Programme Handbook
Bachelor of Pharmacy (B. Pharm)
School of Health Sciences
Sushant University

(*Applicable to students admitted in the academic year 2024- 2025)

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PRELIMINARY DEFINITIONS AND NOMENCLATURE

In this document, unless the context otherwise requires:

1. "**Programme** "means Degree Programme, that is Bachelor of Pharmacy Degree Programme.
2. "**Discipline**" means specialization or branch of Bachelor of Pharmacy Degree Programme, like Pharmaceutics, Pharmaceutical Chemistry, Pharmacology, Pharmacognosy etc.
3. "**Course**" means a theory or practical subject that is normally studied in a semester, like Pharmaceutical Organic Chemistry etc.
4. **"Director, Academic Affairs"** means the authority of the University who is responsible for all academic activities of the Academic Programmes for implementation of relevant rules of this Regulations pertaining to the Academic Programmes.
5. **"Dean/ Director"** means head of the School concerned.
6. **"PD"** means Programme Director of the respective programme of the School concerned.
7. **"Controller of Examinations (COE)"** means the authority of the University who is responsible for all activities of the University Examinations.
8. **"SU/ University"** means Sushant University
9. **"MSE"**- Mid-Semester Evaluation, "**ESE"**- End Semester Examination**, "SGPA"**-Semester Grade Point Average, "**CGPA"**- Cumulative Grade Point Average, "**TDC"-** Trans Disciplinary Certificate

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1. ADMISSION

1.1. Candidates seeking admission to the first semester of B. Pharm 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**.**

1.2. 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 A.

1.3. Migration/Transfer of candidates from another University approved by UGC shall be granted as per the approval of the School level lateral admissions and Migration Committee (LAMC)

1.4. All Migration/ Transfers are subject to the approval of the Vice Chancellor of SU.

2. STRUCTURE OF PROGRAMME

2.1. Credits requirement

Minimum credit requirement is 208 credits for a student to be eligible to get Under Graduate Degree in B. Pharmacy. 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.

2.2. Categorization of Courses

B. Pharmacy Programme will have a curriculum with syllabi consisting of credits divided into Theory courses, Tutorials, Practical, Practice School and Project over the duration of eight semesters.

Table-II: Semester wise credits distribution

S. No.	Category	Suggested breakup of Credits (Total 213)
1	Core Courses	174
2	Discipline Specific Electives (DSE)	11
3	Dissertation/Project/Internship	12
4	Skill Enhancement Courses (SEC)	06
5	Ability Enhancement courses (AEC)	10
	TOTAL	**213**

Semester	Credit Points
I	**27/29$/30#**
II	29
III	26
IV	28
V	26
VI	26
VII	26
VIII	22
Extracurricular/ Co-curricular activities	01*
Total credit points for the program	**211/213$/214#**

* 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.

2.3 Induction Programme

2.3.1. An induction programme with two weeks duration will be conducted before the commencement of I semester class as per the school curriculum or preference. The following physical activities shall be completed during the induction programme.

I. Physical fitness and Health

- Physical fitness Activities
- Sports/Games Related

II. Culture

- Learning an art form
- Heritage
- Intangible Cultural Heritage

III. Literature& Media

- Literature, Cinema and Media
- Group reading of classics

IV. Social Service

- Social Awareness
- Social Service

V. Self-Development

- Spiritual, Mindfulness & Meditation
- Religion and Inter-faith
- Human Values

- Behavioural and Interpersonal skills
- Lectures

VI. Nature

- Nature Club
- Environment Protection (non-credit course)

VII. Innovation

2.3.2. Other Courses

- Constitution of India
- Universal Human Values
- Indian Traditional Knowledge
- Learning an art form

2.4. Bridge Course/Capstone course

Lecture based Modules for Bridge Courses on Perception and Future Prospects of Health Sciences for students to help bridge the gap of their studies at 10+2 and UG level before the commencement of I semester classes.

1. **Perception and Future Prospects of Health Sciences-11 Modules/ Sessions**

   Lecture 1: Overview of SHS

   Lecture 2: Session on social responsibilities

   Lecture 3: Virtual/Online class etiquettes & LMS

   Lecture4: Skill enhancement/Life skills

   Lecture5: Career Planning and aspiration- SHS

   Lecture 6: Student exchange program

   Lecture7: Expert Talk

   Lecture8: Expert Talk

   Lecture9: Personality development

Lecture 10. Expert Talk

Lecture 11: Relaxation session

2.6. Credit Assignment

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.

2.6.1 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.

2.7 Industrial Training/ Internship (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.

2.8 Practice School

In the VII semester, every candidate shall undergo practice school for a period of 150 hours evenly distributed throughout the semester. The student shall opt any one of the domains for practice school declared by the program committee from time to time. At the end of the practice school, every student shall submit a printed report (in triplicate) on the practice school he/she attended (not more than 25 pages). Along with the exams of semester VII, the

report submitted by the student, knowledge and skills acquired by the student through practice school shall be evaluated by the subject experts at college level and grade point shall be awarded.

2.9. Massive Open Online Courses

Students may be permitted to credit one online course under Massive Open Online Course (which are provided with certificate) subject to a maximum of two credits. The approved list of online courses will be provided by the department from portals like Swayam, NPTEL, edX, Udemy before the commencement of every semester. The credit attained through MOOC course has to be transferred to the mark sheet of their respective semester and will be a compulsory course to meet the programme requirements. In a scenario, where the complete assessment is not done by the MOOC platform the School may conduct its own exam for evaluation of the respective course. The details regarding online courses taken up by students should be sent to the Controller of Examinations one month before the commencement of End Semester Examination.

2.10. Medium of Instruction

The medium of instruction is English for all courses, examinations, seminar presentations and project / thesis / dissertation reports.

3. ATTENDANCE REQUIREMENTS FOR COMPLETION OF THE SEMESTER

3.1. A student who has fulfilled the following conditions shall be deemed to have satisfied the requirements for completion of a semester 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. Every student is expected to attend all classes of all the courses and secure 100% attendance. However, in order to give provision for certain unavoidable reasons such as Medical/ participation in sports, the student is expected to attend at least 80% of the classes.

Therefore, **he/ she shall secure not less than 80%** (after rounding off to the nearest integer) of overall attendance.

3.2. However, a student who secures attendance between 65%and74% in the current semester due to medical reasons (prolonged hospitalization / accident / specific illness) / participation in sports events may be permitted to appear for the current semester examinations subject to the condition that the student shall submit the medical certificate/ sports participation certificate attested by the Dean/Director. The same, after approval of the VC shall be forwarded to the Controller of Examinations for record purposes.

3.3. Except special circumstances as mentioned in clause 3.2, students who secure less than 80% attendance in all the courses of the semester and students who do not satisfy the other requirements as specified by their respective programme shall not

be permitted to write the University examination at the end of the semester. They are required to repeat the incomplete semester in the summer exams, as per the norms prescribed and duly notified by the Controller of Examinations.

4. FACULTY MENTOR

To help the students in planning their courses of study and for general advice on the academic programme, the Dean/Director of the Department will attach a certain number of students to a teacher of the Department who shall function as Faculty mentor for those students throughout their period of study. The Faculty Mentor shall advise the students in registering and reappearance registering of courses, authorize the process, monitor their attendance and progress and counsel them periodically. If necessary, the Faculty Mentor may also discuss with or inform the parents about the progress/performance of the students concerned.

The responsibilities for the faculty mentor shall be:

- To act as the channel of communication between the Dean/Principal and the students of the respective group.
- To collect and maintain various statistical details of students.
- To inform the students about the various facilities and activities available to enhance the student's curricular and co-curricular activities.
- To guide student enrolment and registration of the courses.
- To authorize the final registration of the courses at the beginning of each semester.
- To monitor the academic and general performance of the students including attendance and to counsel them accordingly.

Faculty Mentors 2024-25

Semester	Section	Faculty
1 sem	Sec A	Ms Pooja Bidhlan
	Sec B	Pankaj Malhotra
3 Sem	Sec A	Dr. varsha Kadian
	Sec B	Damini
5 Sem	Sec A	Nikita
	SecB	Asha

7 Sem		Dr.Sunil

5. PROGRAMME COMMITTEE

5.1. 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.

5.2. 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.

5.3. 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.

	Committee Name	Incharge	Members
1	Examination	Mr. Saurabh Saraswat	Dr. Varsha
2	Library	Ms Pooja Bidhlan	Ms Deepti
3	Central store(Purchase/repair)	Ms. Asha	-
4	Sports	Mr. Pankaj Malhotra	Mr. Ashok
5	Intership/Placements	Mr. Ashish	Mr. Ashok
6	Events	Ms Nikita	Ms Anjali
7	Time Table	Dr. Sunil	-
8	Herbal garden	Ms Ekta	-
9	Museum	Ms Anjali	-
10	PCI Inspection	Dr. Pankaj Vyas	Dr. Sunil, Dr. Neelam, Mr. Saurabh, Ms Ketki, Ms Manvi
11	Minutes of meeting	Ms Manvi Aggarwal	-
12	Website update	Mr. Pankaj Malhotra	-
13	Social media update	Ms Nikita Savita	-
14	News letter	Ms Ketki Sahore	Ms. Anjali
15	Research & Publications	Dr. Sunil	Dr. Varsha
16	TDCC	Mr. Ashish	-
17	Inventory Register for classroom and Projector.	Ms. Anjali	-

Committee list for Department of Pharmacy even semester 2024

6. COURSE COMMITTEE FOR COMMON COURSES

Not Applicable

7. EXAMINATION SYSTEM

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

7.2. End semester examinations

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

Tables-III: Schemes for internal assessments and end semester examinations semester wise

Semester I

Course code	Name of the course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Exams		Total	Marks	Duration	
			Marks	Duration				
BP101T	Human Anatomy and Physiology I– Theory	10	15	1 Hr	25	75	3 Hrs	100
BP102T	Pharmaceutical Analysis I – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP103T	Pharmaceutics I – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP104T	Pharmaceutical Inorganic Chemistry – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP105T	Communication skills – Theory *	5	10	1 Hr	15	35	1.5 Hrs	50
BP106RBT BP106RMT	Remedial Biology/ Mathematics – Theory*	5	10	1 Hr	15	35	1.5 Hrs	50
BP107P	Human Anatomy and Physiology – Practical	5	10	4 Hrs	15	35	4 Hrs	50
BP108P	Pharmaceutical Analysis I – Practical	5	10	4 Hrs	15	35	4 Hrs	50
BP109P	Pharmaceutics I – Practical	5	10	4 Hrs	15	35	4 Hrs	50
BP110P	Pharmaceutical Inorganic Chemistry – Practical	5	10	4 Hrs	15	35	4 Hrs	50
BP111P	Communication skills – Practical*	5	5	2 Hrs	10	15	2 Hrs	25
BP112RBP	Remedial Biology – Practical*	5	5	2 Hrs	10	15	2 Hrs	25
	Total	**70/75$^{\$}$/80$^{\#}$**	**115/125$^{\$}$/130$^{\#}$**	**23/24$^{\$}$/26$^{\#}$ Hrs**	**185/200$^{\$}$/210$^{\#}$**	**490/525$^{\$}$/ 540$^{\#}$**	**31.5/33$^{\$}$/ 35$^{\#}$ Hrs**	**675/725$^{\$}$/ 750$^{\#}$**

$^{\#}$Applicable ONLY for the students studied Mathematics / Physics / Chemistry at HSC and appearing for Remedial Biology (RB)course.

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

***** Non University Examination (NUE)

Semester II

Course code	Name of the course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Exams		Total	Marks	Duration	
			Marks	Duration				
BP201T	Human Anatomy and Physiology II – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP202T	Pharmaceutical Organic Chemistry I – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP203T	Biochemistry – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP204T	Pathophysiology – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP205T	Computer Applications in Pharmacy – Theory*	10	15	1 Hr	25	50	2 Hrs	75
BP206T	Environmental sciences – Theory*	10	15	1 Hr	25	50	2 Hrs	75
BP207P	Human Anatomy and Physiology II –Practical	5	10	4 Hrs	15	35	4 Hrs	50
BP208P	Pharmaceutical Organic Chemistry I– Practical	5	10	4 Hrs	15	35	4 Hrs	50
BP209P	Biochemistry – Practical	5	10	4 Hrs	15	35	4 Hrs	50
BP210P	Computer Applications in Pharmacy – Practical*	5	5	2 Hrs	10	15	2 Hrs	25
	Total	**80**	**125**	**20 Hrs**	**205**	**520**	**30 Hrs**	**725**

***** The subject experts at college level shall conduct examinations

Semester III

Course code	Name of the course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Exams		Total	Marks	Duration	
			Marks	Duration				
BP301T	Pharmaceutical Organic Chemistry II – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP302T	Physical Pharmaceutics –Theory	10	15	1 Hr	25	75	3 Hrs	100
BP303T	Pharmaceutical Microbiology – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP304T	Pharmaceutical Engineering – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP305P	Pharmaceutical Organic Chemistry II – Practical	5	10	4 Hr	15	35	4 Hrs	50
BP306P	Physical Pharmaceutics I – Practical	5	10	4 Hr	15	35	4 Hrs	50
BP307P	Pharmaceutical Microbiology – Practical	5	10	4 Hr	15	35	4 Hrs	50
BP308P	Pharmaceutical Engineering – Practical	5	10	4 Hr	15	35	4 Hrs	50
Total		**60**	**100**	**20**	**160**	**440**	**28Hrs**	**600**

Semester IV

Course code	Name of the course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Exams		Total	Marks	Duration	
			Marks	Duration				
BP401T	Pharmaceutical Organic Chemistry III– Theory	10	15	1 Hr	25	75	3 Hrs	100
BP402T	Medicinal Chemistry I – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP403T	Physical Pharmaceutics II – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP404T	Pharmacology I – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP405T	Pharmacognosy I – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP406P	Medicinal Chemistry I – Practical	5	10	4 Hr	15	35	4 Hrs	50
BP407P	Physical Pharmaceutics II – Practical	5	10	4 Hrs	15	35	4 Hrs	50
BP408P	Pharmacology I – Practical	5	10	4 Hrs	15	35	4 Hrs	50
BP409P	Pharmacognosy I – Practical	5	10	4 Hrs	15	35	4 Hrs	50
	Total	**70**	**115**	**21 Hrs**	**185**	**515**	**31 Hrs**	**700**

Semester V

Course code	Name of the course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Exams		Total	Marks	Duration	
			Marks	Duration				
BP501T	Medicinal Chemistry II – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP502T	Industrial Pharmacy I– Theory	10	15	1 Hr	25	75	3 Hrs	100
BP503T	Pharmacology II – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP504T	Pharmacognosy II – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP505T	Pharmaceutical Jurisprudence – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP506P	Industrial Pharmacy– Practical	5	10	4 Hr	15	35	4 Hrs	50
BP507P	Pharmacology II – Practical	5	10	4 Hr	15	35	4 Hrs	50
BP508P	Pharmacognosy II – Practical	5	10	4 Hr	15	35	4 Hrs	50
Total		**65**	**105**	**17 Hr**	**170**	**480**	**27 Hrs**	**650**

Semester VI

Course code	Name of the course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Exams		Total	Marks	Duration	
			Marks	Duration				
BP601T	Medicinal Chemistry III – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP602T	Pharmacology III – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP603T	Herbal Drug Technology – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP604T	Biopharmaceutics and Pharmacokinetics – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP605T	Pharmaceutical Biotechnology– Theory	10	15	1 Hr	25	75	3 Hrs	100
BP606T	Quality Assurance– Theory	10	15	1 Hr	25	75	3 Hrs	100
BP607P	Medicinal chemistry III – Practical	5	10	4 Hrs	15	35	4 Hrs	50
BP608P	Pharmacology III – Practical	5	10	4 Hrs	15	35	4 Hrs	50
BP609P	Herbal Drug Technology – Practical	5	10	4 Hrs	15	35	4 Hrs	50
Total		**75**	**120**	**18 Hrs**	**195**	**555**	**30 Hrs**	**750**

Semester VII

Course code	Name of the course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Exams		Total	Marks	Duration	
			Marks	Duration				
BP701T	Instrumental Methods of Analysis – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP702T	Industrial Pharmacy – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP703T	Pharmacy Practice – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP704T	Novel Drug Delivery System – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP705 P	Instrumental Methods of Analysis – Practical	5	10	4 Hrs	15	35	4 Hrs	50
BP706 PS	Practice School*	25	-	-	25	125	5 Hrs	150
BP 707	Biomedical Waste Management-Practical	-	15	2 Hrs	15	35	2 Hrs	50
Total		**70**	**85**	**10 Hrs**	**155**	**495**	**23 Hrs**	**650**

***** The subject experts at college level shall conduct examinations

Course code	Name of the course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Exams		Total	Marks	Duration	
			Marks	Duration				
BP801T	Biostatistics and Research Methodology – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP802T	Social and Preventive Pharmacy – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP803ET	Pharmaceutical Marketing – Theory	10 + 10 = 20	15 + 15 = 30	1 + 1 = 2 Hrs	25 + 25 = 50	75 + 75 = 150	3 + 3 = 6 Hrs	100 + 100 = 200
BP804ET	Pharmaceutical Regulatory Science – Theory							
BP805ET	Pharmacovigilance – Theory							
BP806ET	Quality Control and Standardization of Herbals – Theory							
BP807ET	Computer Aided Drug Design – Theory							
BP808ET	Cell and Molecular Biology – Theory							
BP809ET	Cosmetic Science – Theory							
BP810ET	Experimental Pharmacology – Theory							
BP811ET	Advanced Instrumentation Techniques – Theory							
BP 812 ET	Dietary supplements and nutraceuticals							
BP813PW	Project Work	-	-	-	-	150	4 Hrs	150

	Total	**40**	**60**	**4Hrs**	**100**	**450**	**16Hrs**	**550**

SEMESTER VIII

8. PROCEDURE FOR AWARDING MARKS FOR INTERNAL ASSESSMENT

8.1. Internal assessment: Continuous mode

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

Table-IV: 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- V: 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

8.2 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)OR	=	10x1=10
			OR
	Objective Type Questions(5x2)	=	05x2=10
	(Answer all the questions)		
I.	Long Answers (Answer1outof2)	=	1x10=10
II.	Short Answers (Answer2outof3)	=	2x5=10
		Total =	30marks

For subjects having Non University Examination

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

Question paper pattern for practical sessional examinations

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

8.3 Promotion and award of grades

A student shall be declared PASS and eligible for getting gradein 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.

8.4 Carry forward of marks

In case a student fails to secure the minimum 50% in any Theory or Practical course, 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.

8.5 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-VI: Tentative schedule of end semester examinations

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

8.6. TDCC Courses

For Inter disciplinary/ transdisciplinary certificate courses the External Assessment Marks will be 40 and Internal Assessment will be 60.

8.7. Internship /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.

8.8. Attendance and Assessment Record

Every teacher is required to upload on ERP the 'ATTENDANCE AND ASSESSMENT RECORD' which consists of attendance marked in each lecture or practical or project work class, the test marks and the record of class work (topic covered), separately for each course. The teacher is also expected to safely keep excel of the attendance and the assessments. The University or any inspection team appointed by the University may verify the records of attendance and assessment of both current and previous semesters.

9. EXAM REGULATIONS

9.1. Requirements for appearing for End Semester Examinations- A student shall normally be permitted to appear for the End Semester Examinations for all the courses registered in the current semester if he/she has satisfied the semester completion requirements.

9.2. The students will be graded under **Grading Scheme** as given below:

9.3 Letter grades and grade points allocations:

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

Table – VII: 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

Lessthan50	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.

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 =

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

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

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

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:

$$\textbf{CGPA}=\frac{C_1S_1+C_2S_2+C_3S_3+C_4S_4+C_5S_5+C_6S_6+C_7S_7+C_8S_8}{\text{---------}}$$

$$C_1+C_2+C_3+ C_4+ C_5+C_6+ C_7+ C_8$$

where C_1, C_2, C_3, is the total number of credits for semester I, II, III, and S_1, S_2, S_3,.is the SGPA of semester I, II, III,

Declaration of class

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

First Class with Distinction	=CGPAof.7.50 and
Above First Class	=CGPAof6.00 to 7.49
Second Class	=CGPAof5.00 to 5.99

9.4. Passing Criterion

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.

9.5. Promotion to Next Year The promotion rules are applicable only for under-graduate programs across the university.

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

2. 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.

3. 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.

4. 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 success fully completed.

5. 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.

6. A lateral entry student shall be eligible to carry forward all the courses of III, IV and V semester still 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.

7. 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.

8. 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 normsspecifiedin26.

9. Any student who has given more than 4chances 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.
10. 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

9.6. Exam Duration

All End Semester Examinations (ESE) would be of three hours duration unless specified otherwise.

9.7. Re-Appearing

There is a provision for re-appearing in the examination (without attending the course-work again) for a course. Re-appearing in examination will be in following cases:

1. A student who fails to meet passing criteria in a course shall be eligible to re-appear in the examination of such course as and when scheduled, with a view to improve the performance.
2. A student who fails to appear in the examination shall be eligible to subsequently re-appear in the examination when scheduled for next batch of students.
3. The latest result obtained by the student in re-appear courses is considered as final and same will be considered for calculating his/her SGPA and CGPA.
4. There is provision of re-conduct of the Mid Semester Evaluation (MSE). **Students who have not passed a course need to take the re-appear of the End Semester Examination (ESE). The previous internal marks shall be carried forward.**
5. A student who has to re-appear in ESE in terms of provisions made above shall be examined as per the syllabus in the scheme of teaching applicable at the time of his/her joining the concerned programme.

9.8. Methods for Redressal of Grievances in Evaluation

<u>Re-Checking/Re-Evaluation of Answer Books of ESE:</u>

1. Student is entitled to ask for re-checking or re-evaluation of any of his/her paper(s) on the payment of prescribed fee within the stipulated time as notified by the Controller of Examinations.

2. If the re-evaluated/ re-checked marks are less than the earlier obtained marks, the same less marks will be treated as final.

9.9. Disciplinary Control of Students in Examinations

1. The student shall maintain proper discipline and orderly conduct during the examinations. They shall not make use of any unfair or dishonest means or indulge in disorderly conduct in the examinations.
2. No student will be allowed to appear in the Examination unless he/she is carrying his/her **ID Card and Admit Card during End Semester Examination**. All the students reappearing in End Term Examination will be allowed with the valid admit card.
3. If a student is found in possession of written/printed matter related to the subject of examination on anything (such as mobile phone, piece of paper or cloth, scribbling pad etc.), other than the answer book, any other response sheet specifically provided by the University to the students, it will be treated as act of unfair means and such cases will be forwarded to Unfair Means Committee.

9.10. Duration of the Programme

The minimum period required for completion of a programme shall be as specified in the Scheme of Teaching and Examination and Syllabi for concerned programme approved by the Academic Council on the recommendations of the Board of Studies.

The maximum number of years within which a student must pass the credit requirements for award of a degree is as follows:

For B. Pharm. total duration of the programme will be n+4 years.

The maximum permissible period includes, academic break, if availed by the student.

9.11. Grade sheet

After results are declared, Grade Sheets will be issued to each student which will contain the following details:

- The list of courses registered during the semester and the grade scored.
- The Grade Point Average (GPA)for the semester.
  The Cumulative Grade Point Average (CGPA)of all courses enrolled from first semester onwards would be shown on the final semester grade sheet.

The Semester performance of a student is indicated as “Semester Grade Point Average (SGPA)”. The SGPA is weighted average of Grade Points of all letter grades awarded to a student for all the Courses in the semester. The formula for Computing SGPA is given below:

$$SGPA = \frac{\text{Grade points secured in the Semester}}{\text{Associated Credits in the Semester}}$$

The overall performance of a student in all the previous Semester(s) including the current Semester is indicated as “Cumulative Grade Point Average (CGPA)". The Cumulative Grade Point Average (CGPA) is the weighted average of grade points of all letter grades awarded to a student for all the courses in the previous Semester(s) including the current Semester. The formula for computing CGPA is given below:

$$CGPA = \frac{\text{Cumulative Grade points secured in all the previous Semester(s) including the Current Semester}}{\text{Associated Credits in the previous Semester(s) including the current Semester}}$$

CGPA to Percentage Conversion Formula is given below:

Percentage (%) = CGPA (X) 10

9.12. Eligibility for the Award of the Degree

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

9.13. Declaration of Result

The university shall strive to declare the results of every examination conducted by it within a period of thirty days from the last date of the examination for that particular programme/course and shall in any case declare the results latest within a period of forty-five days from such date

9.14. Convocation

Convocation of the university shall be held every academic year for conferring degrees, diplomas, certificates and shall be conducted as specified in the Act/Statues. The dates for the convocation (normally within six months) shall be notified well in advance to all the students.

10. PROVISION FOR AUTHORISED BREAK OF STUDY

10.1. 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.

11. DISCIPLINE

Every student is required to observe discipline and decorous behaviour both inside and outside the University and not to indulge in any activity which will tend to bring down the prestige of SU. The disciplinary committee of the University enquires into acts of gross in discipline and notify the University about the disciplinary action taken against the student.

12. REVISION OF REGULATIONS, CURRICULUM AND SYLLABI

The curricula and syllabi for the program shall be prescribed from time to time by Pharmacy Council of India, New Delhi. 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.

13. EXTRA/ CO-CURRICULAR ACTIVITIES OF THE SCHOOL

The Schools may have the activities like Physical Activities (Sports), Cultural, literature and Media, Social Service Scheme (NSS), Self-Development such as Yoga and Human Values, Nature Club, Yoga, etc. focusing on the holistic development of its students. A brief profile of School's respective Committees to be added.

14. PROGRAMME STRUCTURE OF THE RESPECTIVE PROGRAM

SNAPSHOT

Name of the Program – Bachelors of Pharmacy

Duration of the Program – 04 Years

Total Semesters – 08 Semesters

Total Credits of the Program – 214Credits

Color Code	Nature of Courses	Actual Percentage
	Core Courses	82.07%
	Discipline specific elective	5.16%
	Dissertation or Internship	5.66%
	Skill Enhancement Course (SEC)	2.83%
	Ability Enhancement Course (AEC)	4.71%

	Core Courses
	Discipline specific electives
	Dissertation or Internship
	Skill Enhancement Course (SEC)
	Ability Enhancement Compulsory Course (AECC)

Table-IX: 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	-	2
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) (According to PCI)

Table-X: 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*	2	-	2
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)(According to PCI)

Table-XI: 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
BP 308P	Pharmaceutical Engineering –Practical	4	-	2
	Total	**28**	**4**	**24**

Table-XII: 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-XIII: 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 Photochemistry II– Theory	3	1	4
BP505T	Pharmaceutical Jurisprudence – Theory	3	1	4
BP506P	Industrial Pharmacy – Practical	4	-	2
BP507P	Pharmacology II – Practical	4	-	2
BP508P	Pharmacognosy and Phytochemistry II – Practical	4	-	2
	Total	**27**	**5**	**26**

Table-XIV: 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-XV: 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
BP 707	Biomedical Waste Management- Practical	2	-	2
	Total	**30**	**4**	**26**

* Non University Examination (NUE)

Table-XIV: 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			
BP812ET	Dietary Supplements and Nutraceuticals			
BP813PW	Project Work	12	-	6
	Total	**24**	**4**	**22**

Department of Pharmacy
Sushant University, Gurgaon

Bachelor of Pharmacy (B. Pharm.) Curriculum

[Framed under Regulation 6, 7 & 8 of the Bachelor of Pharmacy (B. Pharm) course regulations 2014]

CHAPTER- I: REGULATIONS

1. Short Title andCommencement

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 foradmission

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 aboveexaminations.

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 theprogram

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 andexaminations

Medium of instruction and examination shall be in English.

5. Working days in eachsemester

Each semestershall 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 andprogress

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 respectiveexaminations.

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 perweek.

Credit assignment

Theory and Laboratorycourses

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 of2.

Minimum creditrequirements

The minimum credit points required for award of a B. Pharm. degree is 208. These credits are divided into Theory courses, Tutorials, Practical, Practice School and Projectover 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. Academicwork

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

9. Course ofstudy

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 toVIII.

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**

*****NonUniversity 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
BP 308P	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 PharmacyI– 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 PharmacyI – 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 PharmacyII – 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
BP 707	Biomedical Waste Management- Practical	2	-	2
	Total	**30**	**5**	**26**

***** 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			
BP812ET	Dietary Supplements and Nutraceuticals			
BP813PW	Project Work	12	-	6
	Total	**24**	**4**	**22**

Table-IX: Semester wise credits distribution

Semester	Credit Points
I	**27/29$/30#**
II	29
III	26
IV	28
V	26
VI	26
VII	26
VIII	22
Extracurricular/ Co curricular activities	01*
Total credit points for the program	**211/213$/214#**

* 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. Examinations/Assessments

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

End semesterexaminations

The End Semester Examinations for each theory and practical coursethrough semesters I to VIII shall beconducted 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 theuniversity.

Tables-X: Schemes for internal assessments and end semester examinations semester wise

Semester I

Course code	Name of the course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Exams		Total	Marks	Duration	
			Marks	Duration				
BP101T	Human Anatomy and Physiology I– Theory	10	15	1 Hr	25	75	3 Hrs	100
BP102T	Pharmaceutical Analysis I – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP103T	Pharmaceutics I – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP104T	Pharmaceutical Inorganic Chemistry – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP105T	Communication skills – Theory *	5	10	1 Hr	15	35	1.5 Hrs	50
BP106RBT BP106RMT	Remedial Biology/ Mathematics – Theory*	5	10	1 Hr	15	35	1.5 Hrs	50
BP107P	Human Anatomy and Physiology – Practical	5	10	4 Hrs	15	35	4 Hrs	50
BP108P	Pharmaceutical Analysis I – Practical	5	10	4 Hrs	15	35	4 Hrs	50
BP109P	Pharmaceutics I – Practical	5	10	4 Hrs	15	35	4 Hrs	50
BP110P	Pharmaceutical Inorganic Chemistry – Practical	5	10	4 Hrs	15	35	4 Hrs	50
BP111P	Communication skills – Practical*	5	5	2 Hrs	10	15	2 Hrs	25
BP112RBP	Remedial Biology – Practical*	5	5	2 Hrs	10	15	2 Hrs	25
Total		**70/75$/80#**	**115/125$/130#**	**23/24$/26#Hrs**	**185/200$/210#**	**490/525$/540#**	**31.5/33$/35# Hrs**	**675/725$/750#**

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

$Applicable ONLY for the students studied Physics / Chemistry / Botany / Zoology at HSC and appearing for Remedial Mathematics (RM)course.

***** Non University Examination(NUE)

Semester II

Course code	Name of the course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Exams		Total	Marks	Duration	
			Marks	Duration				
BP201T	Human Anatomy and Physiology II – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP202T	Pharmaceutical Organic Chemistry I – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP203T	Biochemistry – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP204T	Pathophysiology – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP205T	Computer Applications in Pharmacy – Theory*	10	15	1 Hr	25	50	2 Hrs	75
BP206T	Environmental sciences – Theory*	10	15	1 Hr	25	50	2 Hrs	75
BP207P	Human Anatomy and Physiology II –Practical	5	10	4 Hrs	15	35	4 Hrs	50
BP208P	Pharmaceutical Organic Chemistry I– Practical	5	10	4 Hrs	15	35	4 Hrs	50
BP209P	Biochemistry – Practical	5	10	4 Hrs	15	35	4 Hrs	50
BP210P	Computer Applications in Pharmacy – Practical*	5	5	2 Hrs	10	15	2 Hrs	25
Total		**80**	**125**	**20 Hrs**	**205**	**520**	**30 Hrs**	**725**

***** The subject experts at college level shall conductexaminations

Semester III

Course code	Name of the course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Exams		Total	Marks	Duration	
			Marks	Duration				
BP301T	Pharmaceutical Organic Chemistry II – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP302T	PhysicalPharmaceuticsI –Theory	10	15	1 Hr	25	75	3 Hrs	100
BP303T	Pharmaceutical Microbiology – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP304T	Pharmaceutical Engineering – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP305P	Pharmaceutical Organic Chemistry II – Practical	5	10	4 Hr	15	35	4 Hrs	50
BP306P	Physical Pharmaceutics I – Practical	5	10	4 Hr	15	35	4 Hrs	50
BP307P	Pharmaceutical Microbiology – Practical	5	10	4 Hr	15	35	4 Hrs	50
BP308P	Pharmaceutical Engineering – Practical	5	10	4 Hr	15	35	4 Hrs	50
Total		**60**	**100**	**20**	**160**	**440**	**28Hrs**	**600**

Semester IV

Course code	Name of the course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Exams		Total	Marks	Duration	
			Marks	Duration				
BP401T	Pharmaceutical Organic Chemistry III– Theory	10	15	1 Hr	25	75	3 Hrs	100
BP402T	Medicinal Chemistry I – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP403T	Physical Pharmaceutics II – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP404T	Pharmacology I – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP405T	Pharmacognosy I – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP406P	Medicinal Chemistry I – Practical	5	10	4 Hr	15	35	4 Hrs	50
BP407P	Physical Pharmaceutics II – Practical	5	10	4 Hrs	15	35	4 Hrs	50
BP408P	Pharmacology I – Practical	5	10	4 Hrs	15	35	4 Hrs	50
BP409P	Pharmacognosy I – Practical	5	10	4 Hrs	15	35	4 Hrs	50
Total		**70**	**115**	**21 Hrs**	**185**	**515**	**31 Hrs**	**700**

Semester V

Course code	Name of the course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Exams		Total	Marks	Duration	
			Marks	Duration				
BP501T	Medicinal Chemistry II – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP502T	Industrial PharmacyI– Theory	10	15	1 Hr	25	75	3 Hrs	100
BP503T	Pharmacology II – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP504T	Pharmacognosy II – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP505T	Pharmaceutical Jurisprudence– Theory	10	15	1 Hr	25	75	3 Hrs	100
BP506P	Industrial PharmacyI– Practical	5	10	4 Hr	15	35	4 Hrs	50
BP507P	Pharmacology II – Practical	5	10	4 Hr	15	35	4 Hrs	50
BP508P	Pharmacognosy II – Practical	5	10	4 Hr	15	35	4 Hrs	50
Total		**65**	**105**	**17 Hr**	**170**	**480**	**27 Hrs**	**650**

Semester VI

Course code	Name of the course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Exams		Total	Marks	Duration	
			Marks	Duration				
BP601T	Medicinal Chemistry III – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP602T	Pharmacology III – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP603T	Herbal Drug Technology – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP604T	Biopharmaceutics and Pharmacokinetics – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP605T	Pharmaceutical Biotechnology– Theory	10	15	1 Hr	25	75	3 Hrs	100
BP606T	Quality Assurance– Theory	10	15	1 Hr	25	75	3 Hrs	100
BP607P	Medicinal chemistry III – Practical	5	10	4 Hrs	15	35	4 Hrs	50
BP608P	Pharmacology III – Practical	5	10	4 Hrs	15	35	4 Hrs	50
BP609P	Herbal Drug Technology – Practical	5	10	4 Hrs	15	35	4 Hrs	50
Total		**75**	**120**	**18 Hrs**	**195**	**555**	**30 Hrs**	**750**

Semester VII

Course code	Name of the course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Exams		Total	Marks	Duration	
			Marks	Duration				
BP701T	Instrumental Methods of Analysis – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP702T	Industrial Pharmacy – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP703T	Pharmacy Practice – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP704T	Novel Drug Delivery System – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP705 P	Instrumental Methods of Analysis – Practical	5	10	4 Hrs	15	35	4 Hrs	50
BP706 PS	Practice School*	25	-	-	25	125	5 Hrs	150
BP 707	Biomedical Waste Management-Practical	-	15	2 Hrs	15	35	2 Hrs	50
Total		**70**	**85**	**10Hrs**	**155**	**495**	**23 Hrs**	**650**

***** The subject experts at college level shall conductexaminations

Semester VIII

Course code	Name of the course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Exams		Total	Marks	Duration	
			Marks	Duration				
BP801T	Biostatistics and Research Methodology – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP802T	Social and Preventive Pharmacy – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP803ET	Pharmaceutical Marketing – Theory	10 + 10 = 20	15 + 15 = 30	1 + 1 = 2 Hrs	25 + 25 = 50	75 + 75 = 150	3 + 3 = 6 Hrs	100 + 100 = 200
BP804ET	Pharmaceutical Regulatory Science – Theory							
BP805ET	Pharmacovigilance – Theory							
BP806ET	Quality Control and Standardization of Herbals – Theory							
BP807ET	Computer Aided Drug Design – Theory							
BP808ET	Cell and Molecular Biology – Theory							
BP809ET	Cosmetic Science – Theory							
BP810ET	Experimental Pharmacology – Theory							
BP811ET	Advanced Instrumentation Techniques – Theory							
BP812ET	Dietary Supplements and Nutraceuticals							
BP813PW	Project Work	-	-	-	-	150	4 Hrs	150
	Total	**40**	**60**	**4 Hrs**	**100**	**450**	**16 Hrs**	**550**

Internal assessment: Continuous mode

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

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

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 Sessionalexaminations

Forsubjects having Universityexamination

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

For subjects having Non University Examination

I. Long Answers (Answer 1 out of 2)	=	1 x 10 = 10
II. Short Answers (Answer 4 out of 6)	=	4x5 =20
Total	=	30 marks

Question paper pattern for practical sessional examinations

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

11. Promotion and award of grades

A student shall be declared PASS and eligible for getting gradein 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.

12. Carry forward of marks

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

13. Improvement of internal assessment

A studentshall have the opportunity to improvehis/her performance only oncein 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.

14. Re-examination of end semester examinations

Reexamination ofend semester examinationshall be conducted as per the schedule given in table XIII. The exact dates of examinations shall be notified from time totime.

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 theoryexaminations

For 75 markspaper

I. Multiple Choice Questions(MCQs) = 20 x1 = 20
OR OR
Objective Type Questions (10 x 2) = 10x2 =20
(Answer all the questions)
II. Long Answers (Answer 2 out of 3) = 2 x 10 = 20
III. Short Answers (Answer 7 out of 9) = 7x5 =35

Total = 75 marks

For 50 markspaper

I. Long Answers (Answer 2 out of3) = 2 x 10 =20
II. Short Answers (Answer 6 out of8) = 6x5 =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) = 5x5 =25

Total = 35 marks

Question paper pattern for end semester practical examinations

I. Synopsis = 5
II. Experiments = 25
III. Viva voce = 5

Total = 35 marks

15. AcademicProgression:

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 successfullycompleted.

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 successfullycompleted.

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 successfullycompleted.

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 in26.

Any student who hasgiven 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 anysemester.

Note: Grade ABshould 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 anysemester.

17. Grading ofperformances

Letter grades and grade pointsallocations:

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

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

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

A learner who remains absent for any end semester examination shall be assigned a letter grade of ABand 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 obtainedin 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 pointsin these courses are G1, G2, G3, G4 and G5, respectively, and then students' SGPA is equalto:

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

The SGPA is calculated to two decimal points.It should be noted that, the SGPA for any semester shall take into consideration the F and ABSgrade awarded in that semester. For example if a learner has a F or ABS grade in course 4, theSGPA 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 statusin case of F grade(s),till the course(s) is/are passed. When the course(s)is/are passedby obtaining a pass grade on subsequent examination(s) theCGPA shall only reflect the new grade and not the fail grades earned earlier.The CGPA is calculatedas:

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

where $C_1, C_2, C_3,\ldots$ is the total number of credits for semester I,II,III,…. and $S_1,S_2, S_3,\ldots$is the SGPA of semester I,II,III,…. .

20. Declaration ofclass

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

First ClasswithDistinction	= CGPA of. 7.50 andabove
FirstClass	= CGPA of 6.00 to7.49
SecondClass	= CGPA of 5.00 to5.99

21. Projectwork

All the students shall undertake a projectunder 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 givenbelow.

Evaluation of Dissertation Book:

Objective(s) of theworkdone		15Marks
Methodologyadopted		20Marks
Results andDiscussions		20Marks
ConclusionsandOutcomes		20Marks
	Total	**75Marks**

Evaluation of Presentation:

Presentationofwork		25Marks
Communication skills		20Marks
Question andanswerskills		30Marks
	Total	**75Marks**

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 aPharmaceuticalIndustry/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. PracticeSchool

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

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 leveland grade point shall be awarded.

24. Award ofRanks

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 ofRanks.

25. Award ofdegree

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 ofstudy

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 freshRegistration.

27. Re-admission after break ofstudy

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 requiredfees.

CHAPTER - II: SYLLABUS

MISSION – SUSHANT UNIVERSITY:

M1: Transform lives and communities through education and research

M2: Achieve excellence through participatory governance and focus on quality research and innovation

M3: Attract talent through international partnerships and collaborations to achieve highest standards

M4: Facilitate learning through student centric and empathetic approach

M5: Develop thought leadership with industry integration

PROGRAM EDUCATIONAL OUTCOMES:

PEO1: To provide students with competence of technical skills of various disciplines of Pharmaceutics, Pharmaceutical Chemistry, Pharmacology and Pharmacognosy to meet the requirements of Industries, Community and Hospital.

PEO2: To prepare students to utilize their abilities in postgraduate programs and technical professions.

PEO3: To develop the ability in pharmacy graduates to assess benefits and deficiencies of the subject matters they studied and philosophies they observed in the field of pharmaceutical sciences.

Mapping of Mission Statement of Ansal University to Programme Outcomes:

PEO / M	**PEO1**	**PEO2**	**PEO3**
M1	H	H	M
M2	M	H	M
M3	M	M	L
M4	H	H	H
M5	M	M	H

PROGRAME SPECIFIC OUTCOMES:

PSO1: To implement the Pharmaceutical knowledge in formulating the best suitable dosage form by research oriented activities.

PSO2: To service the public by providing patient centric effective treatments for improving their health and well-being of society.

PSO3: To build and shape lifelong career of personal and practicing professional growth with ethical codes and self-esteem.

Mappimg of PEOs with PSOs:

PSO / PEO	PSO1	PSO2	PSO3
PEO1	H	M	L
PEO2	H	M	M
PEO3	L	M	H

PROGRAMME OUTCOMES (POs):

PO 01: To develop graduates with high practical capabilities inculcated with strong hold on fundamental concepts of Pharmaceutical sciences.

PO 02: Able to apply technical skills learned during the course to correlate interdisciplinary approach for solving complex problems of research in pharmaceutical sciences.

PO 03: Inculcate professional and ethical values as a pharmacist as well as knowledge and skills to successfully practice the profession of pharmacy.

PO 04: Able to communicate effectively, provide adequate technical information for patient counselling and effective participation in health care programs.

PO 05: To impart knowledge of formulation, synthesis and evaluation of drugs of synthetic/ herbal origin along with their identification, purification and isolation.

PO 06: To train students as per industrial expectations and entrepreneurship establishment.

PO 07: Understand the ongoing recent advancements in the field of medicine for patient benefit and encouraged for novel innovations

PO 08: To develop students with critical thinking skills by integrated technical knowledge obtained during course of study.

PO 09: Students understand different dosage forms, Pharmaceutical preparations, and their route of administration, mechanism of action and Bioavailability concept in conjunction with human anatomy and physiology.

PO 10: Understand various regulatory guidelines for import and export of drugs, clinical trials, cultivation and collection of drugs, IPR, QA & QC and various laws governing pharmacy profession.

Mapping of PSOs with POs:

PO / PSO	**PO 01**	**PO 02**	**PO 03**	**PO 04**	**PO 05**	**PO 06**	**PO 07**	**PO 08**	**PO 09**	**PO 10**
PSO1	H	M	M	H	L	L	M	H	L	L
PSO2	H	H	M	H	L	L	M	H	H	M
PSO3	H	M	L	H	L	M	M	H	H	L

Semester I

BP101T. HUMAN ANATOMY AND PHYSIOLOGY-I (Theory)

45 Hours

Sushant University soaring high	**School of Health Sciences** **Bachelor of Pharmacy**

Course Title: HUMAN ANATOMY AND PHYSIOLOGY-I			
Semester: I	**Course code: BP 101 T**	**Credits: 6**	**Core / Elective: Core**
No. of lectures/ tutorials: 4/week		**No. of practical hours: 4/week**	
Course Pre-requisites: None			

COURSE OUTCOMES (COs):

Upon completion of this course the student should be able to

CO01: Explain the gross morphology, structure and functions of various organs of the human body.

CO02: Describe the various homeostatic mechanisms and theirimbalances.

CO03: Identify the various tissues and organs of different systems of humanbody.

CO04: Perform the various experiments related to special senses and nervoussystem.

CO05: Appreciate coordinated working pattern of different organs of eachsystem

Mapping	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10
CO 01	H	M	M	H	L	L	M	H	H	L
CO 02	H	M	M	H	L	L	M	H	H	L
CO 03	H	M	M	H	L	L	M	H	H	L
CO 04	M	H	H	L	L	H	H	H	H	H
CO 05	H	H	M	H	L	L	H	H	H	L

Course Content:

UnitI **10 hours**

- **Introduction to humanbody**
  Definition and scope of anatomy and physiology, levels of structural organization and body systems, basic life processes, homeostasis, basic anatomical terminology.
- **Cellular level oforganization**
  Structure and functions of cell, transport across cell membrane, cell division,

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

- **Tissue level oforganization**

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

Unit II **10 hours**

- **Integumentarysystem**

  Structure and functions ofskin

- **Skeletalsystem**

  Divisions of skeletal system, types of bone, salient features andfunctions of bones of axial and appendicular skeletalsystem

Organization of skeletal muscle, physiology of muscle contraction, neuromuscular junction

- **Joints**
  Structural and functional classification, types of joints movements and its articulation

UnitIII **10 hours**

- **Body fluids and blood**
- Body fluids, composition and functions of blood, hemopoeisis, formation of hemoglobin, anemia, mechanisms of coagulation, blood grouping, Rh factors, transfusion, its significance and disorders of blood, Reticulo endothelialsystem.
- **Lymphaticsystem**

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

UnitIV **08 hours**

Peripheral nervous system:

Classification of peripheral nervous system: Structure and functions of sympathetic and parasympathetic nervous system.
Origin and functions of spinal and cranial nerves.

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

UnitV **07 hours**

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

BP107P. HUMAN ANATOMY AND PHYSIOLOGY (Practical)

4 Hours/week

Practical physiology is complimentary to the theoretical discussionsin physiology. Practicals allow the verification of physiological processes discussed in theory classes through experiments on living tissue, intact animals or normal human beings. This is helpful for developing an insight on thesubject**.**

1. Study of compoundmicroscope.
2. Microscopic study of epithelial and connectivetissue
3. Microscopic study of muscular and nervoustissue
4. Identification of axialbones
5. Identification of appendicularbones

6. Introduction tohemocytometry.
7. Enumeration of white blood cell (WBC)count
8. Enumeration of total red blood corpuscles (RBC)count
9. Determination of bleedingtime
10. Determination of clottingtime
11. Estimation of hemoglobincontent
12. Determination of bloodgroup.
13. Determination of erythrocyte sedimentation rate(ESR).
14. Determination of heart rate and pulserate.
15. Recording of bloodpressure.

Recommended Books (Latest Editions)

1. Essentials of Medical Physiology by K. Sembulingam and P. Sembulingam. Jaypee brothers medical publishers, New Delhi.
2. Anatomy and Physiology in Health and Illness by Kathleen J.W. Wilson, Churchill Livingstone, NewYork
3. Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co,Riverview,MIUSA
4. Text book of Medical Physiology- Arthur C,Guyton andJohn.E. Hall. Miamisburg, OH, U.S.A.
5. Principles of Anatomy and Physiology byTortora Grabowski. Palmetto, GA, U.S.A.

6. Textbook of Human Histology by Inderbir Singh, Jaypee brother's medical publishers, NewDelhi.
7. Textbook of Practical Physiology by C.L. Ghai, Jaypee brother's medical publishers, NewDelhi.
8. Practical workbook of Human Physiology by K. Srinageswari and Rajeev Sharma, Jaypee brother's medical publishers, NewDelhi.

Reference Books (Latest Editions)

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

BP102T. PHARMACEUTICAL ANALYSIS (Theory)

45 Hours

Sushant University soaring high	**School of Health Sciences** **Bachelor of Pharmacy**		
Course Title: PHARMACEUTICAL ANALYSIS			
Semester: I	**Course code: BP 102 T**	**Credits: 6**	**Core / Elective: Core**
No. of lectures/ tutorials: 4/week		**No. of practical hours: 4/week**	
Course Pre-requisites: None			

COURSE OUTCOMES (COs):

Upon completion of the course student shall be able to

CO 01: understand the principles of volumetric and electro chemicalanalysisand develop analyticalskills

CO 02: carryout various volumetric and electrochemicaltitrations

CO 03: learn to determine purity, concentration, precision and accuracy in preparing standards

Mapping	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10
CO 01	H	H	H	L	H	L	L	M	M	L
CO 02	H	M	H	M	H	L	L	M	L	L
CO 03	M	H	H	L	H	L	M	H	L	L

Course Content:

UNIT-I **10Hours**

(a) Pharmaceutical analysis- Definition andscope

i) Different techniques ofanalysis

ii) Methods of expressingconcentration

iii) Primary and secondarystandards.

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

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

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

UNIT-II **10Hours**

- **Acid base titration**: Theories of acid base indicators, classification of acid base titrations and theory involved in titrations of strong, weak,and very weak acids and bases, neutralizationcurves
- **Non aqueous titration**: Solvents, acidimetry and alkalimetry titration and estimation of Sodium benzoate and EphedrineHCl

UNIT-III **10Hours**

- **Precipitation titrations**: Mohr's method, Volhard's, Modified Volhard's, Fajans method, estimation of sodiumchloride.
- **Complexometric titration**: Classification, metal ion indicators, masking and demasking reagents, estimation of Magnesium sulphate, and calcium gluconate.
- **Gravimetry**: Principle and steps involved in gravimetric analysis. Purity of the precipitate: co-precipitation and post precipitation, Estimation of bariumsulphate.

- Basic Principles, methods and application of diazotisationtitration.

UNIT-IV **08Hours**

Redox titrations

(a) Concepts of oxidation andreduction

(b) Types of redox titrations (Principles andapplications)

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

UNIT-V **07Hours**

- **Electrochemical methods ofanalysis**
  - **Conductometry**- Introduction, Conductivity cell, Conductometric titrations,applications.
  - **Potentiometry -** Electrochemical cell, construction and working of reference (Standard hydrogen, silver chloride electrode and calomel electrode) and indicator electrodes (metal electrodes and glass electrode), methods to determine end point of potentiometric titration andapplications.
  - **Polarography** - Principle, Ilkovic equation, construction and working of dropping mercury electrode and rotating platinum electrode,applications

BP108P. PHARMACEUTICAL ANALYSIS (Practical)

4 Hours / Week

I Limit Test of thefollowing

(1) Chloride
(2) Sulphate
(3) Iron
(4) Arsenic

II Preparation and standardizationof

(1) Sodiumhydroxide
(2) Sulphuricacid
(3) Sodiumthiosulfate
(4) Potassiumpermanganate
(5) Ceric ammonium sulphate

III Assay of the following compounds along with Standardization ofTitrant

(1) Ammonium chloride by acid basetitration
(2) Ferrous sulphate byCerimetry
(3) Copper sulphate byIodometry
(4) Calcium gluconate bycomplexometry
(5) Hydrogen peroxide byPermanganometry
(6) Sodium benzoate by non-aqueoustitration
(7) Sodium Chloride by precipitationtitration

IV Determination of Normality by electro-analyticalmethods

(1) Conductometric titration of strong acid against strongbase
(2) Conductometric titration of strong acid and weak acid against strongbase
(3) Potentiometric titration of strong acid against strongbase

Recommended Books: (Latest Editions)

1. A.H. Beckett & J.B. Stenlake's, Practical Pharmaceutical Chemistry Vol I &II, Stahlone Press of University ofLondon
2. A.I. Vogel, Text Book of Quantitative Inorganicanalysis
3. P. Gundu Rao, Inorganic PharmaceuticalChemistry
4. Bentley and Driver's Textbook of PharmaceuticalChemistry
5. John H. Kennedy, Analytical chemistryprinciples
6. IndianPharmacopoeia.

BP103T. PHARMACEUTICS- I (Theory)

45 Hours

Sushant University soaring high	**School of Health Sciences** **Bachelor of Pharmacy**		
Course Title: PHARMACEUTICS- I			
Semester: I	**Course code: BP 103 T**	**Credits: 6**	**Core / Elective: Core**
No. of lectures/ tutorials: 4/week		**No. of practical hours: 4/week**	
Course Pre-requisites: None			

COURSE OUTCOMES (COs):

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

CO 01: Know the history of profession ofpharmacy

CO 02: Understand the basics of different dosage forms, pharmaceutical incompatibilities and pharmaceuticalcalculations

CO 03: Understand the professional way of handling theprescription

CO 04: Preparation of various conventional dosageforms

Mapping	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10
CO 01	M	L	L	L	L	H	L	L	L	L
CO 02	H	M	H	M	H	M	M	L	H	L
CO 03	M	L	L	H	H	L	L	M	H	L
CO 04	H	M	M	L	H	H	L	L	H	L

Course Content:

UNIT– I **10Hours**

- **Historical background and development of profession of pharmacy**: History of profession of Pharmacy in India in relation to pharmacy education, industry and organization, Pharmacy as a career, Pharmacopoeias: Introduction to IP, BP, USP and ExtraPharmacopoeia.
- **Dosage forms:** Introduction to dosage forms, classification anddefinitions

- **Prescription:** Definition, Parts of prescription, handling of Prescriptionand Errors inprescription.
- **Posology:** Definition, Factors affecting posology. Pediatric dosecalculations based on age, body weight and body surfacearea.

UNIT– II **10Hours**

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

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

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

UNIT– III **08Hours**

- **Monophasic liquids:** Definitions and preparations of Gargles, Mouthwashes, Throat Paint, Eardrops, Nasal drops, Enemas, Syrups, Elixirs, Liniments and Lotions.
- **Biphasicliquids:**
- **Suspensions:** Definition, advantages and disadvantages, classifications, Preparation of suspensions; Flocculated and Deflocculated suspension & stability problems and methods toovercome.
- **Emulsions:** Definition, classification, emulsifying agent, test for the identification of type ofEmulsion, Methods of preparation & stability problems and methods to overcome.

UNIT– IV **08Hours**

- **Suppositories**: Definition, types, advantages and disadvantages, types of bases, methods of preparations. Displacement value & its calculations, evaluation of suppositories.
- **Pharmaceutical incompatibilities**: Definition, classification, physical, chemical and therapeutic incompatibilities withexamples.

UNIV– V **07Hours**

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

BP109P. PHARMACEUTICSI(Practical)

3 Hours / week

1 .Syrups

a) SyrupIP'66

b) Compound syrup of Ferrous PhosphateBPC'68

2. Elixirs a) Piperazine citrateelixir

b) Paracetamol pediatric elixir

3.Linctus a) Terpin Hydrate LinctusIP'66

b) Iodine Throat Paint (Mandles Paint)

4. Solutions

a) Strong solution of ammoniumacetate

b) Cresol with soapsolution

c) Lugol'ssolution

5. Suspensions

a) Calaminelotion

b) Magnesium Hydroxidemixture

c) Aluminimum Hydroxidegel

6. Emulsions a) TurpentineLiniment

b) Liquid paraffin emulsion

7. Powders and Granules

a) ORS powder(WHO)

b) Effervescentgranules

c)Dustingpowder

d)Divdedpowders

8. Suppositories

a) Glycero gelatinsuppository

b) Coca buttersuppository

c) Zinc Oxidesuppository

8. Semisolids

a) Sulphurointment

b) Non staining-iodine ointment with methylsalicylate

c) Carbopalgel

9. Gargles andMouthwashes

a) Iodinegargle

b) Chlorhexidinemouthwash

Recommended Books: (Latest Editions)

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

BP104T. PHARMACEUTICAL INORGANIC CHEMISTRY (Theory)

45 Hours

Sushant University soaring high	**School of Health Sciences** **Bachelor of Pharmacy**

Course Title: PHARMACEUTICAL INORGANIC CHEMISTRY			
Semester: I	**Course code: BP 104 T**	**Credits: 6**	**Core / Elective: Core**
No. of lectures/ tutorials: 4/week		**No. of practical hours: 4/week**	
Course Pre-requisites: None			

COURSE OUTCOMES (COs):

Upon completion of course student shall be able to

CO 01: know the sources of impurities and methods to determine the impurities ininorganic drugs and pharmaceuticals

CO 02: understand the medicinal and pharmaceutical importance of inorganiccompounds

CO 03: prepare the simple inorganic compounds of pharmaceutical use

Mapping	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10
CO 01	H	H	L	L	H	H	M	L	L	L
CO 02	H	M	L	L	H	H	L	L	L	L
CO 03	H	H	L	L	H	H	L	L	M	L

Course Content:

UNITI **10Hours**

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

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

UNITII **10Hours**

- **Acids, Bases and Buffers:** Buffer equations and buffer capacity in general, buffers in pharmaceutical systems, preparation, stability, buffered isotonic solutions, measurements of tonicity, calculations and methods of adjusting isotonicity.
- **Major extra and intracellular electrolytes**: Functions of major physiological ions, Electrolytes used in the replacement therapy: Sodium chloride*, Potassium chloride, Calcium gluconate* and Oral Rehydration Salt (ORS), Physiological acid basebalance.
- **Dental products**: Dentifrices, role of fluoride in the treatment of dental caries, Desensitizing agents, Calcium carbonate, Sodium fluoride, and Zinc eugenolcement.

UNITIII **10Hours**

- **Gastrointestinalagents**

  Acidifiers: Ammonium chloride* and Dil. HCl

  Antacid: Ideal properties of antacids, combinations of antacids,Sodium

Bicarbonate*, Aluminum hydroxide gel, Magnesium hydroxide mixture

Cathartics: Magnesium sulphate, Sodium orthophosphate, Kaolin and Bentonite

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

UNITIV **08Hours**

- **Miscellaneouscompounds**

Expectorants: Potassium iodide, Ammonium chloride*.

Emetics: Copper sulphate*, Sodium potassium tartarate

Haematinics: Ferrous sulphate*, Ferrous gluconate

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

Astringents: Zinc Sulphate, Potash Alum

UNITV **07Hours**

- **Radiopharmaceuticals**: Radio activity, Measurement of radioactivity, Properties of α, β, γ radiations, Half life, radio isotopes and study of radio isotopes - Sodium iodide I^{131}, Storage conditions, precautions & pharmaceutical application of radioactivesubstances.

BP110P. PHARMACEUTICAL INORGANIC CHEMISTRY (Practical)

4 Hours / Week

I **Limit tests for followingions**

Limit test for Chlorides and Sulphates
Modified limit test for Chlorides and Sulphates
Limit test for Iron
Limit test for Heavymetals
Limit test forLead
Limit test forArsenic

II **Identification test**

Magnesium hydroxide
Ferrous sulphate
Sodium bicarbonate
Calcium gluconate
Copper sulphate

III **Test forpurity**

Swelling power of Bentonite
Neutralizing capacity of aluminum hydroxide gel
Determination of potassium iodate and iodine in potassium
Iodide IV **Preparation of inorganicpharmaceuticals**

Boric acid
Potash alum
Ferrous sulphate

Recommended Books (Latest Editions)

1. A.H. Beckett & J.B. Stenlake's, Practical Pharmaceutical Chemistry Vol I &II, Stahlone Press of University of London, 4th edition.
2. A.I. Vogel, Text Book of Quantitative Inorganic analysis
3. P. Gundu Rao, Inorganic Pharmaceutical Chemistry, 3rd Edition
4. M.L Schroff, Inorganic PharmaceuticalChemistry
5. Bentley and Driver's Textbook of PharmaceuticalChemistry
6. Anand & Chatwal, Inorganic PharmaceuticalChemistry
7. Indian Pharmacopoeia

BP105T.COMMUNICATION SKILLS (Theory)

30 Hours

Sushant University soaring high	**School of Health Sciences** **Bachelor of Pharmacy**		
Course Title: COMMUNICATION SKILLS			
Semester: I	**Course code: BP 105 T**	**Credits: 3**	**Core / Elective: Core**
No. of lectures/ tutorials: 2/week		**No. of practical hours: 2/week**	
Course Pre-requisites: None			

COURSE OUTCOMES (COs)

Upon completion of the course the student shall be able to

CO 01: Understand the behavioral needs for a Pharmacist to function effectively in the areas of pharmaceuticaloperation

CO 02: Communicate effectively (Verbal and NonVerbal)

CO 03: Effectively manage the team as a teamplayer

CO 04: Develop interviewskills

CO 05: Develop Leadership qualities andessentials

Mapping	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10
CO 01	L	L	H	H	L	M	H	L	L	L
CO 02	L	L	H	H	L	H	H	L	L	L
CO 03	L	L	H	H	L	M	H	L	L	L
CO 04	L	L	H	H	L	L	L	L	L	L
CO 05	L	L	H	H	L	H	M	L	L	L

Course content:

UNIT– I **07Hours**

- **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, Emotionalbarriers

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

UNIT– II **07Hours**

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

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

UNIT– III **07Hours**

- **Basic Listening Skills:** Introduction, Self-Awareness, Active Listening, Becoming an Active Listener, Listening in DifficultSituations
- **Effective Written Communication:** Introduction, When and When Not to Use Written Communication - Complexity of the Topic, Amount of Discussion' Required, Shades of Meaning, FormalCommunication
- **Writing Effectively:** Subject Lines, Put the Main Point First, Know Your Audience, Organization of theMessage

UNIT– IV **05Hours**

- **Interview Skills:** Purpose of an interview, Do's and Dont's of aninterview
- **Giving Presentations:** Dealing with Fears, Planning your Presentation, Structuring Your Presentation, Delivering Your Presentation, Techniques ofDelivery

UNIT– V **04Hours**

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

BP111P.COMMUNICATION SKILLS (Practical)

2 Hours / week

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

Basic communication covering the following topics

Meeting People

Asking Questions

Making Friends

What did you do?

Do's and Dont's

Pronunciations covering the following topics

Pronunciation (Consonant Sounds)

Pronunciation and Nouns

Pronunciation (Vowel Sounds)

Advanced Learning

Listening Comprehension / Direct and Indirect Speech

Figures of Speech

Effective Communication

Writing Skills

Effective Writing

Interview Handling Skills

E-Mail etiquette

Presentation Skills

Recommended Books: (Latest Edition)

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

BP 106RBT.REMEDIAL BIOLOGY (Theory)

30 Hours

Sushant University soaring high	**School of Health Sciences** **Bachelor of Pharmacy**		
Course Title: REMEDIAL BIOLOGY			
Semester: I	**Course code: BP 106 T**	**Credits: 3**	**Core / Elective: Core**
No. of lectures/ tutorials: 2/week		**No. of practical hours: 2/week**	
Course Pre-requisites: None			

COURSE OUTCOMES (COs):

Upon completion of the course, the student shall be able to

CO 01: know the classification and salient features of five kingdoms oflife

CO 02: understand the basic components of anatomy & physiology ofplant

CO 03: know understand the basic components of anatomy & physiology animalwith special reference tohuman

Mapping	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10
CO 01	L	M	L	L	H	M	L	L	H	L
CO 02	H	M	L	L	H	M	L	L	H	L
CO 03	H	M	L	L	H	L	H	M	H	L

Course content:

UNITI **07Hours**

Living world:

- Definition and characters of livingorganisms
- Diversity in the livingworld
- Binomialnomenclature
- Five kingdoms of life and basis of classification. Salient features of Monera, Potista, Fungi, Animalia and Plantae,Virus,

Morphology of Flowering plants

- Morphology of different parts of flowering plants – Root, stem,inflorescence, flower, leaf, fruit,seed.
- General Anatomy of Root, stem, leaf of monocotyledons &Dicotylidones.

UNITII **07Hours**

Body fluids and circulation

- Composition of blood, blood groups, coagulation ofblood
- Composition and functions oflymph
- Human circulatorysystem
- Structure of human heart and bloodvessels
- Cardiac cycle, cardiac output andECG

Digestion and Absorption

- Human alimentary canal and digestiveglands
- Role of digestiveenzymes
- Digestion, absorption and assimilation of digestedfood

Breathing and respiration

- Human respiratorysystem
- Mechanism of breathing and itsregulation
- Exchange of gases, transport of gases and regulation ofrespiration
- Respiratoryvolumes

UNITIII **07Hours**

Excretory products and their elimination

- Modes ofexcretion
- Human excretory system- structure andfunction
- Urineformation
- Rennin angiotensinsystem

Neural control and coordination

- Definition and classification of nervoussystem
- Structure of aneuron
- Generation and conduction of nerveimpulse
- Structure of brain and spinalcord
- Functions of cerebrum, cerebellum, hypothalamus and medullaoblongata

Chemical coordination and regulation

- Endocrine glands and theirsecretions
- Functions of hormones secreted by endocrineglands

Human reproduction

- Parts of female reproductivesystem
- Parts of male reproductivesystem
- Spermatogenesis andOogenesis
- Menstrualcycle

UNITIV **05Hours**

Plants and mineral nutrition:

- Essential mineral, macro andmicronutrients
- Nitrogen metabolism, Nitrogen cycle, biological nitrogenfixation

Photosynthesis

- Autotrophic nutrition, photosynthesis, Photosynthetic pigments, Factors affecting photosynthesis.

UNITV **04Hours**

Plant respiration: Respiration, glycolysis, fermentation (anaerobic).

Plant growth and development

- Phases and rate of plant growth, Condition of growth,Introduction to plant growth regulators

Cell - The unit of life

- Structure and functions of cell and cell organelles.Celldivision

Tissues

- Definition, types of tissues, location andfunctions.

Text Books

a. Text book of Biology by S. B.Gokhale
b. A Text book of Biology by Dr. Thulajappa and Dr.Seetaram.

Reference Books

a. A Text book of Biology by B.V. SreenivasaNaidu
b. A Text book of Biology by Naidu andMurthy
c. Botany for Degree students ByA.C.Dutta.
d.Outlines of Zoology by M. Ekambaranatha ayyer and T. N. Ananthakrishnan.
e. A manual for pharmaceutical biology practical by S.B. Gokhale and C. K. Kokate

BP112RBP.REMEDIAL BIOLOGY (Practical)

30 Hours

1. Introduction to experiments inbiology
   a) Study ofMicroscope
   b) Section cuttingtechniques
   c) Mounting andstaining
   d) Permanent slidepreparation
2. Study of cell and itsinclusions
3. Study of Stem, Root, Leaf, seed, fruit, flower and theirmodifications
4. Detailed study of frog byusing computer models
5. Microscopic study and identification of tissues pertinent to Stem,Root Leaf, seed, fruit and flower
6. Identification ofbones
7. Determination of bloodgroup
8. Determination of bloodpressure
9. Determination of tidalvolume

Reference Books

1. Practical human anatomy and physiology. byS.R.Kale andR.R.Kale.
2. A Manual of pharmaceutical biology practical by S.B.Gokhale, C.K.Kokateand S.P.Shriwastava.
3. Biology practical manual according to National core curriculum .Biologyforum of Karnataka. Prof.M.J.H.Shafi

BP 106RMT.REMEDIAL MATHEMATICS (Theory)

30 Hours

Sushant University soaring high	**School of Health Sciences** **Bachelor of Pharmacy**		
Course Title: REMEDIAL MATHEMATICS			
Semester: I	**Course code: BP 106 T**	**Credits: 2**	**Core / Elective: Core**
No. of lectures/ tutorials: 2/week		**No. of practical hours: 0/week**	
Course Pre-requisites: None			

COURSE OUTCOMES (COs):

Upon completion of the course the student shall be able to:-

CO 01: Know the theory and their application inPharmacy

CO 02: Solve the different types of problems by applyingtheory

CO 03: Appreciate the important application of mathematics inPharmacy

Mapping	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10
CO 01	L	M	L	L	H	L	L	L	H	L
CO 02	L	M	L	L	L	L	L	L	H	L
CO 03	L	H	L	L	H	L	L	L	H	L

Course Content:

UNIT– I **06Hours**

- **Partialfraction**

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

- **Logarithms**

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

- **Function***:*

Real Valued function, Classification of real valued functions,

- **Limits and continuity**:

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

UNIT–II **06Hours**

- **Matrices and Determinant:**

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

UNIT– III **06Hours**

- **Calculus**

Differentiation : Introductions, Derivative of a function, Derivative of a constant, Derivative of a product of a constant and a function , Derivative of the sum or difference of twofunctions, Derivative of the product of two functions(productformula), Derivative of the quotient of two functions (Quotient formula) –**WithoutProof**, Derivative of x^n *w.r.t*x,where *n* is any rationalnumber, Derivative of e^x,, Derivative of $\log_e x$, Derivative of a^x,Derivative of trigonometric functions from first principles**(without Proof)**, Successive Differentiation, Conditions for a function to be a maximum or a minimum at a point.Application

UNIT– IV **06Hours**

- **Analytical Geometry**

Introduction: Signs of the Coordinates, Distance formula,

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

Integration:

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

UNIT-V **06Hours**

- **Differential Equations** : Some basic definitions, Order and degree, Equations in separable form , Homogeneous equations, Linear Differential equations, Exact equations, **Application in solving Pharmacokineticequations**
- **Laplace Transform** : Introduction, Definition, Properties of Laplace transform, Laplace Transforms of elementary functions, Inverse Laplace transforms, Laplace transform of derivatives, Application to solve Linear differential equations, **Application in solving Chemical kinetics and Pharmacokinetics equations**

Recommended Books (LatestEdition)

1. Differential Calculus byShanthinarayan
2. Pharmaceutical Mathematics with application to Pharmacy byPanchaksharappa GowdaD.H.
3. Integral Calculus byShanthinarayan
4. Higher Engineering Mathematics byDr.B.S.Grewal

Semester II

BP 201T. HUMAN ANATOMY AND PHYSIOLOGY-II (Theory)

45 Hours

Sushant University soaring high	**School of Health Sciences** **Bachelor of Pharmacy**		
Course Title: HUMAN ANATOMY AND PHYSIOLOGY-II			
Semester: II	**Course code: BP 201 T**	**Credits: 6**	**Core / Elective: Core**
No. of lectures/ tutorials: 4/week		**No. of practical hours: 4/week**	
Course Pre-requisites: None			

COURSE OUTCOMES (COs):

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

CO 01: Explain the gross morphology, structure and functions of various organs of the humanbody.

CO 02: Describe the various homeostatic mechanisms and theirimbalances.

CO 03: Identify the various tissues and organs of different systems of humanbody.

CO04: Perform the hematological tests like blood cell counts, haemoglobin estimation, bleeding/clotting time etc and also record blood pressure, heart rate, pulse and respiratoryvolume.

CO05: Appreciate the interlinked mechanisms in the maintenance of normal functioning (homeostasis) of human body.

Mapping	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10
CO 01	H	L	L	L	H	M	H	M	H	L
CO 02	L	L	L	L	H	M	H	L	H	L
CO 03	H	H	L	L	H	H	H	M	H	L
CO 04	L	H	L	L	H	H	H	M	H	L
CO 05	L	H	L	L	H	M	H	L	H	L

Course Content:

UnitI **10 hours**

- **Nervoussystem**

Organization of nervous system, neuron, neuroglia, classification and properties of nerve fibre, electrophysiology, action potential, nerve impulse, receptors, synapse,neurotransmitters.

Central nervous system: Meninges, ventricles of brain and cerebrospinal fluid.structure and functions of brain (cerebrum, brain stem, and cerebellum), spinal cord (gross structure, functions of afferent and efferent nerve tracts, reflexactivity)

UnitII **06 hours**

- **Digestivesystem**

Anatomy of GI Tract with special reference to anatomy and functions of stomach, (Acid production in the stomach, regulation of acid production through parasympathetic nervous system, pepsin role in protein digestion) small intestine

and large intestine, anatomy and functions of salivary glands, pancreas and liver, movements of GIT, digestion and absorption of nutrients and disorders of GIT.

- **Energetics**

  Formation and role of ATP, Creatinine Phosphate and BMR.

Unit III

- **Respiratorysystem** **10 hours**

  Anatomy of respiratory system with special reference to anatomy of lungs, mechanism of respiration, regulation of respiration

  Lung Volumes and capacities transport of respiratory gases, artificial respiration, and resuscitation methods.

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

UnitIV **10 hours**

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

UnitV **09 hours**

- **Reproductivesystem**

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

- **Introduction togenetics**

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

BP 207 P. HUMAN ANATOMY AND PHYSIOLOGY (Practical)

4 Hours/week

Practical physiology is complimentary to the theoretical discussionsin physiology. Practicals allow the verification of physiological processes discussed in theory classes through experiments on living tissue, intact animals or normal human beings. This is helpful for developing an insight on thesubject**.**

1. To study the integumentary and special senses using specimen, models,etc.,
2. To study the nervous system using specimen, models,etc.,
3. To study the endocrine system using specimen, models,etc
4. To demonstrate the general neurologicalexamination
5. To demonstrate the function of olfactorynerve
6. To examine the different types oftaste.
7. To demonstrate the visualacuity
8. To demonstrate the reflexactivity
9. Recording of bodytemperature
10. To demonstrate positive and negative feedbackmechanism.
11. Determination of tidal volume and vitalcapacity.
12. Study of digestive, respiratory, cardiovascular systems, urinary and reproductive systems with the help of models, charts and specimens.
13. Recording of basalmassindex .
14. Study of familyplanning devices and pregnancy diagnosis test.
15. Demonstration of total blood count by cellanalyser
16. Permanent slides of vital organs andgonads.

Recommended Books (Latest Editions)

1. Essentials of Medical Physiology by K. Sembulingam and P. Sembulingam. Jaypee brothers medical publishers, New Delhi.
2. Anatomy and Physiology in Health and Illness by Kathleen J.W. Wilson, Churchill Livingstone, NewYork
3. Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co,Riverview,MIUSA

4. Text book of Medical Physiology- Arthur C,Guyton andJohn.E. Hall. Miamisburg, OH, U.S.A.
5. Principles of Anatomy and Physiology byTortora Grabowski. Palmetto, GA, U.S.A.
6. Textbook of Human Histology by Inderbir Singh, Jaypee brothers medical publishers, NewDelhi.
7. Textbook of Practical Physiology by C.L. Ghai, Jaypee brothers medical publishers, New Delhi.
8. Practical workbook of Human Physiology by K. Srinageswari and Rajeev Sharma, Jaypee brother's medical publishers, New Delhi.

Reference Books:

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

BP202T. PHARMACEUTICAL ORGANIC CHEMISTRY –I (Theory)

45 Hours

Sushant University soaring high	**School of Health Sciences** **Bachelor of Pharmacy**		
Course Title: PHARMACEUTICAL ORGANIC CHEMISTRY –I			
Semester: II	**Course code: BP 202 T**	**Credits: 6**	**Core / Elective: Core**
No. of lectures/ tutorials: 4/week		**No. of practical hours: 4/week**	
Course Pre-requisites: None			

COURSE OUTCOMES (COs):

Upon completion of the course the student shall be able to

CO 01: write the structure, name and the type of isomerism of the organiccompound

CO 02: write the reaction, name the reaction and orientation ofreactions

CO 03: account for reactivity/stability ofcompounds,

CO 04: identify/confirm the identification of organiccompound

Mapping	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10
CO 01	H	H	L	L	L	L	H	L	H	L
CO 02	H	H	L	M	H	L	H	M	H	L
CO 03	H	H	L	M	H	H	M	L	M	L
CO 04	H	H	L	L	H	H	H	L	H	L

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-I **07Hours**

- **Classification, nomenclature andisomerism**

  Classification of Organic Compounds

  Common and IUPAC systems of nomenclature of organic compounds

  (up to 10 Carbons open chain and carbocyclic compounds)

Structural isomerisms in organic compounds

UNIT-II10 Hours

- **Alkanes*, Alkenes* and Conjugateddienes***

  SP^3hybridizationinalkanes,Halogenationofalkanes,usesofparaffins.

  Stabilities of alkenes, SP^2 hybridization inalkenes

  E_1 and E_2 reactions – kinetics, order of reactivity of alkyl halides, rearrangement of carbocations, Saytzeffs orientation and evidences. E_1 verses E_2 reactions, Factors affecting E_1 and E_2 reactions. Ozonolysis, electrophilic addition reactions of alkenes, Markownikoff's orientation, free radical addition reactions of alkenes, Anti Markownikoff's orientation.

  Stability of conjugated dienes, Diel-Alder, electrophilic addition, free radical addition reactions of conjugated dienes, allylic rearrangement

UNIT-III10 Hours

- **Alkyl halides***

  SN_1 and SN_2 reactions - kinetics, order of reactivity of alkyl halides, stereochemistry and rearrangement of carbocations.

  SN_1 versus SN_2 reactions, Factors affecting SN_1 and SN_2 reactions

  Structure and uses of ethylchloride, Chloroform, trichloroethylene, tetrachloroethylene, dichloromethane, tetrachloromethane and iodoform.

- **Alcohols*-** Qualitative tests, Structure and uses of Ethyl alcohol, Methyl alcohol, chlorobutanol, Cetosteryl alcohol, Benzyl alcohol, Glycerol, Propyleneglycol

UNIT-IV10 Hours

- **Carbonyl compounds* (Aldehydes andketones)**

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

UNIT-V **08Hours**

- **Carboxylicacids***

  Acidity of carboxylic acids, effect of substituents on acidity, inductive effect and qualitative tests for carboxylic acids ,amide and ester

  Structure and Uses of Acetic acid, Lactic acid, Tartaric acid, Citric acid, Succinic acid. Oxalic acid, Salicylic acid, Benzoic acid, Benzyl benzoate, Dimethyl phthalate, Methyl salicylate and Acetyl salicylic acid

- **Aliphatic amines* -** Basicity, effect of substituent on Basicity. Qualitative test, Structure and uses of Ethanolamine, Ethylenediamine,Amphetamine

BP208P. PHARMACEUTICAL ORGANIC CHEMISTRY -I (Practical)

4 Hours /week

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

Recommended Books (Latest Editions)

1. Organic Chemistry by Morrison andBoyd
2. Organic Chemistry by I.L. Finar ,Volume-I
3. Textbook of Organic Chemistry by B.S. Bahl & ArunBahl.
4. Organic Chemistry byP.L.Soni
5. Practical Organic Chemistry by Mann andSaunders.
6. Vogel's text book of Practical OrganicChemistry
7. Advanced Practical organic chemistry byN.K.Vishnoi.
8. Introduction to Organic Laboratory techniques by Pavia, Lampman andKriz.
9. Reaction and reaction mechanism byAhluwaliah/Chatwal.

BP203 T. BIOCHEMISTRY (Theory)

45 Hours

Sushant University soaring high	**School of Health Sciences** **Bachelor of Pharmacy**		
Course Title: BIOCHEMISTRY			
Semester: II	**Course code: BP 203 T**	**Credits: 6**	**Core / Elective: Core**
No. of lectures/ tutorials: 4/week		**No. of practical hours: 4/week**	
Course Pre-requisites: None			

COURSE OUTCOMES (COs):

Upon completion of course student shell able to

CO 01: Understand the catalytic role of enzymes, importance of enzyme inhibitors in design of new drugs, therapeutic and diagnostic applications ofenzymes.

CO 02: Understand the metabolism of nutrient molecules in physiological and pathologicalconditions.

CO 03: Understand the genetic organization of mammalian genome and functions of DNA in the synthesis of RNAs and proteins.

Mapping	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10
CO 01	H	H	L	L	M	M	H	L	M	L
CO 02	H	M	L	L	L	M	H	L	L	L
CO 03	H	H	L	L	M	M	H	M	L	L

Course Content:

UNITI **08Hours**

- **Biomolecules**

  Introduction, classification, chemical nature and biological role of carbohydrate, lipids, nucleic acids, amino acids and proteins.

- **Bioenergetics**

  Concept of free energy, endergonic and exergonic reaction, Relationship between free energy, enthalpy and entropy; Redox potential.

  Energy rich compounds; classification; biological significances of ATP and cyclic AMP

UNITII **10Hours**

- **Carbohydratemetabolism**

  Glycolysis – Pathway, energetics and significance

  Citric acid cycle- Pathway, energetics and significance

  HMP shunt and its significance; Glucose-6-Phosphate dehydrogenase (G6PD) deficiency

  Glycogen metabolism Pathways and glycogen storage diseases (GSD)

  Gluconeogenesis- Pathway and its significance

  Hormonal regulation of blood glucose level and Diabetes mellitus

- **Biologicaloxidation**

  Electron transport chain (ETC) and its mechanism.

Oxidative phosphorylation & its mechanism and substrate level phosphorylation

Inhibitors ETC and oxidative phosphorylation/Uncouplers

UNITIII **10Hours**

- **Lipidmetabolism**

  β-Oxidation of saturated fatty acid (Palmitic acid)

Formation and utilization of ketone bodies; ketoacidosis

De novo synthesis of fatty acids (Palmitic acid)

Biological significance of cholesterol and conversion of cholesterol into bile acids, steroid hormone and vitamin D

Disorders of lipid metabolism: Hypercholesterolemia, atherosclerosis, fatty liver andobesity.

- **Amino acidmetabolism**

  General reactions of amino acid metabolism: Transamination, deamination & decarboxylation, urea cycle and itsdisorders

  Catabolism of phenylalanine and tyrosine and their metabolic disorders (Phenyketonuria, Albinism, alkeptonuria, tyrosinemia)

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

  Catabolism of heme; hyperbilirubinemia and jaundice

UNITIV **10Hours**

- **Nucleic acid metabolism and genetic informationtransfer**

  Biosynthesis of purine and pyrimidine nucleotides

  Catabolism of purine nucleotides and Hyperuricemia and Gout disease

  Organization of mammalian genome

  Structure of DNA and RNA and their functions

  DNA replication (semi conservative model)

  Transcription or RNA synthesis

  Genetic code, Translation or Protein synthesis and inhibitors

UNITV **07Hours**

- **Enzymes**

  Introduction, properties, nomenclature and IUB classification of enzymes

  Enzyme kinetics (Michaelis plot, Line Weaver Burke plot)

  Enzyme inhibitors with examples

  Regulation of enzymes: enzyme induction and repression, allosteric enzymes regulation

  Therapeutic and diagnostic applications of enzymes and isoenzymes

  Coenzymes –Structure and biochemical functions

BP 209 P. BIOCHEMISTRY (Practical)

4 Hours / Week

1. Qualitative analysis of carbohydrates (Glucose, Fructose, Lactose,Maltose, Sucrose andstarch)
2. Identification tests for Proteins (albumin andCasein)
3. Quantitative analysis of reducing sugars (DNSA method) andProteins (Biuretmethod)
4. Qualitative analysis of urine for abnormalconstituents
5. Determination of bloodcreatinine
6. Determination of bloodsugar
7. Determination of serum totalcholesterol
8. Preparation of buffer solution and measurement ofpH
9. Study of enzymatic hydrolysis ofstarch
10. Determination of Salivary amylaseactivity
11. Study the effect of Temperature on Salivary amylaseactivity.
12. Study the effect of substrate concentration on salivary amylaseactivity.

Recommended Books (Latest Editions)

1. Principles of Biochemistry byLehninger.
2. Harper's Biochemistry by Robert K. Murry, Daryl K. Granner and Victor W.Rodwell.
3. Biochemistry byStryer.
4. Biochemistry by D. Satyanarayan andU.Chakrapani
5. Textbook of Biochemistry by RamaRao.
6. Textbook of Biochemistry byDeb.
7. Outlines of Biochemistry by Conn andStumpf
8. Practical Biochemistry by R.C. Gupta and S.Bhargavan.
9. Introduction of Practical Biochemistry by David T. Plummer. (3rdEdition)
10. Practical Biochemistry for Medical students by Rajagopal andRamakrishna.
11. Practical Biochemistry by HaroldVarley.

BP 204T.PATHOPHYSIOLOGY (THEORY)

45Hours

Sushant University soaring high	**School of Health Sciences** **Bachelor of Pharmacy**		
Course Title: PATHOPHYSIOLOGY			
Semester: II	**Course code: BP 204 T**	**Credits: 4**	**Core / Elective: Core**
No. of lectures/ tutorials: 4/week		**No. of practical hours: 0/week**	
Course Pre-requisites: None			

COURSE OUTCOMES (COs):

Upon completion of the subject student shall be able to –

CO 01: Describe the etiology and pathogenesis of the selected diseasestates;

CO 02: Name the signs and symptoms of the diseases;and

CO 03: Mention the complications of thediseases.

Mapping	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10
CO 01	H	M	L	M	H	M	H	L	H	L
CO 02	H	M	L	H	M	M	M	L	H	L

CO 03	M	L	L	M	M	M	H	M	H	L

Course content:

UnitI **10Hours**

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

- **Basic mechanism involved in the process of inflammation andrepair:**
  Introduction, Clinical signs of inflammation, Different types of Inflammation,Mechanism of Inflammation – Alteration in vascular permeability and blood flow, migration of WBC's,Mediators of inflammation,Basic principles of wound healing in the skin,Pathophysiology of Atherosclerosis

Unit II **10Hours**

- **CardiovascularSystem:**
  Hypertension, congestive heart failure, ischemic heart disease (angina,myocardial infarction, atherosclerosis and arteriosclerosis)
- **Respiratory system:**Asthma, Chronic obstructive airwaysdiseases.
- **Renal system:**Acute and chronicrenalfailure .

Unit II **10Hours**

- **HaematologicalDiseases:**
  Iron deficiency, megaloblastic anemia (Vit B12 and folic acid), sickle cell anemia, thalasemia, hereditary acquired anemia, hemophilia
- **Endocrine system:** Diabetes, thyroid diseases, disorders of sexhormones
- **Nervous system:** Epilepsy, Parkinson's disease, stroke, psychiatricdisorders: depression, schizophrenia and Alzheimer'sdisease.
- **Gastrointestinal system:** PepticUlcer
-

UnitIV **8Hours**

- Inflammatory bowel diseases, jaundice, hepatitis (A,B,C,D,E,F) alcoholicliver disease.
- **Disease of bones and joints:** Rheumatoid arthritis, osteoporosis andgout
- **Principles of cancer:** classification, etiology and pathogenesis ofcancer
- **Diseases of bones and joints:**Rheumatoid Arthritis,Osteoporosis,Gout

- **Principles of Cancer:** Classification, etiology and pathogenesis ofCancer

UnitV **7Hours**

- **Infectiousdiseases:**Meningitis,Typhoid,Leprosy,Tuberculosis

Urinary tractinfections

- **Sexually transmitted diseases:**AIDS, Syphilis,Gonorrhea

Recommended Books (Latest Editions)

1. Vinay Kumar, Abul K. Abas, Jon C. Aster; Robbins &Cotran Pathologic Basis of Disease; South Asia edition; India; Elsevier;2014.
2. Harsh Mohan; Text book of Pathology; 6th edition; India; Jaypee Publications;2010.
3. Laurence B, Bruce C, Bjorn K. ; Goodman Gilman's The Pharmacological Basis of Therapeutics; 12th edition; New York; McGraw-Hill;2011.
4. Best, Charles Herbert 1899-1978; Taylor, Norman Burke 1885-1972; West, John B (John Burnard); Best and Taylor's Physiological basis of medical practice; 12th ed; unitedstates;
5. William and Wilkins, Baltimore;1991 [1990printing].
6. Nicki R. Colledge, Brian R. Walker, Stuart H. Ralston;Davidson's Principles and Practice of Medicine; 21st edition; London; ELBS/Churchill Livingstone;2010.
7. Guyton A, John .E Hall; Textbook of Medical Physiology; 12th edition; WB Saunders Company;2010.
8. Joseph DiPiro, Robert L. Talbert, Gary Yee, Barbara Wells, L. Michael Posey; Pharmacotherapy: A Pathophysiological Approach; 9th edition; London; McGraw-Hill Medical; 2014.
9. V. Kumar, R. S. Cotran and S. L. Robbins; Basic Pathology; 6th edition; Philadelphia; WB Saunders Company;1997.
10. Roger Walker, Clive Edwards; Clinical Pharmacy and Therapeutics; 3rd edition; London; Churchill Livingstone publication;2003.

Recommended Journals

1. The Journal of Pathology. ISSN: 1096-9896(Online)
2. The American Journal of Pathology. ISSN:0002-9440
3. Pathology. 1465-3931 (Online)
4. International Journal of Physiology, Pathophysiology and Pharmacology. ISSN: 1944-8171 (Online)
5. Indian Journal of Pathology and Microbiology.ISSN-0377-4929.

BP205 T. COMPUTER APPLICATIONS IN PHARMACY (Theory)

30 Hrs (2 Hrs/Week)

Sushant University soaring high	**School of Health Sciences** **Bachelor of Pharmacy**		
Course Title: PATHOPHYSIOLOGY			
Semester: II	**Course code: BP 205 T**	**Credits: 4**	**Core / Elective: Core**
No. of lectures/ tutorials: 3/week		**No. of practical hours: 2/week**	
Course Pre-requisites: None			

COURSE OUTCOMES (COs):

Upon completion of the course the student shall be able to

CO 01: know the various types of application of computers inpharmacy

CO 02: know the various types ofdatabases

CO 03: know the various applications of databases inpharmacy

Mapping	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10
CO 01	H	H	M	M	H	M	M	M	M	L
CO 02	H	H	M	H	M	M	L	L	M	L
CO 03	H	H	M	H	H	M	M	L	L	L

Course content:

UNIT– I **06 hours**

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

multiplication, binary division

Concept of Information Systems and Software : Information gathering,

Requirement and feasibility analysis, data flow diagrams, process specifications, input/output design, process life cycle, planning and

06 hours

Web technologies:Introduction to HTML, XML,CSS and

Programming languages, introduction to web servers and Server

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

UNIT– III **06 hours**

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

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

UNIT –IV **06 hours**

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

UNIT-V **06hours**

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

BP210P. COMPUTER APPLICATIONS IN PHARMACY (Practical)

1. Design a questionnaire using a word processing package to gatherinformation about a particulardisease.
2. Create a HTML web page to show personalinformation.
3 Retrieve the information of a drug and its adverse effects using onlinetools
4 Creating mailing labels Using Label Wizard , generating label in MSWORD
5 Create a database in MS Access to store the patient information with therequired fields Usingaccess
6. Design a form in MS Access to view, add, delete and modify the patient recordin thedatabase
7. Generating report and printing the report from patientdatabase
8. Creating invoice table using – MSAccess
9. Drug information storage and retrieval using MSAccess
10. Creating and working with queries in MSAccess
11. Exporting Tables, Queries, Forms and Reports to webpages
12. Exporting Tables, Queries, Forms and Reports to XMLpages

Recommended books (Latest edition):

1. Computer Application in Pharmacy – William E.Fassett –Lea and Febiger,600 South Washington Square, USA, (215)922-1330.
2. Computer Application in Pharmaceutical Research and Development –Sean Ekins– Wiley-Interscience, A John Willey and Sons, INC., Publication, USA
3. Bioinformatics (Concept, Skills and Applications) – S.C.Rastogi-CBS Publishersand Distributors, 4596/1- A, 11 Darya Gani, New Delhi – 110002(INDIA)
4. Microsoft office Access - 2003, Application Development Using VBA, SQLServer, DAP and Infopath– Cary N.Prague – Wiley Dreamtech India (P) Ltd., 4435/7, Ansari Road, Daryagani, New Delhi -110002

BP 206 T. ENVIRONMENTAL SCIENCES (Theory)

30 hours

Sushant University soaring high	**School of Health Sciences** **Bachelor of Pharmacy**		
Course Title: ENVIRONMENTAL SCIENCES			
Semester: II	**Course code: BP 206 T**	**Credits: 3**	**Core / Elective: Core**
No. of lectures/ tutorials: 3/week		**No. of practical hours: 0/week**	
Course Pre-requisites: None			

COURSE OUTCOMES (COs):

Upon completion of the course the student shall be able to**:**

CO 01: Create the awareness about environmental problems amonglearners.

CO 02: Impart basic knowledge about the environment and its alliedproblems.

CO 03: Develop an attitude of concern for theenvironment.

CO 04: Motivate learner to participate in environment protection andenvironment improvement.

CO 05: Acquire skills to help the concerned individuals in identifying andsolving environmentalproblems.

Mapping	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10
CO 01	L	M	H	M	L	L	L	L	L	L
CO 02	L	M	H	H	L	L	L	L	L	L
CO 03	M	M	H	M	M	L	L	L	M	L
CO 04	M	L	H	M	M	L	L	L	L	L
CO 05	L	L	H	H	L	L	L	L	L	L

Course content:

Unit-I **10hours**

The Multidisciplinary nature of environmental studies
Natural Resources
Renewable and non-renewable resources:
Natural resources and associated problems
a) Forest resources; b) Water resources; c) Mineral resources; d) Food resources; e) Energy resources; f) Land resources: Role of an individual in conservation of naturalresources.

Unit-II **10hours**

Ecosystems

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

Unit-III **10hours**

Environmental Pollution: Air pollution; Water pollution; Soil pollution

Recommended Books (Latest edition):

1. Y.K. Sing, Environmental Science, New Age International Pvt, Publishers, Bangalore
2. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd.Bikaner.
3. Bharucha Erach, The Biodiversity of India, Mapin Pu blishing Pvt. Ltd., Ahmedabad – 380 013,India,
4. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc.480p
5. Clark R.S., Marine Pollution, Clanderson PressOxford
6. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumbai,1196p
7. De A.K., Environmental Chemistry, Wiley EasternLtd.
8. Down of Earth, Centre for Science andEnvironment

SEMESTER III

BP301T. PHARMACEUTICAL ORGANIC CHEMISTRY –II (Theory)

45 Hours

Sushant University soaring high	**School of Health Sciences** **Bachelor of Pharmacy**		
Course Title: PHARMACEUTICAL ORGANIC CHEMISTRY –II			
Semester: III	**Course code: BP 301 T**	**Credits: 6**	**Core / Elective: Core**
No. of lectures/ tutorials: 4/week		**No. of practical hours: 4/week**	
Course Pre-requisites: None			

COURSE OUTCOMES (COs):

Upon completion of the course the student shall be able to

CO 01: write the structure, name and the type of isomerism of the organiccompound

CO 02: write the reaction, name the reaction and orientation ofreactions

CO 03: account for reactivity/stability ofcompounds,

CO 04: prepare organiccompounds

Mapping	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10
CO 01	H	H	L	M	M	M	M	M	L	L
CO 02	H	M	L	M	H	M	L	L	L	L
CO 03	H	H	L	H	H	M	L	M	L	L
CO 04	H	M	L	M	H	L	M	L	L	L

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

UNITI **10Hours**

- **Benzene and itsderivatives**
  - **A.** Analytical, synthetic and other evidences in the derivation of structure

of benzene, Orbital picture, resonance in benzene, aromatic characters, Huckel'srule

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

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

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

UNITII **10Hours**

- **Phenols*** - Acidity of phenols, effect of substituents on acidity, qualitative tests, Structure and uses of phenol, cresols, resorcinol,naphthols
- **Aromatic Amines* -** Basicity of amines, effect of substituents on basicity, and synthetic uses of aryl diazoniumsalts
- **Aromatic Acids* –**Acidity, effect of substituents on acidity and important reactions of benzoicacid.

UNIT III

10 Hours

- **Fats andOils**

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 theirdetermination.

UNITIV **08Hours**

- **Polynuclearhydrocarbons:**

a. Synthesis, reactions

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

UNITV **07Hours**

- **Cycloalkanes***

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

BP305P. PHARMACEUTICAL ORGANIC CHEMISTRY -II (Practical)

4 Hrs/week

I Experiments involving laboratorytechniques

- Recrystallization
- Steamdistillation

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

- Acidvalue
- Saponificationvalue
- Iodinevalue

III Preparation ofcompounds

- Benzanilide/Phenyl benzoate/Acetanilide from Aniline/ Phenol /Aniline by acylation reaction.
- 2,4,6-Tribromo aniline/Para bromo acetanilide fromAniline/
- Acetanilide by halogenation (Bromination)reaction.
- 5-Nitro salicylic acid/Meta di nitro benzene from Salicylic acid / Nitro benzene by nitrationreaction.
- Benzoic acid from Benzyl chloride by oxidationreaction.
- Benzoic acid/ Salicylic acid from alkyl benzoate/ alkyl salicylate by hydrolysisreaction.
- 1-Phenyl azo-2-napthol from Aniline by diazotization and coupling reactions.
- Benzil from Benzoin by oxidationreaction.
- Dibenzal acetone from Benzaldehyde by Claison Schmidtreaction
- Cinnammic acid from Benzaldehyde by Perkinreaction
- *P*-Iodo benzoic acid from *P*-amino benzoicacid

Recommended Books (Latest Editions)

1. Organic Chemistry by Morrison andBoyd
2. Organic Chemistry by I.L. Finar ,Volume-I
3. Textbook of Organic Chemistry by B.S. Bahl & ArunBahl.
4. Organic Chemistry byP.L.Soni
5. Practical Organic Chemistry by Mann andSaunders.
6. Vogel's text book of Practical OrganicChemistry
7. Advanced Practical organic chemistry byN.K.Vishnoi.

8. Introduction to Organic Laboratory techniques by Pavia, Lampman andKriz.

BP302T. PHYSICAL PHARMACEUTICS-I (Theory)

45Hours

Sushant University soaring high	**School of Health Sciences** **Bachelor of Pharmacy**		
Course Title: PHYSICAL PHARMACEUTICS-I			
Semester: III	**Course code: BP 302 T**	**Credits: 6**	**Core / Elective: Core**
No. of lectures/ tutorials: 4/week		**No. of practical hours: 4/week**	
Course Pre-requisites: None			

COURSE OUTCOMES (COs):

Upon the completion of the course student shall be able to

CO 01: Understand various physicochemical properties of drug molecules in the designing the dosageforms

CO 02: Know the principles of chemical kinetics & to use them for stability testing nad determination of expiry date offormulations

CO 03: Demonstrate use of physicochemical properties in the formulation development and evaluation of dosageforms.

Mapping	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10
CO 01	H	H	L	L	M	H	H	H	M	L
CO 02	H	M	L	L	H	M	H	M	H	L
CO 03	H	H	L	L	M	M	H	H	H	L

Course Content:

UNIT-I **10Hours**

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 andapplications

UNIT-II **10Hours**

States of Matter and properties of matter: State of matter, changes in the state of matter, latent heats, vapour pressure, sublimation critical point, eutectic mixtures, gases, aerosols

– inhalers, relative humidity, liquid complexes, liquid crystals, glassy states, solid-crystalline, amorphous & polymorphism.

Physicochemical properties of drug molecules: Refractive index, optical rotation, dielectric constant, dipole moment, dissociation constant, determinations and applications

UNIT-III **08Hours**

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 solidinterface.

UNIT-IV **08Hours**

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.

UNIT-V **07Hours**

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 isotonicsolutions.

BP306P. PHYSICAL PHARMACEUTICS – I(Practical)

4 Hrs/week

1. Determination the solubility of drug at roomtemperature
2. Determination of pKa value by Half Neutralization/ HendersonHasselbalch equation.
3. Determination of Partition co- efficient of benzoic acid in benzene andwater
4. Determination of Partition co- efficient of Iodine in CCl_4 andwater
5. Determination of % composition of NaCl in a solution using phenol-water system by CSTmethod
6. Determination of surface tension of given liquids by drop count and dropweight method
7. Determination of HLB number of a surfactant by saponificationmethod
8. Determination of Freundlich and Langmuir constants using activated charcoal
9. Determination of critical micellar concentration of surfactants
10. Determination of stability constant and donor acceptor ratio ofPABA-Caffeine complex by solubilitymethod
11. Determination of stability constant and donor acceptor ratio ofCupric-Glycine complex by pH titrationmethod

Recommended Books: (Latest Editions)

1. Physical Pharmacy by AlfredMartin
2. Experimental Pharmaceutics by Eugene,Parott.
3. Tutorial Pharmacy by Cooper andGunn.
4. Stocklosam J. Pharmaceutical Calculations, Lea &Febiger, Philadelphia.
5. Liberman H.A, Lachman C., Pharmaceutical Dosage forms, Tablets, Volume-1to 3, MarcelDekkarInc.
6. Liberman H.A, Lachman C, Pharmaceutical Dosage forms.Disperse systems, volume 1, 2, 3. Marcel Dekkar Inc.
7. Physical Pharmaceutics by Ramasamy C andManavalanR.
8. Laboratory Manual of Physical Pharmaceutics, C.V.S. Subramanyam,J. Thimmasettee
9. Physical Pharmaceutics by C.V.S.Subramanyam
10. Test book of Physical Phramacy, by Gaurav Jain & Roop K.Khar

BP 303 T. PHARMACEUTICAL MICROBIOLOGY (Theory)

45Hours

Sushant University soaring high	**School of Health Sciences** **Bachelor of Pharmacy**		
Course Title: PHARMACEUTICAL MICROBIOLOGY			
Semester: III	**Course code: BP 303 T**	**Credits: 6**	**Core / Elective: Core**
No. of lectures/ tutorials: 4/week		**No. of practical hours: 4/week**	
Course Pre-requisites: None			

COURSE OUTCOMES (COs):

Upon completion of the subject student shall be able to;

CO 01: Understand methods of identification, cultivation and preservation of variousmicroorganisms

CO 02: To understand the importance and implementation of sterlization in pharmaceutical processing andindustry

CO 03: Learn sterility testing of pharmaceuticalproducts.

CO 04: Carried out microbiological standardization ofPharmaceuticals.

CO 05: Understand the cell culture technology and its applications in pharmaceutical industries.

Mapping	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10
CO 01	H	H	L	L	M	H	H	H	M	L
CO 02	H	M	L	L	H	M	H	M	H	L
CO 03	H	H	L	L	M	M	H	H	H	L
CO 04	M	H	L	M	H	H	M	M	M	L
CO 05	H	H	L	L	H	M	M	M	L	L

Course content:

UnitI **10Hours**

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 & viablecount).
Study of different types of phase constrast microscopy, dark field microscopy and electron microscopy.

UnitII **10Hours**

Identification of bacteria using staining techniques (simple, Gram's &Acid fast staining) and biochemical tests (IMViC).

Study of principle, procedure, merits, demerits and applications of physical, chemical gaseous,radiation and mechanical method of sterilization.

Evaluation of the efficiency of sterilization methods.

Equipments employed in large scale sterilization.

Sterility indicators.

UnitIII **10Hours**

Study of morphology, classification, reproduction/replication and cultivation of Fungi andViruses.

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.

UnitIV **08Hours**

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

UnitV **07Hours**

Types of spoilage, factors affecting the microbial spoilage of pharmaceutical products, sources and types of microbial contaminants, assessment of microbial contamination andspoilage.

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.

BP 307P.PHARMACEUTICAL MICROBIOLOGY (Practical)

4 Hrs/week

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 experimentalmicrobiology.
2. Sterilization of glassware, preparation and sterilization ofmedia.
3. Sub culturing of bacteria and fungus. Nutrient stabs and slantspreparations.
4. Staining methods- Simple, Grams staining and acid fast staining (Demonstration with practical).
5. Isolation of pure culture of micro-organismsby multiple streak plate technique and other techniques.
6. Microbiological assay of antibiotics by cup plate method and othermethods
7. Motility determination by Hanging dropmethod.
8. Sterility testing ofpharmaceuticals.
9. Bacteriological analysis ofwater
10. Biochemicaltest.

Recommended Books (Latestedition)

1. W.B. Hugo and A.D. Russel: Pharmaceutical Microbiology, BlackwellScientific publications, Oxford London.
2. Prescott and Dunn., Industrial Microbiology, 4th edition, CBS Publishers &Distributors, Delhi.
3. Pelczar, Chan Kreig, Microbiology, Tata McGraw Hill edn.
4. Malcolm Harris, Balliere Tindall and Cox: PharmaceuticalMicrobiology.
5. Rose: IndustrialMicrobiology.
6. Probisher, Hinsdill et al: Fundamentals of Microbiology, 9th ed.Japan
7. Cooper and Gunn's: Tutorial Pharmacy, CBS Publisher andDistribution.
8. Peppler: MicrobialTechnology.
9. I.P., B.P., U.S.P.- latesteditions.
10. Ananthnarayan : Text Book of Microbiology, Orient-Longman,Chennai
11. Edward: Fundamentals ofMicrobiology.
12. N.K.Jain: Pharmaceutical Microbiology, Vallabh Prakashan, Delhi
13. Bergeys manual of systematic bacteriology, Williams and Wilkins- A Waverlycompany

BP 304 T. PHARMACEUTICAL ENGINEERING (Theory)

45 Hours

Sushant University soaring high	**School of Health Sciences** **Bachelor of Pharmacy**

Course Title: PHARMACEUTICAL ENGINEERING			
Semester: III	**Course code: BP 304 T**	**Credits: 6**	**Core / Elective: Core**
No. of lectures/ tutorials: 4/week		**No. of practical hours: 4/week**	
Course Pre-requisites: None			

COURSE OUTCOMES (COs):

Upon completion of the course student shall be able:

CO 01: To know various unit operations used in Pharmaceuticalindustries.

CO 02: To understand the material handlingtechniques.

CO 03: To perform various processes involved in pharmaceutical manufacturingprocess.

CO 04: To appreciate and comprehend significance of plant lay out design for optimum use ofresources.

CO 05: To appreciate the various preventive methods used for corrosion control in Pharmaceuticalindustries.

Mapping	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10
CO 01	H	H	L	L	M	H	H	H	M	L
CO 02	H	M	L	L	H	M	H	M	H	L
CO 03	H	H	L	L	M	M	H	H	H	L
CO 04	M	H	L	M	H	H	M	M	M	L
CO 05	H	H	L	L	H	M	M	M	L	L

Course content:

UNIT-I **10Hours**

- **Flow of fluids:** Types of manometers, Reynolds number and its significance, Bernoulli's theorem and its applications, Energy losses, Orifice meter, Venturimeter, Pitot tube andRotometer.

- **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 runnermill.
- **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 & elutriationtank.

UNIT-II **10Hours**

- **Heat Transfer:** Objectives, applications & Heat transfer mechanisms. Fourier's law, Heat transfer by conduction, convection & radiation. Heat interchangers & heatexchangers.

- **Evaporation:** Objectives, applications and factors influencing evaporation, differences between evaporation and other heat process. principles, construction, working, uses, merits and demerits of Steam jacketed kettle, horizontal tube evaporator, climbing film evaporator, forced circulation evaporator, multiple effect evaporator& Economy of multiple effectevaporator.

- **Distillation:** Basic Principles and methodology of simple distillation,flash distillation, fractional distillation, distillation under reduced pressure, steam distillation & moleculardistillation

UNIT-III **08Hours**

- **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, freezedryer.

- **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 & SilversonEmulsifier,

UNIT-IV **08Hours**

- **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 Seidtzfilter.

- **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.

UNIT-V **07Hours**

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

Recommended Books: (Latest Editions)

1. Introduction to chemical engineering – Walter L Badger & Julius Banchero, Latest edition.
2. Solid phase extraction, Principles, techniques and applications by Nigel J.K. Simpson-Latestedition.
3. Unit operation of chemical engineering – Mcabe Smith, Latestedition.
4. Pharmaceutical engineering principles and practices – C.V.S Subrahmanyam et al., Latest edition.
5. Remington practice of pharmacy- Martin, Latestedition.
6. Theory and practice of industrial pharmacy byLachmann.,Latestedition.
7. Physical pharmaceutics- C.V.S Subrahmanyam et al., Latestedition.
8. Cooper and Gunn's Tutorial pharmacy, S.J. Carter, Latestedition.

BP308P - PHARMACEUTICAL ENGINEERING (Practical)

4 Hours/week

I. Determination of radiation constant of brass, iron, unpainted and paintedglass.
II. Steam distillation – To calculate the efficiency of steamdistillation.
III. To determine the overall heat transfer coefficient by heatexchanger.
IV. Construction of drying curves (for calcium carbonate andstarch).
V. Determination of moisture content and loss ondrying.
VI. Determination of humidity of air – i) From wet and dry bulb temperatures –use of Dew pointmethod.
VII. Description of Construction working and application of Pharmaceutical Machinery such as rotary tablet machine, fluidized bed coater, fluid energy mill, dehumidifier.
VIII. Size analysis by sieving – To evaluate size distribution of tablet granulations – Construction of various size frequency curves including arithmetic andlogarithmic probabilityplots.
IX. Size reduction: To verify the laws of size reduction using ball mill and determining Kicks, Rittinger's, Bond's coefficients, power requirement and critical speed of BallMill.
X. Demonstration of colloid mill, planetary mixer, fluidized bed dryer, freeze dryer and such othermajorequipment.
XI. Factors affecting Rate of Filtration and Evaporation (Surface area,Concentration and Thickness/viscosity
XII. To study the effect of time on the Rate ofCrystallization.
XIII. To calculate the uniformity Index for given sample by using Double Cone Blender.

SEMESTER IV

BP401T. PHARMACEUTICAL ORGANIC CHEMISTRY –III (Theory)

45 Hours

Sushant University soaring high	**School of Health Sciences** **Bachelor of Pharmacy**

Course Title: PHARMACEUTICAL ORGANIC CHEMISTRY –III			
Semester: IV	**Course code: BP 401 T**	**Credits: 4**	**Core / Elective: Core**
No. of lectures/ tutorials: 4/week		**No. of practical hours: 0/week**	
Course Pre-requisites: None			

COURSE OUTCOMES (COs):

At the end of the course, the student shall be able to

CO 01: understand the methods of preparation and properties of organiccompounds

CO 02: explain the stereo chemical aspects of organic compounds and stereo chemical reactions

CO 03: know the medicinal uses and other applications of organiccompounds

Mapping	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10
CO 01	H	H	L	M	M	M	M	M	L	L
CO 02	H	M	L	M	H	M	L	L	L	L
CO 03	H	H	L	H	H	M	L	M	L	L

Course Content:

Note: To emphasize on definition, types, mechanisms, examples, uses/applications

UNIT-I **10Hours**

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

UNIT-II **10Hours**

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

UNIT-III **10Hours**

Heterocyclic compounds:

Nomenclature and classification

Synthesis, reactions and medicinal uses of following compounds/derivatives

Pyrrole, Furan, and Thiophene

Relative aromaticity and reactivity of Pyrrole, Furan and Thiophene

UNIT-IV **8Hours**

Synthesis, reactions and medicinal uses of following compounds/derivatives

Pyrazole, Imidazole, Oxazole and Thiazole.

Pyridine, Quinoline, Isoquinoline, Acridine and Indole. Basicity of pyridine

Synthesis and medicinal uses of Pyrimidine, Purine, azepines and their derivatives

UNIT-V **07Hours**

Reactions of syntheticimportance

Metal hydride reduction ($NaBH_4$ and $LiAlH_4$), Clemmensen reduction, Birch reduction, Wolff Kishnerreduction.

Oppenauer-oxidation and Dakin reaction.

Beckmanns rearrangement and Schmidt rearrangement.

Claisen-Schmidt condensation

Recommended Books (Latest Editions)

1. Organic chemistry by I.L. Finar, Volume-I &II.
2. A text book of organic chemistry – Arun Bahl, B.S.Bahl.
3. Heterocyclic Chemistry by Raj K.Bansal
4. Organic Chemistry by Morrison andBoyd
5. Heterocyclic Chemistry by T.L.Gilchrist

BP402T. MEDICINAL CHEMISTRY – I (Theory)

45 Hours

Sushant University soaring high	**School of Health Sciences** **Bachelor of Pharmacy**		
Course Title: MEDICINAL CHEMISTRY – I			
Semester: IV	**Course code: BP 402 T**	**Credits: 6**	**Core / Elective: Core**
No. of lectures/ tutorials: 4/week		**No. of practical hours: 4/week**	
Course Pre-requisites: None			

COURSE OUTCOMES (COs):

Upon completion of the course the student shall be able to

CO 01: understand the chemistry of drugs with respect to their pharmacologicalactivity

CO 02: understand the drug metabolic pathways, adverse effect and therapeutic value of drugs

CO 03: know the Structural Activity Relationship (SAR) of different class ofdrugs

CO 04: write the chemical synthesis of somedrugs

Mapping	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10
CO 01	H	H	L	M	M	M	M	M	L	L
CO 02	H	M	L	M	H	M	L	L	L	L
CO 03	H	H	L	H	H	M	L	M	L	L
CO 04	H	M	L	M	H	L	M	L	L	L

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-I **10Hours**

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.

UNIT-II **10Hours**

Drugs acting on Autonomic Nervous System

Adrenergic Neurotransmitters:

Biosynthesis and catabolism of catecholamine.

Adrenergic receptors (Alpha & Beta) and their distribution.

Sympathomimetic agents: SAR of Sympathomimetic agents

Direct acting: Nor-epinephrine, Epinephrine, Phenylephrine*, Dopamine,

Methyldopa, Clonidine, Dobutamine, Isoproterenol, Terbutaline, Salbutamol*, Bitolterol, Naphazoline, Oxymetazoline and Xylometazoline.

- Indirect acting agents: Hydroxyamphetamine, Pseudoephedrine, Propylhexedrine.
- Agents with mixed mechanism: Ephedrine,Metaraminol.

Adrenergic Antagonists:

Alpha adrenergic blockers: Tolazoline*, Phentolamine, Phenoxybenzamine, Prazosin, Dihydroergotamine,Methysergide.

Beta adrenergic blockers: SAR of beta blockers, Propranolol*, Metibranolol, Atenolol, Betazolol, Bisoprolol, Esmolol, Metoprolol, Labetolol, Carvedilol.

UNIT-III **10Hours**

Cholinergic neurotransmitters:

Biosynthesis and catabolism of acetylcholine.

Cholinergic receptors (Muscarinic & Nicotinic) and their distribution.

Parasympathomimetic agents: SAR of Parasympathomimetic agents

Direct acting agents: Acetylcholine, Carbachol*, Bethanechol, Methacholine, Pilocarpine.

Indirect acting/ Cholinesterase inhibitors (Reversible & Irreversible): Physostigmine, Neostigmine*, Pyridostigmine, Edrophonium chloride, Tacrine hydrochloride, Ambenonium chloride, Isofluorphate, 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, Ethopropazinehydrochloride.

UNIT-IV **08Hours**

Drugs acting on Central Nervous System

A. Sedatives and Hypnotics:

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

Barbiturtes: SAR of barbiturates, Barbital*, Phenobarbital, Mephobarbital, Amobarbital, Butabarbital, Pentobarbital, Secobarbital

Miscelleneous:

Amides & imides: Glutethmide.

Alcohol & their carbamate derivatives: Meprobomate, Ethchlorvynol.

Aldehyde & their derivatives: Triclofos sodium, Paraldehyde.

B. Antipsychotics

Phenothiazeines: SAR of Phenothiazeines - Promazine hydrochloride, Chlorpromazine hydrochloride*, Triflupromazine, Thioridazine hydrochloride, Piperacetazine hydrochloride, Prochlorperazine maleate, Trifluoperazine hydrochloride.

Ring Analogues of Phenothiazeines: 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

UNIT– V **07Hours**

Drugs acting on Central Nervous System

General anesthetics:

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

Ultra short acting barbitutrates: Methohexital sodium*, Thiamylal sodium, Thiopentalsodium.

Dissociative anesthetics: Ketamine hydrochloride.*

Narcotic and non-narcotic analgesics

Morphine and related drugs: SAR of Morphine analogues, Morphine sulphate, Codeine, Meperidine hydrochloride, Anilerdine hydrochloride, Diphenoxylate hydrochloride, Loperamide hydrochloride, Fentanyl citrate*, Methadone hydrochloride*, Propoxyphene hydrochloride, Pentazocine, Levorphanol tartarate.

Narcotic antagonists: Nalorphine hydrochloride, Levallorphan tartarate, Naloxone hydrochloride.

Anti-inflammatory agents: Sodium salicylate, Aspirin, Mefenamic acid*, Meclofenamate, Indomethacin, Sulindac, Tolmetin, Zomepriac, Diclofenac, Ketorolac, Ibuprofen*, Naproxen, Piroxicam, Phenacetin, Acetaminophen, Antipyrine, Phenylbutazone.

BP406P. MEDICINAL CHEMISTRY – I (Practical)

4 Hours/Week

I Preparation of drugs/intermediates

1 1,3-pyrazole

2 1,3-oxazole

3 Benzimidazole

4 Benztriazole

5 2,3- diphenylquinoxaline

6 Benzocaine

7 Phenytoin

8 Phenothiazine

9 Barbiturate

II Assay ofdrugs

1 Chlorpromazine

2 Phenobarbitone

3 Atropine

4 Ibuprofen

5 Aspirin

6 Furosemide

III Determination of Partition coefficient for any twodrugs

Recommended Books (Latest Editions)

1. Wilson and Giswold's Organic medicinal and PharmaceuticalChemistry.
2. Foye's Principles of MedicinalChemistry.
3. Burger's Medicinal Chemistry, Vol I toIV.
4. Introduction to principles of drug design- Smith andWilliams.
5. Remington's Pharmaceutical Sciences.
6. Martindale's extrapharmacopoeia.

7. Organic Chemistry by I.L. Finar, Vol.II.
8. The Organic Chemistry of Drug Synthesis by Lednicer, Vol.1-5.
9. IndianPharmacopoeia.
10. Text book of practical organic chemistry-A.I.Vogel.

BP 403 T. PHYSICAL PHARMACEUTICS-II (Theory)

45Hours

Sushant University soaring high	**School of Health Sciences** **Bachelor of Pharmacy**		
Course Title: PHYSICAL PHARMACEUTICS-II			
Semester: IV	**Course code: BP 403 T**	**Credits: 6**	**Core / Elective: Core**
No. of lectures/ tutorials: 4/week		**No. of practical hours: 4/week**	
Course Pre-requisites: None			

COURSE OUTCOMES (COs):

Upon the completion of the course student shall be able to

CO 01: Understand various physicochemical properties of drug molecules in the designing the dosageforms

CO 02: Know the principles of chemical kinetics & to use them for stability testing nad determination of expiry date offormulations

CO 03: Demonstrate use of physicochemical properties in the formulation development and evaluation of dosageforms.

Mapping	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10
CO 01	H	H	L	L	M	H	H	H	M	L
CO 02	H	M	L	L	H	M	H	M	H	L
CO 03	H	H	L	L	M	M	H	H	H	L

Course Content:

UNIT-I **07Hours**

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& protectiveaction.

UNIT-II **10Hours**

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

UNIT-III **10Hours**

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

UNIT-IV **10Hours**

Micromeretics: 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 & flowproperties.

UNIT-V **10Hours**

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

BP 407P. PHYSICAL PHARMACEUTICS- II (Practical)

3 Hrs/week

1. Determination of particle size, particle size distribution using sievingmethod
2. Determination of particle size, particle size distribution using Microscopicmethod
3. Determination of bulk density, true density andporosity
4. Determine the angle of repose and influence of lubricant on angle ofrepose
5. Determination of viscosity of liquid using Ostwald'sviscometer
6. Determination sedimentation volume with effect of different suspendingagent
7. Determination sedimentation volume with effect of different concentration of single suspendingagent
8. Determination of viscosity of semisolid by using Brookfieldviscometer
9. Determination of reaction rate constant firstorder.
10. Determination of reaction rate constant secondorder
11. Accelerated stabilitystudies

Recommended Books: (LatestEditions)

1. Physical Pharmacy by Alfred Martin, Sixthedition
2. Experimental pharmaceutics by Eugene,Parott.
3. Tutorial pharmacy by Cooper andGunn.
4. Stocklosam J. Pharmaceutical calculations, Lea & Febiger,Philadelphia.
5. Liberman H.A, Lachman C., Pharmaceutical Dosage forms, Tablets, Volume-1 to 3, Marcel DekkarInc.
6. Liberman H.A, Lachman C, Pharmaceutical dosage forms. Disperse systems, volume1, 2, 3. Marcel DekkarInc.
7. Physical Pharmaceutics by Ramasamy C, and ManavalanR.

BP 404 T. PHARMACOLOGY-I (Theory)

45 Hrs

Sushant University soaring high	**School of Health Sciences** **Bachelor of Pharmacy**		
Course Title: PHARMACOLOGY-I			
Semester: IV	**Course code: BP 404 T**	**Credits: 6**	**Core / Elective: Core**
No. of lectures/ tutorials: 4/week		**No. of practical hours: 4/week**	
Course Pre-requisites: None			

COURSE OUTCOMES (COs):

Upon completion of this course the student should be able to

CO 01: Understand the pharmacological actions of different categories ofdrugs

CO 02: Explain the mechanism of drug action at organ system/subcellular/ macromolecularlevels.

CO 03: Apply the basic pharmacological knowledge in the prevention and treatmentof variousdiseases.

CO 04: Observe the effect of drugs on animals by simulatedexperiments

CO 05: Appreciate correlation of pharmacology with other bio medicalsciences

Mapping	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10
CO 01	H	L	L	L	H	M	H	M	H	L
CO 02	L	L	L	L	H	M	H	L	H	L
CO 03	H	H	L	L	H	H	H	M	H	L
CO 04	L	H	L	L	H	H	H	M	H	L
CO 05	L	H	L	L	H	M	H	L	H	L

Course Content:

UNIT-I **08hours**

1. GeneralPharmacology

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

UNIT-II **12Hours**

General Pharmacology

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

UNIT-III **10Hours**

2. Pharmacology of drugs acting on peripheral nervoussystem

a. Organization and function ofANS.

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 anestheticagents.

f. Drugs used in myasthenia gravis andglaucoma

UNIT-IV **08Hours**

3. Pharmacology of drugs acting on central nervoussystem

a. Neurohumoral transmission in the C.N.S.special emphasis on importance ofvarious neurotransmitters like with GABA, Glutamate, Glycine, serotonin,dopamine.

b. General anesthetics and pre-anesthetics**.**

c. Sedatives, hypnotics and centrally acting musclerelaxants.

d. Anti-epileptics

e. Alcohols anddisulfiram

UNIT-V **07Hours**

3. Pharmacology of drugs acting on central nervous system

a. Psychopharmacological agents: Antipsychotics, antidepressants, anti-anxietyagents, anti-manics andhallucinogens.

b. Drugs used in Parkinsons disease and Alzheimer'sdisease.

c. CNS stimulants andnootropics.

d. Opioid analgesics andantagonists

e. Drug addiction, drug abuse, tolerance anddependence.

BP 408 P.PHARMACOLOGY-I (Practical)

4Hrs/Week

1. Introduction to experimentalpharmacology.
2. Commonly used instruments in experimentalpharmacology.
3. Study of common laboratoryanimals.
4. Maintenance of laboratory animals as per CPCSEAguidelines.
5. Common laboratory techniques. Blood withdrawal, serum and plasma separation, anesthetics and euthanasia used for animalstudies.
6. Study of different routes of drugs administration inmice/rats.
7. Study of effect of hepatic microsomal enzyme inducers on the phenobarbitone sleeping time inmice.
8. Effect of drugs on ciliary motility of frogoesophagus
9. Effect of drugs on rabbiteye.
10. Effects of skeletal muscle relaxants using rota-rodapparatus.
11. Effect of drugs on locomotor activity usingactophotometer.
12. Anticonvulsant effect of drugs by MES and PTZmethod.
13. Study of stereotype and anti-catatonic activity of drugs onrats/mice.
14. Study of anxiolytic activity of drugs usingrats/mice.
15. Study of local anesthetics by differentmethods

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

Recommended Books (LatestEditions)

1. Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Rang andDale's Pharmacology,.Churchil LivingstoneElsevier
2. Katzung B. G., Masters S. B., Trevor A. J., Basic and clinical pharmacology, TataMc Graw-Hill
3. Goodman and Gilman's, The Pharmacological Basis ofTherapeutics
4. Marry Anne K. K., Lloyd Yee Y., Brian K. A., Robbin L.C., Joseph G. B., Wayne A. K., Bradley R.W., Applied Therapeutics, The Clinical use of Drugs, The PointLippincott Williams &Wilkins
5. Mycek M.J, Gelnet S.B and Perper M.M. Lippincott's IllustratedReviews-Pharmacology

6. K.D.Tripathi. Essentials of Medical Pharmacology, JAYPEE Brothers Medical Publishers (P) Ltd, NewDelhi.

7. Sharma H. L., Sharma K. K., Principles of Pharmacology, Paras medicalpublisher

8. Modern Pharmacology with clinical Applications, by Charles R.Craig&Robert,

9. Ghosh MN. Fundamentals of Experimental Pharmacology. Hilton & Company, Kolkata.

10. Kulkarni SK. Handbook of experimental pharmacology.VallabhPrakashan,

BP 405 T. PHARMACOGNOSY AND PHYTOCHEMISTRY I (Theory)

45 Hours

Sushant University soaring high	**School of Health Sciences** **Bachelor of Pharmacy**		
Course Title: PHARMACOGNOSY AND PHYTOCHEMISTRY I			
Semester: IV	**Course code: BP 405 T**	**Credits: 6**	**Core / Elective: Core**
No. of lectures/ tutorials: 4/week		**No. of practical hours: 4/week**	
Course Pre-requisites: None			

COURSE OUTCOMES (COs):

Upon completion of the course, the student shall be able

CO 01: to know the techniques in the cultivation and production of crudedrugs

CO 02: to know the crude drugs, their uses and chemicalnature

CO 03: know the evaluation techniques for the herbaldrugs

CO 04: to carry out the microscopic and morphological evaluation of crudedrugs

Mapping	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10
CO 01	H	M	L	L	H	L	H	L	L	L
CO 02	H	H	L	L	H	M	H	L	L	L
CO 03	M	H	L	L	H	L	H	M	L	L
CO 04	H	H	L	L	H	M	H	L	L	L

Course Content:

UNIT-I **10 Hours**

Introduction to Pharmacognosy:

(a) Definition, history, scope and development ofPharmacognosy

(b) Sources of Drugs – Plants, Animals, Marine & Tissueculture

(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, leafconstants, camera lucida and diagrams of microscopic objects to scale with camera lucida.

UNIT-II **10 Hours**

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

Cultivation and Collection of drugs of natural origin
Factors influencing cultivation of medicinal plants.
Plant hormones and their applications.

Polyploidy, mutation and hybridization with reference to medicinal plants

Conservation of medicinal plants

UNIT-III **07 Hours**

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

UNITIV **10 Hours**

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

UNITV **08 Hours**

Study of biological source, chemical nature and uses of drugs of natural origin containing following drugs

Plant Products:

Fibers - Cotton, Jute, Hemp

Hallucinogens, Teratogens, Natural allergens

Primary metabolites:

General introduction, detailed study with respect to chemistry, sources, preparation, evaluation, preservation, storage, therapeutic used and commercial utility as Pharmaceutical Aids and/or Medicines for the following Primary metabolites:

Carbohydrates: Acacia, Agar, Tragacanth,Honey

Proteins and Enzymes : Gelatin, casein, proteolytic enzymes (Papain, bromelain, serratiopeptidase, urokinase, streptokinase,pepsin).

Lipids(Waxes, fats, fixed oils) : Castor oil, Chaulmoogra oil, Wool Fat, Bees Wax

Marine Drugs:

Novel medicinal agents from marine sources

BP408 P. PHARMACOGNOSY AND PHYTOCHEMISTRY I (Practical)

4 Hours/Week

1. Analysis of crude drugs by chemical tests: **(**i)Tragaccanth (ii) Acacia (iii)Agar (iv) Gelatin (v) starch (vi) Honey (vii) Castoroil
2. Determination of stomatal number andindex
3. Determination of vein islet number, vein islet termination and palisideratio.
4. Determination of size of starch grains, calcium oxalate crystals by eye piece micrometer
5. Determination of Fiber length andwidth
6. Determination of number of starch grains by Lycopodium sporemethod
7. Determination of Ashvalue
8. Determination of Extractive values of crudedrugs
9. Determination of moisture content of crudedrugs
10. Determination of swelling index andfoaming

Recommended Books: (Latest Editions)

1. W.C.Evans, Trease and Evans Pharmacognosy, 16th edition, W.B. Sounders &Co., London,2009.
2. Tyler, V.E., Brady, L.R. and Robbers, J.E., Pharmacognosy, 9th Edn.,Leaand Febiger, Philadelphia,1988.
3. Text Book of Pharmacognosy by T.E.Wallis
4. Mohammad Ali. Pharmacognosy and Phytochemistry, CBS Publishers& Distribution, NewDelhi.
5. Text book of Pharmacognosy by C.K. Kokate, Purohit, Gokhlae (2007),37thEdition, Nirali Prakashan, NewDelhi.
6. Herbal drugindustrybyR.D.Choudhary(1996),IstEdn, EasternPublisher,New Delhi.
7. EssentialsofPharmacognosy,Dr.SH.Ansari,IIndedition,Birlapublications,New Delhi, 2007
8. Practical Pharmacognosy: C.K. Kokate, Purohit,Gokhlae
9. Anatomy of Crude Drugs by M.A.Iyengar

SEMESTER V

BP501T. MEDICINAL CHEMISTRY – II (Theory)

45 Hours

Sushant University soaring high	**School of Health Sciences** **Bachelor of Pharmacy**		
Course Title: MEDICINAL CHEMISTRY – II			
Semester: V	**Course code: BP 501 T**	**Credits: 4**	**Core / Elective: Core**
No. of lectures/ tutorials: 4/week		**No. of practical hours: 0/week**	
Course Pre-requisites: None			

Course Objectives: Upon completion of the course the student shall be able to

1. Understand the chemistry of drugs with respect to their pharmacological activity
2. Understand the drug metabolic pathways, adverse effect and therapeutic value of drugs
3. Know the Structural Activity Relationship of different class of drugs
4. Study the chemical synthesis of selected drugs

COURSE OUTCOMES (COs):

Upon completion of the course the student shall be able to

CO 01: Understand the chemistry of drugs with respect to their pharmacologicalactivity

CO 02: Understand the drug metabolic pathways, adverse effect and therapeutic value of drugs

CO 03: Know the Structural Activity Relationship of different class ofdrugs

CO 04: Study the chemical synthesis of selecteddrugs

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-I **10Hours**

Antihistaminic agents: Histamine, receptors and their distribution in the humanbody

H_1–antagonists: Diphenhydramine hydrochloride*, Dimenhydrinate, Doxylamines cuccinate, Clemastine fumarate, Diphenylphyraline hydrochloride, Tripelenamine hydrochloride, Chlorcyclizine hydrochloride, Meclizine hydrochloride, Buclizine hydrochloride, Chlorpheniramine maleate, Triprolidine hydrochloride*, Phenidamine tartarate, Promethazine hydrochloride*, Trimeprazine tartrate, Cyproheptadine hydrochloride, Azatidine maleate, Astemizole, Loratadine, Cetirizine, Levocetrazine Cromolynsodium

H_2-antagonists: Cimetidine*, Famotidine, Ranitidin.

Gastric Proton pump inhibitors: Omeprazole, Lansoprazole, Rabeprazole, Pantoprazole

Anti-neoplastic agents:

Alkylating agents: Meclorethamine*, Cyclophosphamide, Melphalan,

Chlorambucil, Busulfan, Thiotepa

Antimetabolites: Mercaptopurine*, Thioguanine, Fluorouracil, Floxuridine, Cytarabine, Methotrexate*, Azathioprine

Antibiotics: Dactinomycin, Daunorubicin, Doxorubicin, Bleomycin

Plant products: Etoposide, Vinblastin sulphate, Vincristin sulphate

Miscellaneous: Cisplatin, Mitotane.

UNIT– II **10Hours**

Anti-anginal:

Vasodilators: Amyl nitrite, Nitroglycerin*, Pentaerythritol tetranitrate, Isosorbide dinitrite*, Dipyridamole.

Calcium channel blockers: Verapamil, Bepridil hydrochloride, Diltiazem hydrochloride, Nifedipine, Amlodipine, Felodipine, Nicardipine,Nimodipine.

Diuretics:

Carbonic anhydrase inhibitors: Acetazolamide*, Methazolamide, Dichlorphenamide.

Thiazides: Chlorthiazide*, Hydrochlorothiazide, Hydroflumethiazide, Cyclothiazide,

Loop diuretics: Furosemide*, Bumetanide, Ethacrynic acid.

Potassium sparing Diuretics: Spironolactone, Triamterene,Amiloride.

Osmotic Diuretics:Mannitol

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

UNIT-III **10Hours**

Anti-arrhythmic Drugs: Quinidine sulphate, Procainamide hydrochloride, Disopyramide phosphate*, Phenytoin sodium, Lidocaine hydrochloride, Tocainide hydrochloride, Mexiletine hydrochloride, Lorcainide hydrochloride, Amiodarone,Sotalol.

Anti-hyperlipidemic agents: Clofibrate, Lovastatin, Cholesteramine and Cholestipol

Coagulant & Anticoagulants: Menadione, Acetomenadione, Warfarin*, Anisindione, clopidogrel

Drugs used in Congestive Heart Failure: Digoxin, Digitoxin, Nesiritide, Bosentan, Tezosentan.

UNIT-IV **08Hours**

Drugs acting on Endocrine system

Nomenclature, Stereochemistry and metabolism of steroids

Sex hormones: Testosterone, Nandralone, Progestrones, Oestriol, Oestradiol, Oestrione, Diethyl stilbestrol.
Drugs for erectile dysfunction: Sildenafil, Tadalafil.

Oral contraceptives: Mifepristone, Norgestril, Levonorgestrol

Corticosteroids: Cortisone, Hydrocortisone, Prednisolone, Betamethasone, Dexamethasone
Thyroid and antithyroid drugs: L-Thyroxine, L-Thyronine, Propylthiouracil, Methimazole.

UNIT– V **07Hours**

Antidiabetic agents:

Insulin and its preparations

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

Biguanides: Metformin.

Thiazolidinediones: Pioglitazone, Rosiglitazone.

Meglitinides: Repaglinide, Nateglinide.

Glucosidase inhibitors: Acrabose, Voglibose.

Local Anesthetics: SAR of Local anesthetics

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

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

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

Miscellaneous: Phenacaine, Diperodon, Dibucaine.*

Pedagogy

- Presentations learning methodology
- Demonstration on equipments
- Doubt solving sessions
- WhatsApp Group Support
- Real world Projects, Case Study & Assignments

Course Assessment Components

This course is of 100 marks and will have the following assessment components. Final Grades will be based on the relative performance of a student in the class

Average of Two Sessional Semester Examination	Continuous mode(Attendance/ Assignment(s)/Student-teacher interaction)	Total Internal Component	End Semester Examination
15	10	25	75

Recommended Books (Latest Editions)

1. A.H. Beckett & J.B. Stenlake's, Practical Pharmaceutical Chemistry Vol I & II, Stahlone Press of University of London
2. A.I. Vogel, Text Book of Quantitative Inorganic analysis
3. P. Gundu Rao, Inorganic Pharmaceutical Chemistry
4. Bentley and Driver's Textbook of Pharmaceutical Chemistry
5. John H. Kennedy, Analytical chemistry principles
6. Indian Pharmacopoeia.

PROGRAMME OUTCOMES (POs):

PO 01: To develop graduates with high practical capabilities inculcated with strong hold on fundamental concepts of Pharmaceutical sciences.

PO 02: Able to apply technical skills learned during the course to correlate interdisciplinary approach for solving complex problems of research in pharmaceutical sciences.

PO 03: Inculcate professional and ethical values as a pharmacist as well as knowledge and skills to successfully practice the profession of pharmacy.

PO 04: Able to communicate effectively, provide adequate technical information for patient counselling and effective participation in health care programs.

PO 05: To impart knowledge of formulation, synthesis and evaluation of drugs of synthetic/ herbal origin along with their identification, purification and isolation.

PO 06: To train students as per industrial expectations and entrepreneurship establishment.

PO 07: Understand the ongoing recent advancements in the field of medicine for patient benefit and encouraged for novel innovations

PO 08: To develop students with critical thinking skills by integrated technical knowledge obtained during course of study.

PO 09: Students understand different dosage forms, Pharmaceutical preparations, and their route of administration, mechanism of action and Bioavailability concept in conjunction with human anatomy and physiology.

PO 10: Understand various regulatory guidelines for import and export of drugs, clinical trials, cultivation and collection of drugs, IPR, QA & QC and various laws governing pharmacy profession.

Matrix 1- Mapping of COs with Pos

Mapping	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10
CO 01	H	H	L	M	M	M	M	M	L	L
CO 02	H	M	L	M	H	M	L	L	L	L
CO 03	H	H	L	H	H	M	L	M	L	L
CO 04	H	M	L	M	H	L	M	L	L	L

BP 502 T. Industrial PharmacyI (Theory)

45 Hours

Sushant University soaring high	**School of Health Sciences** **Bachelor of Pharmacy**		
Course Title: Industrial PharmacyI			
Semester: V	**Course code: BP 502 T**	**Credits: 6**	**Core / Elective: Core**
No. of lectures/ tutorials: 4/week		**No. of practical hours: 4/week**	
Course Pre-requisites: None			

COURSE OUTCOMES (COs):

Upon completion of the course the student shall be able to

CO 01: Know the various pharmaceutical dosage forms and their manufacturing techniques.

CO 02: Know various considerations in development of pharmaceutical dosageforms

CO 03: Formulate solid, liquid and semisolid dosage forms and evaluate them for their quality

Mapping	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10
CO 01	M	H	L	L	L	H	L	M	M	M
CO 02	M	H	L	L	M	H	L	H	M	M
CO 03	M	H	L	L	M	H	L	H	M	M

Course content:

3 hours/ week

UNIT-I **07Hours**

Preformulation Studies: Introduction to preformulation, goals and objectives, study of physicochemical characteristics of drug substances.

a. Physical properties: Physical form (crystal & amorphous), particle size, shape, flow properties, solubility profile (pKa, pH, partition coefficient),polymorphism

b. Chemical Properties: Hydrolysis, oxidation, reduction, racemisation,polymerization

BCS classification of drugs & itssignificant

Application of preformulation considerations in the development of solid, liquid oral and parenteral dosage forms and its impact on stability of dosage forms.

UNIT-II **10Hours**

Tablets:

a. Introduction, ideal characteristics of tablets, classification of tablets. Excipients, Formulation of tablets, granulation methods, compression and processing problems. Equipments and tablettooling.

b. Tablet coating: Types of coating, coating materials, formulation of coating composition, methods of coating, equipment employed and defects incoating.

c. Quality control tests: In process and finished producttests

Liquid orals: Formulation and manufacturing consideration of syrups and elixirs suspensions and emulsions; Filling and packaging; evaluation of liquid orals official inpharmacopoeia

UNIT-III **08Hours**

Capsules:

a. ***Hard gelatin capsules:*** Introduction, Production of hard gelatin capsule shells. size of capsules, Filling, finishing and special techniques of formulation of hard gelatin capsules, manufacturing defects. In process and final product quality control tests forcapsules.

b. ***Soft gelatin capsules:*** Nature of shell and capsule content, size of capsules,importance of base adsorption and minim/gram factors, production, in process and final product quality control tests. Packing, storage and stability testing of soft gelatin capsules and theirapplications.

Pellets: Introduction, formulation requirements, pelletization process, equipments for manufacture of pellets

UNIT-IV **10Hours**

Parenteral Products:

a. Definition, types, advantages and limitations. Preformulation factors and essential requirements, vehicles, additives, importance ofisotonicity

b. Production procedure, production facilities and controls, asepticprocessing

c. Formulation of injections, sterile powders, large volume parenterals and lyophilizedproducts.

d. Containers and closures selection, filling and sealing of ampoules, vials and infusion fluids. Quality control tests of parenteralproducts.

Ophthalmic Preparations: Introduction, formulation considerations; formulation of eyedrops, eye ointments and eye lotions; methods of preparation; labeling, containers; evaluation of ophthalmic preparations

UNIT-V **10Hours**

Cosmetics: Formulation and preparation of the following cosmetic preparations: lipsticks, shampoos, cold cream and vanishing cream, tooth pastes, hair dyes and sunscreens.

Pharmaceutical Aerosols: Definition, propellants, containers, valves, types of aerosol systems; formulation and manufacture of aerosols; Evaluation of aerosols; Quality control and stabilitystudies.

Packaging Materials Science: Materials used for packaging of pharmaceutical products, factors influencing choice of containers, legal and official requirements for containers, stability aspects of packaging materials, quality control tests.

BP 506 P. Industrial PharmacyI (Practical)

4 Hours/week

1. Preformulation studies on paracetamol/asparin/or any otherdrug
2. Preparation and evaluation of Paracetamoltablets
3. Preparation and evaluation of Aspirintablets
4. Coating of tablets- film coating oftables/granules
5. Preparation and evaluation of Tetracyclinecapsules
6. Preparation of Calcium Gluconateinjection
7. Preparation of Ascorbic Acid injection
8. Qulaity control test of (as per IP) marketed tablets andcapsules
9. Preparation of Eye drops/ and Eyeointments
10. Preparation of Creams (cold / vanishingcream)
11. Evaluation of Glass containers (as perIP)

Recommended Books: (Latest Editions)

1. Pharmaceutical dosage forms - Tablets, volume 1 -3 by H.A. Liberman, LeonLachman &J.B.Schwartz
2. Pharmaceutical dosage form - Parenteral medication vol- 1&2 by Liberman & Lachman
3. Pharmaceutical dosage form disperse system VOL-1 by Liberman &Lachman
4. Modern Pharmaceutics by Gilbert S. Banker & C.T. Rhodes, 3rdEdition
5. Remington: The Science and Practice of Pharmacy, 20th edition Pharmaceutical Science(RPS)
6. Theory and Practice of Industrial Pharmacy by Liberman &Lachman
7. Pharmaceutics- The science of dosage form design by M.E.Aulton, Churchill livingstone, Latestedition
8. Introduction to Pharmaceutical Dosage Forms by H. C.Ansel, Lea &Febiger, Philadelphia, 5th edition,2005
9. Drug stability - Principles and practice by Cartensen & C.J. Rhodes, 3rd Edition, Marcel Dekker Series, Vol107.

BP 503 T. PHARMACOLOGY-II (Theory)

45 Hours

Sushant University soaring high	**School of Health Sciences** **Bachelor of Pharmacy**		
Course Title: PHARMACOLOGY-II			
Semester: V	**Course code: BP 503 T**	**Credits: 6**	**Core / Elective: Core**
No. of lectures/ tutorials: 4/week		**No. of practical hours: 4/week**	
Course Pre-requisites: None			

COURSE OUTCOMES (COs):

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

CO 01: Understand the mechanism of drug action and its relevance in the treatmentof differentdiseases

CO 02: Demonstrate isolation of different organs/tissues from the laboratory animals by simulatedexperiments

CO 03: Demonstrate the various receptor actions using isolated tissuepreparation

CO 04: Appreciate correlation of pharmacology with related medicalsciences

Mapping	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10
CO 01	H	L	L	L	H	M	H	M	H	L
CO 02	L	L	L	L	H	M	H	L	H	L
CO 03	H	H	L	L	H	H	H	M	H	L
CO 04	L	H	L	L	H	H	H	M	H	L

Course Content:

UNIT-I **10hours**

1. Pharmacology of drugs acting on cardio vascularsystem

a. Introduction to hemodynamic and electrophysiology ofheart.
b. Drugs used in congestive heartfailure
c. Anti-hypertensivedrugs.
d. Anti-anginaldrugs.
e. Anti-arrhythmicdrugs.
f. Anti-hyperlipidemicdrugs.

UNIT-II **10hours**

1. Pharmacology of drugs acting on cardio vascularsystem

a. Drug used in the therapy ofshock.

b. Hematinics, coagulants andanticoagulants.
c. Fibrinolytics and anti-plateletdrugs
d. Plasma volumeexpanders

2. Pharmacology of drugs acting on urinarysystem

a. Diuretics
b. Anti-diuretics.

UNIT-III **10hours**

3. Autocoids and relateddrugs

a. Introduction to autacoids andclassification
b. Histamine, 5-HT and theirantagonists.
c. Prostaglandins, Thromboxanes andLeukotrienes.
d. Angiotensin, Bradykinin and SubstanceP.
e. Non-steroidal anti-inflammatoryagents
f. Anti-gout drugs
g. Antirheumaticdrugs

UNIT-IV **08hours**

5. Pharmacology of drugs acting on endocrinesystem

a. Basic concepts in endocrinepharmacology.
b. Anterior Pituitary hormones- analogues and theirinhibitors.
c. Thyroid hormones- analogues and theirinhibitors.
d. Hormones regulating plasma calcium level- Parathormone, Calcitonin and Vitamin-D.
d. Insulin, Oral Hypoglycemic agents and glucagon.
e. ACTH and corticosteroids.

UNIT-V **07hours**

5. Pharmacology of drugs acting on endocrinesystem

a. Androgens and Anabolicsteroids.
b. Estrogens, progesterone and oralcontraceptives.
c. Drugs acting on theuterus.

6. Bioassay

a. Principles and applications of bioassay.
b.Types of bioassay
c. Bioassay of insulin, oxytocin, vasopressin, ACTH,d-tubocurarine,digitalis, histamine and 5-HT

BP 507 P. PHARMACOLOGY-II (Practical)

4Hrs/Week

1. Introduction to *in-vitro* pharmacology and physiological saltsolutions.
2. Effect of drugs on isolated frogheart.
3. Effect of drugs on blood pressure and heart rate ofdog.
4. Study of diuretic activity of drugs usingrats/mice.
5. DRC of acetylcholine using frog rectus abdominismuscle.
6. Effect of physostigmine and atropine on DRC of acetylcholine using frogrectus abdominis muscle and rat ileumrespectively.
7. Bioassay of histamine using guinea pig ileum by matchingmethod.
8. Bioassay of oxytocin using rat uterine horn by interpolationmethod.
9. Bioassay of serotonin using rat fundus strip by three pointbioassay.
10. Bioassay of acetylcholine using rat ileum/colon by four pointbioassay.
11. Determination of PA_2 value of prazosin using rat anococcygeus muscle(by Schilds plotmethod).
12. Determination of PD_2 value using guinea pigileum.
13. Effect of spasmogens and spasmolytics using rabbitjejunum.
14. Anti-inflammatory activity of drugs using carrageenan induced paw-edema model.
15. Analgesic activity of drug using central and peripheralmethods

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

Recommended Books (Latest Editions)

1. RangH.P.,DaleM.M.,RitterJ.M.,Flower R.J.,RangandDale'sPharmacology, Churchil LivingstoneElsevier
2. Katzung B. G., Masters S. B., Trevor A. J., Basic and clinical pharmacology, TataMc Graw-Hill.
3. Goodman and Gilman's, The Pharmacological Basis ofTherapeutics
4. Marry Anne K. K., Lloyd Yee Y., Brian K. A., Robbin L.C., Joseph G. B., Wayne A. K., Bradley R.W., Applied Therapeutics, The Clinical use of Drugs, The Point Lippincott Williams & Wilkins.
5. Mycek M.J, Gelnet S.B and Perper M.M. Lippincott's IllustratedReviews-Pharmacology.
6. K.D.Tripathi. Essentials of Medical Pharmacology, , JAYPEE BrothersMedical Publishers (P) Ltd, NewDelhi.
7. Sharma H. L., Sharma K. K., Principles of Pharmacology, Paras medicalpublisher
8. Modern Pharmacology with clinical Applications, by Charles R.Craig&Robert.
9. Ghosh MN. Fundamentals of Experimental Pharmacology. Hilton &Company, Kolkata.
10. Kulkarni SK. Handbook of experimental pharmacology. VallabhPrakashan.

BP504 T. PHARMACOGNOSY AND PHYTOCHEMISTRY II (Theory)

45Hours

Sushant University soaring high	**School of Health Sciences** **Bachelor of Pharmacy**		
Course Title: PHARMACOGNOSY AND PHYTOCHEMISTRY II			
Semester: V	**Course code: BP 504 T**	**Credits: 6**	**Core / Elective: Core**
No. of lectures/ tutorials: 4/week		**No. of practical hours: 4/week**	
Course Pre-requisites: None			

COURSE OUTCOMES (COs):

Upon completion of the course, the student shall be able

CO 01: to know the modern extraction techniques, characterization and identification of the herbal drugs andphytoconstituents

CO 02: to understand the preparation and development of herbalformulation.

CO 03: to understand the herbal druginteractions

CO 04: to carryout isolation and identification ofphytoconstituents

Mapping	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10
CO 01	H	M	L	L	H	L	H	L	L	L
CO 02	H	H	L	L	H	M	H	L	L	L
CO 03	M	H	L	L	H	L	H	M	L	L
CO 04	H	H	L	L	H	M	H	L	L	L

Course Content:

UNIT-I **7 Hours**

Metabolic pathways in higher plants and their determination

a) Brief study of basic metabolic pathways and formation of different secondary metabolites throughthesepathways-ShikimicacidpathwayAcetatepathwaysandAminoacidpathway.
b) Study of utilization of radioactive isotopes in the investigation ofBiogenetic studies.

UNIT-II **14 Hours**

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

secondary metabolites:

Alkaloids: Vinca, Rauwolfia, Belladonna, Opium,

Phenylpropanoids and Flavonoids: Lignans, Tea, Ruta

Steroids, Cardiac Glycosides & Triterpenoids: Liquorice, Dioscorea, Digitalis

Volatile oils: Mentha, Clove, Cinnamon, Fennel, Coriander,

Tannins: Catechu, Pterocarpus

Resins: Benzoin, Guggul, Ginger, Asafoetida, Myrrh, Colophony

Glycosides: Senna, Aloes, Bitter Almond

Iridoids, Other terpenoids & Naphthaquinones: Gentian, Artemisia, taxus, carotenoids

UNIT-III **06 Hours**

Isolation, Identification and Analysis of Phytoconstituents

a) Terpenoids: Menthol, Citral,Artemisin
b) Glycosides: Glycyrhetinic acid &Rutin
c) Alkaloids: Atropine,Quinine,Reserpine,Caffeine
d) Resins: Podophyllotoxin,Curcumin

UNIT-IV **10 Hours**

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

UNITV **8Hours**

Basics of Phytochemistry

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

BP 508 P. PHARMACOGNOSY AND PHYTOCHEMISTRY II (Practical)

4 Hours/Week

1. Morphology,histologyandpowdercharacteristics&extraction&detectionof: Cinchona, Cinnamon, Senna, Clove, Ephedra, Fennel andCoriander
2. Exercise involving isolation & detection of activeprinciples
   a. Caffeine - from teadust.
   b. Diosgenin fromDioscorea
   c. Atropine fromBelladonna
   d. Sennosides fromSenna
3. Separation of sugars by Paperchromatography
4. TLC of herbalextract
5. Distillation of volatile oils and detection of phytoconstitutents byTLC
6. Analysis of crude drugs by chemical tests: **(**i) Asafoetida (ii) Benzoin (iii) Colophony (iv) Aloes (v) Myrrh

Recommended Books: (Latest Editions)

1. W.C.Evans, Trease and Evans Pharmacognosy, 16th edition, W.B. Sounders &Co., London,2009.
2. Mohammad Ali. Pharmacognosy and Phytochemistry, CBS Publishers& Distribution, NewDelhi.
3. Text book of Pharmacognosy by C.K. Kokate, Purohit, Gokhlae (2007),37thEdition, Nirali Prakashan, NewDelhi.
4. Herbal drugindustrybyR.D.Choudhary(1996),IstEdn, EasternPublisher,New Delhi.
5. EssentialsofPharmacognosy,Dr.SH.Ansari,IIndedition,Birlapublications,New Delhi, 2007
6. Herbal Cosmetics by H.Pande, Asia Pacific Business press, Inc, NewDelhi.
7. A.N.Kalia,TextbookofIndustrialPharmacognosy,CBSPublishers,NewDelhi, 2005.
8. R Endress, Plant cell Biotechnology, Springer-Verlag, Berlin,1994.
9. Pharmacognosy & Pharmacobiotechnology. James Bobbers, Marilyn KS, VETylor.
10. The formulation and preparation of cosmetic, fragrances andflavours.
11. Remington's Pharmaceutical sciences.
12. Text Book of Biotechnology by Vyas andDixit.
13. Text Book of Biotechnology by R.C.Dubey.

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BP 505 T. PHARMACEUTICAL JURISPRUDENCE (Theory)

45 Hours

Sushant University soaring high	**School of Health Sciences** **Bachelor of Pharmacy**		
Course Title: PHARMACEUTICAL JURISPRUDENCE			
Semester: V	**Course code: BP 505 T**	**Credits: 4**	**Core / Elective: Core**
No. of lectures/ tutorials: 4/week		**No. of practical hours: 0/week**	
Course Pre-requisites: None			

COURSE OUTCOMES (COs):

Upon completion of the course, the student shall be able to understand:

CO 01: The Pharmaceutical legislations and their implications in the developmentand marketing ofpharmaceuticals.

CO 02: Various Indian pharmaceutical Acts andLaws

CO 03: The regulatory authorities and agencies governing the manufacture and saleof pharmaceuticals

CO 04: The code of ethics during the pharmaceuticalpractice

Mapping	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10
CO 01	L	L	H	L	L	L	L	M	M	H
CO 02	L	L	H	M	L	L	M	L	L	H
CO 03	L	L	H	L	M	L	M	L	M	H
CO 04	L	L	H	L	M	L	M	L	L	H

Course Content:

UNIT-I **10Hours**

Drugs and Cosmetics Act, 1940 and its rules 1945:

Objectives, Definitions, Legal definitions of schedules to the Act and Rules

Import of drugs – Classes of drugs and cosmetics prohibited from import, Import under license or permit. Offences and penalties**.**

Manufacture of drugs – Prohibition of manufacture and sale of certain drugs,

Conditions for grant of license and conditions of license for manufacture of drugs, Manufacture of drugs for test, examination and analysis, manufacture of new drug, loan license and repacking license.

UNIT-II **10Hours**

Drugs and Cosmetics Act, 1940 and its rules 1945.

Detailed study of Schedule G, H, M, N, P,T,U, V, X, Y, Part XII B, Sch F & DMR (OA)

Sale of Drugs – Wholesale, Retail sale and Restricted license. Offences and penalties

Labeling & Packing of drugs- General labeling requirements and specimen labels for drugs and cosmetics, List of permitted colors. Offences and penalties.

Administration of the Act and Rules – Drugs Technical Advisory Board, Central drugs Laboratory, Drugs Consultative Committee, Government drug analysts, Licensing authorities, controlling authorities, Drugs Inspectors

UNIT-III **10Hours**

- **Pharmacy Act –1948**: Objectives, Definitions, Pharmacy Council of India; its constitution and functions, Education Regulations, State and Joint state pharmacy councils; constitution and functions, Registration of Pharmacists, Offencesand

Penalties

- **Medicinal and Toilet Preparation Act –1955**: Objectives, Definitions, Licensing, Manufacture In bond and Outside bond, Export of alcoholic preparations, Manufacture of Ayurvedic, Homeopathic, Patent & Proprietary Preparations. Offences andPenalties.
- **Narcotic Drugs and Psychotropic substances Act-1985 and Rules**: Objectives, Definitions, Authorities and Officers, Constitution and Functions of narcotic & Psychotropic Consultative Committee, National Fund for Controlling the Drug Abuse, Prohibition, Control and Regulation, opium poppy cultivation and production of poppy straw, manufacture, sale and export of opium, Offences andPenalties

UNIT-IV **08Hours**

- **Study of Salient Features of Drugs and Magic Remedies Act and its rules:** Objectives, Definitions, Prohibition of certain advertisements, Classes of Exempted advertisements, Offences andPenalties
- **Prevention of Cruelty to animals Act-1960:** Objectives, Definitions, Institutional Animal Ethics Committee, CPCSEA guidelines for Breeding and Stocking of Animals, Performance of Experiments, Transfer and acquisition of animals for experiment, Records, Power to suspend or revoke registration, Offences andPenalties
- **National Pharmaceutical Pricing Authority:** Drugs Price Control Order (DPCO)-2013. Objectives, Definitions, Sale prices of bulk drugs, Retail price of formulations, Retail price and ceiling price of scheduled formulations, National List of Essential Medicines(NLEM)

UNIT-V **07Hours**

- **Pharmaceutical Legislations –** A brief review, Introduction, Study of drugs enquiry committee, Health survey and development committee, Hathi committee and Mudaliarcommittee
- **Code of Pharmaceutical ethics** D efinition, Pharmacist in relation to his job, trade, medical profession and his profession, Pharmacist'soath
- **Medical Termination of PregnancyAct**
- **Right to InformationAct**
- **Introduction to Intellectual Property Rights(IPR)**

Recommended books: (Latest Edition)

1. Forensic Pharmacy by B.Suresh

2. Text book of Forensic Pharmacy by B.M.Mithal

3. Hand book of drug law-by M.L.Mehra

4. A text book of Forensic Pharmacy by N.K.Jain

5. Drugs and Cosmetics Act/Rules by Govt. of Indiapublications.

6. Medicinal and Toilet preparations act 1955 by Govt. of Indiapublications.

7. Narcotic drugs and psychotropic substances act by Govt. of Indiapublications

8. Drugs and Magic Remedies act by Govt. of Indiapublication

9.Bare Acts of the said laws published by Government. Reference books(Theory)

SEMESTER VI

BP601T. MEDICINAL CHEMISTRY – III (Theory)

45 Hours

Sushant University soaring high	**School of Health Sciences** **Bachelor of Pharmacy**		
Course Title: MEDICINAL CHEMISTRY – III			
Semester: VI	**Course code: BP 601T**	**Credits: 6**	**Core / Elective: Core**
No. of lectures/ tutorials: 4/week		**No. of practical hours: 4/week**	
Course Pre-requisites: None			

COURSE OUTCOMES (COs):

Upon completion of the course student shall be able to

CO 01: Understand the importance of drug design and different techniques ofdrug design.

CO 02: Understand the chemistry of drugs with respect to their biologicalactivity.

CO 03: Know the metabolism, adverse effects and therapeutic value ofdrugs.

CO 04: Know the importance of SAR ofdrugs.

Mapping	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10
CO 01	H	H	L	M	M	M	M	M	L	L
CO 02	H	M	L	M	H	M	L	L	L	L
CO 03	H	H	L	H	H	M	L	M	L	L
CO 04	H	M	L	M	H	L	M	L	L	L

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 by (*)

UNIT– I **10Hours**

Antibiotics

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

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

Aminoglycosides: Streptomycin, Neomycin, Kanamycin

Tetracyclines: Tetracycline,Oxytetracycline, Chlortetracycline, Minocycline,Doxycycline

UNIT– II **10Hours**

Antibiotics

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

Macrolide: Erythromycin Clarithromycin, Azithromycin.

Miscellaneous: Chloramphenicol*, Clindamycin.

Prodrugs: Basic concepts and application of prodrugs design.

Antimalarials: Etiology of malaria.

Quinolines: SAR, Quinine sulphate, Chloroquine*, Amodiaquine, Primaquine phosphate, Pamaquine*, Quinacrine hydrochloride,Mefloquine.

Biguanides and dihydro triazines: Cycloguanil pamoate, Proguanil.

Miscellaneous: Pyrimethamine, Artesunete, Artemether, Atovoquone.

UNIT– III **10Hours**

Anti-tubercular Agents

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

Anti tubercular antibiotics: Rifampicin, Rifabutin, Cycloserine Streptomycine, Capreomycinsulphate.

Urinary tract anti-infective agents

Quinolones: SAR of quinolones, Nalidixic Acid,Norfloxacin, Enoxacin, Ciprofloxacin*, Ofloxacin,Lomefloxacin,Sparfloxacin, Gatifloxacin, Moxifloxacin

Miscellaneous: Furazolidine, Nitrofurantoin*, Methanamine.

Antiviral agents:

Amantadine hydrochloride, Rimantadine hydrochloride, Idoxuridine trifluoride, Acyclovir*, Gancyclovir, Zidovudine, Didanosine, Zalcitabine, Lamivudine, Loviride, Delavirding, Ribavirin, Saquinavir, Indinavir, Ritonavir.

UNIT– IV **08Hours**

Antifungal agents:

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

Synthetic Antifungal agents: Clotrimazole, Econazole, Butoconazole, Oxiconazole Tioconozole, Miconazole*, Ketoconazole, Terconazole, Itraconazole, Fluconazole, Naftifine hydrochloride,Tolnaftate*.

Anti-protozoal Agents: Metronidazole*, Tinidazole, Ornidazole, Diloxanide,

Iodoquinol, Pentamidine Isethionate, Atovaquone,Eflornithine.

Anthelmintics: Diethylcarbamazine citrate*, Thiabendazole, Mebendazole*, Albendazole, Niclosamide, Oxamniquine, Praziquantal, Ivermectin.

Sulphonamides and Sulfones

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

Folate reductase inhibitors: Trimethoprim*, Cotrimoxazole.

Sulfones: Dapsone*.

UNIT– V **07Hours**

Introduction to Drug Design

Various approaches used in drug design.

Physicochemical parameters used in quantitative structure activity relationship (QSAR) such as partition coefficient, Hammet's electronic parameter, Tafts steric parameter and Hanschanalysis.

Pharmacophore modeling and docking techniques.

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

BP607P. MEDICINAL CHEMISTRY- III(Practical)

4 Hours / week

I Preparation of drugs andintermediates

1 Sulphanilamide

2 7-Hydroxy, 4-methylcoumarin

3 Chlorobutanol

4 Triphenylimidazole

5 Tolbutamide

6 Hexamine

II Assay ofdrugs

1 Isonicotinic acidhydrazide

2 Chloroquine

3 Metronidazole

4 Dapsone

5 Chlorpheniraminemaleate

6 Benzylpenicillin

III Preparation of medicinally important compounds or intermediates byMicrowave irradiationtechnique

IV Drawing structures and reactions using chemdraw®

V Determination of physicochemical properties such as logP, clogP, MR, Molecular weight, Hydrogen bond donors and acceptors for class of drugs course content using drug design software Drug likeliness screening (LipinskiesRO5)

Recommended Books (Latest Editions)

1. Wilson and Giswold's Organic medicinal and PharmaceuticalChemistry.
2. Foye's Principles of MedicinalChemistry.
3. Burger's Medicinal Chemistry, Vol I toIV.
4. Introduction to principles of drug design- Smith andWilliams.
5. Remington's Pharmaceutical Sciences.
6. Martindale's extrapharmacopoeia.

7. Organic Chemistry by I.L. Finar, Vol.II.
8. The Organic Chemistry of Drug Synthesis by Lednicer, Vol.1-5.
9. IndianPharmacopoeia.
10. Text book of practical organic chemistry-A.I.Vogel.

BP602 T. PHARMACOLOGY-III (Theory)

45 Hours

Sushant University soaring high	**School of Health Sciences** **Bachelor of Pharmacy**		
Course Title: PHARMACOLOGY-III			
Semester: VI	**Course code: BP 602T**	**Credits: 6**	**Core / Elective: Core**
No. of lectures/ tutorials: 4/week		**No. of practical hours: 4/week**	
Course Pre-requisites: None			

COURSE OUTCOMES (COs):
Upon completion of this course the student should be able to:

CO 01: understand the mechanism of drug action and its relevance in the treatmentof different infectiousdiseases

CO 02: comprehend the principles of toxicology and treatment of variouspoisoningsand

CO 03: appreciate correlation of pharmacology with related medicalsciences.

Mapping	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10
CO 01	H	L	L	L	H	M	H	M	H	L
CO 02	L	L	L	L	H	M	H	L	H	L
CO 03	H	H	L	L	H	H	H	M	H	L

Course Content:

UNIT-I **10hours**

1. Pharmacology of drugs acting on Respiratorysystem

a. Anti -asthmaticdrugs
b. Drugs used in the management ofCOPD
c. Expectorants and antitussives
d. Nasaldecongestants
e. Respiratorystimulants

2. Pharmacology of drugs acting on the GastrointestinalTract

a. Antiulceragents.
b. Drugs for constipation anddiarrhoea.
c. Appetite stimulants andsuppressants.
d. Digestants andcarminatives.
e. Emetics andanti-emetics.

UNIT-II **10hours**

3. Chemotherapy

a. General principles ofchemotherapy.

b. Sulfonamides andcotrimoxazole.

c. Antibiotics- Penicillins, cephalosporins, chloramphenicol,macrolides, quinolones and fluoroquinolins, tetracycline andaminoglycosides

UNIT-III **10hours**

3. Chemotherapy

a. Antitubercular agents

b. Antileproticagents

c. Antifungalagents

d. Antiviral drugs

e.Anthelmintics

f. Antimalarial drugs

g. Antiamoebic agents

UNIT-IV **08hours**

3. Chemotherapy

l. Urinary tract infections and sexually transmitted diseases.

m. Chemotherapy of malignancy.

4. Immunopharmacology

a. Immunostimulants

b. Immunosuppressant

Protein drugs, monoclonal antibodies, target drugs to antigen, biosimilars

UNIT-V **07hours**

5. Principles oftoxicology

a. Definition and basic knowledge of acute, subacute and chronictoxicity.

b. Definition and basic knowledge of genotoxicity, carcinogenicity, teratogenicity andmutagenicity

c. General principles of treatment of poisoning

d. Clinical symptoms and management of barbiturates, morphine, organophosphosphorus compound and lead, mercury and arsenicpoisoning.

6. Chronopharmacology

a. Definition of rhythm andcycles.

b. Biological clock and their significance leading tochronotherapy.

BP 608 P. PHARMACOLOGY-III (Practical)

4Hrs/Week

1. Dose calculation in pharmacologicalexperiments
2. Antiallergic activity by mast cell stabilizationassay
3. Study of anti-ulcer activity of a drug using pylorus ligand (SHAY) rat modeland NSAIDS induced ulcermodel.
4. Study of effect of drugs on gastrointestinalmotility
5. Effect of agonist and antagonists on guinea pigileum
6. Estimation of serum biochemical parameters by using semi-autoanalyser
7. Effect of saline purgative on frogintestine
8. Insulin hypoglycemic effect inrabbit
9. Test for pyrogens (rabbit method)
10. Determination of acute oral toxicity (LD50) of a drug from a givendata
11. Determination of acute skin irritation / corrosion of a testsubstance
12. Determination of acute eye irritation / corrosion of a testsubstance
13. Calculation of pharmacokinetic parameters from a givendata
14. Biostatistics methods in experimental pharmacology(student's t test,ANOVA)
15. Biostatistics methods in experimental pharmacology (Chi square test,Wilcoxon Signed Ranktest)

**Experiments are demonstrated by simulated experiments/videos*

Recommended Books (Latest Editions)

1. RangH.P.,DaleM.M.,RitterJ.M.,FlowerR.J.,RangandDale'sPharmacology, Churchil LivingstoneElsevier
2. Katzung B. G., Masters S. B., Trevor A. J., Basic and clinical pharmacology, Tata Mc Graw-Hill
3. Goodman and Gilman's, The Pharmacological Basis ofTherapeutics
4. Marry Anne K. K., Lloyd Yee Y., Brian K. A., Robbin L.C., Joseph G. B., Wayne A. K., Bradley R.W., Applied Therapeutics, The Clinical use of Drugs. The PointLippincott Williams &Wilkins
5. Mycek M.J, Gelnet S.B and Perper M.M. Lippincott's IllustratedReviews-Pharmacology
6. K.D.Tripathi. Essentials of Medical Pharmacology, , JAYPEE Brothers Medical Publishers (P) Ltd, NewDelhi.
7. Sharma H. L., Sharma K. K., Principles of Pharmacology, Paras medical publisher Modern Pharmacology with clinical Applications, by Charles R.Craig&Robert,
8. Ghosh MN. Fundamentals of Experimental Pharmacology. Hilton & Company, Kolkata,
9. Kulkarni SK. Handbook of experimental pharmacology.VallabhPrakashan,
10. N.Udupa and P.D. Gupta, Concepts inChronopharmacology.

BP 603 T. HERBAL DRUG TECHNOLOGY
(Theory)

45 hours

Sushant University soaring high	**School of Health Sciences** **Bachelor of Pharmacy**		
Course Title: HERBAL DRUG TECHNOLOGY			
Semester: VI	**Course code: BP 603 T**	**Credits: 6**	**Core / Elective: Core**
No. of lectures/ tutorials: 4/week		**No. of practical hours: 4/week**	
Course Pre-requisites: None			

COURSE OUTCOMES (COs):

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

CO 01: understand raw material as source of herbal drugs from cultivation to herbal drug product

CO 02: know the WHO and ICH guidelines for evaluation of herbaldrugs

CO 03: know the herbal cosmetics, natural sweeteners,nutraceuticals

CO 04: appreciate patenting of herbal drugs, GMP.

Mapping	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10
CO 01	H	M	L	L	H	L	H	L	L	L
CO 02	H	H	L	L	H	M	H	L	L	L
CO 03	M	H	L	L	H	L	H	M	L	L
CO 04	H	H	L	L	H	M	H	L	L	L

Course content:

UNIT-I **11 Hours**

Herbs as raw materials

Definition of herb, herbal medicine, herbal medicinal product, herbal drug preparation
Source of Herbs

Selection, identification and authentication of herbal materials
Processing of herbal raw material

Biodynamic Agriculture

Good agricultural practices in cultivation of medicinal plants including Organic farming.
Pest and Pest management in medicinal plants: Biopesticides/Bioinsecticides.

Indian Systems of Medicine

a) Basic principles involved in Ayurveda, Siddha, Unani andHomeopathy
b) PreparationandstandardizationofAyurvedicformulationsvizAristasandAsawas, Ghutika,Churna, Lehya andBhasma.

UNIT-II **7 Hours**

Nutraceuticals

General aspects, Market, growth, scope and types of products available in the market.Health benefits and role of Nutraceuticals in ailments like Diabetes, CVS diseases, Cancer, Irritable bowel syndrome and various Gastro intestinal diseases.

Study of following herbs as health food: Alfaalfa, Chicory, Ginger, Fenugreek, Garlic, Honey, Amla, Ginseng, Ashwagandha, Spirulina

Herbal-Drug and Herb-Food Interactions: General introduction to interaction and classification. Study of following drugs and their possible side effects and interactions: Hypercium, kava-kava, Ginkobiloba, Ginseng, Garlic, Pepper & Ephedra.

UNIT-III **10Hours**

Herbal Cosmetics

Sources and description of raw materials of herbal origin used via, fixed oils, waxes, gums colours, perfumes, protective agents, bleaching agents, antioxidants in products such as skin care, hair care and oral hygiene products.

Herbal excipients:

Herbal Excipients – Significance of substances of natural origin as excipients – colorants, sweeteners, binders, diluents, viscosity builders, disintegrants, flavors & perfumes.

Herbal formulations :

Conventional herbal formulations like syrups, mixtures and tablets and Novel dosage forms like phytosomes

UNIT-IV **10 Hours**

Evaluation of Drugs WHO & ICH guidelines for the assessment of herbal drugs
Stability testing of herbal drugs.

Patenting and Regulatory requirements of natural products:

a) Definition of the terms: Patent, IPR, Farmers right, Breeder's right, Bioprospecting and Biopiracy
b) Patenting aspects of Traditional Knowledge and Natural Products. Case study of Curcuma &Neem.

Regulatory Issues - Regulations in India (ASU DTAB, ASU DCC), Regulation of manufacture of ASU drugs - Schedule Z of Drugs & Cosmetics Act for ASU drugs.

UNIT-V **07 Hours**

General Introduction to Herbal Industry

Herbal drugs industry: Present scope and future prospects.

A brief account of plant based industries and institutions involved in work on medicinal and aromatic plants in India.

S**chedule T – Good Manufacturing Practice of Indian systems of medicine**

Components of GMP (Schedule – T) and its objectives

Infrastructural requirements, working space, storage area, machinery and equipments, standard operating procedures, health and hygiene, documentation and records.

BP 609 P. HERBAL DRUG TECHNOLOGY (Practical)

4 hours/ week

1. To perform preliminary phytochemical screening of crudedrugs.
2. Determination of the alcohol content of Asava andArista
3. Evaluation of excipients of naturalorigin
4. Incorporationofpreparedandstandardizedextractincosmeticformulationslikecreams , lotions and shampoos and theirevaluation.
5. Incorporation of prepared and standardized extract in formulations like syrups, mixtures and tablets and their evaluation as per Pharmacopoeialrequirements.
6. Monograph analysis of herbal drugs from recentPharmacopoeias
7. Determination of Aldehydecontent
8. Determination of Phenolcontent
9. Determination of totalalkaloids

Recommended Books: (Latest Editions)

1. Textbook of Pharmacognosy by Trease &Evans.
2. Textbook of Pharmacognosy byTyler, Brady & Robber.
3. Pharmacognosy by Kokate, Purohit andGokhale
4. Essential of Pharmacognosy byDr.S.H.Ansari
5. Pharmacognosy & Phytochemistry byV.D.Rangari
6. Pharmacopoeal standards for Ayurvedic Formulation (Council of Research in Indian Medicine &Homeopathy)
7. Mukherjee, P.W. Quality Control of Herbal Drugs: An Approach to Evaluation of Botanicals. Business Horizons Publishers, New Delhi, India,2002.

BP 604 T. BIOPHARMACEUTICS AND PHARMACOKINETICS
(Theory)

45 Hours

Sushant University soaring high	**School of Health Sciences** **Bachelor of Pharmacy**		
Course Title: BIOPHARMACEUTICS AND PHARMACOKINETICS			
Semester: VI	**Course code: BP 604 T**	**Credits: 4**	**Core / Elective: Core**
No. of lectures/ tutorials: 4/week		**No. of practical hours: 0/week**	
Course Pre-requisites: None			

COURSE OUTCOMES (COs):

Upon completion of the course student shall be able to:

CO 01: Understand the basic concepts in biopharmaceutics and pharmacokineticsand theirsignificance.

CO 02: Use of plasma drug concentration-time data to calculate the pharmacokinetic parameters to describe the kinetics of drug absorption, distribution, metabolism, excretion,elimination.

CO 03: To understand the concepts of bioavailability and bioequivalence ofdrug products and theirsignificance.

CO 04: Understand various pharmacokinetic parameters, their significance& applications.

Mapping	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10
CO 01	H	H	L	L	L	H	H	H	H	L
CO 02	H	M	L	L	M	H	H	H	H	L
CO 03	H	H	L	L	M	H	H	H	H	L
CO 04	H	H	M	L	L	H	H	H	H	L

Course Content:

UNIT-I **10Hours**

Introduction toBiopharmaceutics

Absorption; Mechanisms of drug absorption through GIT, factors influencing drug absorption though GIT, absorption of drug from Non per oral extra-vascular routes,

Distribution Tissue permeability of drugs, binding of drugs, apparent, volume of drug distribution, plasma and tissue protein binding of drugs, factors affecting protein-drug binding. Kinetics of protein binding, Clinical significance of protein binding ofdrugs

UNIT-II **10**Hours

Elimination: Drug metabolism and basic understanding metabolic pathways renal excretion of drugs, factors affecting renal excretion of drugs, renal clearance, Non renal routes of drug excretion of drugs

Bioavailability and Bioequivalence: Definition and Objectives of bioavailability, absolute and relative bioavailability, measurement of bioavailability, *in-vitro* drug dissolution models, *in-vitro-in-vivo* correlations, bioequivalence studies, methods to enhance the dissolution rates and bioavailability of poorly soluble drugs.

UNIT-III **10Hours**

Pharmacokinetics: Definition and introduction to Pharmacokinetics, Compartment models, Non compartment models, physiological models, One compartment open model. (a). Intravenous Injection (Bolus) (b). Intravenous infusion and (c) Extra vascular administrations. Pharmacokinetics parameters - K_E ,t1/2,Vd,AUC,Ka, Clt and CL_R- definitions methods of eliminations, understanding of their significance and application

UNIT-IV **08Hours**

Multicompartment models: Two compartment open model. IV bolus

Kinetics of multiple dosing, steady state drug levels, calculation of loading and mainetnance doses and their significance in clinical settins.

UNIT-V **07Hours**

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

c. Michaelis-mentonmethodofestimatingparameters,Explanationwithexampleof drugs.

Recommended Books: (Latest Editions)

1. Biopharmaceutics and Clinical Pharmacokinetics by, MiloGibaldi.
2. Biopharmaceutics and Pharmacokinetics; By Robert FNotari
3. Applied biopharmaceutics and pharmacokinetics, Leon Shargel and Andrew B.C.YU 4th edition,Prentice-Hall Inernationaledition.USA
4. Bio pharmaceutics and Pharmacokinetics-A Treatise, By D. M. Brahmankarand Sunil B.Jaiswal,Vallabh Prakashan Pitampura,Delhi
5. Pharmacokinetics: By Milo Glbaldi Donald, R. Mercel DekkerInc.
6. Hand Book of Clinical Pharmacokinetics, By Milo Gibaldi and Laurie Prescott by ADIS Health SciencePress.
7. Biopharmaceutics; BySwarbrick
8. Clinical Pharmacokinetics, Concepts and Applications: By Malcolm Rowlandand
9. Thomas, N. Tozen, Lea and Febrger, Philadelphia,1995.
10. Dissolution, Bioavailability and Bioequivalence, By Abdou H.M,Mack, Publishing Company,Pennsylvania1989.
11. Biopharmaceutics and Clinical Pharmacokinetics-An introduction 4thedition Revised and expanded by Rebort F Notari Marcel Dekker Inn, New York and Basel,1987.
12. Remington's Pharmaceutical Sciences, By Mack PublishingCompany, Pennsylvnia

BP 605 T. PHARMACEUTICAL BIOTECHNOLOGY(Theory)

45 Hour

Sushant University soaring high	**School of Health Sciences** **Bachelor of Pharmacy**		
Course Title: PHARMACEUTICAL BIOTECHNOLOGY			
Semester: VI	**Course code: BP 605 T**	**Credits: 4**	**Core / Elective: Core**
No. of lectures/ tutorials: 4/week		**No. of practical hours: 0/week**	
Course Pre-requisites: None			

COURSE OUTCOMES (COs):
Upon completion of the subject student shall be able to;

CO 01: Understanding the importance of Immobilized enzymes inPharmaceutical Industries

CO 02: Genetic engineering applications in relation to production ofpharmaceuticals

CO 03: Importance of Monoclonal antibodies inIndustries

CO 04: Appreciate the use of microorganisms in fermentationtechnology

Mapping	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10
CO 01	H	H	L	L	M	H	H	H	M	L
CO 02	H	M	L	L	H	M	H	M	H	L
CO 03	H	H	L	L	M	M	H	H	H	L
CO 04	M	H	L	M	H	H	M	M	M	L

UnitI **10Hours**

a) Brief introduction to Biotechnology with reference to PharmaceuticalSciences.
b) Enzyme Biotechnology- Methods of enzyme immobilization andapplications.
c) Biosensors- Working and applications of biosensors in PharmaceuticalIndustries.
d) Brief introduction to ProteinEngineering.
e) Use of microbes in industry. Production of Enzymes- General consideration -

Amylase, Catalase, Peroxidase, Lipase, Protease,Penicillinase.

f) Basic principles of geneticengineering.

UnitII **10Hours**

a) Study of cloning vectors, restriction endonucleases and DNAligase.

b) Recombinant DNA technology. Application of genetic engineering inmedicine.

c) Application of r DNA technology and genetic engineering in the productionof:

i) Interferon ii) Vaccines- hepatitis- B iii) Hormones-Insulin.

d) Brief introduction toPCR

UnitIII **10Hours**

Types of immunity- humoral immunity, cellular immunity

a) Structure ofImmunoglobulins
b) Structure and Function ofMHC
c) Hypersensitivity reactions, Immune stimulation and Immune suppressions.
d) General method of the preparation of bacterial vaccines, toxoids, viral vaccine, antitoxins, serum-immune blood derivatives and other products relative toimmunity.
e) Storage conditions and stability of officialvaccines
f) Hybridoma technology- Production, Purification andApplications
g) Blood products and PlasmaSubstituties.

UnitIV **08Hours**

a) Immuno blotting techniques- ELISA, Western blotting, Southernblotting.
b) Genetic organization of Eukaryotes andProkaryotes
c) Microbial genetics including transformation, transduction, conjugation, plasmids and transposons.
d) Introduction to Microbial biotransformation andapplications.
e) Mutation: Types ofmutation/mutants.

UnitV **07Hours**

a) Fermentation methods and general requirements, study of media, equipments, sterilization methods, aeration process,stirring.
b) Large scale production fermenter design and its variouscontrols.
c) Study of the production of - penicillins, citric acid, Vitamin B12, Glutamic acid, Griseofulvin,
d) Blood Products: Collection, Processing and Storage of whole human blood, dried human plasma, plasmaSubstituties.

Recommended Books (Latest edition):

1. B.R. Glick and J.J. Pasternak: Molecular Biotechnology: Principles and Applications of RecombinantDNA: ASM Press WashingtonD.C.
2. RA Goldshy et. al., : KubyImmunology.
3. J.W. Goding: MonoclonalAntibodies.
4. J.M. Walker and E.B. Gingold: Molecular Biology and Biotechnology byRoyal

Society of Chemistry.
5. Zaborsky: Immobilized Enzymes, CRC Press, Degraland,Ohio.
6. S.B. Primrose: Molecular Biotechnology (Second Edition) Blackwell Scientific Publication.
7. Stanbury F., P., Whitakar A., and Hall J., S., Principles of fermentation technology, 2nd edition, Aditya books Ltd., NewDelhi

BP606 T PHARMACEUTICAL QUALITY ASSURANCE (Theory)

45 Hours

Sushant University soaring high	**School of Health Sciences** **Bachelor of Pharmacy**		
Course Title: PHARMACEUTICAL QUALITY ASSURANCE			
Semester: VI	**Course code: BP 606 T**	**Credits: 4**	**Core / Elective: Core**
No. of lectures/ tutorials: 4/week		**No. of practical hours: 0/week**	
Course Pre-requisites: None			

COURSE OUTCOMES (COs):

Upon completion of the course student shall be able to:

CO 01: understand the cGMP aspects in a pharmaceuticalindustry

CO 02: appreciate the importance ofdocumentation

CO 03: understand the scope of quality certifications applicable topharmaceutical industries

CO 04: understand the responsibilities of QA & QCdepartments

Mapping	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10
CO 01	M	M	H	L	H	L	L	L	L	H
CO 02	M	L	H	L	H	L	L	L	L	H
CO 03	L	L	H	L	H	L	L	L	L	H
CO 04	L	L	H	L	H	L	L	L	L	H

Course content:

UNIT– I **10Hours**

Quality Assurance and Quality Management concepts: Definition and concept of Quality control, Quality assurance and GMP

Total Quality Management (TQM): Definition, elements, philosophies

ICH Guidelines: purpose, participants, process of harmonization, Brief overview of QSEM, with special emphasis on Q-series guidelines, ICH stability testing guidelines
Quality by design (QbD): Definition, overview, elements of QbD program, tools
ISO 9000 & ISO14000: Overview, Benefits, Elements, steps for registration **NABL accreditation** : Principles and procedures

UNIT-II **10 Hours**
Organization and personnel: Personnel responsibilities, training, hygiene and personalrecords.
Premises: Design, construction and plant layout, maintenance, sanitation, environmental control, utilities and maintenance of sterile areas, control ofcontamination.
Equipments and raw materials: Equipment selection, purchase specifications, maintenance, purchase specifications and maintenance of stores for raw materials.

UNIT– III **10 Hours**
Quality Control: Quality control test for containers, rubber closures and secondary packing

materials.

Good Laboratory Practices: General Provisions, Organization and Personnel, Facilities, Equipment, Testing Facilities Operation, Test and Control Articles, Protocol for Conduct of a Nonclinical Laboratory Study, Records and Reports, Disqualification of Testing Facilities

UNIT– IV **08 Hours**

Complaints: Complaints and evaluation of complaints, Handling of return good, recalling and waste disposal.

Document maintenance in pharmaceutical industry: Batch Formula Record, Master Formula Record, SOP, Quality audit, Quality Review and Quality documentation, Reports and documents, distribution records.

UNIT– V **07Hours**

Calibration and Validation: Introduction, definition and general principles of calibration, qualification and validation, importance and scope of validation, types of validation, validation master plan. Calibration of pH meter, Qualification of UV-Visible spectrophotometer, General principles of Analytical method Validation.

Warehousing: Good warehousing practice, materials management

Recommended Books: (Latest Edition)

1. Quality Assurance Guide by organization of Pharmaceutical Products ofIndia.
2. Good Laboratory Practice Regulations, 2nd Edition, Sandy Weinberg Vol.69.
3. Quality Assurance of Pharmaceuticals- A compendium of Guide lines and Related materials Vol I WHOPublications.
4. A guide to Total Quality Management- Kushik Maitra and Sedhan KGhosh
5. How to Practice GMP's – P P Sharma.
6. ISO 9000 and Total Quality Management – Sadhank GGhosh
7. The International Pharmacopoeia – Vol I, II, III, IV- General Methods of Analysis and Quality specification for Pharmaceutical Substances, Excipients and Dosage forms
8. Good laboratory Practices – Marcel DeckkerSeries
9. ICH guidelines, ISO 9000 and 14000guidelines

SEMESTER VII

BP701T. INSTRUMENTAL METHODS OF ANALYSIS (Theory)

45 Hours

Sushant University soaring high	**School of Health Sciences** **Bachelor of Pharmacy**		
Course Title: PHARMACEUTICAL QUALITY ASSURANCE			
Semester: VI	**Course code: BP 701 T**	**Credits: 6**	**Core / Elective: Core**
No. of lectures/ tutorials: 4/week		**No. of practical hours: 4/week**	
Course Pre-requisites: None			

COURSE OUTCOMES (COs):

Upon completion of the course the student shall be able to

CO 01: Understand the interaction of matter with electromagnetic radiations and its applications in druganalysis

CO 02: Understand the chromatographic separation and analysis of drugs.

CO 03: Perform quantitative & qualitative analysis of drugs using various analytical instruments.

Mapping	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10
CO 01	H	H	H	L	H	L	L	M	M	L
CO 02	H	M	H	M	H	L	L	M	L	L
CO 03	M	H	H	L	H	L	M	H	L	L

Course Content:

UNIT–I **10Hours**

UV Visible spectroscopy

Electronic transitions, chromophores, auxochromes, spectral shifts, solvent effect on absorption spectra, Beer and Lambert's law, Derivation and deviations.

Instrumentation - Sources of radiation, wavelength selectors, sample cells, detectors- Photo tube, Photomultiplier tube, Photo voltaic cell, Silicon Photodiode.

Applications - Spectrophotometric titrations, Single component and multi component analysis

Fluorimetry

Theory, Concepts of singlet, doublet and triplet electronic states, internal and external conversions, factors affecting fluorescence, quenching, instrumentation and applications

UNIT–II **10Hours**

IR spectroscopy

Introduction, fundamental modes of vibrations in poly atomic molecules, sample handling, factors affecting vibrations

Instrumentation - Sources of radiation, wavelength selectors, detectors - Golay cell, Bolometer, Thermocouple, Thermister, Pyroelectric detector andapplications

Flame Photometry-Principle, interferences, instrumentation andapplications

Atomic absorption spectroscopy- Principle, interferences, instrumentation and applications

Nepheloturbidometry- Principle, instrumentation and applications

UNIT–III **10Hours**

Introduction to chromatography

Adsorption and partition column chromatography-Methodology, advantages, disadvantages and applications.

Thin layer chromatography- Introduction, Principle, Methodology, Rf values, advantages, disadvantages and applications.

Paper chromatography-Introduction, methodology, development techniques, advantages, disadvantages andapplications

Electrophoresis– Introduction, factors affecting electrophoretic mobility, Techniques of paper, gel, capillary electrophoresis, applications

UNIT–IV **08Hours**

Gas chromatography - Introduction, theory, instrumentation, derivatization, temperature programming, advantages, disadvantages andapplications

High performance liquid chromatography (HPLC)-Introduction, theory, instrumentation, advantages and applications.

UNIT–V **07Hours**

Ion exchange chromatography- Introduction, classification, ion exchange resins, properties, mechanism of ion exchange process, factors affecting ion exchange, methodology and applications

Gel chromatography- Introduction, theory, instrumentation and applications

Affinity chromatography- Introduction, theory, instrumentation and applications

BP705P. INSTRUMENTAL METHODS OF ANALYSIS (Practical)

4 Hours/Week

1. Determination of absorption maxima and effect of solvents on absorption maxima of organiccompounds
2. Estimation of dextrose bycolorimetry
3. Estimation of sulfanilamide bycolorimetry
4. Simultaneous estimation of ibuprofen and paracetamol by UVspectroscopy
5. Assay of paracetamol by UV-Spectrophotometry
6. Estimation of quinine sulfate byfluorimetry
7. Study of quenching offluorescence
8. Determination of sodium by flamephotometry
9. Determination of potassium by flamephotometry
10. Determination of chlorides and sulphates by nepheloturbidometry
11. Separation of amino acids by paperchromatography
12. Separation of sugars by thin layerchromatography
13. Separation of plant pigments by columnchromatography
14. Demonstration experiment onHPLC
15. Demonstration experiment on GasChromatography

Recommended Books (Latest Editions)

1. Instrumental Methods of Chemical Analysis by B.KSharma
2. Organic spectroscopy by Y.RSharma
3. Text book of Pharmaceutical Analysis by Kenneth A.Connors
4. Vogel's Text book of Quantitative Chemical Analysis by A.I.Vogel
5. Practical Pharmaceutical Chemistry by A.H. Beckett and J.B.Stenlake
6. Organic Chemistry by I. L.Finar
7. Organic spectroscopy by WilliamKemp
8. Quantitative Analysis of Drugs by D. C.Garrett
9. Quantitative Analysis of Drugs in Pharmaceutical Formulations by P. D.Sethi
10. Spectrophotometric identification of Organic Compounds bySilverstein

BP 702 T. INDUSTRIAL PHARMACYII (Theory)

45 Hours

Sushant University soaring high	**School of Health Sciences** **Bachelor of Pharmacy**		
Course Title: INDUSTRIAL PHARMACY II			
Semester: VII	**Course code: BP 702 T**	**Credits: 4**	**Core / Elective: Core**
No. of lectures/ tutorials: 4/week		**No. of practical hours: 0/week**	
Course Pre-requisites: None			

COURSE OUTCOMES (COs):

Upon completion of the course, the student shall be able to:

CO 01: Know the process of pilot plant and scale up of pharmaceutical dosageforms

CO 02: Understand the process of technology transfer from lab scale to commercialbatch

CO 03: Know different Laws and Acts that regulate pharmaceuticalindustry

CO 04: Understand the approval process and regulatory requirements for drugproducts

Mapping	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10
CO 01	H	H	L	L	L	H	L	M	M	M
CO 02	M	H	L	L	M	H	L	H	M	M
CO 03	M	M	L	L	M	H	L	H	M	M
CO 04	H	H	L	L	L	H	L	M	M	M

Course Content:

UNIT-I **10Hours**

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

UNIT-II **10Hours**

Technology development and transfer: WHO guidelines for Technology Transfer(TT): Terminology, Technology transfer protocol, Quality risk management, Transfer from R & D to production (Process, packaging and cleaning), Granularity of TT Process (API, excipients, finished products, packaging materials) Documentation, Premises and equipments, qualification and validation, quality control, analytical method transfer, Approved regulatory bodies and agencies, Commercialization - practical aspects and problems (case studies), TT agencies in India - APCTD, NRDC, TIFAC, BCIL, TBSE / SIDBI; TT related documentation - confidentiality agreement, licensing, MoUs, legalissues

UNIT-III **10Hours**

Regulatory affairs: Introduction, Historical overview of Regulatory Affairs, Regulatory authorities, Role of Regulatory affairs department, Responsibility of Regulatory Affairs Professionals

Regulatory requirements for drug approval: Drug Development Teams, Non-Clinical Drug Development, Pharmacology, Drug Metabolism and Toxicology, General considerations of Investigational New Drug (IND) Application, Investigator's Brochure (IB) and New Drug Application (NDA), Clinical research / BE studies, Clinical Research Protocols, Biostatistics in Pharmaceutical Product Development, Data Presentation for FDA Submissions, Management of Clinical Studies.

UNIT-IV **08Hours**

Quality management systems: Quality management & Certifications: Concept of Quality, Total Quality Management, Quality by Design (QbD), Six Sigma concept, Out of Specifications (OOS), Change control, Introduction to ISO 9000 series of quality systems standards, ISO 14000, NABL,GLP

UNIT-V **07Hours**

Indian Regulatory Requirements: Central Drug Standard Control Organization (CDSCO) and State Licensing Authority: Organization, Responsibilities, Certificate of Pharmaceutical Product (COPP), Regulatory requirements and approval procedures for New Drugs.

Recommended Books: (Latest Editions)

1. Regulatory Affairs from Wikipedia, the free encyclopedia modified on 7th April available at http,//en.wikipedia.org/wiki/Regulatory_Affairs.
2. International Regulatory Affairs Updates, 2005. available at http://www.iraup.com/about.php
3. Douglas J Pisano and David S. Mantus. Text book of FDA Regulatory Affairs A Guide for Prescription Drugs, Medical Devices, and Biologics' SecondEdition.
4. Regulatory Affairs brought bylearning plus, inc. available at http.//www.cgmp.com/ra.htm.

BP 703T. PHARMACY PRACTICE (Theory)

45 Hours

Sushant University soaring high	**School of Health Sciences** **Bachelor of Pharmacy**		
Course Title: PHARMACY PRACTICE			
Semester: VII	**Course code: BP 703 T**	**Credits: 4**	**Core / Elective: Core**
No. of lectures/ tutorials: 4/week		**No. of practical hours: 0/week**	
Course Pre-requisites: None			

COURSE OUTCOMES (COs):

Upon completion of the course, the student shall be able to

CO 01: appreciate the pharmacy stores management and inventorycontrol

CO 02: obtain medication history interview and counsel thepatients

CO 03: detect and assess adverse drugreactions

CO 04: know pharmaceutical careservices

CO 05: appreciate the concept of Rational drugtherapy.

Mapping	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10
CO 01	M	M	H	H	L	M	L	L	H	L
CO 02	L	M	H	H	L	L	L	L	H	L
CO 03	M	L	H	H	L	M	L	L	M	L
CO 04	L	L	H	H	L	M	L	L	H	L
CO 05	L	L	H	H	L	M	L	L	M	L

UnitI: **10Hours**

a) Hospital and it's organization

Definition, Classification of hospital- Primary, Secondary and Tertiary hospitals, Classification based on clinical and non- clinical basis, Organization Structure of a

Hospital, and Medical staffs involved in the hospital and their functions.

b) Hospital pharmacy and its organization

Definition, functions of hospital pharmacy, Organization structure, Location, Layout and staff requirements, and Responsibilities and functions of hospital pharmacists.

c) Adverse drugreaction

Classifications - Excessive pharmacological effects, secondary pharmacological effects, idiosyncrasy, allergic drug reactions, genetically determined toxicity, toxicity following sudden withdrawal of drugs, Drug interaction- beneficial interactions, adverse interactions, and pharmacokinetic drug interactions, Methods fordetecting

drug interactions, spontaneous case reports and record linkage studies, and Adverse drug reaction reporting and management.

d) CommunityPharmacy

Organization and structure of retail and wholesale drug store, types and design, Legal requirements for establishment and maintenance of a drug store, Dispensing of proprietary products, maintenance of records of retail and wholesale drug store.

UnitII: 10Hours

a) Drug distribution system in ahospital

Dispensing of drugs to inpatients, types of drug distribution systems, charging policy and labelling, Dispensing of drugs to ambulatory patients, and Dispensing ofcontrolleddrugs.

b) Hospitalformulary

Definition, contents of hospital formulary, Differentiation of hospital formulary and Drug list, preparation and revision, and addition and deletion of drug from hospital formulary.

c) Therapeutic drugmonitoring

Need for Therapeutic Drug Monitoring, Factors to be considered during the Therapeutic Drug Monitoring, and Indian scenario for Therapeutic Drug Monitoring.

d) Medicationadherence

Causes of medication non-adherence, pharmacist role in the medication adherence, and monitoring of patient medicationadherence.

e) Patient medication historyinterview

Need for the patient medication history interview, medication interview forms.

f) Community pharmacymanagement

Financial, materials, staff, and infrastructure requirements.

UnitIII: 10Hours

a) Pharmacy and therapeuticcommittee

Organization, functions, Policies of the pharmacy and therapeutic committee in including drugs into formulary, inpatient and outpatient prescription, automatic stop order, and emergency drug list preparation.

b) Drug information services

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

c) Patient counseling

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

d) Education and training program in thehospital

Role of pharmacist in the education and training program, Internal and external training program, Services to the nursing homes/clinics, Code of ethics for community pharmacy, and Role of pharmacist in the interdepartmental communication and community healtheducation.

e) Prescribed medication order and communicationskills

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

UnitIV 8Hours

a) Budget preparation and implementation

Budget preparation and implementation

b) Clinical Pharmacy

Introduction to Clinical Pharmacy, Concept of clinical pharmacy, functions and responsibilities of clinical pharmacist, Drug therapy monitoring - medication chart review, clinical review, pharmacist intervention, Ward round participation, Medication history and Pharmaceutical care.

Dosing pattern and drug therapy based on Pharmacokinetic & disease pattern.

c) Over the counter (OTC)sales

Introduction and sale of over the counter, and Rational use of common over the countermedications.

UnitV 7Hours

a) Drug store management and inventorycontrol

Organisation of drug store, types of materials stocked and storage conditions, Purchase and inventory control: principles, purchase procedure, purchase order, procurement and stocking, Economic order quantity, Reorder quantity level, and Methods used for the analysis of the drugexpenditure

b) Investigational use ofdrugs

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

c) Interpretation of Clinical LaboratoryTests

Blood chemistry, hematology, and urinalysis

Recommended Books (Latest Edition):

1. Merchant S.H. and Dr. J.S.Quadry. *A textbook of hospital pharmacy*, 4thed. Ahmadabad: B.S. Shah Prakakshan;2001.
2. Parthasarathi G, Karin Nyfort-Hansen, Milap C Nahata. *A textbook ofClinical Pharmacy Practice- essential concepts and skills*, 1st ed. Chennai: Orient Longman Private Limited;2004.
3. William E. Hassan. *Hospital pharmacy*, 5th ed. Philadelphia: Lea & Febiger; 1986.
4. Tipnis Bajaj. *Hospital Pharmacy*, 1st ed. Maharashtra: Career Publications;2008.
5. Scott LT. *Basic skills in interpreting laboratory data*, 4thed. American Society of Health System Pharmacists Inc;2009.
6. Parmar N.S. *Health Education and Community Pharmacy*, 18th ed. India:CBS Publishers & Distributers;2008.

Journals:

1. Therapeutic drug monitoring. ISSN:0163-4356
2. Journal of pharmacy practice. ISSN :0974-8326
3. American journal of health system pharmacy. ISSN: 1535-2900(online)
4. Pharmacy times (Monthlymagazine)

BP 704T: NOVEL DRUG DELIVERY SYSTEMS (Theory)

45 Hours

Sushant University soaring high	**School of Health Sciences** **Bachelor of Pharmacy**

Course Title: NOVEL DRUG DELIVERY SYSTEMS			
Semester: VII	**Course code: BP 704 T**	**Credits: 4**	**Core / Elective: Core**
No. of lectures/ tutorials: 4/week		**No. of practical hours: 0/week**	
Course Pre-requisites: None			

COURSE OUTCOMES (COs):

Upon completion of the course student shall be able

CO 01: To understand various approaches for development of novel drug deliverysystems.

CO 02: To understand the criteria for selection of drugs and polymers for the development of Novel drug delivery systems

CO 03: To gain knowledge of formulation andevaluation of novel drug delivery systems

Mapping	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10
CO 01	H	H	L	L	L	H	H	M	H	L
CO 02	H	H	L	L	M	H	H	L	H	L
CO 03	H	H	L	L	M	H	H	L	H	L

Course content:

Unit-I **10Hours**

Controlled drug delivery systems: Introduction, terminology/definitions and rationale, advantages, disadvantages, selection of drug candidates.Approaches to design controlled release formulations based on diffusion, dissolution and ion exchange principles. Physicochemical and biological properties of drugs relevant to controlled release formulations

Polymers: Introduction, classification, properties, advantages and application of polymers

in formulation of controlled release drug deliverysystems.

Unit-II **10Hours**

Microencapsulation: Definition, advantages and disadvantages, microspheres /microcapsules, microparticles, methods of microencapsulation, applications

Mucosal Drug Delivery system: Introduction, Principles of bioadhesion / mucoadhesion, concepts, advantages and disadvantages, transmucosal permeability and formulation considerations of buccal deliverysystems

Implantable Drug Delivery Systems: Introduction, advantages and disadvantages, concept of implantsand osmotic pump

Unit-III **10Hours**

Transdermal Drug Delivery Systems: Introduction, Permeation through skin, factors affecting permeation, permeation enhancers, basic components of TDDS, formulation approaches

Gastroretentive drug delivery systems: Introduction, advantages, disadvantages, approaches for GRDDS – Floating, high density systems, inflatable and gastroadhesive systems and their applications

Nasopulmonary drug delivery system: Introduction to Nasal and Pulmonary routes of drug delivery, Formulation of Inhalers (dry powder and metered dose), nasal sprays, nebulizers

Unit-IV **08Hours**

Targeted drug Delivery: Concepts and approaches advantages and disadvantages, introduction to liposomes, niosomes, nanoparticles, monoclonal antibodies and their applications

Unit-V **07Hours**

Ocular Drug Delivery Systems: Introduction, intra ocular barriers and methods to overcome –Preliminary study, ocular formulations and ocuserts

Intrauterine Drug Delivery Systems: Introduction, advantages and disadvantages, development of intra uterine devices (IUDs) and applications

Recommended Books: (Latest Editions)

1. Y W. Chien, Novel Drug Delivery Systems, 2nd edition, revised and expanded, Marcel Dekker, Inc., New York,1992.
2. Robinson, J. R., Lee V. H. L, Controlled Drug Delivery Systems, Marcel Dekker, Inc., New York,1992.
3. Encyclopedia of Controlled Delivery. Edith Mathiowitz, Published by Wiley Interscience Publication, John Wiley and Sons, Inc, New York.Chichester/Weinheim
4. N.K. Jain, Controlled and Novel Drug Delivery, CBS Publishers & Distributors, New Delhi, First edition 1997 (reprint in2001).
5. S.P. Vyas and R.K. Khar, Controlled Drug Delivery -concepts and advances, Vallabh Prakashan, New Delhi, First edition 2002.

Journals

1. Indian Journal of Pharmaceutical Sciences(IPA)
2. Indian Drugs(IDMA)
3. Journal of Controlled Release (ElsevierSciences)
4. Drug Development and Industrial Pharmacy (Marcel &Decker)
5. International Journal of Pharmaceutics (ElsevierSciences)

BP 707 T: BIOMEDICAL WASTE MANAGEMENT

Sushant University soaring high	**School of Health Sciences** **Bachelor of Pharmacy**		
Course Title: Biomedical Waste Management.			
Semester: VIII	**Course code:** BP 707 T	**Credits: 2**	**Core / Elective: Core**
No. of lectures/ tutorials: 2/week		**No. of practical hours: 0/week**	
Course Pre-requisites: None			

1. **Course Outcomes:** Upon successful completion of the course, the student should be able to

CO1: To understand the source of different types of bio medical waste
CO2: To characterize medical waste and its segregation
CO3: To understand handling, storage and transportation of medical waste.
CO4: To understand about disposal of hazardous waste.
CO5: To understand about safety aspects.

Mapping	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10
CO 01	M	M	H	H	L	M	L	L	H	L
CO 02	L	M	H	H	L	L	L	L	H	L
CO 03	M	L	H	H	L	M	L	L	M	L
CO 04	L	L	H	H	L	M	L	L	H	L
CO 05	L	L	H	H	L	M	L	L	M	L

Course content:

UNIT-1 7 Hours

To carryout identification, separation and labelling of bio- waste.
To study about hazardous biomedical waste.
To study about incineration process of laboratory animals.

UNIT-II 7 Hours

To visit bio-waste management agency to learn about bio-waste management.
To visit waste management re-cycling plants.
To carry out survey in nearby village about awareness on biomedical waste.
To carry out survey in nearby hospitals about awareness on biomedical waste.

UNIT-III 6 Hours

To carry out training sessions on personnel care.
To carry out group discussion National Green Tribunals NGT.
To visit bio gas plant.

2. Text Books

Hospital waste management: A guide for self-assessment and review by Shishir Bhaskar, Jaypee Brothers Medical publisher Pvt. Ltd.

3. Reference Books

Evaluation of Biomedical waste management system by Khalid Maryam, LAP lambert academic publishing

Infectious and Medical waste Management by Peter Reinhardt, CRC press

Environment waste management by Ramchandra, CRC press

ICT/ MOOCs references

1. **http://neptel.ac.in/courses/105/106/105106056/**
2. https://www.env.gov.in/BMW%20Rules.pdf
3. https://dhr.gov.in/sites/default/files/Bio-medical_Waste_Management_Rules_2016.pdf
4. **https://cpcb.nic.in/uploads/Projects/Bio-Medical-Waste/Guidelines_healthcare_June_2018.pdf**

SEMESTER VIII

BP801T. BIOSTATISITCS AND RESEARCH METHODOLOGY (Theory)

45 Hours

Sushant University soaring high	**School of Health Sciences** **Bachelor of Pharmacy**		
Course Title: BIOSTATISITCS AND RESEARCH METHODOLOGY			
Semester: VIII	**Course code: BP 801 T**	**Credits: 4**	**Core / Elective: Core**
No. of lectures/ tutorials: 4/week		**No. of practical hours: 0/week**	
Course Pre-requisites: None			

COURSE OUTCOMES (COs):

Upon completion of the course the student shall be able to

CO 01: Know the operation of M.S. Excel, SPSS, R and MINITAB®, DoE (Designof Experiment)

CO 02: Know the various statistical techniques to solve statisticalproblems

CO 03: Appreciate statistical techniques in solving theproblems.

Mapping	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10
CO 01	L	H	L	H	L	L	L	L	L	L
CO 02	L	H	L	H	L	L	L	L	L	L
CO 03	L	H	L	H	L	L	L	L	L	L

Course content:

Unit-I **10Hours**

Introduction: Statistics, Biostatistics, Frequency distribution

Measures of central tendency: Mean, Median, Mode- Pharmaceutical examples
Measures of dispersion: Dispersion, Range, standard deviation, Pharmaceutical problems

Correlation: Definition, Karl Pearson's coefficient of correlation, Multiple correlation - Pharmaceuticals examples

Unit-II **10Hours**

Regression: Curve fitting by the method of least squares, fitting the lines y= a + bx and x = a + by, Multiple regression, standard error of regression– Pharmaceutical Examples

Probability: Definition of probability, Binomial distribution, Normal distribution, Poisson's distribution, properties - problems

Sample, Population, large sample, small sample, Null hypothesis, alternative hypothesis, sampling, essence of sampling, types of sampling, Error-I type, Error-II type, Standard error of mean (SEM) - Pharmaceutical examples

Parametric test: t-test(Sample, Pooled or Unpaired and Paired) , ANOVA, (One way and Two way), Least Significance difference

Unit-III **10Hours**

Non Parametric tests: Wilcoxon Rank Sum Test, Mann-Whitney U test, Kruskal-Wallis test, Friedman Test

Introduction to Research: Need for research, Need for design of Experiments, Experiential Design Technique, plagiarism

Graphs: Histogram, Pie Chart, Cubic Graph, response surface plot, Counter Plot graph
Designing the methodology: Sample size determination and Power of a study, Report writing and presentation of data,Protocol,Cohorts studies, Observational studies, Experimental studies, Designing clinical trial, variousphases.

Unit-IV **8Hours**

Blocking and confounding system for Two-level factorials
Regression modeling: Hypothesis testing in Simple and Multiple regressionmodels
Introduction to Practical components of Industrial and Clinical Trials Problems: Statistical Analysis Using Excel, SPSS, MINITAB®, DESIGN OF EXPERIMENTS, R - Online Statistical Software's to Industrial and Clinical trial approach

Unit-V **7Hours**

Design and Analysis of experiments:

Factorial Design: Definition, 2^2, 2^3design. Advantage of factorial design
Response Surface methodology: Central composite design, Historical design, Optimization Techniques

Recommended Books (Latest edition):

1. Pharmaceutical statistics- Practical and clinical applications, Sanford Bolton, publisher Marcel Dekker Inc.NewYork.
2. Fundamental of Statistics – Himalaya Publishing House-S.C.Guptha
3. Design and Analysis of Experiments –PHI Learning Private Limited, R. Pannerselvam,
4. Design and Analysis of Experiments – Wiley Students Edition, Douglas and C.Montgomery

BP 802T SOCIAL AND PREVENTIVE PHARMACY

Hours: 45

Sushant University soaring high	**School of Health Sciences** **Bachelor of Pharmacy**		
Course Title: SOCIAL AND PREVENTIVE PHARMACY			
Semester: VIII	**Course code: BP 802 T**	**Credits: 4**	**Core / Elective: Core**
No. of lectures/ tutorials: 4/week		**No. of practical hours: 0/week**	
Course Pre-requisites: None			

COURSE OUTCOMES (COs):

After the successful completion of this course, the student shall be able to:

CO 01: Acquire high consciousness/realization of current issuesrelated to health and pharmaceutical problems within the country andworldwide.

CO 02: Have a critical way of thinking based on current healthcaredevelopment.

CO 03: Evaluate alternative ways of solving problems related tohealthand pharmaceuticalissues

Mapping	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10
CO 01	H	M	L	H	L	M	L	M	L	L
CO 02	H	M	L	H	L	L	L	H	L	L
CO 03	H	L	L	H	L	M	L	M	L	L

Course content:

UnitI: **10Hours**

Concept of health and disease: Definition, concepts and evaluation of public health. Understanding the concept of prevention and control of disease, social causes of diseases and social problems of the sick.

Social and health education: Food in relation to nutrition and health, Balanced diet, Nutritional deficiencies, Vitamin deficiencies, Malnutrition and its prevention.

Sociology and health: Socio cultural factors related to health and disease, Impact of urbanization on health and disease, Poverty and health

Hygiene and health: personal hygiene and health care; avoidable habits

UnitII: 10Hours

Preventive medicine: General principles of prevention and control of diseases such as cholera, SARS, Ebola virus, influenza, acute respiratory infections, malaria, chicken guinea, dengue, lymphatic filariasis, pneumonia, hypertension, diabetes mellitus, cancer, drug addiction-drug substance abuse

UnitIII: 10Hours

National health programs, its objectives, functioning and outcome of the following: HIV AND AIDS control programme, TB, Integrated disease surveillance program (IDSP),Nationalleprosycontrolprogramme,Nationalmentalhealthprogram,National

programme for prevention and control of deafness, Universal immunization programme, National programme for control of blindness, Pulse polio programme.

UnitIV: 08Hours

National health intervention programme for mother and child, National family welfare programme, National tobacco control programme, National Malaria Prevention Program, National programme for the health care for the elderly, Social health programme; role of WHO in Indian national program

UnitV: 07Hours

Community services in rural, urban and school health: Functions of PHC, Improvement in rural sanitation, national urban health mission, Health promotion and education in school.

Recommended Books (Latest edition)*:*

1. Short Textbook of Preventive and Social Medicine, Prabhakara GN, 2nd Edition, 2010, ISBN: 9789380704104, JAYPEE Publications
2. Textbook of Preventive and Social Medicine (Mahajan and Gupta), Edited by Roy Rabindra Nath, Saha Indranil, 4th Edition, 2013, ISBN: 9789350901878, JAYPEE Publications
3. Review of Preventive and Social Medicine (Including Biostatistics), Jain Vivek, 6th Edition, 2014, ISBN: 9789351522331, JAYPEE Publications
4. Essentials of Community Medicine—A Practical Approach, Hiremath Lalita D, Hiremath Dhananjaya A, 2nd Edition, 2012, ISBN: 9789350250440, JAYPEE Publications
5. Park Textbook of Preventive and Social Medicine, K Park, 21st Edition, 2011, ISBN-14: 9788190128285, BANARSIDAS BHANOTPUBLISHERS.
6. Community Pharmacy Practice, Ramesh Adepu, BSP publishers,Hyderabad

Recommended Journals:

1. Research in Social and Administrative Pharmacy, Elsevier, Ireland

BP803 ET. PHARMA MARKETING MANAGEMENT (Theory)

45 Hours

Sushant University soaring high	**School of Health Sciences** **Bachelor of Pharmacy**		
Course Title: PHARMA MARKETING MANAGEMENT			
Semester: VIII	**Course code: BP 803 ET**	**Credits: 4**	**Core / Elective: Core**
No. of lectures/ tutorials: 4/week		**No. of practical hours: 0/week**	
Course Pre-requisites: None			

COURSE OUTCOMES (COs):
After the successful completion of this course, the student shall be able to:

CO 01: Understand marketing concepts including sales and product management.

CO 02: Learntechniques and their applications required to run pharmaceutical industry.

CO 03: Take complex decisions which are imperative for the growth of the industry.

Mapping	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10
CO 01	H	H	M	M	L	H	L	L	L	H
CO 02	H	H	M	M	L	H	L	L	L	H
CO 03	H	H	M	M	L	H	L	L	L	H

UnitI **10Hours**

Marketing:

Definition, general concepts and scope of marketing; Distinction between marketing & selling; Marketing environment; Industry and competitive analysis; Analyzing consumer buying behavior; industrial buying behavior.

Pharmaceutical market:

Quantitative and qualitative aspects; size and composition of the market; demographic descriptions and socio-psychological characteristics of the consumer; market

segmentation& targeting.Consumer profile; Motivation and prescribing habits of the physician; patients' choice of physician and retail pharmacist.Analyzing the Market;Role of marketresearch.

UnitII **10Hours**

Product decision:

Classification, product line and product mix decisions, product life cycle,product portfolio analysis; product positioning; New product decisions; Product branding, packaging and labeling decisions, Product management in pharmaceutical industry.

UnitIII **10Hours**

Promotion:

Methods, determinants of promotional mix, promotional budget; An overview of personal selling, advertising, direct mail, journals, sampling, retailing, medical exhibition, public relations, online promotional techniques for OTCProducts.

UnitIV **10Hours**

Pharmaceutical marketing channels:

Designing channel, channel members, selecting the appropriate channel, conflict in channels, physical distribution management: Strategic importance, tasks in physical distribution management.

Professional sales representative (PSR):

Duties of PSR, purpose of detailing, selection and training, supervising, norms for customer calls, motivating, evaluating, compensation and future prospects of the PSR.

UnitV **10Hours**

Pricing:

Meaning, importance, objectives, determinants of price; pricing methods and strategies, issues in price management in pharmaceutical industry. An overview of DPCO (Drug Price Control Order)and NPPA (National Pharmaceutical PricingAuthority).

Emerging concepts in marketing:

Vertical & Horizontal Marketing; RuralMarketing; Consumerism; Industrial Marketing; Global Marketing.

Recommended Books: (Latest Editions)

1. Philip Kotler and Kevin Lane Keller: Marketing Management, Prentice Hall of India,NewDelhi
2. Walker, Boyd and Larreche : Marketing Strategy- Planning and Implementation, Tata MC GrawHill, NewDelhi.
3. Dhruv Grewal and Michael Levy: Marketing, Tata MC GrawHill
4. Arun Kumar and N Menakshi: Marketing Management, Vikas Publishing,India
5. Rajan Saxena: Marketing Management; Tata MC Graw-Hill (IndiaEdition)
6. Ramaswamy, U.S & Nanakamari, S: Marketing Managemnt:Global Perspective, IndianContext,Macmilan India, NewDelhi.
7. Shanker, Ravi: Service Marketing, Excell Books, NewDelhi
8. Subba Rao Changanti, Pharmaceutical Marketing in India (GIFT – Excel series) Excel Publications.

BP804 ET: PHARMACEUTICAL REGULATORY SCIENCE (Theory)

45Hours

Sushant University soaring high	**School of Health Sciences** **Bachelor of Pharmacy**		
Course Title: PHARMACEUTICAL REGULATORY SCIENCE			
Semester: VIII	**Course code:** BP804 ET	**Credits: 4**	**Core / Elective: Core**
No. of lectures/ tutorials: 4/week		**No. of practical hours: 0/week**	
Course Pre-requisites: None			

COURSE OUTCOMES (COs):

Upon completion of the subject student shall be able to;:

CO 01: Know about the process of drug discovery anddevelopment

CO 02: Know the regulatory authorities and agencies governing the manufacture andsale ofpharmaceuticals

CO 03: Know the regulatory approval process and their registration in Indian and internationalmarkets

Mapping	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10
CO 01	H	H	M	L	L	L	L	L	L	H
CO 02	H	H	M	L	L	L	L	L	L	H
CO 03	H	H	M	L	L	L	L	L	L	H

Course content:

UnitI **10Hours**

New Drug Discovery and development

Stages of drug discovery, Drug development process, pre-clinical studies, non-clinical activities, clinical studies, Innovator and generics, Concept of generics, Generic drug

product development.

UnitII **10Hours**

Regulatory Approval Process

Approval processes and timelines involved in Investigational New Drug (IND), New Drug Application (NDA), Abbreviated New Drug Application (ANDA). Changes to an approved NDA / ANDA.

Regulatory authorities and agencies

Overview of regulatory authorities of India, United States, European Union, Australia, Japan, Canada (Organization structure and types of applications)

UnitIII **10Hours**

Registration of Indian drug product in overseas market

Procedure for export of pharmaceutical products, Technical documentation, Drug Master Files (DMF), Common Technical Document (CTD), electronic Common Technical

Document (eCTD), ASEAN Common Technical Document (ACTD)research.

UnitIV **08Hours**

Clinical trials

Developing clinical trial protocols, Institutional Review Board / Independent Ethics committee - formation and working procedures, Informed consent process and procedures, GCP obligations of Investigators, sponsors & Monitors, Managing and Monitoring clinical trials, Pharmacovigilance - safety monitoring in clinicaltrials

UnitV **07Hours**

Regulatory Concepts

Basic terminology, guidance, guidelines, regulations, Laws and Acts, Orange book, Federal Register, Code of Federal Regulatory, Purple book

Recommended books (Latest edition):

1. Drug Regulatory Affairs by Sachin Itkar, Dr. N.S. Vyawahare, NiraliPrakashan.
2. The Pharmaceutical Regulatory Process, Second Edition Edited by Ira R. Berry and Robert P. Martin, Drugs and the Pharmaceutical Sciences,Vol.185. Informa Health carePublishers.
3. New Drug Approval Process: Accelerating Global Registrations ByRichard A Guarino, MD, 5th edition, Drugs and the PharmaceuticalSciences,Vol.190.
4. Guidebook for drug regulatory submissions / Sandy Weinberg. ByJohn Wiley & Sons.Inc.
5. FDA Regulatory Affairs: a guide for prescription drugs, medical devices,and biologics /edited by Douglas J. Pisano, DavidMantus.
6. Generic Drug Product Development, Solid Oral Dosage forms, Leon Shargel and Isader Kaufer, Marcel Dekker series,Vol.143
7. Clinical Trials and Human Research: A Practical Guide to Regulatory Compliance ByFayA.RozovskyandRodneyK.Adams
8. Principles and Practices of Clinical Research, Second Edition Edited by John I. Gallin and Frederick P.Ognibene
9. Drugs: From Discovery to Approval, Second Edition By RickNg

BP 805T: PHARMACOVIGILANCE (Theory)

45 hours

Sushant University soaring high	**School of Health Sciences** **Bachelor of Pharmacy**		
Course Title: PHARMACOVIGILANCE			
Semester: VIII	**Course code:** BP 805T	**Credits: 4**	**Core / Elective: Core**
No. of lectures/ tutorials: 4/week		**No. of practical hours: 0/week**	
Course Pre-requisites: None			

COURSE OUTCOMES (COs):

CO 01: Learn drug safety monitoring

CO 02: Detect new adverse drug reactions, theirassessment and reporting

CO 03: Pharmacovigilance Program of India (PvPI)

CO 04: Gain knowledge of ICH guidelines for ICSR, PSUR and pharmacovigilanceplanning

CO 05: Write case narratives of adverse events and theirquality.

Mapping	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10
CO 01	H	M	L	L	L	H	L	M	L	L
CO 02	M	H	L	L	L	H	L	L	L	L
CO 03	L	L	L	L	L	H	L	L	L	L
CO 04	L	L	L	L	L	H	L	M	L	L
CO 05	M	M	L	L	L	M	L	M	L	L

Course Content

UnitI **10Hours**

Introduction to Pharmacovigilance

- History and development ofPharmacovigilance

- Importance of safety monitoring ofMedicine
- WHO international drug monitoringprogramme
- Pharmacovigilance Program of India(PvPI)

Introduction to adverse drug reactions

- Definitions and classification ofADRs
- Detection andreporting
- Methods in Causalityassessment
- Severity and seriousnessassessment
- Predictability and preventabilityassessment
- Management of adverse drugreactions

Basic terminologies used in pharmacovigilance

- Terminologies of adverse medication relatedevents
- Regulatoryterminologies

Unit II **10 hours**

Drug and disease classification

- Anatomical, therapeutic and chemical classification ofdrugs
- International classification ofdiseases
- Daily defineddoses
- International Non proprietary Names fordrugs

Drug dictionaries and coding in pharmacovigilance

- WHO adverse reactionterminologies
- MedDRA and Standardised MedDRAqueries
- WHO drugdictionary
- Eudravigilance medicinal productdictionary

Information resources in pharmacovigilance

- Basic drug informationresources
- Specialised resources forADRs

Establishing pharmacovigilance programme

- Establishing in ahospital
- Establishment & operation of drug safety department inindustry
- Contract Research Organisations(CROs)
- Establishing a nationalprogramme

Unit III **10Hours**

Vaccine safety surveillance

- VaccinePharmacovigilance
- Vaccinationfailure
- Adverse events followingimmunization

Pharmacovigilance methods

- Passive surveillance – Spontaneous reports and caseseries
- Stimulatedreporting
- Active surveillance – Sentinel sites, drug event monitoring andregistries
- Comparativeobservationalstudies–Crosssectionalstudy,casecontrolstudyand cohort study
- Targeted clinicalinvestigations

Communication in pharmacovigilance

- Effective communication inPharmacovigilance
- Communication in Drug Safety Crisismanagement
- CommunicatingwithRegulatoryAgencies,BusinessPartners,Healthcarefacilities& Media

UnitIV **8Hours**

Safety data generation

- Pre clinicalphase
- Clinical phase
- Post approval phase(PMS)

ICH Guidelines for Pharmacovigilance

- Organization and objectives ofICH
- Expeditedreporting
- Individual case safetyreports
- Periodic safety updatereports
- Post approval expeditedreporting
- Pharmacovigilanceplanning
- Good clinical practice in pharmacovigilancestudies

UnitV **7hours**

Pharmacogenomics of adverse drug reactions

- Genetics related ADR with example focusing PKparameters.

Drug safety evaluation in special population

- Paediatrics
- Pregnancy andlactation
- Geriatrics

CIOMS

- CIOMS WorkingGroups
- CIOMS Form

CDSCO (India) and Pharmacovigilance

- D&C Act and ScheduleY
- Differences in Indian and global pharmacovigilancerequirements

Recommended Books (Latest edition):

1. Textbook of Pharmacovigilance: S K Gupta, Jaypee Brothers, MedicalPublishers.
2. Practical Drug Safety from A to Z ByBarton Cobert, Pierre Biron, Jones and BartlettPublishers.
3. Mann's Pharmacovigilance:Elizabeth B. Andrews, Nicholas, WileyPublishers.
4. Stephens' Detection of New Adverse Drug Reactions: John Talbot, Patrick Walle, WileyPublishers.
5. An Introduction to Pharmacovigilance: Patrick Waller,WileyPublishers.
6. Cobert's Manual of Drug Safety and Pharmacovigilance: Barton Cobert,Jones& BartlettPublishers.

7. Textbook of Pharmacoepidemiolog edited by Brian L. Strom, Stephen E Kimmel, Sean Hennessy,WileyPublishers.
8. A Textbook of Clinical Pharmacy Practice -Essential Concepts and Skills:G. Parthasarathi, Karin NyfortHansen,Milap C.Nahata
9. National Formulary ofIndia
10. Text Book of Medicine by YashpalMunjal

11. Text book of Pharmacovigilance: concept and practice by GP Mohanta and PK Manna

12. http://www.whoumc.org/DynPage.aspx?id=105825&mn1=7347&mn2=7259&mn3=7297
13. http://www.ich.org/
14. http://www.cioms.ch/
15. http://cdsco.nic.in/
16. http://www.who.int/vaccine_safety/en/
17. http://www.ipc.gov.in/PvPI/pv_home.html

BP 806 ET. QUALITY CONTROL AND STANDARDIZATION OF HERBALS (Theory)

Sushant University soaring high	**School of Health Sciences** **Bachelor of Pharmacy**

Course Title: QUALITY CONTROL AND STANDARDIZATION OF HERBALS			
Semester: VIII	**Course code:** BP ET 806 T	**Credits: 4**	**Core / Elective: Core**
No. of lectures/ tutorials: 4/week		**No. of practical hours: 0/week**	
Course Pre-requisites: None			

COURSE OUTCOMES (COs):

Upon completion of the subject student shall be able to;

CO 01: know WHO guidelines for quality control of herbaldrugs

CO 02: know Quality assurance in herbal drugindustry

CO 03: know the regulatory approval process and their registration in Indianand internationalmarkets

CO 04: appreciate EU and ICH guidelines for quality control of herbaldrugs

Mapping	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10
CO 01	H	H	M	L	H	H	M	L	H	H
CO 02	H	H	M	L	H	H	L	M	H	H
CO 03	H	H	L	M	H	H	L	L	H	H
CO 04	H	H	L	L	H	H	M	L	H	H

UnitI **10 hours**

Basic tests for drugs – Pharmaceutical substances, Medicinal plants materials and dosage forms

WHO guidelines for quality control of herbal drugs.

Evaluation of commercial crude drugs intended for use

UnitII **10 hours**

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

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

UnitIII **10 hours**

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

UnitIV **08 hours**

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

UnitV **07 hours**

Regulatory requirements for herbal medicines.

WHO guidelines on safety monitoring of herbal medicines in pharmacovigilance systems

Comparison of various Herbal Pharmacopoeias.

Role of chemical and biological markers in standardization of herbal products

Recommended Books: (Latest Editions

1. Pharmacognosy by Trease andEvans
2. Pharmacognosy by Kokate, Purohit andGokhale
3. Rangari, V.D., Text book of Pharmacognosy and Phytochemistry Vol. I , Carrier Pub.,2006.
4. Aggrawal, S.S., Herbal Drug Technology. Universities Press,2002.
5. EMEA. Guidelines on Quality of Herbal Medicinal Products/TraditionalMedicinal Products,
6. Mukherjee, P.W. Quality Control of Herbal Drugs: An Approach to Evaluationof Botanicals. Business Horizons Publishers, New Delhi, India,2002.
7. Shinde M.V., Dhalwal K., Potdar K., Mahadik K. Application of quality control principles to herbal drugs. International Journal of Phytomedicine 1(2009); p.4-8.
8. WHO. Quality Control Methods for Medicinal Plant Materials, World Health Organization, Geneva, 1998. WHO. Guidelines for the Appropriate Use ofHerbal Medicines. WHO Regional Publications, Western Pacific Series No 3, WHO Regional office for the Western Pacific, Manila,1998.
9. WHO. The International Pharmacopeia, Vol. 2: Quality Specifications, 3rdedn. World Health Organization, Geneva,1981.
10. WHO. Quality Control Methods for Medicinal Plant Materials. WorldHealth Organization, Geneva,1999.
11. WHO. WHO Global Atlas of Traditional, Complementary andAlternative Medicine. 2 vol. set. Vol. 1 contains text and Vol. 2, maps. World Health Organization, Geneva,2005.
12. WHO. Guidelines on Good Agricultural and Collection Practices (GACP)for Medicinal Plants. World Health Organization, Geneva,2004.

BP 807 ET. COMPUTER AIDED DRUG DESIGN (Theory)

45 Hours

Sushant University soaring high	**School of Health Sciences** **Bachelor of Pharmacy**		
Course Title: COMPUTER AIDED DRUG DESIGN			
Semester: VIII	**Course code:** BP 807 ET	**Credits: 4**	**Core / Elective: Core**
No. of lectures/ tutorials: 4/week		**No. of practical hours: 0/week**	
Course Pre-requisites: None			

COURSE OUTCOMES (COs):
Upon completion of the course, the student shall be able to understand

CO 01: Design and discovery of leadmolecules

CO 02: The role of drug design in drug discoveryprocess

CO 03: The concept of QSAR anddocking

CO 04: Various strategies to develop new drug likemolecules.

CO 05: The design of new drug molecules using molecular modelling software

Mapping	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10
CO 01	H	H	M	L	H	H	M	L	L	L
CO 02	H	H	M	L	H	H	L	M	L	L
CO 03	H	H	L	M	H	H	L	L	L	L
CO 04	H	H	L	L	H	H	M	L	L	L
CO 05	H	H	M	L	H	H	M	L	L	L

Course Content:

UNIT-I **10Hours**

Introduction to Drug Discovery and Development

Stages of drug discovery and development

Lead discovery and Analog Based Drug Design

Rational approaches to lead discovery based on traditional medicine, Random screening, Non-random screening, serendipitous drug discovery, lead discovery based on drug metabolism, lead discovery based on clinicalobservation.

Analog Based Drug Design: Bioisosterism, Classification, Bioisosteric replacement. Any three case studies

UNIT-II **10Hours**

Quantitative Structure Activity Relationship (QSAR)

SAR versus QSAR, History and development of QSAR, Types of physicochemical parameters, experimental and theoretical approaches for the determination of physicochemical parameters such as Partition coefficient, Hammet's substituent constant and Tafts steric constant. Hansch analysis, Free Wilson analysis, 3D-QSAR approaches like COMFA and COMSIA.

UNIT-III **10Hours**

Molecular Modeling and virtual screening techniques

Virtual Screening techniques: Drug likeness screening, Concept of pharmacophore mapping and pharmacophore based Screening,

Molecular docking: Rigid docking, flexible docking, manual docking, Docking based screening. *De novo* drug design.

UNIT-IV **08Hours**

Informatics & Methods in drug design

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

UNIT-V **07Hours**

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

Recommended Books (Latest Editions)

1. Robert GCK, ed., "Drug Action at the Molecular Level" University Prak PressBaltimore.
2. Martin YC. "Quantitative Drug Design" Dekker, NewYork.
3. Delgado JN, Remers WA eds "Wilson & Gisvolds's Text Book of Organic Medicinal & Pharmaceutical Chemistry" Lippincott, NewYork.
4. Foye WO "Principles of Medicinal chemistry 'Lea &Febiger.
5. Koro lkovas A, Burckhalter JH. "Essentials of Medicinal Chemistry" Wiley Interscience.
6. Wolf ME, ed "The Basis of Medicinal Chemistry, Burger's Medicinal Chemistry" John Wiley & Sons, NewYork.
7. Patrick Graham, L., An Introduction to Medicinal Chemistry, Oxford University Press.
8. Smith HJ, Williams H, eds, "Introduction to the principles of Drug Design" WrightBoston.
9. Silverman R.B. "The organic Chemistry of Drug Design and Drug Action" Academic Press New York.

BP808ET: CELL AND MOLECULAR BIOLOGY (Elective subject)

45 Hours

Sushant University soaring high	**School of Health Sciences** **Bachelor of Pharmacy**		
Course Title: CELL AND MOLECULAR BIOLOGY			
Semester: VIII	**Course code:** BP808ET	**Credits: 4**	**Core / Elective: Core**
No. of lectures/ tutorials: 4/week		**No. of practical hours: 0/week**	
Course Pre-requisites: None			

COURSE OUTCOMES (COs):

Upon completion of the subject student shall be ableto;

CO 01: Summarize cellular functioning andcomposition.

CO 02: Describe the chemical foundations of cellbiology.

CO 03: Summarize the DNA properties of cellbiology.

CO 04: Describe protein structure andfunction.

CO 05: Describe basic molecular geneticmechanisms.

Mapping	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10
CO 01	H	M	M	H	L	L	M	H	H	L
CO 02	H	M	M	H	L	L	M	H	H	L
CO 03	H	M	M	H	L	L	M	H	H	L
CO 04	M	H	H	L	L	H	H	H	H	H
CO 05	H	H	M	H	L	L	H	H	H	L

Course content:

UnitI **10Hours**

a) Cell and Molecular Biology: Definitions theory and basics andApplications.
b) Cell and Molecular Biology: History andSummation.
c) Properties of cells and cellmembrane.
d) Prokaryotic versusEukaryotic
e) CellularReproduction

f) Chemical Foundations – an Introduction and Reactions(Types)

UnitII **10Hours**

a) DNA and the Flow of MolecularInformation
b) DNAFunctioning
c) DNA andRNA
d) Types ofRNA
e) Transcription andTranslation

UnitIII **10Hours**

a) Proteins: Defined **and** AminoAcids
b) ProteinStructure

c) Regularities in Protein Pathways
d) CellularProcesses
e) Positive Control and significance of ProteinSynthesis

UnitIV **08Hours**

a) Science ofGenetics
b) Transgenics and Genomic Analysis
c) Cell Cycleanalysis
d) Mitosis andMeiosis
e) Cellular Activities andCheckpoints

UnitV **07Hours**

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

Recommended Books (latest edition):

1. W.B. Hugo and A.D. Russel: Pharmaceutical Microbiology, BlackwellScientific publications, Oxford London.
2. Prescott and Dunn., Industrial Microbiology, 4th edition, CBS Publishers& Distributors,Delhi.
3. Pelczar, Chan Kreig, Microbiology, Tata McGraw Hilledn.
4. Malcolm Harris, Balliere Tindall and Cox: PharmaceuticalMicrobiology.
5. Rose: IndustrialMicrobiology.
6. Probisher, Hinsdill et al: Fundamentals of Microbiology, 9th ed.Japan
7. Cooper and Gunn's: Tutorial Pharmacy, CBS Publisher andDistribution.
8. Peppler: MicrobialTechnology.
9. Edward: Fundamentals ofMicrobiology.
10. N.K.Jain: Pharmaceutical Microbiology, Vallabh Prakashan, Delhi
11. Bergeys manual of systematic bacteriology, Williams and Wilkins- A Waverly company
12. B.R. Glick and J.J. Pasternak: Molecular Biotechnology: Principles and Applications of RecombinantDNA: ASM Press WashingtonD.C.
13. RA Goldshy et. al., : KubyImmunology.

BP809ET. COSMETICSCIENCE(Theory)

45Hours

Sushant University soaring high	**School of Health Sciences** **Bachelor of Pharmacy**		
Course Title: COSMETICSCIENCE			
Semester: VIII	**Course code: BP809ET**	**Credits: 4**	**Core / Elective: Core**
No. of lectures/ tutorials: 4/week		**No. of practical hours: 0/week**	
Course Pre-requisites: None			

COURSE OUTCOMES (COs):

Upon completion of this course, student shall be ableto:

CO 01: Know the regulatory requirements for cosmetic products

CO 02: Understand the need of cosmetic product

CO 03: Formulate and evaluate various cosmetics

CO 04: Application and indication of available cosmetic products

Mapping	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10
CO 01	H	H	L	L	H	H	H	H	M	M
CO 02	H	M	L	L	H	M	H	M	M	H
CO 03	H	H	L	L	M	M	H	H	M	H
CO 04	H	H	L	L	M	H	H	H	L	M
CO 05	H	M	L	L	H	M	H	M	L	M

UNITI **10Hours**

Classification of cosmetic and cosmeceutical products

Definition of cosmetics as per Indian and EU regulations, Evolution of cosmeceuticals from cosmetics, cosmetics as quasi and OTC drugs

Cosmetic excipients: Surfactants, rheology modifiers, humectants, emollients, preservatives. Classification and application

Skin: Basic structure and function of skin.

Hair: Basic structure of hair. Hair growth cycle.

Oral Cavity: Common problem associated with teeth and gums**.**

UNITII **10Hours**

Principles of formulation and building blocks of skin care products:

Face wash,
Moisturizing cream, Cold Cream, Vanishing cream and their advantages and disadvantages.Application of these products in formulation of cosmecuticals.**Antiperspants & deodorants**- Actives & mechanism of action.

Principles of formulation and building blocks of Hair care products:

Conditioning shampoo, Hair conditioner,anti-dandruff shampoo.
Hair oils.
Chemistry and formulation of Para-phylene diamine based hair dye.
Principles of formulation and building blocks of oral care products:
Toothpaste for bleeding gums, sensitive teeth. Teeth whitening, Mouthwash.

UNITIII **10Hours**

Sun protection, Classification of Sunscreens and SPF.

Role of herbs in cosmetics:

Skin Care: Aloe and turmeric
Hair care: Henna and amla.
Oral care: Neem and clove

Analytical cosmetics: BIS specification and analytical methods for shampoo, skin-cream and toothpaste**.**

UNITIV **08Hours**.

Principles of Cosmetic Evaluation:Principles of sebumeter, corneometer. Measurement of TEWL, Skin Color, Hair tensile strength, Hair combingproperties
Soaps,and syndet bars. Evolution and skin benfits.

UNITV **07Hours**

Oily and dry skin, causes leading to dry skin, skin moisturisation. Basic understanding of the terms Comedogenic, dermatitis.

Cosmetic problems associated with Hair and scalp: Dandruff, Hair fall causes

Cosmetic problems associated with skin: blemishes, wrinkles, acne, prickly heat and body odor.

Antiperspirants and Deodorants- Actives and mechanism of action

References

1) Harry's Cosmeticology, Wilkinson, Moore, Seventh Edition, GeorgeGodwin.
2) Cosmetics – Formulations, Manufacturing and Quality Control, P.P. Sharma, 4th Edition, Vandana Publications Pvt. Ltd., Delhi.
3) Text book of cosmelicology by Sanju Nanda & Roop K. Khar, TataPublishers.

BP810 ET. PHARMACOLOGICAL SCREENING METHODS

45 Hours

Sushant University soaring high	**School of Health Sciences** **Bachelor of Pharmacy**

Course Title: PHARMACOLOGICAL SCREENING METHODS			
Semester: VIII	**Course code:** BP810 ET	**Credits: 4**	**Core / Elective: Core**
No. of lectures/ tutorials: 4/week		**No. of practical hours: 0/week**	
Course Pre-requisites: None			

COURSE OUTCOMES (COs):

Upon completion of the course the student shall be able to,

CO 01: Appreciate the applications of various commonly used laboratoryanimals.

CO 02: Appreciateanddemonstrate the various screening methods used in preclinical research

CO 03: Appreciate and demonstrate the importance of biostatistics andresearchmethodology

CO 04: Design and execute a research hypothesisindependently

Mapping	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10
CO 01		L	L	L	H	M	H	M	H	L
CO 02	L	L	L	L	H	M	H	L	H	L
CO 03	H	H	L	L	H	H	H	M	H	L
CO 04	L	H	L	L	H	H	H	M	H	L

Unit –I	**08 Hours**

Laboratory Animals: Study of CPCSEA and OECD guidelines for maintenance, breeding and conduct of experiments on laboratory animals, Common lab animals: Description and applications of different species and strains of animals. Popular transgenic and mutantanimals. Techniques for collection of blood and common routes of drug administration in laboratory animals, Techniques of blood collection andeuthanasia.	
Unit –II	**10 Hours**
Preclinical screening models a. Introduction: Dose selection, calculation and conversions, preparation of drug solution/suspensions, grouping of animals and importance of sham negative and positive control groups. Rationale for selection of animal species and sex for thestudy. **b. Study of screening animal modelsfor** Diuretics, nootropics, anti-Parkinson's,antiasthmatics, **Preclinical screening models:** for CNS activity- analgesic, antipyretic,anti-inflammatory, general anaesthetics, sedative and hypnotics, antipsychotic, antidepressant, antiepileptic, antiparkinsonism, alzheimer's disease	

Unit –III **Preclinical screening models:** for ANS activity, sympathomimetics, sympatholytics, parasympathomimetics, parasympatholytics, skeletal muscle relaxants, drugs acting on eye, local anaethetics	
Unit –IV **Preclinical screening models:** for CVS activity- antihypertensives, diuretics, antiarrhythmic, antidyslepidemic, anti aggregatory, coagulants, and anticoagulants Preclinical screening models for other important drugs like antiulcer, antidiabetic, anticancer and antiasthmatics.	
Research methodology and Bio-statistics Selection of research topic, review of literature, research hypothesis and study design Pre-clinical data analysis and interpretation using Students 't' test and One-way ANOVA. Graphical representation of data	**05 Hours**

Recommended Books (latest edition):

1. Fundamentals of experimental Pharmacology-byM.N.Ghosh
2. Hand book of ExperimentalPharmacology-S.K.Kulakarni
3. CPCSEA guidelines for laboratory animalfacility.
4. Drug discovery and Evaluation by VogelH.G.
5. Drug Screening Methods by Suresh Kumar Gupta and S. K.Gupta
6. Introduction to biostatistics and research methods by PSS Sundar Rao and J Richard

BP 811 ET. ADVANCED INSTRUMENTATION TECHNIQUES

45 Hours

COURSE OUTCOMES (COs):

Upon completion of the course the student shall be able to

CO 01: understand the advanced instruments used and its applications in druganalysis

CO 02: understand the chromatographic separation and analysis ofdrugs.

CO 03: understand the calibration of various analyticalinstruments

CO 04: know analysis of drugs using various analyticalinstruments.

Mapping	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10
CO 01	H	H	H	L	H	L	L	M	H	L
CO 02	H	M	H	M	M	L	L	M	H	L
CO 03	M	H	H	L	H	L	M	H	M	L
CO 04	H	M	H	M	M	L	L	M	L	L

Course Content:

UNIT-I **10Hours**

Nuclear Magnetic Resonance spectroscopy

Principles of H-NMR and C-NMR, chemical shift, factors affecting chemical shift, coupling constant, Spin - spin coupling, relaxation, instrumentation and applications

Mass Spectrometry- Principles, Fragmentation, Ionization techniques – Electron impact, chemical ionization, MALDI, FAB,Analyzers-Timeof flight and Quadrupole, instrumentation,applications

UNIT-II **10Hours**

Thermal Methods of Analysis: Principles, instrumentation and applications of ThermogravimetricAnalysis (TGA), Differential Thermal Analysis (DTA), Differential Scanning Calorimetry(DSC)

X-Ray Diffraction Methods: Origin of X-rays, basic aspects of crystals, X-ray

Crystallography, rotating crystal technique, single crystal diffraction,powder diffraction, structural elucidation and applications.

UNIT-III **10Hours**

Calibration and validation-as per ICH and USFDA guidelines

Calibration of following Instruments

Electronic balance, UV-Visible spectrophotometer, IR spectrophotometer,

Fluorimeter, Flame Photometer, HPLC and GC

UNIT-IV **08Hours**

Radio immune assay: Importance, various components, Principle, different methods, Limitation and Applications of Radio immuno assay

Extraction techniques:General principle and procedure involved in the solid phase extraction and liquid-liquid extraction

UNIT-V **07Hours**

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

Recommended Books (Latest Editions)

1. Instrumental Methods of Chemical Analysis by B.KSharma
2. Organic spectroscopy by Y.RSharma
3. Text book of Pharmaceutical Analysis by Kenneth A.Connors
4. Vogel's Text book of Quantitative Chemical Analysis by A.I.Vogel
5. Practical Pharmaceutical Chemistry by A.H. Beckett and J.B.Stenlake
6. Organic Chemistry by I. L.Finar
7. Organic spectroscopy by WilliamKemp
8. Quantitative Analysis of Drugs by D. C.Garrett
9. Quantitative Analysis of Drugs in Pharmaceutical Formulations by P. D.Sethi
10. Spectrophotometric identification of Organic Compounds bySilverstein

BP 812 ET. DIETARY SUPPLEMENTS AND NUTRACEUTICALS

No. of hours:3 **Tutorial:1** **Credit point:4**

COURSE OUTCOMES (COs):

By the end of the course, students should be able to :

CO 01: Understand the need of supplements by the different group of people tomaintain healthylife.

CO 02: Understand the outcome of deficiencies in dietarysupplements.

CO 03: Appreciate the components in dietary supplements and theapplication.

CO 04: Appreciate the regulatory and commercial aspects of dietary supplementsincluding healthclaims.

Mapping	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10
CO 01	H	H	L	L	H	H	H	H	M	M
CO 02	H	M	L	L	H	M	H	M	M	H
CO 03	H	H	L	L	M	M	H	H	M	H
CO 04	H	H	L	L	M	H	H	H	L	M

UNITI **07 hours**

a. Definitions of Functional foods, Nutraceuticals and Dietary supplements. Classification of Nutraceuticals, Health problems and diseases that can be prevented or cured by Nutraceuticals i.e. weight control, diabetes, cancer, heart disease, stress, osteoarthritis, hypertensionetc.
b. Public health nutrition, maternal and child nutrition, nutrition and ageing, nutrition education incommunity.
c. Source, Name of marker compounds and their chemical nature, Medicinal uses and health benefits of following used as nutraceuticals/functional foods: Spirulina, Soyabean, Ginseng, Garlic, Broccoli, Gingko,Flaxseeds

UNITII **15 hours**

Phytochemicals as nutraceuticals: Occurrence and characteristic features(chemical nature medicinal benefits) of following

a) Carotenoids- α and β-Carotene, Lycopene, Xanthophylls,leutin
b) Sulfides: Diallyl sulfides, Allyltrisulfide.
c) Polyphenolics:Reservetrol
d) Flavonoids- Rutin , Naringin, Quercitin, Anthocyanidins, catechins,Flavones
e) Prebiotics / Probiotics.: Fructo oligosaccharides, Lactobacillum
f) Phyto estrogens : Isoflavones, daidzein, Geebustin,lignans

g) Tocopherols
h) Proteins, vitamins, minerals, cereal, vegetables and beverages as functional foods: oats, wheat bran, rice bran, sea foods, coffee, tea and thelike.

UNITIII **07 hours**

a) Introduction to free radicals: Free radicals, reactive oxygen species, production of free radicals in cells, damaging reactions of free radicals on lipids, proteins, Carbohydrates, nucleic acids.

b) Dietary fibres and complex carbohydrates as functional foodingredients..

UNITIV **10 hours**

a) Free radicals in Diabetes mellitus, Inflammation, Ischemic reperfusion injury,Cancer, Atherosclerosis, Free radicals in brain metabolism and pathology, kidney damage, muscle damage. Free radicals involvement in other disorders. Free radicals theory of ageing.

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

c) Functional foods for chronic diseaseprevention

UNITV **06 hours**

a) Effect of processing, storage and interactions of various environmental factors on the potential of nutraceuticals.

b) Regulatory Aspects; FSSAI, FDA, FPO, MPO, AGMARK. HACCP and GMPs on Food Safety. Adulteration offoods.

c) Pharmacopoeial Specifications for dietary supplements andnutraceuticals.

References:

1. Dietetics by SriLakshmi
2. Role of dietary fibres and neutraceuticals in preventing diseases by K.T Agusti and P.Faizal:BSPunblication.
3. Advanced Nutritional Therapies by Cooper. K.A.,(1996).
4. The Food Pharmacy by Jean Carper, Simon & Schuster, UK Ltd.,(1988).
5. Prescription for Nutritional Healing by James F.Balch and Phyllis A.Balch 2nd Edn., Avery Publishing Group, NY(1997).
6. G. Gibson and C.williams Editors *2000 Functional foods* WoodheadPubl.Co.London.
7. Goldberg, I. *Functional Foods*. 1994. Chapman and Hall, NewYork.
8. Labuza, T.P. 2000 Functional Foods and Dietary Supplements: Safety, Good Manufacturing Practice (GMPs) and Shelf Life Testing in *Essentials of Functional Foods* M.K. Sachmidl and T.P. Labuza eds. AspenPress.
9. Handbook of Nutraceuticals and Functional Foods, Third Edition (ModernNutrition)
10. Shils, ME, Olson, JA, Shike, M. 1994 *Modern Nutrition in Health and Disease*. Eighth edition. Lea andFebiger

Semester VIII – Elective course on Pharmaceutical ProductDevelopment

No ofHours:3 Tutorial:1 Creditpoints:4

COURSE OUTCOMES (COs):

By the end of the course, students should be able to:

CO 01: Understand the preformulation, formulation and postformulation principles in order to develop pharmaceutical product

CO 02: Optimize the formulation by selecting appropriate excipients

CO 03: Focus on stability assessment of finished pharmaceutical product

CO 04: Perform quality control testing of different dosage forms and their packaging

Mapping	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10
CO 01	H	H	L	L	L	H	H	M	H	L
CO 02	H	H	L	L	M	H	H	L	H	L
CO 03	H	H	L	L	M	H	H	L	H	L
CO 04	H	H	L	L	M	H	H	L	H	L

Unit-I **10Hours**

Introduction to pharmaceutical product development, objectives, regulations related to preformulation, formulation development, stability assessment, manufacturing and quality control testing of different types of dosageforms

Unit-II **10Hours**

An advanced study of Pharmaceutical Excipients in pharmaceutical product development with a special reference to the following categories

i. Solvents andsolubilizers
ii. Cyclodextrins and theirapplications
iii. Non - ionic surfactants and theirapplications
iv. Polyethylene glycols andsorbitols
v. Suspending and emulsifyingagents
vi. Semi solidexcipients

Unit-III **10Hours**

An advanced study of Pharmaceutical Excipients in pharmaceutical product development with a special reference to the following categories

i. Tablet and capsuleexcipients
ii. Directly compressiblevehicles

iii. Coatmaterials
iv. Excipients in parenteral and aerosolsproducts
v. Excipients for formulation ofNDDS

Selection and application of excipients in pharmaceutical formulations with specific industrial applications

Unit-IV **08Hours**

Optimization techniques in pharmaceutical product development.A study of various optimization techniques for pharmaceutical product development with specific examples.Optimization by factorial designs and their applications.A study of QbD and its application in pharmaceutical product development.

Unit-V **07Hours**

Selection and quality control testing of packaging materials for pharmaceutical product development- regulatory considerations.

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Recommended Books (Latest editions)

1. Pharmaceutical Statistics Practical and Clinical Applications byStanford Bolton, CharlesBon; Marcel DekkerInc.
2. Encyclopedia of Pharmaceutical Technology, edited by James swarbrick,Third Edition,Informa Healthcarepublishers.
3. Pharmaceutical Dosage Forms, Tablets, Volume II, edited by Herbert A.Lieberman andLeon Lachman; Marcel Dekker,Inc.
4. The Theory and Practice of Industrial Pharmacy, Fourth Edition, edited by Roop kKhar, S P Vyas, Farhan J Ahmad, Gaurav K Jain; CBS Publishers andDistributors Pvt.Ltd.2013.
5. Martin's Physical Pharmacy and Pharmaceutical Sciences, Fifth Edition, editedby Patrick J. Sinko, BI Publications Pvt.Ltd.
6. Targeted and Controlled Drug Delivery, Novel Carrier Systems by S. P. Vyasand R. K.Khar, CBS Publishers and Distributors Pvt. Ltd, First Edition 2012.
7. Pharmaceutical Dosage Forms and Drug Delivery Systems, Loyd V. Allen Jr., Nicholas B.Popovich, Howard C. Ansel, 9th Ed.40
8. Aulton's Pharmaceutics – The Design and Manufacture of Medicines, MichaelE. Aulton,3rdEd.
9. Remington – The Science and Practice of Pharmacy, 20thEd.
10. Pharmaceutical Dosage Forms – Tablets Vol 1 to 3, A. Liberman, Leon Lachman andJoseph B. Schwartz
11. Pharmaceutical Dosage Forms – Disperse Systems Vol 1 to 3, H.A. Liberman, Martin, M.R and Gilbert S. Banker.
12. Pharmaceutical Dosage Forms – Parenteral Medication Vol 1 & 2, Kenneth E. Avis andH.A.Libermann.
13. Advanced Review Articles related to thetopics.