldehydes and Ketones, Alcohols, Esters, Aromatic and Halogenated Hydrocarbons, Nitro compounds and Anilides.
 5. Melting point/Boiling point of organic compounds
 6. Identification of the unknown compound from the literature using melting point/ boiling point.
 7. Preparation of the derivatives and confirmation of the unknown compound by melting point/ boiling point.
 8. Minimum 5 unknown organic compounds to be analysed systematically.
2. Preparation of suitable solid derivatives from organic compounds
3. Construction of molecular models

| COURSE | CO | Course Outcome's | PO/PSO | BTL |
|----------------------------|-----|---|--------|-----|
| 17PH1209 : BIOCHEMISTRY | CO1 | Understand the principles of chemistry in biology | 1,4 | 1,2 |
| | CO2 | Understand the catalytic role of enzymes, importance of enzyme inhibitors in design of new drugs, therapeutic and diagnostic applications of enzymes. | 1,4 | 1,2 |
| | CO3 | Understand the metabolism of nutrient molecules in physiological and pathological conditions. | 1,4 | 1,2 |
| | CO4 | Understand the genetic organization of mammalian genome and functions of DNA in the synthesis of RNAs and proteins. | 1,4 | 1,2 |
| | CO5 | Apply the knowledge to estimate various biochemical parameters in physiological systems | 1,2 | 2,3 |

•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

- 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 level phosphorylation

Inhibitors ETC and oxidative phosphorylation/Uncouplers

- Lipid metabolism

β -Oxidation of saturated fatty acid (Palmitic acid)

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, alpeptonuria, tyrosinemia)

Synthesis and significance of biological substances; 5-HT, melatonin, dopamine, noradrenaline, adrenaline

Catabolism of heme; hyperbilirubinemia and jaundice

- 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

- 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

17PH1209 P. BIOCHEMISTRY (Practical)

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.
12. Study the effect of substrate concentration on salivary amylase activity.

| COURSE | CO | Course Outcome's | PO/PSO | BTL |
|---------------------------|-----|--|--------|-----|
| 17PH12010:PATHOPHYSIOLOGY | CO1 | Understand the conditions leading to a disease | 1,7 | 1,2 |
| | CO2 | Describe the etiology and pathogenesis of the selected disease states; | 1,7 | 1,2 |
| | CO3 | Name the signs and symptoms of the diseases; and | 1,7 | 1,2 |
| | CO4 | Mention the complications of the diseases. | 1,7 | 1,2 |

- 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
- 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.
- Haematological Diseases:
Iron deficiency, megaloblastic anemia (Vit B12 and folic acid), sickle cell anemia, thalassemia, 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
- 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
- Infectious diseases: Meningitis, Typhoid, Leprosy, Tuberculosis Urinary tract infections
- Sexually transmitted diseases: AIDS, Syphilis, Gonorrhoea

| COURSE | CO | Course Outcome's | PO/PSO | BTL |
|--|-----|---|---------|-----|
| 17PH1211 : COMPUTER APPLICATIONS IN PHARMACY | CO1 | know the various types of application of computers in pharmacy | 3, PSO2 | 2,3 |
| | CO2 | know the various types of databases | 3, PSO2 | 2,3 |
| | CO3 | know the various applications of databases in pharmacy | 3, PSO2 | 2,3 |
| | CO4 | Know the web based tools for pharmacy practice | 3, PSO2 | 2,3 |
| | CO5 | Apply the knowledge to design and develop digital tools for pharmaceutical applications | 6, PSO2 | 3,4 |

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
Programming languages, introduction to web servers and Server
Products

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

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

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

Computers as data analysis in Preclinical development: Chromatographic data analysis(CDS), Laboratory Information management System (LIMS) and Text Information Management System(TIMMS)

17PH1211P. COMPUTER APPLICATIONS IN PHARMACY (Practical)

1.Design a questionnaire using a word processing package to gather information about a particular disease.

2. Create a HTML web page 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 MS WORD

6.Create a database in MS Access to store the patient information with the required fields Using access

7. Design a form in MS Access to view, add, delete and modify the patient record in the database

8. Generating report and printing the report from patient database

9. Creating invoice table using – MS Access

10. Drug information storage and retrieval using MS Access

11. Creating and working with queries in MS Access

12. Exporting Tables, Queries, Forms and Reports to web pages

13. Exporting Tables, Queries, Forms and Reports to XML pages

| COURSE | CO | Course Outcome's | PO/PSO | BTL |
|---|-----|--|--------|-----|
| 17PH1212 : ENVIRONMENTAL SCIENCES | CO1 | Create the awareness about environmental problems among learners. | 4,7 | 1,2 |
| | CO2 | Impart basic knowledge about the environment and its allied problems. | 4,7 | 1,2 |
| | CO3 | Develop an attitude of concern for the environment. | 4,7 | 1,2 |
| | CO4 | Motivate learner to participate in environment protection and environment improvement. | 7,8 | 1,2 |

The Multidisciplinary nature of environmental studies 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.

Ecosystems

☐ 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)

Environmental Pollution: Air pollution; Water pollution; Soil pollution

| COURSE | CO | Course Outcome's | PO/PSO | BTL |
|--------|----|------------------|--------|-----|
|--------|----|------------------|--------|-----|

| | | | | |
|--|-----|---|--------|-----|
| 17PH2113: PHARMACEUTICAL ORGANIC CHEMISTRY –II | CO1 | write the structure, name and the type of isomerism of the organic compound | 2,PSO1 | 1,2 |
| | CO2 | write the reaction, name the reaction and orientation of reactions | 2,PSO1 | 1,2 |
| | CO3 | account for reactivity/stability of compounds, | 2,PSO1 | 1,2 |
| | CO4 | prepare organic compounds | 2,PSO1 | 1,2 |
| | CO5 | Apply the knowledge to synthesize various organic compounds | 2,PSO1 | 2,3 |

•Benzene and its derivatives

A.Analytical, synthetic and other evidences in the derivation of structure of benzene, Orbital picture, resonance in benzene, aromatic characters, Huckel's rule

B.Reactions of benzene - nitration, sulphonation, halogenation- reactivity, Friedelcrafts alkylation- reactivity, limitations, Friedelcrafts acylation.

C.Substituents, effect of substituents on reactivity and orientation of mono substituted benzene compounds towards electrophilic substitution reaction

D.Structure and uses of DDT, Saccharin, BHC and Chloramine

•Phenols* - Acidity of phenols, effect of substituents on acidity, qualitative tests, Structure and uses of phenol, cresols, resorcinol, naphthols

•Aromatic Amines* - Basicity of amines, effect of substituents on basicity, and synthetic uses of aryl diazonium salts

•Aromatic Acids* –Acidity, effect of substituents on acidity and important reactions of benzoic acid.

•Fats and Oils

a.Fatty acids – reactions.

b.Hydrolysis, Hydrogenation, Saponification and Rancidity of oils, Drying oils.

c.Analytical constants – Acid value, Saponification value, Ester value, Iodine value, Acetyl value, Reichert Meissl (RM) value – significance and principle involved in their determination.

•Polynuclear hydrocarbons:

a.Synthesis, reactions

b.Structure and medicinal uses of Naphthalene, Phenanthrene, Anthracene, Diphenylmethane, Triphenylmethane and their derivatives

•Cyclo alkanes*

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

17PH2113P. PHARMACEUTICAL ORGANIC CHEMISTRY -II (Practical)

I Experiments involving laboratory techniques

• Recrystallization

• Steam distillation

II Determination of following oil values (including standardization of reagents)

• Acid value

• Saponification value

• Iodine value

III Preparation of compounds

• Benzanilide/Phenyl benzoate/Acetanilide from Aniline/Phenol

/Aniline by acylation reaction.

• 2,4,6-Tribromo aniline/Para bromo acetanilide from Aniline/

• Acetanilide by halogenation (Bromination) reaction.

• 5-Nitro salicylic acid/Meta di nitro benzene from Salicylic acid / Nitro benzene by nitration reaction.

• Benzoic acid from Benzyl chloride by oxidation reaction.

• Benzoic acid/ Salicylic acid from alkyl benzoate/ alkyl salicylate by hydrolysis reaction.

• 1-Phenyl azo-2-naphthol from Aniline by diazotization and coupling reactions.

- Benzil from Benzoin by oxidation reaction.
- Dibenzal acetone from Benzaldehyde by Claisen Schmidt reaction
- Cinnamic acid from Benzaldehyde by Perkin reaction
- P-Iodo benzoic acid from P-amino benzoic acid

| COURSE | CO | Course Outcome's | PO/PSO | BTL |
|------------------------------------|-----|---|--------|-----|
| 17PH2114: PHYSICAL PHARMACEUTICS-I | CO1 | Understand the principles of physical chemistry in pharmaceutical technology | 1,2 | 1,2 |
| | CO2 | Understand various physicochemical properties of drug molecules in the designing the dosage forms | 1,2 | 1,2 |
| | CO3 | Know the principles of chemical kinetics & to use them for stability testing and determination of expiry date of formulations | 1,2 | 1,2 |
| | CO4 | Understand the use of physicochemical properties in the formulation development and evaluation of dosage forms. | 1,2 | 1,2 |
| | CO5 | Demonstrate use of physicochemical properties in the formulation development and evaluation of dosage forms. | 1,2 | 2,3 |

Solubility of drugs: 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

States of Matter and properties of matter: 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

Surface and interfacial phenomenon: 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.

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

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

17PH2114P. PHYSICAL PHARMACEUTICS – I (Practical)

1. Determination the solubility of drug at room temperature
2. Determination of pKa value by Half Neutralization/ Henderson Hasselbalch equation.
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 HLB number of a surfactant by saponification method
8. Determination of Freundlich and Langmuir constants using activated char coal
9. Determination of critical micellar concentration of surfactants
10. Determination of stability constant and donor acceptor ratio of PABA-Caffeine complex by solubility method
11. Determination of stability constant and donor acceptor ratio of Cupric-Glycine complex by pH

| titration method | | | | |
|---|-----|--|--------|-----|
| COURSE | CO | Course Outcome's | PO/PSO | BTL |
| 17PH2115 : PHARMACEUTICAL MICROBIOLOGY | CO1 | Understand methods of identification, cultivation and preservation of various microorganisms | 1,4 | 1,2 |
| | CO2 | To understand the importance and implementation of sterilization in pharmaceutical processing and industry | 1,4 | 1,2 |
| | CO3 | Learn sterility testing of pharmaceutical products. | 1,4 | 1,2 |
| | CO4 | Understand microbiological standardization of Pharmaceuticals. | 1,4 | 1,2 |
| | CO5 | Apply microbiological testing tools in pharmaceutical products. | 2,4 | 2,3 |
| <p>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 contrast microscopy, dark field microscopy and electron microscopy. 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. 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. Principles and methods of different microbiological assay. Methods for standardization of antibiotics, vitamins and amino acids. Assessment of a new antibiotic. Types of spoilage, assessment of microbial contamination and spoilage. Preservation of pharmaceutical products using antimicrobial agents, evaluation of microbial stability of formulations. Growth of animal cells in culture, general procedure for cell culture, Primary, established and transformed cell cultures. Application of cell cultures in pharmaceutical industry and research.</p> <p>17PH2115P.PHARMACEUTICAL MICROBIOLOGY (Practical)</p> <ol style="list-style-type: none"> Introduction and study of different equipments and processing, e.g., B.O.D. incubator, laminar flow, aseptic hood, autoclave, hot air sterilizer, deep freezer, refrigerator, microscopes used in experimental microbiology. Sterilization of glassware, preparation and sterilization of media. Sub culturing of bacteria and fungus. Nutrient stabs and slants preparations. Staining methods- Simple, Grams staining and acid fast staining (Demonstration with practical). Isolation of pure culture of micro-organisms by multiple streak plate technique 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 | CO | Course Outcome's | PO/PSO | BTL |
| 17PH2116 : PHARMACEUTICAL ENGINEERING | CO1 | To know various unit operations used in Pharmaceutical industries. | 1,4 | 1,2 |
| | CO2 | To understand the material handling techniques. | 1,4 | 1,2 |
| | CO3 | Understand various processes involved in pharmaceutical manufacturing process. | 1,4 | 1,2 |
| | CO4 | Acquire knowledge on operation of pharmaceutical manufacturing equipment | 1,4 | 1,2 |
| | CO5 | Demonstrate the ability to use and operate pharmaceutical manufacturing equipment | 1,2 | 2,3 |
| <ul style="list-style-type: none"> •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, Air separator, Bag filter & elutriation tank. •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 •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, •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. •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. | | | | |
| 17PH2116P - PHARMACEUTICAL ENGINEERING (Practical) | | | | |
| I. Determination of radiation constant of brass, iron, unpainted and painted glass. | | | | |

- II. Steam distillation – To calculate the efficiency of steam distillation.
- III. To determine the overall heat transfer coefficient by heat exchanger.
- IV. Construction of drying curves (for calcium carbonate and starch).
- V. Determination of moisture content and loss on drying.
- VI. Determination of humidity of air – i) from wet and dry bulb temperatures –use of Dew point method.
- VII. Description of Construction working and application of Pharmaceutical Machinery such as rotary tablet machine, fluidized bed coater, fluid energy mill, de humidifier.
- VIII. Size analysis by sieving – To evaluate size distribution of tablet granulations – Construction of various size frequency curves including arithmetic and logarithmic probability plots.
- IX. Size reduction: To verify the laws of size reduction using ball mill and determining Kicks, Rittinger's, Bond's coefficients, power requirement and critical speed of Ball Mill.
- X. Demonstration of colloid mill, planetary mixer, fluidized bed dryer, freeze dryer and such other major equipment.
- XI. Factors affecting Rate of Filtration and Evaporation (Surface area, Concentration and Thickness/viscosity)
- XII. To study the effect of time on the Rate of Crystallization.
- XIII. To calculate the uniformity Index for given sample by using Double Cone Blender.

| COURSE | CO | Course Outcome's | PO/PSO | BTL |
|---|-----|--|--------|-----|
| 17PH2217: PHARMACEUTICAL ORGANIC CHEMISTRY – III | CO1 | understand the methods of preparation and properties of organic compounds | 1,4 | 1,2 |
| | CO2 | explain the stereo chemical aspects of organic compounds and stereo chemical reactions | 1,4 | 1,2 |
| | CO3 | know the medicinal uses and other applications of organic compounds | 1,4 | 1,2 |
| | CO4 | Introduce to assymmetric synthesis | 1,4 | 1,2 |

Stereo isomerism

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 Geometrical isomerism

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

Heterocyclic compounds:

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

Synthesis, reactions and medicinal uses of 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

Reactions of synthetic importance

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

| COURSE | CO | Course Outcome's | PO/PSO | BTL |
|-----------------------------------|-----|---|--------|-----|
| 17PH2218: MEDICINAL CHEMISTRY – I | CO1 | understand the chemistry of drugs with respect to their pharmacological activity | 1 | 1,2 |
| | CO2 | understand the drug metabolic pathways, adverse effect and therapeutic value of drugs | 1 | 1,2 |
| | CO3 | know the Structural Activity Relationship (SAR) of different class of drugs | 1,4 | 1,2 |
| | CO4 | write the chemical synthesis of some drugs | 1,4 | 1,2 |
| | CO5 | Perform chemical synthesis of some drugs | 4,PSO1 | 2,3 |

Introduction to Medicinal Chemistry

History and development of medicinal chemistry Physicochemical properties in relation to 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 including stereo chemical aspects.

Drugs acting on Autonomic Nervous System 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: Hydroxyamphetamine, 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, Labetolol, Carvedilol.

Cholinergic neurotransmitters:

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, Isoflurophate, Echothiophate iodide, Parathione, Malathion.

Cholinesterase reactivator: Pralidoxime chloride.

Cholinergic Blocking agents: SAR of cholinolytic agents

Solanaceous alkaloids and analogues: Atropine sulphate, Hyoscyamine sulphate, 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, Piperidine hydrochloride, Procyclidine hydrochloride*, Tridihexethyl chloride, Isopropamide iodide, Ethopropazine hydrochloride.

Drugs acting on Central Nervous System

A. Sedatives and Hypnotics:

Benzodiazepines: SAR of Benzodiazepines, Chlordiazepoxide, Diazepam*, Oxazepam, Chlorazepate, Lorazepam, Alprazolam, Zolpidem

Barbiturates: SAR of barbiturates, Barbitol*, Phenobarbital, Mephobarbital, Amobarbital, Butobarbital, Pentobarbital, Secobarbital

Miscellaneous:

Amides & imides: Glutethimide.

Alcohol & their carbamate derivatives: Meprobamate, 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.

Fluoro buterophenones: Haloperidol, Droperidol, Risperidone.

Beta amino ketones: Molindone hydrochloride.

Benzamides: Sulpieride.

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

Barbiturates: Phenobarbitone, Methobarbital. Hydantoin: Phenytoin*, Mephentyoin, Ethotoin

Oxazolidinone diones: Trimethadione, Paramethadione Succinimides: Phensuximide, Methsuximide,

Ethosuximide* Urea and monoacylureas: Phenacemide, Carbamazepine* Benzodiazepines: Clonazepam

Miscellaneous: Primidone, Valproic acid, Gabapentin, Felbamate

General anesthetics:

Inhalation anesthetics: Halothane*, Methoxyflurane, Enflurane, Sevoflurane, Isoflurane, Desflurane.

Ultra short acting barbiturates: Methohexital sodium*, Thiethyl sodium, Thiopental sodium.

Dissociative anesthetics: Ketamine hydrochloride.*

Narcotic and non-narcotic analgesics

Morphine and related drugs: SAR of Morphine analogues, Morphine sulphate, Codeine, Meperidine hydrochloride, Anileridine 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, Zomepirac, Diclofenac, Ketorolac, Ibuprofen*, Naproxen, Piroxicam, Phenacetin, Acetaminophen, Antipyrine, Phenylbutazone.

17PH2218P. MEDICINAL CHEMISTRY – I (Practical)

I Preparation of drugs/ intermediates

1 1,3-pyrazole

2 1,3-oxazole

3 Benzimidazole

4 Benzotriazole

5 2,3- diphenyl quinoxaline

6 Benzocaine

7 Phenytoin

8 Phenothiazine

9 Barbiturate

II Assay of drugs

1 Chlorpromazine

2 Phenobarbitone

3 Atropine

| | |
|-----|--|
| 4 | Ibuprofen |
| 5 | Aspirin |
| 6 | Furosemide |
| III | Determination of Partition coefficient for any two drugs |

| COURSE | CO | Course Outcome's | PO/PSO | BTL |
|--------------------------------------|-----|---|--------|-----|
| 17PH2219 : PHYSICAL PHARMACEUTICS-II | CO1 | Understand the principles of physical chemistry in pharmaceutical technology | 1,4 | 1,2 |
| | CO2 | Understand various physicochemical properties of drug molecules in the designing the dosage forms | 1,4 | 1,2 |
| | CO3 | Know the principles of chemical kinetics & to use them for stability testing nad determination of expiry date of formulations | 1,4 | 1,2 |
| | CO4 | Understand the use of physicochemical properties in the formulation development and evaluation of dosage forms. | 1,4 | 1,2 |
| | CO5 | Demonstrate use of physicochemical properties in the formulation development and evaluation of dosage forms. | 2,4 | 2,3 |

Colloidal dispersions: 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.

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

Coarse dispersion: 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.

Micromeritics: 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.

Drug stability: 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 product: temperature, solvent, ionic strength, dielectric constant, specific & general acid base catalysis, 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

17PH2219P. PHYSICAL PHARMACEUTICS- II (Practical)

- Determination of particle size, particle size distribution using sieving method
- Determination of particle size, particle size distribution using Microscopic method
- Determination of bulk density, true density and porosity
- Determine the angle of repose and influence of lubricant on angle of repose
- Determination of viscosity of liquid using Ostwald's viscometer
- Determination sedimentation volume with effect of different suspending agent
- Determination sedimentation volume with effect of different concentration of single suspending agent
- Determination of viscosity of semisolid by using Brookfield viscometer
- Determination of reaction rate constant first order.
- Determination of reaction rate constant second order
- Accelerated stability studies

| COURSE | CO | Course Outcome's | PO/PSO | BTL |
|------------------------------|-----|--|--------|-----|
| 17PH2220 : PHARMACOLOGY-I | CO1 | Understand the pharmacological actions of different categories of drugs | 1,4 | 1,2 |
| | CO2 | Explain the mechanism of drug action at organ system/sub cellular/ macromolecular levels. | 1,4 | 1,2 |
| | CO3 | Apply the basic pharmacological knowledge in the prevention and treatment of various diseases. | 1,4 | 1,2 |
| | CO4 | Understand the effect of drugs on physiological systems | 1,4 | 1,2 |
| | CO5 | Observe the effect of drugs on animals by simulated experiments | 4 | 2,3 |

1. General Pharmacology
 - 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
 - General Pharmacology
 - 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 receptor, transmembrane enzyme linked receptors, transmembrane JAK-STAT binding receptor 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.
 2. Pharmacology of drugs acting on peripheral nervous system
 - 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
 3. Pharmacology of drugs acting on central nervous system
 - a. Neurohumoral transmission in the C.N.S.special emphasis on importance of various neurotransmitters like with GABA, Glutamate, Glycine, serotonin, dopamine.
 - b. General anesthetics and pre-anesthetics.
 - c. Sedatives, hypnotics and centrally acting muscle relaxants.
 - d. Anti-epileptics
 - e. Alcohols and disulfiram
 - f. Psychopharmacological agents: Antipsychotics, antidepressants, anti-anxiety agents, anti-manics and hallucinogens.
 - a. Drugs used in Parkinsons disease and Alzheimer's disease.
 - b. CNS stimulants and nootropics.
 - c. Opioid analgesics and antagonists
 - d. Drug addiction, drug abuse, tolerance and dependence.
- 17PH2220 P.PHARMACOLOGY-I (Practical)
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 used for animal studies.
6. Study of different routes of drugs administration in mice/rats.
7. Study of effect of hepatic microsomal enzyme inducers on the phenobarbitone sleeping time in mice.
8. Effect of drugs on ciliary motility of frog oesophagus
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 anxiolytic activity of drugs using rats/mice.
15. Study of local anesthetics by different methods

| COURSE | CO | Course Outcome's | PO/PSO | BTL |
|--|-----|---|--------|-----|
| 17PH2221 :PHARMACOGNOSY AND PHYTOCHEMISTRY I | CO1 | to know the techniques in the cultivation and production of crude drugs | 1,PSO1 | 1,2 |
| | CO2 | to know the crude drugs, their uses and chemical nature | 1,PSO1 | 1,2 |
| | CO3 | know the evaluation techniques for the herbal drugs | 1,PSO1 | 1,2 |
| | CO4 | Understand the microscopic and morphological features of crude drugs | 1,PSO1 | 1,2 |
| | CO5 | Perform the microscopic experiments and morphological evaluation of crude drugs | 1,2 | 2,3 |

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 and 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:

Adulteration of drugs of natural origin. Evaluation by organoleptic, microscopic, physical, chemical and biological methods and properties.

Quantitative microscopy of crude drugs including lycopodium spore method, leaf constants, camera lucida and diagrams of microscopic objects to scale with camera lucida.

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

Cultivation and Collection of drugs of natural origin Factors influencing cultivation of medicinal plants.

Plant hormones and their applications.

Polyploidy, mutation and hybridization with reference to medicinal plants

Conservation of medicinal plants

Plant tissue culture:

Historical development of plant tissue culture, types of cultures, Nutritional requirements, growth and their maintenance.

Applications of plant tissue culture in pharmacognosy. Edible vaccines

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
 Study of biological source, chemical nature and uses of drugs of natural origin containing following drugs
 Plant Products:
 Fibers - Cotton, Jute, Hemp
 Hallucinogens, Teratogens, Natural allergens
 Primary metabolites:
 General introduction, detailed study with respect to chemistry, sources, preparation, evaluation, preservation, storage, therapeutic used 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

| COURSE | CO | Course Outcome's | PO/PSO | BTL |
|-----------------------------------|-----|---|--------|-----|
| 17PH3122 : Medicinal Chemistry II | CO1 | understand the chemistry of drugs with respect to their pharmacological activity | 1,4 | 1,2 |
| | CO2 | understand the drug metabolic pathways, adverse effect and therapeutic value of drugs | 1,4 | 1,2 |
| | CO3 | know the Structural Activity Relationship (SAR) of different class of drugs | 1,4 | 1,2 |
| | CO4 | write the chemical synthesis of some drugs | 1,4 | 1,2 |

Antihistaminic agents: Histamine, receptors and their distribution in the humanbody
 H1-antagonists: Diphenhydramine hydrochloride*, Dimenhydrinate, Doxylamines succinate, Clemastine fumarate, Diphenylpyraline 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: Meclorothamine*, 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 Miscellaneous: Cisplatin, Mitotane.
 Anti-anginal:
 Vasodilators: Amyl nitrite, Nitroglycerin*, Pentaerythritol tetranitrate, Isosorbide dinitrite*, Dipyridamole.
 Calciumchannelblockers: 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.
 Anti-arrhythmic Drugs: Quinidine sulphate, Procainamide hydrochloride, Disopyramide phosphate*, Phenytoin sodium, Lidocaine hydrochloride, Tocainide hydrochloride, Mexiletine hydrochloride, Lorcaïnide 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, Bosentan, Tezosentan.

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.

Antidiabetic agents:

Insulin and its preparations

Sulfonyl ureas: Tolbutamide*, Chlorpropamide, Glipizide, Glimepiride. Biguanides: Metformin.

Thiazolidinediones: Pioglitazone, Rosiglitazone. Meglitinides: Repaglinide, Nateglinide.

Glucosidase inhibitors: Acarbose, Voglibose.

Local Anesthetics: SAR of Local anesthetics

Benzoic Acid derivatives; Cocaine, Hexylcaine, Meprylcaine, Cyclomethycaine, Piperocaine.

Amino Benzoic acid derivatives: Benzocaine*, Butamben, Procaine*, Butacaine, Propoxycaïne, Tetracaine, Benoxinate.

Lidocaine/Anilide derivatives: Lignocaine, Mepivacaine, Prilocaine, Etidocaine.

Miscellaneous: Phenacaine, Dipiperodon, Dibucaine.*

| COURSE | CO | Course Outcome's | PO/PSO | BTL |
|---------------------------------|-----|--|--------|-----|
| 17PH3123: Industrial Pharmacy I | CO1 | Know the design and layout of various procedures in pharmaceutical industry | 1,PSO1 | 1,2 |
| | CO2 | Know the various pharmaceutical dosage forms and their manufacturing techniques. | 1,PSO1 | 1,2 |
| | CO3 | Know various considerations in development of pharmaceutical dosage forms | 1,PSO1 | 1,2 |
| | CO4 | Understand the quality control of solid, liquid and semisolid dosage forms | 1,PSO1 | 1,2 |
| | CO5 | Formulate solid, liquid and semisolid dosage forms and evaluate them for their quality | 2,PSO1 | 2,3 |

Preformulation Studies: 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.

Tablets:

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

Capsules:

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

Parenteral Products:

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

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.

17PH3123 P. Industrial Pharmacy (Practical)

1. Preformulation studies on paracetamol/asparin/or any other drug
2. Preparation and evaluation of Paracetamol tablets
3. Preparation and evaluation of Aspirin tablets
4. Coating of tablets- film coating of tables/granules
5. Preparation and evaluation of Tetracycline capsules
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)

| COURSE | CO | Course Outcome's | PO/PSO | BTL |
|---------------------------|-----|--|--------|-----|
| 17PH3124: Pharmacology II | CO1 | Understand the mechanism of drug action and its relevance in the treatment of different diseases | 1,4 | 1,2 |
| | CO2 | Apply the basic pharmacological knowledge in the prevention and treatment of various diseases. | 1,4 | 1,2 |
| | CO3 | Understand the effect of drugs on physiological systems | 1,4 | 1,2 |
| | CO4 | Appreciate correlation of pharmacology with related medical sciences | 1,4 | 1,2 |

| | CO5 | Perform various invitro experiments to demonstrate receptor actions using isolated tissue preparation | 2,4 | 2,3 |
|---|-----|---|-----|-----|
| <ol style="list-style-type: none"> 1. Pharmacology of drugs acting on cardio vascular system <ol style="list-style-type: none"> a. Introduction to hemodynamic and electrophysiology of heart. b. Drugs used in congestive heart failure c. Anti-hypertensive drugs. d. Anti-anginal drugs. e. Anti-arrhythmic drugs. f. Anti-hyperlipidemic drugs. 1. Pharmacology of drugs acting on cardio vascular system <ol style="list-style-type: none"> a. Drug used in the therapy of shock. b. Hematinics, coagulants and anticoagulants. c. Fibrinolytics and anti-platelet drugs d. Plasma volume expanders 2. Pharmacology of drugs acting on urinary system <ol style="list-style-type: none"> a. Diuretics b. Anti-diuretics. 3. Autocoids and related drugs <ol style="list-style-type: none"> 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 5. Pharmacology of drugs acting on endocrine system <ol style="list-style-type: none"> 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. 5. Pharmacology of drugs acting on endocrine system <ol style="list-style-type: none"> a. Androgens and Anabolic steroids. b. Estrogens, progesterone and oral contraceptives. c. Drugs acting on the uterus. 6. Bioassay <ol style="list-style-type: none"> a. Principles and applications of bioassay. b.Types of bioassay c. Bioassay of insulin, oxytocin, vasopressin, ACTH,d-tubocurarine,digitalis, histamine and 5-HT <p>17PH3124 P. PHARMACOLOGY-II (Practical)</p> <ol style="list-style-type: none"> 1. 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. 5. DRC of acetylcholine using frog rectus abdominis muscle. 6. Effect of physostigmine and atropine on DRC of acetylcholine using frog rectus abdominis muscle and rat ileum respectively. 7. Bioassay of histamine using guinea pig ileum by matching method. 8. Bioassay of oxytocin using rat uterine horn by interpolation method. 9. Bioassay of serotonin using rat fundus strip by three point bioassay. 10. Bioassay of acetylcholine using rat ileum/colon by four point bioassay. | | | | |

11. Determination of PA₂ value of prazosin using rat anococcygeus muscle (by Schild's plot method).
12. Determination of PD₂ value using guinea pig ileum.
13. Effect of spasmogens and spasmolytics using rabbit jejunum.
14. Anti-inflammatory activity of drugs using carrageenan induced paw-edema model.
15. Analgesic activity of drug using central and peripheral methods

| COURSE | CO | Course Outcome's | PO/PSO | BTL |
|--|-----|---|--------|-----|
| 17PH3125 : Pharmacognosy and Phytochemistry II | CO1 | to know the modern extraction techniques, characterization and identification of the herbal drugs and phytoconstituents | 1,PSO2 | 1,2 |
| | CO2 | to understand the preparation and development of herbal formulation. | 1,PSO2 | 1,2 |
| | CO3 | to understand the herbal drug interactions | 1,PSO2 | 1,2 |
| | CO4 | Understand the isolation procedures and identification of phytoconstituents | 1,PSO2 | 1,2 |
| | CO5 | to carryout isolation and identification of phytoconstituents | 2,PSO1 | 2,3 |

Metabolic pathways in higher plants and their determination

a) Brief study of basic metabolic pathways and formation of different secondary metabolites through these pathways- Shikimic acid pathway, Acetate pathways and Amino acid pathway.

b) Study of utilization of radioactive isotopes in the investigation of Biogenetic studies.

General introduction, composition, chemistry & chemical classes, biosources, therapeutic uses and commercial applications of following secondary metabolites:

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

Isolation, Identification and Analysis of Phytoconstituents

a) Terpenoids: Menthol, Citral, Artemisin

b) Glycosides: Glycyrrhetic acid & Rutin

c) Alkaloids: Atropine, Quinine, Reserpine, Caffeine

d) Resins: Podophyllotoxin, Curcumin

Industrial production, estimation and utilization of the following phytoconstituents: Forskolin, Sennoside, Artemisinin, Diosgenin, Digoxin, Atropine, Podophyllotoxin, Caffeine, Taxol, Vincristine and Vinblastine

Basics of Phytochemistry

Modern methods of extraction, application of latest techniques like Spectroscopy, chromatography and electrophoresis in the isolation, purification and identification of crude drugs.

17PH3125 P. PHARMACOGNOSY AND PHYTOCHEMISTRY II (Practical)

1. Morphology, histology and powder characteristics & extraction & detection of: Cinchona, Cinnamon, Senna, Clove, Ephedra, Fennel and Coriander

2. Exercise involving isolation & detection of active principles

a. Caffeine - from tea dust.

b. Diosgenin from Dioscorea

c. Atropine from Belladonna

d. Sennosides from Senna

3. Separation of sugars by Paper chromatography

4. TLC of herbal extract

5. Distillation of volatile oils and detection of phytoconstituents by TLC
 6. Analysis of crude drugs by chemical tests: (i) Asafoetida (ii) Benzoin (iii) Colophony (iv) Aloes (v) Myrrh

| COURSE | CO | Course Outcome's | PO/PSO | BTL |
|---|-----|---|--------|-----|
| 17PH3126 : PHARMACEUTICAL JURISPRUDENCE | CO1 | The Pharmaceutical legislations and their implications in the development and marketing of pharmaceuticals. | 1,8 | 1,2 |
| | CO2 | Various Indian pharmaceutical Acts and Laws | 1,8 | 1,2 |
| | CO3 | The regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals | 1,8 | 1,2 |
| | CO4 | The code of ethics during the pharmaceutical practice | 1,8 | 1,2 |

Drugs and Cosmetics Act, 1940 and its rules 1945:

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.

Drugs and Cosmetics Act, 1940 and its rules 1945.

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

- 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

- Study of Salient Features of Drugs and Magic Remedies Act and its rules: 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)

- Pharmaceutical Legislations – 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)

| COURSE | CO | Course Outcome's | PO/PSO | BTL |
|-------------------------------------|-----|---|--------|-----|
| 17PH3227: MEDICINAL CHEMISTRY – III | CO1 | Understand the importance of drug design and different techniques of drug design. | 1,4 | 1,2 |
| | CO2 | Understand the chemistry of drugs with respect to their biological activity. | 1,4 | 1,2 |
| | CO3 | Know the metabolism, adverse effects and therapeutic value of drugs. | 1,4 | 1,2 |
| | CO4 | Know the importance of SAR of drugs. | 1,4 | 1,2 |
| | CO5 | Perform synthesis and SAR of drugs. | 2,PSO1 | 2,3 |

Antibiotics

Historical background, Nomenclature, Stereochemistry, Structure activity relationship, Chemical degradation classification and important products of the following classes.

β -Lactam antibiotics: Penicillin, Cephalosporins, β -Lactamase inhibitors, Monobactams

Aminoglycosides: Streptomycin, Neomycin, Kanamycin

Tetracyclines: Tetracycline, Oxytetracycline, Chlortetracycline, Minocycline, Doxycycline

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, Quininesulphate, Chloroquine*, Amodiaquine, Primaquine phosphate, Pamaquine*, Quinacrine hydrochloride, Mefloquine.

Biguanides and dihydro triazines: Cycloguanil pamoate, Proguanil.

Miscellaneous: Pyrimethamine, Artesunate, Artemether, Atovaquone.

Anti-tubercular Agents

Synthetic anti tubercular agents: Isoniazid*, Ethionamide, Ethambutol, Pyrazinamide, Para amino salicylic acid.*

Anti tubercular antibiotics: Rifampicin, Rifabutin, Cycloserine, Streptomycin, 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.

Antifungal agents:

Antifungal antibiotics: Amphotericin-B, Nystatin, Natamycin, Griseofulvin.

Synthetic Antifungal agents: Clotrimazole, Econazole, Butoconazole, Oxiconazole, Tioconazole, 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.

Sulphonamides and Sulfones

Historical development, chemistry, classification and SAR of Sulfonamides: Sulphamethizole, Sulfisoxazole, Sulphamethizine, Sulfacetamide*, Sulphapyridine, Sulfamethoxazole*, Sulphadiazine, Mefenide acetate, Sulfasalazine.

Folate reductase inhibitors: Trimethoprim*, Cotrimoxazole.

Sulfones: Dapsone*.

Introduction to Drug Design

Various approaches used in drug design.

Physicochemical parameters used in quantitative structure activity relationship (QSAR) such as partition coefficient, Hammett's electronic parameter, Taft's steric parameter and Hansch analysis.

Pharmacophore modeling and docking techniques.

Combinatorial Chemistry: Concept and applications chemistry: solid phase and solution phase synthesis. of combinatorial

17PH3227P. MEDICINAL CHEMISTRY- III (Practical)

I Preparation of drugs and intermediates

1 Sulphanilamide

2 7-Hydroxy, 4-methyl coumarin

3 Chlorobutanol

4 Triphenyl imidazole

5 Tolbutamide

6 Hexamine

II Assay of drugs

1 Isonicotinic acid hydrazide

2 Chloroquine

3 Metronidazole

4 Dapsone

5 Chlorpheniramine maleate

6 Benzyl penicillin

III Preparation of medicinally important compounds or intermediates by Microwave irradiation technique

IV Drawing structures and reactions using chem draw®

V 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 (Lipinski's RO5)

| COURSE | CO | Course Outcome's | PO/PSO | BTL |
|-------------------------------|--|---|--------|-----|
| 17PH3228: PHARMACOLOGY-III | CO1 | understand the mechanism of drug action and its relevance in the treatment of different infectious diseases | 1,4 | 1,2 |
| | CO2 | comprehend the principles of toxicology and treatment of various poisonings and | 1,4 | 1,2 |
| | CO3 | appreciate correlation of pharmacology with related medical sciences. | 1,4 | 1,2 |
| | CO4 | To be able to ascertain the pharmacodynamics of medicinal agents | 1,4 | 1,2 |
| | CO5 | Perform various invitro experiments to demonstrate receptor actions using isolated tissue preparation | 2,4 | 2,3 |
| 1. | Pharmacology of drugs acting on Respiratory system | | | |

- a. Anti -asthmatic drugs
- b. Drugs used in the management of COPD
- c. Expectorants and antitussives
- d. Nasal decongestants
- e. Respiratory stimulants
2. 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.
3. Chemotherapy
 - a. General principles of chemotherapy.
 - b. Sulfonamides and cotrimoxazole.
 - c. Antibiotics- Penicillins, cephalosporins, chloramphenicol, macrolides, quinolones and fluoroquinolins, tetracycline and aminoglycosides
 - a. Antitubercular agents
 - b. Antileprotic agents
 - c. Antifungal agents
 - d. Antiviral drugs e. Anthelmintics
 - f. Antimalarial drugs
 - g. Antiamoebic agents
3. Chemotherapy
 - l. Urinary tract infections and sexually transmitted diseases.
 - m. Chemotherapy of malignancy.
4. Immunopharmacology
 - a. Immunostimulants
 - b. Immunosuppressant
- Protein drugs, monoclonal antibodies, target drugs to antigen, biosimilars
5. 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, organophosphorus compound and lead, mercury and arsenic poisoning.
6. Chronopharmacology
 - a. Definition of rhythm and cycles.
 - b. Biological clock and their significance leading to chronotherapy.
- 17PH3228 P. PHARMACOLOGY-III (Practical)
 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 effect of drugs on gastrointestinal motility
 5. Effect of agonist and antagonists on guinea pig ileum
 6. Estimation of serum biochemical parameters by using semi- autoanalyser
 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 | CO | Course Outcome's | PO/PSO | BTL |
| 17PH3229 : HERBAL DRUG TECHNOLOGY | CO1 | understand raw material as source of herbal drugs from cultivation to herbal drug product | 1,PSO2 | 1,2 |
| | CO2 | know the WHO and ICH guidelines for evaluation of herbal drugs | 1,PSO2 | 1,2 |
| | CO3 | know the herbal cosmetics, natural sweeteners, nutraceuticals | 1,PSO2 | 1,2 |
| | CO4 | appreciate patenting of herbal drugs, GMP . | 1,PSO2 | 1,2 |
| | CO5 | Prepare various herbal formulations | 2,PSO1 | 2,3 |
| <p>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 cultivation of medicinal plants including Organic farming. Pest and Pest management in medicinal plants: Biopesticides/Bioinsecticides. Indian Systems of Medicine a) Basic principles involved in Ayurveda, Siddha, Unani and Homeopathy b) Preparation and standardization of Ayurvedic formulations viz Aristas and Asawas, Ghutika,Churna, Lehya and Bhasma. 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 Gastro intestinal diseases. Study of following herbs as health food: Alfaalfa, Chicory, Ginger, Fenugreek, Garlic, Honey, Amla, Ginseng, Ashwagandha, Spirulina Herbal-Drug and Herb-Food Interactions: General introduction to interaction and classification. Study of following drugs and their possible side effects and interactions: Hypercium, kava-kava, Ginkobiloba, Ginseng, Garlic, Pepper & Ephedra. Herbal Cosmetics Sources and description of raw materials of herbal origin used via, fixed oils, waxes, gums colours, perfumes, protective agents, bleaching agents, 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 Evaluation of Drugs WHO & ICH guidelines for the assessment of herbal drugs Stability testing of herbal drugs. Patenting and Regulatory requirements of natural products: a) Definition of the terms: Patent, IPR, Farmers right, Breeder's right, Bioprospecting and Biopiracy b) 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. General Introduction to Herbal Industry</p> | | | | |

Herbal drugs industry: Present scope and future 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 equipments, standard operating procedures, health and hygiene, documentation and records.

17PH3229 P. HERBAL DRUG TECHNOLOGY (Practical)

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 and 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

| COURSE | CO | Course Outcome's | PO/PSO | BTL |
|---|-----|---|--------|-----|
| 17PH3230 : BIOPHARMACEUTICS AND PHARMACOKINETICS | CO1 | Understand the basic concepts in biopharmaceutics and pharmacokinetics and their significance. | 2,PSO1 | 1,2 |
| | CO2 | Use of plasma drug concentration-time data to calculate the pharmacokinetic parameters to describe the kinetics of drug absorption, distribution, metabolism, excretion, elimination. | 2,PSO1 | 1,2 |
| | CO3 | To understand the concepts of bioavailability and bioequivalence of drug products and their significance. | 2,PSO1 | 1,2 |
| | CO4 | Understand various pharmacokinetic parameters, their significance & applications. | 2,PSO1 | 1,2 |

Introduction to Biopharmaceutics

Absorption; Mechanisms of drug absorption through GIT, factors influencing drug absorption through GIT, absorption of drug from Non per oral extra-vascular routes, 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
Bioavailability and Bioequivalence: 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.

Pharmacokinetics: 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 - KE , $t_{1/2}$, V_d , AUC , K_a , Cl_t and CLR - definitions methods of eliminations, understanding of their significance and application

Multicompartment models: 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.

Nonlinear Pharmacokinetics: a. Introduction, b. Factors causing Non-linearity.

c. Michaelis-menton method of estimating parameters, Explanation with example of drugs.

| COURSE | CO | Course Outcome's | PO/PSO | BTL |
|--|-----|--|--------|-----|
| 17PH3231: PHARMACEUTICAL BIOTECHNOLOGY | CO1 | Understanding the importance of Immobilized enzymes in Pharmaceutical Industries | 1,4 | 1,2 |
| | CO2 | Genetic engineering applications in relation to production of pharmaceuticals | 1,4 | 1,2 |
| | CO3 | Importance of Monoclonal antibodies in Industries | 1,4 | 1,2 |
| | CO4 | Appreciate the use of microorganisms in fermentation technology | 1,4 | 1,2 |

- 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.

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

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

g) Blood products and Plasma Substitutes.

a) Immuno blotting techniques- ELISA, Western blotting, Southern blotting.

b) Genetic organization of Eukaryotes and Prokaryotes

c) Microbial genetics including transformation, transduction, conjugation, plasmids and transposons.

d) Introduction to Microbial biotransformation and applications.

e) Mutation: Types of mutation/mutants.

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, plasma Substitutes.

| COURSE | CO | Course Outcome's | PO/PSO | BTL |
|--|-----|--|--------|-----|
| 17PH3232: PHARMACEUTICAL QUALITY ASSURANCE | CO1 | understand the cGMP aspects in a pharmaceutical industry | 1,PSO1 | 1,2 |
| | CO2 | appreciate the importance of documentation | 1,PSO1 | 1,2 |
| | CO3 | understand the scope of quality certifications applicable to pharmaceutical industries | 1,PSO1 | 1,2 |

| | | | | |
|---|-----------|--|---------------|------------|
| | CO4 | understand the responsibilities of QA & QC departments | 1,PSO1 | 1,2 |
| <p>Quality Assurance and Quality Management concepts: Definition and concept of Quality control, Quality assurance and GMP</p> <p>Total Quality Management (TQM): Definition, elements, philosophies</p> <p>ICH Guidelines: purpose, participants, process of harmonization, Brief overview of QSEM, with special emphasis on Q-series guidelines, ICH stability testing guidelines</p> <p>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</p> <p>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.</p> <p>Equipments and raw materials: Equipment selection, purchase specifications, maintenance, purchase specifications and maintenance of stores for raw materials.</p> <p>Quality Control: Quality control test for containers, rubber closures and secondary packing materials.</p> <p>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</p> <p>Complaints: Complaints and evaluation of complaints, Handling of return good, recalling and waste disposal.</p> <p>Document maintenance in pharmaceutical industry: Batch Formula Record, Master Formula Record, SOP, Quality audit, Quality Review and Quality documentation, Reports and documents, distribution records.</p> <p>Calibration and Validation: Introduction, definition and general principles of calibration, qualification and validation, importance and scope of validation, types of validation, validation master plan. Calibration of pH meter, Qualification of UV-Visible spectrophotometer, General principles of Analytical method Validation.</p> <p>Warehousing: Good warehousing practice, materials management</p> | | | | |
| COURSE | CO | Course Outcome's | PO/PSO | BTL |
| 17PH4133: INSTRUMENTAL METHODS OF ANALYSIS | CO1 | Know about various instruments and standard operating procedures | 2,4 | 1,2 |
| | CO2 | Understand the interaction of matter with electromagnetic radiations and its applications in drug analysis | 2,4 | 1,2 |
| | CO3 | Understand the chromatographic separation and analysis of drugs. | 2,4 | 1,2 |
| | CO4 | Understand the principle and application of advanced analytical instruments. | 2,4 | 1,2 |
| | CO5 | Perform quantitative & qualitative analysis of drugs using various analytical instruments. | 2,4 | 2,3 |
| <p>UV Visible spectroscopy</p> <p>Electronic transitions, chromophores, auxochromes, spectral shifts, solvent effect on absorption spectra, Beer and Lambert's law, Derivation and deviations.</p> <p>Instrumentation - Sources of radiation, wavelength selectors, sample cells, detectors- Photo tube, Photomultiplier tube, Photo voltaic cell, Silicon Photodiode.</p> <p>Applications - Spectrophotometric titrations, Single component and multi component analysis</p> <p>Fluorimetry</p> <p>Theory, Concepts of singlet, doublet and triplet electronic states, internal and external conversions, factors affecting fluorescence, quenching, instrumentation and applications</p> <p>IR spectroscopy</p> <p>Introduction, fundamental modes of vibrations in poly atomic molecules, sample handling, factors affecting vibrations</p> | | | | |

Instrumentation - Sources of radiation, wavelength selectors, detectors - Golay cell, Bolometer, Thermocouple, Thermister, Pyroelectric detector and applications
 Flame Photometry-Principle, interferences, instrumentation and applications
 Atomic absorption spectroscopy- Principle, interferences, instrumentation and applications
 Nepheloturbidometry- Principle, instrumentation and applications
 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
 Gas chromatography - Introduction, theory, instrumentation, derivatization, temperature programming, advantages, disadvantages and applications
 High performance liquid chromatography (HPLC)-Introduction, theory, instrumentation, advantages and applications.
 Ion exchange chromatography- Introduction, classification, ion exchange resins, properties, mechanism of ion exchange process, factors affecting ion exchange, methodology and applications
 Gel chromatography- Introduction, theory, instrumentation and applications
 Affinity chromatography- Introduction, theory, instrumentation and applications
 17PH4133P. INSTRUMENTAL METHODS OF ANALYSIS (Practical)
 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

| COURSE | CO | Course Outcome's | PO/PSO | BTL |
|----------------------------------|-----|--|--------|-----|
| 17PH4134 : INDUSTRIAL PHARMACYII | CO1 | Know the process of pilot plant and scale up of pharmaceutical dosage forms | 1,PSO1 | 1,2 |
| | CO2 | Understand the process of technology transfer from lab scale to commercial batch | 1,PSO1 | 1,2 |
| | CO3 | Know different Laws and Acts that regulate pharmaceutical industry | 1,PSO1 | 1,2 |
| | CO4 | Understand the approval process and regulatory requirements for drug products | 1,PSO1 | 1,2 |

Pilot plant scale up techniques: General considerations - including significance of personnel requirements, space requirements, raw materials, Pilot plant scale up considerations for solids, liquid orals, semi solids and relevant documentation, SUPAC guidelines, Introduction to platform technology

Technology development and transfer: 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

Regulatory affairs: 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.

Quality management systems: 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

Indian Regulatory Requirements: 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.

| COURSE | CO | Course Outcome's | PO/PSO | BTL |
|-----------------------------|-----|---|--------|-----|
| 17PH4135: PHARMACY PRACTICE | CO1 | know various drug distribution methods in a hospital | 5,7 | 1,2 |
| | CO2 | appreciate the pharmacy stores management and inventory control | 5,7 | 1,2 |
| | CO3 | monitor drug therapy of patient through medication chart review and clinical review | 5,7 | 1,2 |
| | CO4 | obtain medication history interview and counsel the patients | 5,7 | 1,2 |

a) 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.

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.

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.

Drug information services

Drug and Poison information centre, Sources of drug information, Computerised services, and storage and retrieval of information.

a) Patient counseling

Definition of patient counseling; steps involved in patient counseling, and Special cases that require the pharmacist

b) 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.

c) Prescribed medication order and communication skills

Prescribed medication order- interpretation and legal requirements, and Communication skills- communication with prescribers and patients.

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.

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

a) Investigational use of drugs

Description, principles involved, classification, control, identification, role of hospital pharmacist, advisory committee.

b) Interpretation of Clinical Laboratory Tests

Blood chemistry, hematology, and urinalysis

| COURSE | CO | Course Outcome's | PO/PSO | BTL |
|--------|----|------------------|--------|-----|
|--------|----|------------------|--------|-----|

| | | | | |
|---|-----------|---|---------------|------------|
| 17PH4136: NOVEL DRUG DELIVERY SYSTEMS | CO1 | Know about current developments in drug delivery technologies | 2,PSO2 | 1,2 |
| | CO2 | To understand various approaches for development of novel drug delivery systems. | 2,PSO2 | 1,2 |
| | CO3 | To understand the criteria for selection of drugs and polymers for the development of Novel drug delivery systems, their formulation and evaluation | 2,PSO2 | 1,2 |
| | CO4 | To be able to design or recommend a drug delivery system | 2,PSO2 | 1,2 |
| <p>Controlled drug delivery systems: 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</p> <p>Polymers: Introduction, classification, properties, advantages and application of polymers in formulation of controlled release drug delivery systems.</p> <p>Microencapsulation: Definition, advantages and disadvantages, microspheres /microcapsules, microparticles, methods of microencapsulation, applications</p> <p>Mucosal Drug Delivery system: Introduction, Principles of bioadhesion / mucoadhesion, concepts, advantages and disadvantages, transmucosal permeability and formulation considerations of buccal delivery systems</p> <p>Implantable Drug Delivery Systems: Introduction, advantages and disadvantages, concept of implants and osmotic pump</p> <p>Transdermal Drug Delivery Systems: Introduction, Permeation through skin, factors affecting permeation, permeation enhancers, basic components of TDDS, formulation approaches</p> <p>Gastroretentive drug delivery systems: Introduction, advantages, disadvantages, approaches for GRDDS – Floating, high density systems, inflatable and gastroadhesive systems and their applications</p> <p>Nasopulmonary drug delivery system: Introduction to Nasal and Pulmonary routes of drug delivery, Formulation of Inhalers (dry powder and metered dose), nasal sprays, nebulizers</p> <p>Targeted drug Delivery: Concepts and approaches advantages and disadvantages, introduction to liposomes, niosomes, nanoparticles, monoclonal antibodies and their applications</p> <p>Ocular Drug Delivery Systems: Introduction, intra ocular barriers and methods to overcome – Preliminary study, ocular formulations and ocuserts</p> <p>Intrauterine Drug Delivery Systems: Introduction, advantages and disadvantages, development of intra uterine devices (IUDs) and applications</p> | | | | |
| COURSE | CO | Course Outcome's | PO/PSO | BTL |
| 17PH4238: BIOSTATISTICS AND RESEARCH METHODOLOGY | CO1 | Know the operation of M.S. Excel, SPSS, R and MINITAB®, DoE (Design of Experiment) | 4,5 | 1,2 |
| | CO2 | Know the various statistical techniques to solve statistical problems | 4,5 | 1,2 |
| | CO3 | Appreciate statistical techniques in solving the problems. | 4,5 | 1,2 |
| | CO4 | Know the applications of statistics in clinical data management | 4,5 | 1,2 |
| <p>Introduction: Statistics, Biostatistics, Frequency distribution</p> <p>Measures of central tendency: Mean, Median, Mode- Pharmaceutical examples Measures of dispersion: Dispersion, Range, standard deviation, Pharmaceutical problems</p> <p>Correlation: Definition, Karl Pearson's coefficient of correlation, Multiple correlation - Pharmaceuticals examples</p> <p>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</p> <p>Probability: Definition of probability, Binomial distribution, Normal distribution, Poisson's distribution,</p> | | | | |

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
 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.
 Blocking and confounding system for Two-level factorials
 Regression modeling: Hypothesis testing in Simple and Multiple regression models 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
 Design and Analysis of experiments:
 Factorial Design: Definition, 22, 23 design. Advantage of factorial design Response Surface methodology: Central composite design, Historical design, Optimization Techniques

| COURSE | CO | Course Outcome's | PO/PSO | BTL |
|--|-----|--|--------|-----|
| 17PH4239: SOCIAL AND PREVENTIVE PHARMACY | CO1 | Acquire high consciousness/realization of current issues related to health and pharmaceutical problems within the country and worldwide. | 7,8 | 1,2 |
| | CO2 | Have a critical way of thinking based on current healthcare development. | 7,8 | 1,2 |
| | CO3 | Evaluate alternative ways of solving problems related to health and pharmaceutical issues | 7,8 | 1,2 |
| | CO4 | Design a better health care service system | 7,8 | 1,2 |

Concept of health and disease: 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

Preventive medicine: 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

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.

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

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.

| COURSE | CO | Course Outcome's | PO/PSO | BTL |
|---|-----|--|--------|-----|
| 17PH4240ET. PHARMA MARKETING MANAGEMENT | CO1 | to provide an understanding of sales and marketing of pharmaceutical products. | 6,PSO2 | 1,2 |
| | CO2 | Know about various policies for drug inventory management | 6,PSO2 | 1,2 |
| | CO3 | Know about retail and wholesale marketing | 6,PSO2 | 1,2 |
| | CO4 | Understand business potential and development in product sales and manufacturing | 6,PSO2 | 1,2 |

Marketing:

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 market:

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.

Product decision:

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.

Promotion:

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.

Pharmaceutical marketing channels:

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.

Pricing:

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.

| COURSE | CO | Course Outcome's | PO/PSO | BTL |
|-------------|-----|---|--------|-----|
| 17PH4241ET: | CO1 | Know about legal aspects and quality policies for | 1,PSO1 | 1,2 |

| | | | | |
|--|-----------|--|---------------|------------|
| PHARMACEUTICAL REGULATORY SCIENCE | | drug manufacturing | | |
| | CO2 | Know about the process of drug discovery and development | 1,PSO1 | 1,2 |
| | CO3 | Know the regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals | 1,PSO1 | 1,2 |
| | CO4 | Know the regulatory approval process and their registration in Indian and international markets | 1,PSO1 | 1,2 |
| <p>New Drug Discovery and development 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.</p> <p>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)</p> <p>Registration of Indian drug product in overseas market 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.</p> <p>Clinical trials 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</p> <p>Regulatory Concepts Basic terminology, guidance, guidelines, regulations, Laws and Acts, Orange book, Federal Register, Code of Federal Regulatory, Purple book</p> | | | | |
| COURSE | CO | Course Outcome's | PO/PSO | BTL |
| 17PH4242ET: PHARMACOVIGILANCE | CO1 | Why drug safety monitoring is important? | 6,PSO2 | 1,2 |
| | CO2 | History and development of pharmacovigilance | 6,PSO2 | 1,2 |
| | CO3 | National and international scenario of pharmacovigilance | 6,PSO2 | 1,2 |
| | CO4 | Dictionaries, coding and terminologies used in pharmacovigilance | 6,PSO2 | 1,2 |
| <p>Introduction to Pharmacovigilance</p> <ul style="list-style-type: none"> History and development of Pharmacovigilance Importance of safety monitoring of Medicine WHO international drug monitoring programme Pharmacovigilance Program of India(PvPI) <p>Introduction to adverse drug reactions</p> <ul style="list-style-type: none"> 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

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 Standardised MedDRA queries
- WHO drug dictionary
- Eudravigilance medicinal product dictionary

Information resources in pharmacovigilance

- Basic drug information resources
- Specialised resources for ADRs

Establishing pharmacovigilance programme

- Establishing in a hospital
- Establishment & operation of drug safety department in industry
- Contract Research Organisations (CROs)
- Establishing a national programme

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

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

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.

| COURSE | CO | Course Outcome's | PO/PSO | BTL |
|--|-----|---|--------|-----|
| 17PH4243ET. QUALITY CONTROL AND STANDARDIZATION OF HERBALS | CO1 | know WHO guidelines for quality control of herbal drugs | 2,PSO1 | 1,2 |
| | CO2 | know Quality assurance in herbal drug industry | 2,PSO1 | 1,2 |
| | CO3 | know the regulatory approval process and their registration in Indian and international markets | 2,PSO1 | 1,2 |
| | CO4 | appreciate EU and ICH guidelines for quality control of herbal drugs | 2,PSO1 | 1,2 |

Basic tests for drugs – Pharmaceutical substances, Medicinal plants materials and dosage forms
 WHO guidelines for quality control of herbal drugs. Evaluation of commercial crude drugs intended for use

Quality assurance in herbal drug industry of cGMP, GAP, GMP and GLP in traditional system of medicine.

WHO Guidelines on current good manufacturing Practices (cGMP) for Herbal Medicines WHO Guidelines on GACP for Medicinal Plants.

EU and ICH guidelines for quality control of herbal drugs.
 Research Guidelines for Evaluating the Safety and Efficacy of Herbal Medicines

Stability testing of herbal medicines. Application of various chromatographic techniques in standardization of herbal products.
 Preparation of documents for new drug application and export registration GMP requirements and Drugs & Cosmetics Act provisions.

Regulatory requirements for herbal medicines.
 WHO guidelines on safety monitoring of herbal medicines in pharmacovigilance systems Comparison of various Herbal Pharmacopoeias.
 Role of chemical and biological markers in standardization of herbal products

| COURSE | CO | Course Outcome's | PO/PSO | BTL |
|--|-----|--|--------|-----|
| 17PH4244ET. COMPUTER AIDED DRUG DESIGN | CO1 | Design and discovery of lead molecules | 3,PSO2 | 1,2 |
| | CO2 | The role of drug design in drug discovery process | 3,PSO2 | 1,2 |
| | CO3 | The concept of QSAR and docking | 3,PSO2 | 1,2 |
| | CO4 | Various strategies to develop new drug like molecules. | 3,PSO2 | 1,2 |

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

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, Hammett's substituent constant and Taft's steric constant. Hansch analysis, Free Wilson analysis, 3D-QSAR approaches like COMFA and COMSIA.

Molecular Modeling and virtual screening techniques

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.

Informatics & Methods in drug design

Introduction to Bioinformatics, cheminformatics. ADME databases, chemical, biochemical and pharmaceutical databases.

Molecular Modeling: Introduction to molecular mechanics and quantum mechanics. Energy Minimization methods and Conformational Analysis, global conformational minima determination.

| COURSE | CO | Course Outcome's | PO/PSO | BTL |
|--|-----|--|--------|-----|
| 17PH4245ET: CELL AND MOLECULAR BIOLOGY | CO1 | Summarize cell and molecular biology history. | 2,4 | 1,2 |
| | CO2 | Summarize cellular functioning and composition. | 2,4 | 1,2 |
| | CO3 | Describe the chemical foundations of cell biology. | 2,4 | 1,2 |
| | CO4 | Summarize the DNA properties of cell biology. | 2,4 | 1,2 |

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)

a) DNA and the Flow of Molecular Information

b) DNA Functioning

c) DNA and RNA

d) Types of RNA

e) Transcription and Translation

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

a) Science of Genetics

b) Transgenics and Genomic Analysis

c) Cell Cycle analysis

d) Mitosis and Meiosis

e) Cellular Activities and Checkpoints

- a) Cell Signals: Introduction
- b) Receptors for Cell Signals
- c) Signaling Pathways: Overview
- d) Misregulation of Signaling Pathways
- e) Protein-Kinases: Functioning

| COURSE | CO | Course Outcome's | PO/PSO | BTL |
|------------------------------|-----|---|------------|-----|
| 17PH4246ET. COSMETIC SCIENCE | CO1 | Principles of formulation and building blocks of skin care products | PSO1,PS O2 | 1,2 |
| | CO2 | Principles of formulation and building blocks of Hair care products | PSO1,PS O2 | 1,2 |
| | CO3 | Role of herbs in cosmetics | PSO1,PS O2 | 1,2 |
| | CO4 | Principles of Cosmetic Evaluation | PSO1,PS O2 | 1,2 |

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. Antiperspirants & 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 Para-phenylene diamine based hair dye. Principles of formulation and building blocks of oral care products: Toothpaste for bleeding gums, sensitive teeth. Teeth whitening, Mouthwash.

Sun protection, Classification of Sunscreens and SPF.
Role of herbs in cosmetics: 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.

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.

Oily and dry skin, causes leading to dry skin, skin moisturisation. Basic understanding of the terms Comedogenic, dermatitis.
Cosmetic problems associated with Hair and scalp: Dandruff, Hair fall causes Cosmetic problems associated with skin: blemishes, wrinkles, acne, prickly heat and body odor.
Antiperspirants and Deodorants- Actives and mechanism of action

| COURSE | CO | Course Outcome's | PO/PSO | BTL |
|---------------------------------------|-----|---|--------|-----|
| 17PH4247ET. EXPERIMENTAL PHARMACOLOGY | CO1 | Appreciate the applications of various commonly used laboratory animals. | 2,4 | 1,2 |
| | CO2 | Appreciate and demonstrate the various screening methods used in preclinical research | 2,4 | 1,2 |
| | CO3 | Appreciate and demonstrate the importance of biostatistics and research methodology | 2,4 | 1,2 |
| | CO4 | Design and execute a research hypothesis independently | 2,4 | 1,2 |

Laboratory Animals:
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.

Preclinical screening models

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, 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 ANS activity, sympathomimetics, sympatholytics, parasympathomimetics, parasympatholytics, skeletal muscle relaxants, drugs acting on eye, local anaesthetics

Preclinical screening models: for CVS activity- antihypertensives, diuretics, antiarrhythmic, antidyslipidemic, anti aggregatory, coagulants, and anticoagulants

Preclinical screening models for other important drugs like antiulcer, antidiabetic, anticancer and antiasthmatics.

Research methodology and Bio-statistics

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

| COURSE | CO | Course Outcome's | PO/PSO | BTL |
|---|-----------|--|---------------|------------|
| 17PH4248ET. ADVANCED INSTRUMENTATION TECHNIQUES | CO1 | understand the advanced instruments used and its applications in drug analysis | 2,4 | 1,2 |
| | CO2 | understand the chromatographic separation and analysis of drugs. | 2,4 | 1,2 |
| | CO3 | understand the calibration of various analytical instruments | 2,4 | 1,2 |
| | CO4 | know analysis of drugs using various analytical instruments. | 2,4 | 1,2 |

Nuclear Magnetic Resonance spectroscopy

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, applications

Thermal Methods of Analysis: Principles, instrumentation and applications of Thermogravimetric Analysis (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.

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

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
 Hyphenated techniques-LC-MS/MS, GC-MS/MS, HPTLC-MS

| COURSE | CO | Course Outcome's | PO/PSO | BTL |
|--|-----|--|-----------|-----|
| 17PH4249ET. DIETARY SUPPLEMENTS AND NUTRACEUTICALS | CO1 | Understand the need of supplements by the different group of people to maintain healthy life. | PSO1,PSO2 | 1,2 |
| | CO2 | Understand the outcome of deficiencies in dietary supplements. | PSO1,PSO2 | 1,2 |
| | CO3 | Appreciate the components in dietary supplements and the application. | PSO1,PSO2 | 1,2 |
| | CO4 | Appreciate the regulatory and commercial aspects of dietary supplements including health claims. | PSO1,PSO2 | 1,2 |

- 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 ageing, nutrition education in community.
- c. Source, Name of marker compounds and their chemical nature, Medicinal uses and health benefits of following used as nutraceuticals/functional foods: Spirulina, Soyabean, Ginseng, Garlic, Broccoli, Gingko, Flaxseeds

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: Resveratrol
- d) Flavonoids- Rutin, Naringin, Quercetin, Anthocyanidins, catechins, Flavones
- e) Prebiotics / Probiotics.: Fructo oligosaccharides, Lacto bacillum
- 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, sea foods, coffee, tea and the like.

- 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) Dietary fibres and complex carbohydrates as functional food ingredients..

- a) 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.

- b) Antioxidants: Endogenous antioxidants – enzymatic and nonenzymatic antioxidant defence, Superoxide dismutase, catalase, Glutathione peroxidase, Glutathione Vitamin C, Vitamin E, α - Lipoic acid, melatonin

Synthetic antioxidants: Butylated hydroxy Toluene, Butylated hydroxy Anisole.

- c) Functional foods for chronic disease prevention

- 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.