



**Revised Ordinance Governing
Bachelor of Pharmacy (B. Pharm.)
Degree Course
Pharmacy Council of India.**

**Rules & Syllabus for the Bachelor of
Pharmacy
(S. Y. B. Pharm) Course**



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SANJAY GHODAWAT UNIVERSITY KOLHAPUR

Sanjay Ghodawat University (SGU) is established in the Academic Year 2017-18, as a State Private University under Govt. of Maharashtra Act No. XL of 2017 dated 3rd May 2017, with the approval of the UGC and the state Government. "For the true measure of giving is giving without measure." Spread across 150 Acres, Sou. Sushila Danchand Ghodawat Charitable Trust's Sanjay Ghodawat University (SGU) is situated in serene atmosphere amidst idyllic hills and lush green meadows to study in harmony with Nature. The Institution aspires to run along the lines of best-in-the-world education and become a world-class institution where teaching-learning process gets a far deeper meaning. SGU always stands as the guiding star of brilliance, quality and deliverance beyond expectations. Innovativeness and Creativity are the hallmarks of a genius enterprise and SGU stands to be a stage where these qualities would be nurtured, encouraged and blossomed. The genius is incomplete without the sense of social responsibility and SGU's ultimate goal remains the development of an attitude of gratitude that freely gives back without expectations. The Sanjay Ghodawat University stands as a beacon of light to guide the younger generation of the day on the right path to fulfillment in career and life. The USP of the University is its research based curriculum and academically oriented teaching staff. The world class ambience and infrastructure helps the students to easily accommodate themselves in an environment that is conducive to the teaching- learning process. Hands on experience, challenge based case studies, maximum participation of students in the classroom, use of modern digital technology, smart classrooms, solution oriented thinking promotion, stress on research and innovation, international tie ups, choice based credit system for flexibility in choosing areas of interest etc. are some of the features of the University. The university will help students develop as a unique individual-to be educated as a whole person, intellectually, emotionally, socially, ethically, and spiritually. The educational program designs are worked out meticulously in line with best in class universities with special focus on:

- Flexible Choice Based Credit System
- OBE-Outcome Based Education System
- Experiential Learning
- Project Based Learning
- Case Based Learning
- Training need analysis based on Performance Appraisal System
- Active Learning tools for effective delivery
- Mentoring / Proctorship
- On line learning /Self learning platforms
- Flipped Classroom concept
- Effective Student Feedback Mechanism



VISION

Internationally recognized university of excellence in creating and disseminating knowledge through value-based quality education leading to betterment of mankind

MISSION

- To prepare students for life-long learning and leadership in a global academic culture
- To create intellectual manpower relevant to the industry and society at large
- To collaborate with institutions of international repute for academic excellence
- To promote research and development through conducive environment
- To encourage entrepreneurship and skill development programs

CORE VALUES

- Integrity
- Transparency
- Accountability
- Equality
- Empathy
- Stewardship

QUALITY POLICY

Sanjay Ghodawat University is committed to establish high standards in value-based quality education to enhance and nurture young minds to excel in their chosen profession and develop into socially responsible citizens through resourceful collaboration, innovation and research

OUTCOME BASED EDUCATION (OBE) MODEL

Sanjay Ghodawat University (SGU) has implemented OBE model of education, which is a learner centered approach. SGU has witnessed a sea change in the entire academic systems with implementation of all three components of OBE – Design, Delivery and Assessment. The SGU model of autonomy focuses on experiential learning which believes in learning by doing. This is achieved through hands on experience, industrial assignments, mini projects and live problem solving and collaboration with industries.

SGU is set in to dynamics of transformation and witnessing a shift in focus from teaching to learning and entire academic system of SGU is designed to provide multiple learning opportunities for students to acquire and demonstrate the Knowledge, Skills and Attitudes (KSA) for rewarding career. The Vision and Mission of the Management, contribution from eminent BOG members and knowledgeable members of Academic Council and Board of Studies, the motivation and drive of the Director, the relentless efforts of the fellow Deans and Head of Departments and all teaching and non teaching staff along with commitment to learning of students made it possible to successfully transform the institute and stand out to carve a niche for itself as an Institute of repute.

OBE is an approach of curriculum design and teaching that focuses on what students should be able to do (attained) at the end of course/ program. Outcome based education (OBE) is student-centered instruction model that focuses on measuring student performance through outcomes. Outcomes include knowledge, skills and attitudes (KSA). Its focus remains on evaluation of outcomes of the program by stating the knowledge, skill and behavior a graduate is expected to attain upon completion of a program and after 4 – 5 years of graduation. In the OBE model, the required knowledge and skill sets for a particular degree is predetermined and the students are evaluated for all the required parameters (Outcomes) during the course of the program.

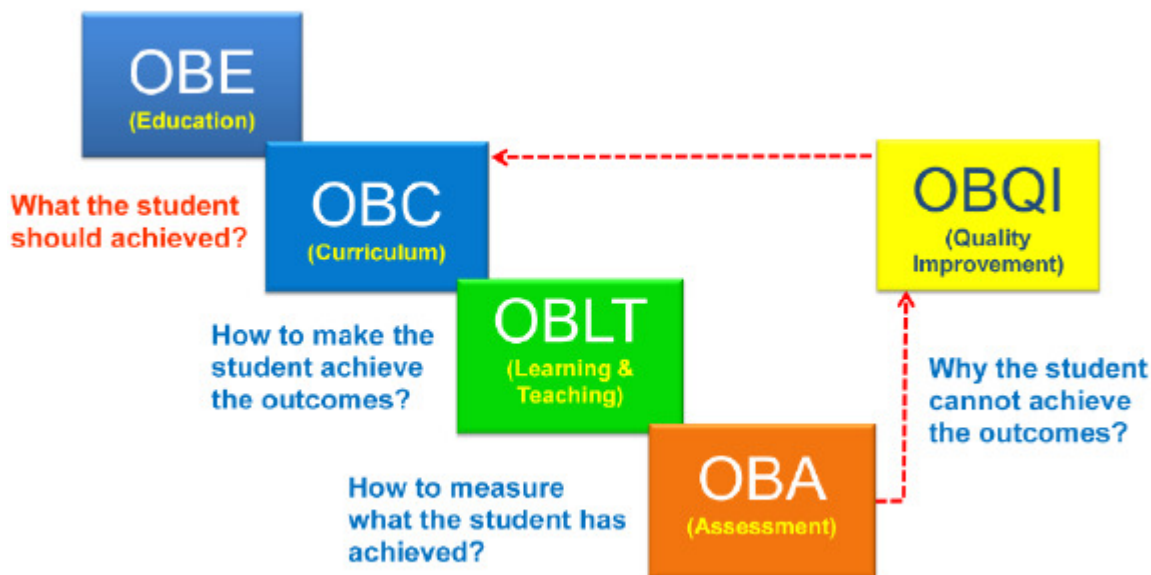
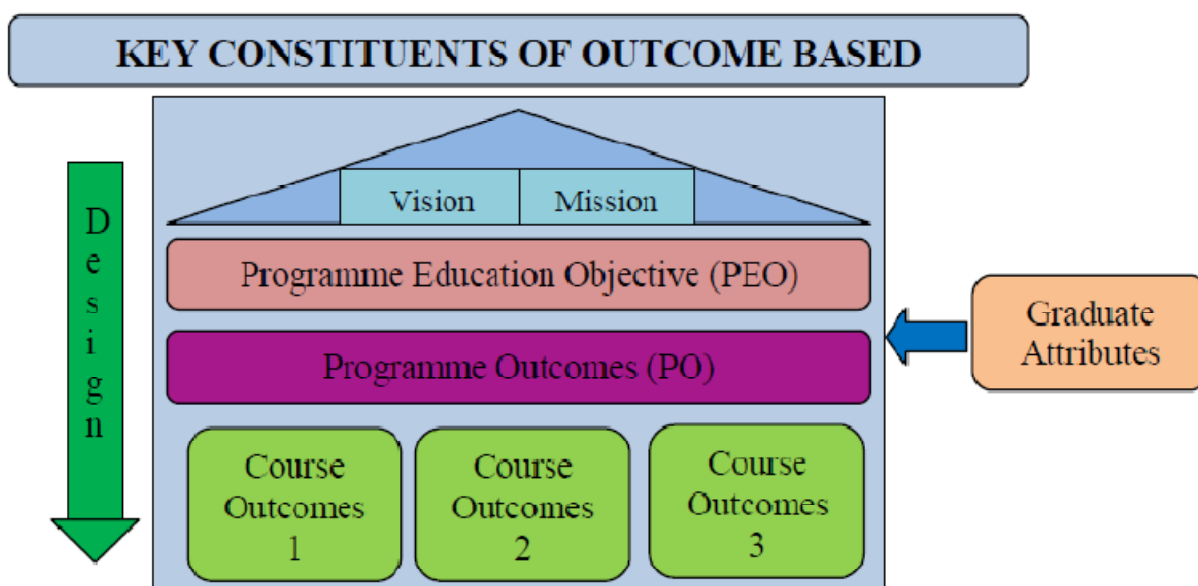


Figure 1: OBE flows and description



The OBE model measures the progress of the graduate in three parameters, which are

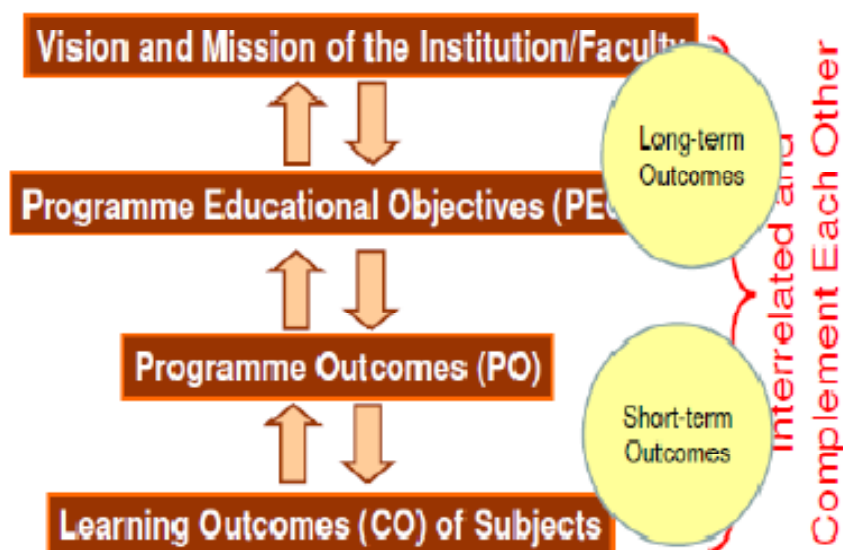
- Program Educational Objectives (PEO)
- Program Outcomes (PO)
- Course Outcomes (CO)

Program Educational Objectives (PEO) are broad statements that describe the career and professional accomplishments that the program is preparing the graduates to achieve. PEO's are measured 4-5 years after graduation. Program outcomes are narrower statements that describe what students are expected to know and be able to do by the time of graduation. They must reflect the Graduate attributes. Course outcomes are the measurable parameters which evaluates each students performance for each course that the student undertakes in every semester.

The various assessment tools for measuring Course Outcomes include Tests and End Semester Examinations, Tutorials, Assignments, Project work, Labs, Presentations, Employer/Alumni Feedback etc.,. These course outcomes are mapped to Graduate attributes and Program outcomes based on relevance. This evaluation pattern helps Institutions to measure the Program Outcome. The Program Educational Objective is measure through Employer satisfaction survey (Yearly), Alumni survey (Yearly), Placement records and higher education records.

Outcomes in OBE

A Model Hierarchy of Outcomes



Special Features of OBE

- OBE is an educational process that focuses on what students can do or the qualities they should develop after they are taught.
- OBE involves the restructuring of curriculum, assessment and reporting practices in education to reflect the achievement of high order learning and mastery rather than accumulation of course credits.
- Both structures and curricula are designed to achieve those capabilities or qualities.
- Discourages traditional education approaches based on direct instruction of facts and standard methods.
- It requires that the students demonstrate that they have learnt the required skills and content.



CHAPTER-I:

REGULATIONS



1. Short Title and Commencement

These regulations shall be called as “The Revised Regulations for the B. Pharm. Degree Program (CBCS) of the Pharmacy Council of India, New Delhi”. They shall come into effect from the Academic Year 2016-17. The regulations framed are subject to modifications from time to time by Pharmacy Council of 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 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.

Sr. No	Component	Hours	Credit
	B. Pharm (Direct)		
1	Theory	1hr	1
2	Tutorial	1hr	1
3	Practical	Hr	½ per Hr
	Lateral Entry		
	D. Pharm		52
	Remedial Course Communication Skills (Theory and Practical) and 'Computer Applications in Pharmacy)		7

7.2 Minimum credit requirements

The minimum credit points required for award of 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.



Table I: Course of study for Semester-I

Course code	Name of the course	No. of hours	Tutorial	Credit points
BP101T	Human Anatomy and Physiology-I (Theory)	3	1	4
BP102T	Pharmaceutical Analysis-I (Theory)	3	1	4
BP103T	Pharmaceutics-I (Theory)	3	1	4
BP104T	Pharmaceutical Inorganic Chemistry (Theory)	3	1	4
BP105T	Communication skills (Theory) *	2	-	2
BP106RBT BP106RMT	Remedial Biology/ Remedial Mathematics (Theory)*	2	-	2
BP107P	Human Anatomy and Physiology (Practical)	4	-	2
BP108P	Pharmaceutical Analysis-I (Practical)	4	-	2
BP109P	Pharmaceutics-I (Practical)	4	-	2
BP110P	Pharmaceutical Inorganic Chemistry (Practical)	4	-	2
BP111P	Communication skills (Practical)*	2	-	1
BP112RBP	Remedial Biology (Practical)*	2	-	1
Total		32/34 ^{\$} /36 [#]	4	27/29 ^{\$} /30 [#]

[#]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	Tutorial	Credit points
BP201T	Human Anatomy and Physiology-II (Theory)	3	1	4
BP202T	Pharmaceutical Organic Chemistry-I (Theory)	3	1	4
BP203T	Biochemistry (Theory)	3	1	4
BP204T	Pathophysiology (Theory)	3	1	4
BP205T	Computer Applications in Pharmacy (Theory)*	3	-	3
BP206T	Environmental Sciences (Theory)*	3	-	3
BP207P	Human Anatomy and Physiology-II (Practical)	4	-	2
BP208P	Pharmaceutical Organic Chemistry-I (Practical)	4	-	2
BP209P	Biochemistry (Practical)	4	-	2
BP210P	Computer Applications in Pharmacy (Practical)*	2	-	1
Total		32	4	29

*Non University Examination (NUE)

**Table III: Course of study for Semester-III**

Course code	Name of the course	No. of hours	Tutorial	Credit points
BP301T	Pharmaceutical Organic Chemistry-II (Theory)	3	1	4
BP302T	Physical Pharmaceutics-I (Theory)	3	1	4
BP303T	Pharmaceutical Microbiology (Theory)	3	1	4
BP304T	Pharmaceutical Engineering (Theory)	3	1	4
BP305P	Pharmaceutical Organic Chemistry-II (Practical)	4	-	2
BP306P	Physical Pharmaceutics-I (Practical)	4	-	2
BP307P	Pharmaceutical Microbiology (Practical)	4	-	2
BP308P	Pharmaceutical Engineering (Practical)	4	-	2
Total		28	4	24

Table IV: Course of study for Semester-IV

Course code	Name of the course	No. of hours	Tutorial	Credit points
BP401T	Pharmaceutical Organic Chemistry-III (Theory)	3	1	4
BP402T	Medicinal Chemistry-I (Theory)	3	1	4
BP403T	Physical Pharmaceutics-II (Theory)	3	1	4
BP404T	Pharmacology-I (Theory)	3	1	4
BP405T	Pharmacognosy and Phytochemistry-I (Theory)	3	1	4
BP406P	Medicinal Chemistry-I (Practical)	4	-	2
BP407P	Physical Pharmaceutics-II (Practical)	4		2
BP408P	Pharmacology-I (Practical)	4	-	2
BP409P	Pharmacognosy and Phytochemistry-I (Practical)	4	-	2
Total		31	5	28

**Table V: Course of study for Semester-V**

Course code	Name of the course	No. of hours	Tutorial	Credit points
BP501T	Medicinal Chemistry-II (Theory)	3	1	4
BP502T	Industrial Pharmacy (Theory)	3	1	4
BP503T	Pharmacology-II (Theory)	3	1	4
BP504T	Pharmacognosy and Phytochemistry-II (Theory)	3	1	4
BP505T	Pharmaceutical Jurisprudence (Theory)	3	1	4
BP506P	Industrial Pharmacy-I (Practical)	4	-	2
BP507P	Pharmacology-II (Practical)	4	-	2
BP508P	Pharmacognosy and Phytochemistry-II (Practical)	4	-	2
Total		27	5	26

Table VI: Course of study for Semester-VI

Course code	Name of the course	No. of hours	Tutorial	Credit points
BP601T	Medicinal Chemistry-III (Theory)	3	1	4
BP602T	Pharmacology-III (Theory)	3	1	4
BP603T	Herbal Drug Technology (Theory)	3	1	4
BP604T	Biopharmaceutics and Pharmacokinetics (Theory)	3	1	4
BP605T	Pharmaceutical Biotechnology (Theory)	3	1	4
BP606T	Quality Assurance (Theory)	3	1	4
BP607P	Medicinal Chemistry-III (Practical)	4	-	2
BP608P	Pharmacology-III (Practical)	4	-	2
BP609P	Herbal Drug Technology (Practical)	4	-	2
Total		30	6	30



Table VII: Course of study for Semester-VII

Course code	Name of the course	No. of hours	Tutorial	Credit points
BP701T	Instrumental Methods of Analysis (Theory)	3	1	4
BP702T	Industrial Pharmacy-II (Theory)	3	1	4
BP703T	Pharmacy Practice (Theory)	3	1	4
BP704T	Novel Drug Delivery System (Theory)	3	1	4
BP705P	Instrumental Methods of Analysis (Practical)	4	-	2
BP706PS	Practice School*	12	-	6
Total		28	5	24

* Non University Examination (NUE)

Table VIII: Course of study for semester VIII

Course code	Name of the course	No. of hours	Tutorial	Credit points
BP801T	Biostatistics and Research Methodology	3	1	4
BP802T	Social and Preventive Pharmacy	3	1	4
BP803ET	Pharma Marketing Management	3 + 3 = 6	1 + 1 = 2	4 + 4 = 8
BP804ET	Pharmaceutical Regulatory Science			
BP805ET	Pharmacovigilance			
BP806ET	Quality Control and Standardization of Herbals			
BP807ET	Computer Aided Drug Design			
BP808ET	Cell and Molecular Biology			
BP809ET	Cosmetic Science			
BP810ET	Experimental Pharmacology			
BP811ET	Advanced Instrumentation Techniques	12	-	6
BP812ET	Dietary Supplements and Nutraceuticals			
BP813PW	Project Work			
Total		24	4	22



Table IX: Semester wise credits distribution

Semester	Credit Points
I	27/29 ^{\$} /30 [#]
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	210/212 ^{\$} /213 [#] + (01*)

* 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.

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

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

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 Sessional exam (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 (ESE) 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.



Table X: - SEMESTER - III

Course Code	Course Title	L	T	P	C	Component (Marks)	Exam	WT		Passing Min. (%)
BP301T	Pharmaceutical Organic Chemistry-II (Theory)	3	1	-	4	Theory (100)	CA	10	10	50
							Sessional-1	15	15	
							Sessional-2	15		
							ESE		75	
BP302T	Physical Pharmaceutics-I (Theory)	3	1	-	4	Theory (100)	CA	10	10	50
							Sessional-1	15	15	
							Sessional-2	15		
							ESE		75	
BP303T	Pharmaceutical Microbiology (Theory)	3	1	-	4	Theory (100)	CA	10	10	50
							Sessional-1	15	15	
							Sessional-2	15		
							ESE		75	
BP304T	Pharmaceutical Engineering (Theory)	3	1	-	4	Theory (100)	CA	10	10	50
							Sessional-1	15	15	
							Sessional-2	15		
							ESE		75	
BP305P	Pharmaceutical Organic Chemistry-II (Practical)	-	-	4	2	Practical (50)	CA	05	05	50
							Sessional-1	10	10	
							Sessional-2	10		
							ESE		35	
BP306P	Physical Pharmaceutics-I (Practical)	-	-	4	2	Practical (50)	CA	05	05	50
							Sessional-1	10	10	
							Sessional-2	10		
							ESE		35	
BP307P	Pharmaceutical Microbiology (Practical)	-	-	4	2	Practical (50)	CA	05	05	50
							Sessional-1	10	10	
							Sessional-2	10		
							ESE		35	
BP308P	Pharmaceutical Engineering (Practical)	-	-	4	2	Practical (50)	CA	05	05	50
							Sessional-1	10	10	
							Sessional-2	10		
							ESE		35	
BP105T	Communication Skill (Theory)*	2	-	-	2	Theory (50)	CA	05	05	50
							Sessional-1	10	10	
							Sessional-2	10		
							ESE		35	
BP111P	Communication Skill (Practical)*	-	-	2	1	Practical (25)	CA	05	05	50
							Sessional-1	05	05	
							Sessional-2	05		
							ESE		15	
Total		12	4	16	24					
Total (Lateral entry)		14		18	27					

*Applicable only to lateral entry student only (For 3 credits)



Table X: SEMESTER-IV

Course Code	Course Title	L	T	P	C	Component (Marks)	Exam	WT		Passing Min (%)
BP401T	Pharmaceutical Organic Chemistry-III (Theory)	3	1	-	4	Theory (100)	CA	10	10	50
							Sessional-1	15	15	
							Sessional-2	15		
							ESE		75	
BP402T	Medicinal Chemistry-I (Theory)	3	1	-	4	Theory (100)	CA	10	10	50
							Sessional-I	15	15	
							Sessional-II	15		
							ESE		75	
BP403T	Physical Pharmaceutics-II (Theory)	3	1	-	4	Theory (100)	CA	10	10	50
							Sessional-I	15	15	
							Sessional-II	15		
							ESE		75	
BP404T	Pharmacology-I (Theory)	3	1	-	4	Theory (100)	CA	10	10	50
							Sessional-I	15	15	
							Sessional-II	15		
							ESE		75	
BP405T	Pharmacognosy and Phytochemistry -I (Theory)	3	1	-	4	Theory (100)	CA	10	10	50
							Sessional-I	15	15	
							Sessional-II	15		
							ESE		50	
BP406T	Medicinal Chemistry-I (Practical)	-	-	4	2	Practical (50)	CA	05	05	50
							Sessional-I	10	10	
							Sessional-II	10		
							ESE		35	
BP407P	Physical Pharmaceutics-II (Practical)	-	-	4	2	Practical (50)	CA	05	05	50
							Sessional-I	10	10	
							Sessional-II	10		
							ESE		35	
BP408P	Pharmacology-I (Practical)	-	-	4	2	Practical (50)	CA	05	05	50
							Sessional-I	10	10	
							Sessional-II	10		
							ESE		35	
BP409P	Pharmacognosy and Phytochemistry -I (Practical)	-	-	4	2	Practical (50)	CA	05	05	50
							Sessional-I	10	10	
							Sessional-II	10		
							ESE		35	
BP205T	Computer Application in Pharmacy (Theory)*	3	-	-	3	Theory (75)	CA	10	10	50
							Sessional-I	15	15	
							Sessional-II	15		
							ESE		50	
BP210P	Computer Application in Pharmacy (Practical)*	-	-	2	1	Practical (25)	CA	05	05	50
							Sessional-I	05	05	
							Sessional-II	05		
							ESE		15	
Total		15	5	16	28					
Total (Lateral entry)		18		18	32					

* Applicable to lateral entry students only (For 4 credits)

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) OR Objective Type Questions (5 x 2) (Answer all questions)	10 x 1 = 10 05 x 2 = 10
II	Long Answer Questions (Answer 1 out of 2)	01 x 10 = 10
III	Short Answers (Answer 2 out of 3)	02 x 05 = 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 Major experiment Minor experiment	15 10
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 Assessment 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

Reexamination of end semester examination 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) OR Objective Type Questions (10 x 2) (Answer all the questions)	20 x 1 = 20 OR 10 x 2 = 20
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 05 = 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
	Experiments	25
	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–XIV.

Table XIV: 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:

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

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 F or ABS grade in course 4, the SGPA shall then be computed as:

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

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:

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

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
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First Class	=	CGPA of 6.00 to 7.49
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Second Class	=	CGPA of 5.00 to 5.99
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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 semester-VII, 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.

28. Audit Course:

A student may have to register for an audit course in a D. Pharm Part-I or Part-II which could be institute requirement or department requirement.

An audit course may include either a) a regular course required to be done as per structure or required as pre-requisite of any higher level course or b) the programs like practical training, industry visits, societal activities etc

Audit course shall not carry any credits but shall be reflected in Grade Card as "PP"/"NP" depending upon the satisfactory performance in the semester evaluation as per the course curriculum structure.



29. Facilitation to Students:

29.1 Faculty Advisor:

On joining the institute, a student or a group of students shall be assigned to a faculty advisor who shall be mentor for a student throughout his/her tenure in the institute. A student shall be expected to consult the faculty advisor on any matter relating to his/her academic performance and the courses he/she may take in various semesters/summer term. A faculty advisor shall be the person to whom the parents/guardians should contact for performance related issues of their ward.

The role of the Faculty Adviser is outlined below:

- a) Guide the students about the rules and regulations governing the courses of study for a particular degree.
- b) Advise the students for registering courses as per curriculum given. For this purpose, the Faculty Adviser has to discuss with the student his/her academic performance during the previous semester and then decide the number and nature of the courses for which He / She can register during the semester as per the curriculum.
- c) Approve the registration of the students.
- d) Advise students to overload/drop one or more courses/activities based on her/his academic performance as per the prescribed rules.
- e) At the end of the first semester/year, the Faculty Adviser may even advise a reduced load program for a poorly performing student.
- f) Pay special attention to weak students and carefully monitor performance of students recommended for slow track option.
- g) Advise students for Course Adjustment/Dropping of courses during the Semester within the stipulated time frame given in the Academic calendar.
- h) Advise students seeking semester drop either during the ongoing semester or before the commencement of the semester. FA has to ensure strict compliance of rules and regulations laid down for this purpose. Recommend the cases to the appropriate authorities for consideration.
- i) Make revised plan of study for weak/bright students based on their semester wise performance.
- j) Suggest modalities for course/credit requirements for the students recommended for exchange program.
- k) Guidance and liaison with parents of students for their performance.
- l) To ensure that students are not permitted to reregister for courses, which they have already passed.
- m) Inform students that any academic activity (course/Lab/seminar/project/noncredit requirement etc.) undergone without proper registration will not be counted towards the requirements of his/her degree.



- n) Strictly warn students that if she/he fails to register during any semester without prior approval, his/her studentship is liable to be cancelled.
- o) Keep the students updated about the Academic Administration of the University.

29 .2. Helping Weaker Students:

A student with backlog/s should continuously seek help from his/her faculty advisor, Head of the Department and the Dean of respective schools. Additionally, he/she must also be in constant touch with his/her parents/local guardians for keeping them informed about academic performance. The university also shall communicate to the parents/guardians of such student at-least once during each semester regarding his/her performance in various tests and examination and also about his/her attendance. It shall be expected that the parents/guardians too keep constant touch with the concerned faculty advisor or Head of the Department, and if necessary - the Dean of the respective school.

30. Discipline and Conduct:

- Every student shall be required to observe discipline and decorous behavior both inside and outside the campus and not to indulge in any activity, which shall tend to bring down the prestige of the university.
- Any act of indiscipline of a student reported to the Dean, Student Development, shall be discussed in a Disciplinary Action Committee of the institute. The Committee shall enquire into the charges and recommend suitable punishment if the charges are substantiated.
- If a student while studying in the university is found indulging in anti-national activities contrary to the provisions of acts and laws enforced by Government, he/she shall be liable to be expelled from the institute without any notice.
- If a student is involved in any kind of ragging, the student shall be liable for strict action as per provisions in the Maharashtra anti-ragging act.
- If any statement/information supplied by the student in connection with his/her admission is found to be false/ incorrect at any time, his/ her admission shall be cancelled and he/she shall be expelled from the university and fees paid shall be forfeited.
- If a student is found guilty of malpractice in examinations, then he/she shall be punished as per the recommendations of the Grievance Redressal Committee (CRC) constituted by Board of Examinations.
- Every admitted student shall be issued photo identification (ID) card which must be retained by the student while he/she is registered at Sanjay Ghodawat University Kolhapur. The student must have valid ID card with him/her while in the University Campus.
- Any student who alters or intentionally mutilates an ID card or who uses the ID card of another student or allows his/her ID card to be used by another, student shall be subjected to disciplinary action.
- The valid ID card must be presented for identification purpose as and when



demanded by authorities. Any student refusing to provide an ID card shall be subjected to disciplinary action.

- Students should switch off the Mobiles during the Instructional hours and in the academic areas of university Building, Library, Reading room etc. Strict action will be taken if students do not adhere to this.
- During the conduct of any Tests and Examination students must not bring their mobiles. A student in possession of the mobile whether in use or switched off condition will face disciplinary action and will be debarred from appearing for the Test / Examination.

31. Academic Calendar

The academic activities of the institute are regulated by Academic Calendar and are made available to the student's/ faculty members and all other concerned in electronic form or hard copy. It shall be mandatory for students / faculty to strictly adhere to the academic calendar for completion of academic activities.



CHAPTER - II:

SYLLABUS



Semester III

Course code	Name of the course	No. of Hr/wk	Tutorial	Internal		ESE	Credit points
				CA	SE		
BP301T	Pharmaceutical Organic Chemistry-II (T)	3	1	10	15	75	4
BP302T	Physical Pharmaceutics-I (T)	3	1	10	15	75	4
BP303T	Pharmaceutical Microbiology (T)	3	1	10	15	75	4
BP304T	Pharmaceutical Engineering (T)	3	1	10	15	75	4
BP305P	Pharmaceutical Organic Chemistry-II (P)	4	-	5	10	35	2
BP306P	Physical Pharmaceutics-I (P)	4	-	5	10	35	2
BP307P	Pharmaceutical Microbiology (P)	4	-	5	10	35	2
BP 308P	Pharmaceutical Engineering (P)	4		5	10	35	2
BP105T	Communication Skill (T)*	2	-	5	10	35	2
BP111P	Communication Skill (P)*	2		5	5	15	1
Total		28/32*	4	60/ 70*	100/ 115*	440/ 490*	24/ 27*
				600/675*			

* Applicable to lateral entry students only (For 3 credits)

**BP301T. PHARMACEUTICAL ORGANIC CHEMISTRY–II (Theory)****45 Hours**

Course Code	Course Title	L	T	P	C	Component	Exam	WT		Passing Min. (%)
BP301T	Pharmaceutical Organic Chemistry–II (Theory)	3	1	-	4	Theory (100 marks)	CA	10	10	50
							Sessional-1	15	15	
							Sessional-2	15		
							ESE		75	

Scope:

This subject deals with general methods of preparation and reactions of some organic compounds. Reactivity of organic compounds are also studied here. The syllabus emphasizes on mechanisms and orientation of reactions. Chemistry of fats and oils are also included in the syllabus.

Objectives:

Upon completion of this course the student should be able to

- CO1. Define, classify¹** name and correctly identify various functional groups of organic compounds.
- CO2. Describe²** the reaction, its differences and orientation.
- CO3. Illustrate⁴** the principles/mechanisms and application of various organic reactions
Perform
- CO4. Determine³** the analytical constant of fat and oil.

Course Content:

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

UNIT	Description	Hours
I	Benzene and its derivatives	10
	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.	
II	Phenols*- Acidity of phenols, effect of substituents on acidity, qualitative tests, Structure and uses of phenol, cresols, resorcinol, naphthols	10



	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.	
III	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	10
IV	Polynuclear hydrocarbons: a. Synthesis, reactions. b. Structure and medicinal uses of Naphthalene, Phenanthrene, Anthracene, Diphenylmethane, Triphenylmethane and their derivatives.	08
V	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.	07

Recommended Books (Latest Editions)

1. Morrison RT, Boyd RN, Bhattachargee SK. **Organic Chemistry**. New Delhi: Dorling Kindersley (India) Pvt Ltd Licensees of Pearson Education.
2. Finar IL. **Organic Chemistry Volume-I**. Noida: Pearson Education
3. Bahl A, Bahl BS. **Textbook of organic chemistry**. New Delhi: S. Chand Publishing.
4. Soni PL, Chawla HM. **Text book of organic Chemistry**. New Delhi: Sultan Chand and Sons Pvt Ltd.
5. Mann FG, Saunders BC. **Practical Organic Chemistry**. Noida: Pearson Education
6. Furniss BS, Hannaford AJ, Smith Peter WG, Tatchell AR. **Vogel’s text book of Practical Organic Chemistry**. Noida: Pearson Education
7. Vishnoi NK. **Advanced Practical organic chemistry**. New Delhi: Vikas Publishing House Pvt. Ltd.
8. Engel RG, Pavia DL, Lampman GM, Kriz GS. **Introduction to Organic Laboratory techniques**. Brooks/Cole Publishing

**BP305P. PHARMACEUTICAL ORGANIC CHEMISTRY -II (Practical)****4 Hours / week**

Course Code	Course Title	L	T	P	C	Component	Exam	WT		Passing Min. (%)
BP305P	Pharmaceutical Organic Chemistry -II (Practical)	-	-	4	2	Practical (50 Marks)	CA	05	05	50
							Sessional-1	10	10	
							Sessional-2	10		
							ESE		35	

Objectives:

Upon completion of this course the student should be able to

CO1. Explain² the principle involved in synthesis, purification and characterization of these compounds.

CO2. Synthesize⁶ purify and characterize different compounds

CO3. Determine and Calculate³ the analytical constant of fat and oil.

CO4. Standardize⁵ all reagents and calculate factors involved in the experiment

No.	Description
1. Experiments involving laboratory techniques	i) Recrystallization ii) Steam distillation
2. Determination of following oil values (including standardization of reagents)	Acid value, Saponification value, Iodine value
3. Preparation of compounds.	
3.1	Benzanilide/Phenyl benzoate/Acetanilide from Aniline/ Phenol /Aniline by acylation reaction
3.2	2,4,6-Tribromo aniline/Para bromo acetanilide from Aniline
3.3	Acetanilide by halogenation (Bromination) reaction
3.4	5-Nitro salicylic acid/Meta di nitro benzene from Salicylic acid/ Nitro benzene by nitration reaction
3.5	Benzoic acid from Benzyl chloride by oxidation reaction
3.6	Benzoic acid/ Salicylic acid from alkyl benzoate/ alkyl salicylate by hydrolysis reaction
3.7	1-Phenyl azo-2-naphthol from Aniline by diazotization and coupling reactions
3.8	Benzil from Benzoin by oxidation reaction
3.9	Dibenzal acetone from Benzaldehyde by Claisen Schmidt reaction
3.10	Cinnamic acid from Benzaldehyde by Perkin reaction
3.11	P-Iodo benzoic acid from P-amino benzoic acid

Recommended Books (Latest Editions)

1. Mann FG, Saunders BC. **Practical Organic Chemistry**. Noida: Pearson Education
2. Furniss BS, Hannaford AJ, Smith Peter WG, Tatchell AR. **Vogel's text book of Practical Organic Chemistry**. Noida: Pearson Education
3. Vishnoi NK. **Advanced Practical organic chemistry**. New Delhi: Vikas Publishing House Pvt. Ltd.
4. Engel RG, Pavia DL, Lampman GM, Kriz GS. **Introduction to Organic Laboratory techniques**. Brooks/Cole Publishing

**BP302T. PHYSICAL PHARMACEUTICS-I (Theory)****45 Hours**

Course Code	Course Title	L	T	P	C	Component	Exam	WT		Passing Min. (%)
BP302T	Physical Pharmaceutics-I (Theory)	3	1	-	4	Theory (100 marks)	CA	10	10	50
							Sessional-1	15	15	
							Sessional-2	15		
							ESE		75	

Scope:

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

Objectives:

Upon completion of the course student shall be able to

- CO1. Describe²** fundamentals of states of matter, buffers, isotonic solutions, complexation and protein binding.
- CO2. Explain¹** surface and interfacial phenomenon and applicability to biphasic systems.
- CO3. Classify¹** and measure complexation and protein binding and its application
- CO4. Differentiate⁴** between various properties of matter and drugs.
- CO5. Apply⁵** concept of pH, buffer and its application to pharmaceutical and biological systems

Course Content

UNIT	Description	Hours
I	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	10
II	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, solidcrystalline, amorphous & polymorphism. Physicochemical properties of drug molecules: Refractive index, optical rotation, dielectric constant, dipole moment, dissociation constant, determinations and applications.	10



III	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.	10
IV	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.	08
V	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.	07

Recommended Books: (Latest Editions)

1. Martin A, Bustamante P, Chun AHC. **Martin Physical Pharmacy**-Physical Chemical Principles in The Pharmaceutical Sciences. New Delhi: B. I. Waverly Pvt Ltd
2. Carter SJ. **Cooper and Gunn's Tutorial pharmacy**. New Delhi: CBS Publications.
3. Stoklosa MJ, Ansel HC. **Pharmaceutical Calculations**. Lea & Febiger, Washington Square, Philadelphia.
4. Liberman HA, Lachman C. **Pharmaceutical Dosage forms: Tablets**. Volume-1, 2, 3, New York: Marcel Dekker
5. Liberman HA, Lachman C. **Pharmaceutical Dosage forms: Disperse systems**. volume 1, 2, 3. New York: Marcel Dekker.
6. Manavalan R, Ramasamy C. **Physical Pharmaceutics**. PharmaMed Press

**BP306P. PHYSICAL PHARMACEUTICS – I (Practical)****4 Hours / Week**

Course Code	Course Title	L	T	P	C	Component	Exam	WT		Passing Min. (%)
BP306P	Physical Pharmaceutics – I (Practical)	-	-	4	2	Practical (50 marks)	CA	05	05	50
							Sessional-1	10	10	
							Sessional-2	10		
							ESE		35	

Objectives:

Upon completion of the course student shall be able to

CO1. Determine⁵ pka, solubility, partition coefficient.

CO2. Determine⁵ Surface tension, HLB, critical micellar concentration

CO3. Determine⁵ Freundlich and Langmuir, complexation

No.	Description
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, Determination of Partition co-efficient of salicylic acid in chloroform and water-n-octanol and water system
4.	Determination of Partition co-efficient of Iodine in CCl ₄ 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

Recommended Books: (Latest Editions)

1. Subramanyam CVS, Vasantharaju SG. **Laboratory Manual of Physical Pharmaceutics.** Delhi: Vallabh Prakashan.
2. Parrott EL, Sasaki W. **Experimental pharmaceutics.** Burgess Publication.
3. Stoklosa MJ, Ansel HC. **Pharmaceutical Calculations.** Lea & Febiger, Washington Square, Philadelphia.
4. Carter SJ. **Cooper and Gunn's Tutorial pharmacy.** New Delhi: CBS Publications.



BP303T. PHARMACEUTICAL MICROBIOLOGY (Theory)

45 Hours

Course Code	Course Title	L	T	P	C	Component	Exam	WT		Passing Min. (%)
BP303T	Pharmaceutical Microbiology (Theory)	3	1	-	4	Theory (100 Marks)	CA	10	10	50
							Sessional-1	15	15	
							Sessional -2	15		
							ESE		75	

Scope:

Study of all categories of microorganisms especially for the production of alcohol antibiotics, vaccines, vitamins, enzymes etc.

Objectives:

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

- CO1. Describe¹** the basic concept, classify microorganism and equipments/instruments used in microbiology
- CO2. Explain²** methods of identification, culture, pure culture, cultivation and preservation of various microorganisms and cells.
- CO3. Illustrate³** sterilization techniques, as per standards and its importance and applications in pharmaceutical sterile preparation.
- CO4. Explain²** various sources of microbial contamination, aseptic area, disinfection method concept and techniques related to prevention
- CO5. Illustrate³** the uses of microorganisms in standardization of pharmaceuticals and concept of use of preservatives in formulations.

Course Content:

UNIT	Description	Hours
I	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). Microscopes: Study of different types of phase contrast microscopy, dark field microscopy and electron microscopy. Immunity, primary and secondary, defensive mechanisms of body, microbial resistance.	10
II	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	10



	physical, chemical gaseous, radiation and mechanical method of sterilization. Evaluation of the efficiency of sterilization methods. Equipments employed in large scale sterilization. Sterility indicators.	
III	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. Air microbiology- Microorganisms in the air, sampling techniques, air borne pathogens.	10
IV	Designing of aseptic area, laminar flow equipments: study of different sources of contamination in an aseptic area and methods of prevention, clean area classification. Principles and methods of different microbiological assay. Methods for standardization of antibiotics, vitamins and amino acids. Assessment of a new antibiotic.	08
V	Types of spoilage, factors affecting the microbial spoilage of pharmaceutical products, sources and types of microbial contaminants, assessment of microbial contamination and spoilage. Preservation of pharmaceutical products using antimicrobial agents, evaluation of microbial stability of formulations. 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	07

Recommended Books: (Latest Editions)

1. Hugo WB, Russel AD. **Pharmaceutical Microbiology**. Blackwell Scientific publications, Oxford London.
2. **Prescott and Dunn's Industrial Microbiology**. Delhi: CBS Publishers & Distributors
3. Pelczar MJ, Chan ECS, Krieg NR. **Microbiology**. New Delhi: Tata McGraw Hill
4. Harris M. **Pharmaceutical Microbiology**. London: Balliere Tindall and Cox:
5. Rose AH. **Industrial Microbiology**. London: Butterworths Publication
6. Frobisher M, Hinsdill R, Crabtree KT, Goodheart CR. **Fundamentals of microbiology**. W B Saunders Co.
7. Carter SJ. **Cooper and Gunn's Tutorial pharmacy**. New Delhi: CBS Publications
8. Peppler HJ, Perlman D. **Microbial Technology**. Academic Press.
9. Ananthanarayan R. **Ananthanarayan Textbook of Microbiology**. Orient-Longman, Chennai
10. Jain NK. **Pharmaceutical Microbiology**. Delhi: Vallabh Prakashan

BP307P. PHARMACEUTICAL MICROBIOLOGY (Practical)

4 Hours / week

Course Code	Course Title	L	T	P	C	Component	Exam	WT		Passing Min. (%)
BP307P	Pharmaceutical Microbiology (Practical)	-	-	4	2	Practical (50 Marks)	CA	05	05	50
							Sessional-1	10	10	
							Sessional-2	10		
							ESE		35	

Objectives:

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

- CO1. Demonstrate³** the basic concept, classify microorganism and equipments/instruments used in microbiology
- CO2. Evaluate⁵** microbes type, count, growth, motility, isolation, using biochemical tests, culturing and staining techniques in microbiology.
- CO3. Measure⁶** the growth of microorganism in presence and absence of antibiotics.
- CO4. Perform and report⁶** sterility of pharmaceuticals and analysis of water.

No.	Description
1.	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.
2.	Sterilization of glassware, preparation and sterilization of media.
3.	Sub culturing of bacteria and fungus. Nutrient stabs and slants preparations.
4.	Staining methods- Simple, Grams staining and acid fast staining (Demonstration with practical).
5.	Isolation of pure culture of micro-organisms by multiple streak plate 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

Recommended Books: (Latest Editions)

- Prescott and Dunn's Industrial Microbiology.** Delhi: CBS Publishers & Distributors
- United State Pharmacopoeia (USP).**
- Bergey DH, Breed RS, Murray EGD, Hitchens AP **Bergey's Manual of Determinative Bacteriology.** Baltimore: The Williams & Wilkins Co.
- Anonymus. **Indian pharmacopoeia.** Ghaziabad: Indian Pharmacopoeia Commission Ministry of Health & Family Welfare, Govt. of India
- Anonymus. **British pharmacopoeia.** UK: The British Pharmacopoeia Commission (BPC), The Department of Health and Social Care



BP304T. PHARMACEUTICAL ENGINEERING (Theory)

45 Hours

Course Code	Course Title	L	T	P	C	Component	Exam	WT	Passing Min. (%)
BP304T	Pharmaceutical Engineering (Theory)	3	1	-	4	Theory (100 marks)	CA	10	10
							Sessional-1	15	15
							Sessional-2	15	15
							ESE		75

Scope:

This course is designed to impart a fundamental knowledge on the art and science of various unit operations used in pharmaceutical industry.

Objectives:

Upon completion of course student shall be able to

- CO1. Describe²** layout designs and various unit operations of Pharmaceutical industries
- CO2. Illustrate⁴** principles, laws and mechanisms of operational processes in Pharmaceutical industries.
- CO3. Appraise⁴** construction, working, uses, merits and demerits of equipments used for size reduction, separation.
- CO4. Explain²** design, working, uses, merits and demerits of equipments used for centrifugation, filtration, heat transfer, evaporation, and distillation
- CO5. Justify⁵** selection of material for pharmaceutical plant construction based on factors affecting, corrosion, handling and types of material.

Course Content:

UNIT	Description	Hours
I	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.	10
II	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	10

	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	
III	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	10
IV	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.	08
V	Brief introduction of layout design. 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 non-ferrous metals, inorganic and organic non metals, basic of material handling systems.	07

Recommended Books: (Latest Editions)

1. **Badger WL, Banchero JT.** Introduction to chemical engineering. **New York: McGraw-Hill book company, Inc.**
2. **Nigel J. K. Simpson.** Solid-Phase Extraction: Principles, Techniques and Applications **Dekker: New York and Basel.**
3. **McCabe W, Smith J, Harriott P.** Unit Operations of Chemical Engineering. **McGraw Hill Education.**
4. **Subrahmanyam CVS, Devi KV, Sarasija S, Setty TJ.** Pharmaceutical Engineering Principles and Practices. **Vallabh Prakashan.**
5. **Carter SJ.** Cooper and Gunn's Tutorial pharmacy. New Delhi: CBS Publications.
6. **Adejare A. (Ed)** Remington: The Science and Practice of Pharmacy. Academic Press
7. **Khar RK, Vyas, SP, Ahmad FJ, Jain GK.** Lachman Liebermans The Theory And Practice Of Industrial Pharmacy. **Delhi: CBS Publication.**

BP308P - PHARMACEUTICAL ENGINEERING (Practical)

4 Hours/Week

Course Code	Course Title	L	T	P	C	Component	Exam	WT		Passing Min. (%)
BP308P	Pharmaceutical Engineering (Practical)	-	-	4	2	Practical (50 Marks)	CA	05	05	50
							Sessional-1	10	10	
							Sessional-2	10		
							ESE		35	

Objectives:

Upon completion of course student shall be able to

CO1.Determine⁴ radiation constant, heat transfer, moisture constant, Loss on drying, humidity of air.

CO2.Analyse⁴ efficiency of steam distillation, uniformity index, size of granules, size reduction, drying curve.

CO3.Demonstrate³ Construction, working and application of pharmaceutical machinery and equipments.

CO4.Evaluate⁶ factors affecting different unit operations.

No.	Description
1.	Determination of radiation constant of brass, iron, unpainted and painted glass.
2.	Steam distillation– To calculate the efficiency of steam distillation.
3.	To determine the overall heat transfer coefficient by heat exchanger.
4.	Construction of drying curves (for calcium carbonate and starch).
5.	Determination of moisture content and loss on drying.
6.	Determination of humidity of air– i) From wet and dry bulb temperatures –use of Dew point method.
7.	Description of Construction, working and application of pharmaceutical machinery such as rotary tablet machine, fluidized bed coater, fluid energy mill, de humidifier
8.	Size analysis by sieving– To evaluate size distribution of tablet granulations – Construction of various size frequency curves including arithmetic and logarithmic probability plots
9.	Size reduction: To verify the laws of size reduction using ball mill and determining Kicks, Rittinger's, Bond's coefficients, power requirement and critical speed of Ball Mill.
10.	Demonstration of colloid mill, planetary mixer, fluidized bed dryer, freeze dryer and such other major equipment.
11.	Factors affecting rate of filtration and evaporation (surface area, concentration and thickness/ viscosity)
12.	To study the effect of time on the rate of crystallization.
13.	To calculate the uniformity index for given sample by using Double Cone Blender.

Recommended Books (Latest Editions)

- McCabe W, Smith J, Harriott P. **Unit Operations of Chemical Engineering**. McGraw Hill Education.
- Carter SJ. **Cooper and Gunn's Tutorial pharmacy**. New Delhi: CBS Publications.

**BP105T. COMMUNICATION SKILLS (Theory)****30 Hours**

Course Code	Course Title	L	T	P	C	Component	Exam	WT		Passing Min. (%)
BP105T	Communication skills (Theory) *	2	-	-	2	Theory (50 Marks)	CA	05	05	50
							Sessional-1	10	10	
							Sessional-2	10		
							ESE		35	

Scope:

This course will prepare the young pharmacy student to interact effectively with doctors, nurses, dentists, physiotherapists and other health workers. At the end of this course the student will get the soft skills set to work cohesively with the team as a team player and will add value to the pharmaceutical business.

Objectives:

Upon completion of the course the student shall be able to

- CO1. Understand²** the behavioral needs for a pharmacist to function effectively in the areas of pharmaceutical operation
- CO2. Communicate²** effectively (Verbal and Non Verbal)
- CO3. Perform³** effectively as team leader and team player
- CO4. Develop⁶** interview skills
- CO5. Develop⁶** Leadership qualities and essentials

Course content:

UNIT	Description	Hours
I	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	07
II	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	07



	Communication Style, Systematic Communication Style, Considerate Communication Style	
III	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	07
IV	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	05
V	Group Discussion: Introduction, Communication skills in group discussion, Do's and Dont's of group discussion. Professional Conflict resolution.	04

Recommended Books: (Latest Edition)

1. Ruther AJ. **Basic communication skills for Technology**, Delhi: Pearson Education.
2. Sanjay Kumar, Pushpa Lata. **Communication skills**. New Delhi: Oxford University Press.
3. Robbins SP, Judge TA, Vohra N. **Organizational Behaviour**. Delhi: Pearson Education
4. Hasson G. **Brilliant communication skills**. Pearson Life
5. Dalley D, Burton L, Greenhall M. **Developing Your Influencing Skills: How to Influence People by Increasing Your Credibility, Trustworthiness and Communication Skills** Universe of Learning LTD.
6. Nira K. **Communication skills for professionals**. New Delhi: PHI Learning Private Limited
7. Butterfield J. **Soft skill for everyone**. Noida: Cengage Learning India Private Limited
8. Francis Peters SJ. **Soft skills and professional communication**. Noida: McGraw-Hill Education
9. Adair J. **Effective communication**. Sydney: Pan Macmillan
10. Daniels AC. **Bringing out the best in people**. Noida: McGraw-Hill Education.

**BP111P. COMMUNICATION SKILLS (Practical)****2 Hours / week**

Course Code	Course Title	L	T	P	C	Component	Exam	WT		Passing Min. (%)
BP111P	Communication skills – Practical*	--	-	2	1	Practical (25 Marks)	CA	05	05	50
							Sessional-1	05	05	
							Sessional-2	05	05	
							ESE		15	

Objectives:

Upon completion of the course the student shall be able to

CO1. Communicate² effectively using verbal and nonverbal modes.

CO2. Illustrate³ and use the different types of pronunciation.

CO3. Comprehend² listening and writing.

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

No.	Description
1.	Basic communication covering the following topics: Meeting People, Asking Questions, Making Friends, What did you do? Do's and Don't's
2.	Pronunciations covering the following topics: Pronunciation (Consonant Sounds) Pronunciation and Nouns Pronunciation (Vowel Sounds)
3.	Advanced Learning: Listening Comprehension / Direct and Indirect Speech Figures of Speech, Effective Communication, Writing Skills, Effective Writing, Interview Handling Skills, E-Mail etiquette, Presentation Skills.
	Personality development

Recommended Books: (Latest Edition)

1. Robbins SP, Judge TA, Vohra N. **Organizational Behaviour**. Delhi: Pearson Education
2. Hasson G. **Brilliant communication skills**. Pearson Life
3. Ramesh G., Ramesh M. **The Ace of Soft Skills: Attitude, Communication and Etiquette for success**. Delhi: Pearson Education
4. Dalley D, Burton L, Greenhall M. **Developing Your Influencing Skills: How to Influence People by Increasing Your Credibility, Trustworthiness and Communication Skills** Universe of Learning LTD.
5. Nira K. **Communication skills for professionals**. New Delhi: PHI Learning Private Limited
6. Mitra BK. **Personality development and soft skills**. New Delhi: Oxford University Press



Semester IV

Course code	Name of the course	No. of hours	Tutorial	Internal		ESE	Credit points
				CA	SE		
BP401T	Pharmaceutical Organic Chemistry III– (T)	3	1	10	15	75	4
BP402T	Medicinal Chemistry I – (T)	3	1	10	15	75	4
BP403T	Physical Pharmaceutics II – (T)	3	1	10	15	75	4
BP404T	Pharmacology I – (T)	3	1	10	15	75	4
BP405T	Pharmacognosy and Phytochemistry I– (T)	3	1	10	15	75	4
BP406P	Medicinal Chemistry I – (P)	4	-	5	10	35	2
BP407P	Physical Pharmaceutics II – (P)	4	-	5	10	35	2
BP408P	Pharmacology I – (P)	4	-	5	10	35	2
BP409P	Pharmacognosy and Phytochemistry I – (P)	4	-	5	10	35	2
BP205	Computer application in Pharmacy- (T)*	3	-	10	15	50	3
BP210	Computer application in Pharmacy- (P)*	2	-	5	5	15	1
Total		31/36*	5	70/ 85*	115/ 135*	515/ 580*	28/ 32*
				700/ 800*			

* Applicable to lateral entry students only (for 4 credits)

**BP401T. PHARMACEUTICAL ORGANIC CHEMISTRY –III (Theory)****45 Hours**

Course Code	Course Title	L	T	P	C	Component	Exam	WT		Passing Min. (%)
BP401T	Pharmaceutical Organic Chemistry –III (Theory)	3	1	-	4	Theory (100 Marks)	CA	10	10	50
							Sessional-1	15	15	
							Sessional-2	15		
							ESE		75	

Scope:

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

Objectives:

Upon completion of the course the student shall be able to

- CO1. Define and classify¹** organic compounds along with its uses.
- CO2. Draw³** three dimensional structure of stereoisomers and cyclohexane derivatives and other organic compound.
- CO3. Identify¹** different heterocyclic rings and name them.
- CO4. Illustrate⁴** the reactions involved in the synthesise of heterocyclic derivatives of medicinal use.
- CO5. Explain²** applications of various reagents in synthetic reactions.

Course Content:

UNIT	Description	Hours
I	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	10
II	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	10
III	Heterocyclic compounds:	10



	<ul style="list-style-type: none">• 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	
IV	Synthesis, reactions and medicinal uses of following compounds/derivatives: <ul style="list-style-type: none">• 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. Name of the drugs containing above heterocyclic compounds (Examples)	10
V	Reactions of synthetic importance <ul style="list-style-type: none">• Metal hydride reduction (NaBH_4 and LiAlH_4), Clemmensen reduction, Birch reduction, Wolff Kishner reduction.• Oppenauer-oxidation and Dakin reaction.• Beckmanns rearrangement and Schmidt rearrangement.• Claisen-Schmidt condensation	09

Recommended Books (Latest Editions)

1. Morrison RT, Boyd RN, Bhattachargee SK. **Organic Chemistry**. New Delhi: Dorling Kindersley (India) Pvt Ltd Licensees of Pearson Education.
2. Finar IL. **Organic Chemistry Volume-I**. Noida: Pearson Education
3. Bahl A, Bahl BS. **Textbook of organic chemistry**. New Delhi: S. Chand Publishing.
4. Bansal RK. **Heterocyclic Chemistry**. New Delhi: New Age International (P) Ltd
5. Gilchrist TL. **Heterocyclic Chemistry**. John Wiley & Sons Inc
6. Soni PL, Chawla HM. **Text book of organic Chemistry**. New Delhi: Sultan Chand and Sons Pvt Ltd.

**BP402T. MEDICINAL CHEMISTRY-I (Theory)****45 Hours**

Course Code	Course Title	L	T	P	C	Component	Exam	WT		Passing Min. (%)
BP402T	Medicinal Chemistry- I (Theory)	3	1	-	4	Theory (100 Marks)	CA	10	10	50
							Sessional-1	15	15	
							Sessional-2	15		
							ESE		75	

Scope:

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

Objectives:

Upon completion of the course the student shall be able to

- CO1. Classify¹** the drugs on the basis of their chemical structure.
- CO2. Illustrate⁴** the drug metabolic pathways and their impact on ADME and drug activity.
- CO3. Describe²** the chemistry of drugs, Structural Activity Relationship (SAR) with respect to their pharmacological activity.
- CO4. Write³** the chemical synthesis of some drugs

Course Content

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

UNIT	Description	Hrs
I	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.	10
II	Drugs acting on Autonomic Nervous System Adrenergic Neurotransmitters: <ul style="list-style-type: none"> Biosynthesis and catabolism of catecholamine. Adrenergic receptors (Alpha & Beta) and their distribution. Sympathomimetic agents: SAR of Sympathomimetic agents <ul style="list-style-type: none"> Direct acting: Nor-epinephrine, Epinephrine, Phenylephrine*, Dopamine, Methyl dopa, Clonidine, Dobutamine, Isoproterenol, Terbutaline, Salbutamol*, Bitolterol, Naphazoline, Oxymetazoline and Xylometazoline. 	10

- **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.

III Cholinergic neurotransmitters: Biosynthesis and catabolism of acetylcholine. 10

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, Isofluorophate, 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, Biperidine hydrochloride, Procyclidine hydrochloride*, Tridihexethyl chloride, Isopropamide iodide, Ethopropazine hydrochloride.

IV Drugs acting on Central Nervous System 08

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.

Fluro buterophenones: Haloperidol, Droperidol, Risperidone.

Beta amino ketones: Molindone hydrochloride.

Benzamides: Sulpieride.

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

Barbiturates: Phenobarbitone, Methabarbital.

Hydantoins: Phenytoin*, Mephenytoin, Ethotoin

Oxazolidine diones: Trimethadione, Paramethadione

Succinimides: Phensuximide, Methsuximide, Ethosuximide*

Urea and monoacylureas: Phenacemide, Carbamazepine*

Benzodiazepines: Clonazepam

Miscellaneous: Primidone, Valproic acid, Gabapentin, Felbamate

V **Drugs acting on Central Nervous System**

07

General anesthetics:

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

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

Dissociative anesthetics: Ketamine hydrochloride.*

Narcotic and non-narcotic analgesics

Morphine and related drugs: SAR of Morphine 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.

Recommended Books (Latest Editions)

1. Beale JM, Block J. **Wilson and Giswold's Organic medicinal and Pharmaceutical Chemistry**. Lippincott Williams and Wilkins.
2. Williams A.D (Editor). **Foye's Principles of Medicinal Chemistry**. Lippincott Williams and Wilkins.
3. Abraham DJ, Rotella DP. (Editor). **Burger's Medicinal Chemistry, Drug Discovery, and Development**. Wiley-Blackwell.
4. Smith JH, Williams H. **Smith and Williams' Introduction to the Principles of Drug Design and Action**. CRC Press.
5. Final IL. **Organic Chemistry, Volume 2: Stereochemistry and the Chemistry Natural Products**. Pearson Education India

**BP406P. MEDICINAL CHEMISTRY-I (Practical)****4 Hours/week**

Course Code	Course Title	L	T	P	C	Component	Exam	WT		Passing Min. (%)
BP406P	Medicinal Chemistry- I (Practical)	-	-	4	2	Practical (50 Marks)	CA	05	05	50
							Sessional-1	10	10	
							Sessional-2	10		
							ESE		35	

Objectives:

Upon completion of the course the student shall be able to

CO1. Synthesize⁶, purify and characterize different compounds.

CO2. Illustrate³ the principle involved in synthesis, purification and characterization of these compounds.

CO3. Evaluate⁶ the partition coefficient of drug.

CO4. Analyse⁴ Percentage purity of drugs

No.	Description	
1. Preparation of drugs/ intermediates		
	1) 1,3-pyrazole	5) 2,3- diphenyl quinoxaline
	2) 1,3-oxazole	6) Benzocaine
	3) Benzimidazole	7) Phenytoin
	4) Benztriazole	8) Phenothiazine
		9) Barbiturate
	•Recrystallization of synthesized compound.	
	•Identification of synthesized compounds by M.P., TLC etc	
2. Assay of drugs		
	1) Chlorpromazine	4) Ibuprofen
	2) Phenobarbitone	5) Aspirin
	3) Atropine	6) Furosemide
3. Determination of Partition coefficient for any two drugs		

Recommended Books (Latest Editions)

1. Adejare A. (Ed) Remington: The Science and Practice of Pharmacy. Academic Press.
2. Anonymus. Indian pharmacopoeia. Ghaziabad: Indian Pharmacopoeia Commission Ministry of Health & Family Welfare, Govt. of India.
3. Furniss BS, Hannaford AJ, Smith Peter WG, Tatchell AR. **Vogel's text book of Practical Organic Chemistry**. Noida: Pearson Education
4. Lednicer D. The Organic Chemistry of Drug Synthesis **Vol 1-5**. Wiley-Blackwell.
5. Martindale W, Westcott W. Martindale: The Extra Pharmacopoeia. Pharmaceutical Press

**BP403T. PHYSICAL PHARMACEUTICS-II (Theory)****45 Hours**

Course Code	Course Title	L	T	P	C	Component	Exam	WT		Passing Min. (%)
BP403T	Physical Pharmaceutics-II (Theory)	3	1	-	4	Theory (100 Marks)	CA	10	10	50
							Sessional-1	15	15	
							Sessional-2	15		
							ESE		75	

Scope:

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

Objectives:

Upon completion of course student shall able to

- CO1. Explain²** disperse system, colloids, their properties and role in designing dosage form.
- CO2. Differentiate⁴** between disperse systems, types of flow for liquids and solids, micromeretic properties and rheological properties of formulations
- CO3. Illustrate³** micromeritics, methods of determining the same and its applications in pharmaceutical industry
- CO4. Describe²** principle of chemical kinetics and depict expiry date of formulations based on the same
- CO5. Analyze⁴** factors affecting stability and stabilization of dosage forms

Course Content

UNIT	Description	Hours
I	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.	07
II	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	08
III	Coarse dispersion: Suspension, interfacial properties of suspended	10

	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	
IV	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.	10
V	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	10

Recommended Books (Latest Editions)

1. Martin A, Bustamante P, Chun AHC. **Martin Physical Pharmacy**-Physical Chemical Principles in The Pharmaceutical Sciences. New Delhi: B. I. Waverly Pvt Ltd
2. Carter SJ. **Cooper and Gunn's Tutorial pharmacy**. New Delhi: CBS Publications.
3. Stoklosa MJ, Ansel HC. **Pharmaceutical Calculations**. Lea & Febiger, Washington Square, Philadelphia.
4. Liberman HA, Lachman C. **Pharmaceutical Dosage forms: Tablets**. Volume-1, 2, 3, New York: Marcel Dekker
5. Liberman HA, Lachman C. **Pharmaceutical Dosage forms: Disperse systems**. volume 1, 2, 3. New York: Marcel Dekker.
6. Manavalan R, Ramasamy C. **Physical Pharmaceutics**. PharmaMed Press

**BP407P. PHYSICAL PHARMACEUTICS-II (Practical)****4 Hours / Week**

Course Code	Course Title	L	T	P	C	Component	Exam	WT		Passing Min. (%)
BP407P	Physical Pharmaceutics- II (Practical)	-	-	3	2	Practical (50 Marks)	CA	05	05	50
							Sessional-1	10	10	
							Sessional-2	10		
							ESE		35	

Objectives:

Upon completion of course student shall able to

CO1. Determine⁶ particle size and size distribution using various methodology and analyze the data.

CO2. Evaluate⁶ flow and related properties and interpret the data.

CO3. Justify⁶ selection of viscometer for biphasic formulations.

CO4. Determine⁶ shelf life of given formulations based on chemical kinetics.

No.	Description
1.	Determination of particle size, particle size distribution using sieving method
2.	Determination of particle size, particle size distribution using microscopic method
3.	Determination of bulk density, true density and porosity
4.	Determine the angle of repose and influence of lubricant on angle of repose
5.	Determination of viscosity of liquid using Ostwald's viscometer
6.	Determination sedimentation volume with effect of different suspending agent
7.	Determination sedimentation volume with effect of different concentration of single suspending agent
8.	Determination of viscosity of semisolid by using Brookfield viscometer
9.	Determination of reaction rate constant first order
10.	Determination of reaction rate constant second order
11.	Accelerated stability studies

Recommended Books (Latest Editions)

1. Subramanyam CVS, Vasantharaju SG. **Laboratory Manual of Physical Pharmaceutics.** Delhi: Vallabh Prakashan.
2. Parrott EL, Saski W. **Experimental pharmaceutics.** Burgess Publication.
3. Stoklosa MJ, Ansel HC. **Pharmaceutical Calculations.** Lea & Febiger, Washington Square, Philadelphia.
4. Carter SJ. **Cooper and Gunn's Tutorial pharmacy.** New Delhi: CBS Publications.

BP404T. PHARMACOLOGY-I (Theory)

45Hours

Course Code	Course Title	L	T	P	C	Component	Exam	WT		Min. Passing (%)
BP404T	Pharmacology-I (Theory)	3	1	-	4	Theory (100 Marks)	CA	10	10	50
							Sessional-1	15	15	
							Sessional -2	15		
							ESE		75	

Scope:

The main purpose of the subject is to understand what drugs do to the living organisms and how their effects can be applied to therapeutics. The subject covers the information about the drugs like, mechanism of action, physiological and biochemical effects (pharmacodynamics) as well as absorption, distribution, metabolism and excretion (pharmacokinetics) along with the adverse effects, clinical uses, interactions, doses, contraindications and routes of administration of different classes of drugs.

Objectives:

Upon completion of the subject student shall be able to –

- CO1. Classify²** drugs on the basis of therapeutic use, acting on various organ systems
- CO2. Describe²** basic concepts of pharmacology, pharmacodynamics and pharmacokinetics of drugs.
- CO3. Illustrate⁴** pharmacological effects, mechanism of action, indications, contraindications and adverse effects of drugs.
- CO4. Apply³** basic pharmacological knowledge in the prevention and treatment of various diseases.
- CO5. Explain²** steps and regulations involved in drug discovery and clinical evaluation of new drugs.

Course content

UNIT	Description	Hours
I	1. General Pharmacology	08
	a. <u>Introduction to Pharmacology</u> - 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. <u>Pharmacokinetics</u> - Membrane transport, absorption, distribution, metabolism and excretion of drugs. Enzyme induction, enzyme inhibition, kinetics of elimination	
II	General Pharmacology	12
	a. <u>Pharmacodynamics</u> - 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, spare 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. <u>Adverse drug reactions.</u>	
	c. <u>Drug interactions</u> (pharmacokinetic and pharmacodynamic)	
	d. <u>Drug discovery and clinical evaluation of new drugs-</u> Drug discovery phase, preclinical evaluation phase, clinical trial phase, phases of clinical trials and pharmacovigilance	
III	2. Pharmacology of drugs acting on peripheral nervous system	10
	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	
IV	3. Pharmacology of drugs acting on central nervous system	08
	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	
V	3. Pharmacology of drugs acting on central nervous system	07
	a. Psychopharmacological agents: Antipsychotics, antidepressants, anti-anxiety agents, anti-manics and hallucinogens.	
	b. Drugs used in Parkinsons disease and Alzheimer's disease.	
	c. CNS stimulants and nootropics.	
	d. Opioid analgesics and antagonists	
	e. Drug addiction, drug abuse, tolerance and dependence.	

Recommended Books (Latest Editions)

1. Satoskar RS, Rege N, Bhandarkar SD. **Pharmacology and Pharmacotherapeutics.** Elsevier India
2. Rang HP, Dale MM, Ritter JM, Flower RJ. **Rang and Dale's Pharmacology.** Churchill



Livingstone Elsevier

3. Katzung BG, Masters SB, Trevor AJ. **Basic and clinical pharmacology**. Tata Mc Graw-Hill
4. Marry Anne KK, Lloyd Yee Y, Brian KA, Robbin LC, Joseph G B, Wayne AK, Bradley RW. **Applied Therapeutics, The Clinical use of Drugs**. Lippincott Williams &Wilkins
5. Brunton L, Chabner BA, Knollman B. Goodman and Gilman's, The Pharmacological Basis of Therapeutics. McGraw Hill Education
6. Mycek MJ, Gelnet SB, Perper MM. **Lippincott's Illustrated Reviews- Pharmacology**. Lippincott Williams and Wilkins
7. K.D.Tripathi. **Essentials of Medical Pharmacology**. JAYPEE Brothers Medical Publishers (P) Ltd, New Delhi.
8. Sharma HL, Sharma KK. **Principles of Pharmacology**. Paras medical publisher.
9. Craig CR, Stitzel RE. **Modern Pharmacology with clinical Applications**. Lippincott Williams and Wilkins

**BP408P. PHARMACOLOGY-I (Practical)****4 Hours / Week**

Course Code	Course Title	L	T	P	C	Component	Exam	WT		Min. Passing (%)
BP408P	Pharmacology-I (Practical)	-	-	4	2	Practical (50 Marks)	CA	05	05	50
							Sessional-1	10	10	
							Sessional-2	10	10	
							ESE		35	

Objectives:

Upon completion of the subject student shall be able to –

- CO1. Justify⁶** use of animals in laboratory experiment for testing of pharmacological activities and CPCSEA guideline
- CO2. Demonstrate³** principle and procedures of various instruments /apparatus used in experimental pharmacology.
- CO3. Interpret⁶** effect of drug on animal testing model based on simulated models.
- CO4. Illustrate³** different routes of administration and common laboratory techniques for the animal studies

No.	Description
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

Note: *All laboratory techniques and animal experiments are demonstrated by simulated experiments by softwares and videos*

Recommended Books (Latest Editions)

1. Ghosh MN. **Fundamentals of Experimental Pharmacology**. Hilton & Company, Kolkata.
2. Kulkarni SK. **Handbook of experimental pharmacology**. Vallabh Prakashan.
3. Vogel HG, Vogel WH. **Drug Discovery and Evaluation: Pharmacological Assays**. Springer-Verlag Berlin Heidelberg.
4. CPCSEA (Committee for the Purpose of Control and Supervision of Experiments on Animals) **Standard Operating Procedures for Institutional Animal Ethics Committee (IEAC)**. Animal Welfare Division, Ministry of Environment and Forest.

**BP405T. PHARMACOGNOSY AND PHYTOCHEMISTRY-I (Theory)****45 Hours**

Course Code	Course Title	L	T	P	C	Component	Exam	WT		Min. Passing (%)
BP405T	Pharmacognosy And Phytochemistry-I (Theory)	4	1	-	4	Theory (100 Marks)	CA	10	10	50
							Sessional-1	15	15	
							Sessional-2	15		
							ESE		75	

Scope:

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

Objectives:

Upon completion of the course the student shall be able to

- CO1. Describe²** the basic concepts of Pharmacognosy, sources, categories and quality control of natural drugs and plant products
- CO2. Illustrate³** techniques in the cultivation, collection, conservation, processing and storage of drugs of natural origin
- CO3. Describe²** history, techniques, and application of plant tissue culture.
- CO4. Explain²** traditional medicinal therapies and primary, secondary metabolites of crude drugs
- CO5. Distinguish⁴** drugs and aids of natural origin based on their biological source, chemical nature and other pharmacognostic parameters.

Course content

UNIT	Description	Hours
I	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.	10
II	Cultivation, Collection, Processing and storage of drugs of natural	10

	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	
III	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	07
IV	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	10
V	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 Primarymetabolites: 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	08

Recommended books (Latest edition):

1. Evans WC. **Trease and Evans Pharmacognosy**. W.B. Saunders & Co., London, 2009.
2. Tyler VE, Brady LR, Robbers JE. **Pharmacognosy** Lea and Febiger, Philadelphia,
3. Wallis TE. **Text Book of Pharmacognosy**. New Delhi: CBS Publication.
4. Mohammad Ali. **Pharmacognosy and Phytochemistry**. New Delhi: CBS Publishers & Distribution,.
5. Kokate CK, Purohit AP, Gokhale SB. **Text book of Pharmacognosy**. New Delhi: Nirali Prakashan,.
6. Choudhary RD, Chopra RD. **Herbal drug industry:A Practical Approach to Industrial Pharmacognosy**. New Delhi: Eastern Publisher.

BP408P. PHARMACOGNOSY AND PHYTOCHEMISTRY-I (Practical)

4 Hours/week

Course Code	Course Title	L	T	P	C	Component	Exam	WT		Min. Passing (%)
BP408P	Pharmacognosy And Phytochemistry- I (Practical)	-	-	2	1	Practical (50 Marks)	CA	05	05	50
							Sessional-1	10	10	
							Sessional-2	10		
							ESE		35	

Objectives:

Upon completion of the course the student shall be able to

CO1. Determine⁶ microscopic and morphological characteristics of crude drugs.

CO2. Analyze⁴ crude drugs by qualitative parameters

CO3. Analyze⁴ crude drugs by quantitative parameters

CO4. Describe² evaluation techniques for herbal drugs

No.	Description
1.	Analysis of crude drugs by chemical tests: (i) Tragacanth (ii) Acacia (iii) Agar (iv) Gelatin (v) starch (vi) Honey (vii) Castor oil
2.	2. Determination of stomatal number and index
3.	3. Determination of vein islet number, vein islet termination and palisade ratio
4.	4. Determination of size of starch grains, calcium oxalate crystals by eye piece micrometer
5.	5. Determination of Fiber length and width
6.	6. Determination of number of starch grains by Lycopodium spore method
7.	7. Determination of Ash value
8.	8. Determination of Extractive values of crude drugs
9.	9. Determination of moisture content of crude drugs
10.	10. Determination of swelling index and foaming

Recommended books (Latest edition):

1. Gokhale SB, Kokate CK. **Practical Pharmacognosy**. Nirali Prakashan
2. Iyengar MA. **Anatomy of Crude Drugs**. PharmaMed Press
3. Khandelwal KR. **Practical Pharmacognosy**. Nirali Prakashan.
4. **Quality Control Methods for Herbal Material**. World Health Organisation. 2011

**P205 T. COMPUTER APPLICATIONS IN PHARMACY (Theory)****30 Hrs (2 Hrs/Week)**

Course Code	Course Title	L	T	P	C	Component	Exam	WT		Passing Min. (%)
BP205T	Computer Applications in Pharmacy (Theory) *	3	-	-	3	Theory (75 Marks)	CA	10	10	50
							Sessional-1	15	15	
							Sessional-2	15		
							ESE		50	

Scope:

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

Objectives:

Upon completion of the course the student shall be able to

CO1. Describe² various systems of computer applications and web technologies

CO2. Explain² various types of databases and applications of computer in pharmacy

CO3. Illustrate³ bioinformatics and utilization of various databasis in preclinical development.

CO4. Create⁶ web page an databases using relevant computer programs.

Course content

UNIT	Description	Hours
I	<p>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</p> <p>Concept of Information Systems and Software : Information gathering, requirement and feasibility analysis, data flow diagrams, process specifications, input/output design, process life cycle, planning and managing the project</p>	06
II	<p>Web technologies: Introduction to HTML, XML, CSS and Programming languages, introduction to web servers and Server Products. Introduction to databases, MYSQL, MS ACCESS, Pharmacy Drug database</p>	06
III	<p>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.</p> <p>Diagnostic System, Lab-diagnostic System, Patient Monitoring System, Pharma Information System</p>	06



IV	Bioinformatics: Introduction, Objective of Bioinformatics, Bioinformatics Databases, Concept of Bioinformatics, Impact of Bioinformatics in Vaccine Discovery	06
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V	Computers as data analysis in Preclinical development: Chromatographic data analysis(CDS), Laboratory Information management System (LIMS) and Text Information Management System(TIMs)	06
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Recommended books (Latest edition):

1. Fassett WE, Christensen DB, editors, Campbell WH, Koup JR, Malone PM. **Computer Application in Pharmacy** Philadelphia, PA : Lea & Febiger.
2. Ekins S, editor. **Computer Application in Pharmaceutical Research and Development.** New Jersey: Wiley-Interscience, A John Wiley and Sons, INC., Publication.
3. Rastogi SC, Mendiratta N, Rastogi P. **Bioinformatics Concept, Skills and Applications.** New Delhi: CBS Publishers and Distributors.
4. **Microsoft office Access -2003**, Application Development Using VBA, SQL Server, AP and Infopath –Cary N.Prague – Wiley Dreamtech India (P) Ltd., 4435/7, Ansari Road, Daryagani, New Delhi – 110002

BP210P. COMPUTER APPLICATIONS IN PHARMACY (Practical)

Course Code	Course Title	L	T	P	C	Component	Exam	WT		Passing Min. (%)
BP210P	Computer Applications in Pharmacy (Practical)*	-	-	2	1	Practical (25 Marks)	CA	05	05	50
							Sessional-1	05	05	
							Sessional-2	05		
							ESE		15	

Objectives:

Upon completion of the course the student shall be able to

CO1. Create⁶ web page and databases using relevant computer programs.

CO2. Design⁶ the documents of pharmaceutical importance using suitable computer program.

CO3. Demonstrate³ exporting of various data to web and XML format.

CO4. Demonstrate³ medical coding and modeling of chemical structure.

No.	Description
11.	Design a questionnaire using a word processing package to gather information about a particular disease.
12.	Create a HTML web page to show personal information
13.	Retrieve the information of a drug and its adverse effects using online tools
14.	Creating mailing labels Using Label Wizard , generating label in MS WORD
15.	Create a database in MS Access to store the patient information with the required fields Using access
16.	Design a form in MS Access to view, add, delete and modify the patient record in the database
17.	Generating report and printing the report from patient database
18.	Creating invoice table using – MS Access
19.	Drug information storage and retrieval using MS Access
20.	Creating and working with queries in MS Access
21.	Exporting Tables, Queries, Forms and Reports to web pages
22.	Exporting Tables, Queries, Forms and Reports to XML pages
23.	Medical coding
24.	Modeling of chemical structures

Recommended books (Latest edition):

1. Fassett WE, Christensen DB, editors, Campbell WH, Koup JR, Malone PM. **Computer Application in Pharmacy** Philadelphia, PA : Lea & Febiger.
2. Ekins S, editor. **Computer Application in Pharmaceutical Research and Development**. New Jersey: Wiley-Interscience, A John Wiley and Sons, INC..
3. **Microsoft office Access -2003**, Application Development Using VBA, SQL Server, AP and Infopath – Cary N. Prague – Wiley Dreamtech India (P) Ltd., 4435/7, Ansari Road, Daryagani, New Delhi – 110002