THE DALE VIEW
COLLEGE OF PHARMACY & RESEARCH CENTRE
Approved by PCI, AICTE and Affiliated to Kerala University of Health sciences
An ISO 9001-2015 Certified Institution **Accredited by NAAC**
Recognized under Section 2 (f) of the UGC Act 1956
Punalal.P.O., Thiruvananthapuram, Pin :695575. Phone: 0472-2853763, 2852394, 9446802073
Website:www.daleviewcollege.com/new Email : dvpharma@gmail.com

1. **The list of courses, scheme and structure of syllabus as provided by affiliating University documents. Certificate of Principal showing total number of subjects/courses/papers a student has to appear in University examination for each program, for all the programs, scheme and structure of syllabus for all the 5 assessment years.**

SL.NO	LIST OF COURSE
1	B.PHARM (Bachelor of Pharmacy)
2	M.PHARM Pharmaceutical Chemistry and Pharmaceutics
3	PHARM.D (Doctor of Pharmacy)

Bachelor of Pharmacy (B.PHARM)

First Semester

Course Code	Name of the Course	No. of hours	Tutorial	Credit points
BP101T	Human Anatomyand 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	Remedial Biology – Theory *	2	-	2
BP106RMT	Remedial Mathematics – Theory*			
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#**

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Principal

Second Semester

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**

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**

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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**

Semester V

Course Code	Name of the Course	No. of hours	Tutorial	Credit points
BP501T	Medicinal Chemistry II – Theory	3	1	4
BP502T	Formulative Pharmacy– Theory	3	1	4
BP503T	Pharmacology II – Theory	3	1	4
BP504T	Pharmacognosy and Phytochemistry II– Theory	3	1	4
BP505T	Pharmaceutical Jurisprudence – Theory	3	1	4
BP506P	Formulative Pharmacy – Practical	4	-	2
BP507P	Pharmacology II – Practical	4	-	2
BP508P	Pharmacognosy and Phytochemistry II – Practical	4	-	2
	Total	**27**	**5**	**26**

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Semester VI

Course	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**

Semester VII

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

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Semester VIII

Course	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	Pharmaceutical Marketing	3 +3 =6	1 +1 =2	4 + 4 = 8
BP804ET	Pharmaceutical Regulatory Science			
BP805ET	Pharmacovigilance			
BP806ET	Quality Control and Standardization of Herbs			
BP807ET	Computer Aided Drug Designing			
BP808ET	Cell and Molecular Biology			
BP809ET	Cosmetic Science			
BP810ET	Experimental Pharmacology			
BP811ET	Advanced Instrumentation Techniques			
BP812PW	Project work	12	-	6
	Total	**24**	**4**	**22**

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PHARM.D (Doctor of Pharmacy)

First Year

S.No	Name of Subject	No. of hours of Theory	No. of hours of Practical	No. of hours of Tutorial
(1)	(2)	(3)	(4)	(5)
1.1	Human Anatomy and Physiology	3	3	1
1.2	Pharmaceutics	2	3	1
1.3	Medicinal Biochemistry	3	3	1
1.4	Pharmaceutical Organic Chemistry	3	3	1
1.5	Pharmaceutical Inorganic Chemistry	2	3	1
1.6	Remedial Mathematics/ Biology	3	3*	1
	Total hours	16	18	6=(40)

Second Year

S.No	Name of Subject	No. of hours of Theory	No. of hours of Practical	No. of hours of Tutorial
(1)	(2)	(3)	(4)	(5)
2.1	Pathophysiology	3	-	1
2.2	Pharmaceutical Microbiology	3	3	1
2.3	Pharmacognosy & Phytopharmaceuticals	3	3	1
2.4	Pharmacology-I	3	-	1
2.5	Community Pharmacy	2	-	1
2.6	Pharmacotherapeutics-I	3	3	1
	Total hours	17	9	6=(32)

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Third Year

S.No	Name of Subject	No. of hours of Theory	No. of hours of Practical	No. of hours of Tutorial
(1)	(2)	(3)	(4)	(5)
3.1	Pharmacology-II	3	3	1
3.2	Pharmaceutical Analysis	3	3	1
3.3	Pharmacotherapeutics-II	3	3	1
3.4	Pharmaceutical Jurisprudence	2	-	-
3.5	Medicinal Chemistry	3	3	1
3.6	Pharmaceutical Formulations	2	3	1
	Total hours	16	15	6=(36)

Fourth Year

S.No	Name of Subject	No. of hours of Theory	No. of hours of Practical	No. of hours of Tutorial
(1)	(2)	(3)	(4)	(5)
4.1	Pharmacotherapeutics-III	3	3	1
4.2	Hospital Pharmacy	2	3	1
4.3	Clinical Pharmacy	3	3	1
4.4	Biostatistics & Research Methodology	2	-	1
4.5	Biopharmaceutics & Pharmacokinetics	3	3	1
4.6	Clinical Toxicology	2	-	1
	Total hours	15	12	6=(33)

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Fifth Year

S.No	Name of Subject	No. of hours of Theory	No. of hours of Practical	No. of hours of Tutorial
(1)	(2)	(3)	(4)	(5)
5.1	Clinical Research	3	-	1
5.2	Pharmacoepidemiology and Pharmacoeconomics	3	-	1
5.3	Clinical Pharmacokinetics & Pharmacotherapeutic Drug Monitoring	2	-	1
5.4	Clerkship *	-	-	1
5.5	Project work (Six Months)	-	20	-
	Total hours	8	20	4=(32)

Sixth Year:

Internship or residency training, including postings in specialty units. The student should independently provide the clinical pharmacy services to the allotted wards.

(i) Six months in General Medicine department, and
(ii) Two months each in three other speciality departments.

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M.Pharm. PHARMACEUTICAL CHEMISTRY

MPC	Pharmaceutical Chemistry				
CourseCode	**Course**	**CreditHours**	**Credit points**	**Hrs./wk**	**Marks**
	Semester I				
MPT 101T	Modern Pharmaceutical Analytical Techniques	4	4	4	100
MPC 102T	Advanced Organic Chemistry –I	4	4	4	100
MPC 103T	Advanced Medicinal Chemistry	4	4	4	100
MPC 104T	Chemistry of Natural Products	4	4	4	100
MPC 105P	Pharmaceutical Chemistry Practical – I	12	6	12	150
-	Seminar/Assignment	7	4	7	100
Total		**35**	**26**	**35**	**650**
	Semester II				
MPC 201T	Advanced Spectral Analysis	4	4	4	100
MPC 202T	Advanced Organic Chemistry –II	4	4	4	100
MPC 203T	Computer Aided Drug Design	4	4	4	100
MPC 204T	Pharmaceutical Process Chemistry	4	4	4	100
MPC 205P	Pharmaceutical Chemistry Practical II	12	6	12	150
-	Seminar /Assignment	7	4	7	100
Total		**35**	**26**	**35**	**650**

Course of study for M. Pharm. III & IV Semester

Course Code	Course	Credit Hours	Credit Points	Marks
	Semester III			
MRM 301T	Research Methodology and Biostatistics	4	4	100
-	Journal Club	1	1	25
-	Discussion / Presentation (proposal presentation)	2	2	25
-	Research Work	28	14	350
Total		**35**	**21**	**500**
	Semester IV			
-	Journal Club	1	1	25
-	Pre submission Discussion / Presentation	3	3	75
-	Research Work	31	16	400
Total		**35**	**20**	**500**

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M.Pharm PHARMACEUTICS

MPH	PHARMACEUTICS				
Course Code	**Course**	**Credit Hours**	**Credit Points**	**Hrs./wk**	**Marks**
	Semester I				
MPT101T	Modern Pharmaceutical Analytical Techniques	4	4	4	100
MPH 102T	Drug Delivery Systems	4	4	4	100
MPH 103T	Modern Pharmaceutics	4	4	4	100
MPH 104T	Regulatory Affairs	4	4	4	100
MPH105P	Pharmaceutics Practical I	12	6	12	150
-	Seminar/Assignment	7	4	7	100
Total		**35**	**26**	**35**	**650**
	Semester II				
MPH 201T	Molecular Pharmaceutics (Nano Tech and Targeted DDS)	4	4	4	100
MPH 202T	Advanced Biopharmaceutics &Pharmacokinetics	4	4	4	100
MPH 203T	Computer Aided Drug Development	4	4	4	100
MPH 204T	Cosmetics and Cosmeceuticals	4	4	4	100
MPH205P	Pharmaceutics Practical II	12	6	12	150
-	Seminar /Assignment	7	4	7	100
Total		**35**	**26**	**35**	**650**

Course of study for M. Pharm. III & IV Semester

Course Code	Course	Credit Hours	CreditPoints	Marks
	Semester III			
MRM 301T	Research Methodology and Biostatistics	4	4	100
-	Journal Club	1	1	25
-	Discussion / Presentation(proposal presentation)	2	2	25
-	Research Work	28	14	350
Total		**35**	**21**	**500**
	Semester IV			
-	Journal Club	1	1	25
-	Presubmission Discussion / Presentation	3	3	75
-	Research Work	31	16	400
Total		**35**	**20**	**500**

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2. Tabulated list (excel sheet) of courses offered in the College, showing sl. no., program code, name of program, course code, name of the course for the program, whether course available in that assessment year, year of introduction, for each year separately for all the 5 assessment years.

2016-17				
Program code	**Program Name**	**Course code**	**Course Name**	**Year of introduction**
PD	PHARMACY	282	PHARM.D	2013
BP	PHARMACY	9	B.PHARM	2003
MPC, MPH	PHARMACY	277, 276	M.PHARM PHARMACEUTICAL CHEMISTRY AND PHARMACEUTICS	2011
2017-18				
Program code	**Program Name**	**Course code**	**Course Name**	**Year of introduction**
PD	PHARMACY	282	PHARM.D	2013
BP	PHARMACY	9	B.PHARM	2003
MPC, MPH	PHARMACY	277, 276	M.PHARM PHARMACEUTICAL CHEMISTRY AND PHARMACEUTICS	2011
2018-19				
Program code	**Program Name**	**Course code**	**Course Name**	**Year of introduction**
PD	PHARMACY	282	PHARM.D	2013
BP	PHARMACY	9	B.PHARM	2003
MPC, MPH	PHARMACY	277, 276	M.PHARM PHARMACEUTICAL CHEMISTRY AND PHARMACEUTICS	2011
2019-20				
Program code	**Program Name**	**Course code**	**Course Name**	**Year of introduction**
PD	PHARMACY	282	PHARM.D	2013
BP	PHARMACY	9	B.PHARM	2003
MPC, MPH	PHARMACY	277, 276	M.PHARM PHARMACEUTICAL CHEMISTRY AND PHARMACEUTICS	2011
2020-21				
Program code	**Program Name**	**Course code**	**Course Name**	**Year of introduction**
PD	PHARMACY	282	PHARM.D	2013
BP	PHARMACY	9	B.PHARM	2003
MPC, MPH	PHARMACY	277, 276	M.PHARM PHARMACEUTICAL CHEMISTRY AND PHARMACEUTICS	2011

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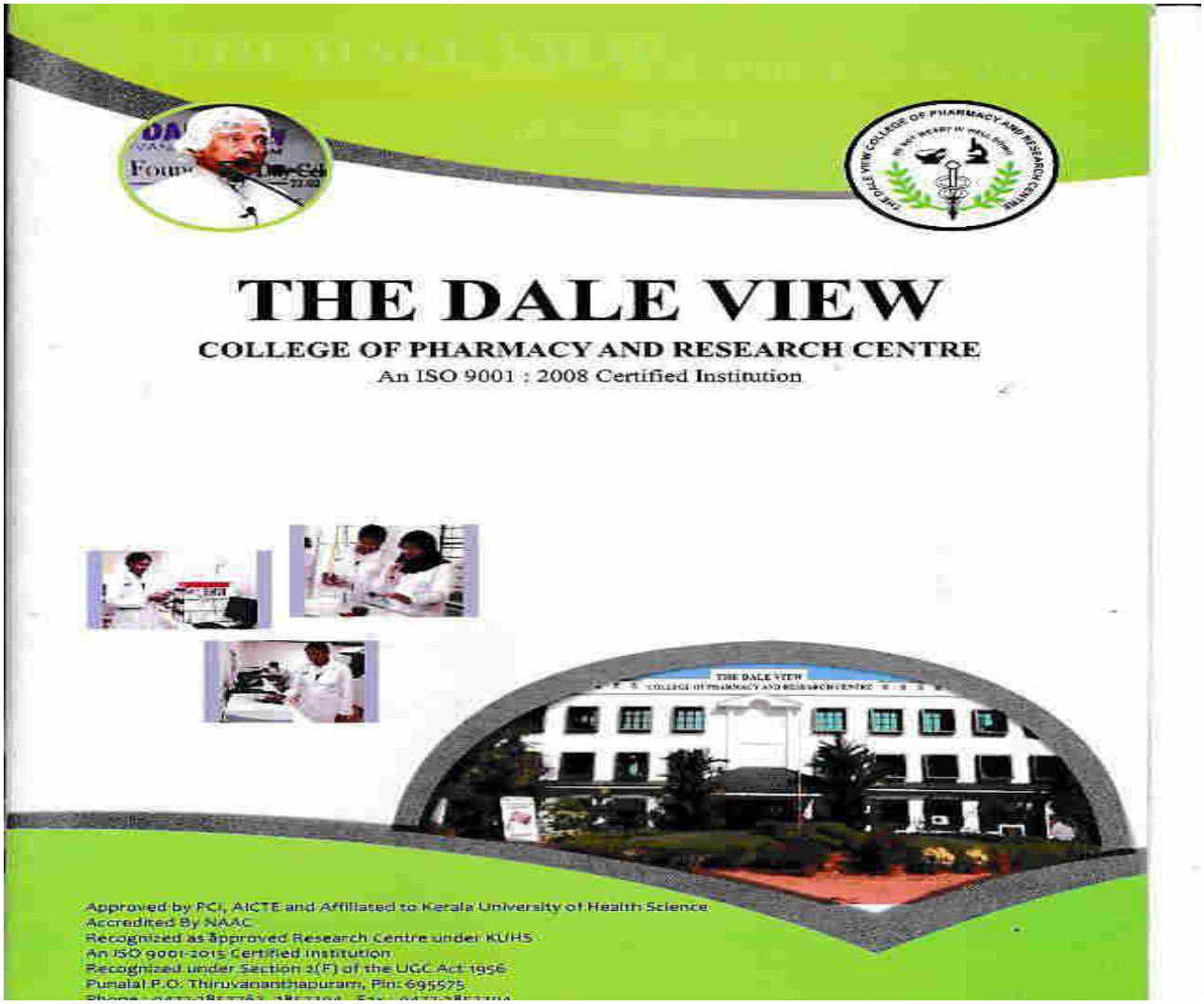
4. Brochure/prospectus, and handbook/syllabus book highlighting programs and courses offered for each year for all the 5 assessment years, attested by Principal.



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THE DALE VIEW

Chairman's Message

Dear Student,

Since inception, The Dale View College of Pharmacy & Research Centre has been one of the best pharmacy colleges in Kerala. Combining advanced research and scholarship with an educational environment that values the whole student experience, Dale View is an unique and vibrant college which emphasises the importance of a liberal education.

Your dream and leadership quality to be a leader in global healthcare sector can be highly driven, and you can achieve results beyond expectations. On choosing The Dale View College of Pharmacy & Research Centre, you are ready in joining an elite community that leverages India's strength and you can build your career, your life and that of others.

Our curriculam equips graduates with necessary tools to face challenging responsibilities by encouraging soft skills like communication, critical thinking ability, problem solving, and multi-cultural teamwork capacity & leadership quality, as well as integrated understanding of pharmaceutical fundamentals. We want our graduates to make a difference in the world using the power of knowledge as their means.

The years ahead promise many challenges for the students of Pharmaceutical Sciences in terms of organization, education and research. As the founder Director of Dale View College, we are well equipped to take up these challenges and ensure that our graduates will continue to be in demand and able to make highly qualified contributions as drug experts in the pharmaceutical industry, community pharmacies, hospitals and throughout the public sector.

C. Christu Das
Chairman and Founder Director

Principal's Message

Dear Student,

Pharmacy is a well respected profession for individuals with an aptitude in science and a desire to apply their knowledge of medicines for patient care in a variety of settings. Pharmacists are the "drug experts" among health professionals. With the lengthening life span of human beings world wide, coupled with increasing cost of pharmaceutical treatment, in todays health care environment, pharmacists currently enjoy a wealth of exciting career opportunities in academics, industry and government.

Backed by a strong management with a noble vision to reach milestones in pharma education and a team of dedicated faculty members, we believe in free thinking, where the faculty and students are given the freedom and liberty to put forth their creative ideas. We believe in team work, where in, our institution serve as a platform to develop the interpersonal skills and organising ability of faculty and students by organising extra curricular programmes with vivid activities like blood donation, health education to the public and conduct of medical camps.

We look forward towards updating the pharmacist's know how of latest trends in pharma industries through the conduct of guest lectures by reputed professionals from pharmaceutical industry. Our aim is to impart quality education to budding pharmacists by having well qualified and competent faculties, library and well equipped laboratories with state of art facilities, in a calm environment blessed with plethora of medicinal herbs. Besides this, we are working out processes where by the meritorious students passing out of our institution gets suitable placements in the pharma sector. So our efforts are in the ongoing process to realise the dream of serene and healthy world by nurturing young pharmacists with professional skills in to

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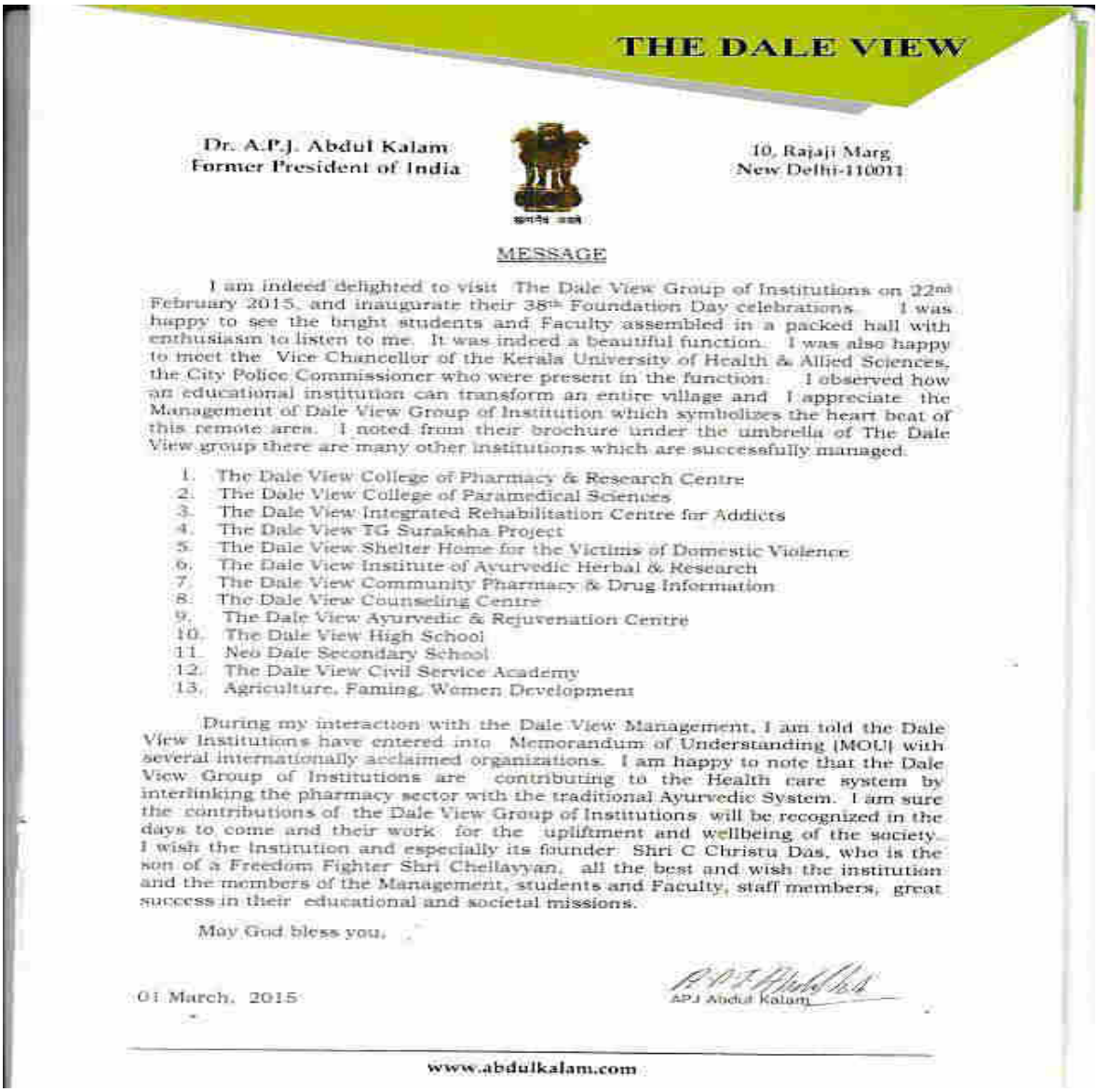

THE DALE VIEW

Dr. A.P.J. Abdul Kalam
Former President of India

10, Rajaji Marg
New Delhi-110011

MESSAGE

I am indeed delighted to visit The Dale View Group of Institutions on 22nd February 2015, and inaugurate their 38th Foundation Day celebrations. I was happy to see the bright students and Faculty assembled in a packed hall with enthusiasm to listen to me. It was indeed a beautiful function. I was also happy to meet the Vice Chancellor of the Kerala University of Health & Allied Sciences, the City Police Commissioner who were present in the function. I observed how an educational institution can transform an entire village and I appreciate the Management of Dale View Group of Institution which symbolizes the heart beat of this remote area. I noted from their brochure under the umbrella of The Dale View group there are many other institutions which are successfully managed.

1. The Dale View College of Pharmacy & Research Centre
2. The Dale View College of Paramedical Sciences
3. The Dale View Integrated Rehabilitation Centre for Addicts
4. The Dale View TG Suraksha Project
5. The Dale View Shelter Home for the Victims of Domestic Violence
6. The Dale View Institute of Ayurvedic Herbal & Research
7. The Dale View Community Pharmacy & Drug Information
8. The Dale View Counseling Centre
9. The Dale View Ayurvedic & Rejuvenation Centre
10. The Dale View High School
11. Neo Dale Secondary School
12. The Dale View Civil Service Academy
13. Agriculture, Faming, Women Development

During my interaction with the Dale View Management, I am told the Dale View Institutions have entered into Memorandum of Understanding (MOU) with several internationally acclaimed organizations. I am happy to note that the Dale View Group of Institutions are contributing to the Health care system by interlinking the pharmacy sector with the traditional Ayurvedic System. I am sure the contributions of the Dale View Group of Institutions will be recognized in the days to come and their work for the upliftment and wellbeing of the society. I wish the Institution and especially its founder Shri C Christu Das, who is the son of a Freedom Fighter Shri Chellayyan, all the best and wish the institution and the members of the Management, students and Faculty, staff members, great success in their educational and societal missions.

May God bless you,

01 March, 2015

APJ Abdul Kalam

www.abdulkalam.com

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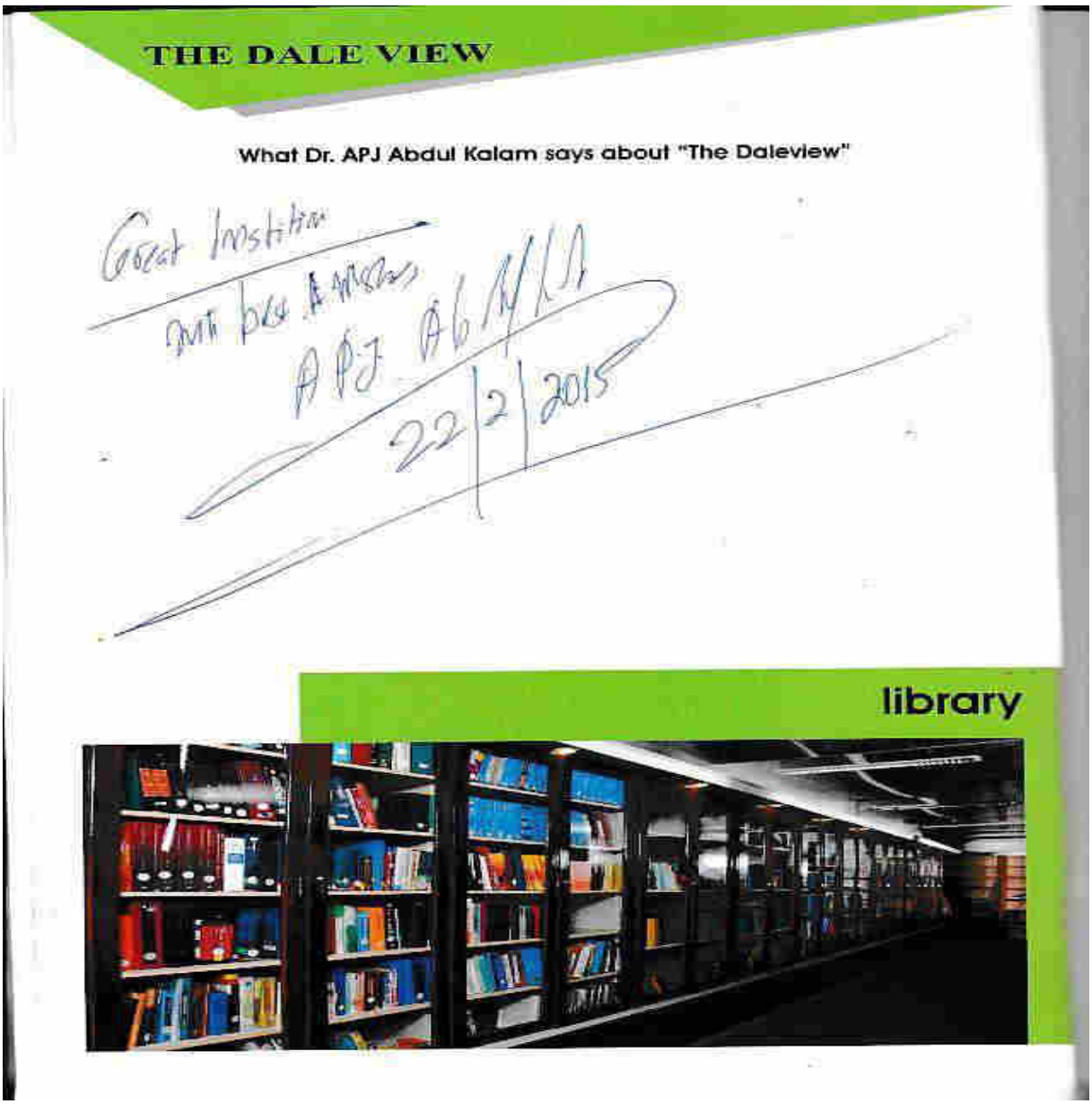

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Recognized under Section 2 (f) of the UGC Act 1956
Punalal.P.O., Thiruvananthapuram, Pin :695575. Phone: 0472-2853763, 2852394, 9446802073
Website:www.daleviewcollege.com/new Email : dvpharma@gmail.com

THE DALE VIEW

The Dale View College of Pharmacy & Research centre came into existence as a realization of dream of our Chairman & Managing Director Sri. C.Christu Das to impart quality professional education in rural villages. The Dale View College of Pharmacy & research Centre was started in the year 2003 with a vision to impart quality education in Pharmacy. The College presently offers B. Pharm, Pharm.D and M. Pharm programmes.

The Dale View College of Pharmacy & research Centre provides education and research focusing on the pharmaceutical sector covering the main aspects of drugs, their use and role in society.

The institution is functioning under the able leadership of Dr. D. Shaiju Alfi, Director and Dr. P. Manoj Kumar, Principal. The Dale View College has a dedicated and experienced team of faculties working with mission to provide quality education and mentoring students in pharmaceutical research. The Dale View College of Pharmacy & Research centre is run with the advise of eminent educationalists, industrialists and philanthropists of the society.

VISION

To be a pre-eminent centre for pharmaceutical knowledge and practice through advancements in research, teaching and service.

MISSION

To be committed to internationally significant innovation in the discovery and mobilisation of pharmaceutical knowledge in the pursuit of health.

THE NEED

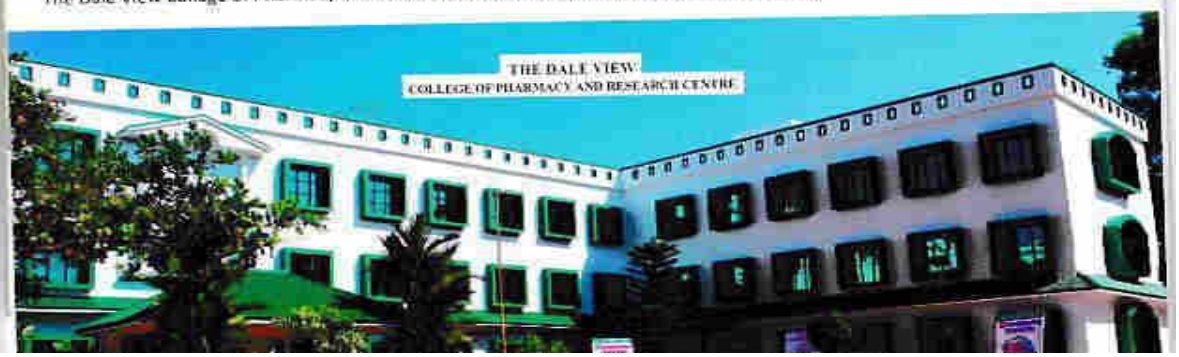
Pharmaceutical exports have increased dramatically in recent years and this vigorous growth has generated a corresponding increase in demand for pharmacists and other graduates with a pharmaceutical background. The rapid development India is currently undergoing in the fields of clinical pharmacy and pharmacotherapy is boosting the need in both the primary and the secondary health care sectors for pharmacists with relevant expertise.

THE PROGRAMME

The programme in pharmacy aims to provide a scientific platform of theoretical knowledge, ethical, critical and analytical methods, and practical skills in the pharmaceutical sciences.

The college conducts three courses in Pharmacy. They are B.Pharm, M.Pharm and Pharm.D

The Dale View College of Pharmacy & Research Centre admits 60 undergraduate students a year.



Prof.(Dr.)P.Manoj Kumar, M.Pharm.,Ph.D.
Principal

THE DALE VIEW
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ADMISSION:

FEE STRUCTURE

The Annual tuition fees now proposed by all the member colleges B.Pharm is Rs.85,000/- (Rupees eighty five thousand only) plus special fees per annum for four years (Ref. Page No. 8) and fee for Pharm. D course is Rs.1,90,000/- (Rupees One Lakh Ninety Thousand only) per annum for six year. In case the Fee Regulatory Committee decideds on any lower fee the matter will be taken up before the Honorable High Court and the ultimate fee will be as per the directions of the Honorable High Court. If the fee collected is in excess and any such directions, the same will be refunded or adjusted towards future fees.

FEE FOR NRI STUDENTS

The fee for B.Pharm NRI student shall be liable to pay annual fees up to Rs. 2,37,605/- (Rupees Two Lakh Thirty Seven Thousand Six Hundred and Five Only) for the first year, Rs. 2,27,605/- (Rupees Two Lakhs Twenty Seven Thousand Six Hundred and Five Only) for the second year, Rs. 2,27,605/- (Rupees Two Lakh Twenty Seven Thousand Six Hundred and Five Only) for the third year and Rs. 2,35,605/- (Rupees Two Lakh Thirty Five Thousand Six Hundred and Five Only) and Rs.2.80 Lakhs per annum for pharm.D course

Discontinuation of the course and payment of liquidated damages

If any candidate discontinues the course after closing of admissions on such date as could be decided by the competent authority including the court of Law, the candidate has to pay liquidated damages to the tune of full fee of the course. The student shall claim for TC and other certificates after clearing all the dues.

ELEGIBILITY FOR ADMISSION(I) Academic

a) **B.Pharm:** Candidates who have passed Higher Secondary Examination, Kerala or examinations recognized as equivalent thereto, with 50% marks in Biology/ Mathematics/ Biotechnology/Computer science separately and 50% marks in Physics, Chemistry and Biology/Mathematics/Biotechnology/Computer Science put together are eligible. Candidates from National Open School are not eligible to apply for the course.

b) **Pharm.D:** (a) Candidates who have passed Higher Secondary Examination, Kerala or examinations recognized as equivalent thereto, with 50% marks in Biology/Mathematics separately and 50% marks in Physics, Chemistry and biology/Mathematics put together are eligible. OR (b) A pass in D.Pharm. Course with a minimum of 50% marks in D.Pharm. Examination from an institution approved by pharmacy Council of India under Section 12 of the Pharmacy Act. (c) Any other qualifications approved by the pharmacy Council of India as equivalent to any of the above examinations

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N.B: However candidates who have passed their qualifying examinations from outside the state of Kerala shall produce the certificate of recognition and equivalency of qualifying examination from Kerala University of Health Sciences, Thrissur. This should be furnished at the time of admission. Eligibility for admission to the candidates belonging to OBC,OEC,SC/ST will be as per the requirements of the Kerala University of Health Sciences, Thrissur.

(ii) Age

Applicants should have completed 17 years of age on 31/12/2017

Copy of relevant page of school record namely SSLC/CBSE/ICSE certificate showing the date of birth/ copy of the birth certificate from appropriate authority should be furnished along with the application attested by Gazetted Officer/Head of the Institution where the student had studied.

(iii) Nationality Candidates must be citizens of India.

HOW TO APPLY

Applications forms

The applications form together with the information brochure can be obtained from the college office.

Submission of Application Form

The duly filled in application along with self attested copies of necessary documents shall be submitted directly or by registered post with A/D to the college so as to reach the college on or before the prescribed date.

SELECTION PROCEDURE

Preparation of common Merit list and Allotment of candidates:

Admissions will be done on the basis of marks obtained by the candidates in the qualifying examination as mentioned below.

The marks obtained by the candidates in the relevant subjects in the qualifying examination conducted by various Boards or authority of other states shall be equated with the marks obtained by the candidates in the same subjects in the qualifying examination conducted by the Director of HSE, Kerala. Marks obtained by the candidates under various streams of examinations such as HSE in Kerala/CBSE/ICSE ect. will be subject to the process of normalization.

Explanations: Under the method of normalization, the highest mark obtained by students of various Boards in each subject shall be equated to the highest marks obtained by students of Kerala Higher Secondary examination in that subject and the relative marks obtained by other students in that subject shall be determined accordingly.

Illustration: If the highest marks secured by the student of the Kerala state HSE, in physics is 100 and the highest mark secured by a student on any other board in the same subject is 90, both the highest marks will be considered to be equal to 100, if a student of the other board secures 60 marks in physics when the highest mark in physics in the same board is 90, the 60 marks will be considered to be equal to 66.66 marks as arrived at below:

100 x 60/90 = 66.66%

Those candidates, who have passed the qualifying examination of any state other then Kerala, will be treated at par with those students who have passed the Higher Secondary Exam of this state.

Since the normalized marks depend on the applications of a college, the index marks of an applicant may vary from college to college.

For allotment of D.Pharm students to the Pharm.D course, Rank List will be prepared on the basis of the marks obtained by candidates in first and second year of D.Pharm examination from an institution approved by PCI under section 12 of the Pharmacy Act.

RESERVATION OF SEATS

i. 5% Of the seats in the college will be reserved to SC/ST candidates in the ratio 4:1

ii. If sufficient candidates are not available for the reserved seats, the vacant seats will be reverted to the open merit.

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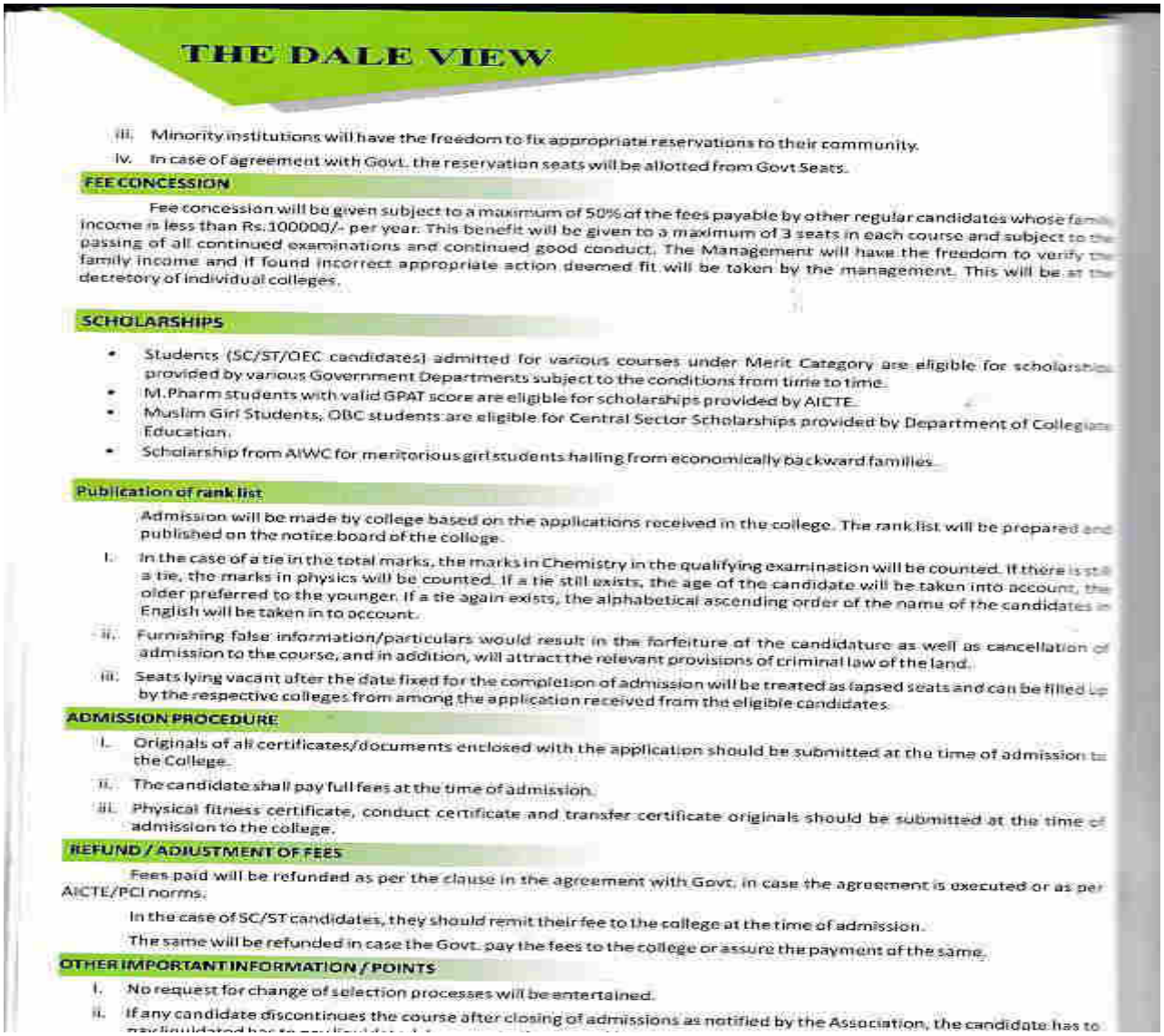

THE DALE VIEW

iii. Minority institutions will have the freedom to fix appropriate reservations to their community.
iv. In case of agreement with Govt. the reservation seats will be allotted from Govt Seats.

FEE CONCESSION

Fee concession will be given subject to a maximum of 50% of the fees payable by other regular candidates whose family income is less than Rs.100000/- per year. This benefit will be given to a maximum of 3 seats in each course and subject to the passing of all continued examinations and continued good conduct. The Management will have the freedom to verify the family income and if found incorrect appropriate action deemed fit will be taken by the management. This will be at the decretory of individual colleges.

SCHOLARSHIPS

- Students (SC/ST/OEC candidates) admitted for various courses under Merit Category are eligible for scholarships provided by various Government Departments subject to the conditions from time to time.
- M.Pharm students with valid GPAT score are eligible for scholarships provided by AICTE.
- Muslim Girl Students, OBC students are eligible for Central Sector Scholarships provided by Department of Collegiate Education.
- Scholarship from AIWC for meritorious girl students hailing from economically backward families.

Publication of rank list

Admission will be made by college based on the applications received in the college. The rank list will be prepared and published on the notice board of the college.

i. In the case of a tie in the total marks, the marks in Chemistry in the qualifying examination will be counted. If there is still a tie, the marks in physics will be counted. If a tie still exists, the age of the candidate will be taken into account, the older preferred to the younger. If a tie again exists, the alphabetical ascending order of the name of the candidates in English will be taken in to account.
ii. Furnishing false information/particulars would result in the forfeiture of the candidature as well as cancellation of admission to the course, and in addition, will attract the relevant provisions of criminal law of the land.
iii. Seats lying vacant after the date fixed for the completion of admission will be treated as lapsed seats and can be filled up by the respective colleges from among the application received from the eligible candidates.

ADMISSION PROCEDURE

i. Originals of all certificates/documents enclosed with the application should be submitted at the time of admission to the College.
ii. The candidate shall pay full fees at the time of admission.
iii. Physical fitness certificate, conduct certificate and transfer certificate originals should be submitted at the time of admission to the college.

REFUND / ADJUSTMENT OF FEES

Fees paid will be refunded as per the clause in the agreement with Govt. in case the agreement is executed or as per AICTE/PCI norms.

In the case of SC/ST candidates, they should remit their fee to the college at the time of admission.

The same will be refunded in case the Govt. pay the fees to the college or assure the payment of the same.

OTHER IMPORTANT INFORMATION / POINTS

i. No request for change of selection processes will be entertained.
ii. If any candidate discontinues the course after closing of admissions as notified by the Association, the candidate has to

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PROHIBITION OF RAGGING

iii) Ragging in any form which includes harassment by word, action, gesture, intimidation, coercion, physical or mental insult/assault, teasing etc. which are capable of causing mental/physical stress or mental torture or agony to other students or staff inside/outside the premises of the College or hostel etc. is strictly comming under the word Ragging and is prohibited in the college. The College is committed to abolish Ragging in our campus. Hence, any student who indulges in any form of Ragging will be subjected to penal action as per provisions of law. Students and parents shall at the time of admission furnish an Affidavit to the effect that the students shall not indulge in any form of Ragging.

iv) Use of mobile phone by students is prohibited in the campus. Any violation will lead to disciplinary action as deemed fit to be taken by the College authorities.

vi) Every student is required to adhere strictly to the code of conduct and discipline of the institution.

TERMS AND CONDITIONS OF THE AGREEMENT WITH GOVT.

1. 50% of the total seats in B.PHARM course will be filled up by the Government from the list prepared by the Commissioner for Entrance Examinations on the basis of marks obtained in the Common Entrance Examinations and the rank list prepared based on this in accordance with merit and reservation principles followed by Government from time to time.
2. The Government shall furnish the list of the students to be admitted in the college by the management concerned and management concerned shall admit the students specified in the list. The students in the list will be given specific instruction as to the date and time of presentation before the college for admissions, the amount of fees to be paid and the records to be submitted at the time of admission. The management concerned shall admit the students who have complied with the instructions as certified by the Government.
3. If any student is not admitted by the management concerned for specific defects or for any reason what so ever, it shall intimate the Government the defects or reasons as the case may be and the Government shall rectify the defects or state the reasons for accepting the list or furnish a revised list which the management concerned shall accept and admit the student accordingly following the above procedures.
4. The Management concerned shall be entitled to collect up to Rs.1,22,605/- (Rupees One Lakh Twenty Two Thousand Six Hundred and Five Only) for the first year, Rs.1,10,605/-(Rupees One Lakh Ten Thousand Six Hundred and Five Only) for the second year, Rs.1,10,605/-(Rupees One Lakh Twenty Two Thousand Six Hundred and Five Only) for the third year and Rs.1,20,605/- (Rupees One Lakh Twenty Thousand Six Hundred and Five Only) for the fourth year as fixed by the Government, as annual fees from the students, except those belonging to SC/ST communities, admitted against the 50% seats mentioned in clause 1 above, for which signed receipt with seal of the college shall be given. Annual fees for SC/ST students, shall be paid by the SC, ST Development department, Government of Kerala to the Management at the rate as fixed by the Government. The first year s fees from the Government merit quota students (except SC/ST) will be collected by the Government at the time of allotment and transferred to the respective colleges immediately on closing of admission.
5. The annual fees fixed shall be inclusive of all amounts collected as in the case of similarly admitted students in Government controlled self financing colleges. The management concerned shall not collect any amount from any student so admitted, other than those specified above.
6. 35% of the total seats shall be treated as Management seats and shall be filled up from among the candidates who are eligible as per the prospectus for the course published by the Government based on applications received against notification by the College/Management directly and in accordance with merit in the qualifying examination. The students so admitted shall be liable to pay annual fees not exceeding Rs. 1,22,605/-(Rupees One Lakh Twenty Two Thousand Six Hundred and Five Only) for the first year, Rs.1,10,605/-(Rupees One Lakh Ten Thousand Six Hundred and Five Only) for the Second year, Rs.1,10,605/-(Rupees One Lakh Twenty Two Thousand Six Hundred and Five Only) for the third year and Rs.1,20,605/-(Rupees One Lakh Twenty Thousand Six Hundred and Five Only) for the fourth year

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7. The cut-off date for allotment of seats under Government merit quota for the year 2017-18 shall be 15/07/2017 . The management concerned shall be entitled to fill those seats still remaining unfilled after 15/07/2017. The Government shall not have any claim over such seats after 15/07/2017. The forfeited vacancies shall not be brought forward to succeeding year for compensation. The managements concerned shall be entitled to collect liquidated damages of Rs.3,40,000/- (Rupees Three Lakh and Forty Thousand only) from the students who discontinue the course after closure of admissions to B.pharm course.
8. The Management concerned undertakes that no consideration in cash or kind other than those specified above shall be received, accepted or collected in any from whatsoever from any student admitted to the college. It shall be the liability of the Management concerned to redress complaints from the students, parents on any matter other than those covered by the terms and conditions of this agreement.
9. The Government undertakes to extent all the benefits that may be received by similarly situated managements who have not entered in to agreement with the Government with respect to the subject matter of this agreement by virtue of court orders and that the Management will not be disadvantaged for the reason of entering into this agreement.
10. This consensual agreement shall be submitted by the first party/second party before the Admission Supervisory Committee and the Fee Regulatory Committee constituted by the state Government and shall be subject to their approval.

List of documents to be produced at the time of admission

1. 10th Std. pass certificate for proof of date of birth – Original + 3 attested copies
2. 12th Std. equivalent marks card/pass certificate – Original + 3 attested copies
3. Transfer Certificate from the institution last attended – Original + 3 attested copies
4. Conduct Certificate from the institution last attended – Original only
5. Eligibility Certificate
6. Migration Certificate from the Board of the institution last attended, if outside Kerala
7. Physical fitness certificate from a registered medical practitioner
8. Blood group certificate
9. Photographs: Passport size 05, Stamp size 05
10. Affidavit on the rules and regulations of the institution, fees payments and liquidated damages
11. Pharmacy Council Registration Certificate – Original + 3 attested copies (for M.Pharm)
12. B.Pharm Mark sheets and certificates – Original + 3 attested copies (for M.Pharm)
13. GPAT Score Card
14. Allotment Memo (for merit seats)

For additional information contact any of the following numbers

College Office : 0472 2853763, 2852394
08590279727, 9895501660,
9605548782.

You can also write to us to
dvpharma@gmail.com

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INDUSTRY INTERACTION CELL

The Cell was established with a prime objective of creating opportunities for the students to interact and learn from reputed corporates towards meeting aspirations of all the stakeholders. The Cell is devoted to cater to the needs of organizations in conducting Seminars, workshops, symposiums and exhibitions and also campus interviews for placement. Interactions with organizations are regularly done for placement requirements. Placement cell also conducts career guidance workshops to the final and pre-final year students to face their future with confidence. The cell is utilizing the facilities of college like conference halls equipped with home theatres, LCD projector, PA system, laptops, desktops, laser printers, web cam, digital camera, etc. The function of cell is co - ordinated by Dr Shaiju David Alfi.

Objectives

1. To make DVCP & RC the favourite destination for all multinational companies.
2. To establish state of the art in house training facility for honing the skills of the students.
3. To build DVCP & RC brand value in the corporate world.
4. Plan more industry-institution interactions to benefit students and faculty.
5. To train the students on soft skills & technical skills.
6. Introducing video conferencing with industry experts & successful alumni to create awareness for Campus to Corporate Transformation.
7. Scheduling training programs from 1st year to prepare students to meet corporate needs & requirements.

Beyond The Classroom

National Service Scheme | Red Ribbon Club | Herbal Club | Project Society
Journal Club | Quiz Club | Pharma Sidus | Alumni

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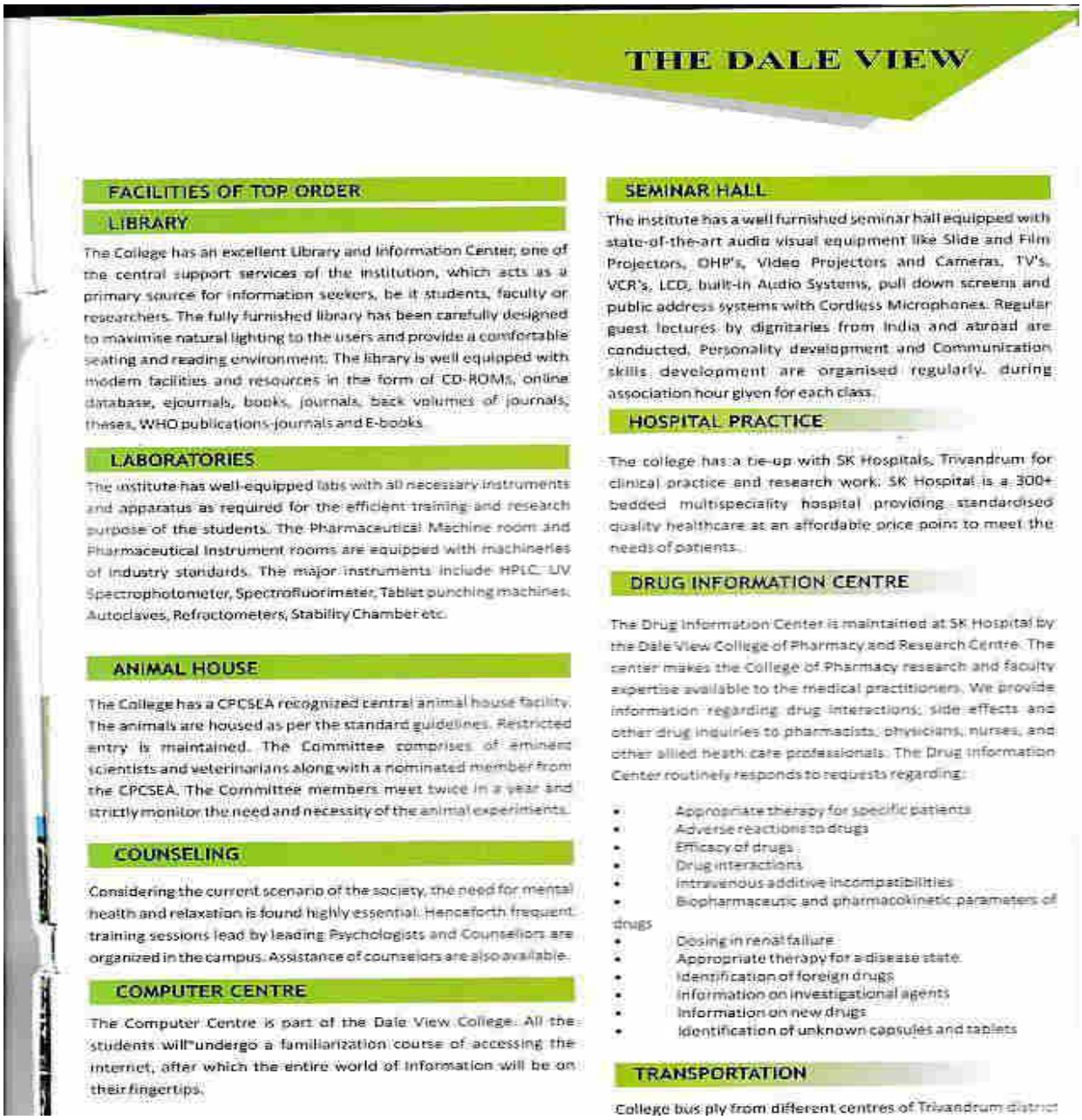

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FACILITIES OF TOP ORDER

LIBRARY

The College has an excellent Library and Information Center, one of the central support services of the institution, which acts as a primary source for information seekers, be it students, faculty or researchers. The fully furnished library has been carefully designed to maximise natural lighting to the users and provide a comfortable seating and reading environment. The library is well equipped with modern facilities and resources in the form of CD-ROMs, online database, ejournals, books, journals, back volumes of journals, theses, WHO publications-journals and E-books.

LABORATORIES

The institute has well-equipped labs with all necessary instruments and apparatus as required for the efficient training and research purpose of the students. The Pharmaceutical Machine room and Pharmaceutical Instrument rooms are equipped with machineries of industry standards. The major instruments include HPLC, UV Spectrophotometer, Spectrofluorimeter, Tablet punching machines, Autoclaves, Refractometers, Stability Chamber etc.

ANIMAL HOUSE

The College has a CPCSEA recognized central animal house facility. The animals are housed as per the standard guidelines. Restricted entry is maintained. The Committee comprises of eminent scientists and veterinarians along with a nominated member from the CPCSEA. The Committee members meet twice in a year and strictly monitor the need and necessity of the animal experiments.

COUNSELING

Considering the current scenario of the society, the need for mental health and relaxation is found highly essential. Henceforth frequent training sessions lead by leading Psychologists and Counsellors are organized in the campus. Assistance of counselors are also available.

COMPUTER CENTRE

The Computer Centre is part of the Dale View College. All the students will undergo a familiarization course of accessing the internet, after which the entire world of information will be on their fingertips.

SEMINAR HALL

The institute has a well furnished seminar hall equipped with state-of-the-art audio visual equipment like Slide and Film Projectors, OHP's, Video Projectors and Cameras, TV's, VCR's, LCD, built-in Audio Systems, pull down screens and public address systems with Cordless Microphones. Regular guest lectures by dignitaries from India and abroad are conducted. Personality development and Communication skills development are organised regularly, during association hour given for each class.

HOSPITAL PRACTICE

The college has a tie-up with SK Hospitals, Trivandrum for clinical practice and research work. SK Hospital is a 300+ bedded multispeciality hospital providing standardised quality healthcare at an affordable price point to meet the needs of patients.

DRUG INFORMATION CENTRE

The Drug Information Center is maintained at SK Hospital by the Dale View College of Pharmacy and Research Centre. The center makes the College of Pharmacy research and faculty expertise available to the medical practitioners. We provide information regarding drug interactions, side effects and other drug inquiries to pharmacists, physicians, nurses, and other allied health care professionals. The Drug Information Center routinely responds to requests regarding:

- Appropriate therapy for specific patients
- Adverse reactions to drugs
- Efficacy of drugs
- Drug interactions
- Intravenous additive incompatibilities
- Biopharmaceutic and pharmacokinetic parameters of drugs
- Dosing in renal failure
- Appropriate therapy for a disease state
- Identification of foreign drugs
- Information on investigational agents
- Information on new drugs
- Identification of unknown capsules and tablets

TRANSPORTATION

College bus ply from different centres of Trivandrum district

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Principal

Contact

THE DALE VIEW COLLEGE OF PHARMACY AND RESEARCH CENTRE
PUNALAL P.O., POOVACHAL(Via),
TRIVANDRUM - 695 575, KERALA.
Ph : +91 472 2852394, 2853763.
Mobile : 08590279727, 9895501660, 9605548782.
Email : dvpharma@gmail.com
Website : www.daleviewcollege.com.

Route I	Route II	Route III	Route IV
-Trivandrum -Poojapura -Peyad -Vilappilsala -Uriyacode -Konniyoor -DVCPRC* Near 22 kilometers 40mins	-Nevyattinkara -Kattakkada -Poovachal -Konniyoor -DVCPRC*	-Trivandrum -Peroorkada -Aruvikkara -Vellanad -DVCPRC*	-Attingal -Venjaramoodu -Vembayam -Nedumangadu -Vellanad -DVCPRC* Near 40 kilometers

* The Dale View College of Pharmacy and Research Centre

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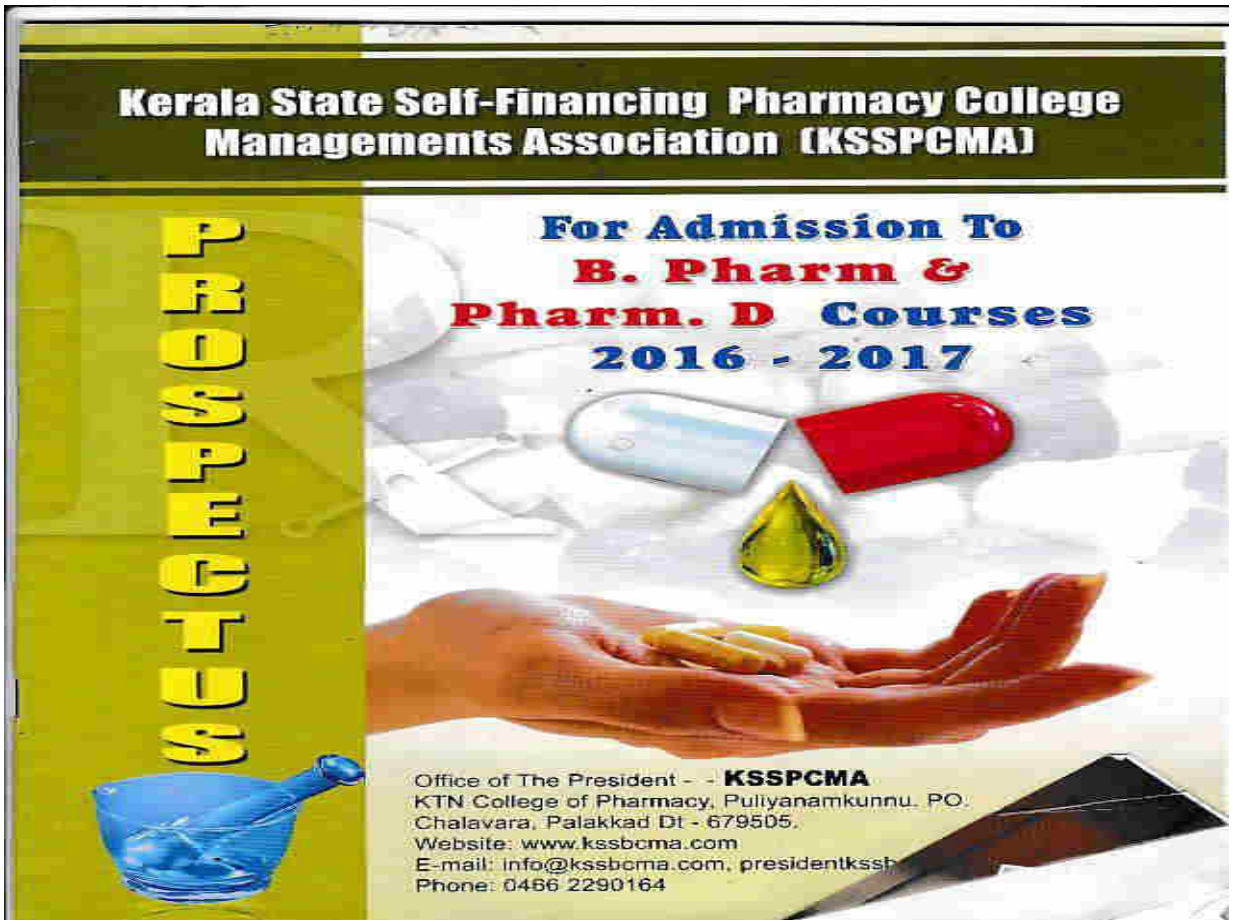

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Principal

LIST OF B.PHARM & PHARM. D COLLEGES (KSSPCMA)

ANNEXURE - I

Sl. No.	College Name	District	Page
1.	The Dale View College of Pharmacy & Research Centre*	Thiruvanathapuram	10
2.	Ezhuthachan College of Pharmaceutical Sciences*	Thiruvanathapuram	11
3.	Mar Dioscrous College of Pharmacy	Thiruvanathapuram	12
4.	Mount Zion College of Pharmaceutical Sciences and Research	Pathanamthitta	13
5.	Nazareth College of Pharmacy*	Pathanamthitta	14
6.	Pushpagiri College of Pharmacy*	Pathanamthitta	15
7.	Dr. Joseph Mar Thoma Institute Of Pharmaceutical Sciences & Research	Alappuzha	16
8.	St. Joseph's College of Pharmacy*	Alappuzha	17
9.	KVM College of Pharmacy*	Alappuzha	18
10.	Nirmala College of Pharmacy*	Ernakulam	19
11.	Chemists College of Pharmaceutical Science & Research Centre	Ernakulam	20
12	St. Jame's College of Pharmaceutical Sciences*	Thrissur	21
13.	Nehru College of Pharmacy*	Thrissur	22
14.	Grace College of Pharmacy *	Palakkad	23
15	Ahalia College of Pharmacy	Palakkad	24
16.	Prime College of Pharmacy	Palakkad	25
17.	Sanjo College of Pharmaceutical Studies	Palakkad	26
18.	KTN College of Pharmacy	Palakkad	27
19	Karuna College of Pharmacy	Palakkad	28
20.	Alshifa College of Pharmacy*	Malappuram	29
21.	Moulana College of Pharmacy	Malappuram	30
22.	Devaki Amma Memorial College of Pharmacy *	Malappuram	31
23.	Jamia Salafia Pharmacy College	Malappuram	32
24.	J. D. T Islam College of Pharmacy	Kozhikode	33
25.	National College of Pharmacy*	Kozhikode	34
26.	KMCT College Of Pharmaceutical Sciences	Kozhikode	35
27.	College of Pharmacy - Kannur Medical College	Kannur	36
28.	Crescent College of Pharmacy*	Kannur	37
29	Malik Deenar College of Pharmacy	Kasargode	38
30.	Rajiv Gandhi Institute of Pharmacy	Kasargode	39.

*Denote the colleges offering both B. Pharm and Pharm. D Courses.

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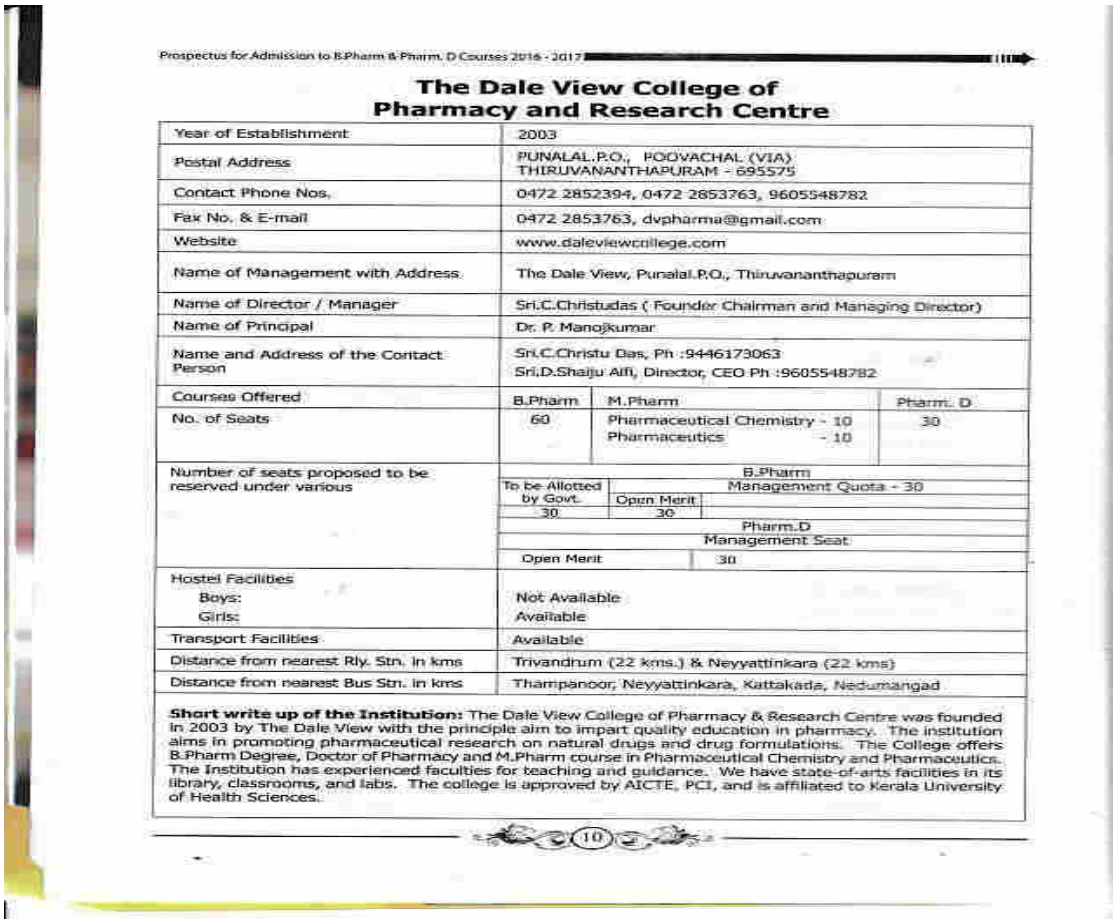

Prospectus for Admission to B.Pharm & Pharm. D Courses 2016 - 2017

The Dale View College of Pharmacy and Research Centre

Year of Establishment	2003		
Postal Address	PUNALAL.P.O., POOVACHAL (VIA) THIRUVANANTHAPURAM - 695575		
Contact Phone Nos.	0472 2852394, 0472 2853763, 9605548782		
Fax No. & E-mail	0472 2853763, dvpharma@gmail.com		
Website	www.daleviewcollege.com		
Name of Management with Address	The Dale View, Punalal.P.O., Thiruvananthapuram		
Name of Director / Manager	Sri.C.Christudas (Founder Chairman and Managing Director)		
Name of Principal	Dr. P. Manojkumar		
Name and Address of the Contact Person	Sri.C.Christu Das, Ph :9446173063 Sri.D.Shaiju Alfi, Director, CEO Ph :9605548782		
Courses Offered	B.Pharm	M.Pharm	Pharm. D
No. of Seats	60	Pharmaceutical Chemistry - 10 Pharmaceutics - 10	30
Number of seats proposed to be reserved under various	B.Pharm		
	To be Allotted by Govt.	Management Quota - 30	
	30	Open Merit 30	
	Pharm.D		
	Management Seat		
	Open Merit	30	
Hostel Facilities Boys: Girls:	 Not Available Available		
Transport Facilities	Available		
Distance from nearest Rly. Stn. in kms	Trivandrum (22 kms.) & Neyyattinkara (22 kms)		
Distance from nearest Bus Stn. in kms	Thampanoor, Neyyattinkara, Kattakada, Nedumangad		

Short write up of the Institution: The Dale View College of Pharmacy & Research Centre was founded in 2003 by The Dale View with the principle aim to impart quality education in pharmacy. The institution aims in promoting pharmaceutical research on natural drugs and drug formulations. The College offers B.Pharm Degree, Doctor of Pharmacy and M.Pharm course in Pharmaceutical Chemistry and Pharmaceutics. The Institution has experienced faculties for teaching and guidance. We have state-of-arts facilities in its library, classrooms, and labs. The college is approved by AICTE, PCI, and is affiliated to Kerala University of Health Sciences.

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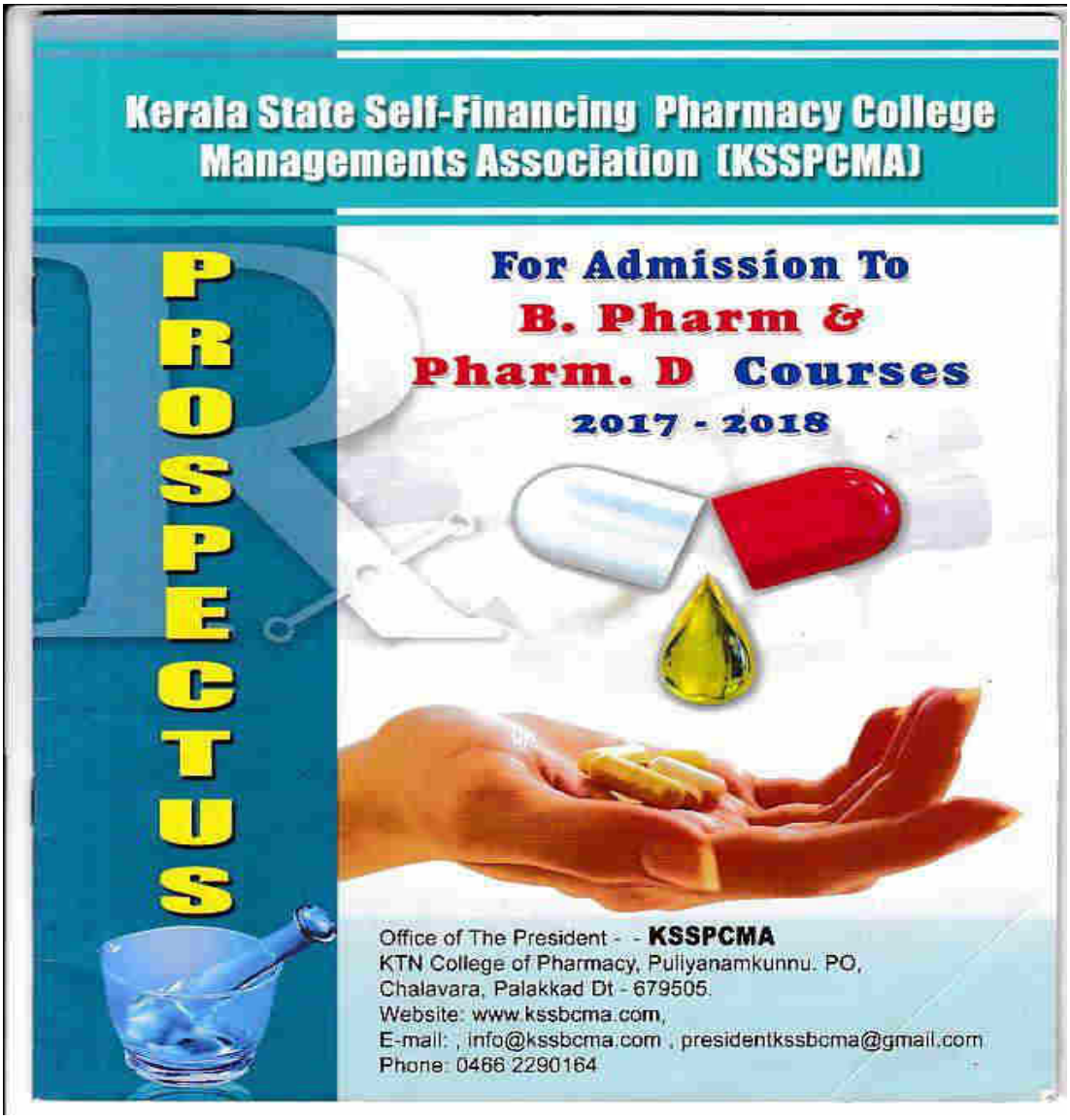
Prof.(Dr.)P.Manoj Kumar, M.Pharm.,Ph.D.
Principal



Prof.(Dr.)P.Manoj Kumar, M.Pharm.,Ph.D.
Principal

THE DALE VIEW
COLLEGE OF PHARMACY & RESEARCH CENTRE

Approved by PCI, AICTE and Affiliated to Kerala University of Health sciences
An ISO 9001-2015 Certified Institution **Accredited by NAAC**
Recognized under Section 2 (f) of the UGC Act 1956
Punalal.P.O., Thiruvananthapuram, Pin :695575. Phone: 0472-2853763, 2852394, 9446802073
Website:www.daleviewcollege.com/new Email : dvpharma@gmail.com

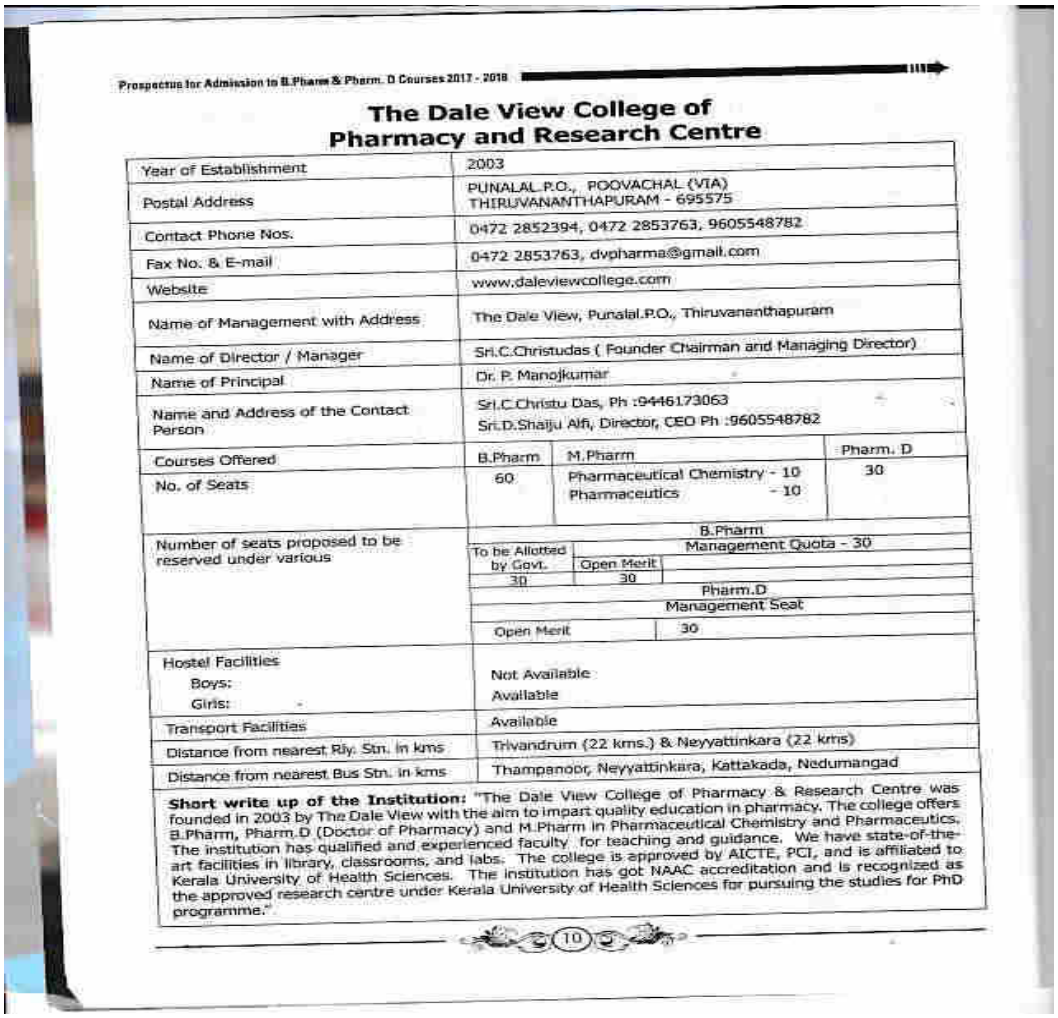
LIST OF B.PHARM & PHARM. D COLLEGES (KSSPCMA)

ANNEXURE - I

Sl. No.	College Name	District	Page
1.	The Dale View College of Pharmacy & Research Centre*	Thiruvanathapuram	10
2.	Ezhuthachan College of Pharmaceutical Sciences*	Thiruvanathapuram	11
3.	Mar Dioscrous College of Pharmacy	Thiruvanathapuram	12
4.	Mount Zion College of Pharmaceutical Sciences and Research	Pathanamthitta	13
5.	Nazareth College of Pharmacy*	Pathanamthitta	14
6.	Pushpagiri College of Pharmacy*	Pathanamthitta	15
7.	Dr. Joseph Mar Thoma Institute Of Pharmaceutical Sciences & Research	Alappuzha	16
8.	St. Joseph's College of Pharmacy*	Alappuzha	17
9.	KVM College of Pharmacy*	Alappuzha	18
10.	St. John's College of Pharmaceutical Sciences & Research	Idukki	19
11.	Nirmala College of Pharmacy*	Ernakulam	20
12.	Chemists College of Pharmaceutical Science & Research Centre	Ernakulam	21
13.	Mookambika College of Pharmaceutical Science & Research Centre	Ernakulam	22
14.	St. Jame's College of Pharmaceutical Sciences*	Thrissur	23
15.	Nehru College of Pharmacy*	Thrissur	24
16.	Elims College of Pharmacy	Thrissur	25
17.	Nirmala College of Health Science	Thrissur	26
18.	Grace College of Pharmacy *	Palakkad	27
19.	Ahalia School of Pharmacy	Palakkad	28
20.	Prime College of Pharmacy	Palakkad	29
21.	Sanjo College of Pharmaceutical Studies	Palakkad	30
22.	KTN College of Pharmacy	Palakkad	31
23.	Karuna College of Pharmacy	Palakkad	32
24.	Alshifa College of Pharmacy*	Malappuram	33
25.	Moulana College of Pharmacy	Malappuram	34
26.	Devaki Amma Memorial College of Pharmacy *	Malappuram	35
27.	Jamia Salafia Pharmacy College	Malappuram	36
28.	J. D. T Islam College of Pharmacy	Kozhikode	37
29.	National College of Pharmacy*	Kozhikode	38
30.	KMCT College Of Pharmaceutical Sciences	Kozhikode	39
31.	College of Pharmacy - Kannur Medical College	Kannur	40
32.	Crescent College of Pharmacy*	Kannur	41
33.	Malik Deenar College of Pharmacy	Kasargode	42
34.	Rajiv Gandhi Institute of Pharmacy	Kasargode	43

*Denote the colleges offering both B. Pharm and Pharm. D Courses.

Prof.(Dr.)P.Manoj Kumar, M.Pharm.,Ph.D.
Principal



Prospectus for Admission to B.Pharm & Pharm. D Courses 2017 - 2018

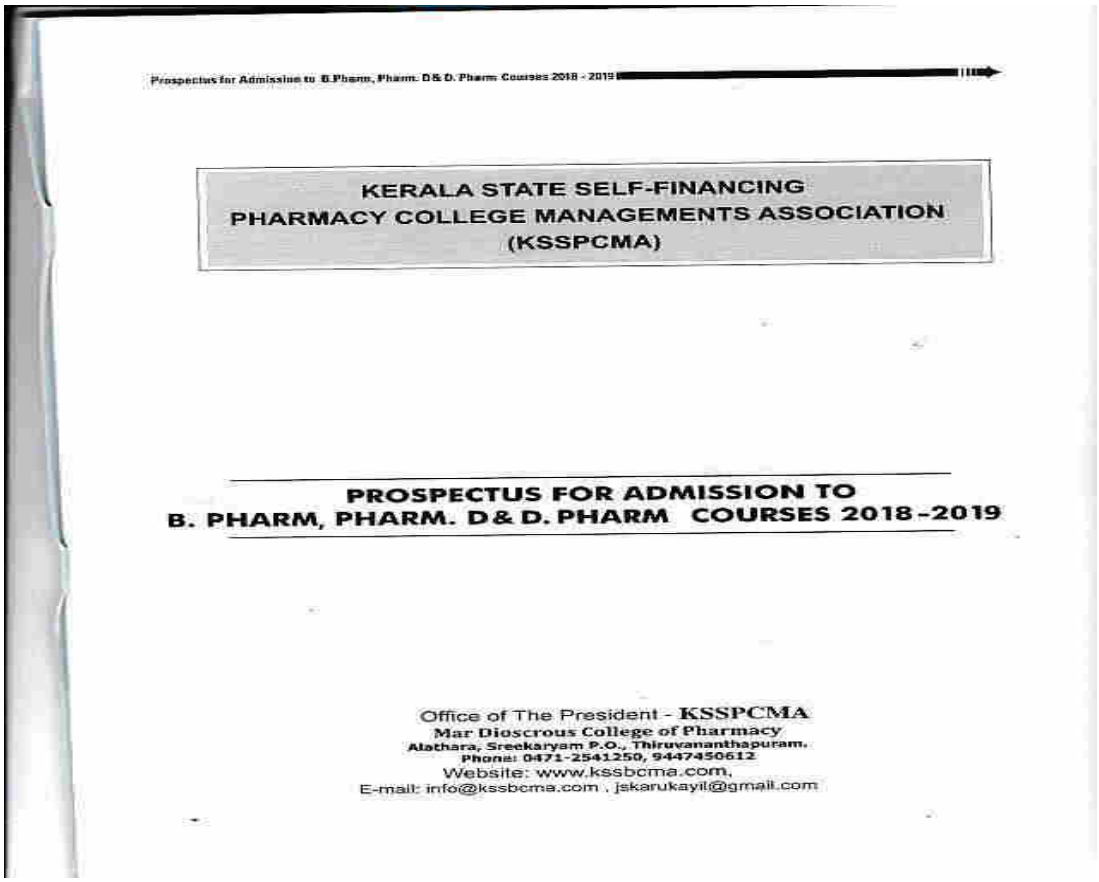
The Dale View College of Pharmacy and Research Centre

Year of Establishment	2003		
Postal Address	PUNALAL.P.O., POOVACHAL (VIA) THIRUVANANTHAPURAM - 695575		
Contact Phone Nos.	0472 2852394, 0472 2853763, 9605548782		
Fax No. & E-mail	0472 2853763, dvpharma@gmail.com		
Website	www.daleviewcollege.com		
Name of Management with Address	The Dale View, Punalal.P.O., Thiruvananthapuram		
Name of Director / Manager	Sri.C.Christudas (Founder Chairman and Managing Director)		
Name of Principal	Dr. P. Manojkumar		
Name and Address of the Contact Person	Sri.C.Christu Das, Ph :9446173063 Sri.D.Shaiju Alfi, Director, CEO Ph :9605548782		
Courses Offered	B.Pharm	M.Pharm	Pharm. D
No. of Seats	60	Pharmaceutical Chemistry - 10 Pharmaceutics - 10	30
Number of seats proposed to be reserved under various	B.Pharm To be Allotted by Govt. / Open Merit 30 / 30 Management Quota - 30 Pharm.D Management Seat Open Merit - 30		
Hostel Facilities Boys: Girls:	Not Available Available		
Transport Facilities	Available		
Distance from nearest Rly. Stn. in kms	Trivandrum (22 kms.) & Neyyattinkara (22 kms)		
Distance from nearest Bus Stn. in kms	Thampanoor, Neyyattinkara, Kattakada, Nedumangad		

Short write up of the Institution: "The Dale View College of Pharmacy & Research Centre was founded in 2003 by The Dale View with the aim to impart quality education in pharmacy. The college offers B.Pharm, Pharm.D (Doctor of Pharmacy) and M.Pharm in Pharmaceutical Chemistry and Pharmaceutics. The institution has qualified and experienced faculty for teaching and guidance. We have state-of-the-art facilities in library, classrooms, and labs. The college is approved by AICTE, PCI, and is affiliated to Kerala University of Health Sciences. The institution has got NAAC accreditation and is recognized as the approved research centre under Kerala University of Health Sciences for pursuing the studies for PhD programme."

10

Prof.(Dr.)P.Manoj Kumar, M.Pharm.,Ph.D.
Principal



Prospectus for Admission to B.Pharm, Pharm. D & D. Pharm Courses 2018 - 2019

KERALA STATE SELF-FINANCING
PHARMACY COLLEGE MANAGEMENTS ASSOCIATION
(KSSPCMA)

PROSPECTUS FOR ADMISSION TO
B. PHARM, PHARM. D & D. PHARM COURSES 2018 -2019

Office of The President - KSSPCMA
Mar Dioscrous College of Pharmacy
Alathara, Sreekaryam P.O., Thiruvananthapuram.
Phone: 0471-2541250, 9447450612
Website: www.kssbcma.com,
E-mail: info@kssbcma.com , jskarukayil@gmail.com

Prof.(Dr.)P.Manoj Kumar, M.Pharm.,Ph.D.
Principal

INTRODUCTION

i. The Kerala State Self- Financing Pharmacy College Managements Association (KSSPCMA) has decided to conduct a separate selection procedure for admission to the B. Pharm , Pharm. D & D. Pharm Courses in the member colleges except for NRI seats and seats that may be set apart for allotment by the state and by the individual colleges.
ii. The self-financing colleges listed in this prospectus conduct 4 years degree course in Pharmacy (B.Pharm) , 6 years Doctor of Pharmacy Programme (Pharm. D) and 2 years Diploma in Pharmacy Course (D. Pharm) as per the syllabus of the Kerala University of Health Sciences, Thrissur / D.M.E.
iii. This prospectus is subject to modification, addition or deletion as may be deemed necessary by the Association and subject to the Judgments of Honourable Courts of law.
iv. The prospectus contains the rules and regulations applicable to the seats to be filled by the Managements of the Self-Financing Pharmacy Colleges to the B. Pharm , Pharm. D & D. Pharm Courses for the year2018 - 2019 for the colleges who are members of the K.S.S.P.C.M.A.
Vi. Each college will have its own policies of reservation.

COLLEGES AND NUMBER OF SEATS

i. The Details of member of colleges under the Association are given in the Annexure - I
ii. The maximum number of seats in each college is as per the sanction obtained by each college from the AICTE / PCI / Kerala University of Health Sciences, Thrissur / DME
iii. This prospectus is for taking of the 50% seats in B. Pharm & D. Pharm and 100% seats in Pharm D. In case no agreement is arrived at, the colleges will fillup the entire seats. Seats that may remain unfilled by the Government also will be filled by the colleges concerned.

FEE STRUCTURE

The Annual tuition fees now fixed for all the member colleges for B.Pharm is Rs. 98,000/- (Ninety Eight thousand only) **plus special fees per annum for four years.** And fee for Pharm. Dcourse is Rs. 1,90,000/-(Rupees One Lakhs Ninety Thousend only)**plus special fees per annum for six years.** And for D. Pharm the present fee is 40,000/-**plus special fees** per year.

FEE for NRI students

The fee for NRI student will be Rs.1.50 lakhs per annum for the B.Pharm course and Rs.3.0 lakhs per annum for Pharm.D courseand Special fee as fixed by Govt for 2018-19

Discontinuation of the course and payment of liquidated damages

If any candidate discontinues the course after closing of admissions on 31/07/2018
The candidate has to pay liquidated damages to the tune of full fee of the course. The student shall claim for TC and other certificates after clearing all the dues.

ELIGIBILITY FOR ADMISSION

(i) **Academic**

a) **B. Pharm:** Candidates who have passed Higher Secondary Examination, Kerala or examinations recognized as equivalent thereto, with 50% marks in Biology/ Mathematics/Biotechnology/Computer Science separately and 50% marks in Physics, Chemistry and Biology /Mathematics /Biotechnology/ Computer Science put together are eligible. Candidates from National Open School are not eligible to apply for the course.

b) **Pharm. D:** (a) Candidates who have passed Higher Secondary Examination, Kerala or examinations recognized as equivalent thereto, with 50% marks in Biology/ Mathematics separately and 50% marks in Physics, Chemistry and Biology/Mathematics put together are eligible. OR (b) A pass in D.Pharm. Course with a minimum of 50% marks in D. Pharm. examination from an institution approved by Pharmacy Council of India under Section 12 of the Pharmacy Act.(3) Any other qualification approved by the Pharmacy Council of India as equivalent to any of the above examinations

Prof.(Dr.)P.Manoj Kumar, M.Pharm.,Ph.D.
Principal

c). D. Pharm.:

A pass in any of the following Examinations with Physics, Chemistry and Biology or Mathematics: i) Intermediate examination in science; ii) the first year of three year degree course in science; iii) 10+2 examination (academic stream) in science; iv) pre-degree examination; or v) any other qualifications approved by PCI as equivalent to any of the above examinations.

N.B: However candidates who have passed their qualifying examination from outside the state of Keralashall produce the certificate of recognition and equivalency of qualifying examination from Kerala University of Health Sciences, Thrissur. This should be furnished at the time of admission. Eligibility for admission to the candidates belonging to OBC,OEC,SC/ST will be as per the requirements of the D.M.E

(ii) Age

Applicants should have completed 17 years of age on 31/12/2018

Copy of relevant page of school record namely SSLC/CBSE/ICSE certificate showing the date of birth/copy of the birth certificate from appropriate authority should be furnished along with the application attested by Gazetted Officer / Head of the Institution where the student had last studied.

(iii) Nationality

Candidates must be citizen of India.

HOW TO APPLY

Application forms

The application form together with the information brochure can be obtained from any of the member colleges of the Association listed in the annexure I, on payment of Rs. 1000/- for B. Pharm & Pharm. D and Rs. 500 for D. Pharm by cash or by sending Rs.1025/- for B. Pharm / Pharm D and Rs.525/- for D. Pharm by way of DD favouring the KSSPCMA , payable at Chalakudy and to such candidates application form and prospectus will be sent by post. Request for application form by post should reach the concerned colleges latest by 5 p.m. on 02-07-2018 and the last date for receiving filled in application form is 06-07-2018. Separate application forms shall be submitted to each college and the candidate is free to apply to as many colleges as needed. Application form issued by one college cannot be used for applying in another college.

Submission of Application Form

The duly filled in application along with self attested copies of necessary documents shall be submitted directly or by registered post with A/D to the respective colleges so as to reach there on or before the prescribed date.

Applications submitted to the colleges should be complete in all respects. The candidate should fill in all items in the application form in his/her own handwriting.

Application not accompanied by documents in proof of claims made therein will be summarily rejected without further intimation. Documents/Certificates furnished after submission of the application will not be entertained under any circumstances. Also no opportunity will be given to incorporate any details or document after the submission of the application. Late and incomplete applications will be rejected.

List of self attested copies of following certificate / documents to be submitted with the application.

1. 12th / 10th certificate in proof of the date of birth.
2. Mark list of qualifying examinations.
3. Caste Certificate
4. Candidates should enclose a self addressed envelope (25x12 cm size) with Indian postage stamp/ stamps sufficient for sending the Selection Memo by Registered post with set of application form.

Note:

i. Applications received late will not be accepted.

Prof.(Dr.)P.Manoj Kumar, M.Pharm.,PhD.
Principal

The Dale View College of Pharmacy and Research Centre

Year of Establishment	2003		
Postal Address	PUNALAL.P.O., POOVACHAL (VIA) THIRUVANANTHAPURAM - 695575		
Contact Phone Nos.	0472 2852394, 0472 2853763, 9605548782		
Fax No. & E-mail	0472 2853763, dvpharma@gmail.com		
Website	www.daleviewcollege.com		
Name of Management with Address	The Dale View, Punalal.P.O., Thiruvananthapuram		
Name of Director / Manager	Sri.C.Christudas (Founder Chairman and Managing Director)		
Name of Principal	Dr. P. Manojkumar		
Name and Address of the Contact Person	Sri.C.Christu Das, Ph :9446173063 Sri.D.Shaiju Alfi, Director, CEO Ph :9605548782		
Courses Offered	B.Pharm	M.Pharm	Pharm. D
No. of Seats	60	Pharmaceutical Chemistry - 10 Pharmaceutics - 10	30
Number of seats proposed to be reserved under various	B.Pharm To be Allotted by Govt. 30 / Management Quota - 30: Open Merit 30 Pharm.D Management Seat Open Merit 30		
Hostel Facilities Boys: Girls:	 Not Available Available		
Transport Facilities	Available		
Distance from nearest Rly. Stn. in kms	Trivandrum (22 kms.) & Neyyattinkara (22 kms)		
Distance from nearest Bus Stn. in kms	Thampanoor, Neyyattinkara, Kattakada, Nedumangad		

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Principal

ANNEXURE-I

LIST OF MEMBER COLLEGES OFFERING B.PHARM, PHARM.D & D.PHARM COURSES (KSSPCMA) WITH SEAT MATRIX

Sl No.	Name of the College	District	Total No. of Seats		
			B.Pharm	Pharm .D	D.Pharm
01	The Dale View College of Pharmacy & Research Centre***	Thiruvananthapuram	60	30	60
02	Ezhuthachan College of Pharmaceutical Sciences***	Thiruvananthapuram	60	30	60
03	Mar Dioscrous College of Pharmacy**	Thiruvananthapuram	60	Nil	60
04	Mount Zion College of Pharmaceutical Sciences and Research	Pathanamthitta	60	Nil	Nil
05	Nazareth College of Pharmacy*	Pathanamthitta	60	30	Nil
06	Pushpagiri College of Pharmacy *	Pathanamthitta	60	30	Nil
07	Dr. Joseph Mar Thoma Institute of Pharmaceutical Sciences & Research **	Alappuzha	60	Nil	60
08	St. Joseph's College of Pharmacy *	Alappuzha	60	30	Nil
09	KVM College of Pharmacy ***	Alappuzha	60	30	60
10	St. John's College of Pharmaceutical Sciences & Research	Idukki	60	Nil	Nil
11	Nirmala College of Pharmacy, Muvattupuzha *	Ernakulam	60	30	Nil
12	Chemists College of Pharmaceutical Science & Research **	Ernakulam	60	Nil	60
13	Mookambika College of Pharmaceutical Science & Research	Ernakulam	60	Nil	Nil
14	St. James College of Pharmaceutical Sciences *	Thrissur	60	30	Nil
15	Nehru College of Pharmacy ***	Thrissur	100	30	60
16	Elims College of Pharmacy	Thrissur	60	Nil	Nil
17	Nirmala College of Health Science**	Thrissur	60	Nil	60
18	Grace College of Pharmacy *	Palakkad	60	30	Nil
19	Ahalia School of Pharmacy	Palakkad	60	Nil	Nil
20	Prime College of Pharmacy **	Palakkad	60	Nil	60
21	Sanjo College of Pharmaceutical Studies**	Palakkad	60	Nil	60

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Prof.(Dr.)P.Manoj Kumar, M.Pharm, Ph.D.
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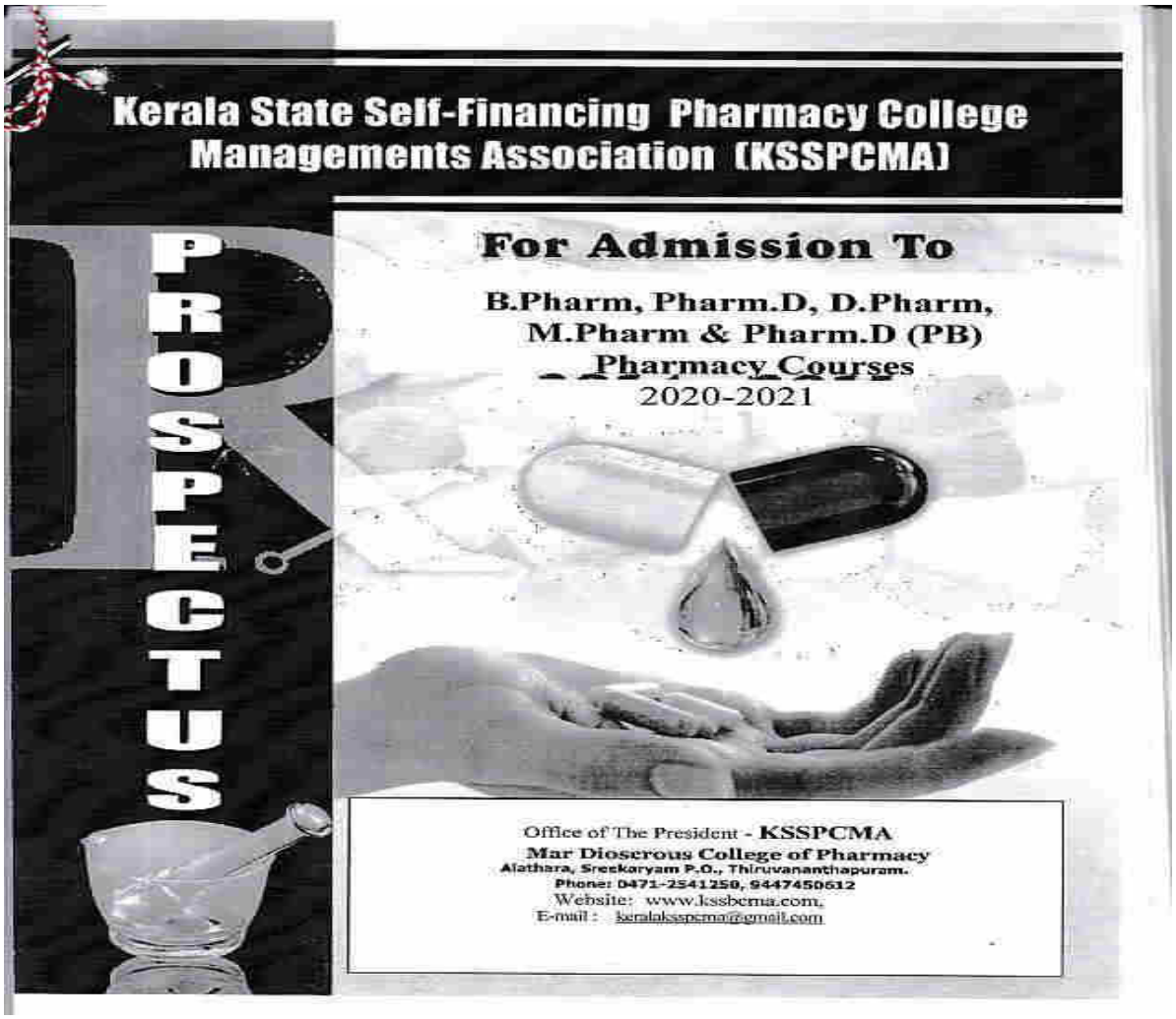

Prof.(Dr.)P.Manoj Kumar, M.Pharm, Ph.D.
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ANNEXURE-I

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04	Mount Zion College of Pharmaceutical Sciences and Research	Pathanamthitta	60	Nil	Nil
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06	Pushpagiri College of Pharmacy *	Pathanamthitta	60	30	Nil
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12	Chemists College of Pharmaceutical Science & Research **	Ernakulam	60	Nil	60
13	Mookambika College of Pharmaceutical Science & Research	Ernakulam	60	Nil	Nil
14	St. James College of Pharmaceutical Sciences *	Thrissur	60	30	Nil
15	Nehru College of Pharmacy ***	Thrissur	100	30	60
16	Elims College of Pharmacy	Thrissur	60	Nil	Nil
17	Nirmala College of Health Science**	Thrissur	60	Nil	60
18	Grace College of Pharmacy *	Palakkad	60	30	Nil
19	Ahalia School of Pharmacy	Palakkad	60	Nil	Nil
20	Prime College of Pharmacy **	Palakkad	60	Nil	60
21	Sanjo College of Pharmaceutical Studies**	Palakkad	60	Nil	60

20

Prof.(Dr.)P.Manoj Kumar, M.Pharm, Ph.D.
Principal

REGULATIONS 2016

Scheme and structure of syllabus in the document/notification of affiliating University, showing number of exam papers to be taken by a student in each program, for each semester, for all the programs, attested by Principal

SYLLABUS

for Courses affiliated to the

Kerala University of Health Sciences

Thrissur 680596

DOCTOR OF PHARMACY (PHARM D)

Course Code: 282

(2016-17 Academic year onwards)

2016

2. COURSE CONTENT

Title of course:

Doctor of Pharmacy (Pharm D)

Objectives of course

The Doctor of Pharmacy education will aim at producing post graduates, having profound knowledge of pharmacy supplemented with knowledge of scientific advances in Modern medicine along with extensive practical training; who will become efficient Physicians fully competent to serve the health care professional.

The aim of the course is to mould the student to suit the varied requirements of

i. Practice settings in – Hospital Pharmacy and Community Pharmacy.
ii. Clinical Pharmacy services
    a. Patient counseling
    b. Drug information
    c. Therapeutic Drug Monitoring(TDM) and Dose calculation
iii. Academics.
iv. Regulatory affairs.

Medium of instruction:

The medium of instruction for the course shall be English.

Course outline

The course of study for Pharm.D shall include the subjects as given in the Tables below. The number of hours in a week, devoted to each subject to its teaching in theory, practical and tutorial shall not be less than that noted against it in columns (3), (4) and (5) below

☆

First Year

S.No	Name of Subject	No. of hours of Theory	No. of hours of Practical	No. of hours of Tutorial
(1)	(2)	(3)	(4)	(5)
1.1	Human Anatomy and Physiology	3	3	1
1.2	Pharmaceutics	2	3	1
1.3	Medicinal Biochemistry	3	3	1
1.4	Pharmaceutical Organic Chemistry	3	3	1
1.5	Pharmaceutical Inorganic Chemistry	2	3	1
1.6	Remedial Mathematics/ Biology	3	3*	1
	Total hours	16	18	6=(40)

* Only for Biology

Second Year

S.No	Name of Subject	No. of hours of Theory	No. of hours of Practical	No. of hours of Tutorial
(1)	(2)	(3)	(4)	(5)
2.1	Pathophysiology	3	-	1
2.2	Pharmaceutical Microbiology	3	3	1
2.3	Pharmacognosy & Phytopharmaceuticals	3	3	1
2.4	Pharmacology-I	3	-	1
2.5	Community Pharmacy	2	-	1
2.6	Pharmacotherapeutics-I	3	3	1
	Total hours	17	9	6=(32)

☆

Third Year

S.No	Name of Subject	No. of hours of Theory	No. of hours of Practical	No. of hours of Tutorial
(1)	(2)	(3)	(4)	(5)
3.1	Pharmacology-II	3	3	1
3.2	Pharmaceutical Analysis	3	3	1
3.3	Pharmacotherapeutics-II	3	3	1
3.4	Pharmaceutical Jurisprudence	2	-	-
3.5	Medicinal Chemistry	3	3	1
3.6	Pharmaceutical Formulations	2	3	1
	Total hours	16	15	6=(36)

Fourth Year

S.No	Name of Subject	No. of hours of Theory	No. of hours of Practical	No. of hours of Tutorial
(1)	(2)	(3)	(4)	(5)
4.1	Pharmacotherapeutics-III	3	3	1
4.2	Hospital Pharmacy	2	3	1
4.3	Clinical Pharmacy	3	3	1
4.4	Biostatistics & Research Methodology	2	-	1
4.5	Biopharmaceutics & Pharmacokinetics	3	3	1
4.6	Clinical Toxicology	2	-	1
	Total hours	15	12	6=(33)

☆

Fifth Year

S.No	Name of Subject	No. of hours of Theory	No. of hours of Practical	No. of hours of Tutorial
(1)	(2)	(3)	(4)	(5)
5.1	Clinical Research	3	-	1
5.2	Pharmacoepidemiology and Pharmacoeconomics	3	-	1
5.3	Clinical Pharmacokinetics & Pharmacotherapeutic Drug Monitoring	2	-	1
5.4	Clerkship *	-	-	1
5.5	Project work (Six Months)	-	20	-
	Total hours	8	20	4=(32)

*Attending ward rounds on a daily basis.

Sixth Year:

Internship or residency training, including postings in specialty units. The student should independently provide the clinical pharmacy services to the allotted wards.

(i) Six months in General Medicine department, and

(ii) Two months each in three other speciality departments.

Duration

The duration of the course shall be six academic years (five years of study and one year of internship or residency) full time with each academic year spread over a period of not less than 200 working days. The period of six years duration is divided into two phases –

Phase I – consisting of first, Second, Third, fourth and the fifth academic year.

Phase II – consisting of internship or residency training during the sixth year involving posting in specialty units.

It is a phase of training wherein a student is exposed to actual pharmacy practice or clinical pharmacy services and acquires skill under supervision so that he or she may become capable of functioning independently.

Syllabus

As mentioned in "Content of each subject in each year" (clause 2.10)

The concept of health care counselling shall be incorporated in all relevant areas.

☆

Total number of hours

As mentioned in "Content of each subject in each year" (clause 2.10)

Branches if any, with definition

As mentioned in "Content of each subject in each year" (clause 2.10)

Teaching, learning methods

Classroom lectures using Blackboard and PowerPoint presentations.
Teaching with Counselling heads, Case presentations, Seminar, Clerkships and projects and any other methods decided by the respective H.O.D's

Content of each subject in each year

FIRST YEAR

1.1 HUMAN ANATOMY & PHYSIOLOGY (THEORY)

Theory: 3 Hrs. /Week

1 Scope and Objectives: This course is designed to impart a fundamental knowledge on the structure and functions of the human body. It also helps in understanding both homeostasis mechanisms and homeostatic imbalances of various body systems. Since a medicament, which is produced by a pharmacist, is used to correct the deviations in the human body, it enhances the understanding of how the drugs act on the various body systems in correcting the disease state of the organs.

2. Upon completion of the course the student shall be able to:

a. Describe the structure (gross and histology) and functions of various organs of the human body;
b. Describe the various homeostatic mechanisms and their imbalances of various systems;
c. Identify the various tissues and organs of the different systems of the human body;
d. Perform the hematological tests and also record blood pressure, heart rate, pulse and Respiratory volumes;
e. Appreciate coordinated working pattern of different organs of each system;
f. Appreciate the interlinked mechanisms in the maintenance of normal functioning (homeostasis) of human body

3. Course material :

Textbooks

a. Tortora Gerard J. and Nicholas, P. Principles of anatomy and physiology Publisher Harpercollins college New York.
b. Wilson, K.J.W. Ross and Wilson's foundations of anatomy and physiology. Publisher: Churchill Livingstone, Edinburg.

Reference books

a. Guyton arthur, C. *Physiology of human body*. Publisher: Holtsaunders.
b. Chatterjee,C.C. *Human physiology*. Volume 1&11. Publisher: medical allied agency, Calcutta.
c. Peter L. Williams, Roger Warwick, Mary Dyson and Lawrence, H.
d. *Gray's anatomy.* Publisher:Churchill Livingstone, London.

4. Lecture wise program :

Topics

1 Scope of anatomy and physiology, basic terminologies used in this subject (Description of the body as such planes and terminologies)
2 Structure of cell – its components and their functions.
3 Elementary tissues of the human body: epithelial, connective, Muscular and nervous tissues-their sub-types and characteristics
4 a) Osseous system - structure, composition and functions of the Skeleton. (done in practical classes - 6hrs)
b) Classification of joints, Types of movements of joints and disorders of joints (Definitions only)
5 <u>Haemopoetic System</u>
a) Composition and functions of blood
b) Haemopoesis and disorders of blood components (definition of disorder)
c) Blood groups
d) Clotting factors and mechanism
e) Platelets and disorders of coagulation
6 <u>Lymph</u>
a) Lymph and lymphatic system, composition, formation and circulation.
b) Spleen: structure and functions, Disorders
c) Disorders of lymphatic system (definition only)
7 <u>Cardiovascular system</u>
a) Anatomy and functions of heart
b) Blood vessels and circulation (Pulmonary, coronary and systemic circulation)
c) Electrocardiogram (ECG)

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d) Cardiac cycle and heart sounds

e) Blood pressure – its maintenance and regulation

f) Definition of the following disorders

Hypertension, Hypotension, Arteriosclerosis, Atherosclerosis, Angina, Myocardial infarction, Congestive heart failure, Cardiac arrhythmias

8 Respiratory system

a) Anatomy of respiratory organs and functions

b) Mechanism / physiology of respiration and regulation of respiration

c) Transport of respiratory gases

d) Respiratory volumes and capacities, and Definition of: Hypoxia, Asphyxia, Dybarism, Oxygen therapy and resuscitation.

9 Digestive system

a) Anatomy and physiology of GIT

b) Anatomy and functions of accessory glands of GIT

c) Digestion and absorption

d) Disorders of GIT (definitions only)

10 Nervous system

a) Definition and classification of nervous system

b) Anatomy, physiology and functional areas of cerebrum

c) Anatomy and physiology of cerebellum

d) Anatomy and physiology of mid brain

e) Thalamus, hypothalamus and Basal Ganglia

f) Spinal cord: Structure & reflexes – mono-poly-planter

g) Cranial nerves – names and functions

h) ANS – Anatomy & functions of sympathetic & parasympathetic N.S.

11 Urinary system

a) Anatomy and physiology of urinary system

b) Formation of urine

c) Renin Angiotensin system – Juxtaglomerular apparatus - acid base Balance

d) Clearance tests and micturition

12 Endocrine system

a) Pituitary gland

b) Adrenal gland

c) Thyroid and Parathyroid glands

d) Pancreas and gonads

13 Reproductive system

a) Male and female reproductive system

b) Their hormones – Physiology of menstruation

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c) Spermatogenesis & Oogenesis
d) Sex determination (genetic basis)
e) Pregnancy and maintenance and parturition
f) Contraceptive devices

14 Sense organs
a) Eye
b) Ear
c) Skin
d) Tongue & Nose

15 Skeletal muscles
a) Histology
b) Physiology of Muscle contraction
c) Physiological properties of skeletal muscle and their disorders (definitions)

16 Sports physiology
a) Muscles in exercise, Effect of athletic training on muscles and muscle performance,
b) Respiration in exercise, CVS in exercise, Body heat in exercise, Body fluids and salts in exercise,
c) Drugs and athletics.

- HUMAN ANATOMY & PHYSIOLOGY (PRACTICAL)

Practical: 3 Hrs./Week

General Requirements: Dissection box, Laboratory Napkin, muslin cloth, record, Observation book (100pages), Stationary items, Blood lancet.

Course materials:

Textbooks

Goyal, R. K, Natvar M.P, and Shah S.A, Practical anatomy, physiology and biochemistry, latest edition, Publisher: B.S Shah Prakashan, Ahmedabad.

Reference books

Ranade VG, Textbook of practical physiology, Latest edition, Publisher: PVG, Pune
Anderson Experimental Physiology, Latest edition, Publisher: NA

List of Experiments:

1. Study of tissues of human body
   (a) Epithelial tissue.

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(b) Muscular tissue.

2. Study of tissues of human body
   (a) Connective tissue.
   (b) Nervous tissue.
3. Study of appliances used in hematological experiments.
4. Determination of W.B.C. count of blood.
5. Determination of R.B.C. count of blood.
6. Determination of differential count of blood.
7. Determination of
   (a) Erythrocyte Sedimentation Rate.
   (b) Hemoglobin content of Blood.
   (c) Bleeding time & Clotting time.
8. Determination of
   (a) Blood Pressure.
   (b) Blood group.
9. Study of various systems with the help of charts, models & specimens
   (a) Skeleton system part I-axial skeleton.
   (b) Skeleton system part II- appendicular skeleton.
   (c) Cardiovascular system.
   (d) Respiratory system.
   (e) Digestive system.
   (f) Urinary system.
   (g) Nervous system.
   (h) Special senses.
   (i) Reproductive system.
10. Study of different family planning appliances.
11. To perform pregnancy diagnosis test.
12. Study of appliances used in experimental physiology.
13. To record simple muscle curve using gastrocnemius sciatic nerve preparation.
14. To record simple summation curve using gastrocnemius sciatic nerve preparation.
15. To record the simple effect of temperature using gastrocnemius sciatic nerve preparation.
16. To record the simple effect of load & after load using gastrocnemius sciatic nerve preparation.
17. To record the simple fatigue curve using gastrocnemius sciatic nerve preparation.

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Scheme of Practical Examination:

	Sessionals	**Annual**
Identification	04	10
Synopsis	04	10
Major Experiment	07	20
Minor Experiment	03	15
Viva	02	15
Max Marks	**20**	**70**
Duration	**03hrs**	**04hrs**

Note: Total sessional marks is 30 (20 for practical sessional plus 10 marks for regularity, promptness, viva-voce and record maintenance).

- PHARMACEUTICS (THEORY)

Theory : 2 Hrs. /Week

1. **Scope and objectives:** This course is designed to impart a fundamental knowledge on the art and science of formulating different dosage forms. It prepares the students for the most basic of the applied field of pharmacy.

2. **Upon the completion of the course the student should be able to:**
   a. know the formulation aspects of different dosage forms;
   b. do different pharmaceutical caluculation involved in formulation;
   c. formulate different types of dosage forms; and
   d. appreciate the importance of good formulation for effectiveness.

3. **Course materials: Textbooks**
   a. Cooper and Gunns Dispensing for pharmacy students.
   b. A Textbook Professional Pharmacy by N.K.Jain and S.N.Sharma.

   Reference books
   a. Introduction to Pharmaceutical dosage forms by Howard C. Ansel.
   b. Remington's Pharmaceutical Sciences.
   c. Register of General Pharmacy by Cooper and Gunn.
   d. General Pharmacy by M.L.Schroff.

4. **Lecture wise programme: Topics**
   1 a. Introduction to dosage forms - classification and definitions

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b. Prescription: definition, parts and handling

c. Posology: Definition, Factors affecting dose selection. Calculation of children and infant doses.

2 Historical background and development of profession of pharmacy and pharmaceutical industry in brief.

3 Development of Indian Pharmacopoeia and introduction to other Pharmacopoeias such as BP, USP, European Pharmacopoeia, Extra pharmacopoeia and Indian national formulary.

4 Weights and measures, Calculations involving percentage solutions, allegation, proof spirit, isotonic solutions etc.

5 Powders and Granules: Classification advantages and disadvantages, Preparation of simple, compound powders, Insufflations, Dusting powders, Eutectic and Explosive powders, Tooth powder and effervescent powders and granules.

6 Monophasic Dosage forms: Theoretical aspects of formulation including adjuvant like stabilizers, colorants, flavours with examples. Study of Monophasic liquids like gargles, mouth washes, Throat paint, Ear drops, Nasal drops, Liniments and lotions, Enemas and collodions.

7 Biphasic dosage forms: Suspensions and emulsions, Definition, advantages and disadvantages, classification, test for the type of emulsion, formulation, stability and evaluation.

8 Suppositories and pessaries: Definition, advantages and disadvantages, types of base, method of preparation, Displacement value and evaluation.

9 Galenicals: Definition, equipment for different extraction processes like infusion, Decoction, Maceration and Percolation, methods of preparation of spirits, tinctures and extracts.

10 Pharmaceutical calculations.

11 Surgical aids: Surgical dressings, absorbable gelatin sponge, sutures, ligatures and medicated bandages.

12 Incompatibilities: Introduction, classification and methods to overcome the incompatibilities.

- PHARMACEUTICS (PRACTICAL)

Practical : 3 Hrs./Week

List of Experiments:

1. Syrups

a. Simple Syrup I.P

b. Syrup of Ephedrine Hcl NF

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c. Syrup Vasaka IP
d. Syrup of ferrous Phosphate IP
e. Orange Syrup

2. Elixir

a. Piperizine citrate elixir BP
b. Cascara elixir BPC
c. Paracetamol elixir BPC

3. Linctus

a. Simple Linctus BPC
b. Pediatric simple Linctus BPC

4. Solutions

a. Solution of cresol with soap IP
b. Strong solution of ferric chloride BPC
c. Aqueous Iodine Solution IP
d. Strong solution of Iodine IP
e. Strong solution of ammonium acetate IP

5. Liniments

a. Liniment of turpentine IP*
b. Liniment of camphor IP

6. Suspensions*

a. Calamine lotion
b. Magnesium Hydroxide mixture BP

7. Emulsions*

a. Cod liver oil emulsion
b. Liquid paraffin emulsion

8. Powders♣

a. Eutectic powder
b. Explosive powder
c. Dusting powder
d. Insufflations

9. Suppositories♣

a. Boric acid suppositories
b. Chloral suppositories

10. Incompatibilities

a. Mixtures with Physical
b. Chemical & Therapeutic incompatibilities

***** colourless bottles required for dispensing **♣** Paper envelope (white), butter paper and white paper required for dispensing.

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Scheme of Practical Examination:

	Sessionals	**Annual**
Synopsis	05	15
Major Experiment	10	25
Minor Experiment	03	15
Viva	02	15
Max Marks	**20**	**70**
Duration	**03hrs**	**04hrs**

Note : Total sessional marks is 30 (20 for practical sessional plus 10 marks for regularity, promptness, viva-voce and record maintenance).

- MEDICINAL BIOCHEMISTRY (THEORY)

Theory: 3 Hrs. /Week

1. **Scope of the Subject:** Applied biochemistry deals with complete understanding of the molecular level of the chemical process associated with living cells.Clinical chemistry deals with the study of chemical aspects of human life in health and illness and the application of chemical laboratory methods to diagnosis, control of treatment, and prevention of diseases.

2. **Objectives of the Subject** (Know, do, appreciate) :
   The objective of the present course is providing biochemical facts and the principles to the students of pharmacy. Upon completion of the subject student shall be able to –
   a. understand the catalytic activity of enzymes and importance of isoenzymes in diagnosis of diseases;
   b. know the metabolic process of biomolecules in health and illness (metabolic disorders);
   c. understand the genetic organization of mammalian genome; protein synthesis; replication; mutation and repair mechanism;
   d. know the biochemical principles of organ function tests of kidney, liver and endocrine gland; and
   e. do the qualitative analysis and determination of biomolecules in the body fluids.

Textbooks (Theory)

a. Harpers review of biochemistry - Martin

b. Textbook of biochemistry – D.Satyanarayana

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c. Textbook of clinical chemistry- Alex kaplan &Laverve L.Szabo

Reference books (Theory)

a. Principles of biochemistry -- Lehninger
b. Textbook of biochemistry -- Ramarao
c. Practical Biochemistry-David T.Plummer.
d. Practical Biochemistry-Pattabhiraman.

3. Lecture wise programme:

Topics

1 **Introduction to biochemistry:** Cell and its biochemical organization, transport process across the cell membranes. Energy rich compounds; ATP, Cyclic AMP and their biological significance.

2 **Enzymes**: Definition; Nomenclature; IUB classification; Factor affecting enzyme activity; Enzyme action; enzyme inhibition. Isoenzymes and their therapeutic and diagnostic applications; Coenzymes and their biochemical role and deficiency diseases.

3 **Carbohydrate metabolism**: Glycolysis, Citric acid cycle (TCA cycle), HMP shunt, Glycogenolysis, gluconeogenesis, glycogenesis. Metabolic disorders of carbohydrate metabolism (diabetes mellitus and glycogen storage diseases); Glucose, Galactose tolerance test and their significance; hormonal regulation of carbohydrate metabolism.

4 **Lipid metabolism:** Oxidation of saturated (β-oxidation); Ketogenesis and ketolysis; biosynthesis of fatty acids, lipids; metabolism of cholesterol; Hormonal regulation of lipid metabolism. Defective metabolism of lipids (Atheroslerosis, fatty liver, hypercholesterolmiea).

5 **Biological oxidation:** Coenzyme system involved in Biological oxidation. Electron transport chain (its mechanism in energy capture; regulation and inhibition); Uncouplers of ETC; Oxidative phosphorylation;

6 **Protein and amino acid metabolism:** protein turn over; nitrogen balance; Catabolism of Amino acids (Transamination, deamination & decarboxylation). Urea cycle and its metabolic disorders; production of bile pigments; hyperbilirubinemia, porphoria, jaundice. Metabolic disorder of Amino acids.

7 **Nucleic acid metabolism:** Metabolism of purine and pyrimidine nucleotides; Protein synthesis; Genetic code; inhibition of protein synthesis; mutation and repair mechanism; DNA replication (semiconservative /onion peel models) and DNA repair mechanism.

8 **Introduction to clinical chemistry: Cell**; composition; malfunction; Roll of the clinical chemistry laboratory.

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9 **The kidney function tests:** Role of kidney; Laboratory tests for normal function includes-

a) Urine analysis (macroscopic and physical examination, quantitative and semiquantitative tests.)
b) Test for NPN constituents. (Creatinine /urea clearance, determination of blood and urine creatinine, urea and uric acid)
c) Urine concentration test
d) Urinary tract calculi. (stones)

10 **Liver function tests:** Physiological role of liver, metabolic, storage, excretory, protective, circulatory functions and function in blood coagulation.

a) Test for hepatic dysfunction-Bile pigments metabolism.
b) Test for hepatic function test- Serum bilirubin, urine bilirubin, and urine urobilinogen.
c) Dye tests of excretory function.
d) Tests based upon abnormalities of serum proteins.

11. **Lipid profile tests:** Lipoproteins, composition, functions. Determination of serum lipids, total cholesterol, HDL cholesterol, LDL cholesterol and triglycerides.
12. **Immunochemical techniques** for determination of hormone levels and protein levels in serum for endocrine diseases and infectious diseases.
    Radio immuno assay (RIA) and Enzyme Linked Immuno Sorbent Assay (ELISA)
13. **Electrolytes:** Body water, compartments, water balance, and electrolyte distribution. Determination of sodium, calcium, potassium, chlorides, bicarbonates in the body fluids.

- MEDICINAL BIOCHEMISTRY (PRACTICAL)

Practical : 3 Hrs./Week

Title of the Experiment:

1. Qualitative analysis of normal constituents of urine.*
2. Qualitative analysis of abnormal constituents of urine.*
3. Quantitative estimation of urine sugar by Benedict's reagent method.**
4. Quantitative estimation of urine chlorides by Volhard's method.**
5. Quantitative estimation of urine creatinine by Jaffe's method.**
6. Quantitative estimation of urine calcium by precipitation method.**
7. Quantitative estimation of serum cholesterol by Libermann Burchard's method.**
8. Preparation of Folin Wu filtrate from blood.*

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9. Quantitative estimation of blood creatinine.**
10. Quantitative estimation of blood sugar Folin-Wu tube method.**
11. Estimation of SGOT in serum.**
12. Estimation of SGPT in serum.**
13. Estimation of Urea in Serum.**
14. Estimation of Proteins in Serum.**
15. Determination of serum bilirubin**
16. Determination of Glucose by means of Glucoseoxidase.**
17. Enzymatic hydrolysis of Glycogen/Starch by Amylases.**
18. Study of factors affecting Enzyme activity. (pH & Temp.)**
19. Preparation of standard buffer solutions and its pH measurements (any two)*
20. Experiment on lipid profile tests**
21. Determination of sodium,calcium and potassium in serum.**

** indicate major experiments & * indicate minor experiments

Assignments:

Format of the assignment

1. Minimum & Maximum number of pages.
2. It shall be computer draft copy.
3. Reference(s) shall be included at the end.
4. Name and signature of the student.
5. Assignment can be a combined presentation at the end of the academic year.
6. Time allocated for presentation may be 8+2 Min.

Scheme of Practical Examination:

	Sessionals	**Annual**
Synopsis	05	15
Major Experiment	10	25
Minor Experiment	03	15
Viva	02	15
Max Marks	**20**	**70**
Duration	**03hrs**	**04hrs**

Note : Total sessional marks is 30 (20 for practical sessional plus 10 marks for regularity, promptness, viva-voce and record maintenance).

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- PHARMACEUTICAL ORGANIC CHEMISTRY

(THEORY)Theory: 3 Hrs. /Week

1. **Scope and objectives**: This course is designed to impart a very good knowledge about
   a) IUPAC/Common system of nomenclature of simple organic compounds belonging to different classes of organic compounds;
   b) Some important physical properties of organic compounds;
   c) Free radical/ nucleophyllic [alkyl/ acyl/ aryl] /electrophyllic substitution, free radical/ nucleophyllic / electrophyllic addition, elimination, oxidation and reduction reactions with mechanism, orientation of the reaction, order of reactivity, stability of compounds;
   d) Some named organic reactions with mechanisms; and
   e) Methods of preparation, test for purity, principle involved in the assay, important medicinal uses of some important organic compounds.

2. **Course materials: Text books**
   a) T.R.Morrison and R. Boyd - Organic chemistry,
   b) Bentley and Driver-Text book of Pharmaceutical chemistry
   c) I.L.Finer- Organic chemistry, the fundamentals of chemistry

   Reference books
   1 Organic chemistry – J.M.Cram and D.J.Cram
   2 Organic chemistry- Brown
   3 Advanced organic chemistry- Jerry March, Wiley
   4 Organic chemistry- Cram and Hammered, Pine Hendrickson

3. **Lecture wise programme : Topics**

   1. Structures and Physical properties:
      a) Polarity of bonds, polarity of molecules, M.P, Inter molecular forces, B.P, Solubility, non ionic solutes and ionic solutes, protic and aprotic Solvents, ion pairs,
      b) Acids and bases, Lowry bronsted and Lewis theories
      c) Isomerism

2. Nomenclature of organic compound belonging to the following classes Alkanes, Alkenes, Dienes, Alkynes, Alcohols, Aldehydes, Ketones, Amides, Amines, Phenols, Alkyl Halides, Carboxylic Acid, Esters, Acid Chlorides And Cycloalkanes.

3. Free radicals chain reactions of alkane : Mechanism, relative reactivity and stability

4. Alicyclic compounds : Preparations of cyclo alkanes, Bayer strain theory and orbital picture of angle strain.

5. Nuclophilic aliphatic substitution mechanism: Nucleophiles and leaving groups, kinetics of second and first order reaction, mechanism and kinetics of SN_2 reactions. Stereochemistry and steric hindrance, role of solvents, phase transfer catalysis, mechanism and kinetics of SN1 reactions, stereochemistry, carbocation and their stability, rearrangement of carbocation, role of solvents in SN1 reaction, Ion dipole bonds, SN2 versus SN1 solvolyses, nucleophilic assistance by the solvents.

6. Dehydro halogenation of alkyl halides: 1,2 elimination, kinetics, E2 and E1 mechanism, elimination via carbocation, evidence for E2 mechanism, absence of rearrangement isotope effect, absence hydrogen exchange, the element effect, orientation and reactivity, E2 versus E1, elimination versus substitution, dehydration of alcohol, ease of dehydration, acid catalysis, reversibility, orientation.

7. Electrophillic and free radicals addition: Reactions at carbon-carbon, double bond, electrophile, hydrogenation, heat of hydrogenation and stability of alkenes, markownikoff rule, addition of hydrogen halides, addition of hydrogen bromides, peroxide effect, electrophillic addition, mechanism, rearrangement, absence of hydrogen exchange, orientation and reactivity, addition of halogen, mechanism, halohydin formation, mechanism of free radicals additon, mechanism of peroxide initiated addition of hydrogen bromide, orientation of free addition, additions of carbene to alkene, cyclo addition reactions.

8. Carbon-carbon double bond as substituents: Free radical halogenations of alkenes, comparision of free radical substitution with free radical addition, free radical substitution in alkenes, orientation and reactivity, allylic rearrangements.

9. Theory of resonance: Allyl radical as a resonance hybrid, stability, orbital picture, resonance stabilisation of allyl radicals, hyper conjugation, allyl cation as a resonance hybrid, nucleophyllic substitution in allylic substrate, SN1 reactivity, allylic rearrangement, resonance stabilisation of allyl cation, hyper conjugation, nucleophilic substitution in allylic substrate, SN2 nucleophilic substituion in vinylic substrate, vinylic cation, stability of conjugated dienes, resonance in alkenes, hyper conjugation, ease of formation of conjugated dienes, orientation of elimination, electrophilic addition to conjugated dienes, 1,4- addition, 1,2-versus 1,4-addition, rate versus equilibrium, orientation and reactivity of free radical addition to conjugated dienes.

10. Elecrophilic aromatic substitution: Effect of substituent groups, determination of orientation, determination of relative reactivity, classification of substituent group, mechanism of nitration, sulphonation, halogenation, friedel craft alkylation, friedel craft acylation, reactivity and orientation, activating and deactivating O,P,M directing groups, electron release via resonance, effect of halogen on electrophilic aromatic substitution in alkyl benzene, side chain halogination of alkyl benzene, resonance stabilization of benzyl radical.

11. Nucleophilic addition reaction: Mechanism, ionisation of carboxylic acids, acidity constants, acidity of acids, structure of carboxylate ions, effect of substituent on acidity, nucleophilic acyl substitution reaction, conversion of acid to acid chloride, esters, amide and anhydride. Role of caboxyl group, comparison of alkyl nucleophilic substitution with acyl nucleophilic substitution.

12. Mechanism of aldol condensation, claisen condensation, cannizzaro reaction, crossed aldol condensation, crossed cannizzaro reaction, benzoin condensation, perkin condensation. Knoevenagel, Reformatsky reaction, Wittig reaction, Michael addition.

13. Hoffman rearrangement: Migration to electron deficient nitrogen, Sandmeyer's reaction, basicity of amines, diazotisation and coupling, acidity of phenols, Williamson synthesis, Fries rearrangement, Kolbe reaction, Reimer tieman's reactions.

14. Nucleophilic aromatic substitution: Bimolecular displacement mechanisms, orientation, comparison of aliphatic nucleophilic substitution with that of aromatic.

15. Oxidation reduction reaction.

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16. Study of the following official compounds- preparation, test for purity, assay and medicinal uses of Chlorbutol, Dimercaprol, Glyceryl trinitrate, Urea, Ethylene diamine dihyrate, Vanillin, Paraldehyde, Ethylene chloride, Lactic acid, Tartaric acid, citric acid, salicylic acid, aspirin, methyl salicylate, ethyl benzoate, benzyl benzoate, dimethyl pthalate, sodium lauryl sulphate, saccharin sodium, mephensin.

- PHARMACEUTICAL ORGANIC CHEMISTRY (PRACTICAL)

Practical : 3 Hrs./Week

1. **Introduction to the various laboratory techniques through demonstration involving synthesis of the following compounds (at least 8 compounds to be synthesised):**
    1. Acetanilde / aspirin (Acetylation)
    2. Benzanilide / Phenyl benzoate (Benzoylation)
    3. P-bromo acetanilide / 2,4,6 – tribromo aniline (Bromination)
    4. Dibenzylidene acetone (Condensation)
    5. 1-Phenylazo-2-napthol (Diazotisation and coupling)
    6. Benzoic acid / salicylic acid (Hydrolysis of ester)
    7. M-dinitro benzene (Nitration)
    8. 9, 10 – Antharaquinone (Oxidation of anthracene) / preparation of benzoic acid from toluene or benzaldehyde
    9. M-phenylene diamine (Reduction of M-dinitrobenzene) / Aniline from nitrobenzene
    10. Benzophenone oxime
    11. Nitration of salicylic acid
    12. Preparation of picric acid
    13. Preparation of O-chlorobenzoic acid from O-chlorotolune
    14. Preparation of cyclohexanone from cyclohexanol
2. **Identification of organic compounds belonging to the following classes by :**

    Systematic qualitative organic analysis including preparation of derivatives Phenols, amides, carbohydrates, amines, carboxylic acids, aldehyde and ketones, Alcohols, esters, hydrocarbons, anilides, nitrocompounds.
3. **Introduction to the use of stereo models:**

    Methane, Ethane, Ethylene, Acetylene, Cis alkene, Trans alkene, inversion of configuration.

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Scheme of Practical Examination:

	Sessionals	**Annual**
Synopsis	05	15
Major Experiment	10	25
Minor Experiment	03	15
Viva	02	15
Max Marks	**20**	**70**
Duration	**03hrs**	**04hrs**

Note : Total sessional marks is 30 (20 for practical sessional plus 10 marks for regularity, promptness, viva-voce and record maintenance).

- PHARMACEUTICAL INORGANIC CHEMISTRY (THEORY)

Theory : 2 Hrs. /Week

1. Scope and objectives: This course mainly deals with fundamentals of Analytical chemistry and also the study of inorganic pharmaceuticals regarding their monographs and also the course deals with basic knowledge of analysis of various pharmaceuticals.

2. Upon completion of the course student shall be able to:

a. under stand the principles and procedures of analysis of drugs and also regarding the application of inorganic pharmaceuticals;
b. know the analysis of the inorganic pharmaceuticals their applications; and
c. appreciate the importance of inorganic pharmaceuticals in preventing and curing the disease.

3. Course materials: Text books

a. A text book Inorganic medicinal chemistry by Surendra N. Pandeya
b. A. H. Beckett and J. B. Stanlake's Practical Pharmaceutical chemistry Vol-I & Vol-II
c. Inorganic Pharmaceutical Chemistry III-Edition P.Gundu Rao

Reference books

a. Inorganic Pharmaceutical Chemistry by Anand & Chetwal
b. Pharmaceutical Inorganic chemistry by Dr.B.G.Nagavi
c. Analytical chemistry principles by John H. Kennedy
d. I.P.1985 and 1996, Govt. of India, Ministry of health

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4. Lecture wise programme:

Topics

1. Errors
2. Volumetric analysis
3. Acid-base titrations
4. Redox titrations
5. Non aqueous titrations
6. Precipitation titrations
7. Complexometric titrations
8. Theory of indicators
9. Gravimetry
10. Limit tests
11. Medicinal gases
12. Acidifiers
13. Antacids
14. Cathartics
15. Electrolyte replenishers
16. Essential Trace elements
17. Antimicrobials
18. Pharmaceutical aids
19. Dental Products
20. Miscellaneous compounds
21. Radio Pharmaceuticals

- PHARMACEUTICAL INORGANIC CHEMISTRY (PRACTICAL)

Practical : 3 Hrs./Week

1 Limit test (6 exercises)

(a) Limit test for chlorides
(b) Limit test for sulphates
(c) Limit test for iron
(d) Limit test for heavy metals
(e) Limit test for arsenic
(f) Modified limit tests for chlorides and sulphates

2 Assays (10 exercises)

(a) Ammonium chloride- Acid-base titration
(b) Ferrous sulphate- Cerimetry

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(c) Copper sulpahte- Iodometry
(d) Calcilugluconate- Complexometry
(e) Hydrogen peroxide – Permanganometry
(f) Sodium benzoate – Nonaqueous titration
(g) Sodium chloride – Modified volhard's method
(h) Assay of KI – KIO_3 titration
(i) Gravimetric estimation of barium as barium sulphate
(j) Sodium antimony gluconate or antimony potassium tartarate

3 Estimation of mixture (Any two exercises)
(a) Sodium hydroxide and sodium carbonate
(b) Boric acid and Borax
(c) Oxalic acid and sodium oxalate

4 Test for identity (Any three exercises)
(a) Sodium bicorbonate
(b) Barium sulphate
(c) Ferrous sulphate
(d) Potassium chloride

5 Test for purity (Any two exercises)
(a) Swelling power in Bentonite
(b) Acid neutralising capacity in aluminium hydroxide gel
(c) Ammonium salts in potash alum
(d) Adsorption power heavy Kaolin
(e) Presence of Iodates in KI

6 Preparations (Any two exercises)
(a) Boric acids
(b) Potash alum
(c) Calcium lactate
(d) Magnesium suphate

Scheme of Practical Examination :

	Sessionals	**Annual**
Synopsis	05	15
Major Experiment	10	25
Minor Experiment1&2	03	15

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Viva	02	15
Max Marks	**20**	**70**
Duration	**03hrs**	**04hrs**

Note : Total sessional marks is 30 (20 for practical sessional plus 10 marks for regularity, promptness, viva-voce and record maintenance).

- REMEDIAL MATHEMATICS/BIOLOGY (THEORY)

Theory : 3 Hrs. /Week

REMEDIAL MATHEMATICS :

1. Scope and objectives: This is an introductory course in mathematics. This subjects deals with the introduction to matrices, determinants, trigonometry, analytical geometry, differential calculus, integral calculus, differential equations, laplace transform.

2. Upon completion of the course the student shall be able to : –

a) Know Trignometry, Analytical geometry, Matrices, Determinant, Integration, Differential equation, Laplace transform and their applications;
b) solve the problems of different types by applying theory; and
c) appreciate the important applications of mathematics in pharmacy.

3. Course materials:

Text books

a) Differential calculus By Shantinarayan
b) Text book of Mathematics for second year pre-university by Prof.B.M.Sreenivas

Reference books

a) Integral calculus By Shanthinarayan
b) Engineering mathematics By B.S.Grewal
c) Trigonometry Part-I By S.L.Loney

4. Lecture wise programme :

Topics

1. **Algebra :** Determinants, Matrices
2. **Trigonometry :** Sides and angles of a triangle, solution of triangles
3. **Analytical Geometry :**Points, Straight line, circle, parabola

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4. **Differential calculus:** Limit of a function, Differential calculus, Differentiation of a sum, Product, Quotient Composite, Parametric, exponential, trigonometric and Logarithmic function. Successive differentiation, Leibnitz's theorem, Partial differentiation, Euler's theorem on homogeneous functions of two variables
5. **Integral Calculus:** Definite integrals, integration by substitution and by parts, Properties of definite integrals.
6. **Differential equations:** Definition, order, degree, variable separable, homogeneous, Linear, heterogeneous, linear, differential equation with constant coefficient, simultaneous linear equation of second order.
7. **Laplace transform:** Definition, Laplace transform of elementary functions, Properties of linearity and shifting.

BIOLOGY :

1 Scope and objectives: This is an introductory course in Biology, which gives detailed study of natural sources such as plant and animal origin. This subject has been introduces to the pharmacy course in order to make the student aware of various naturally occurring drugs and its history, sources, classification, distribution and the characters of the plants and animals. This subject gives basic foundation to Pharmacognosy.

2 Course materials: 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.Sreenivasa Naidu b. A Text book of Biology by Naidu and Murthy

c. Botany for Degree students By A.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.

3. Lecture wise programme :

Topic

PART – A

1. Introduction
2. General organization of plants and its inclusions
3. Plant tissues
4. Plant kingdom and its classification
5. Morphology of plants

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6. Root, Stem, Leaf and Its modifications
7. Inflorescence and Pollination of flowers
8. Morphology of fruits and seeds
9. Plant physiology
10. Taxonomy of Leguminosae, umbelliferae, Solanaceae, Lilliaceae, Zinziberaceae, Rubiaceae
11. Study of Fungi, Yeast, Penicillin and Bacteria

PART-B

1 Study of Animal cell
2 Study animal tissues
3 Detailed study of frog
4 Study of Pisces, Raptiles, Aves
5 Genearal organization of mammals
6 Study of poisonous animals

1.6 - BIOLOGY (PRACTICAL)

Practical : 3 Hrs./Week

Title:

1. Introduction of biology experiments
2. Study of cell wall constituents and cell inclusions
3. Study of Stem modifications
4. Study of Root modifications
5. Study of Leaf modifications
6. Identification of Fruits and seeds
7. Preparation of Permanent slides
8. T.S. of Senna, Cassia, Ephedra, Podophyllum.
9. Simple plant physiological experiments
10. Identification of animals
11. Detailed study of Frog
12. Computer based tutorials

Scheme of Practical Examination :

	Sessionals	**Annual**
Identification	04	10
Synopsis	04	10
Major Experiment	07	20
Minor Experiment	03	15

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Viva	02	15
Max Marks	**20**	**70**
Duration	**03hrs**	**04hrs**

Note : Total sessional marks is 30 (20 for practical sessional plus 10 marks for regularity, promptness, viva-voce and record maintenance.

SECOND YEAR

- PATHOPHYSIOLOGY (THEORY)

Theory : 3 Hrs. /Week

1. **Scope of the Subject:** This course is designed to impart a thorough knowledge of the relevant aspects of pathology of various conditions with reference to its pharmacological applications, and understanding of basic Pathophysiological mechanisms. Hence it will not only help to study the syllabus of pathology, but also to get baseline knowledge of its application in other subject of pharmacy.
2. **Objectives of the Subject :** Upon completion of the subject student shall be able to
   a) describe the etiology and pathogenesis of the selected disease states;
   b) name the signs and symptoms of the diseases; and
   c) mention the complications of the diseases.

Text books (Theory)

a) Pathologic basis of disease by- Cotran, Kumar, Robbins
b) Text book of Pathology- Harsh Mohan
c) Text book of Pathology- Y.M. Bhinde

Reference books (Theory)

a) Clinical Pharmacy and Therapeutics; Second edition; Roger Walker; Churchill Livingstone publication

3. Detailed syllabus and lecture wise schedule: Chapter

1. Basic principles of cell injury and Adaptation

a) Causes, Pathogenesis and morphology of cell injury
b) Abnormalities in lipoproteinaemia, glycogen infiltration and glycogen infiltration and glycogen infiltration and glycogen storage diseases

2. Inflammation

a) Pathogenesis of acute inflammation, Chemical mediators in inflammation, Types of chronic inflammation

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b) Repairs of wounds in the skin, factors influencing healing of wounds

3. Diseases of Immunity

a) Introduction to Tand B cells
b) MHC proteins or transplantation antigens
c) Immune tolerance

- Hypersensitivity

Hypersensitivity type I, II, III, IV, Biological significance, Allergy due to food, chemicals and drugs

- Autoimmunity

Criteria for autoimmunity, Classifications of autoimmune diseases in man, mechanism of autoimmunity, Transplantation and immunologic tolerance, allograft rejections, transplantation antigens, mechanism of rejection of allograft.

- Acquired immune deficiency syndrome (AIDS)
- Amylodosis

4. **Cancer:** differences between benign and malignant tumors, Histological diagnosis of malignancy, invasions and metastasis, patterns of spread, disturbances of growth of cells, classification of tumors, general biology of tumors, spread of malignant tumors, etiology and pathogenesis of cancer.

5. Types of shock, mechanisms, stages and management

6. Biological effects of radiation

7. Environmental and nutritional diseases
   i. Air pollution and smoking- SO2,NO, NO2, and CO
   ii. Protein calorie malnutrition, vitamins, obesity, pathogenesis of starvation.

8. Pathophysiology of common diseases
   a. Parkinsonism
   b. Schizophrenia
   c. Depression and mania
   d. Hypertension,
   e. Stroke (ischaemic and hemorrhage)
   f. Angina, CCF, Atherosclerosis, Myocardial infarction
   g. Diabetes Mellitus
   h. Peptic ulcer and inflammatory bowel diseases

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i. Cirrhosis and Alcoholic liver diseases
j. Acute and chronic renal failure
k. Asthma and chronic obstructive airway diseases

9. Infectious diseases :
Sexually transmitted diseases (HIV,Syphilis,Gonorrhea), Urinary tract infections, Pneumonia, Typhoid, Tuberculosis, Leprosy, Malaria Dysentery (bacterial and amoebic), Hepatitis- infective hepatitis.

4. Assignments :

Title of the Experiment

1. Chemical Mediators of inflammation
2. Drug Hypersensitivity
3. Cigarette smoking & its ill effects
4. Biological Effects of Radiation
5. Etiology and hazards of obesity
6. Complications of diabetes
7. Diagnosis of cancer
8. Disorders of vitamins
9. Methods in Pathology-Laboratory values of clinical significance
10. Pathophysiology of Dengue Hemorrhagic Fever (DHF)

Format of the assignment

1 Minimum & Maximum number of pages.
2. Reference(s) shall be included at the end.
3. Assignment can be a combined presentation at the end of the academic year
4. It shall be computer draft copy.
5. Name and signature of the student
6. Time allocated for presentation may be 8+2 Min.

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- PHARMACEUTICAL MICROBIOLOGY (THEORY)

Theory : 3 Hrs. /Week

1 **Scope of the Subject:** Microbiology has always been an essential component of pharmacy curriculum. This is because of the relevance of microbiology to pharmaceutical sciences and more specifically to pharmaceutical industry. Pharmaceutical biotechnology is the logical extension of pharmaceutical microbiology, which is expected to change the complete drug product scenario in the future.

This course deals with the various aspects of microorganisms, its classification, morphology, laboratory cultivation identification and maintenance. Its also discusses with sterilization of pharmaceutical products, equipment, media etc. The course further discusses the immunological preparations, diseases its transmission, diagnosis, control and immunological tests.

2 **Objectives of the Subject :**

Upon completion of the subject student shall be able to –

a. know the anatomy, identification, growth factors and sterilization of microorganisms;
b. know the mode of transmission of disease causing microorganism, symptoms of disease, and treatment aspect;
c. do estimation of RNA and DNA and there by identifying the source;
d. do cultivation and identification of the microorganisms in the laboratory;
e. do identification of diseases by performing the diagnostic tests; and
f. appreciate the behavior of motility and behavioral characteristics of microorganisms.

Text books (Theory)

a. Vanitha Kale and Kishor Bhusari " Applied Microbiology " Himalaya Publishing house Mumbai.
b. Mary Louis Turgeon " Immunology and Serology in Laboratory Medicines" 2nd edition, 1996 Mosby- Year book inc St. Louis Missouri 63146.
c. Harsh Mohan, " Text book of Pathology" 3rd edition, 1998, B-3 Ansari road Darya ganj N. Delhi.

Reference books (Theory)

a. Prescot L.M., Jarley G.P Klein D.A "Microbiology" 2nd- edition Mc Graw Hill Company Inc

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b. Rawlins E.A."Bentley's Text Book of Pharmaceutics" B ailliere Tindals 24-28 London 1988
c. Forbisher " Fundamentals of Microbiology" Philidelphia W.B. Saunders.
d. Prescott L.M. Jarley G.P., Klein.D.A. " Microbiology."2nd edition WMC Brown Publishers, Oxford. 1993
e. War Roitt, Jonathan Brostoff, David male, " Immunology"3rd edition 1996, Mosby-year book Europe Ltd, London.
f. Pharmacopoeia of India, Govt of India, 1996.

3. Detailed syllabus and lecture wise schedule :

Title of the topic

1. Introduction to the science of microbiology. Major divisions of microbial world and Relationship among them.

2. Different methods of classification of microbes and study of Bacteria, Fungi, virus, Rickettsiae, Spirochetes

3. Nutritional requirements, growth and cultivation of bacteria and virus. Study of different important media required for the growth of aerobic and anaerobic bacteria & fungi. Differential media, enriched media and selective media, maintenance of lab cultures.

4. Different methods used in isolation and identification of bacteria with emphasis to different staining techniques and biochemical reactions. Counting of bacteria -Total and Viable counting techniques.

5. Detailed study of different methods of sterilization including their merits and demerits. Sterilization methods for all pharmaceutical products. Detailed study of sterility testing of different pharmaceutical preparations. Brief information on Validation.

6. Disinfectants- Study of disinfectants, antiseptics, fungicidal and virucidal agents factors affecting their activation and mechanism of action. Evaluation of bactericidal, bacteristatic, , virucidal activities, evaluation of preservatives in pharmaceutical preparations.

7. Immunology- Immunity, Definition, Classification, General principles of natural immunity, Phagocytosis, acquired immunity(active and passive) . Antigens,

chemical nature of antigens structure and formation of Antibodies, Antigen-Antibody reactions. Bacterial exotoxins and endotoxins. Significance of toxoids in active immunity, Immunization programme, and importance of booster dose.

8. Diagnostic tests : Schick's Test, Elisa test, Western Blot test, Southern Blot PCR Widal, QBC, Mantaux Peripheral smear. Study of malarial parasite.

9. Microbial culture sensitivity Testing: Interpretation of results Principles and methods of different microbiological assays, microbiological assay of Penicillin, Streptomycin and vitamin B_2 and B_{12}. Standardisation of vaccines and sera.

10. Study of infectious diseases: Typhoid, Tuberculosis, Malaria, Cholera, Hepatitis, Meningitis, Syphilis & Gonorrhea and HIV.

- PHARMACEUTICAL MICROBIOLOGY (PRACTICAL)

Practical : 3 Hrs./Week

Title of the Experiment:

1. Study of apparatus used in experimental microbiology*.
2. Sterilisation of glass ware's. Preparation of media and sterilisation.*
3. Staining techniques – Simple staining ; Gram's staining ; Negative staining**
4. Study of motility characters*.
5. Enumeration of micro-organisms (Total and Viable)*
6. Study of the methods of isolation of pure culture.*
7. Bio chemical testing for the identification of micro*-organisms.
8. Cultural sensitivity testing for some micro-organisms.*
9. Sterility testing for powders and liquids.*
10. Determination of minimum inhibitory concentration.*
11. Microbiological assay of antibiotics by cup plate method.*
12. Microbiological assay of vitamins by Turbidometric method**
13. Determination of RWC.**
14. Diagnostic tests for some common diseases, Widal, malarial parasite.**

*Indicate minor experiment & ** indicate major experiment

Assignments:

1 Visit to some pathological laboratories & study the activities and equipment/ instruments used and reporting the same.

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2. Visit to milk dairies (Pasturization) and microbial laboratories(other sterization methods) & study the activities and equipment/instruments used and reporting the same.
3. Library assignments
   a. Report of recent microbial techniques developed in diagnosing some common diseases.
   b. Latest advancement developed in identifying, cultivating & handling of microorganisms.

Format of the assignment:

a. Minimum & Maximum number of pages.
b. It shall be computer draft copy.
c. Reference(s) shall be included at the end.
d. Name and signature of the student.
e. Assignment can be a combined presentation at the end of the academic year.
f. Time allocated for presentation may be 8+2 Min.

Scheme of Practical Examination:

	Sessionals	**Annual**
Synopsis	05	15
Major Experiment	10	25
Minor Experiment	03	15
Viva	02	15
Max Marks	**20**	**70**
Duration	**03hrs**	**04hrs**

Note : Total sessional marks is 30 (20 for practical sessional plus 10 marks for regularity, promptness, viva-voce and record maintenance).

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- PHARMACOGNOSY & PHYTOPHARMACEUTICALS (THEORY)

Theory : 3 Hrs. /Week

1. Scope and objectives: This subject has been introduced for the pharmacy course in order to make the student aware of medicinal uses of various naturally occurring drugs its history, sources, distribution, method of cultivation, active constituents, medicinal uses, identification tests, preservation methods, substitutes and adulterants.

2. Upon completion of the course student shall be able to:

a. under stand the basic principles of cultivation, collection and storage of crude drugs;
b. know the source, active constituents and uses of crude drugs; and
c. appreciate the applications of primary and secondary metabolites of the plant.

3. Course materials:

Text books

a. Pharmacognosy by G.E. Trease & W.C.Evans.
b. Pharmacognosy by C.K.Kokate,Gokhale & A.C.Purohit.

Reference books

a. Pharmacognosy by Brady &Tyler.E.
b. Pharmacognosy by T.E.Wallis.
c. Pharmacognosy by C.S. Shah & Qadery.
d. Pharmacognosy by M.A. Iyengar.

4. Lecture wise programme:

Topics

1. Introduction.
2. Definition, history and scope of Pharmacognosy.
3. Classification of crude drugs.
4. Cultivation, collection, processing and storage of crude drugs.
5. Detailed method of cultivation of crude drugs.
6. Study of cell wall constituents and cell inclusions.

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7. Microscopical and powder Microscopical study of crude drugs.
8. Study of natural pesticides.
9. Detailed study of various cell constituents.
10. Carbohydrates and related products.
11. Detailed study carbohydrates containing drugs.(11 drugs)
12. Definition sources, method extraction, chemistry and method of analysis of lipids.
13. Detailed study of oils.
14. Definition, classification, chemistry and method of analysis of protein.
15. Study of plants fibers used in surgical dressings and related products.
16. Different methods of adulteration of crude drugs.

PHARMACOGNOSY & PHYTOPHARMACEUTICALS (PRACTICAL)

Practical : 3 Hrs./Week

General Requirements: Laboratory Napkin, Observation Book 150 pages Zero brush, Needle, Blade, Match box.

List of experiments:

1. Introduction of Pharmacognosy laboratory and experiments.
2. Study of cell wall constituents and cell inclusions.
3. Macro, powder and microscopic study of Datura.
4. Macro, powder and microscopic study of Senna.
5. Macro, powder and microscopic study of Cassia.cinnamon.
6. Macro, powder and microscopic study of Cinchona.
7. Macro, powder and microscopic study of Ephedra.
8. Macro, powder and microscopic study of Quassia.
9. Macro, powder and microscopic study of Clove
10. Macro, powder and microscopic study of Fennel.
11. Macro, powder and microscopic study of Coriander.
12. Macro, powder and microscopic study of Isapgol.
13. Macro, powder and microscopic study of Nux vomica.
14. Macro, powder and microscopic study of Rauwolfia.
15. Macro, powder and microscopic study of Liquorice.

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16. Macro, powder and microscopic study of Ginger.
17. Macro, powder and microscopic study of Podophyllum.
18. Determination of Iodine value.
19. Determination of Saponification value and unsaponifiable matter.
20. Determination of ester value.
21. Determination of Acid value.
22. Chemical tests for Acacia.
23. Chemical tests for Tragacanth.
24. Chemical tests for Agar.
25. Chemical tests for Starch.
26. Chemical tests for Lipids.(castor oil,sesame oil, shark liver oil,bees wax)
27. Chemical tests for Gelatin.

Scheme of Practical Examination:

	Sessionals	**Annual**
Identification	04	10
Synopsis	04	10
Major Experiment	07	20
Minor Experiment	03	15
Viva	02	15
Max Marks	**20**	**70**
Duration	**03hrs**	**04hrs**

Note : Total sessional marks is 30 (20 for practical sessional plus 10 marks for regularity, promptness, viva-voce and record maintenance.

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- PHARMACOLOGY – I (THEORY)

Theory : 3 Hrs. /Week

1. Scope of the Subject: This subject will provide an opportunity for the student to learn about the drug with regard to classification, pharmacodynamic and pharmacokinetic aspects, adverse effects, uses, dose, route of administration, precautions, contraindications and interaction with other drugs. In this subject, apart from general pharmacology, drugs acting on autonomic nervous system, cardiovascular system, central nervous system, blood and blood forming agents and renal system will be taught. In addition to theoretical knowledge, the basic practical knowledge relevant to therapeutics will be imparted.

2. Objectives of the Subject : Upon completion of the subject student shall be able to (Know, do, appreciate) –

a. understand the pharmacological aspects of drugs falling under the above mentioned chapters;
b. handle and carry out the animal experiments;
c. appreciate the importance of pharmacology subject as a basis of therapeutics; and
d. correlate and apply the knowledge therapeutically.

Text books (Theory) (Author, Title, Edition, Publication Place, Publisher, Year of Publication)

a. Tripathi, K. D. Essentials of medical pharmacology. 4th Ed, 1999. Publisher: Jaypee, Delhi.
b. Satoskar, R.S. and Bhadarkar, S.D. Pharmacology and pharmacotherapeutics. 16th edition (single volume), 1999. Publisher: Popular, Dubai.
c. Rang, H.P. & Dale, M.M. Pharmacology. 4th edition, 1999. Publisher: Churchill Living stone.

Reference books (Theory)(Author, Title, Edition, Publication Place, Publisher, Publication Year)

a. Goodman Gilman, A., Rall, T.W., Nies, A.I.S. and Taylor, P. Goodman and Gilman's The pharmacological Basis of therapeutics. 9th Ed, 1996. Publisher Mc Graw Hill, Pergamon press.
b. Craig, C.R.&Stitzel, R.E. Modern Pharmacology. Latest edition. Publisher: Little Brown.Co
c. Katzung, B.G. Basic and clinical pharmacology. Latest edition. Publisher: Prentice Hall, Int.

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d. Shargel and Leon. Applied Biopharmaceutics and pharmacokinetics. Latest edition. Publisher: Prentice Hall, London.

Text books (Practical) :

a. Kulkarni, S. K. and Dandia, P. C. Hand book of experimental pharmacology. Latest edition, Publisher: Vallab, Delhi.

Reference books (Practical)

a. Macleod, L.J. Pharmacological experiments on intact preparations. Latest edition, Publisher: Churchill livingstone.
b. Macleod, L.J. Pharmacological experiments on isolated preparations. Latest edition, Publisher: Churchill livingstone.
c. Ghosh, M.N. Fundamentals of experimental pharmacology. Latest edition, Publisher: Scientific book agency, Kolkata.
d. Ian Kitchen. Textbook of in vitro practical pharmacology. Latest edition, Publisher: Black well Scientific.

3. Detailed syllabus and lecture wise schedule : Title of the topic

1. General Pharmacology

a. Introduction, definitions and scope of pharmacology
b. Routes of administration of drugs
c. Pharmacokinetics (absorption, distribution, metabolism and excretion)
d. Pharmacodynamics
e. Factors modifying drug effects
f. Drug toxicity - Acute, sub- acute and chronic toxicity.
g. Pre-clinical evaluations
h. Drug interactions

Note: The term Pharmacology used here refers to the classification, mechanism of action, pharmacokinetics, pharmacodynamics, adverse effects, contraindications, Therapeutic uses, interactions and dose and route of administration.

2. Pharmacology of drugs acting on ANS

a. Adrenergic and antiadrenergic drugs
b. Cholinergic and anticholinergic drugs
c. Neuromuscular blockers
d. Mydriactics and miotics
e. Drugs used in myasthenia gravis
f. Drugs used in Parkinsonism

3. Pharmacology of drugs acting on cardiovascular system

a. Antihypertensives
b. Anti-anginal drugs
c. Anti-arrhythmic drugs
d. Drugs used for therapy of Congestive Heart Failure
e. Drugs used for hyperlipidaemias

4. Pharmacology of drugs acting on Central Nervous System

a. General anesthetics
b. Sedatives and hypnotics
c. Anticonvulsants
d. Analgesic and anti-inflammatory agents
e. Psychotropic drugs
f. Alcohol and methyl alcohol
g. CNS stimulants and cognition enhancers
h. Pharmacology of local anaesthetics

5. Pharmacology of Drugs acting on Respiratory tract

a. Bronchodilators
b. Mucolytics
c. Expectorants
d. Antitussives
e. NasalDecongestants

6. Pharmacology of Hormones and Hormone antagonists

a. Thyroid and Antithyroid drugs
b. Insulin, Insulin analogues and oral hypoglycemic agents
c. Sex hormones and oral contraceptives
d. Oxytocin and other stimulants and relaxants

7. Pharmacology of autocoids and their antagonists

a. Histamines and Antihistaminics
b. 5-Hydroxytryptamine and its antagonists
c. Lipid derived autocoids and platelet activating factor

- COMMUNITY PHARMACY (THEORY)

Theory : 2 Hrs. /Week

1 Scope: In the changing scenario of pharmacy practice in India, Community Pharmacists are expected to offer various pharmaceutical care services. In order to meet this demand, students will be learning various skills such as dispensing of drugs, responding to minor ailments by providing suitable safe medication, patient counselling, health screening services for improved patient care in the community set up.

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

a. know pharmaceutical care services;
b. know the business and professional practice management skills in community pharmacies;
c. do patient counselling & provide health screening services to public in community pharmacy;
d. respond to minor ailments and provide appropriate medication;
e. show empathy and sympathy to patients; and
f. appreciate the concept of Rational drug therapy.

Text Books:

a. Health Education and Community Pharmacy by N.S.Parmar.
b. WHO consultative group report.
c. Drug store & Business management by Mohammed Ali & Jyoti.

Reference books:

a. Handbook of pharmacy – health care.Edt. Robin J Harman. The Pharmaceutical press.
b. Comprehensive Pharmacy Review – Edt. Leon Shargel. Lippincott Williams & Wilkins.

Special requirements:

1 Either the college is having model community pharmacy (meeting the schedule N requirement) or sign MoU with at least 4-5 community pharmacies nearby to the college for training the students on dispensing and counselling activities.
2 Special equipments like B.P apparatus, Glucometer, Peak flow meter, and apparatus for cholesterol estimation.

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3. Scheme of evaluation (80 Marks)

1.	Synopsis	10
2.	Major Experiment (Counselling of patients with specific diseases – emphasis should be given on Counselling introduction, content, process and conclusion)	30
3.	Minor Experiment(Ability to measure B.P/ CBG / Lung function)	15
4.	Prescription Analysis (Analyzing the prescriptions for probable drug interaction and ability to tell the management)	15
5.	Viva – Voce	10

4. Lecture wise programme :

Topics

1 Definition, scope, of community pharmacy
Roles and responsibilities of Community pharmacist

2 Community Pharmacy Management

a. Selection of site, Space layout, and design
b. Staff, Materials- coding, stocking
c. Legal requirements
d. Maintenance of various registers
e. Use of Computers: Business and health care soft wares

3 Prescriptions – parts of prescription, legality & identification of medication related problems like drug interactions.

4 Inventory control in community pharmacy
Definition, various methods of Inventory Control
ABC, VED, EOQ, Lead time, safety stock

5 Pharmaceutical care
Definition and Principles of Pharmaceutical care.

6 Patient counselling
Definition, outcomes, various stages, barriers, Strategies to overcome barriers
Patient information leaflets- content, design, & layouts, advisory labels

7 Patient medication adherence
Definition, Factors affecting medication adherence, role of pharmacist in improving the adherence.

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8 Health screening services

Definition, importance, methods for screening Blood pressure/ blood sugar/ lung function and Cholesterol testing

9 OTC Medication- Definition, OTC medication list & Counselling

10 Health Education

WHO Definition of health, and health promotion, care for children, pregnant & breast feeding women, and geriatric patients.

Commonly occurring Communicable Diseases, causative agents,

Clinical presentations and prevention of communicable diseases – Tuberculosis, Hepatitis, Typhoid, Amoebiasis, Malaria, Leprosy,

Syphilis, Gonorrhea and AIDS

Balance diet, and treatment & prevention of deficiency disorders Family planning – role of pharmacist

11 Responding to symptoms of minor ailments

Relevant pathophysiology, common drug therapy to,

Pain, GI disturbances (Nausea, Vomiting, Dyspepsia, diarrhea, constipation), Pyrexia, Opthalmic symptoms, worms infestations.

12 Essential Drugs concept and Rational Drug Therapy Role of community pharmacist

13 Code of ethics for community pharmacists

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- PHARMACOTHERAPEUTICS - I (THEORY)

Theory : 3 Hrs. /Week

1. **Scope of the Subject:** This course is designed to impart knowledge and skills necessary for contribution to quality use of medicines. Chapters dealt cover briefly pathophysiology and mostly therapeutics of various diseases. This will enable the student to understand the pathophysiology of common diseases and their management.

2. **Objectives:** At completion of this subject it is expected that students will be able to understand –
   a. the pathophysiology of selected disease states and the rationale for drug therapy;
   b. the therapeutic approach to management of these diseases;
   c. the controversies in drug therapy;
   d. the importance of preparation of individualised therapeutic plans based on diagnosis;
   e. needs to identify the patient-specific parameters relevant in initiating drug therapy, and monitoring therapy (including alternatives, time-course of clinical and laboratory indices of therapeutic response and adverse effects);
   f. describe the pathophysiology of selected disease states and explain the rationale for drug therapy;
   g. summarise the therapeutic approach to management of these diseases including reference to the latest available evidence;
   h. discuss the controversies in drug therapy;
   i. discuss the preparation of individualised therapeutic plans based on diagnosis; and
   j. identify the patient-specific parameters relevant in initiating drug therapy, and monitoring therapy (including alternatives, time-course of clinical and laboratory indices of therapeutic response and adverse effects).

Text Books

a. Clinical Pharmacy and Therapeutics - Roger and Walker, Churchill Livingstone publication.
b. Pharmacotherapy: A Pathophysiologic approach - Joseph T. Dipiro et al. Appleton & Lange.

Reference Books

a. Pathologic basis of disease - Robins SL, W.B.Saunders publication.

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b. Pathology and therapeutics for Pharmacists: A Basis for Clinical Pharmacy Practice - Green and Harris, Chapman and Hall publication.
c. Clinical Pharmacy and Therapeutics - Eric T. Herfindal, Williams and Wilkins Publication.
d. Applied Therapeutics:The clinical Use of Drugs. Lloyd Young and Koda-Kimble MA
e. Avery's Drug Treatment, 4th Edn, 1997, Adis International Limited.
f. Relevant review articles from recent medical and pharmaceutical literature.

3. Detailed syllabus and lecture wise schedule :

Etiopathogenesis and pharmacotherapy of diseases associated with following systems/ diseases

Title of the topic

1 **Cardiovascular system:** Hypertension, Congestive cardiac failure, Angina Pectoris, Myocardial infarction, , Hyperlipidaemias , Electrophysiology of heart and Arrhythmias

2 **Respiratory system :** Introduction to Pulmonary function test, Asthma, Chronic obstructive airways disease, Drug induced pulmonary diseases **Endocrine system :** Diabetes, Thyroid diseases, Oral contraceptives, Hormone replacement therapy, Osteoporosis

3 **General prescribing guidelines for**

i. Paediatric patients
ii. Geriatric patients
iii. Pregnancy and breast feeding

4 **Ophthalmology:** Glaucoma, Conjunctivitis- viral & bacterial

5 **Introduction to rational drug use**

Definition, Role of pharmacist Essential drug concept Rational drug formulations

2.6 - PHARMACOTHERAPEUTICS - I (PRACTICAL)

Practical : 3 Hrs./Week

Practicals :

Hospital postings in various departments designed to complement the lectures by providing practical clinical discussion; attending ward rounds; follow up the progress and changes made in drug therapy in allotted patients; case presentation upon discharge. Students are required to maintain a record of cases presented and the same should be submitted at the end of the course for evaluation. A minimum of 20 cases should be presented and recorded covering most common diseases.

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Assignments :

Students are required to submit written assignments on the topics given to them. Topics allotted should cover recent developments in drug therapy of various diseases. A minimum of THREE assignments [1500 – 2000 words] should be submitted for evaluation.

Format of the assignment:

1 Minimum & Maximum number of pages.
2 Reference(s) shall be included at the end.
3 Assignment can be a combined presentation at the end of the academic year.
4 It shall be computer draft copy.
5 Name and signature of the student.
6 Time allocated for presentation may be 8+2 Min.

Scheme of Practical Examination:

	Sessionals	**Annual**
Synopsis	05	15
Major Experiment	10	25
Minor Experiment	03	15
Viva	02	15
Max Marks	**20**	**70**
Duration	**03hrs**	**04hrs**

Note : Total sessional marks is 30 (20 for practical sessional plus 10 marks for regularity, promptness, viva-voce and record maintenance).

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THIRD YEAR

3.1 - PHARMACOLOGY – II (THEORY)

Theory : 3 Hrs. /Week

1. **Scope of the Subject:** This subject will provide an opportunity for the student to learn about the drug with regard to classification, pharmacodynamic and pharmacokinetic aspects, adverse effects, uses, dose, route of administration, precautions, contraindications and interaction with other drugs. In this subject, drugs acting on autacoids, respiratory system, GIT, immune system and hormones, and pharmacology of autocoids and hormones will be concentrated. In addition, pharmacology of chemotherapeutic agents, vitamines, essential minerals and principles of toxicology are also taught. In addition to theoretical knowledge, the basic practical knowledge relevant to therapeutics will be imparted.

2. **Objectives of the Subject Upon completion of the subject student shall be able to:**
   a. understand the pharmacological aspects of drugs falling under the above mentioned chapters,
   b. carry out the animal experiments confidently,
   c. appreciate the importance of pharmacology subject as a basis of therapeutics, and
   d. correlate and apply the knowledge therapeutically.

Text books (Theory)

1. Tripathi, K. D. Essentials of medical pharmacology. 4th edition, 1999. Publisher: Jaypee, Delhi.
2. Satoskar, R.S. and Bhadarkar, S.D. Pharmacology and pharmacotherapeutics. 16th edition (single volume), 1999. Publisher: Popular, Dubai.
3. Rang, H.P. and Dale, M.M. Pharmacology. 4th edition, 1999. Publisher: Churchill Living stone.

Reference books (Theory)

1 Goodman Gilman, A., Rall, T.W., Nies, A.I.S. and Taylor, P. Goodman and Gilman's The pharmacological Basis of therapeutics. 9th edition, 1996. Publisher: Mc Graw Hill, Pergamon press.

2 Craig, C.R. and Stitzel, R.E. Modern Pharmacology. Latest edition. Publisher: Little Brown and company.

3 Katzung, B.G. Basic and clinical pharmacology. Latest edition. Publisher: Prentice Hall, International.

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4 Gupta, P.K. and Salunkhe, D.K. Modern Toxicology. Volume I, II and III. Latest edition. Publisher: B.V. Gupta, Metropolitan Book Co. (p) Ltd, New Delhi.

Text books (Practical)

1 Kulkarni, S. K. and Dandia, P. C. Hand book of experimental pharmacology. Latest edition, Publisher: Vallab, Delhi.

Reference books (Practical) :

1 Macleod, L.J. Pharmacological experiments on intact preparations. Latest edition, Publisher: Churchill livingstone.
2 Macleod, L.J. Pharmacological experiments on isolated preparations. Latest edition, Publisher: Churchill livingstone.
3 Ghosh, M.N. Fundamentals of experimental pharmacology. Latest edition, Publisher: Scientific book agency, Kolkata.
4 Ian Kitchen. Textbook of in vitro practical pharmacology. Latest edition, Publisher: Black well Scientific.

3. Detailed syllabus and lecture wise schedule:

Title of the topic

1 Pharmacology of Drugs acting on Blood and blood forming agents

a. Anticoagulants
b. Thrombolytics and antiplatelet agents
c. Haemopoietics and plasma expanders

2 Pharmacology of drugs acting on Renal System

a. Diuretics
b. Antidiuretics

3 Chemotherapy

a. Introduction
b. Sulfonamides and co-trimoxazole
c. Penicillins and Cephalosporins
d. Tetracyclins and Chloramphenicol
e. Macrolides, Aminoglycosides, Polyene & Polypeptide antibiotics
f. Quinolines and Fluroquinolines
g. Antifungal antibiotics
h. Antiviral agents
i. Chemotherapy of tuberculosis and leprosy

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j. Chemotherapy of Malaria
k. Chemotherapy of protozoal infections (amoebiasis, Giardiasis)
l. Pharmacology of Anthelmintic drugs
m. Chemotherapy of cancer (Neoplasms)

4 Immunopharmacology

Pharmacology of immunosuppressants and stimulants

5 Principles of Animal toxicology Acute, sub acute and chronic toxicity

6 The dynamic cell: The structures and functions of the components of the cell

a. Cell and macromolecules: Cellular classification, subcellular organelles, macromolecules, large macromolecular assemblies
b. Chromosome structure: Pro and eukaryotic chromosome structures, chromatin structure, genome complexity, the flow of genetic information.
c. DNA replication: General, bacterial and eukaryotic DNA replication.
d. The cell cycle: Restriction point, cell cycle regulators and modifiers.
e. Cell signaling: Communication between cells and their environment, ion-channels, signal transduction pathways (MAP kinase, P38 kinase, JNK, Ras and PI3-kinase pathways, biosensors.

The Gene: Genome structure and function:

a. Gene structure: Organization and elucidation of genetic code.
b. Gene expression: Expression systems (pro and eukaryotic), genetic elements that control gene expression (nucleosomes, histones, acetylation, HDACS, DNA binding protein families.
c. Transcription and Transcription factors: Basic principles of transcription in pro and eukaryotes. Transcription factors that regulate transcription in pro and eukaryotes.

   RNA processing: rRNA, tRNA and mRNA processing.

   Protein synthesis: Mechanisms of protein synthesis, initiation in eukaryotes, translation control and post-translation events

   Altered gene functions: Mutations, deletions, amplifications, LOH, traslocations, trinucleotide repeats and other genetic abnormalities. Oncogenes and tumor suppressor genes.

   The gene sequencing, mapping and cloning of human disease genes.

   Introduction to gene therapy and targeting.

   Recombinant DNA technology: principles. Processes (gene transfer technology) and applications

Books:

1 Molecular Biology of the Cell by Alberts B., Bray, D., Lewis, J., Raff M., Roberts, K and Watson, JD, 3rd edition.

2 Molecular Cell Biology By Lodish, H., Baltimore, D., Berk, A et al., 5th edition.

3 Molecular Biology by Turner, PC., McLennan, AG., Bates, AD and White MRH 2nd edition.

4 Genes VIII by Lewin, B., (2004)

5 Pharmaceutical Biotechnology, by Crommelin, DJA and Sindelar RD (1997)

6 Recombinant DNA by Watson, JD., Gilman, M., et al., (1996)

7 Biopharmaceutical: Biochemistry and Biotechnology by Walsh, G., (1998)

- PHARMACOLOGY – II (PRACTICAL)

Practical : 3 Hrs./Week

List of Experiments:

1 Study of laboratory animals and their handling (a. Frogs, b. Mice, c. Rats, d. Guinea pigs, e. Rabbits).

2 Study of physiological salt solutions used in experimental pharmacology.

3 Study of laboratory appliances used in experimental pharmacology.

4 Study of use of anesthetics in laboratory animals.

5 To record the dose response curve of Ach using isolated ileum/rectus abdominis muscle preparation.

6 To carry out bioassay of Ach using isolated ileum/rectus abdominis muscle preparation by interpolation method.

7 To carry out bioassay of Ach using isolated ileum/rectus abdominis muscle preparation by three point method.

8 To record the dose response curve of Histamine using isolated guinea-pig ileum preparation.

9 Study of agonistic and antagonistic effects of drugs using isolated guinea-pig ileum preparation.

10 To carry out bioassay of Histamine using isolated guinea-pig ileum preparation by interpolation method.

11 To carry out bioassay of Histamine using guinea-pig ileum preparation by three point method.

12 To study the routes of administration of drugs in animals (Rats, Mice, Rabbits).

13 Study of theory, principle, procedure involved and interpretation of given results for the following experiments:

   a. Analgesic property of drug using analgesiometer.

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b. Antiinflammatory effect of drugs using rat-paw edema method.
c. Anticonvulsant activity of drugs using maximal electroshock and pentylene tetrazole methods.
d. Antidepressant activity of drugs using pole climbing apparatus and pentobarbitone induced sleeping time methods.
e. Locomotor activity evaluation of drugs using actophotometer and rotorod.
f. Cardiotonic activity of drugs using isolated frog heart and mammalian heart preparations.

Scheme of Practical Examination:

	Sessionals	**Annual**
Identification	02	10
Synopsis	04	10
Major Experiment (Bioassay)	08	30
Minor Experiment (Interpretation of given Graph or simulated experiment)	04	10
Viva	02	10
Max Marks	**20**	**70**
Duration	**3hrs**	**4hrs**

Note : Total sessional marks is 30 (20 for practical sessional plus 10 marks for regularity, promptness, viva-voce and record maintenance).

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- PHARMACEUTICAL ANALYSIS (THEORY)

Theory : 3 Hrs. /Week

Detailed syllabus and Lecture wise schedule

1. Quality Assurance:

a. Introduction, sources of quality variation, control of quality variation.
b. Concept of statistical quality control.
c. Validation methods- quality of equipment, validation of equipment and validation of analytical instruments and calibration.
d. GLP, ISO 9000.
e. Total quality management, quality review and documentation.
f. ICH- international conference for harmonization-guidelines.
g. Regulatory control.

2. Chromatography:

Introduction, history, classification, separation techniques, choice of methods. The following techniques be discussed with relevant examples of pharmaceutical products involving principles and techniques of separation of drugs from excipients.

a. **Column Chromatography**: Adsorption column chromatography, Operational technique, frontal analysis and elution analysis. Factors affecting column efficiency, applications and partition chromatography.
b. **TLC**: Introduction, principle, techniques, R_f value and applications.
c. **PC:** Introduction, principle, types of paper chromatography, preparation techniques, development techniques, applications.
d. **Ion-exchange chromatography**: Introduction, principles, types of ion exchange synthetic resins, physical properties, factors affecting ion exchange, methodology and applications.
e. **HPLC**: Introduction, theory, instrumentation, and applications.
f. **HPTLC**: Introduction, theory, instrumentation, and applications.
g. **Gas Chromatography**: Introduction, theory, instrumentation-carrier gases, types of columns, stationary phases in GLC & GSC. Detectors-Flame ionization detectors, electron capture detector, thermal

a. conductivity detector. Typical gas chromatogram, derivatisation techniques, programmed temperature gas chromatography, applications.

h. **Electrophoresis**: Principles of separation, equipment for paper and gel electrophoresis, and application.

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i. **Gel filtration** and **affinity chromatography**: Introduction, technique, applications.

3. Electrometric Methods:

Theoretical aspects, instrumentation, interpretation of data/spectra and analytical applications be discussed on the following topics.

a. **Potentiometry**: Electrical potential, electrochemical cell, reference electrodes, indicator electrodes, measurement of potential and pH, construction and working of electrodes, Potentiometric titrations, methods of detecting end point, Karl Fischer titration.
b. **Conductometry**: Introduction, conductivity cell, conductometric titrations and applications.
c. **Polarography**: Instrumentation, DME, residual current, diffusion current and limiting current, polarographic wave, Ilkovic's equation, Effect of oxygen on polarographic wave, Polarographic maxima and suppressors and applications.
d. **Amperometric Titrations:** Introduction, types of electrodes used, reference and indicator electrode, instrumentation, titration procedure, advantages and disadvantages of Amperometry over potentiometry. Pharma applications.

4. Spectroscopy:

Theoretical aspects, instrumentation, elements of interpretation of data/spectra and application of analytical techniques be discussed on:

a. Absorption Spectroscopy:

- Theory of electronic, atomic and molecular spectra. Fundamental laws of photometry, Beer-Lambert's Law, application and its deviation,limitation of Beer law, application of the law to single and multiple component analysis, measurement of equilibrium constant and rate constant by spectroscopy. Spectra of isolated chromophores, auxochromes, batho-chromic shift, hypsochromic shift, hyperchromic and hypochromic effect, effect of solvent on absorption spectra, molecular structure and infrared spectra.

Instrumentation – Photometer, U.V.-Visible spectrophotometer – sources of U.V.-Visible radiations, collimating systems, monochromators, samples cells and following detectors-Photocell, Barrier layer cell, Phototube, Diode array, applications of U.V.-Visible spectroscopy in pharmacy and spectrophotometric titrations.

- Infrared Spectroscopy: Vibrational transitions, frequency – structure correlations, Infrared absorption bands, Instrumentation–IR spectro-meter – sources of IR, Collimating systems, monochromators, samplecells, sample

handling in IR spectroscopy and detectors– Thermocouple, Golay Cells, Thermistor, Bolometer, Pyroelectric detector, Applications of IR in pharmacy.

- Fluorimetric Analysis: Theory, luminescence, factors affecting fluorescence, quenching. Instrumentation, Applications, fluorescent indicators, study of pharmaceutically important compounds estimated by fluorimetry.

b. **Flame Photometry:** Theory, nebulisation, flame and flame temperature, interferences, flame spectrometric techniques and instrumentation and pharmaceutical applications.

c. **Atomic Absorption Spectrometry:** Introduction, Theory, types of electrodes, instrumentation and applications.

d. **Atomic Emission Spectroscopy**: Spectroscopic sources, atomic emission spectrometers, photographic and photoelectric detection.

e. **NMR & ESR (introduction only):** Introduction, theoretical aspects and applications.

f. **Mass Spectroscopy**: (**Introduction only**) – Fragmentation, types of ions produced mass spectrum and applications.

g. **Polarimetry: (Introduction only**) – Introduction to optical rotatory dispersion, circular dichroism, polarimeter.

h. **X-RAY Diffraction: (Introduction only**) – Theory, reciprocal lattice concept, diffraction patterns and applications.

i. **Thermal Analysis**: Introduction, instrumentation, applications, and DSC and DTA.

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- PHARMACEUTICAL ANALYSIS (PRACTICAL)

Practical : 3 Hrs./Week

List of Experiments:

1 Separation and identification of Amino Acids by Paper Chromatography.
2 Separation and identification of Sulpha drugs by TLC technique.
3 Effect of pH and solvent on the UV spectrum of given compound.
4 Comparison of the UV spectrum of a compound with that of its derivatives.
5 Determination of dissociation constant of indicators using UV-Visible spectroscopy.
6 Conductometric titration of mixture of acids with a strong base.
7 Potentiometric titration of a acid with a strong base.
8 Estimation of drugs by Fluorimetric technique.
9 Study of quenching effect in fluorimetry.
10 Colourimetric estimation of Supha drugs using BMR reagent.
11 Simultaneous estimation of two drugs present in given formulation.
12 Assay of Salicylic Acid by colourimetry.
13 Determination of Chlorides and Sulphates in Calcium gluconate by Nepheloturbidimetric Method.
14 Determination of Na/K by Flame Photometry.
15 Determination of pKa using pH meter.
16 Determination of specific rotation.
17 Comparison of the IR spectrum of a compound with that of its derivatives.
18 Demonstration of HPLC.
19 Demonstration of HPTLC.
20 Demonstration of GC-MS.
21 Demonstration of DSC.
22 Interpretation of NMR spectra of any one compound.

Reference Books:

1 Text Book of Pharm. Analysis by Higuchi. T and Hasen. E. B., New York Inter Science Publishers.
2 Quantitative Pharma. Analysis by Jenkins, The Blakiston division, New York.
3 Quantitative Drug Analysis, by Garrot. D, Chapman & Hall Ltd., London.
4 Undergraduate Instrumental Analysis by James. E., CBS Publishers.
5 Instrumental Analysis by Willard and Merritt, EWP, East West Press Ltd., Delhi/Madras.

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6 Pharm Analysis by Skoog and West, Sounders Manipal College Publishing.
7 Text Book of Chemical Analysis, by A.I.Vogel, ELBS with Macmillan press, Hampshire.
8 Textbook of Pharm. Analysis by K.A.Connors, John Wiley & Sons, New York, Brisbane, Singapore.
9 Textbook of Pharm. Analysis (Practical) by Beckett & Stenlake, CBS
10 Textbook of Drug Analysis by P.D. Sethi., CBS Publishers, Delhi.
11 Spectroscopy by Silverstein, John & Wiley & Sons. Inc., Canada & Singapore.
12 How to practise GMP-A Plan for total quality control by P.P. Sharma, Vandana Publications, Agra.
13 The Science & Practice of Pharmacy by Remington Vol-I & II, Mack Publishing Co. Pennsylvania.
14 TLC by Stahl, Spring Verlay.
15 Text Book of Pharm. Chemistry by Chatten, CBS Publications.
16 Spectroscopy by William Kemp, ELBS with Macmillan Press, Hampshire.
17 I.P.-1996, The Controller of Publications, New Delhi.
18 BPC- Dept. of Health, U.K. for HMSO.
19 USP - Mack Publishing Co., Easton, PA.
20 The Extra Pharmacopoeia – The Pharm. Press, London.

Scheme of Practical Examination:

	Sessionals	**Annual**
Synopsis	05	15
Major Experiment	10	25
Minor Experiment	03	15
Viva	02	15
Max Marks	**20**	**70**
Duration	**03hrs**	**04hrs**

Note : Total sessional marks is 30 (20 for practical sessional plus 10 marks for regularity, promptness, viva-voce and record maintenance).

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- PHARMACOTHERAPEUTICS – II (THEORY)

Theory : 3 Hrs. /Week

1. Scope of the Subject: This course is designed to impart knowledge and skills necessary for contribution to quality use of medicines. Chapters dealt cover briefly pathophysiology and mostly therapeutics of various diseases. This will enable the student to understand the pathophysiology of common diseases and their management.

2. Objectives of the Subject Upon completion of the subject student shall be able to –

a. know the pathophysiology of selected disease states and the rationale for drug therapy
b. know the therapeutic approach to management of these diseases;
c. know the controversies in drug therapy;
d. know the importance of preparation of individualised therapeutic plans based on diagnosis; and
e. appreciate the needs to identify the patient-specific parameters relevant in initiating drug therapy, and monitoring therapy (including alternatives, time-course of clinical and laboratory indices of therapeutic response and adverse effects).

Text books (Theory)

a. Clinical Pharmacy and Therapeutics - Roger and Walker, Churchill Livingstone publication

Reference books (Theory)

a. Pharmacotherapy: A Pathophysiologic approach - Joseph T. Dipiro et al. Appleton & Lange
b. Clinical Pharmacy and Therapeutics - Eric T. Herfindal, Williams and Wilkins Publication
c. Applied Therapeutics: The clinical Use of Drugs. Lloyd Young and Koda-Kimble MA]

3. Detailed syllabus and lecture wise schedule :

Etiopathogenesis and pharmacotherapy of diseases associated with following systems / diseases –

Title of the topic

1 **Infectious disease:** Guidelines for the rational use of antibiotics and surgical Prophylaxis, Tuberculosis, Meningitis, Respiratory tract infections, Gastroenteritis, Endocarditis, Septicemia, Urinary tract infections, Protozoal infection- Malaria, HIV

& Opportunistic infections, Fungal infections, Viral infections, Gonarrhoea and Syphillis

2 **Musculoskeletal disorders**

Rheumatoid arthritis, Osteoarthritis, Gout, Spondylitis, Systemic lupus erythematosus.

3 **Renal system**

Acute Renal Failure, Chronic Renal Failure, Renal Dialysis, Drug induced renal disorders

4 **Oncology:** Basic principles of Cancer therapy, General introduction to cancer chemotherapeutic agents, Chemotherapy of breast cancer, leukemia. Management of chemotherapy nausea and emesis

5 **Dermatology:** Psoriasis, Scabies, Eczema, Impetigo

- PHARMACOTHERAPEUTICS – II (PRACTICAL)

Practical : 3 Hrs./Week

Practicals :

Hospital postings in various departments designed to complement the lectures by providing practical clinical discussion; attending ward rounds; follow up the progress and changes made in drug therapy in allotted patients; case presentation upon discharge. Students are required to maintain a record of cases presented and the same should be submitted at the end of the course for evaluation.

The student shall be trained to understand the principle and practice involved in selection of drug therapy including clinical discussion.

A minimum of 20 cases should be presented and recorded covering most common diseases.

Assignments :

Students are required to submit written assignments on the topics given to them. Topics allotted should cover recent developments in drug therapy of various diseases. A minimum of THREE assignments [1500 – 2000 words] should be submitted for evaluation.

Format of the assignment :

1 Minimum & Maximum number of pages.
2 Reference(s) shall be included at the end.
3 Assignment can be a combined presentation at the end of the academic year.
4 It shall be computer draft copy.

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5 Name and signature of the student.

6 Time allocated for presentation may be 8+2 Min.

Scheme of Practical Examination :

	Sessionals	**Annual**
Synopsis	05	15
Major Experiment	10	25
Minor Experiment	03	15
Viva	02	15
Max Marks	**20**	**70**
Duration	**03hrs**	**04hrs**

Note : Total sessional marks is 30 (20 for practical sessional plus 10 marks for regularity, promptness, viva-voce and record maintenance).

- PHARMACEUTICAL JURISPRUDENCE (THEORY)

Theory : 2 Hrs. /Week

1. Scope of the Subject: (4-6 lines): This course exposes the student to several important legislations related to the profession of pharmacy in India. The Drugs and Cosmetics Act, along with its amendments are the core of this course. Other acts, which are covered, include the Pharmacy Act, dangerous drugs, medicinal and toilet preparation Act etc. Besides this the new drug policy, professional ethics, DPCO, patent and design Act will be discussed.

2. Objectives of the Subject: Upon completion of the subject student shall be able to (Know, do, and appreciate) –

a. practice the Professional ethics;
b. understand the various concepts of the pharmaceutical legislation in India;
c. know the various parameters in the Drug and Cosmetic Act and rules;
d. know the Drug policy, DPCO, Patent and design act;

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e. understand the labeling requirements and packaging guidelines for drugs and cosmetics;
f. be able to understand the concepts of Dangerous Drugs Act, Pharmacy Act and Excise duties Act; and
g. other laws as prescribed by the Pharmacy Council of India from time to time including International Laws.

Text books (Theory)

Mithal , B M. Textbook of Forensic Pharmacy. Calcutta :National; 1988.

Reference books (Theory)

a. Singh, KK, editor. Beotra's the Laws of Drugs, Medicines & cosmetics. Allahabad: Law Book House; 1984.
b. Jain, NK. A Textbook of forensic pharmacy. Delhi: Vallabh prakashan ; 1995.
c. Reports of the Pharmaceutical enquiry Committee
d. I.D.M.A., Mumbai. DPCO 1995
e. Various reports of Amendments.
f. Deshapande, S.W. The drugs and magic remedies act 1954 and rules 1955. Mumbai: Susmit Publications; 1998.
g. Eastern Book Company .The narcotic and psychotropic substances act 1985, Lucknow: Eastern; 1987.

3. Detailed syllabus and lecture wise schedule:

Title of the topic

1 Pharmaceutical Legislations – A brief review.

2 Principle and Significance of professional ethics. Critical study of the code of pharmaceutical ethics drafted by PCI.

3 Drugs and Cosmetics Act, 1940,and its rules 1945.

Objectives, Legal definition, Study of Schedule's with reference to Schedule B, C&C1, D, E1, F&F1, F2, F3, FF, G, H, J, K, M, N, P, R, V, W, X, Y.

Sales, Import, labeling and packaging of Drugs And Cosmetics Provisions Relating to Indigenous Systems.

Constitution and Functions of DTAB,DCC,CDL.

Qualification and duties –Govt. analyst and Drugs Inspector.

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4 **Pharmacy Act –1948**.

Objectives Legal Definitions, General Study, Constitution and Functions of State & Central Council, Registration & Procedure, ER.

5 **Medicinal and Toilet Preparation Act –1955**.

Objectives, Legal Definitions, Licensing, Bonded and Non Bonded Laboratory, Ware Housing, Manufacture of Ayurvedic, Homeopathic, Patent & Proprietory Preparations.

6 **Narcotic Drugs and Psychotropic substances Act-1985 and Rules**. Objectives, Legal Definitions, General Study, Constitution and Functions of narcotic & Psychotropic Consultative Committee, National Fund for Controlling the Drug Abuse, Prohibition, Control and regulations, Schedules to the Act.

7 **Study of Salient Features of Drugs and magic remedies Act and its rules.**

8 **Study of essential Commodities Act Relevant to drugs price control Order.**

9 **Drug Price control Order & National Drug Policy (Current).**

10 **Prevention Of Cruelty to animals Act-1960.**

11 **Patents & design Act-1970.**

12 **Brief study of prescription and Non-prescription Products.**

4. Assignments:

Format of the assignment

1. Minimum & Maximum number of pages
2. It shall be a computer draft copy
3. Reference(s) shall be included at the end.
4. Name and signature of the student
5. Assignment can be a combined presentation at the end of the academic year.
6. Time allocated for presentation may be 8+2 Min

Case studies relating to

1 Drugs and Cosmetics Act and rules along with its amendments, Dangerous Drugs Act, Medicinal and Toilet preparation Act, New Drug Policy, Professional Ethics, Drugs (Price control) Order, Patent and Design Act.

2 Various prescription and non-prescription products.

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3 Medical and surgical accessories.

4 Diagnostic aids and appliances available in the market.

- MEDICINAL CHEMISTRY (THEORY)

Theory : 3 Hrs. /Week

1. Modern concept of rational drug design: A brief introduction to Quantitative Structure Activity Relationaship (QSAR), prodrug, combinatorial chemistry and computer aided drug design (CADD) and concept of antisense molecules.

A study of the development of the following classes of drugs including SAR, mechanism of action, synthesis of important compounds, chemical nomenclature, brand names of important marketed products and their side effects.

2. Anti-infective agents

a. Local anti-infective agents
b. Preservatives
c. Antifungal agents
d. Urinary tract anti-infectives
e. Antitubercular agents
f. Antiviral agents and Anti AIDS agents
g. Antiprotozoal agents
h. Anthelmentics
i. Antiscabies and Antipedicular agents

3. Sulphonamides and sulphones

4. Antimalarials

5. Antibiotics

6. Antineoplastic agents

7. Cardiovascular agents

a. Antihypertensive agents
b. Antianginal agents and vasodilators
c. Antiarrhythmic agents
d. Antihyperlipidemic agents
e. Coagulants and Anticoagulants
f. Endocrine

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8. Hypoglycemic agents

9. Thyroid and Antithyroid agents

10. Diureties

11. Diagnostic agents

12. Steroidal Hormones and Adrenocorticoids

- MEDICINAL CHEMISTRY (PRACTICAL)

Practical : 3 Hrs./Week

a. Assays of important drugs from the course content.
b. Preparation of medicinally important compounds or intermediates required for synthesis of drugs.
c. Monograph analysis of important drugs.
d. Determination of partition coefficients, dissociation constants and molar refractivity of compounds for QSAR analysis.

Reference Books:

a. Wilson and Gisvold's Text book of Organic, Medicinal and Pharmaceutical Chemistry, Lippincott-Raven Publishers-New York, Philadelphia.
b. William.O.Foye, Principles of Medicinal Chemistry, B.I. Waverly Pvt. Ltd., New Delhi.
c. Burgers, Medicinal Chemistry, M.E.,Welly Med.Chemistry M.E. Walffed Johnwilley and Sons, Wiley-interscience Publication, New York, Toranto.
d. A Text Book of Medicinal Chemistry Vol. I and II by Surendra N. Pandeya, S.G. Publisher, 6, Dildayal Nagar, Varanasi -10.
e. Indian Pharmacopoeia 1985 and 1996. The Controller of Publications, Civil Lines, Delhi - 54.
f. Current Index of Medical Specialities (CIMS) and MIMS India, MIMS, A.E. Morgan Publications (I) Pvt. Ltd, New Delhi-19.
g. Organic Drug Synthesis-Ledniser Mitzsher Vol. I and II.
h. Pharmaceutical Chemistry drug Synthesis Vol. I and II by H. J. Roth and A. Kleemann.
i. The Science and Practice of Pharmacy Vol. 1 and 2, Remington, MACK Publishing Company, Easton, Pennsylvania.

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- PHARMACEUTICAL FORMULATIONS (THEORY)

Theory : 2 Hrs. /Week

1. **Scope of the Subject:** Scope and objectives of the course: Subject deals with the formulation and evaluation of various pharmaceutical dosage forms.

2. **Objectives of the Subject:** Upon completion of the subject student shall be able to (Know, do, appreciate) –
   a. understand the principle involved in formulation of various pharmaceutical dosage forms;
   b. prepare various pharmaceutical formulation;
   c. perform evaluation of pharmaceutical dosage forms; and
   d. understand and appreciate the concept of bioavailability and bioequivalence, their role in clinical situations.

   Text books (Theory)
   a. Pharmaceutical dosage forms, Vol, I,II and III by lachman
   b. Rowlings Text book of Pharmaceutics
   c. Tutorial Pharmacy – Cooper &Gun

   Reference books (Theory)
   a. Remington's Pharmaceutical Sciences
   b. USP/BP/IP

3. Detailed syllabus and lecture wise schedule:

Title of the topic

1 Pharmaceutical dosage form- concept and classification

2 **Tablets**: Formulation of different types of tablets, tablet excipients, granulation techniques quality control and evaluation of tablets. Tablet coating, Type of coating, quality control tests for coated tablet.

3 **Capsules**; Production and filling of hard gelatin capsules, Raw material for shell, finishing, quality control tests for capsules. Production and filling of soft gelatin capsules, quality control tests for soft gelatin capsules.

4 **Liquid orals**: Formulation and evaluation of suspensions, emulsions and solutions. Stability of these preparations

5 **Parenterals** Introduction Containers used for Parenterals (including official tests) Formulation of large and small volume Parenterals Sterilization

6 **Ophthalmic preparations (Semi – Solids)**: Introduction and classification Factors affecting absorption and anatomy of skin Packaging storage and labeling, Ointments Types of Ointment Base Preparation of ointment, Jellies Types of jellies Formulation of jellies Suppositories, Method of preparation, Types Packaging

7 Definition and concept of **Controlled and novel Drug delivery systems** with available examples, viz. parentral, trans dermal, buccal, rectal, nasal, implants, ocular

3.6 - PHARMACEUTICAL FORMULATIONS (PRACTICAL)

Practical : 3 Hrs./Week

List of Experiments :

1 Manufacture of Tablets
- **a.** Ordinary compressed tablet-wet granulation
- **b.** Tablets prepared by direct compression.
- **c.** Soluble tablet.
- **d.** Chewable tablet.

2 Formulation and filling of hard gelatin capsules

3 Manufacture of parenterals
- **a.** Ascorbic acid injection
- **b.** Calcium gluconate injection
- **c.** Sodium chloride infusion.
- **d.** Dextrose and Sodium chloride injection/ infusion.

4 Evaluation of Pharmaceutical formulations (QC tests)
- **a.** Tablets
- **b.** Capsules
- **c.** Injections

5 Formulation of two liquid oral preparations and evaluation by assay
- **a.** Solution: Paracetamol Syrup
- **b.** Antacid suspensions- Aluminum hydroxide gel

6 Formulation of semisolids and evaluation by assay
- **a.** Salicyclic acid and benzoic acid ointment
- **b.** Gel formulation Diclofenac gel

7 Cosmetic preparations

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a. Lipsticks
b. Cold cream and vanishing cream
c. Clear liquid shampoo
d. Tooth paste and tooth powders.

8 Tablet coating (demonstration)

Scheme of Practical Examination :

	Sessionals	**Annual**
Synopsis	05	15
Major Experiment	10	25
Minor Experiment	03	15
Viva	02	15
Max Marks	**20**	**70**
Duration	**03hrs**	**04hrs**

Note : Total sessional marks is 30 (20 for practical sessional plus 10 marks for regularity, promptness, viva-voce and record maintenance).

FOURTH YEAR

4.1 - PHARMACOTHERAPEUTICS – III (THEORY)

Theory : 3 Hrs. /Week

1 Scope : This course is designed to impart knowledge and skills necessary for contribution to quality use of medicines. Chapters dealt cover briefly pathophysiology and mostly therapeutics of various diseases. This will enable the student to understand the pathophysiology of common diseases and their management.

2 Objectives: At completion of this subject it is expected that students will be able to understand –

a. the pathophysiology of selected disease states and the rationale for drug therapy;
b. the therapeutic approach to management of these diseases;
c. the controversies in drug therapy;

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d. the importance of preparation of individualised therapeutic plans based on diagnosis;
e. needs to identify the patient-specific parameters relevant in initiating drug therapy, and monitoring therapy (including alternatives, time-course of clinical and laboratory indices of therapeutic response and adverse effects);
f. describe the pathophysiology of selected disease states and explain the rationale for drug therapy;
g. to summarize the therapeutic approach to management of these diseases including reference to the latest available evidence;
h. to discuss the controversies in drug therapy;
i. to discuss the preparation of individualised therapeutic plans based on diagnosis; and
j. identify the patient-specific parameters relevant in initiating drug therapy, and monitoring therapy (including alternatives, time-course of clinical and laboratory indices of therapeutic response and adverse effects).

Text Books

a. Clinical Pharmacy and Therapeutics - Roger and Walker, Churchill Livingstone publication
b. Pharmacotherapy: A Pathophysiologic approach - Joseph T. Dipiro et al. Appleton & Lange

Reference Books

a. Pathologic basis of disease - Robins SL, W.B.Saunders publication
b. Pathology and therapeutics for Pharmacists: A Basis for Clinical Pharmacy Practice - Green and Harris, Chapman and Hall publication
c. Clinical Pharmacy and Therapeutics - Eric T. Herfindal, Williams and Wilkins Publication
d. Applied Therapeutics: The clinical Use of Drugs. Lloyd Young and Koda-Kimble MA
e. Avery's Drug Treatment, 4th Edn, 1997, Adis International Limited.
f. Relevant review articles from recent medical and pharmaceutical literature.

3. Detailed syllabus and lecture wise schedule:

Etiopathogenesis and pharmacotherapy of diseases associated with following systems/diseases

Title of the topic

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1. **Gastrointestinal system:** Peptic ulcer disease, Gastro Esophageal Reflux Disease, Inflammatory bowel disease, Liver disorders - Alcoholic liver disease, Viral hepatitis including jaundice, and Drug induced liver disorders.
2. **Haematological system:** Anaemias, Venous thromboembolism, Drug induced blood disorders.
3. **Nervous system:** Epilepsy, Parkinsonism, Stroke, Alzheimer's disease,
4. **Psychiatry disorders:** Schizophrenia, Affective disorders, Anxiety disorders, Sleep disorders, Obsessive Compulsive disorders
5. Pain management including Pain pathways, neuralgias, headaches.
6. Evidence Based Medicine

- PHARMACOTHERAPEUTICS – III (PRACTICAL)

Practical : 3 Hrs./Week

Practicals:

Hospital postings for a period of at least 50 hours is required to understand the principles and practice involved in ward round participation and clinical discussion on selection of drug therapy. Students are required to maintain a record of 15 cases observed in the ward and the same should be submitted at the end of the course for evaluation. Each student should present at least two medical cases they have observed and followed in the wards.

Assignments:

Students are required to submit written assignments on the topics given to them. Topics allotted should cover recent developments in drug therapy of various diseases. A minimum of THREE assignments [1500 – 2000 words] should be submitted for evaluation.

Format of the assignment:

1 Minimum & Maximum number of pages
2 Reference(s) shall be included at the end.
3 Assignment can be a combined presentation at the end of the academic year
4 It shall be computer draft copy
5 Name and signature of the student
6 Time allocated for presentation may be 8+2 Min.

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Scheme of Practical Examination:

	Sessionals	**Annual**
Synopsis	05	15
Major Experiment	10	25
Minor Experiment	03	15
Viva	02	15
Max Marks	**20**	**70**
Duration	**03hrs**	**04hrs**

Note : Total sessional marks is 30 (20 for practical sessional plus 10 marks for regularity, promptness, viva-voce and record maintenance).

- HOSPITAL PHARMACY (THEORY)

Theory : 2 Hrs. /Week

1. **Scope**: In the changing scenario of pharmacy practice in India, for successful practice of Hospital Pharmacy, the students are required to learn various skills like drug distribution, drug dispensing, manufacturing of parenteral preparations, drug information, patient counselling, and therapeutic drug monitoring for improved patient care.

2. **Objectives:** Upon completion of the course, the student shall be able to –
   know various drug distribution methods;
   know the professional practice management skills in hospital pharmacies;
   provide unbiased drug information to the doctors;
   know the manufacturing practices of various formulations in hospital set up;
   appreciate the practice based research methods; and
   appreciate the stores management and inventory control.

Text books: (latest editions)

a. Hospital pharmacy by William .E. Hassan
b. A text book of Hospital Pharmacyby S.H.Merchant & Dr. J.S. Qadry. Revised by R.K.Goyal & R.K. Parikh

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References:

a. WHO consultative group report.
b. R.P.S. Vol.2. Part –B; Pharmacy Practice section.
c. Handbook of pharmacy – health care. Edt. Robin J Harman. The Pharmaceutical press.

3. Lecture wise programme : Topics

1 Hospital - its Organisation and functions

2 Hospital pharmacy-Organisation and management

a. Organizational structure-Staff, Infrastructure & work load statistics
b. Management of materials and finance
c. Roles & responsibilities of hospital pharmacist

3. The Budget – Preparation and implementation

4 Hospital drug policy

a. Pharmacy and Therapeutic committee (PTC)
b. Hospital formulary
c. Hospital committees
   - Infection committee
   - Research and ethical committee
d. developing therapeutic guidelines
e. Hospital pharmacy communication - Newsletter

5. Hospital pharmacy services

a. Procurement & warehousing of drugs and Pharmaceuticals
b. Inventory control
   Definition, various methods of Inventory Control ABC, VED, EOQ, Lead time, safety stock
c. Drug distribution in the hospital
   i. Individual prescription method
   ii. Floor stock method
   iii. Unit dose drug distribution method
d. Distribution of Narcotic and other controlled substances
e. Central sterile supply services – Role of pharmacist

6. Manufacture of Pharmaceutical preparations

a. Sterile formulations – large and small volume parenterals

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b. Manufacture of Ointments, Liquids, and creams
c. Manufacturing of Tablets, granules, capsules, and powders
d. Total parenteral nutrition

7. **Continuing professional development programs** Education and training

8. **Radio Pharmaceuticals – Handling and packaging**

9. **Professional Relations and practices of hospital pharmacist**

- HOSPITAL PHARMACY (PRACTICAL)

Practical : 3 Hrs./Week

1 Assessment of drug interactions in the given prescriptions
2 Manufacture of parenteral formulations, powders.
3 Drug information queries.
4 Inventory control

List of Assignments:

1 Design and Management of Hospital pharmacy department for a 300 bedded hospital.
2 Pharmacy and Therapeutics committee – Organization, functions, and limitations.
3 Development of a hospital formulary for 300 bedded teaching hospital
4 Preparation of ABC analysis of drugs sold in one month from the pharmacy.
5 Different phases of clinical trials with elements to be evaluated.
6 Various sources of drug information and systematic approach to provide unbiased drug information.
7 Evaluation of prescriptions generated in hospital for drug interactions and find out the suitable management.

Special requirements:

1 Each college should sign MoU with nearby local hospital having minimum 150 beds for providing necessary training to the students' on hospital pharmacy activities.
2 Well equipped with various resources of drug information.

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Scheme of Practical Examination:

	Sessionals	**Annual**
Synopsis	05	15
Major Experiment	10	25
Minor Experiment	03	15
Viva	02	15
Max Marks	**20**	**70**
Duration	**03hrs**	**04hrs**

Note : Total sessional marks is 30 (20 for practical sessional plus 10 marks for regularity, promptness, viva-voce and record maintenance).

- CLINICAL PHARMACY (THEORY)

Theory : 3 Hrs. /Week

1. Objectives of the Subject :

Upon completion of the subject student shall be able to (Know, do, appreciate) –

a. monitor drug therapy of patient through medication chart review and clinical review;
b. obtain medication history interview and counsel the patients;
c. identify and resolve drug related problems;
d. detect, assess and monitor adverse drug reaction;
e. interpret selected laboratory results (as monitoring parameters in therapeutics) of specific disease states; and
f. retrieve, analyse, interpret and formulate drug or medicine information.

Text books (Theory)

a. Practice Standards and Definitions - The Society of Hospital Pharmacists of Australia
b. Basic skills in interpreting laboratory data - Scott LT, American Society of Health System Pharmacists Inc.
c. Biopharmaceutics and Applied Pharmacokinetics - Leon Shargel, Prentice Hall publication.

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d. A text book of Clinical Pharmacy Practice; Essential concepts and skills, Dr.G.Parthasarathi etal, Orient Orient Langram Pvt.Ltd. ISSBN8125026

References

a Australian drug information -Procedure manual. The Society of Hospital Pharmacists of Australia.

b Clinical Pharmacokinetics - Rowland and Tozer, Williams and Wilkins Publication.

c Pharmaceutical statistics. Practical and clinical applications. Sanford Bolton, Marcel Dekker, Inc.

2. Detailed syllabus and lecture wise schedule:

Title of the topic

1. **Definitions, development and scope of clinical pharmacy**

2. **Introduction to daily activities of a clinical pharmacist**
   a. Drug therapy monitoring (medication chart review, clinical review, pharmacist interventions)
   b. Ward round participation
   c. Adverse drug reaction management
   d. Drug information and poisons information
   e. Medication history
   f. Patient counseling
   g. Drug utilisation evaluation (DUE) and review (DUR)
   h. Quality assurance of clinical pharmacy services

3. **Patient data analysis**
   The patient's case history, its structure and use in evaluation of drug therapy & Understanding common medical abbreviations and terminologies used in clinical practices.

4. **Clinical laboratory tests used in the evaluation of disease states, and interpretation of test results**
   a. Haematological, Liver function, Renal function, thyroid function tests
   b. Tests associated with cardiac disorders
   c. Fluid and electrolyte balance
   d. Microbiological culture sensitivity tests
   e. Pulmonary Function Tests

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5. **Drug & Poison information**
   a. Introduction to drug information resources available
   b. Systematic approach in answering DI queries
   c. Critical evaluation of drug information and literature
   d. Preparation of written and verbal reports
   e. Establishing a Drug Information Centre
   f. Poisons information- organization & information resources

6. **Pharmacovigilance**
   a. Scope, definition and aims of pharmacovigilance
   b. Adverse drug reactions - Classification, mechanism, predisposing factors, causality assessment [different scales used]
   c. Reporting, evaluation, monitoring, preventing & management of ADRs
   d. Role of pharmacist in management of ADR.

7. Communication skills, including patient counselling techniques, medication history interview, presentation of cases.

8. Pharmaceutical care concepts

9. Critical evaluation of biomedical literature

10. Medication errors

- CLINICAL PHARMACY (PRACTICAL)

Practical : 3 Hrs./Week

Students are expected to perform 15 practicals in the following areas covering the topics dealt in theory class.

a. Answering drug information questions (4 Nos)
b. Patient medication counselling (4 Nos)
c. Case studies related to laboratory investigations (4 Nos)
d. Patient medication history interview (3 Nos)

Assignment:

Students are expected to submit THREE written assignments (1500 – 2000 words) on the topics given to them covering the following areas dealt in theory class.

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Drug information, Patient medication history interview, Patient medication counselling, Critical appraisal of recently published articles in the biomedical literature which deals with a drug or therapeutic issue.

Format of the assignment:

1 Minimum & Maximum number of pages.
2 Reference(s) shall be included at the end.
3 Assignment can be a combined presentation at the end of the academic year.
4 It shall be computer draft copy.
5 Name and signature of the student.
6 Time allocated for presentation may be 8+2 Min.

- BIOSTATISTICS AND RESEARCH METHODOLOGY (THEORY)

Theory : 2 Hrs. /Week

1. Detailed syllabus and lecture wise schedule

1. Research Methodology

a. Types of clinical study designs:
Case studies, observational studies, interventional studies,
b. Designing the methodology
c. Sample size determination and Power of a study
Determination of sample size for simple comparative experiments, determination of sample size to obtain a confidence interval of specified width, power of a study
d. Report writing and presentation of data

2. Biostatistics

a) Introduction
b) Types of data distribution
c) Measures describing the central tendency distributions- average, median, mode
d) Measurement of the spread of data-range, variation of mean, standard deviation, variance, coefficient of variation, standard error of mean.

Data graphics

Construction and labeling of graphs, histogram, piecharts, scatter plots, semilogarthimic plots

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Basics of testing hypothesis

a. Null hypothesis, level of significance, power of test, P value, statistical estimation of confidence intervals.
b. Level of significance (Parametric data)- students t test (paired and unpaired), chi Square test, Analysis of Variance (one-way and two-way)
c. Level of significance (Non-parametric data)- Sign test, Wilcoxan's signed rank test, Wilcoxan rank sum test, Mann Whitney U test, Kruskal-Wall is test (one way ANOVA)
d. Linear regression and correlation- Introduction, Pearsonn's and Spearmann's correlation and correlation co-efficient.
e. Introduction to statistical software: SPSS, Epi Info, SAS.

Statistical methods in epidemiology

Incidence and prevalence, relative risk, attributable risk

3. Computer applications in pharmacy

Computer System in Hospital Pharmacy: Patterns of Computer use in Hospital Pharmacy – Patient record database management, Medication order entry – Drug labels and list – Intravenous solution and admixture, patient medication profiles, Inventory control, Management report & Statistics.

Computer In Community Pharmacy Computerizing the Prescription Dispensing process

Use of Computers for Pharmaceutical Care in community pharmacy Accounting and General ledger system

Drug Information Retrieval & Storage :

Introduction – Advantages of Computerized Literature Retrieval Use of Computerized Retrieval

Reference books:

a) Pharmaceutical statistics- practical and clinical applications, Sanford Bolton 3rd edition, publisher Marcel Dekker Inc. NewYork.
b) Drug Information- A Guide for Pharmacists, Patrick M Malone, Karen L Kier, John E Stanovich , 3rd edition, McGraw Hill Publications 2006

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4.5 - BIOPHARMACEUTICS AND PHARMACOKINETICS (THEORY)

Theory : 3 Hrs. /Week

1. **Biopharmaceutics**
   I. Introduction to Biopharmaceutics
      a) Absorption of drugs from gastrointestinal tract.
      b) Drug Distribution.
      c) Drug Elimination.
2. **Pharmacokinetics**
   2. Introduction to Pharmacokinetics.
      a. Mathematical model
      b. Drug levels in blood.
      c. Pharmacokinetic model
      d. Compartment models
      e. Pharmacokinetic study.

3. One compartment open model.
   a. Intravenous Injection (Bolus)
   b. Intravenous infusion.

4. Multicompartment models.
   a. Two compartment open model.
   b. IV bolus, IV infusion and oral administration

5. Multiple – Dosage Regimens.
   a. Repititive Intravenous injections – One Compartment Open Model
   b. Repititive Extravascular dosing – One Compartment Open model
   c. Multiple Dose Regimen – Two Compartment Open Model

6. Nonlinear Pharmacokinetics.
   a. Introduction
   b. Factors causing Non-linearity.
   c. Michaelis-menton method of estimating parameters.

7. Noncompartmental Pharmacokinetics.
   a. Statistical Moment Theory.
   b. MRT for various compartment models.
   c. Physiological Pharmacokinetic model.

8. Bioavailability and Bioequivalence.

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a. Introduction.
b. Bioavailability study protocol.
c. Methods of Assessment of Bioavailability

- BIOPHARMACEUTICS AND PHARMACOKINETICS (PRACTICAL)

Practical : 3 Hrs./Week

1 Improvement of dissolution characteristics of slightly soluble drugs by some methods.
2 Comparison of dissolution studies of two different marketed products of same drug.
3 Influence of polymorphism on solubility and dissolution.
4 Protein binding studies of a highly protein bound drug and poorly protein bound drug.
5 Extent of plasma-protein binding studies on the same drug (i.e. highly and poorly protein bound drug) at different concentrations in respect of constant time.
6 Bioavailability studies of some commonly used drugs on animal/human model.
7 Calculation of Ka, Ke, $t_1/2$, Cmax, AUC, AUMC, MRT etc. from blood profile data.
8 Calculation of bioavailability from urinary excretion data for two drugs.
9 Calculation of AUC and bioequivalence from the given data for two drugs.
10 In vitro absorption studies.
11 Bioequivalency studies on the different drugs marketed.(eg) Tetracycline, Sulphamethoxzole, Trimethoprim, Aspirin etc., on animals and human volunteers.
12 Absorption studies in animal inverted intestine using various drugs.
13 Effect on contact time on the plasma protein binding of drugs.
14 Studying metabolic pathways for different drugs based on elimination kinetics data.
15 Calculation of elimination half-life for different drugs by using urinary elimination data and blood level data.
16 Determination of renal clearance.

References:

a. Biopharmaceutics and Clinical Pharmacokinetics by, Milo Gibaldi
b. Remington's Pharmaceutical Sciences, By Mack Publishing Company, Pennsylvnia.
c. Pharmacokinetics: By Milo Glbaldi Donald, R. Mercel Dekker Inc.

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d. Hand Book of Clinical Pharmacokinetics, By Milo Gibaldi and Laurie Prescott by ADIS Health Science Press.
e. Biopharmaceutics and Pharmacokinetics; By Robert F Notari
f. Biopharmaceutics; By Swarbrick
g. Bio pharmaceutics and Pharmacokinetics-A Treatise, By D. M. Brahmankar and Sunil

B.Jaiswal, Vallabh Prakashan Pitampura, Delhi

h. Cilincal Pharmacokinetics, Concepts and Applications: By Malcolm Rowland and Thomas, N. Tozen, Lea and Febrger, Philadelphia, 1995.
i. Dissolution, Bioavailability and Bioequivalence, By Abdou H.M, Mack, Publishing Company, Pennsylvania 1989.
j. Biopharmaceutics and Clinical Pharmacokinetics-An introduction 4th edition Revised and expanded by Rebort F Notari Marcel Dekker Inn, New York and Basel, 1987.
k. Encyclopedia of Pharmaceutical Technology, Vol 13, James Swarbrick, James, C. Roylan, Marcel Dekker Inc, New York 1996.

- CLINICAL TOXICOLOGY (THEORY)

Theory : 2 Hrs. /Week

1. General principles involved in the management of poisoning
2. Antidotes and the clinical applications.
3. Supportive care in clinical Toxicology.
4. Gut Decontamination.
5. Elimination Enhancement.
6. Toxicokinetics.
7. Clinical symptoms and management of acute poisoning with the following agents
    a. Pesticide poisoning: organophosphorous compounds, carbamates, organochlorines, pyrethroids.
    b. Opiates overdose.
    c. Antidepressants
    d. Barbiturates and benzodiazepines.
    e. Alcohol: ethanol, methanol.
    f. Paracetamol and salicylates.

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g. Non-steroidal anti-inflammatory drugs.
h. Hydrocarbons: Petroleum products and PEG.
i. Caustics: inorganic acids and alkali.
j. Radiation poisoning

8. Clinical symptoms and management of chronic poisoning with the following agents – Heavy metals: Arsenic, lead, mercury, iron, copper

9. Venomous snake bites: Families of venomous snakes, clinical effects of venoms, general management as first aid, early manifestations, complications and snake bite injuries.

10. Plants poisoning. Mushrooms, Mycotoxins.

11. Food poisonings

12. Envenomations – Arthropod bites and stings.

Substance abuse:

Signs and symptoms of substance abuse and treatment of dependence

a. CNS stimulants :amphetamine
b. Opioids
c. CNS depressants
d. Hallucinogens: LSD
e. Cannabis group
f. Tobacco

References:

a. Matthew J Ellenhorn. Ellenhorns Medical Toxicology – Diagnosis And Treatment Of Poisoning. Second edition. Williams and Willkins publication, London
b. V V Pillay. Handbook of Forensic Medicine And Toxicology. Thirteenth edition 2003 Paras Publication, Hyderabad.

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FIFTH YEAR

- CLINICAL RESEARCH (THEORY)

Theory : 3 Hrs. /Week

1. Drug development process: Introduction

Various Approaches to drug discovery

1 Pharmacological
2 Toxicological
3 IND Application
4 Drug characterization
5 Dosage form

2. Clinical development of drug:

1 Introduction to Clinical trials
2 Various phases of clinical trial.
3 Methods of post marketing surveillance
4 Abbreviated New Drug Application submission.
5 Good Clinical Practice – ICH, GCP, Central drug standard control organisation (CDSCO) guidelines
6 Challenges in the implementation of guidelines
7 Ethical guidelines in Clinical Research
8 Composition, responsibilities, procedures of IRB / IEC
9 Overview of regulatory environment in USA, Europe and India.
10 Role and responsibilities of clinical trial personnel as per ICH GCP
   a. Sponsor
   b. Investigators
   c. Clinical research associate
   d. Auditors
   e. Contract research coordinators
   f. Regulatory authority
11 Designing of clinical study documents (protocol, CRF, ICF, PIC with assignment)
12 Informed consent Process
13 Data management and its components
14 Safety monitoring in clinical trials.

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References :

a. Central Drugs Standard Control Organization. Good Clinical Practices-Guidelines for Clinical Trials on Pharmaceutical Products in India. New Delhi: Ministry of Health; 2001.
b. International Conference on Harmonisation of Technical requirements for registration of Pharmaceuticals for human use. ICH Harmonised Tripartite Guideline. Guideline for Good Clinical Practice.E6; May 1996.
c. Ethical Guidelines for Biomedical Research on Human Subjects 2000. Indian Council of Medical Research, New Delhi.
d. Textbook of Clinical Trials edited by David Machin, Simon Day and Sylvan Green, March 2005, John Wiley and Sons.
e. Principles of Clinical Research edited by Giovanna di Ignazio, Di Giovanna and Haynes.
f. Clinical Data Management edited by R K Rondels, S A Varley, C F Webbs. Second Edition, Jan 2000, Wiley Publications.
g. Goodman & Gilman: JG Hardman, LE Limbard, 10th Edn. McGraw Hill Publications, 2001.

- PHARMACOEPIDEMIOLOGY AND PHARMACOECONOMICS (THEORY)

Theory : 3 Hrs. /Week

1 Pharmacoepidemiology :

Definition and scope:

Origin and evaluation of pharmacoepidemiology need for pharmacoepidemiology, aims and applications.

Measurement of outcomes in pharmacoepidemiology Outcome measure and drug use measures

Prevalence, incidence and incidence rate. Monetary units, number of prescriptions, units of drugs dispensed, defined daily doses and prescribed daily doses, medication adherence measurement

Concept of risk in pharmacoepidemiology

Measurement of risk, attributable risk and relative risk, time-risk relationship and odds ratio

Pharmacoepidemiological methods

Includes theoretical aspects of various methods and practical study of various methods with the help of case studies for individual methods

Drug utilization review, case reports, case series, surveys of drug use, cross –sectional studies, cohort studies, case control studies, case –cohort studies, meta

– analysis studies, spontaneous reporting, prescription event monitoring and record linkage system.

Sources of data for pharmacoepidemiological studies Ad Hoc data sources and automated data systems.

Selected special applications of pharmacoepidemiology

Studies of vaccine safety, hospital pharmacoepidemiology, pharmacoepidemiology and risk management, drug induced birth defects.

2 Pharmacoeconomics:

Definition, history, needs of pharmacoeconomic evaluations Role in formulary management decisions

Pharmacoeconomic evaluation

Outcome assessment and types of evaluation

Includes theoretical aspects of various methods and practical study of various methods with the help of case studies for individual methods:

Cost – minimization, cost- benefit, cost – effectiveness, cost utility

3 Applications of Pharmacoeconomics

Software and case studies

- CLINICAL PHARMACOKINETICS AND THERAPEUTIC DRUG MONITORING (THEORY)

Theory : 2 Hrs. /Week

1. **Introduction to Clinical pharmacokinetics.**
2. **Design of dosage regimens:**

   Nomograms and Tabulations in designing dosage regimen, Conversion from intravenous to oral dosing, Determination of dose and dosing intervals, Drug dosing in the elderly and pediatrics and obese patients.
3. **Pharmacokinetics of Drug Interaction:**
   a. Pharmacokinetic drug interactions
   b. Inhibition and Induction of Drug metabolism
   c. Inhibition of Biliary Excretion.
4. **Therapeutic Drug monitoring:**
   a. Introduction
   b. Individualization of drug dosage regimen (Variability – Genetic, Age and Weight , disease, Interacting drugs).
   c. Indications for TDM. Protocol for TDM.
   d. Pharmacokinetic/Pharmacodynamic Correlation in drug therapy.
   e. TDM of drugs used in the following disease conditions: cardiovascular disease, Seizure disorders, Psychiatric conditions, and Organ transplantations.

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5. **Dosage adjustment in Renal and hepatic Disease.**
    a. Renal impairment
    b. Pharmacokinetic considerations
    c. General approach for dosage adjustment in Renal disease.
    d. Measurement of Glomerular Filtration rate and creatinine clearance.
    e. Dosage adjustment for uremic patients.
    f. Extracorporeal removal of drugs.
    g. Effect of Hepatic disease on pharmacokinetics.
6. **Population Pharmacokinetics.**
    a. Introduction to Bayesian Theory.
    b. Adaptive method or Dosing with feed back.
    c. Analysis of Population pharmacokinetic Data.
7. **Pharmacogenetics**
    a. Genetic polymorphism in Drug metabolism: Cytochrome P-450 Isoenzymes.
    b. Genetic Polymorphism in Drug Transport and Drug Targets.
    c. Pharmacogenetics and Pharmacokinetics / Pharmacodynamic considerations

No: of hours per subject (lecture-tutorial-seminar-group discussion)

As mentioned in “Course outline” (clause 2.4)

Practical training

Hospital posting.- Every student shall be posted in constituent hospital for a period of not less than fifty hours to be covered in not less than 200 working days in each of second, third & fourth year course. Each student shall submit report duly certified by the preceptor and duly attested by the Head of the Department or Institution as prescribed. In the fifth year, every student shall spend half a day in the morning hours attending ward rounds on daily basis as a part of clerkship. Theory teachingmay be scheduled in the afternoon.

Records

Records to be maintained for all practical subjects

Dissertation

Not applicable

Speciality training if any

Not applicable

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Project work to be done if any

To allow the student to develop data collection and reporting skills in the area of community, hospital and clinical pharmacy, a project work shall be carried out under the supervision of a teacher. The project topic must be approved by the Head of the Department or Head of the Institution. The same shall be announced to students within one month of commencement of the fifth year classes. Project work shall be presented in a written report and as a seminar at the end of the year. External and the internal examiners shall do the assessment of the project work. Project work shall comprise of objectives of the work, methodology, results, discussions and conclusions.

Objectives of project work.— The main objectives of the project work is to— (i) show the evidence of having made accurate description of published work of others and of having recorded the findings in an impartial manner; and (ii) develop the students in data collection, analysis and reporting and interpretation skills.

Methodology.— To complete the project work following methodology shall be adopted, namely:—

(i) students shall work in groups of not less than two and not more than four under an authorised teacher;
(ii) project topic shall be approved by the Head of the Department or Head of the Institution;
(iii) project work chosen shall be related to the pharmacy practice in community, hospital and clinical setup. It shall be patient and treatment (Medicine) oriented, like drug utilisation reviews, pharmacoepidemiology, pharmacovigilance or pharmacoeconomics;
(iv) project work shall be approved by the institutional ethics committee;
(v) student shall present at least three seminars, one in the beginning, one at middle and one at the end of the project work; and
(vi) two-page write- up of the project indicating title, objectives, methodology anticipated benefits and references shall be submitted to the Head of the Department or Head of the Institution.

Qualification of Guide: A postgraduate degree in M.Pharm/PharmD with 5 years experience after P.G is eligible to guide maximum of two groups each group consisting maximum of four PharmD students.

Reporting:-

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1) Student working on the project shall submit jointly to the Head of theDepartment or Head of the Institution a project report of about 40-50 pages. Project report should include a certificate issued by the authorised teacher, Head of the Department as well as by the Head of the Institution
2) Project report shall be computer typed in double space using Times Roman font on A4 paper. The title shall be in bold with font size 18, sub- tiles in bold with font size 14 and the text with font size 12. The cover page of the project report shall contain details about the name of the student and the name of the authorised teacher with font size 14.
3) Submission of the project report shall be done at least one month prior to the commencement of annual or supplementary examination.

Evaluation.— The following methodology shall be adopted for evaluating the project work—

(i) Project work shall be evaluated by internal and external examiners.
(ii) Students shall be evaluated in groups for four hours (i.e., about half an hour for a group of four students).
(iii) Three seminars presented by students shall be evaluated for twenty marks each and the average of best two shall be forwarded to the university with marks of other subjects.
(iv) Evaluation shall be done on the following items: Marks

a) Write up of the seminar	(7.5)
b) Presentation of work	(7.5)
c) Communication skills	(7.5)
d) Question and answer skills	(7.5)
Total	(30 marks)

(v) Final evaluation of project work shall be done on the following items: Marks

a) Write up of the seminar	(17.5)
b) b) Presentation of work	(17.5)
c) c) Communication skills	(17.5)
d) d) Question and answer skills	(17.5)
Total	(70 marks)

Explanation.— For the purposes of differentiation in the evaluation in case of topic being the same for the group of students, the same shall be done based on item numbers b, c and d mentioned above.

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Any other requirements [CME, Paper Publishing etc.]

As per the direction of HOD

Prescribed/recommended textbooks for each subject

As mentioned in "Content of each subject in each year" (clause 2.10)

Reference books

As mentioned in "Content of each subject in each year" (clause 2.10)

Journals

All pharmacy and related medical journals

Logbook

Logbook should be maintained wherever necessary

3. EXAMINATIONS

Eligibility to appear for exams

Only such students who produce certificate from the Head of the Institution in which he or she has undergone the Pharm.D. course, in proof of his or her having regularly and satisfactorily undergone the course of study by attending not less than 80% of the classes held both in theory and in practical separately in each subject shall be eligible for appearing at examination.

Schedule of Regular/Supplementary exams

There will be one main examinations and one supplementary examination six months apart in each year.

Scheme of examination showing maximum marks and minimum marks (Minimum marks should be given)

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First Year examination:

S. No	Name of Subject	Maximum marks for Theory			Maximum marks for Practical		
		Examination	Sessional	Total	Examination	Sessional	Total
1.1	Human Anatomy and Physiology	70	30	100	70	30	100
1.2	Pharmaceutics	70	30	100	70	30	100
1.3	Medicinal Biochemistry	70	30	100	70	30	100
1.4	Pharmaceutical Organic Chemistry	70	30	100	70	30	100
1.5	Pharmaceutical Inorganic Chemistry	70	30	100	70	30	100
Total				500			500

S. No	Name of Subject	Maximum marks for Theory			Maximum marks for Practical		
		Examination	Sessional	Total	Examination	Sessional	Total
1.6	Remedial Mathematics / Biology	70	30	100	70	30*	100

* for Biology

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Second Year Examination

S. No	Name of Subject	Maximum marks for Theory			Maximum marks for Practical		
		Examination	Sessional	Total	Examination	Sessional	Total
2.1	Pathophysiology	70	30	100	-	-	-
2.2	Pharmaceutical Microbiology	70	30	100	70	30	100
2.3	Pharmacognosy & Phytopharmaceuticals	70	30	100	70	30	100
2.4	Pharmacology-I	70	30	100	-	-	-
2.5	Community Pharmacy	70	30	100	-	-	-
2.6	Pharmacotherapeutics-I	70	30	100	70	30	100
Total				600			300

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Third Year Examination

S. No	Name of Subject	Maximum marks for Theory			Maximum marks for Practical		
		Examination	Sessional	Total	Examination	Sessional	Total
3.1	Pharmacology-II	70	30	100	70	30	100
3.2	Pharmaceutical Analysis	70	30	100	70	30	100
3.3	Pharmacotherapeutics-II	70	30	100	70	30	100
3.4	Pharmaceutical Jurisprudence	70	30	100	-	-	-
3.5	Medicinal Chemistry	70	30	100	70	30	100
3.6	Pharmaceutical Formulations	70	30	100	70	30	100
Total				600			500

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Fourth Year Examination

S. No	Name of Subject	Maximum marks for Theory			Maximum marks for Practical		
		Examination	Sessional	Total	Examination	Sessional	Total
4.1	Pharmacotherapeutics-III	70	30	100	70	30	100
4.2	Hospital Pharmacy	70	30	100	70	30	100
4.3	Clinical Pharmacy	70	30	100	70	30	100
4.4	Biostatistics & Research Methodology	70	30	100	-	-	-
4.5	Biopharmaceutics & Pharmacokinetics	70	30	100	70	30	100
4.6	Clinical Toxicology	70	30	100	-	-	-
Total				600			400

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Fifth Year Examination

S. No	Name of Subject	Maximum marks for Theory			Maximum marks for Practical		
		Examination	Sessional	Total	Examination	Sessional	Total
5.1	Clinical Research	70	30	100	-	-	-
5.2	Pharmacoepidemiology and Pharmacoeconomics	70	30	100	-	-	-
5.3	Clinical Pharmacokinetics & Pharmacotherapeutic Drug Monitoring	70	30	100	-	-	-
5.4	Clerkship *	-	-	-	70	30	100
5.5	Project work (Six Months)	-	-	-	100**	-	100
	Total			300			200

* **Attending ward rounds on daily basis**

** **30 marks – viva-voce (oral) 70 marks – Thesis work**

Minimum marks for passing examination:

A student shall not be declared to have passed examination unless he or she secures at least 50% marks in each of the subjects separately in the university theory examinations, practical examinations and 50% marks in each of the theory and internal assessment taken together and 50% in practical examinations including internal assessment marks.

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Papers in each year

As mentioned in “Content of each subject in each year” (clause 2.10)

Details of theory exams

Number of papers: As mentioned in “content of each subject in each year” (clause 2.10)

Duration, Type of questions & number of questions and marks: As mentioned in model question paper as given in curriculum

1) Theory examination shall be of three hours and practical examination shall be of four hours duration.
2) Theory examination is for 70 marks consisting of three essay questions each carrying 10 marks (3x10 = 30) and eight short notes each carrying 5 marks (8x5= 40)
3) The practical examination shall be evaluated jointly by an internal and an external examiner appointed by the University.
4) Practical examination shall also consist of a viva –voce (Oral) examination. 70 marks for practical examination in each subject are inclusive of 15 marks Viva-voce
5) A Student who fails in theory or practical examination of a subject shall re-appear both in theory and practical of the same subject.
6) Clerkship examination - Oral examination shall be conducted after the completion of clerkship of students. An external and an internal examiner will evaluate the student. Students may be asked to present the allotted medical cases followed by discussion.

   Students’ capabilities in delivering clinical pharmacy services, pharmaceutical care planning and knowledge of therapeutics shall be assessed.

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Model question paper for each subject with question paper pattern

QP CODE: **Reg.No: .....**

First Year Pharm D Degree Examinations - August 2014

Human Anatomy and Physiology

Time: 3 Hours **Total Marks: 70**

Answer all Questions.

Draw Diagrams wherever necessary.

Essay **(3x10=30)**

1. Describe the features of the skeletal, cardiac and smooth muscles with the help of diagrams. (1+3+3+3)
2. Define hemostasis. Describe the intrinsic and extrinsic blood coagulative pathways (1+9)
3. Define hormones. Classify them and explain its generalized cellular mechanisms of actions. (2+4+4)

Short notes: **(8x5=40)**

4. Factors regulating the glomerular filtration rate
5. Contraceptive methods
6. Functions of lymph
7. Cardiac cycle
8. Physiology of olfaction and hearing
9. Dalton's law and its application in respiration
10. Signal transmission at chemical synapse
11. Functions of liver and gall bladder

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QP CODE: **Reg.No: .....**

First Year Pharm D Degree Examinations - August 2014

Pharmaceutics

Time: 3 Hours **Total Marks: 70**

☐ Answer all Questions.

☐ Draw Diagrams wherever necessary.

Essay **(3x10=30)**

1. Explain in brief about formulation and evaluation of suspensions.
2. Classify powder and explain in detail about divided powders with examples.
3. Define and explain chemical incompatibility with examples.

Short notes: **(8x5=40)**

4. If 30 mg of ephedrine hydrochloride can be given to an adult, what will be the dose for a child of 3 years. If 1500g solution containing 75g of a drug substance, what is the percentage strength (w/w) of the solution.
5. Discuss about the historical development and profession of pharmacy.
6. What are the advantages and disadvantages of suppositories?
7. What are gargles? Explain in brief and differentiate gargles & mouth washes.
8. Method of preparation and sterilization of surgical catgut.
9. Explain about tinctures.
10. What are the different methods of preparation of emulsions? Describe them.
11. Explain in brief on throat paint.

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QP CODE: **Reg.No: .....**

First Year Pharm D Degree Examinations - August 2014

Medicinal Biochemistry

Time: 3 Hours **Total Marks: 70**

☐ Answer all Questions.

☐ Draw Diagrams wherever necessary.

Essay **(3x10=30)**

1. Explain the citric acid cycle with energetics
2. Explain the biosynthesis of cholesterol from acetyl-CoA
3. Explain protein biosynthesis

Short notes: **(8x5=40)**

4 Electron transport chain

5 Genetic code

6 Explain gluconeogenesis and its significance

7 Inborn errors of the amino acid metabolism

8 Competitive inhibition

9 Transamination

10 Ketoacidosis

11 ELISA

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QP CODE: **Reg.No: .....**

First Year Pharm D Degree Examinations - August 2014

Pharmaceutical Organic Chemistry

Time: 3 Hours **Total Marks: 70**

Answer all Questions.

Write equation wherever necessary.

Essay **(3x10=30)**

1. Explain the mechanism, reactivity and stability of free radical chain reaction of alkanes.
2. Briefly narrate the following:

   Lewis acid –base theory-Bronstd-Lowry concept.Theory of resonance.

3. Explain the following reaction with mechanism and its synthetic importance:

   Hoffmann rearrangement. Perkin condensation.

Short notes: **(8x5=40)**

4. Compare and contrast SN_1 versus SN_2.

5. General nomenclature of alcohols and phenols.
6. Protic and aprotic solvents
7. Explain briefly about diazotization and coupling reaction.
8. Explain the cannizaro reaction with mechanism.
9. Mention the structure, chemical name and uses of vanillin and citric acid
10. Explain briefly about activating and deactivating groups.
11. Explain the reaction mechanism of Kolbe's reaction and Sand Meyer's reaction.

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I YEAR PHARM.D EXAMINATION

MODEL QUESTION PAPER

Subject: 1.5 PHARMACEUTICAL INORGANIC CHEMISTRY

Instructions:

- Answer all questions
- Write equations wherever necessary

Time 3 Hrs ***Max Marks 70***

Essay: **(3 x 10 = 30)**

1. Explain theories of indicators and choice of indicators for acid-base titration. What is mixed indicators? Mention their uses.
2. Discuss the principle and procedure involved in the limit test for Arsenic. Add a note on Gutzeit apparatus.
3. What are Antacids? Classify them with example. Write the importance of combination Antacids. Explain the preparation and assay method for Sodium Bicarbonate.

Short notes: **(8 x 5 = 40)**

4. What are the sources of errors in quantitative analysis of pharmaceuticals? How can they be minimized?
5. Describe the preparation, properties and assay of hydrogen peroxide IP.
6. Role of Fluorides as anti-caries agents. Explain the preparation of Sodium Fluoride
7. Physiological role of Potassium and Calcium ion.
8. Explain the preparation and assay method for Medicinal grade Oxygen.
9. Explain Precipitation titration. Write in detail about Modified Volhard's method.
10. Assay of Ferrous sulphate by Cerimetry and Permanganametry.
11. ORS and its components.

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SECOND PHARM D

QP CODE: **Reg.No: .....**

Second Year Pharm D Degree Examinations - August 2014

Pathophysiology

Time: 3 Hours **Total Marks: 70**

☐ Answer all Questions.

☐ Draw Diagrams wherever necessary.

Essay **(3x10=30)**

1. Explain the process of repair of wounds in the skin. Mention the factors that influence the healing of wounds.
2. Define shock. Discuss the types of shock. Add a note on the management of shock.
3. Discuss the pathogenesis and clinical manifestations of asthma.

Short notes **(8x5=40)**

4. Define cell injury and explain the causes of cell injury.
5. Chemical mediators of inflammation.
6. Classify autoimmune diseases and discuss the criteria for autoimmunity.
7. Pathophysiology of urinary tract infection.
8. Biological effects of radiation.
9. Classification of tumors.
10. Pathogenesis of atherosclerosis.
11. Food allergy

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QP CODE: **Reg.No: .....**

Second Year Pharm D Degree Examinations - August 2014

Pharmaceutical Microbiology

Time: 3 Hours **Total Marks: 70**

☐ Answer all Questions.

☐ Draw Diagrams wherever necessary.

Essay **(3x10=30)**

1. Explain the replication of an animal virus in detail.
2. Discuss the different methods of evaluation of bacteriostatic activity of a disinfectant.
3. Enlist the moist heat sterilization methods. Explain the equipment used the process and applications of steam-jacketed autoclave.

Short notes **(8x5=40)**

4. Explain principle and procedure involved in MR and VP tes
5. Schick test.
6. Principle and procedure involved in antibiotic assay.
7. Explain the causative organism, mode of transmission and treatment of tuberculosis.
8. Classify microorganisms depending on its temperature requirement with examples.
9. Explain Whittaker's five kingdom concept.
10. What is viable count. Explain the various techniques of viable count .
11. Explain the cultivation of anaerobic micro organism.

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QP CODE: **Reg.No: .....**

Second Year Pharm D Degree Examinations - August 2014

Pharmacognosy & Phytopharmaceuticals

Time: 3 Hours **Total Marks: 70**

Answer all Questions.

Draw Diagrams wherever necessary.

Essay **(3x10=30)**

1. Discuss various types of classifications of crude drugs giving suitable examples.
2. Explain the source, method of extraction, chemistry and one test for purity of castor oil.
3. Explain the biological source, family, chemistry constituents, uses and one chemical test for any two plant fibers used in surgical dressings.

Short notes **(8x5=40)**

4. How do you perform absorbency test for absorbent cotton as per I.P.
5. What are the possible adulterants of clove buds and how do you find out them .
6. Microscopical characters of senna leaves with a labeled diagram.
7. Significance of acid value and ester value.
8. Explain any two methods of cultivation of medicinal plants with examples.
9. Compare starch and honey.
10. Explain about various cell inclusions.
11. Any two natural pest control agents.

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QP CODE: **Reg.No: ……..**

Second Year Pharm D Degree Examinations - August 2014

Pharmacology - I

Time: 3 Hours **Total Marks: 70**

Answer all Questions.

Draw Diagrams wherever necessary.

Essay **(3x10=30)**

1. Classify anti epileptics. Discuss the pharmacological actions, mechanism of action and adverse effects of phenytoin
2. Discuss the various routes of administration of drugs with its advantages and limitations
3. Classify anti arrhythmics. Discuss the mechanism of action, indications and adverse effects of amiodarone

Short notes **(8x5=40)**

4. Nitrates
5. Neuromuscular blockers
6. Levodopa
7. Oxytocin
8. Barbiturates
9. Local anesthetics
10. Adverse effects of antipsychotics
11. Drug interactions

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QP CODE: **Reg.No: ……..**

Second Year Pharm D Degree Examinations - August 2014

Community Pharmacy

Time: 3 Hours **Total Marks: 70**

Answer all Questions.

Draw Diagrams wherever necessary

Essay **(3x10=30)**

1. What is AIDS. Explain the epidemiology, retroviral transmission and clinical manifestations associated with AIDS in detail.
2. What are the factors affecting medication adherence. Explain the role of pharmacist in improving medication adherence.
3. Define rational drug use. Explain in brief on essential drug concept and guidelines for rational drug use.

Short notes **(8x5=40)**

4 Clinical presentation and prevention of syphilis.

5. Selection of site, layout and design of a community pharmacy.

6. Various stages involved in patient counseling.

7. Care for geriatric patients.

8. Methods for screening blood pressure and counseling involved in controlling blood pressure.

9. Code of ethics for community pharmacists.

10. Role of a pharmacist in family planning.

11 Patient information leaflet.

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QP CODE: **Reg.No: ……..**

Second Year Pharm D Degree Examinations - August 2014

Pharmacotherapeutics - I

Time: 3 Hours **Total Marks: 70**

Answer all Questions.

Draw Diagrams wherever necessary.

Essay **(3x10=30)**

1. Define asthma. Explain the etiology, clinical manifestations and therapeutic management of asthma.
2. Describe the role of various sympatholytics in the treatment of hypertension.
3. Describe the types of heart failure and role of digitalis, including its risk in the treatment of heart failure.

Short notes **(8x5=40]**

4. Oral hypoglycemic agents.
5. Enumerate the methods of estrogen and progesterone administration.
6. Classify the drugs according to the degree of its potential risk during pregnancy.
7. Classification of anti arrythmic drugs
8. Various parameters measured in spirometry.
9. Explain the various etiological factors and management of osteoporosis.
10. Complications of diabetes mellitus.
11. Role of pharmacist in essential drug concept.

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Third Pharm.D.

QP CODE: **Reg.No: .....**

Third Year Pharm D Degree Examinations - September 2014

Pharmacology II

Time: 3 Hours **Total Marks: 70**

Answer all Questions.

Draw Diagrams wherever necessary.

Essays **(3x10=30)**

1. Classify diuretics. Discuss the mechanism of action, indications and adverse effects of loop diuretics
2. Discuss the basic principles of transcription in pro and eukaryotes
3. Classify anti neoplastic agents. Briefly discuss the adverse effects of cancer chemotherapy agents

Short notes **(8x5=40)**

4. Plasma expanders
5. Anti platelets
6. Acute and sub acute toxicity studies
7. Cell cycle regulators
8. Pharmacology of immunosuppressant's
9. RNA processing
10. Gene therapy and targeting
11. Oncogenes

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QP CODE: **Reg.No: .....**

Third Year Pharm D Degree Examinations -September 2014

Pharmaceutical Analysis

Time: 3 Hours **Total Marks: 70**

Answer all Questions.

Draw Diagrams wherever necessary.

Essays(3x10=30)

1. Discuss the principle, stationary phase, mobile phase, development techniques and applications of paper chromatography.
2. Explain the principle and instrumentation of UV-VIS double beam spectrophotometer with a neat diagram.
3. Explain the principle and applications of NMR and mass spectra.

Short notes **(8x5=40)**

4. Applications of DSC and DTA in pharmaceutical analysis.
5. Explain TQM, ICH and Validation.
6. Define mass spectrum. Explain the principle and different types ions produced in mass spectra.
7. List the advantages of HPTLC over TLC.
8. ESR and its application.
9. Differentiate between flame emission and atomic absorption spectroscopy.
10. Dropping mercury electrode- its advantages and disadvantages.
11. Explain quenching.

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QP CODE: **Reg.No: .....**

Third Year Pharm D Degree Examinations -September 2014

Pharmacotherapeutics - II

Time: 3 Hours **Total Marks: 70**

☐ Answer all Questions.

☐ Draw Diagrams wherever necessary.

Essays **(3x10=30)**

1. Explain the different stages of cancer and mention the signs and symptoms, pathophysiology and therapeutic management ofbreast cancer
2. Explain the pathophysiology, signs and symptoms and therapeutic management of gout. Mention the difference between osteoarthritis and rheumatoid arthritis
3. Describe the signs and symptoms, pathophysiology and management of endocarditis

Short notes **(8x5=40)**

4. Drug induced renal failure
5. Therapeutic management of eczema
6. Explain various HIV regimens
7. Treatment of gastroenteritis
8. Need of rational use of antibiotic
9. Systemic lupus erythematous
10. Pathophysiology and management of fungal infection
11. Pharmacotherapeutic management of respiratory tract infection.

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QP CODE: **Reg.No: .....**

Third Year Pharm D Degree Examinations -September 2014

Pharmaceutical Jurisprudence

Time: 3 Hours **Total Marks: 70**

Answer all Questions.

Draw Diagrams wherever necessary.

Essays **(3x10=30)**

1. Explain the constitution & functions of state and joint state pharmacy council.
2. Discuss the prevention of cruelty to animal act – 1960.
3. What conditions are to be satisfied before and after the grant of import license. Explain the class of drugs prohibited from import

Short notes **(8x5=40)**

4. Functions of drug consultative committee.
5. Explain how duty paid alcoholic goods can be exported from India.
6. Schedule "Y".
7. Non-prescription products.
8. Patent and design act-1960.
9. How are the retail prices of formulations fixed under Drugs price control order.
10. Mention the offences and penalties of NDPS act.
11. Classes of advertisements are prohibited to import or export

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QP CODE: **Reg.No: ……..**

Third Year Pharm D Degree Examinations -September 2014

Medicinal Chemistry

Time: 3 Hours **Total Marks: 70**

Answer all Questions.

Draw Diagrams wherever necessary.

Essays **(3x10=30)**

1. What are hypolipidemic agents and classify it with structures. Outline the synthesis of benzafibrate and nicotinic acid
2. What are thiazide diuretics and mention the examples with structures. Explain the structure activity relationship of it.
3. What are the diagnostic agents classify it with examples. Outline the synthesis of any two of them

Short notes **(8x5=40)**

4. Explain any two electronic parameters of QSAR drug design.
5. Outline the mechanism of carrier linked pro drugs with special reference to carboxylic acid moiety and carbonyl moiety
6. How will you carry out the combinatorial synthesis on solid support.
7. Classify anticancer agents and add a note on mechanism of action of alkylating agents
8. Explain the synthesis of hexachlorophene and halazone.
9. Synthesis of propyl paraben and methyl paraben.
10. Explain the synthesis of any one second generation quinolones used as urinary tract anti infective agents.
11. What are anti viral agents. Outline the synthesis of lamivudine.

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QP CODE: **Reg.No: .....**

Third Year Pharm D Degree Examinations - September 2014

Pharmaceutical Formulations

Time: 3 Hours **Total Marks: 70**

Answer all Questions.

Draw Diagrams wherever necessary.

Essays(3x10=30)

1. Explain the different granulation techniques in detail
2. Write a detailed note on quality control tests for parenteral preparation
3. Explain nasal drug delivery system in detail.

Short notes **(8x5=40)**

4. Occusert.
5. Different suppository bases.
6. Stability problems of emulsion.
7. Buccal tablets.
8. Binders used in tablet dosage form.
9. Merits and demerits of rectal drug delivery.
10. Pan coating method of tablet coating.
11. Types and method of preparation of syrups.

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Fourth PharmD

Q.P. Code: **Reg. no.:**.....

Fourth Year Pharm D Degree Examinations, August 2014

Pharmacotherapeutics III

Time: 3 Hours **Total Marks: 70**

Answer all questions

Draw diagrams wherever necessary

Essay: **(3x10=30)**

1. Explain the clinical presentation and management of Parkinsons disease.
2. Describe the etio-pathogenesis of chronic liver disorders. Explain the management of ascitis and hepatic encephalopathy in alcoholic liver disease.
3. Explain the pathophysiology and management of two major types of stroke

Short notes: **(8x5=40)**

4. Classify anemia based in RBC morphology and describe the management of megaloblastic anemia.
5. Explain the treatment algorithm of status epilepticus.
6. Explain the etiology and management of drug induced hemolytic anemia
7. Enumerate on Evidence based Medicine
8. Explain the factors which enhance gastroesophageal reflux.
9. Explain the pharmacological management of neuralgias
10. Management of viral hepatitis.
11. Describe various regimen for eradication for H.Pylori infection.

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Q.P. Code: **Reg. no.: .....**

Fourth Year Pharm D Degree Examinations, August 2014

Hospital Pharmacy

Time: 3 Hours **Total Marks: 70**

Answer all questions

Draw diagrams wherever necessary

Essay: **(3x10=30)**

1. What is a pharmacy and therapeutics committee (PTC). Explain the composition, operation and functions of PTC in a hospital.
2. Define inventory and purchase. Explain ABC analysis and economic order quantity (EOQ) methods of inventory control.
3. Enumerate various methods of drug distribution system to the inpatients. Explain any two methods with its advantages and disadvantages.

Short notes: **(8x5=40)**

4. Institutional ethical committee of a hospital.
5. Explain the compounding plan for an adult total parentral nutrition (TPN) solution regimen
6. Explain the handling of radiopharmaceuticals in the hospital.
7. What is continuing professional development for pharmacist. Explain its purpose and principles.
8. Explain the procedure to obtain the ward stock of narcotics from the pharmacy.
9. Budget preparation for hospital pharmacy.
10. Explain the packaging and handling of radiopharmaceuticals in a hospital.
11. Discuss the methods of sterilization for small volume parenterals.

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Q.P. Code: **Reg. no.: .....**

Fourth Year Pharm D Degree Examinations, August 2014

Clinical Pharmacy

Time: 3 Hours **Total Marks:70**

Answer all questions

Draw diagrams wherever necessary

Essay: **(3x10=30)**

1. Classify the different types of medication errors. Outline the various measures which can be taken in the minimization of medication errors.
2. Discuss the various salient pharmaceutical care concepts for optimizing patient care.
3. Explain the importance of communication skills, including patient counseling techniques.

Short notes: **(8x5=40)**

4. Outline the various parameters involved in pulmonary function tests.
5. Discuss the role of a pharmacist in management of adverse drug reaction.
6. Enumerate the steps involved in the establishment of drug poison information center in a hospital setup.
7. Medication chart review
8. Patient's case history analysis.
9. Drug dosing in renal impairment patients.
10. Drug utilization review.
11. Define the following medical terminologies:

DyspnoeaDyslipidemiaMalenaAtaxiaDelusion

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Q.P. Code: **Reg. no.: .....**

Fourth Year Pharm D Degree Examinations, August 2014

Biostatistics & Research Methodology

Time: 3 Hours **Total Marks: 70**

Answer all questions

Draw diagrams wherever necessary

Essay: **(3x10=30)**

1. Classify the various types of clinical study designs. Explain case and observational studies with suitable examples.
2. Explain the advantages and disadvantages of non - parametric tests. Enumerate the various non-parametric tests. Add a note on Wilcoxan's signed rank test.
3. Define testing hypothesis. Outline the different stages involved in testing of a hypothesis.

Short notes: **(8x5=40)**

4. Estimate mean, standard deviation for the hemoglobin values (gm/dl) of 10 children receiving therapy for haemolytic anemia.

   1.39.1 10.0 9.9 11.3 12.3 9.13 9.8 7.5 and 6.6

5. Explain different statistical softwares.
6. Semi-logarthimic plots.
7. Computerized literature retrieval.
8. Type-I and type-II errors.
9. Paired and unpaired t-tests.
10. One way Anova
11. Relative and attributable risks.

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Q.P. Code: **Reg. no.: .....**

Fourth Year Pharm D Degree Examinations, August 2014

Biopharmaceutics & Pharmacokinetics

Time: 3 Hours **Total Marks: 70**

Answer all questions

Draw diagrams wherever necessary

Essay: **(3x10=30)**

1. After administration of single i.v bolus dose of 100 mg of drug. The plasma concentration – time profile can be described by the following expression. $C_p = 2.6\ e^{-(5.0t)} + 0.52\ e^{-(0.4t)}$, where t is in hours and C_p is in mg/L. What is the area under the curve and total body clearance of this drug.

2. Discuss in detail about nonlinear pharmacokinetics.

3. Describe one compartment open model Pharmacokinetics – Intravenous infusion

Short notes: **(8x5=40)**

4. Distribution of drugs to various organs
5. Repititive Intravenous injections – One Compartment Open Model
6. Importance of compartment model
7. Factors affecting elimination of drug
8. Gastric emptying time and motility
9. Clinical importance of drug bioavailability
10. Area under the first moment curve
11. Extraction ratio

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Q.P. Code: **Reg. no.: ……**

Fourth Year Pharm D Degree Examinations, August 2014

Clinical Toxicology

Time: 3 Hours **Total Marks: 70**

Answer all questions

Draw diagrams wherever necessary

Essays: **(3x10=30)**

1. Explain the complications and management of acute organophosphorus poisoning.
2. Explain food poisoning
3. Explain first aid measures in snake bite poisoning and explain the management of cobra envenomation.

Short notes: **(8x5=40)**

4. Explain the role of poison severity scale in assessment of severity of poisoning.
5. Describe the management of lead poisoning.
6. Explain the management of iron poisoning
7. Explain the management of cocaine detoxification.
8. Explain the role of gastric lavage and charcoal administration in gut decontamination process.
9. Explain the role of atropine and pralidoxime in the management of opium poisoning.
10. Discuss about the nicotine therapy in smoking cessation.
11. Explain the management of Paracetamol poisoning

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QP Code: **Reg. No.:.....**

Fifth Year Pharm. D Degree Examinations

(Model Question Paper)

Clinical Research

Time: 3 hrs

Max.Marks: 70

•Answer all questions

•Draw diagram wherever necessary

Essays: (3x10=30)

1. Explain clinical trial protocol as per ICH-GCP guidelines
2. Describe briefly the various phases of clinical trials.
3. Discuss the composition, responsibilities and procedures of IRB/IEC

Short notes (8x5=40)

4. ANDA submission.
5. Explain the safety monitoring in clinical research
6. Explain the role of investigator
7. Explain the design of a patient informed consent with a suitable example
8. Pharmacological approaches to drug discovery
9. Challenges in implementing the ethical guidelines
10. Clinical trial design
11. Methods of post marketing surveillance

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QP Code: **Reg. No.:.....**

Fifth Year Pharm. D Degree Examinations

(Model Question Paper)

PHARMACOEPIDEMIOLOGY AND PHARMACOECONOMICS

Time: 3 hrs

Max.Marks: 70

•Answer all questions

•Draw diagram wherever necessary

Essays: (3x10=30)

1. Define pharmacoepidemiology. Explainthe history, scope and applicationsof pharmacoepidemiology.
2. Define DUE and explain the steps involved in a DUE. Mention the role of pharmacist in a DUE study.
3. Explain the cost effectiveness analysis and cost utility analysis with its applications in pharmacoeconomic study.

Short notes

(8x5=40)

4. Explain incidence and prevalence in pharmacoepidemiological study.
5. Explain the meta analysis models with examples.
6. Describe the various types of costs in pharmacoeconomic study.
7. Explain the role of pharmacoeconomics in formulary management.
8. Explain the relative risk and attributable risk in pharmacoepidemiological study.
9. Describe spontaneous reporting system.
10. Briefly explain about the pharmacoepidemiological outcome measurements.
11. Explain case control studies with suitable examples.

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QP Code: **Reg. No.:.....**

Fifth Year Pharm. D Degree Examinations

(Model Question Paper)

CLINICAL PHARMACOKINETICS AND THERAPEUTIC DRUG MONITORING

Time: 3 hrs

Max.Marks: 70

•Answer all questions

•Draw diagram wherever necessary

Essays:

(3x10=30)

1. Explain therapeutic drug monitoring. Discuss the indications and protocol for TDM
2. Discuss the dosing of drugs in the elderly &children and in obese patients with suitable examples.
3. Explain the approaches of analysis of population pharmacokinetic data and mention applications.

Short notes (8x5=40)

4. Bayesian theory of adaptive method
5. Dosage adjustment for uremic patients.
6. Effect of genetic polymorphism in drug transport and drug targets.
7. Genetic polymorphism.
8. TDM of drugs used in cardiac and seizure disorders.
9. Extracorporeal removal of drugs.
10. Drug interactions related to inhibition and induction of drug metabolism with one example.
11. Dosage adjustment in renal disease.

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Internal assessment component

As given in Scheme of examination showing maximum marks and minimum marks (clause 3.3)

Details of practical/clinical practical exams

As given in content of each subject in each year (clause 2.10)

Number of examiners needed (Internal & External) and their qualifications

Examiner – From within this University or other Universities with 5 years Post PG teaching experience.

There shall be two examiners for practical examination-one internal and one external, who will jointly evaluate the performance of the candidate and conduct viva voce examination and award marks.

Details of viva:

- ***Scheme of Practical Examination:***

	Sessionals	**Annual**
Identification	04	10
Synopsis	04	10
Major Experiment	07	20
Minor Experiment	03	15
Viva	02	15
Max Marks	**20**	**70**
Duration	**03hrs**	**04hrs**

Note : Total sessional marks is 30 (20 for practical sessional plus 10 marks for regularity, promptness, viva-voce and record maintenance).

4. INTERNSHIP

Eligibility for internship

The student will join the compulsory rotatory internship programme after passing the final professional examination.

Every candidate shall be required, after passing the final Pharm.D examination as the case may be to undergo compulsory rotational internship to the satisfaction of the College authorities and University concerned for a period of twelve months so as to be eligible for the award of the degree of Pharm.D as the case may be.

Details of internship, Duration

Internship or residency training including postings in speciality units. Student should independently provide the clinical pharmacy services to the allotted wards.

(i) Six months in General Medicine department,

(ii) Two months each in three other speciality departments

SPECIFIC OBJECTIVES :

(i) To provide patient care in cooperation with patients, prescribers, and other members of an inter professional health care team based upon sound therapeutic principles and evidence-based data, taking into account relevant legal, ethical, social cultural, economic, and professional issues, emerging technologies, and evolving biomedical, pharmaceutical, social or behavioral or administrative, and clinical sciences that may impact therapeutic outcomes.

(ii) to manage and use resources of the health care system, in cooperation with patients, prescribers, other health care providers, and administrative and supportive personnel, to promote health; to provide, assess, and coordinate safe, accurate, and time-sensitive medication distribution; and to improve therapeutic outcomes of medication use.

(iii) to promote health improvement, wellness, and disease prevention in cooperation with patients, communities, at-risk population, and other members of an interprofessional team of health care providers.

(iv) to demonstrate skills in monitoring of the National Health Programmes and schemes, oriented to provide preventive and promotive health care services to the community.

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(v) To develop leadership qualities to function effectively as a member of the health care team organised to deliver the health and family welfare services in existing socio economic, political and cultural environment.

(vi) To communicate effectively with patients and the community.

The intern shall maintain a record of work which is to be verified and certified by the preceptor (teacher practitioner) under whom he/she works. Apart from scrutiny of the record of work, assessment and evaluation of training shall be undertaken by an objective approach using situation tests in knowledge, skills and attitude during and at the end of the training. Based on the record of work and date of evaluation, the Dean or Principal shall issue certificate of satisfactory completion of training, following which the university shall award the degree or declare him eligible for it.

Model of Internship Mark lists

Satisfactory completion of internship shall be determined on the basis of the following:-

1) Proficiency of knowledge required for each case management. SCORE 0-5
2) The competency in skills expected for providing Clinical Pharmacy Services SCORE 0-5
3) Responsibility, punctuality, work up of case, involvement in patient care SCORE 0-5
4) Ability to work in a team (Behavior with other healthcare professionals including medical doctors, nursing staff and colleagues SCORE 0-5
5) Initiative, participation in discussions, research aptitude. SCORE 0-5

Poor	Fair	Below Average	Average	Above Average	Excellent
0	1	2	3	4	5

A Score of less than 3 in any of above items will represent unsatisfactory completion of internship.

Extension rules

- Extension of internship: Internship shall be extended by the number of days the students remains absent. These extended days of internship should be completed in the respective external/internal institution.

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- Any other leave other than eligible leave less than six months has to be compensated by extension granted by the principal.

Details of Training given

Sixth Year:

- Internship or residency training including postings in specialty units. Student should independently provide the clinical pharmacy services to the allotted wards.
- Six months in General Medicine department, and Two months each in three other speciality departments.

5. ANNEXURES

Check Lists for Monitoring:
Log Book, Seminar Assessment etc., to be formulated by the curriculum committee of the concerned Institution

APPENDIX-A

(See regulation 1.4)

CONDITIONS TO BE FULFILLED BY THE

ACADEMIC TRAINING INSTITUTION

1) Any authority or institution in India applying to the Pharmacy Council of India for approval of courses of study for Pharm.D under sub-section (1) of section 12 of the Pharmacy Act, 1948 shall comply with the infrastructural facilities as prescribed by the Pharmacy Council of India from time to time.

2) Pharm.D programmes shall be conducted only in those institutions which -
   a) are approved by the Pharmacy Council of India for B.Pharm
   b) course as providedunder section 12 of the Pharmacy Act, 1948;
   c) have 300 bedded hospital attached to it.

(i) Hospital Details

1. Institution with their own hospital of minimum 300 beds.

2. Teaching hospital recognised by the Medical Council of India or University, or a Government hospital not below the level of district headquarter hospital with 300 beds with clearly defined Memorandum of Understanding including housing pharmacy practice department with minimum carpet area of 30 square feet per student along with consent to provide the professional manpower to support the programme.
3. Corporate type hospital with minimum 300 beds with clearly defined Memorandum of Understanding including housing pharmacy practice department with minimum carpet area of 30 square feet per student along with consent to provide the professional manpower to support the programme.
4. Number of institutions which can be attached to one hospital shall be restricted by the student pharmacist to bed ratio of 1:10.

(ii) Speciality

a) Tertiary care hospitals are desirable
b) Medicine[compulsory], and any three specialization of the following
    1. Surgery
    2. Pediatrics
    3. Gynecology and obstetrics
    4. Psychiatry
    5. Skin and VD
    6. Orthopedics

(iii) Location of the Hospital

It should be within the same limits of Corporation or Municipality or Campus with Medical Faculty involvement as adjunct faculty.

In case the hospital and institution are located in different corporations or municipalities or campuses, the distance between the two shall not be more than 30 kms by road.

(iv) The University shall ascertain that the College is having facilities as per Appendix – A by appointing Technical Expert Committee, constituted for the purpose periodically, for inspection.

3) TEACHING STAFF REQUIREMENT

i) Staff Pattern : All faculty shall be full time. However part time perceptors in hospital shall be allowed.
ii) Subject wise specialisation of the Teaching Staff :

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S.No.	Subject	Specialisation required
1.	Pharmacy Practice	M.Pharm in Pharmacy Practice or Pharmacology or Pharmaceutics.
2.	Human Anatomy & Physiology	M.Pharm in Pharmacology or Pharmacy Practice
3.	Pharmaceutics (Dispensing & General Pharmacy)	M.Pharm in Pharmaceutics
4.	Pharmacognosy-I	M.Pharm in Pharmacognosy
5.	Pharmaceutical Organic Chemistry-I	M.Pharm in Pharmaceutical chemistry or Pharmaceutical Analysis or Quality assurance or Bulk Drug
6.	Pharmaceutical Inorganic Chemistry	M.Pharm in Pharmaceutical chemistry or Pharmaceutical Analysis or Quality assurance or Bulk Drug
7.	Pharmaceutical microbiology	M.Pharm in Pharmaceutics or Pharmaceutical Biotechnology
8.	Pathophysiology	M.Pharm Pharmacy practice or Pharmacology
9.	Applied Biochemistry & Clinical Chemistry	M.Pharm in Pharmacology or Pharmacy practice or Pharmaceutical chemistry
10.	Pharmacology-I	M.Pharm in Pharmacology or Pharmacy Practice
11.	Pharmaceutical Jurisprudence	M.Pharm in Pharmaceutics
12.	Pharmacology-II	M.Pharm in Pharmacology or Pharmacy Practice
13.	Pharmaceutical Dosage Forms	M.Pharm in Pharmaceutics or Industrial Pharmacy
14.	Pharmacotherapeutics –I, II and III	M.Pharm Pharmacy practice or Pharmacology
15.	Community Pharmacy	M.Pharm in Pharmacy practice or Pharmacology or Pharmaceutics

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16.	Hospital Pharmacy	M.Pharm in Pharmacy practice or Pharmacology or Pharmaceutics
17.	Clinical Pharmacy	M.Pharm in Pharmacy practice
18.	Computer Science or Computer Application in pharmacy	MCA
19.	Mathematics	M.Sc. (Maths)

iii) Teaching Staff :

Department/Division	**Name of the post**	**No.**
Department of Pharmaceutics	Professor	1
	Asst. Professor	1
	Lecturer	2
Department of Pharmaceutical Chemistry (Including Pharmaceutical Analysis)	Professor	1
	Asst. Professor	1
	Lecturer	3
Department of Pharmacology	Professor	1
	Asst. Professor	1
	Lecturer	2
Department of Pharmacognosy	Professor	1
	Asst. Professor	1
	Lecturer	1
Department of Pharmacy Practice	Professor	1
	Asst. Professor	2
	Lecturer	3

vi) Workload of Faculty : Professor – 8 hrs. per week Assistant Professor – 12 hrs. per week Lecturers – 16 hrs. per week

v) Training of Pharmacy Practice Faculty :

a) Teaching staff will be trained as per the module prescribed by the Central Council.

b) Duration of – Minimum 3 months.

training

c) Training sites – Institutions running pharmacy practice or Programmes for atleast five years.

d) Trainer – Professor or Assistant Professor with minimum of five years of clinical pharmacy teaching and practice experience.

5) **ACCOMMODATION :**

Suitable and sufficient accommodation with adequate ventilation, lighting and other hygienic conditions should be provided to the rooms for Principal or the Head of the department, office, class rooms, library, staff, staff common room, students common room, museum, laboratories, stores, etc.

At least two lecture halls alongwith eight laboratories as specified below should be provided for: —

1. Pharmaceutics and Pharmacokinetics Lab - 2
2. Life Science (Pharmacology, Physiology, Pathophysiology) - 2
3. Phytochemistry or Pharmaceutical Chemistry - 2
4. Pharmacy Practice - 2

Total = 8

In addition to the laboratories, balance room, aseptic room or cabinet, animal house and a machine room shall also be provided.

Floor area of the laboratory should not be less than 30 square feet per student required to work in the laboratory at any given time subject to a minimum of 750 square feet.

Laboratories should be fitted and constructed in a manner that these can be kept reasonably clean. Gas and water fittings, shelves, fuming cupboards be provided wherever necessary.

6. EQUIPMENT AND APPARATUS :

<u>Department wise list of minimum equipments</u>

A. DEPARTMENT OF PHARMACOLOGY :

I. Equipment:

S.No.	Name	Minimum required Nos.
1	Microscopes	15
2	Haemocytometer with Micropipettes	20

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3	Sahli's haemocytometer	20
4	Hutchinson's spirometer	01
5	Spygmomanometer	05
6	Stethoscope	05
7	Permanent Slides for various tissues	One pair of each tissue Organs and endocrine glands One slide of each organ system
8	Models for various organs	One model of each organ system
9	Specimen for various organs and Systems	One model for each organ system
10	Skeleton and bones	One set of skeleton and one spare bone
11	Different Contraceptive Devices and Models	One set of each device
12	Muscle electrodes	01
13	Lucas moist chamber	01
14	Myographic lever	01
15	Stimulator	01
16	Centrifuge	01
17	Digital Balance	01
18	Physical /Chemical Balance	01
19	Sherrington's Kymograph Machine or Polyrite	10
20	Sherrington Drum	10
21	Perspex bath assembly (single unit)	10
22	Aerators	10
23	Computer with LCD	01
24	Software packages for experiment	01
25	Standard graphs of various drugs	Adequate number
26	Actophotometer	01
27	Rotarod	01
28	Pole climbing apparatus	01
29	Analgesiometer (Eddy's hot plate and radiant heat methods)	01
30	Convulsiometer	01
31	Plethysmograph	01

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32	Digital pH meter	01

II.Apparatus:

S.No	Name	Minimum required Nos.
1	Folin-Wu tubes	60
2	Dissection Tray and Boards	10
3	Haemostatic artery forceps	10
4	Hypodermic syringes and needles of size 15,24,26G	10
5	Levers, cannulae	20

NOTE: Adequate number of glassware commonly used in the laboratory should be provided in each laboratory and department.

B. DEPARTMENT OF PHARMACOGNOSY :

I. Equipment:

S.No.	Name	Minimum required Nos.
1	Microscope with stage micrometer	15
2	Digital Balance	02
3	Autoclave	02
4	Hot air oven	02
5	B.O.D.incubator	01
6	Refrigerator	01
7	Laminar air flow	01
8	Colony counter	02
9	Zone reader	01
10	Digital pH meter	01
11	Sterility testing unit	01
12	Camera Lucida	15
13	Eye piece micrometer	15
14	Incinerator	01
15	Moisture balance	01
16	Heating mantle	15
17	Flourimeter	01
18	Vacuum pump	02
19	Micropipettes (Single and multi	02

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	channeled)	
20	Micro Centrifuge	01
21	Projection Microscope	01

II. Apparatus:

S.No.	Name	Minimum required Nos.
1	Reflux flask with condenser	20
2	Water bath	20
3	Clavengers apparatus	10
4	Soxhlet apparatus	10
5	TLC chamber and sprayer	10
6	Distillation unit	01

NOTE: Adequate number of glassware commonly used in the laboratory should be provided in each laboratory and department.

C. DEPARTMENT OF PHARMACEUTICAL CHEMISTRY :

I. Equipment:

S.No.	Name	Minimum required Nos.
1	Hot plates	05
2	Oven	03
3	Refrigerator	01
4	Analytical Balances for demonstration	05
5	Digital balance 10mg sensitivity	10
6	Digital Balance (1mg sensitivity)	01
7	Suction pumps	06
8	Muffle Furnace	01
9	Mechanical Stirrers	10
10	Magnetic Stirrers with Thermostat	10
11	Vacuum Pump	01
12	Digital pH meter	01
13	Microwave Oven	02

II. Apparatus:

S.No.	Name	Minimum required Nos.
1	Distillation Unit	02
2	Reflux flask and condenser single	20

	Necked	
3	Reflux flask and condenser double/ triple necked	20
4	Burettes	40
5	Arsenic Limit Test Apparatus	20
6	Nesslers Cylinders	40

NOTE: Adequate number of glassware commonly used in the laboratory should be provided in each laboratory and department.

D. DEPARTMENT OF PHARMACEUTICS :

I. Equipment:

S.No	Name	Minimum required Nos.
1	Mechanical stirrers	10
2	Homogenizer	05
3	Digital balance	05
4	Microscopes	05
5	Stage and eye piece micrometers	05
6	Brookfield's viscometer	01
7	Tray dryer	01
8	Ball mill	01
9	Sieve shaker with sieve set	01
10	Double cone blender	01
11	Propeller type mechanical agitator	05
12	Autoclave	01
13	Steam distillation still	01
14	Vacuum Pump	01
15	Standard sieves, sieve no. 8, 10, 12,22,24, 44, 66, 80	10 sets
16	Tablet punching machine	01
17	Capsule filling machine	01
18	Ampoule washing machine	01
19	Ampoule filling and sealing machine	01
20	Tablet disintegration test apparatus IP	01
21	Tablet dissolution test apparatus IP	01

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22	Monsanto's hardness tester	01
23	Pfizer type hardness tester	01
24	Friability test apparatus	01
25	Clarity test apparatus	01
26	Ointment filling machine	01
27	Collapsible tube crimping machine	01
28	Tablet coating pan	01
29	Magnetic stirrer, 500ml and 1 liter capacity with speed control	05 EACH 10
30	Digital pH meter	01
31	All purpose equipment with all Accessories	01
32	Aseptic Cabinet	01
33	BOD Incubator	02
34	Bottle washing Machine	01
35	Bottle Sealing Machine	01
36	Bulk Density Apparatus	02
37	Conical Percolator (glass/copper/ stainless steel)	10
38	Capsule Counter	02
39	Energy meter	02
40	Hot Plate	02
41	Humidity Control Oven	01
42	Liquid Filling Machine	01
43	Mechanical stirrer with speed regulator	02
44	Precision Melting point Apparatus	01
45	Distillation Unit	01

II. Apparatus:

S.No	Name	Minimum required Nos.
1	Ostwald's viscometer	15
2	Stalagmometer	15
3	Desiccator*	05
4	Suppository moulds	20
5	Buchner Funnels (Small, medium, large)	05 each

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6	Filtration assembly	01
7	Permeability Cups	05
8	Andreason's Pipette	03
9	Lipstick moulds	10

NOTE: Adequate number of glassware commonly used in the laboratory should be provided in each laboratory and department.

E. DEPARTMENT OF PHARMACEUTICAL BIOTECHNOLOGY :

S.No.	Name	Minimum required Nos.
1	Orbital shaker incubator	01
2	Lyophilizer (Desirable)	01
3	Gel Electrophoresis (Vertical and Horizontal)	01
4	Phase contrast/Trinocular Microscope	01
5	Refrigerated Centrifuge	01
6	Fermenters of different capacity (Desirable)	01
7	Tissue culture station	01
8	Laminar airflow unit	01
9	Diagnostic kits to identify infectious agents	01
10	Rheometer	01
11	Viscometer	01
12	Micropipettes (single and multi channeled)	01 each
13	Sonicator	01
14	Respinometer	01
15	BOD Incubator	01
16	Paper Electrophoresis Unit	01
17	Micro Centrifuge	01
18	Incubator water bath	01
19	Autoclave	01
20	Refrigerator	01

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21	Filtration Assembly	01
22	Digital pH meter	01

NOTE: Adequate number of glassware commonly used in the laboratory should be provided in each laboratory and department.

F. DEPARTMENT OF PHARMACY PRACTICE : Equipment:

S.No.	Name	Minimum required Nos.
1	Colorimeter	2
2	Microscope	Adequate
3	Permanent slides (skin, kidney,	Adequate
	pancreas, smooth muscle, liver etc.,)	
4	Watch glass	Adequate
5	Centrifuge	1
6	Biochemical reagents for analysis of normal and pathological constituents in urine and blood facilities	Adequate
7	Filtration equipment	2
8	Filling Machine	1
9	Sealing Machine	1
10	Autoclave sterilizer	1
11	Membrane filter	1 Unit
12	Sintered glass funnel with complete filtering assemble	Adequate
13	Small disposable membrane filter for IV admixture filtration	Adequate
14	Laminar air flow bench	1
15	Vacuum pump	1
16	Oven	1
17	Surgical dressing	Adequate
18	Incubator	1
19	PH meter	1
20	Disintegration test apparatus	1
21	Hardness tester	1
22	Centrifuge	1
23	Magnetic stirrer	1
24	Thermostatic bath	1

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NOTE:

1. **Computers and Internet connection (Broadband), six computers for students with internet and staff computers as required.**
2. **Adequate number of glassware commonly used in the laboratory should be provided in each laboratory and the department.**

G. CENTRAL INSTRUMENTATION ROOM :

S.No.	Name	Minimum required Nos.
1	Colorimeter	01
2	Digital pH meter	01
3	UV- Visible Spectrophotometer	01
4	Flourimeter	01
5	Digital Balance (1mg sensitivity)	01
6	Nephelo Turbidity meter	01
7	Flame Photometer	01
8	Potentiometer	01
9	Conductivity meter	01
10	Fourier Transform Infra Red Spectrometer (Desirable)	01
11	HPLC	01
12	HPTLC (Desirable)	01
13	Atomic Absorption and Emission spectrophotometer (Desirable)	01
14	Biochemistry Analyzer (Desirable)	01
15	Carbon, Hydrogen, Nitrogen Analyzer (Desirable)	01
16	Deep Freezer (Desirable)	01
17	Ion- Exchanger	01
18	Lyophilizer (Desirable)	01

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APPENDIX-B

(See regulation 3)

CONDITIONS TO BE FULFILLED BY

THE EXAMINING AUTHORITY

1. The Examining Authority shall be a statutory Indian University constituted by the Central Government/State Government/Union Territory Administration. It shall ensure that discipline and decorum of the examinations are strictly observed at the examination centers.
2. It shall permit the Inspector or Inspectors of the Pharmacy Council of India to visit and inspect the examinations.
3. It shall provide:-
   (a) adequate rooms with necessary furniture for holding written examinations;
   (b) well-equipped laboratories for holding practical examinations;
   (c) an adequate number of qualified and responsible examiners and staff to conduct and invigilate the examinations; and
   (d) such other facilities as may be necessary for efficient and proper conduct of examinations.
4. It shall, if so required by a candidate, furnish the statement of marks secured by a candidate in the examinations after payment of prescribed fee, if any, to the Examining Authority.
5. It shall appoint examiners whose qualifications should be similar to those of the teachers in the respective subjects as shown in Appendix–A.
6. In pursuance of sub–section (3) of section 12 of the Pharmacy Act, 1948, the Examining Authority shall communicate to the Secretary, Pharmacy Council of India, not less than six weeks in advance the dates fixed for examinations, the time-table for such examinations, so as to enable the Council to arrange for inspection of the examinations.
7. The Examining Authority shall ensure that examiners for conducting examination for Pharm.D programmes shall be persons possessing pharmacy qualification and are actually involved in the teaching of the Pharm.D programmes in an approved institution.

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REGULATIONS 2017

SYLLABUS

For Courses affiliated to the

KERALA UNIVERSITY OF HEALTH SCIENCES

Thrissur 680596

BACHELOR OF PHARMACY

Course Code: 009

BACHELOR OF PHARMACY (B. Pharm)

(2017-18 Academic year onwards)

2017

2. COURSE CONTENT

Title of course:

Bachelor of Pharmacy − B. Pharm

Objectives of course

The objective of the course is to mold the student to suit the varied requirements of

1. Pharmaceutical industry –Research & Development, Manufacturing, Formulation, Quality Control, Quality assurance, Packaging, Marketing.
2. Practice settings in −Hospital Pharmacy, Clinical Pharmacy and Community Pharmacy.
3. Academics.
4. Regulatory affairs.
5. Clinical Research.
6. Drug discovery and development

Medium of instruction:

Medium of instruction and examinations shall be English

Course Outline

Program/Course credit structure

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

Theory and Laboratory courses

a. Credit assignment

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.

b. Minimum credit requirements

The minimum credit points required for award of a B. Pharm degree is 210. These credits are divided into Theory courses, Tutorials, Practical, Practice School and Project over the duration of eight semesters. The credits are distributed semester− wise as shown in Table IX. Courses generally progress in sequences, building competencies and their positioning indicates certain academic maturity on the part of the learners. Learners are expected to follow the semester−wise schedule of courses given in the syllabus. The lateral entry students shall get 52 credit points transferred from their D. Pharm program. Such students shall take up additional remedial courses of _Communication Skills‘ (Theory and Practical) and _Computer

Applications in Pharmacy‘ (Theory and Practical) equivalent to 3 and 4 credit points respectively, a total of 7 credit points to attain 59 credit points, the maximum of I and II semesters.

Academic work

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

Course of study

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

Table-I: Course of study for semester I

Course Code	Name of the Course	No. of hours	Tutorial	Credit points
BP101T	Human Anatomy and Physiology I– Theory	3	1	4
BP102T	Pharmaceutical Analysis I – Theory	3	1	4
BP103T	Pharmaceutics I – Theory	3	1	4
BP104T	Pharmaceutical Inorganic Chemistry – Theory	3	1	4
BP105T	Communication skills – Theory *	2	-	2
BP106RBT	Remedial Biology – Theory *			
BP106RMT	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	Name of the Course	No. of hours	Tutorial	Credit points
BP201T	Human Anatomy and Physiology II – Theory	3	1	4
BP202T	Pharmaceutical Organic Chemistry I – Theory	3	1	4
BP203T	Biochemistry – Theory	3	1	4
BP204T	Pathophysiology – Theory	3	1	4
BP205T	Computer Applications in Pharmacy – Theory *	3	-	3
BP206T	Environmental sciences – Theory *	3	-	3
BP207P	Human Anatomy and Physiology II –Practical	4	-	2
BP208P	Pharmaceutical Organic Chemistry I– Practical	4	-	2
BP209P	Biochemistry – Practical	4	-	2
BP210P	Computer Applications in Pharmacy – Practical*	2	-	1
	Total	**32**	**4**	**29**

*Non University Examination (NUE)

Table-III: Course of study for semester III

Course	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	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	Name of the Course	No. of hours	Tutorial	Credit points
BP501T	Medicinal Chemistry II – Theory	3	1	4
BP502T	Formulative Pharmacy– Theory	3	1	4
BP503T	Pharmacology II – Theory	3	1	4
BP504T	Pharmacognosy and Phytochemistry II– Theory	3	1	4
BP505T	Pharmaceutical Jurisprudence – Theory	3	1	4
BP506P	Formulative Pharmacy – 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	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	Name of the Course	No. of hours	Tutorial	Credit points
BP701T	Instrumental Methods of Analysis – Theory	3	1	4
BP702T	Industrial Pharmacy – Theory	3	1	4
BP703T	Pharmacy Practice – Theory	3	1	4
BP704T	Novel Drug Delivery System – Theory	3	1	4
BP705P	Instrumental Methods of Analysis – Practical	4	-	2
BP706PS	Practice School*	12	-	6
	Total	**28**	**4**	**24**

* Non University Examination (NUE)

Table-VIII: Course of study for semester VIII

Course	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	Pharmaceutical Marketing	3 +3 =6	1 +1 =2	4 + 4 = 8
BP804ET	Pharmaceutical Regulatory Science			
BP805ET	Pharmacovigilance			
BP806ET	Quality Control and Standardization of Herbs			
BP807ET	Computer Aided Drug Designing			
BP808ET	Cell and Molecular Biology			
BP809ET	Cosmetic Science			
BP810ET	Experimental Pharmacology			
BP811ET	Advanced Instrumentation Techniques			
BP812PW	Project work	12	-	6
	Total	**24**	**4**	**22**

Table-IX: Semester wise credits distribution

Semester	Credit Points
I	27/29$ /30#
II	29
III	24
IV	28
V	26
VI	30
VII	24
VIII	22
Extracurricular/ Co curricular activities	01*
Total credit points for the program	**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**.**

Examinations/Assessments

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

End semester examinations

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

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	1Hr	25	75	3Hrs	100
BP102T	Pharmaceutical Analysis I–Theory	10	15	1Hr	25	75	3Hrs	100
BP103T	Pharmaceutics I– Theory	10	15	1Hr	25	75	3Hrs	100
BP104T	Pharmaceutical Inorganic Chemistry–Theory	10	15	1Hr	25	75	3Hrs	100
BP105T	Communication skills–Theory*	5	10	1Hr	15	35	1.5Hrs	50
BP106RBT BP106RMT	Remedial Biology/ Mathematics–Theory*	5	10	1Hr	15	35	1.5Hrs	50
BP107P	Human Anatomy and Physiology–Practical	5	10	4Hrs	15	35	4Hrs	50
BP108P	Pharmaceutical Analysis I–Practical	5	10	4Hrs	15	35	4Hrs	50
BP109P	Pharmaceutics I–Practical	5	10	4Hrs	15	35	4Hrs	50
BP110P	Pharmaceutical Inorganic Chemistry–Practical	5	10	4Hrs	15	35	4Hrs	50
BP111P	Communication skills–Practical*	5	5	2Hrs	10	15	2Hrs	25
BP112RBP	Remedial Biology–Practical*	5	5	2Hrs	10	15	2Hrs	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#**

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	1Hr	25	75	3Hrs	100
BP202T	Pharmaceutical Organic Chemistry I – Theory	10	15	1Hr	25	75	3Hrs	100
BP203T	Biochemistry –Theory	10	15	1Hr	25	75	3Hrs	100
BP204T	Pathophysiology –Theory	10	15	1Hr	25	75	3Hrs	100
BP205T	Computer Applications in Pharmacy– Theory*	10	15	1Hr	25	50	2Hrs	75
BP206T	Environmental sciences –Theory*	10	15	1Hr	25	50	2Hrs	75
BP207P	Human Anatomy and Physiology II –Practical	5	10	4Hrs	15	35	4Hrs	50
BP208P	Pharmaceutical Organic Chemistry I– Practical	5	10	4Hrs	15	35	4Hrs	50
BP209P	Biochemistry – Practical	5	10	4Hrs	15	35	4Hrs	50
BP210P	Computer Applications in Pharmacy– Practical*	5	5	2Hrs	10	15	2Hrs	25
Total		**80**	**125**	**20Hrs**	**205**	**520**	**30Hrs**	**725**

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

Semester III

Course	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	1Hr	25	75	3Hrs	100
BP302T	Physical Pharmaceutics I – Theory	10	15	1Hr	25	75	3Hrs	100
BP303T	Pharmaceutical Microbiology – Theory	10	15	1Hr	25	75	3Hrs	100
BP304T	Pharmaceutical Engineering – Theory	10	15	1Hr	25	75	3Hrs	100
BP305P	Pharmaceutical Organic Chemistry II – Practical	5	10	4Hr	15	35	4Hrs	50
BP306P	Physical Pharmaceutics I – Practical	5	10	4Hr	15	35	4Hrs	50
BP307P	Pharmaceutical Microbiology – Practical	5	10	4Hr	15	35	4Hrs	50
BP308P	Pharmaceutical Engineering – Practical	5	10	4Hr	15	35	4Hrs	50
Total		**60**	**100**	**20**	**160**	**440**	**28Hrs**	**600**

Semester 12

Course	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	1Hr	25	75	3Hrs	100
BP402T	Medicinal Chemistry I−Theory	10	15	1Hr	25	75	3Hrs	100
BP403T	Physical Pharmaceutics II−Theory	10	15	1Hr	25	75	3Hrs	100
BP404T	Pharmacology I−Theory	10	15	1Hr	25	75	3Hrs	100
BP405T	Pharmacognosy I−Theory	10	15	1Hr	25	75	3Hrs	100
BP406P	Medicinal Chemistry I−Practical	5	10	4Hr	15	35	4Hrs	50
BP407P	Physical Pharmaceutics II−Practical	5	10	4Hrs	15	35	4Hrs	50
BP408P	Pharmacology I−Practical	5	10	4Hrs	15	35	4Hrs	50
BP409P	Pharmacognosy I−Practical	5	10	4Hrs	15	35	4Hrs	50
Total		**70**	**115**	**21Hrs**	**185**	**515**	**31Hrs**	**700**

Semester 13

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	1Hr	25	75	3Hrs	100
BP502T	Formulative Pharmacy−Theory	10	15	1Hr	25	75	3Hrs	100
BP503T	Pharmacology II−Theory	10	15	1Hr	25	75	3Hrs	100
BP504T	Pharmacognosy II−Theory	10	15	1Hr	25	75	3Hrs	100
BP505T	Pharmaceutical Jurisprudence – Theory	10	15	1Hr	25	75	3Hrs	100
BP506P	Formulative Pharmacy −Practical	5	10	4Hr	15	35	4Hrs	50
BP507P	Pharmacology II−Practical	5	10	4Hr	15	35	4Hrs	50
BP508P	Pharmacognosy II−Practical	5	10	4Hr	15	35	4Hrs	50
Total		**65**	**105**	**17Hr**	**170**	**480**	**27Hrs**	**650**

Semester 14

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	1Hr	25	75	3Hrs	100
BP602T	Pharmacology III−Theory	10	15	1Hr	25	75	3Hrs	100
BP603T	Herbal Drug Technology −Theory	10	15	1Hr	25	75	3Hrs	100
BP604T	Biopharmaceutics and Pharmacokinetics−Theory	10	15	1Hr	25	75	3Hrs	100
BP605T	Pharmaceutical Biotechnology− Theory	10	15	1Hr	25	75	3Hrs	100
BP606T	Quality Assurance−Theory	10	15	1Hr	25	75	3Hrs	100
BP607P	Medicinal chemistry III −Practical	5	10	4Hrs	15	35	4Hrs	50
BP608P	Pharmacology III−Practical	5	10	4Hrs	15	35	4Hrs	50
BP609P	Herbal Drug Technology − Practical	5	10	4Hrs	15	35	4Hrs	50
Total		**75**	**120**	**18Hrs**	**195**	**555**	**30Hrs**	**750**

Semester 15

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	1Hr	25	75	3Hrs	100
BP702T	Industrial Pharmacy −Theory	10	15	1Hr	25	75	3Hrs	100
BP703T	Pharmacy Practice −Theory	10	15	1Hr	25	75	3Hrs	100
BP704T	Novel Drug Delivery System−Theory	10	15	1Hr	25	75	3Hrs	100
BP705P	Instrumental Methods of Analysis −Practical	5	10	4Hrs	15	35	4Hrs	50
BP706PS	Practice School*	25	-	-	25	125	5Hrs	150
Total		**70**	**70**	**8Hrs**	**140**	**460**	**21Hrs**	**600**

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

Semester 16

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	1Hr	25	75	3Hrs	100
BP802T	Social and Preventive Pharmacy− Theory	10	15	1Hr	25	75	3Hrs	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 Standardizations 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							
BP812PW	Project Work	-	-	-	-	150	4Hrs	150
Total		40	60	4hrs	100	450	16	550

Internal assessment: Continuous mode

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

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

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

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

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

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 for15marks. 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

(Answer all the questions)

I. Long Answers		=	01 x 10 = 10
II. Short Answers		=	02 x 05 = 10
III. Objective type questions		=	05 x 02 = 10
	Total	=	30 Marks

For subject shaving Non University Examination

I.	Long Answers	=	01 x 10 = 10
II.	Short Answers	=	04 x 05 = 20
	Total	=	30 Marks

Question paper pattern for practical Sessional examinations

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

Promotion and award of grades

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

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.

Improvement of internal assessment

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

Re-examination of end semester examinations

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

Table-XIII: Tentative schedule of end semester examinations

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

Question paper pattern for end semester theory examinations

For 75 marks paper

(Answer all the questions)

I.	Long Answers	=	02 x 10 = 20
II.	Short Answers	=	07 x 05 = 35
III.	Objective type questions	=	10 x 02 = 20
	Total	=	75 Marks

For 50 marks paper

I.	Long Answers	=	02 x 10 = 20
II.	Short Answers	=	06 x 05 = 30
	Total	=	50 Marks

For 35 marks paper

I.	Long Answers	=	01 x 10 = 10
II.	Short Answers	=	05 x 05 = 25
	Total	=	35 Marks

Question paper pattern for end semester practical examinations

I.	Synopsis	=	05
II.	Experiments	=	25
III.	Viva voce	=	05
	Total	=	35 Marks

Academic Progression:

No student shall be admitted to any examination unless he/she fulfills the norms given. 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 success fully completed.

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

A student shall be eligible to carry forward all the courses of V, VI semesters till the VII semester examinations. However, he/she shall not be eligible to get the course completion certificate

Until all the courses of I to VIII semesters are successfully completed.

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

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

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

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

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

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

Grading of performances

Letter grades and grade points allocations:

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

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

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

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

The Semester grade point average (SGPA)

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

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

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

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

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:

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

Where C_1, C_2, C_3,….. 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	=	CGPA of 7.50 and above
First Class	=	CGPA of 6.00 to 7.49
Second Class	=	CGPA of 5.00 to 5.99

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.

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

Total	**75Marks**

Evaluation of Presentation:

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

Total	**75Marks**

Explanation: The75 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.

Industrial training

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.

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.

Award of Ranks

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

Award of degree

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

Duration of the program

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

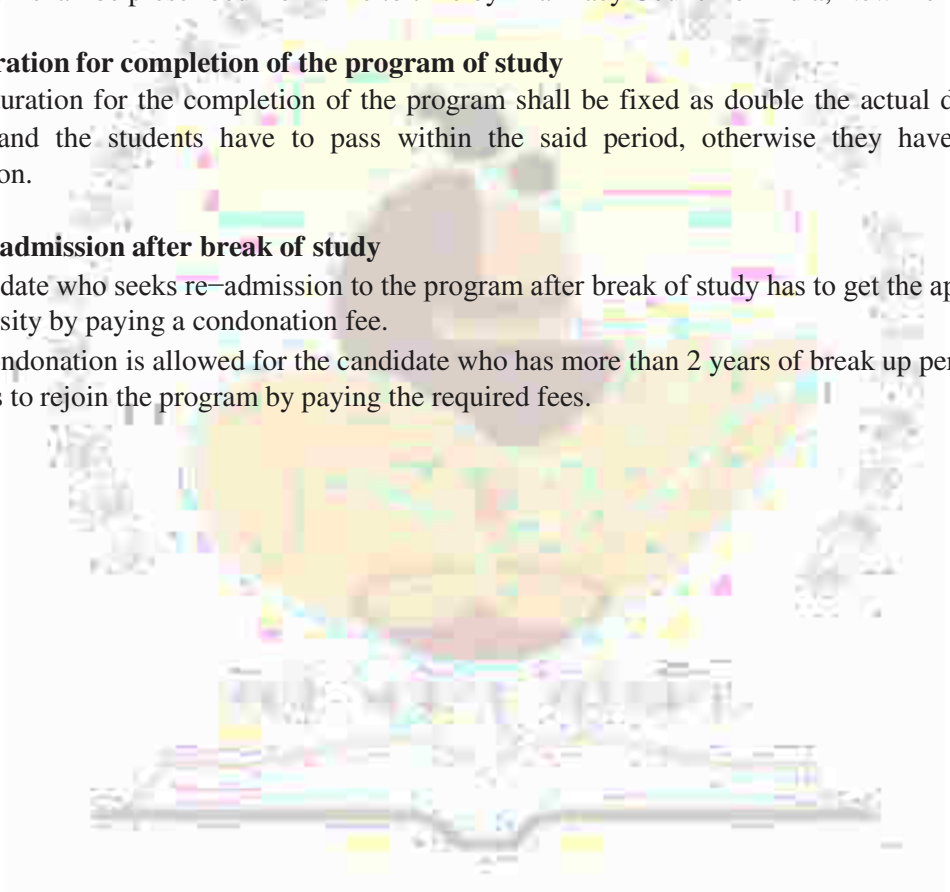
Duration for completion of the program of study

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

Re-admission after break of study

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

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



SYLLABUS

Semester-I

BP101T. HUMAN ANATOMY AND PHYSIOLOGY-I (Theory) **45 Hours**

Scope: This subject is designed to impart fundamental knowledge on the structure and functions of the various systems of the human body. It also helps in understanding both homeostatic mechanisms. The subject provides the basic knowledge required to understand the various disciplines of pharmacy.

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

1. Explain the gross morphology, structure and functions of various organs of the human body.
2. Describe the various homeostatic mechanisms and their imbalances.
3. Identify the various tissues and organs of different systems of human body.
4. Perform the various experiments related to special senses and nervous system.
5. Appreciate coordinated working pattern of different organs of each system

Course Content:

Unit I **10 Hours**

- **Introduction to human body**

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

- **Cellular level of organization**

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

- **Tissue level of organization**

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

Unit II **10 Hours**

- **Integumentary system**

  Structure and functions of skin

- **Skeletal system**

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

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

- **Joints**

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

Unit III **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 endothelial system.

- **Lymphatic system**

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

Unit IV **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.

Special senses

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

Unit V **07 Hours**

Cardiovascular system

Heart – anatomy of heart, blood circulation, blood vessels, structure and functions of artery, vein and capillaries, elements of conduction system of heart and heartbeat, 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 discussions in physiology. Practical 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 the subject**.**

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

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, New York
3. Physiological basis of Medical Practice Best and Tailor. Williams & Wilkins Co, Riverview, MI USA
4. Text book of Medical Physiology− Arthur C,Guyton andJohn.E. Hall. Miamisburg, OH, U.S.A.
5. Principles of Anatomy and Physiology by Tortora Grabowski. Palmetto, GA, U.S.A.
6. Textbook of Human Histology by Inderbir Singh, Jaypee brother‘s medical publishers, New Delhi.
7. Textbook of Practical Physiology by C.L. Ghai, Jaypee brother‘s 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 (Latest Editions)

1. Physiological basis of Medical Practice−Best and Tailor. Williams & Wilkins Co, Riverview, MI USA
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 Publishers Kolkata

BP102T. PHARMACEUTICAL ANALYSIS (Theory) 45 Hours

Scope: This course deals with the fundamentals of analytical chemistry and principles of electrochemical analysis of drugs

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

1. understand the principles of volumetric and electro chemical analysis
2. Carryout various volumetric and electrochemical titrations
3. develop analytical skills

Course Content:

UNIT-I 10 Hours

(a) **Pharmaceutical analysis** − Definition and scope

i) Different techniques of analysis
ii) Methods of expressing concentration
iii) Primary and secondary standards.
iv) Preparation and standardization of various molar and normal solutions− Oxalic acid, sodium hydroxide, hydrochloric acid, sodium thiosulphate, sulphuric acid, potassium permanganate and cerric ammonium sulphate

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

UNIT-II 10 Hours

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

curves

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

UNIT-III **10 Hours**

- **Precipitation titrations**: Mohr's method, Volhard's, Modified volhard's, Fajans method, estimation of sodium chloride.
- **Complexometric titration**: Classification, metal ion indicators, masking and demasking reagents,estimation of Magnesium sulphate, and calcium gluconate
- **Gravimetry**: Principle and steps involved in gravimetric analysis. Purity of the precipitate: co−precipitation and post precipitation, Estimation of barium sulphate
- Basic Principles, methods and application of Diazotisation titration

UNIT-IV **08 Hours**

Redox titrations

(a) Concepts of oxidation and reduction

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

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

UNIT-V **07 Hours**

Electrochemical methods of analysis

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

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BP108P. PHARMACEUTICAL ANALYSIS (Practical) **4 Hours / Week**

I Limit test of the following

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

II Preparation and standardization of

(1) Sodium hydroxide
(2) Sulphuric acid
(3) Sodium thiosulfate
(4) Potassium permanganate
(5) Ceric ammonium sulphate

III Assay of the following compounds along with Standardization of Titrant

(1) Ammonium chloride by acid base titration
(2) Ferrous sulphate by Cerimetry
(3) Copper sulphate by Iodometry
(4) Calcium gluconate by complexometry

(5) Hydrogen peroxide by Permanganometry
(6) Sodium benzoate by non−aqueous titration
(7) Sodium Chloride by precipitation titration

IV Determination of Normality by electro-analytical methods

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

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. 5.John H. Kennedy, Analytical chemistry principles 6.Indian Pharmacopoeia.

BP103T. PHARMACEUTICS- I (Theory) 45 Hours

Scope: This course is designed to impart a fundamental knowledge on the preparatory pharmacy with arts and science of preparing the different conventional dosage forms.

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

1. Know the history of profession of pharmacy
2. Understand the basics of different dosage forms, pharmaceutical incompatibilities and pharmaceutical calculations
3. Understand the professional way of handling the prescription
4. Preparation of various conventional dosage forms

Course Content:

UNIT – I 10 Hours

- **Historical background and development of profession of pharmacy**: History of profession of Pharmacy in India in relation to pharmacy education, industry and organization, Pharmacy as a career, Pharmacopoeias: Introduction to IP, BP, USP and Extra Pharmacopoeia.
- **Dosage forms:** Introduction to dosage forms, classification and definitions
- **Prescription:** Definition, Parts of prescription, handling of Prescription and Errors in prescription.
- **Posology:** Definition, Factors affecting posology. Pediatric dose calculations based on age, body weight and body surface area.

UNIT – II 10 Hours

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

- **Powders:** Definition, classification, advantages and disadvantages, Simple & compound powders − official preparations, dusting powders, effervescent, efflorescent and hygroscopic powders, eutectic mixtures. Geometric dilutions.
- **Liquid dosage forms:** Advantages and disadvantages of liquid dosage forms. Excipients used in formulation of liquid dosage forms. Solubility enhancement techniques

UNIT – III **10 Hours**

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

UNIT – IV **08 Hours**

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

UNIT– V **07 Hours**

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

BP109P. PHARMACEUTICS I (Practical) **3 Hours / week**

1. Syrups a) Syrup IP‘66 b) Compound syrup of Ferrous phosphate BPC‘68

2. Elixirs a) Piperazine citrate elixir b) Paracetamol pediatric elixir

3. Linctus a) Terpine hydrate Linctus I P‘66 b) Iodine Throat paint(Mandles Paint)

4. Solutions

a) Strong solution of ammonium acetate
b) Cresol with soap solution
c) Lugol‘s Solution

5. Suspensions

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

6. Emulsions

a) Turpentine Liniment b) Liquid paraffin emulsion

7. Powders and Granules

a) ORS powder (WHO)
b) Effervescent granules
c) Dusting powder

d) Divided powders

8. Suppositories

a. Glycero gelatin suppository
b. Cocoa butter suppository
c. Zinc oxide suppository

9. Semisolids

a. Sulphur ointment
b. Non staining iodine ointment with methyl salicylate
c. Carbopol gel

10. Gargles and Mouthwashes

a. Iodine Gargle
b. Chlorhexidine mouthwash

Recommended Books: (Latest Editions)

1. H.C. Ansel et al., Pharmaceutical Dosage Form and Drug Delivery System, Lippincott Williams and Walkins, New Delhi.
2. Carter S.J., Cooper and Gunn's–Dispensing for Pharmaceutical Students, CBS publishers, New Delhi.
3. M.E. Aulton, Pharmaceutics, The Science& Dosage Form Design, Churchill Livingstone, Edinburgh.
4. Indian pharmacopoeia.
5. British pharmacopoeia.
6. Lachmann. Theory and Practice of Industrial Pharmacy,Lea& Febiger Publisher, The University of Michigan.
7. Alfonso R. Gennaro Remington. The Science and Practice of Pharmacy, Lippincott Williams, New Delhi.
8. Carter S.J., Cooper and Gunn's. Tutorial Pharmacy, CBS Publications, New Delhi.
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, New York.
11. Dilip M. Parikh: Handbook of Pharmaceutical Granulation Technology, Marcel Dekker, INC, New York.
12. Francoise Nieloud and Gilberte Marti–Mestres: Pharmaceutical Emulsions and Suspensions, Marcel Dekker, INC, New York.

BP104T. PHARMACEUTICAL INORGANIC CHEMISTRY (Theory) 45 Hours

Scope: This subject deals with the monographs of inorganic drugs and.

Objectives: Upon completion of course student shall be able to

1. know the sources of impurities and methods to determine the impurities in inorganic drugs and pharmaceuticals
2. understand the medicinal and pharmaceutical importance of inorganic compounds

Course Content:

UNIT I **10 Hours**

- **Impurities in pharmaceutical substances:** History of Pharmacopoeia,
  Sources and types of impurities, principle involved in the limit test for Chloride, Sulphate, Iron, Arsenic, Lead and Heavy metals, modified limit test for Chloride and Sulphate
- **General methods of preparation**, assay for the compounds superscripted with **asterisk (*),** Properties and medicinal uses of inorganic compounds belonging to the following classes

UNIT II **10 Hours**

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

UNIT III **10 Hours**

- **Gastrointestinal agents Acidifiers:** Ammonium chloride* and Dil. HCl

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

Cathartics: Magnesium sulphate, Sodium orthophosphate**, Pharmaceutical Aid** Kaolin and Bentonite

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

UNIT IV **08 Hours**

- **Miscellaneous compounds**

  Expectorants: Potassium iodide, Ammonium chloride*. **Emetics**: Copper sulphate*, Antimony potassium tartarate **Haematinics:** Ferrous sulphate*, Ferrous gluconate
  Poison and Antidote: Sodium thiosulphate*, Activated charcoal, Sodium nitrite333

  Astringents: Zinc Sulphate, Potash Alum

UNIT V **07 Hours**

- **Radiopharmaceuticals**: Radio activity, Measurement of radioactivity, Properties of a, þ, y radiations, Half-life, radio isotopes and study of radio isotopes − Sodium iodide I^{131}, Storage conditions, precautions & pharmaceutical application of radioactive substances.

BP110P. PHARMACEUTICAL INORGANIC CHEMISTRY (Practical) 4Hours / Week

I Limit tests for following ions

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

II **Identification test**

Magnesium hydroxide Ferrous sulphate Sodium bicarbonate Calcium gluconate Copper sulphate

III **Test for purity**

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

IV **Preparation ofinorganic pharmaceuticals**

Boric acid Potashalum 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 Pharmaceutical Chemistry
5. Bentley and Driver's Textbook of Pharmaceutical Chemistry
6. Anand & Chatwal, Inorganic Pharmaceutical Chemistry
7. Indian Pharmacopoeia

BP105T.COMMUNICATION SKILLS (Theory) 30 Hours

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

Objectives:

Upon completion of the course the student shall be able to

1. Understand the behavioral needs for a Pharmacist to function effectively in the areas of pharmaceutical operation
2. Communicate effectively (Verbal and Non Verbal)
3. Effectively manage the team as a team player
4. Develop interview skills
5. Develop Leadership qualities and essentials

Course content:

UNIT – I **07 Hours**

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

- **Barriers to communication:** Physiological Barriers, Physical Barriers, Cultural Barriers, Language Barriers, Gender Barriers, Interpersonal Barriers, Psychological Barriers, Emotional barriers
- **Perspectives in Communication:** Introduction, Visual Perception, Language, Other factors affecting our perspective − Past Experiences, Prejudices, Feelings, Environment

UNIT – II **07 Hours**

- **Elements of Communication:** Introduction, Face to Face Communication − Tone of Voice, Body Language (Non−verbal communication), Verbal Communication, Physical Communication
- **Communication Styles:** Introduction, The Communication Styles Matrix with example for each − Direct Communication Style, Spirited Communication Style, Systematic Communication Style, Considerate Communication Style

UNIT – III **07 Hours**

- **Basic Listening Skills:** Introduction, Self−Awareness, Active Listening, Becoming an Active Listener, Listening in Difficult Situations
- **Effective Written Communication:** Introduction, When and When Not to Use Written Communication − Complexity of the Topic, Amount of Discussion‘ Required, Shades of Meaning, Formal Communication
- W**riting Effectively:** Subject Lines, Put the Main Point First, Know Your Audience, Organization of the Message

UNIT – IV **05 Hours**

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

UNIT – V **04 Hours**

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

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

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

Basic communication covering the following topics Meeting People Asking Questions Making Friends What did you do? Do‘s and Dont‘s

Pronunciations covering the following topics

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

Advanced Learning

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

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. Communication skills for professionals, Konar nira, 2ndEdition, New arrivals − 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 Mac Millan,2009
12. Bringing out the best in people, Aubrey Daniels, 2ndEdition, Mc Graw Hill, 1999

BP 106RBT.REMEDIAL BIOLOGY (Theory) 30 Hours

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

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

1. know the classification and salient features of five kingdoms of life
2. understand the basic components of anatomy & physiology of plant
3. know understand the basic components of anatomy & physiology animal with special reference to human

UNIT I 07 Hours

Living world:

- Definition and characters of living organisms
- Diversity in the living world
- Binomial nomenclature

- Five kingdoms of life and basis of classification. Salient features of Monera, 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.

UNIT II **07 Hours**

Body fluids and circulation

- Composition of blood, blood groups, coagulation of blood
- Composition and functions of lymph
- Human circulatory system
- Structure of human heart and blood vessels
- Cardiac cycle, cardiac output and ECG

Digestion and Absorption

- Human alimentary canal and digestive glands
- Role of digestive enzymes
- Digestion, absorption and assimilation of digested food

Breathing and respiration

- Human respiratory system
- Mechanism of breathing and its regulation
- Exchange of gases, transport of gases and regulation of respiration
- Respiratory volumes

UNIT III **07 Hours**

Excretory products and their elimination

- Modes of excretion
- Human excretory system− structure and function
- Urine formation
- Rennin angiotensin system

Neural control and coordination

- Definition and classification of nervous system
- Structure of a neuron
- Generation and conduction of nerve impulse
- Structure of brain and spinal cord
- Functions of cerebrum, cerebellum, hypothalamus and medulla oblongata

Chemical coordination and regulation

- Endocrine glands and their secretions
- Functions of hormones secreted by endocrine glands

Human reproduction

- Parts of female reproductive system
- Parts of male reproductive system

- Spermatogenesis and Oogenesis
- Menstrual cycle

UNIT IV **05 Hours**

Plants and mineral nutrition:

- Essential mineral, macro and micronutrients
- Nitrogen metabolism, Nitrogen cycle, biological nitrogen fixation

Photosynthesis

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

UNIT V **04 Hours**

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

Plant growth and development

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

Cell - The unit of life

- Structure and functions of cell and cell organelles. Cell division

Tissues

- Definition, types of tissues, location and functions.

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. Sreenivasa Naidu
b. A Text book of Biology by Naidu and Murthy
c. Botany for Degree students By A.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 in biology
    a) Study of Microscope
    b) Section cutting techniques
    c) Mounting and staining
    d) Permanent slide preparation
2. Study of cell and its inclusions
3. Study of Stem, Root, Leaf and its modifications
4. Detailed study of frog by using computer models
5. Microscopic study and identification of tissues pertinent to stem, root, leaf, seed, fruit and flower.

6. Identification of bones
7. Determination of blood group
8. Determination of blood pressure
9. Determination of tidal volume

Reference Books

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

BP 106RMT.REMEDIAL MATHEMATICS (Theory) 30 Hours

Scope: This is an introductory course in mathematics. This subject deals with the introduction to Partial fraction, Logarithm, matrices and Determinant, Analytical geometry, Calculus, differential equation and Laplace transform.

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

1. Know the theory and their application in Pharmacy
2. Solve the different types of problems by applying theory
3. Appreciate the important application of mathematics in Pharmacy

Course Content:

UNIT – I 06 Hours

- **Partial fraction**

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

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

  Real Valued function, Classification of real valued functions,
- **Limits and continuity**:

  Introduction , Limit of a function, Definition of limit of a function (-definition) ,

$$\lim_{x\to a}\frac{x^n-a^n}{x-a}=na^{n-1}\text{ , }\lim_{8\to 0}\frac{\sin 8}{8}=1$$

UNIT –II 06 hours

- **Matrices and Determinant:**

Introduction matrices, Types of matrices, Operation on matrices, Transpose of a matrix, Matrix Multiplication, Determinants, Properties of determinants, Product of determinants, Minors and co−Factors, Adjoint or adjugate of a square matrix , Singular and non−singular matrices, Inverse of

a matrix, Solution of system of linear of equations using matrix method, Cramer's rule, Characteristic equation and roots of a square matrix, Cayley− Hamilton theorem, Application of Matrices in solving Pharmacokinetic equations

UNIT – III **06 Hours**

- **Calculus**

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

UNIT – IV **06 Hours**

Analytical Geometry

Introduction: Signs of the Coordinates, Distance formula,

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

Integration:

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

UNIT-V **06 Hours**

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

Recommended Books (Latest Edition)

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

Semester II

BP 201T. HUMAN ANATOMY AND PHYSIOLOGY-II (Theory) 45 Hours

Scope: This subject is designed to impart fundamental knowledge on the structure and functions of the various systems of the human body. It also helps in understanding both homeostatic mechanisms. The subject provides the basic knowledge required to understand the various disciplines of pharmacy.

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

1. Explain the gross morphology, structure and functions of various organs of the human body.
2. Describe the various homeostatic mechanisms and their imbalances.
3. Identify the various tissues and organs of different systems of human body.
4. Perform the hematological tests like blood cell counts, hemoglobin estimation, bleeding/ clotting time etc. and also record blood pressure, heart rate, pulse and respiratory volume.
5. Appreciate coordinated working pattern of different organs of each system
6. Appreciate the interlinked mechanisms in the maintenance of normal functioning (homeostasis) of human body.

Course Content:

Unit I **10 hours**

- **Nervous system**

Organization of nervous system, neuron, neuroglia, classification and properties of nerve fiber, 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, reflex activity)

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Unit II **06 hours**

- **Digestive system**

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

- **Energetics**

Formation and role of ATP, Creatinine Phosphate and BMR.

Unit III **10 hours**

- **Respiratory system**

Anatomy of respiratory system with special reference to anatomy of Lungs, Mechanism of respiration, regulation of respiration

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

- **Urinary system**

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

Unit IV **10 Hours**

- **Endocrine system**

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

Unit V **09 hours**

- **Reproductive system**

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

- **Introduction to genetics**

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

BP 207 P. HUMAN ANATOMY AND PHYSIOLOGY (Practical) **4 Hours/week**

Practical physiology is complimentary to the theoretical discussions in 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 the subject**.**

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 endicrine system using specimen, models, etc.,
4. To demonstrate the general neurological examination
5. To demonstrate the function of olfactory nerve
6. To examine the different types of Taste
7. To demonstrate the visual acuity.
8. To demonstrate the reflex activity.
9. Recording of body temperature.
10. To demonstrate positive and negative feedback mechanism.
11. Determination of tidal volume and vital capacity
12. Study of digestive, respiratory, cardiovascular systems, urinary and reproductive systems with the help of models, charts and specimens.
13. Recording of basal mass index .
14. Study of family planning devices and pregnancy diagnosis test.
15. Demonstration of total blood count by cell analyser
16. Permanent slides of vital organs and gonads.

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, New York
3. Physiological basis of Medical Practice–Best and Tailor. Williams & Wilkins Co,Riverview,MI USA
4. Text book of Medical Physiology– Arthur C,Guyton andJohn.E. Hall. Miamisburg, OH, U.S.A.
5. Principles of Anatomy and Physiology by Tortora Grabowski. Palmetto, GA, U.S.A.
6. Textbook of Human Histology by Inderbir Singh, Jaypee brothers medical publishers, New Delhi.
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, MI USA
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 Publishers Kolkata

BP202T. PHARMACEUTICAL ORGANIC CHEMISTRY –I (Theory) 45 Hours

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

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

1. write the structure, name and the type of isomerism of the organic compound
2. write the reaction, name the reaction and orientation of reactions
3. account for reactivity/stability of compounds,
4. identify/confirm the identification of organic compound

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 07 Hours

- **Classification, nomenclature and isomerism**

Classification of Organic Compounds

Common and IUPAC systems of nomenclature of organic compounds

(up to 10 Carbons open chain and carbocyclic compounds) Structural isomerisms in organic compounds

UNIT-II **10 Hours**

- **Alkanes*, Alkenes* and Conjugated dienes***

SP^3 hybridization in alkanes, Halogenation of alkanes, uses of paraffins. Stabilities of alkenes, SP^2 hybridization in alkenes

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-III **10 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, Distinguishing tests between 10 Structure and uses of Ethyl alcohol, Methyl alcohol, chlorobutanol, Cetosteryl alcohol, Benzyl alcohol, Glycerol, Propylene glycol

UNIT-IV **10 Hours**

- **Carbonyl compounds* (Aldehydes and ketones)**

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

UNIT-V **08 Hours**

- **Carboxylic acids***

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

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

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

BP208P. PHARMACEUTICAL ORGANIC CHEMISTRY -I (Practical) 4 Hours / week

I. Systematic qualitative analysis of unknown organic compounds like

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

II. Preparation of suitable solid derivatives from organic compounds

III. Construction of molecular models

Recommended Books (Latest Editions)

1. Organic Chemistry by Morrison and Boyd
2. Organic Chemistry by I.L. Finar , Volume−I
3. Textbook of Organic Chemistry by B.S. Bahl & Arun Bahl.
4. Organic Chemistry by P.L.Soni
5. Practical Organic Chemistry by Mann and Saunders.
6. Vogel's text book of Practical Organic Chemistry
7. Advanced Practical organic chemistry by N.K.Vishnoi.
8. Introduction to Organic Laboratory techniques by Pavia, Lampman and Kriz.
9. Reaction and reaction mechanism by Ahluwaliah/Chatwal.

BP203 T. BIOCHEMISTRY (Theory) 45 Hours

Scope: Biochemistry deals with complete understanding of the molecular levels of the chemical process associated with living cells. The scope of the subject is providing biochemical facts and the principles to understand metabolism of nutrient molecules in physiological and pathological conditions. It is also emphasizing on genetic organization of mammalian genome and hetero & autocatalytic functions of DNA.

Objectives: Upon completion of course student shall able to

1. Understand the catalytic role of enzymes, importance of enzyme inhibitors in design of new drugs, therapeutic and diagnostic applications of enzymes.
2. Understand the metabolism of nutrient molecules in physiological and pathological conditions.
3. Understand the genetic organization of mammalian genome and functions of DNA in the synthesis of RNAs and proteins.

Course Content:

UNIT I **07 Hours**

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.

UNIT II **08 Hours**

- **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.

Unit III **10 Hours**

- **Carbohydrate metabolism**

Glycolysis-Pathway, energetics and significance, Citric acid cycle-Pathway, energetics and significance.

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

Glycogen metabolism Pathways and glycogen storage diseases (GSD) Gluconeogenesis− Pathway and its significance.

Hormonal regulation of blood glucose level and Diabetes mellitus.

- **Biological oxidation**

Electron transport chain (ETC) and its mechanism. Oxidative phosphorylation & its mechanism and substrate level phosphorylation.

Inhibitors, ETC and oxidative phosphorylation/Uncouplers.

UNIT IV **10 Hours**

- **Lipid metabolism**

β-Oxidation of saturated fatty acid (Palmitic acid)

Formation and utilization of ketone bodies; ketoacidosis

De novo synthesis of fatty acids (Palmitic acid)

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

Disorders of lipid metabolism: Hypercholesterolemia, atherosclerosis, fatty liver and obesity.

- **Amino acid metabolism**

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

Catabolism of phenylalanine and tyrosine and their metabolic disorders (Phenylketonuria, Albinism, alkaptonuria, tyrosinemia)

Synthesis and significance of biological substances; 5−HT, melatonin, dopamine, noradrenaline, adrenaline
Catabolism of heme; hyperbilirubinemia and jaundice

UNIT V **10 Hours**

- **Nucleic acid metabolism and genetic information transfer**

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

BP 209 P. BIOCHEMISTRY (Practical) **4 Hours / Week**

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

Recommended Books (Latest Editions)

1. Principles of Biochemistry by Lehninger.
2. Harper‘s Biochemistry by Robert K. Murray, Daryl K. Granner and Victor W. Rodwell.
3. Biochemistry by Stryer.
4. Biochemistry by D. Satyanarayana and U.Chakrapani
5. Textbook of Biochemistry by Rama Rao.
6. Textbook of Biochemistry by Deb.
7. Outlines of Biochemistry by Conn and Stumpf
8. Practical Biochemistry by R.C. Gupta and S. Bhargavan.
9. Introduction of Practical Biochemistry by David T. Plummer. (3rd Edition)
10. Practical Biochemistry for Medical students by Rajagopal and Ramakrishna.
11. Practical Biochemistry by Harold Varley.

BP 204T.PATHOPHYSIOLOGY (THEORY) **45 Hours**

Scope: Pathophysiology is the study of causes of diseases and reactions of the body to such disease producing causes. This course is designed to impart a thorough knowledge of the relevant aspects of

pathology of various conditions with reference to its pharmacological applications, and understanding of basic pathophysiological mechanisms. Hence it will not only help to study the syllabus of pathology, but also to get baseline knowledge required to practice medicine safely, confidently, rationally and effectively.

Objectives: Upon completion of the subject student shall be able to –

1.Describe the etiology and pathogenesis of the selected disease states;
2.Name the signs and symptoms of the diseases; and

3.Mention the complications of the diseases.

Course content:

Unit I **10 Hours**

- **Basic principles of Cell injury and Adaptation:**

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

- **Basic mechanism involved in the process of inflammation and repair:**

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

Unit II **10 Hours**

- **Cardiovascular System:**

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

- **Respiratory system:** Asthma, Chronic obstructive airways diseases.
- **Renal system:** Acute and chronic renal failure .

Unit III **10 Hours**

- **Haematological Diseases:**
  Iron deficiency, megaloblastic anemia (Vit B12 and folic acid), sickle cell anemia, thalasemia, hereditary acquired anemia, hemophilia
- **Endocrine system:** Diabetes, thyroid diseases, disorders of sex hormones
- **Nervous system:** Epilepsy, Parkinson‘s disease, stroke, psychiatric disorders: depression, schizophrenia and Alzheimer‘s disease.
- **Gastrointestinal system:** Peptic Ulcer

Unit IV **8 Hours**

- Inflammatory bowel diseases, jaundice, hepatitis (A,B,C,D,E,F) alcoholic liver disease.
- **Disease of bones and joints:** Rheumatoid arthritis, osteoporosis and gout
- **Principles of cancer:** classification, etiology and pathogenesis of cancer

Unit V **7 Hours**

- **Infectious diseases:** Meningitis, Typhoid, Leprosy, Tuberculosis Urinary tract infections
- **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. Laurence B, Bruce C, Bjorn K. ; Goodman Gilman's The Pharmacological Basis of Therapeutics; 12th edition; New York; McGraw-Hill; 2011.
3. 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; united states;
4. William and Wilkins, Baltimore;1991 [1990 printing].
5. Nicki R. Colledge, Brian R. Walker, Stuart H. Ralston;Davidson's Principles and Practice of Medicine; 21st edition; London; ELBS/Churchill Livingstone; 2010.
6. Guyton A, John .E Hall; Textbook of Medical Physiology; 12th edition; WB Saunders Company; 2010.
7. Joseph DiPiro, Robert L. Talbert, Gary Yee, Barbara Wells, L. Michael Posey; Pharmacotherapy: A Pathophysiological Approach; 9th edition; London; McGraw- Hill Medical; 2014.
8. V. Kumar, R. S. Cotran and S. L. Robbins; Basic Pathology; 6th edition; Philadelphia; WB Saunders Company; 1997.
9. 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)

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

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

1. know the various types of application of computers in pharmacy
2. know the various types of databases
3. know the various applications of databases in pharmacy

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 managing the project

UNIT –II **06 Hours**

Web technologies:

Introduction to HTML, XML,CSS and Programming languages, introduction to web servers and Server Products Introduction to databases, MYSQL, MS ACCESS, Pharmacy Drug database

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 **06 Hours**

Computers as data analysis in Preclinical development:

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

BP210P. COMPUTER APPLICATIONS IN PHARMACY (Practical) **(2 hours/week)**

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

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 Publishers and Distributors, 4596/1- A, 11 Darya Gani, New Delhi – 110 002(INDIA)

4. Microsoft office Access - 2003, Application Development Using VBA, SQL Server, 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**

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

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

1. Create the awareness about environmental problems among learners.
2. Impart basic knowledge about the environment and its allied problems.
3. Develop an attitude of concern for the environment.
4. Motivate learner to participate in environment protection and environment improvement.
5. Acquire skills to help the concerned individuals in identifying and solving environmental problems.
6. Strive to attain harmony with Nature.

Course content:

Unit-I **10 hours**

The Multidisciplinary nature of environmental studies

Natural Resources

Renewable and non-renewable resources: Natural resources and associated problems

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

Unit-II **10 hours**

- Ecosystems
- Concept of an ecosystem.
- Structure and function of an ecosystem.

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

Unit- III **10 hours**

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 013, India,
4. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p

5. Clark R.S., Marine Pollution, Clanderson Press Oxford
Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001,
6. Environmental Encyclopedia, Jaico Publ. House, Mumbai, 1196p
7. De A.K., Environmental Chemistry, Wiley Eastern Ltd.
8. Down of Earth, Centre for Science and Environment

Semester- III

BP301T. PHARMACEUTICAL ORGANIC CHEMISTRY - II (Theory) 45 Hours

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

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

1. write the structure, name and the type of isomerism of the organic compound
2. write the reaction, name the reaction and orientation of reactions
3. account for reactivity/stability of compounds,
4. prepare organic compounds

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 10 Hours

- **Benzene and its derivatives**

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

B. Reactions of benzene - nitration, sulphonation, halogenation- reactivity, Friedel crafts alkylation reactivity, limitations, Friedel craftsacylation.

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

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

UNIT II 10 Hours

- **Phenols*** - Acidity of phenols, effect of substituents on acidity, qualitative tests, Structure and uses of phenol, cresols, resorcinol, naphthols
- **Aromatic Amines* -** Basicity of amines, effect of substituents on basicity, and synthetic uses of aryl diazonium salts

UNIT III 10 Hours

- **Fats and Oils**

a. Fatty acids – reactions.

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

UNIT IV 08 Hours

Polynuclear hydrocarbons: Synthesis, Reactions and Structure of Naphthalene, Phenanthrene, Anthracene, Diphenyl methane, Triphenyl methane and medicinal uses of their derivatives.

UNIT V **07 Hours**

Cyclo alkanes*

Stabilities Baeyer s strain theory, limitation of Baeyer s strain theory, Coulson and Moffitts modification, Sachse Mohr theory (Theory of strainless rings), reactions of cyclopropane and cyclobutane only

BP305P. PHARMACEUTICAL ORGANIC CHEMISTRY – II (Practical) **4 Hrs/week**

I. Experiments involving laboratory techniques

- Recrystalisation
- Steam distillation

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

- Acid value
- Saponification value
- Iodine value

III. Preparation of Compounds

- Benzanilide/Phenyl benzoate/Acetanilide from Aniline/Phenol/Aniline by acylation reaction
- 2,4,6–tribromo aniline/parabromo acetanilide from aniline/acetanilide by halogenation (Bromination reaction)
- 5–nitro salicylic acid/meta dinitro benzene from salicylic acid/ Nitrobenzene by nitration reaction
- Benzoic acid from benzoyl chloride by oxidation reaction
- Benzoic acid/ Salicylic acid from alkyl benzoate/ Alkyl salicylate by hydrolyses reaction
- 1-phenyl-azo-2-naphtho aniline by diazotization and coupling reaction
- Benzil from benzoin by oxidation reaction.
- Dibenzal acetone from benzaldehyde by Claisen Schmidt reaction
- Cinnamic acid from benzaldehyde by Perkin reaction
- p-iodo benzoic acid from p-amino benzoic acid

Recommended Books (Latest Editions)

1. Organic Chemistry by Morrison and Boyd
2. Organic Chemistry by I.L.Finar, Vol.I
3. Text book of organic chemistry by B.S.Bahl and Arun Bahl
4. Organic Chemistry by P.L.Soni
5. Practical Organic Chemistry by Mann and Saunders.
6. Vogel s text book of Practical Organic Chemistry
7. Advanced Practical organic chemistry by N.K.Vishnoi.57
8. Introduction to Organic Laboratory techniques by Pavia, Lampman and Kriz.

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

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

Objectives.: upon the completion of the course student shall be able to

Understand various physicochemical properties of drug molecules in the designing the dosageform

1. Demonstrate use of physicochemical properties in evaluation of dosage forms.
2. Appreciate physicochemical properties of drug molecules in formulation research anddevelopment

Course Content:

UNIT-I **10 Hours**

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

UNIT-II **10 Hours**

States of Matter and properties of matter: State of matter, changes in the state of matter, latent heats, vapour pressure, sublimation critical point, eutectic mixtures, gases, aerosols inhalers, relative humidity, liquid complexes, liquid crystals, glassy states, solidcrystalline, amorphous & polymorphism.

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

UNIT-III **10 Hours**

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

UNIT-IV **08 Hours**

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 **07 Hours**

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

BP306P. PHYSICAL PHARMACEUTICS – I (Practical) 4 Hrs/week

1. Determination the solubility of drug at room t e m p e rature
2. Determination of pKa value by Half Neutralization/ Henderson Hassel Balch equation.
3. Determination of Partition co− efficient of benzoic acid in benzene and water
4. Determination of Partition co− efficient of Iodine in CCl_4 and water
5. Determination of % composition of NaCl in a solution using phenol−water system by CST method
6. Determination of particle size, particle size distribution using sieving method
7. Determination of particle size, particle size distribution using Microscopic method
8. Determination of bulk density, true density and porosity
9. Determine the angle of repose and influence of lubricant on angle of repose
10. Determination of stability constant and donor acceptor ratio of PABA−Caffeine complex by solubility method
11. Determination of stability constant and donor acceptor ratio of Cupric−Glycine complex by pH titration method

Recommended Books: (Latest Editions)

1. Physical pharmacy by Alfred Martin 2.Experimental pharmaceutics by Eugene, Parott.
3. Tutorial pharmacy by Cooper and Gunn.
4. Stocklosam J. Pharmaceutical calculations, Lea &Febiger, Philadelphia.
5. Liberman H.A, Lachman C., Pharmaceutical Dosage forms, Tablets, Volume−1 to 3, Marcel Dekkar Inc.
6. Liberman H.A, Lachman C, Pharmaceutical dosage forms. Disperse systems, volume 1, 2, 3. Marcel Dekkar Inc.
7. Physical pharmaceutics by Ramasamy C and ManavalanR.
8. Laboratory manual of physical pharmaceutics, C.V.S. Subramanyam, J. Thimma settee

BP 303 T. PHARMACEUTICAL MICROBIOLOGY (Theory) 45Hours

Scope:

In the broadest sense, scope of microbiology is the study of all organisms that are invisible to the naked eye− that is the study of microorganisms. Microorganisms are necessary for the production of bread, cheese, beer, antibiotics, vaccines, vitamins, enzymes etc. Microbiology has an impact on medicine, agriculture, food science, ecology, genetics, biochemistry, immunology etc.

Objectives: Upon completion of the subject student shall be able to;

1. Understand methods of identification, cultivation and preservation of various microorganisms
2. Importance of sterilization in microbiology. and pharmaceutical industry
3. Learn sterility testing of pharmaceutical products.
4. Microbiological standardization of Pharmaceuticals.
5. Understand the cell culture technology and its applications in pharmaceutical industries.

Course content:

UNIT I **10 Hours**

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, and quantitative measurement of bacterial growth (total & viable count).
Study of different types of phase contrast microscopy, dark field microscopy and electron microscopy.

UNIT II **10 Hours**

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 and mechanical method of sterilization.
Evaluation of the efficiency of sterilization methods.

UNIT III **10 Hours**

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

UNIT IV 08 **Hours**

Designing of aseptic area, laminar flow equipments; study of different sources of contamination in an aseptic area and methods of prevention, clean area classification.

Principles and methods of different microbiological assay.Methods for standardization of antibiotics, vitamins and amino acids. Assessment of a new antibiotic .

UNIT V **07 Hours**

Types of spoilage, factors affecting the microbial spoilage of pharmaceutical products, sources and types of microbial contaminants, assessment of microbial contamination and spoilage. Preservation of pharmaceutical products using antimicrobial agents, evaluation of microbial stability of formulations. Growth of animal cells in culture, general procedure for cell culture, Primary, established and transformed cell cultures. Application of cell cultures in pharmaceutical industry and research

BP 307P. PHARMACEUTICAL MICROBIOLOGY (Practical) **04 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 experimental microbiology.

2. Sterilization of glassware, preparation and sterilization of media.
3. Sub culturing of bacteria and fungus. Nutrient stabs and slants preparations.
4. Staining methods− Simple, Grams staining and acid fast staining (Demonstration with practical).
5. Isolation of pure culture of micro−organisms by multiple streak plate technique and othertechniques.
6. Microbiological assay of antibiotics by cup plate method and other methods
7. Motility determination by Hanging drop method.
8. Sterility testing of pharmaceuticals.
9. Bacteriological analysis of water
10. Biochemical test (IMViC reactions)
11. Revision Practical Class

Recommended Books (Latest edition)

1. W.B. Hugo and A.D. Russel: Pharmaceutical Microbiology, Blackwell Scientific 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: Pharmaceutical Microbiology.
5. Rose: Industrial Microbiology.
6. Probisher, Hinsdill et al: Fundamentals of Microbiology, 9th ed. Japan
7. Cooper and Gunn's: Tutorial Pharmacy, CBS Publisher and Distribution.
8. Peppler: Microbial Technology.
9. I.P., B.P., U.S.P.− latest editions.
10. Ananthnarayan : Text Book of Microbiology, Orient−Longman, Chennai
11. Edward: Fundamentals of Microbiology.
12. N.K.Jain: Pharmaceutical Microbiology, Vallabh Prakashan, Delhi
13. Bergeys manual of systematic bacteriology, Williams and Wilkins− A Waverly company

BP304T. PHARMACEUTICAL ENGINEERING (Theory) 45 Hours

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

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

1. To know various unit operations used in Pharmaceutical industries.
2. To understand the material handling techniques.
3. To perform various processes involved in pharmaceutical manufacturing process.
4. To carry out various test to prevent environmental pollution.
5. To appreciate and comprehend significance of plant lay out design for optimum use of resources.
6. To appreciate the various preventive methods used for corrosion control in Pharmaceuticalindustries.

Course content:

UNIT-I 10 Hours

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

- **Size Reduction:** Objectives, Mechanisms & Laws governing size reduction, factors affecting size reduction, principles, construction, working, uses, merits and demerits of Hammer mill, ball mill, fluid energy mill, Edge runner mill & end runner mill.

- **Size Separation:** Objectives, applications & mechanism of size separation, official standards of powders, sieves, size separation Principles, construction, working, uses, merits and demerits of Sieve shaker, cyclone separator, Air separator, Bag filter & elutriation tank.
- **Mixing:** Objectives, applications & factors affecting mixing, Difference between solid and liquid mixing, mechanism of solid mixing, liquids mixing and semisolids mixing. Principles, Construction, Working, uses, Merits and Demerits of Double cone blender, twin shell blender, ribbon blender, Sigma blade mixer, planetary mixers, Propellers, Turbines, Paddles & Silverson Emulsifier.

UNIT-II **10 Hours**

- **Evaporation:** Objectives, applications and factors influencing evaporation, differences between evaporation and other heat process. principles, construction, working, uses, merits and demerits of Steam jacketed kettle, horizontal tube evaporator, climbing film evaporator, forced circulation evaporator, multiple effect evaporator& Economy of multiple effect evaporator.
- **Heat Transfer:** Objectives, applications & Heat transfer mechanisms. Fourier's law, Heat transfer by conduction, convection & radiation. Heat interchangers & heat exchangers.

UNIT- III **10 Hours**

- **Drying:** Objectives, applications & mechanism of drying process, measurements & applications of Equilibrium Moisture content, rate of drying curve. principles, construction, working, uses, merits and demerits of Tray dryer, drum dryer spray dryer, fluidized bed dryer, vacuum dryer, freeze dryer.

- **Distillation:** Objectives, applications & types of distillation. principles, construction, working, uses, merits and demerits of (lab scale and industrial scale) Simple distillation, preparation of purified water and water for injection BP by distillation, flash distillation, fractional distillation, distillation under reduced pressure, steam distillation & molecular distillation

UNIT-IV **08 Hours**

- **Filtration:** Objectives, applications, Theories & Factors influencing filtration, filter aids, filter medias. Principle, Construction, Working, Uses, Merits and demerits of plate & frame filter, filter leaf, rotary drum filter, Meta filter & Cartridge filter, membrane filters and Seidtz filter.

- **Centrifugation:** Objectives, principle & applications of Centrifugation, principles, construction, working, uses, merits and demerits of perforated basket centrifuge, Non− perforated basket centrifuge, semi continuous centrifuge & super centrifuge.

UNIT- V **7 Hours**

- **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.

- **Material handling systems:** Objectives & applications of Material handling systems, different types of conveyors such as belt, screw and pneumatic conveyors.

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− Latest edition.
3. Unit operation of chemical engineering − Mcabe Smith, Latest edition.
4. Pharmaceutical engineering principles and practices − C.V.S Subrahmanyam et al., Latest edition.
5. Remington practice of pharmacy− Martin, Latest edition.
6. Theory and practice of industrial pharmacy by Lachmann., Latest edition.
7. Physical pharmaceutics− C.V.S Subrahmanyam et al., Latest edition.
8. Cooper and Gunn's Tutorial pharmacy, S.J. Carter, Latest edition.

BP308P - PHARMACEUTICAL ENGINEERING (Practical) 4 Hours/week

I. Particle size determination by beaker decantation method.

II. To determine the overall heat transfer coefficient by heat exchanger.

III. Construction of drying curves (for calcium carbonate and starch).

IV. Determination of moisture content and loss on drying.

V. Determination of humidity of air −From wet and dry bulb temperatures (use of Dew point method).

VI. Description of Construction, working and application of Pharmaceutical Machinery such as rotary tablet machine, fluidized bed coater, fluid energy mill, de humidifier.

VII. Size analysis by sieving − To evaluate size distribution of tablet granulations− Construction of various size frequency curves including arithmetic and Logarithmic probability plots.

VIII. Size reduction: To verify the laws of size reduction using ball mill and determining Kicks, Rittinger's, Bond's coefficients, power requirement and critical speed of Ball Mill.

IX. Demonstration of colloid mill, planetary mixer, fluidized bed dryer, freeze dryer and such other major equipment.

X. Factors affecting Rate of Filtration and Evaporation (Surface area, Concentration And Thickness/ viscosity)

XI. To calculate the mixing index for given sample by using Double Cone Blender.

Semester-IV

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

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

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

1. understand the methods of preparation and properties of organic compounds
2. explain the stereo chemical aspects of organic compounds and stereo chemical reaction
3. know the medicinal uses and other applications of organic compounds

Course Content:

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

UNIT-I **10 Hours**

Stereo isomerism **10 Hours**

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
- Racemic modification and resolution of racemic mixture.
- Asymmetric synthesis: partial and absolute

UNIT-II **10 Hours**

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 stereo selective reactions

UNIT-III **10 Hours**

Heterocyclic Compounds

Nomenclature and classification

Synthesis, reactions and medicinal uses of following compounds/derivatives

Pyrrole, Furan, and Thiophene − Relative aromaticity, reactivity and Basicity of pyrrole

UNIT-IV **8 Hours**

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 **7 Hours**

Reactions of synthetic importance

Metal hydride reduction ($NaBH_4$ and $LiAlH_4$), Clemmensen reduction,

Birch reduction, Wolff Kishner reduction.

Oppenauer oxidation Dakin reaction.

Beckmanns rearrangement 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 and Boyd
5. Heterocyclic Chemistry by T.L. Gilchrist

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

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

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

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 (SAR) of different class of drugs
4. write the chemical synthesis of some drugs

Course Content:

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

UNIT- I **10 hours**

- 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:

Principles - Phase I and Phase II.

Factors affecting drug metabolism including stereo chemical aspects.

UNIT- II **10 hours**

Drugs acting on Autonomic Nervous System Sympathomimetic agents:

SAR of Sympathomimetic agents

Direct acting: Nor-epinephrine, Epinephrine, Phenylephrine*, Dopamine, Methyldopa, Clonidine, Isoproterenol, Terbutaline, Salbutamol*, Naphazoline, Oxymetazoline and Xylometazoline.

Indirect acting agents: Hydroxyamphetamine, Pseudoephedrine,

Agents with mixed mechanism: Ephedrine.

Adrenergic Antagonists:

- Alpha adrenergic blockers**:** Tolazoline*, Phentolamine, Prazosin.
- Beta adrenergic blockers**:** SAR of beta blockers, Propranolol*, Atenolol, , Esmolol, Metoprolol, Labetolol, Carvedilol.

UNIT-III **10 hours**

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, Homatropine hydrobromide, Ipratropium bromide*.

Synthetic cholinergic blocking agents: Tropicamide, Cyclopentolate hydrochloride, Clidinium bromide, Dicyclomine hydrochloride*, Glycopyrrolate, , Propantheline bromide, Benztropine mesylate, Orphenadrine citrate, Biperidine hydrochloride, Procyclidine hydrochloride*, Ethopropazine hydrochloride.

UNIT- IV **8 Hours**

Drugs acting on Central Nervous System

A. Sedative and Hypnotics

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

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

Miscelleneous:

Amides & imides: Glutethmide.

Alcohol & their carbamate derivatives: Meprobomate.

Aldehyde & their derivatives: Triclofos sodium, Paraldehyde.

B. Antipsychotics

Phenothiazeines: SAR of Phenothiazeines − Promazine hydrochloride, Chlorpromazine hydrochloride*, Triflupromazine, Thioridazine 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,
Hydantoins: Phenytoin*.
Oxazolidine diones: Trimethadione, Paramethadione Succinimides: Phensuximide, Methsuximide, Ethosuximide* Urea and monoacylureas: Carbamazepine*
Benzodiazepines: Clonazepam
Miscellaneous: Primidone, Valproic acid , Gabapentin, Felbamate

UNIT – V **7 Hours**

Drugs acting on Central Nervous System

General Anesthetics:

Inhalation anesthetics: Halothane*, Methoxyflurane, Enflurane, Sevoflurane, Isoflurane, Desflurane.
Ultra-short acting barbitutrates: Methohexital sodium*, , Thiopental sodium.
Dissociative anesthetics: Ketamine hydrochloride.*

Narcotic and non-narcotic analgesics

Morphine and related drugs: SAR of Morphine analogues, Morphine sulphate, Codeine, Meperidine hydrochloride, Anilerdine hydrochloride, Diphenoxylate hydrochloride, Loperamide hydrochloride, Fentanyl citrate*, Methadone hydrochloride*, Propoxyphene hydrochloride, Pentazocine.
Narcotic antagonists**:** Nalorphine hydrochloride, Naloxone hydrochloride.

Anti-inflammatory agents: Sodium salicylate, Aspirin, Mefenamic acid*, Meclofenamate, Indomethacin, Sulindac, Diclofenac, Ketorolac, Ibuprofen*, Naproxen, Piroxicam, Phenacetin, Acetaminophen, 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− diphenyl quinoxaline
6 Benzocaine
7 Phenytoin
8 Phenothiazine
9 Barbiturate

II. Assay of drugs

1. Chlorpromazine
2. Phenobarbitone
3. Atropine
4. Ibuprofen
5. Aspirin
6. Furosemide

III. Determination of Partition coefficient for any two drugs

Recommended Books (Latest Editions)

1. Wilson and Giswold's Organic medicinal and Pharmaceutical Chemistry.
2. Foye's Principles of Medicinal Chemistry.
3. Burger's Medicinal Chemistry, Vol I to IV.
4. Introduction to principles of drug design– Smith and Williams.
5. Remington's Pharmaceutical Sciences.
6. Martindale's extra pharmacopoeia.
7. Organic Chemistry by I.L. Finar, Vol. II.
8. The Organic Chemistry of Drug Synthesis by Lednicer, Vol. 1–5.
9. Indian Pharmacopoeia.
10. Text book of practical organic chemistry– A.I.Vogel.

BP 403 T. PHYSICAL PHARMACEUTICS-II (Theory) 45Hours

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

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

1. Understand various physicochemical properties of drug molecules in the designing the dosageform
2. Know the principles of chemical kinetics & to use them in assigning expiry date for Formulation
3. Demonstrate use of physicochemical properties in evaluation of dosage forms
4. Appreciate physicochemical properties of drug molecules in formulation research and Development

Course Content:

UNIT-I 10 hours

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

UNIT-II 10 hours

Rheology: Newtonian systems, law of flow, kinematic viscosity, effect of temperature, non– Newtonian systems, pseudoplastic, dilatants, 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 **10 hours**

Coarse dispersion: Suspension, interfacial properties of suspended particles, settling in suspensions, formulation of suspensions. Emulsions and theories of emulsification, microemulsion and multiple emulsions; Physical stability of emulsions, preservation of emulsions, rheological properties of emulsions.

UNIT-IV **8 hours**

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

UNIT-V **7 hours**

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

BP 407P. PHYSICAL PHARMACEUTICS- II (Practical) **4 Hrs/week**

1. Determination of surface tension of given liquids by drop count and drop weight method
2. Determination of HLB number of a surfactant by saponification method
3. Determination of Freundlich and Langmuir constants using activated char coal
4. Determination of critical micellar concentration of surfactants
5. Determination of viscosity of liquid using Ostwald‘s viscometer
6. Determination sedimentation volume with effect of different suspending agent
7. Determination sedimentation volume with effect of different concentration of single suspending agent
8. Determination of viscosity of semisolid by using Brookfield viscometer
9. Determination of reaction rate constant first order.
10. Determination of reaction rate constant second order
11. Accelerated stability studies

Recommended Books: (Latest Editions)

1. Physical Pharmacy by Alfred Martin, Sixth edition
2. Experimental pharmaceutics by Eugene, Parott.
3. Tutorial pharmacy by Cooper and Gunn.
4. Stocklosam J. Pharmaceutical calculations, Lea & Febiger, Philadelphia.
5. Liberman H.A, Lachman C., Pharmaceutical Dosage forms, Tablets, Volume−1 to 3, Marcel Dekkar Inc.
6. Liberman H.A, Lachman C, Pharmaceutical dosage forms. Disperse systems, volume 1, 2, 3. Marcel Dekkar Inc.
7. Physical Pharmaceutics by Ramasamy C, and Manavalan R.

BP 404 T. PHARMACOLOGY-I (Theory) **45 Hours**

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

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

1. Understand the pharmacological actions of different categories of drugs
2. Explain the mechanism of drug action at organ system/sub cellular/ macromolecular levels.
3. Apply the basic pharmacological knowledge in the prevention and treatment of variousdiseases.
4. Observe the effect of drugs on animals by simulated experiments
5. Appreciate correlation of pharmacology with other bio medical sciences

Course Content:

UNIT-I **5 Hours**

General Pharmacology

a. Introduction to Pharmacology– Definition, historical landmarks and scope of pharmacology, nature and source of drugs, essential drugs concept and routes of drug administration, Agonists, antagonists (competitive and non competitive), spare receptors, addiction, tolerance, dependence, tachyphylaxis, idiosyncrasy, allergy.

b. Pharmacokinetics– Membrane transport, absorption, distribution, metabolism and excretion of drugs .Enzyme induction, enzyme inhibition, kinetics of elimination

UNIT-II **15 Hours**

General Pharmacology

a. Pharmacodynamics– Principles and mechanisms of drug action. Receptor theories and classification of receptors, regulation of receptors. drug receptors interactions signal transduction mechanisms, G–protein–coupled receptors, ion channel receptor, transmembrane enzyme linked receptors, transmembrane JAK–STAT binding receptor and receptors that regulate transcription factors, dose response relationship, therapeutic index, combined effects of drugs and factors modifying drug action.

b. Adverse drug reactions.

c. Drug interactions (pharmacokinetic and pharmacodynamic)

d. Drug discovery and clinical evaluation of new drugs –Drug discovery phase, preclinical evaluation phase, clinical trial phase, phases of clinical trials and pharmacovigilance.

e. Principles of toxicology - Definition and basic knowledge of acute, subacute and chronic toxicity. Definition and basic knowledge of genotoxicity, carcinogenicity, teratogenicity and mutagenicity General principles of treatment of poisoning.

f. Chronopharmacology - Definition of rhythm and cycles. Biological clock and their significance leading to chronotherapy.

UNIT-III **10 Hours**

Pharmacology of peripheral nervous system

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

UNIT-IV **8 Hours**

Pharmacology of central nervous system

a. Neurohumoral transmission in the C.N.S.special emphasis on importance of various neuro transmitters like with GABA, Glutamate, Glycine, serotonin, dopamine.
b. General anesthetics and pre-anesthetics**.**
c. Sedatives, hypnotics and centrally acting muscle relaxants.
d. Anti-epileptics;
e. Clinical symptoms and management of barbiturates poisoning
f. Alcohols and disulfiram

UNIT-V **07 Hours**

Pharmacology of central nervous system

a. Psychopharmacological agents: Antipsychotics, antidepressants, anti-anxiety agents, antimanics and hallucinogens.
b. Drugs used in Parkinsons disease and Alzheimer‘s disease.
c. CNS stimulants and nootropics.
d. Opioid analgesics and antagonists; Clinical symptoms and management of morphine poisoning
e. Drug addiction, drug abuse, tolerance and dependence.

BP 408 P.PHARMACOLOGY-I (Practical) **4Hrs/Week**

1. Introduction to experimental pharmacology.
   a. Commonly used instruments in experimental pharmacology.
   b. Study of common laboratory animals.
   c. Maintenance of laboratory animals as per CPCSEA guidelines.
   d. Common laboratory techniques. Blood withdrawal, serum and plasma separation, anesthetics and euthanasia used for animal studies.
2. Dose calculation in pharmacological experiments
3. Study of different routes of drugs administration in mice/rats.
4. Introduction to in-vitro pharmacology and physiological salt solutions.
5. DRC of acetylcholine using isolated chicken ileum.
6. Effect of spasmogens and spasmolytics using isolated chicken ileum (eg- physostigmine , atropine)
7. Determination of PA2 value of Atropine using isolated chicken ileum (by Schilds plot method).
8. Study of effect of drugs on gastrointestinal motility

9. Determination of acute oral toxicity (LD50) of a drug from a givendata
10. Determination of acute skin irritation / corrosion of a test substance
11. Determination of acute eye irritation / corrosion of a test substance
12. Calculation of pharmacokinetic parameters from a given data

Note: **Wherever wet laboratory experiments are not feasible**, simulated experiments by software /videos may be used.

Recommended Books (Latest Editions)

1. Rang H. P., Dale M.M., Ritter J. M., Flower R. J., Rang and Dale's Pharmacology,.Churchil Livingstone Elsevier
2. Katzung B. G., Masters S. B., Trevor A. J., Basic and clinical pharmacology, Tata McGraw-Hill
3. Goodman and Gilman's, The Pharmacological Basis of Therapeutics
4. Marry Anne K. K., Lloyd Yee Y., Brian K. A., Robbin L.C., Joseph G. B., Wayne A. K., Bradley R.W., Applied Therapeutics, The Clinical use of Drugs, The Point Lippincott Williams & Wilkins
5. Mycek M.J, Gelnet S.B and Perper M.M. Lippincott's Illustrated Reviews-Pharmacology
6. K.D.Tripathi. Essentials of Medical Pharmacology, JAYPEE Brothers Medical Publishers (P) Ltd, New Delhi.
7. Sharma H. L., Sharma K. K., Principles of Pharmacology, Paras medical publisher
8. Modern Pharmacology with clinical Applications, by Charles R.Craig& Robert,
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

Scope: The subject involves the fundamentals of Pharmacognosy like scope, classification of crude drugs, their identification and evaluation, phytochemicals present in them and their medicinal properties. To study production of plants and phytochemicals through plant tissue culture.

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

1. To know the techniques in the cultivation and production of crude drugs
2. To know the crude drugs, their uses and chemical nature
3. To know the evaluation techniques for the herbal drugs
4. To carry out the microscopic and morphological evaluation of crudedrugs

Course Content

UNIT-I 10 Hours

Introduction to Pharmacognosy:

a. Definition, History, scope and development of Pharmacognosy.
b. Sources of Drugs – Plants, Animals, Marine & Tissue culture
c. Organized drugs,(seed, leaf, bark, wood, root, rhizome, flower, fruit and entire drug) unorganized drugs, (dried latex, dried juices, dried extracts, gums, mucilages, oleoresins and oleo- gum -resins).

Classification of drugs:

Alphabetical, morphological, taxonomical, chemical, pharmacological, chemo and serotaxonomical 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.

Quantitative microscopy of crude drugs including lycopodium spore method, leaf constants, Camera Lucida, and calibration of eye piece micrometer using stage micrometer.

UNIT-II **10 Hours**

Cultivation, Collection, Processing and storage of drugs of natural origin: **General aspects on cultivation and collection, processing and storage 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: In situ and ex situ 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

UNIT IV **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 general tests for identification of Alkaloids, Glycosides, Flavonoids, Tannins, Volatile oil and Resins.

UNIT V **08 Hours**

Study of biological source, chemical constituents and uses of drugs of natural origin containing following Plant drugs /Products:

Fibers - Cotton, Jute, Hemp
Hallucinogen- Cannabis,
Teratogens- Tobacco, Colchicum, Veratrum
Natural allergens-Classification, Preparation and standardization of allergenic extract.

Primary metabolites:

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

Carbohydrates: Acacia, Agar, Starch, 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: Antiviral, Antimicrobial, Anticancer and Cardiovascular agents.

BP409 P. PHARMACOGNOSY AND PHYTOCHEMISTRY I (Practical) **4 Hours/week**

1. Analysis of crude drugs by chemical tests:
   (i) Tragacanth (ii) Acacia (iii)Agar (iv) Gelatin (v) starch (vi) Honey (vii) Castor oil

2. Determination of stomatal number and index
3. Determination of vein islet number, vein termination number and palisade ratio.
4. Determination of size of starch grains, calcium oxalate crystals by eye piece micrometer
5. Determination of Fiber length and width by eye piece micrometer.
6. Determination of number of starch grains by Lycopodium spore method
7. Determination of Ash values.
8. Determination of Extractive values of crude drugs.
9. Determination of moisture content of crude drugs
10. Determination of swelling index and foamingindex. Recommended Books: (Latest Editions)

1. W.C.Evans, Trease and Evans Pharmacognosy, 16th edition, W.B. Saunders & Co., London, 2009.
2. Tyler, V.E., Brady, L.R. and Robbers, J.E., Pharmacognosy, 9th Edition., Lea and Febiger, Philadelphia, 1988.
3. Text Book of Pharmacognosy by T.E. Wallis
4. Mohammad Ali. Pharmacognosy and Phytochemistry, CBS Publishers & Distribution, New Delhi.
5. Text book of Pharmacognosy by C.K. Kokate, Purohit, Gokhlae (2007), 37th Edition, Nirali Prakashan, New Delhi.
6. Herbal drug industry by R.D. Choudhary (1996), 1st Edn, Eastern Publisher, New Delhi.
7. Essentials of Pharmacognosy, Dr.SH.Ansari, IInd edition, Birla publications, New Delhi, 2007
8. Practical Pharmacognosy: C.K. Kokate, Purohit, Gokhale
9. Anatomy of Crude Drugs by M.A. Iyengar
10. Biren Shah ,A.K.Seth,Text Book of Pharmacognosy and phytochemistry, second edition ,Elsevier publications.

Semester-V

BP501T. MEDICINAL CHEMISTRY – II (Theory) **45 Hours**

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

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

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 Structure Activity Relationship of different class of drugs
4. Study the chemical synthesis of selected drugs

Course Content:

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

UNIT- I **10 Hours**

Antihistaminic agents: Histamine receptors and their distribution in the human body

H_1–antagonists: Diphenhydramine hydrochloride*, Dimenhydrinate, Tripelennamine hydrochloride, Chlorcyclizine hydrochloride, Meclizine hydrochloride, Buclizine hydrochloride, Chlorpheniramine maleate, Triprolidine hydrochloride*, Promethazine hydrochloride*, Cyproheptadine hydrochloride, Azatidine maleate, Astemizole, Loratadine, Cetirizine, Cromolyn sodium

H_2-antagonists: Cimetidine*, Famotidine, Ranitidine.

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

Anti-neoplastic agents:

Alkylating agents: Meclorethamine*, Cyclophosphamide, Melphalan, Chlorambucil, Busulfan, Thiotepa

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

Antibiotics: Dactinomycin, Daunorubicin, Doxorubicin, Bleomycin

Plant products: Etoposide, Vinblastin sulphate, Vincristin sulphate

Miscellaneous: Cisplatin, Mitotane.

UNIT – II **10 Hours**

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,
Thiazides:Chlorthiazide*, Hydrochlorothiazide,
Loop diuretics: Furosemide*, Bumetanide, Ethacrynic acid.
Potassium sparing Diuretics: Spironolactone, Triamterene, Amiloride.
Osmotic Diuretics: Mannitol

Anti-hypertensive Agents: Timolol, Captopril, Lisinopril, Enalapril, Benazepril hydrochloride, Clonidine hydrochloride, Sodium nitroprusside, Diazoxide, Minoxidil, Hydralazine hydrochloride.

UNIT- III **10 Hours**

Anti-arrhythmic Drugs: Quinidine sulphate, Procainamide hydrochloride, Disopyramide phosphate*,Phenytoin sodium, Lidocaine hydrochloride, Tocainide 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, Bosentan, Tezosentan.

UNIT- IV **08 Hours**

Drugs acting on Endocrine system

Nomenclature, Stereochemistry and metabolism of steroids

Sex hormones: Testosterone, Nandrolone, Progestrones, Oestriol, Oestradiol, Oestrione, Diethyl stilbestrol.

Drugs for erectile dysfunction: Sildenafil, Tadalafil.

Oral contraceptives: Mifepristone, Norgestrel, Levonorgestrel

Corticosteroids : Cortisone, Hydrocortisone, Prednisolone, Betamethasone, Dexamethasone

Thyroid and antithyroid drugs: L–Thyroxine, L–Thyronine, Propylthiouracil, Methimazole.

UNIT – V **07 Hours**

Antidiabetic agents:

Insulin and its preparations

Sulfonyl ureas: Tolbutamide*, Chlorpropamide, Glipizide, Glimepiride. Biguanides: Metformin. Thiazolidinediones: Pioglitazone, Rosiglitazone. Meglitinides: Repaglinide, Nateglinide. Glucosidase inhibitors: Acarbose, Voglibose.

Local Anesthetics: SAR of Local anesthetics

Benzoic Acid derivatives: Cocaine, Cyclomethycaine, Piperocaine.

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

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

Miscellaneous: Phenacaine, Dibucaine.*

Recommended Books (Latest Editions)

1. Wilson and Giswold's Organic medicinal and Pharmaceutical Chemistry.

2. Foye‘s Principles of Medicinal Chemistry.
3. Burger‘s Medicinal Chemistry, Vol I to IV.
4. Introduction to principles of drug design− Smith and Williams.
5. Remington‘s Pharmaceutical Sciences.
6. Martindale‘s extra pharmacopoeia. Organic Chemistry by I.L. Finar, Vol. II.
7. The Organic Chemistry of Drug Synthesis by Lednicer, Vol. 1to 5.
8. Indian Pharmacopoeia.
9. Text book of practical organic chemistry − A.I.Vogel.

BP 502 T. FORMULATIVE PHARMACY (Theory) 45 Hours

Scope: Course enables the student to understand and appreciate the influence of pharmaceutical additives and various pharmaceutical dosage forms on the performance of the drug product.

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

1. Know the various pharmaceutical dosage forms and their manufacturing techniques.
2. Know various considerations in development of pharmaceutical dosage forms
3. Formulate solid, liquid and semisolid dosage forms and evaluate them for their quality

Course content: **3 hours/ week**

UNIT-I **07 Hours**

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

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 **10 Hours**

Tablets:

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

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

c. Quality control tests: In process and finished product tests

UNIT-III **08 Hours**

Capsules:

a. **Hard gelatin capsules:** Introduction, Extraction of gelatin and production of hard gelatin capsule shells. size of capsules, Filling, finishing and special techniques of formulation of hard gelatin capsules. In process and final product quality control tests for capsules.

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

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

UNIT-IV **10 Hours**

Parenteral Products:

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

b. Production procedure, production facilities and controls.

c. Formulation of injections, sterile powders, emulsions, suspensions, large volume parenterals and lyophilized products, Sterilization.

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

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

UNIT-V **10 Hours**

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

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

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

BP 506 P. FORMULATIVEPHARMACY (Practical) **4Hours/week**

1. Preformulation study for prepared granules
2. Preparation and evaluation of Paracetamol tablets
3. Preparation and evaluation of Aspirin tablets
4. Coating of tablets
5. Preparation and evaluation of Tetracycline capsules
6. Preparation of Calcium Gluconate injection
7. Preparation of Ascorbic Acid injection
8. Preparation of Paracetamol Syrup
9. Preparation of Eye drops
10. Preparation of Pellets by extrusion spheronization technique
11. Preparation of Creams (cold / vanishing cream)
12. Evaluation of Glass containers

Recommended Books: (Latest Editions)

1. Pharmaceutical dosage forms − Tablets, volume 1 −3 by H.A. Liberman, Leon Lachman &J.B.Schwartz
2. Pharmaceutical dosage form − Parenteral medication vol− 1&2 by Liberman & Lachman
3. Pharmaceutical dosage form disperse system VOL−1 by Liberman & Lachman
4. Modern Pharmaceutics by Gilbert S. Banker & C.T. Rhodes, 3rd Edition Remington: The Science and Practice of Pharmacy, 20th edition Pharmaceutical Science (RPS)
5. Theory and Practice of Industrial Pharmacy by Liberman & Lachman
6. Pharmaceutics− The science of dosage form design by M.E.Aulton, Churchill livingstone, Latest edition
7. Introduction to Pharmaceutical Dosage Forms by H. C.Ansel, Lea &Febiger, Philadelphia, 5th edition, 2005
8. Drug stability − Principles and practice by Cartensen & C.J. Rhodes, 3rd Edition, Marcel Dekker Series, Vol 107.

BP503.T. PHARMACOLOGY-II (Theory) **45 Hours**

Scope: This subject is intended to impart the fundamental knowledge on various aspects (classification, mechanism of action, therapeutic effects, clinical uses, side effects and contraindications) of drugs acting on different systems of body and in addition,emphasis on the basic concepts of bioassay.

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

1. Understand the mechanism of drug action and its relevance in the treatment of different diseases
2. Demonstrate isolation of different organs/tissues from the laboratory animals by simulated experiments
3. Demonstrate the various receptor actions using isolated tissue preparation
4. Appreciate correlation of pharmacology with related medical sciences

Course content

UNIT-I **10 Hours**

1. Pharmacology of drugs acting on cardio vascular system

a) Introduction to hemodynamic and electrophysiology of heart.
b) Drugs used in congestive heart failure
c) Anti−hypertensive drugs.
d) Anti−anginal drugs.
e) Anti−arrhythmic drugs.
f) Anti−hyperlipidemic drugs.

UNIT-II **10 Hours**

Pharmacology of drugs acting on blood and blood forming organs.

a) Drug used in the therapy of shock.
b) Hematinics, coagulants and anticoagulants.
c) Fibrinolytics and anti−platelet drugs
d) Plasma volume expanders

Pharmacology of drugs acting on urinary system

e) Diuretics
f) Anti−diuretics.

UNIT-III **10 Hours**

Autocoids and related drugs

a. Introduction to autacoids and classification
b. Histamine, 5−HT and their antagonists.
c. Prostaglandins, Thromboxanes and Leukotrienes.
d. Angiotensin, Bradykinin and Substance P.
e. Non−steroidal anti−inflammatory agents, Clinical symptoms and management of Aspirin poisoning, Paracetamol poisoning.
f. Anti-gout drugs
g. Antiheumatic drugs

UNIT-IV **08 Hours**

Pharmacology of drugs acting on endocrine system

a. Basic concepts in endocrine pharmacology.
b. Anterior Pituitary hormones− analogues and their inhibitors.
c. Thyroid hormones− analogues and their inhibitors.
d. Hormones regulating plasma calcium level− Parathormone, Calcitonin and Vitamin−D.
e. Insulin, Oral Hypoglycemic agents and glucagon.
f. ACTH and corticosteroids.

UNIT-V **07hours**

Pharmacology of drugs acting on endocrine system

a. Androgens and Anabolic steroids.
b. Estrogens, progesterone and oral contraceptives.
c. Drugs acting on the uterus

Bioassay

a) Principles and applications of bioassay.
b) Types of bioassay
c) Bioassay of insulin, oxytocin, vasopressin, ACTH,d−tubocurarine,digitalis, histamine, Heparin sodium, Antirabies vaccine, Diphtheria antitoxin

BP 507 P. PHARMACOLOGY-II (Practical) **4Hrs/Week**

1. Effect of drugs on ciliary motility of frog oesophagus
2. Effect of drugs on rabbit eye.
3. Study of local anesthetics by different methods .
4. Effect of saline purgative on frog intestine
5. Insulin hypoglycemic effect in rabbit
6. Test for pyrogens (Rabbit method)

7. Study of effect of hepatic microsomal enzyme inducers on the phenobarbitone sleeping time in mice.
8. Effect of drugs on isolated frog heart.
9. Effect of drugs on blood pressure and heart rate of dog.
10. Study of diuretic activity of drugs using rats/mice.
11. Bioassay of agonist, eg .Acetyl choline on chicken ileum by matching method.
12. Bioassay of agonist, eg.Acetyl choline on chicken ileum by Bracketing method
13. Bioassay of agonist, eg.Acetyl choline on chicken ileum by interpolation method.
14. Bioassay of agonist, eg.Acetyl choline on chicken ileum by three point bioassay.
15. Bioassay of agonist, eg.Acetyl choline on chicken ileum by four point bioassay. (Demonstration only)

Note: **Wherever wet laboratory experiments are not feasible**, simulated experiments by software /videos may be used.

Recommended Books (Latest Editions)

1. Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Rang and Dale's Pharmacology, Churchil Livingstone Elsevier
2. Katzung B. G., Masters S. B., Trevor A. J., Basic and clinical pharmacology, Tata Mc Graw−Hill.
3. Goodman and Gilmans, The Pharmacological Basis of Therapeutics
4. Marry Anne K. K., Lloyd Yee Y., Brian K. A., Robbin L.C., Joseph G. B., Wayne A. K., Bradley R.W., Applied Therapeutics, The Clinical use of Drugs, The Point Lippincott Williams & Wilkins.
5. Mycek M.J, Gelnet S.B and Perper M.M. Lippincotts Illustrated Reviews-Pharmacology.
6. K.D.Tripathi. Essentials of Medical Pharmacology, JAYPEE Brothers Medical Publishers (P) Ltd, New Delhi.
7. Sharma H. L., Sharma K. K., Principles of Pharmacology, Paras medical publisher
8. Modern Pharmacology with clinical Applications, by Charles R.Craig& Robert.
9. Ghosh MN. Fundamentals of Experimental Pharmacology. Hilton & Company, Kolkata.
10. Kulkarni SK. Handbook of experimental pharmacology. Vallabh Prakashan.

BP504 T. PHARMACOGNOSY AND PHYTOCHEMISTRY II (Theory) 45 Hours

Scope: The main purpose of subject is to impart the students the knowledge of how the secondary metabolites are produced in the crude drugs, how to isolate and identify and produce them industrially.

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

1. to know basic metabolic pathways and formation of different secondary metabolites
2. to know various medicinally important secondary metabolites
3. to know the modern extraction techniques, characterization and identification of the herbal drugs and phytoconstituents
4. to carryout isolation and identification of phytoconstituents

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 through these pathways- Shikimic acid pathway, Acetate pathways and Amino acid pathway.
b) Study of utilization of radioactive isotopes in the investigation of Biogenetic studies.

UNIT-II **20 Hours**

Study of the biological source, cultivation (*marked only), commercial varieties, chemical constituents, chemistry & chemical classes, substitutes, adulterants, Diagnostic, macroscopic and microscopic (# marked only) features, specific chemical tests , general methods of extraction & analysis, therapeutic uses and commercial applications of following secondary metabolites:

Alkaloids: Vinca, Rauwolfia*#, Belladonna, Opium*, Ephedra, Cinchona#

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 **10 Hours**

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

UNIT IV **8 Hours**

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, histology and powder characteristics : Cinchona, Cinnamon, Senna, Clove, Ephedra, Fennel and Coriander
2. Exercise involving isolation & detection of active principles
   a. Caffeine - from tea dust.
   b. Starch from Potato
   c. Calcium citrate from lemon juice
   d. Pectin from lemon peel
   e. Casein from milk
   f. Lawsone from Henna
   g. Curcumin from turmeric
3. Separation of sugars by Paper chromatography
4. TLC of herbal extract
5. Distillation of volatile oils and detection of phytoconstitutents by TLC
6. Analysis of crude drugs by chemical tests: (i) Asafoetida (ii) Benzoin (iii) Colophony (iv) Aloes **(i)** Myrrh

Recommended Books: (Latest Editions)

1. W.C.Evans, Trease and Evans Pharmacognosy, 16_{th} edition, W.B. Saunders & Co., London, 2009.
2. Mohammad Ali. Pharmacognosy and Phytochemistry, CBS Publishers & Distribution, New Delhi.
3. Text book of Pharmacognosy by C.K. Kokate, Purohit, Gokhale (2007), 37_{th} Edition, Nirali Prakashan, New Delhi.
4. Herbal drug industry by R.D. Choudhary (1996), 1^{st} Edn, Eastern Publisher, New Delhi.
5. Essentials of Pharmacognosy, Dr.SH.Ansari, IInd edition, Birla publications, New Delhi, 2007
6. Herbal Cosmetics by H.Pande, Asia Pacific Business press, Inc, New Delhi.
7. A.N. Kalia, Textbook of Industrial Pharmacognosy, CBS Publishers, New Delhi, 2005.
8. R Endress, Plant cell Biotechnology, Springer-Verlag, Berlin, 1994.
9. Pharmacognosy & Pharmacobiotechnology. James Bobbers, Marilyn KS, VE Tylor.
10. Louis Appell, The formulation and preparation of cosmetic, fragrances and flavours, Micelle Press 1994.
11. Remington's Pharmaceutical sciences.
12. Text Book of Biotechnology by Vyas and Dixit.
13. Text Book of Biotechnology by R.C. Dubey.

BP 505 T. PHARMACEUTICAL JURISPRUDENCE (Theory) 45 Hours

Scope: This course is designed to impart basic knowledge on several important legislations related to the profession of pharmacy in India.

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

1. The Pharmaceutical legislations and their implications in the development and marketing
2. Various Indian pharmaceutical Acts and Laws
3. The regulatory authorities and agencies governing the manufacture and sale ofpharmaceuticals
4. The code of ethics during the pharmaceutical practice

Course Content:

UNIT-I 10 Hours

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 10 Hours

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 **10 Hours**

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

- **Medicinal and Toilet Preparation Act 1955**: Objectives, Definitions, Licensing, Manufacture In bond and Outside bond, Export of alcoholic preparations, Manufacture of Ayurvedic, Homeopathic, Patent & Proprietary Preparations. Offences and Penalties.

- **Narcotic Drugs and Psychotropic substances Act-1985 and Rules**: Objectives, Definitions, Authorities and Officers, Constitution and Functions of narcotic & Psychotropic Consultative Committee, National Fund for Controlling the Drug Abuse, Prohibition, Control and Regulation, opium poppy cultivation and production of poppy straw, manufacture, sale and export of opium, Offences and Penalties

UNIT-IV **08 Hours**

- **Study of Salient Features of Drugs and magic remedies Act and its rules:** Objectives, Definitions, Prohibition of certain advertisements, Classes of Exempted advertisements, Offences and Penalties

- **Prevention of Cruelty to animals Act-1960:** Objectives, Definitions, Institutional Animal Ethics Committee, Breeding and Stocking of Animals, Performance of Experiments, Transfer and acquisition of animals for experiment, Records, Power to suspend or revoke registration, Offences and Penalties

- **National Pharmaceutical Pricing Authority:** Drugs Price Control Order (DPCO)2013. Objectives, Definitions, Sale prices of bulk drugs, Retail price of formulations, Retail price and ceiling price of scheduled formulations, National List of Essential Medicines (NLEM)

UNIT-V **07 Hours**

- **Pharmaceutical Legislations** A brief review, Introduction, Study of drugs enquiry committee, Health survey and development committee, Hathi committee and Mudaliar committee
- **Code of Pharmaceutical ethics** Definition, Pharmacist in relation to his job, trade, medical profession and his profession, Pharmacist s oath
- **Medical Termination of pregnancy act**
- **Right to information Act**
- **Introduction to Intellectual Property Rights (IPR)**

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 India publications.
6. Medicinal and Toilet preparations act 1955 by Govt. of India publications.
7. Narcotic drugs and psychotropic substances act by Govt. of India publications
8. Drugs and Magic Remedies act by Govt. of India publication
9. Bare Acts of the said laws published by Government. Reference books (Theory)

Semester-VI

BP601T. MEDICINAL CHEMISTRY III (Theory) **45 Hours**

Scope: This subject is designed to impart fundamental knowledge on the structure, chemistry and therapeutic value of drugs. The subject emphasis on modern techniques of rational drug design like quantitative structure activity relationship (QSAR), Prodrug concept, combinatorial chemistry and Computer aided drug design (CADD). The subject also emphasizes on the chemistry, mechanism of action, metabolism, adverse effects, Structure Activity Relationships (SAR), therapeutic uses and synthesis of important drugs.

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

1. Understand the importance of drug design and different techniques of drugdesign.
2. Understand the chemistry of drugs with respect to their biological activity.
3. Know the metabolism, adverse effects and therapeutic value of drugs.
4. Know the importance of SAR of drugs.

Course Content:

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

UNIT I **10 Hours**

Antibiotics

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

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

Aminoglycosides: Streptomycin, Neomycin, Kanamycin

Tetracyclines: Tetracycline, Oxytetracycline, Chlortetracycline, Minocycline, Doxycycline

UNIT II **10 Hours**

Antibiotics

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

Macrolide: Erythromycin, Clarithromycin, Azithromycin.

Miscellaneous: Chloramphenicol*, Clindamycin.

Prodrugs: Basic concepts and application of prodrugs design.

Antimalarials: Etiology of malaria.

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

Biguanides and dihydro triazines: Cycloguanil pamoate, Proguanil.

Miscellaneous: Pyrimethamine, Artesunate, Artemether, Atovaquone.

UNIT – III **10 Hours**

Anti-tubercular Agents

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

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

Urinary tract anti-infective agents

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

Miscellaneous**:** Furazolidone, Nitrofurantoin*, Methenamine.

Antiviral agents:

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

UNIT – IV **08 Hours**

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, Praziquantel, Ivermectin.

Sulphonamides and Sulfones

Historical development, chemistry, classification and SAR of Sulfonamides:

Sulphamethizole, Sulfisoxazole, Sulphamethazine, Sulfacetamide*, Sulphapyridine, Sulfamethoxazole*, Sulphadiazine, Mefenide acetate, Sulfasalazine.

Folate reductase inhibitors: Trimethoprim*, Cotrimoxazole.

Sulfones: Dapsone*.

UNIT – V **07 Hours**

Introduction to Drug Design

Various approaches used in drug design. Physicochemical parameters used in quantitative structure activity relationship (QSAR) such as partition coefficient, Hammett‘s electronic parameter, Tafts steric parameter and Hansch analysis. 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 and intermediates

1. Sulphanilamide
2. 7-hydroxy, 4-methyl coumarin
3. Chlorobutanol
4. Triphenyl imidazole
5. Tolbutamide
6. Hexamine

II . Assay of drugs

1. Isonicotinic acid hydrazide
2. Chloroquine
3. Metronidazole
4. Dapsone
5. Chlorpheniramine maleate
6. Benzyl penicillin

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

IV Drawing structures and reactions using chem draw®

V Determination of physicochemical properties such as logP, clogP, MR, Molecular weight, Hydrogen bond donors and acceptors for class of drugs course content using drug design software Drug likeliness screening (Lipinski's RO5)

Recommended Books (Latest Editions)

1. Wilson and Gisvold's Organic medicinal and Pharmaceutical Chemistry.
2. Foye's Principles of Medicinal Chemistry.
3. Burger's Medicinal Chemistry, Vol I to IV.
4. Introduction to principles of drug design- Smith and Williams.
5. Remington's Pharmaceutical Sciences.
6. Martindale's extra pharmacopoeia.
7. Organic Chemistry by I.L. Finar, Vol. II.
8. The Organic Chemistry of Drug Synthesis by Lednicer, Vol. 1-5.
9. Indian Pharmacopoeia.
10. Text book of practical organic chemistry- A.I.Vogel.

BP602 T. PHARMACOLOGY-III (Theory) **45 Hours**

Scope: This subject is intended to impart the fundamental knowledge on various aspects (classification, mechanism of action, therapeutic effects, clinical uses, side effects and contraindications) of drugs acting on respiratory and gastrointestinal system, infectious diseases, immuno-pharmacology and in addition,emphasis on the principles of toxicology and chronopharmacology.

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

1. understand the mechanism of drug action and its relevance in the treatment of different infectious diseases
2. comprehend the principles of toxicology and treatment of various poisoningsand
3. appreciate correlation of pharmacology with related medical sciences.

Course Content:

UNIT-I **10hours**

1. Pharmacology of drugs acting on Respiratory system

a. Anti -asthmatic drugs
b. Drugs used in the management of COPD
c. Expectorants and antitussives

d. Nasal decongestants
e. Respiratory stimulants

2. Pharmacology of drugs acting on the Gastrointestinal Tract

a. Antiulcer agents.
b. Drugs for constipation and diarrhea
c. Appetite stimulants and suppressants.
d. Digestants and carminatives.
e. Emetics and anti-emetics.
f. Drugs on skin **-** melanising and demelanising agents, drugs used in psoriasis, acne

UNIT-II **10hours**

3. Chemotherapy

a. General principles of chemotherapy. including classification of chemotherapeutic agents, microbial resistance, chemoprophylaxis
b. Sulfonamides and cotrimoxazole. Urinary antiseptics
c. Antibiotics- Penicillins, cephalosporins, monobactam, carbapenem chloramphenicol, macrolides Lincosamides, quinolones and fluoroquinolones, tetracycline and aminoglycosides, oxazolidinediones

UNIT-III **10 hours**

3. Chemotherapy

a. Antitubercular agents
b. Antileprotic agents
c. Antifungal agents
d. Antiviral drugs including anti HIV drugs
e. Anthelmintics
f. Antimalarial drugs
g. Antiamoebic agents

UNIT-IV **08 hours**

3. Chemotherapy

Drugs used in UTI and STDs.

Anticancer agents

4. Immunopharmacology

Immunostimulants, Immunosuppressant

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

UNIT-V **07 hours**

Gene therapy- concepts, approaches, gene transfer techniques and application Stem cell therapy -an overview

BP 608 P. PHARMACOLOGY-III (Practical) **4Hrs/Week**

1. Anti allergic activity by mast cell stabilization assay
2. Study of anti-ulcer activity of a drug using pylorus ligand (SHAY) rat model and NSAIDS induced ulcer model.

3. Estimation of serum biochemical parameters .
4. Effects of skeletal muscle relaxants using rota-rod apparatus.
5. Effect of drugs on locomotor activity using actophotometer.
6. Anticonvulsant effect of drugs by MES and PTZ method.
7. Study of stereotype and anti-catatonic activity of drugs on rats/mice.
8. Study of anxiolytic activity of drugs using rats/mice.
9. Anti-inflammatory activity of drugs using carrageenan induced paw-edema model.
10. Analgesic activity of drug using central and peripheral methods
11. Biostatistics methods in experimental pharmacology (student s t test, ANOVA)
12. Biostatistics methods in experimental pharmacology (Chi square test, Wilcoxon Signed Rank test)

Note: Wherever **wet laboratory experiments are not feasible**, simulated experiments bysoftware /videos may be used.

Recommended Books (Latest Editions)

1. Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Rang and Dale s Pharmacology, Churchil Livingstone Elsevier
2. Katzung B. G., Masters S. B., Trevor A. J., Basic and clinical pharmacology, Tata McGraw-Hill
3. Goodman and Gilmans, The Pharmacological Basis of Therapeutics
4. Marry Anne K. K., Lloyd Yee Y., Brian K. A., Robbin L.C., Joseph G. B., Wayne A. K., Bradley R.W., Applied Therapeutics, The Clinical use of Drugs. The Point Lippincott Williams & Wilkins
5. Mycek M.J, Gelnet S.B and Perper M.M. Lippincotts Illustrated Reviews-Pharmacology
6. K.D.Tripathi. Essentials of Medical Pharmacology, , JAYPEE Brothers Medical Publishers (P) Ltd, New Delhi.
7. Sharma H. L., Sharma K. K., Principles of Pharmacology, Paras medical publisher 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 in Chronopharmacology.

BP 603 T. HERBAL DRUG TECHNOLOGY (Theory) 45 hours

Scope: This subject gives the student the knowledge of basic understanding of herbal drug industry, the quality of raw material, guidelines for quality of herbal drugs, herbal cosmetics, natural sweeteners, nutraceuticals etc. The subject also emphasizes on Good Manufacturing Practices (GMP), patenting and regulatory issues of herbal drugs

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

1. understand raw material as source of herbal drugs from cultivation to herbal drug product
2. know the WHO and ICH guidelines for evaluation of herbal drugs
3. know the herbal cosmetics, natural sweeteners, nutraceuticals
4. appreciate patenting of herbal drugs, GMP .
5. To understand the preparation and development of herbal formulation
6. To understand the herbal drug interactions.

Course content:

UNIT-I **06 Hours**

Herbs as raw materials

Definition of herb, herbal medicine, herbal medicinal product, herbal drug preparation. 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.

UNIT-II **05 Hours**

a) Basic principles involved in Ayurveda, Siddha, Unani and Homeopathy
b) Preparation and standardization of Ayurvedic formulations viz; Aristas and Asawas, Ghutika,Churna, Lehya and Bhasma.

UNIT-III **07 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: Alfalfa, 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: Hypericum, Kava-kava, Ginkobiloba, Ginseng, Garlic, Pepper & Ephedra.

UNIT-IV **10 Hours**

Herbal Cosmetics

Sources and description of raw materials of herbal origin used in herbal cosmetics such as

a) Fixed oils: Almond oil ,Arachis oil, castor oil ,olive oil, coconut oil
b) Waxes: Bees wax, Carnauba wax, Paraffin wax, Spermaceti
c) Gums: Guar gum, Sodium Alginate, Tragacanth
d) Colours: Cochineal, Saffron, Indigo, Henna
e) Perfumes: Rose oil, Jasmine oil, Lavender oil.
f) Protective agents: Neem, Cucumber, Aloe
g) Bleaching agents: Lemon, Turmeric
h) Antioxidants: Green tea, Sesame oil in products such as skin care, hair care and oral hygiene products.

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- V **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, Breeders 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-VI **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.

Schedule T - Good Manufacturing Practice of Indian systems of medicine

Components of GMP (Schedule- T) and its objectives

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

BP 609 P. HERBAL DRUG TECHNOLOGY (Practical) **4 hours/ week**

1. To perform preliminary phytochemical screening of crude drugs.
2. Determination of Ash values
3. Determination of moisture content of crude drugs
4. Determination of Extractive values of crude drugs
5. Determination of the alcohol content of Asava and Arista
6. Preparation of herbal cosmetics
7. Preparation and standardization of herbalformulation
8. Determination of swelling index and foaming index
9. Monograph analysis of herbal drugs from recent Pharmacopoeias
10. Analysis of fixed oils

Recommended Books: (Latest Editions)

1. Textbook of Pharmacognosy by Trease & Evans.
2. Textbook of Pharmacognosy by Tyler, Brady & Robber.
3. Pharmacognosy by Kokate, Purohit and Gokhale
4. Essential of Pharmacognosy by Dr.S.H.Ansari
5. Pharmacognosy & Phytochemistry by V.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

Scope: This subject is designed to impart knowledge and skills necessary for dose calculations, dose

Adjustments and to apply Biopharmaceutics theories in practical problem solving. Basic theoretical discussions of the principles of Biopharmaceutics and pharmacokinetics are provided to help the students to clarify the concepts.

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

1. Understand the basic concepts in biopharmaceutics and pharmacokinetics.
2. Use plasma data and derive the pharmacokinetic parameters to describe the process of drug absorption, distribution, metabolism and elimination.
3. Critically evaluate biopharmaceutic studies involving drug product equivalency
4. Design and evaluate dosage regimens of the drugs using pharmacokinetic and biopharmaceutic parameters.
5. Detect potential clinical pharmacokinetic problems and apply basic pharmacokinetic principles to solve them

Course Content:

UNIT-I 10 Hours

Introduction to Biopharmaceutics

Absorption; Mechanisms of drug absorption through GIT, factors influencing drug absorption though GIT, absorption of drug from Non per oral extra-vascular routes, Distribution of drugs Tissue permeability of drugs, binding of drugs, apparent, volume of drug distribution, protein binding of drugs, factors affecting protein-drug binding. Kinetics of protein binding, Clinical significance of protein binding of drugs

UNIT- II 10 Hours

Biotransformation Phase I and Phase II reactions.

Drug Elimination: Renal excretion of drugs, factors affecting renal excretion of drugs, renal clearance, Non renal routes of drug excretion of drugs

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

UNIT- III 10 Hours

Pharmacokinetics: Introduction to Pharmacokinetics models, Compartment models, Non compartment models, physiological models, One compartment open model. a. Intravenous Injection (Bolus) b. Intravenous infusion, extra vascular administrations, calculations of Ka and KE. From plasma and urinary excretion data

UNIT- IV 08 Hours

Multicompartment models: Two compartment open model. IV bolus Multiple Dosage Regimens:

a). Repititive Intravenous injections- One Compartment Open Model

b). Repititive Extravascular dosing- One Compartment Open model

UNIT- V **07 Hours**

Nonlinear Pharmacokinetics: Introduction, Factors causing Non-linearity, Michaelis-menton method of estimating parameters,

Recommended Books: (Latest Editions)

1. Biopharmaceutics and Clinical Pharmacokinetics by, Milo Gibaldi.
2. Biopharmaceutics and Pharmacokinetics; By Robert F Notari
3. Applied biopharmaceutics and pharmacokinetics, Leon Shargel and Andrew B.C.YU 4th edition,Prentice-Hall Inernational edition.USA
4. Bio pharmaceutics and Pharmacokinetics-A Treatise, By D. M. Brahmankar and Sunil B.Jaiswal,Vallabh Prakashan Pitampura, Delhi
5. Pharmacokinetics: By Milo Glbaldi Donald, R. Mercel Dekker Inc.
6. Hand Book of Clinical Pharmacokinetics, By Milo Gibaldi and Laurie Prescott by ADIS Health Science Press.
7. Biopharmaceutics; By Swarbrick
8. Clinical Pharmacokinetics, Concepts and Applications: By Malcolm Rowland and
9. Thomas, N. Tozen, Lea and Febrger, Philadelphia, 1995.
10. Dissolution, Bioavailability and Bioequivalence, By Abdou H.M, Mack, Publishing Company, Pennsylvania 1989.
11. Biopharmaceutics and Clinical Pharmacokinetics-An introduction 4th edition Revised and expanded by Rebort F Notari Marcel Dekker Inn, New York and Basel, 1987.
12. Remingtons Pharmaceutical Sciences, By Mack Publishing Company, Pennsylvnia

BP 605 T. PHARMACEUTICAL BIOTECHNOLOGY (Theory) **45 Hours**

Scope:

Biotechnology has a long promise to revolutionize the biological sciences and technology. Scientific application of biotechnology in the field of genetic engineering, medicine and fermentation technology makes the subject interesting. Biotechnology is leading to new biological revolutions in diagnosis, prevention and cure of diseases, new and cheaper pharmaceutical drugs. Biotechnology has already produced transgenic crops and animals and the future promises lot more. It is basically a research-based subject.

Objectives: Upon completion of the subject student shall be able to;

1. Understanding the importance of Immobilized enzymes in Pharmaceutical Industries
2. Genetic engineering applications in relation to production of pharmaceuticals
3. Importance of Monoclonal antibodies in Industries
4. Appreciate the use of microorganisms in fermentation technology

UNIT I **10 Hours**

a) Brief introduction to Biotechnology with reference to Pharmaceutical Sciences.
b) Enzyme Biotechnology- Methods of enzyme immobilization and applications.
c) Biosensors- Working and applications of biosensors in Pharmaceutical Industries.
d) Brief introduction to Protein Engineering.
e) Use of microbes in industry. Production of Enzymes- General consideration - Amylase, Catalase, Peroxidase, Lipase, Protease, Penicillinase.
Basic principles of genetic engineering.

UNIT II **10 Hours**

a) Study of cloning vectors, restriction endonucleases and DNA ligase.
b) Recombinant DNA technology. Application of genetic engineering in medicine.
c) Application of r DNA technology and genetic engineering in the products: i) Interferon ii) hepatitis- B vaccine iii) Insulin hormone.
d) Brief introduction to PCR
e) Types of immunity- humoral immunity, cellular immunity

UNIT III **10 Hours**

a) Structure of Immunoglobulins
b) Structure and Function of MHC
c) Hypersensitivity reactions, Immune stimulation and Immune suppressions.
d) General method of the preparation of bacterial vaccines, toxoids, viral vaccines, antitoxins, serum-immuno blood derivatives and other products relative to immunity.
e) Storage conditions and stability of official vaccines
f) Hybridoma technology- Production, Purification and Applications

UNIT IV **08 Hours**

a) Immuno blotting techniques- ELISA, Western blotting, Southern blotting.
b) Microbial genetics including transformation, transduction, conjugation, plasmids and transposons.
c) Introduction to Microbial biotransformation and applications.

UNIT V **07 Hours**

a) Mutation --Types of mutation/mutants
b) Fermentation methods and general requirements, study of media, equipments, sterilization methods, aeration process, stirring.
c) Large scale production fermenter design and its various controls.
d) Study of the production of - penicillins, citric acid, Vitamin B12, Glutamic acid, Griseofulvin,
e) Blood products: Collection, Processing and Storage of whole human blood, dried plasma, plasma substitutes

Recommended Books (Latest edition):

1. B.R. Glick and J.J. Pasternak: Molecular Biotechnology: Principles and Applications of Recombinant DNA: ASM Press Washington D.C.
2. RA Goldshy et. al., : Kuby Immunology.
3. J.W. Goding: Monoclonal Antibodies.
4. J.M. Walker and E.B. Gingold: Molecular Biology and Biotechnology by Royal 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., New Delhi

BP606 T PHARMACEUTICAL QUALITY ASSURANCE (Theory) 45 Hours

Scope: This course deals with the various aspects of quality control and quality assurance aspects of pharmaceutical industries. It covers the important aspects like cGMP, QC tests, documentation, quality certifications and regulatory affairs.

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

1. understand the CGMP aspects in a pharmaceutical industry appreciate the importance of documentation
2. understand the scope of quality certifications applicable to pharmaceutical industries
3. understand the responsibilities of QA & QC departments

Course content:

UNIT I 10 Hours

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 & ISO 14000: Overview, Benefits, Elements, steps for registration

NABL accreditation : Principles and procedures.

UNIT – II 10 Hours

Organization and personnel: Personnel responsibilities, training, hygiene and personal records.

Premises: Design, construction and plant layout, maintenance, sanitation, environmental control, utilities and maintenance of sterile areas, control of contamination.

Equipments and raw materials: Equipments selection, purchase specifications, maintenance, purchase specifications and maintenance of stores for raw materials.

Warehousing: Good warehousing practice, materials management

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 07 Hours

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.

Recommended Books: (Latest Edition)

1. Quality Assurance Guide by organization of Pharmaceutical Products of India.
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 WHO Publications.
4. A guide to Total Quality Management- Kushik Maitra and Sedhan KGhosh
5. How to Practice GMPs P P Sharma.
6. ISO 9000 and Total Quality Management Sadhank G Ghosh
7. The International Pharmacopoeia Vol I, II, III, IV- General Methods of Analysis and Quality specification for Pharmaceutical Substances, Excipients and Dosage forms
8. Good laboratory Practices Marcel Deckker Series
9. ICH guidelines, ISO 9000 and 14000 guidelines.

Semester-VII

BP701T. INSTRUMENTAL METHODS OF ANALYSIS (Theory) 45 Hours

Scope: This subject deals with the application of instrumental methods in qualitative and quantitative analysis of drugs. This subject is designed to impart a fundamental knowledge on the principles and instrumentation of spectroscopic and chromatographic technique. This also emphasizes on theoretical and practical knowledge on modern analytical instruments that are used for drug testing.

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

1. Understand the interaction of matter with electromagnetic radiations and its applications in drug analysis
2. Understand the chromatographic separation and analysis of drugs.
3. Perform quantitative & qualitative analysis of drugs using various analytical instruments.

Course Content:

UNIT –I 10 Hours

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 10 Hours

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 and applications

Flame Photometry-Principle, interferences, instrumentation and applications

Atomic absorption spectroscopy- Principle, interferences, instrumentation and applications

Nepheloturbidometry- Principle, instrumentation and applications

UNIT –III 10 Hours

Introduction to chromatography

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

Thin layer chromatography &High performance thin layer chromatography: Introduction, Principle, Methodology, Rf values, advantages, disadvantages and applications.

Paper chromatography - Introduction, methodology, development techniques, advantages, disadvantages and applications

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

UNIT –IV **08 Hours**

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

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

UNIT –V **07 Hours**

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

Gel filtration 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 organic compounds
2 Estimation of dextrose by colorimetry
3 Estimation of sulfanilamide by colorimetry
4 Simultaneous estimation of ibuprofen and paracetamol by UV spectroscopy
5 Assay of paracetamol by UV- Spectrophotometry
6 Estimation of quinine sulfate by fluorimetry
7 Study of quenching of fluorescence
8 Determination of sodium by flame photometry
9 Determination of potassium by flame photometry
10 Determination of chlorides and sulphates by nephelo turbidometry
11 Separation of amino acids by paper chromatography
12 Separation of sugars by thin layer chromatography
13 Separation of plant pigments by column chromatography
14 Demonstration experiment on HPLC
15 Demonstration experiment on Gas Chromatography

Recommended Books (Latest Editions)

1. Instrumental Methods of Chemical Analysis by B.K Sharma
2. Organic spectroscopy by Y.R Sharma
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 William Kemp
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 by Silverstein

BP702T. INDUSTRIAL PHARMACY(Theory) 45 Hours

Scope: This course is designed to impart fundamental knowledge on pharmaceutical product commercialization from laboratory to market

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

1. Know the process of pilot plant and scale up of pharmaceutical dosage forms
2. Understand the process of technology transfer from lab scale to commercialbatch
3. Know different laws and acts that regulate pharmaceutical industry in India andUS
4. Understand the approval process and regulatory requirements for drugproducts

Course Content:

UNIT-I 10 Hours

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 10 Hours

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, packing 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 - APCTT, NRDC, TIFAC, BCIL, TBSE / SIDBI; TT or Technology of Transfer (ToT) related documentation - confidentiality agreements, licensing, MoUs, legal issues

UNIT-III 10 Hours

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, General considerations of Investigational New Drug (IND) Application, Investigator‘s Brochure (IB) and New Drug Application(NDA), Data Presentation for FDA Submissions.

UNIT-IV 08 Hours

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

UNIT-V 07 Hours

Industrial Safety: Plant Location & layout, utility services, Mechanical hazards, Chemical hazards, Electrical hazards, Fire Hazards, Pharmaceutical hazards and their safety. Accident records

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' Second Edition.
4. Regulatory Affairs brought by learning plus, inc. available athttp.//www.cgmp.com/ra.htm
5. A concise textbook of Drug Regulatory Affairs: N Uduppa, Krishnamurthy Bhat
6. Drug regulatory Affairs: Singh G
7. Drug Regulatory Affairs: Dr. N S Vyawahare
8. The pharmaceutical regulatory process, 2nd Edition: Bylra R Berry, Robert P Martin

BP 703T. PHARMACY PRACTICE (Theory) 45 Hours

Scope: In the changing scenario of pharmacy practice in India, for successful practice of Hospital Pharmacy, the students are required to learn various skills like drug distribution, drug information, and therapeutic drug monitoring for improved patient care. In community pharmacy, students will be learning various skills such as dispensing of drugs, responding to minor ailments by providing suitable safe medication, patient counseling for improved patient care in the community set up.

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

1. Know various drug distribution methods in a hospital.
2. Appreciate the pharmacy stores management and inventory control.
3. Monitor drug therapy of patient through medication chart review and clinical review.
4. Obtain medication history interview and counsel the patients.
5. Identify drug related problems.
6. Detect and assess adverse drug reactions.
7. Interpret selected laboratory results (as monitoring parameters in therapeutics) of specific disease states.
8. Know pharmaceutical care services.
9. Do patient counseling in community pharmacy .
10. Appreciate the concept of rational drug therapy.

Unit - I 10 Hours

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 staff 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) Drug distribution system in a hospital

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

d) Hospital formulary

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

Unit -II **8 Hours**

a) Pharmacy and therapeutic committee

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

b) Clinical Pharmacy

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

c) Patient medication history interview

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

d) Therapeutic drug monitoring

Need for Therapeutic Drug Monitoring, Factors to be considered during the Therapeutic Drug Monitoring

e) Medication adherence

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

Unit - III **8 Hours**

a) Adverse drug reaction - Classification, reporting and management.
b) Drug interactions - Pharmacokinetic and Pharmacodynamic interactions with examples.
c) Drug information services
   Drug and Poison information center, Sources of drug information, computerized services, and storage and retrieval of information.
d) Patient counseling
   Definition of patient counseling; steps involved in patient counseling.
e) Communication skill , communication skill with prescribers and patients

Unit - IV **12 Hours**

a) Rational use of drugs- rational use of injections, antibiotics and over the counter drugs, sale of over the counter drugs.
b) Pharmacotherapeutics : Drug therapy and management aspect of following disorders
   Diabetes, Hypertension, congestive cardiac failure, myocardial infarction, Asthma, Epilepsy, Peptic ulcer, rheumatoid arthritis and tuberculosis.
c) Interpretation of Clinical Laboratory Tests.
   Hematology, liver function test, renal function test, pulmonary function test.

Unit - V **07 Hours**

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

b) Drug store management and inventory control

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

Recommended Books (Latest Edition):

1. Merchant S.H. and Dr. J.S.Quadry. A textbook of hospital pharmacy, 4th ed. Ahmadabad: B.S. Shah Prakakshan; 2001.
2. Parthasarathi G, Karin Nyfort-Hansen, Milap C Nahata. A textbook of Clinical 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.(can be deleted –health education not included in thesyllabus)
7. Clinical pharmacy and therapeutics by Roger walker-clivie Edwards (Churchill livingstone) –to be included for therapeutics)

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 (Monthly magazine)

BP 704T: NOVEL DRUG DELIVERY SYSTEMS (Theory) 45 Hours

Scope: This subject is designed to impart basic knowledge on the area of novel drug delivery systems

Objectives: Upon completion of the course student shall be able

1. To understand various approaches for development of novel drug delivery systems.
2. To understand the criteria for selection of drugs and polymers for the development of Novel drug delivery systems, their formulation and evaluation

Course content:

Unit-I 10 Hours

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.

Polymers: Introduction, classification, properties, advantages and application of polymers in formulation of controlled release drug delivery systems.

Unit-II10 Hours

Microencapsulation: Definition, advantages and disadvantages, microspheres/microcapsules, micro particles, methods of microencapsulation, applications.

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

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

Unit-III **10 Hours**

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 **08 Hours**

Nanotechnology and its Concepts: Concepts and approaches for targeted drug delivery systems, advantages and disadvantages, introduction to liposomes, niosomes, nanoparticles, monoclonal antibodies and their applications

Unit-V **07 Hours**

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

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 in 2001).
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 (Elsevier Sciences)
4. Drug Development and Industrial Pharmacy (Marcel & Decker)
5. International Journal of Pharmaceutics (Elsevier Sciences)

SEMESTER VIII

BP801T- RESEARCH METHODOLOGY AND BIOSTATISTICS 45 Hours

Scope: To understand the applications of Biostatics in Pharmacy. This subject deals with descriptive statistics, Graphics, Correlation, Regression, logistic regression Probability theory, Sampling technique, Parametric tests, Non Parametric tests, ANOVA, Introduction to Design of Experiments, Phases of Clinical trials and Observational and Experimental studies, SPSS, R and MINITAB statistical software's, analyzing the statistical data using Excel**.**

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

1. How to select a research topic in his/her areas of interest.
2. The fundamentals of collecting, analyzing and interpreting the relevant data.
3. Different computational methods and software's facilitating research

Course content:

Unit-I 10 Hours

An Introduction to Research: Definition and characteristics of Research, Types of Research, Criteria of good research, Research Process, Review of literature and Research gap, Formulating and defining the research problem. Research methods v/s methodology. Format for Research Protocol. Research ethics and importance of Institutional Review Boards. Significance of research in Pharmaceutical Sciences

Unit-II 6 Hours

Different types of data: Different methods for data collection. Experimental and observational studies. Questionnaires and rating scales. Primary and secondary data. Different types of data distribution. Coding and tabulation of data. Graphical representation of data.

Unit-III 8 Hours

Introduction to Epidemiological methods: Types of epidemiology studies. Standard measures in epidemiological studies. Measures of disease frequency, Measures of association. Study designs in epidemiology studies. Intervention studies, Controlled clinical trials. Errors in Epidemiological studies. Validity and Reliability. Bias and confounding.

Unit-IV 8 Hours

Biostatistics: Definition and application. Various terms in statistics, Descriptive statistics: Measures of central tendency. Measures of dispersion. Inferential statistics: Different areas of inferential statistics. Sampling Fundamentals: Need for sampling. Probability and nonprobability samplings. Sample size, criteria for inclusion and exclusion, dropouts.

Unit-V 13 Hours

Research question and Hypothesis: Characteristics of good Hypothesis, Testing of Hypothesis. Procedure for hypothesis testing, Tests for significance. P value, Type I and Type II errors, Different Parametric and Nonparametric tests and their applications. Interpretation of results. Computer software's in Bio statistical Analysis

Thesis writing: Components of Thesis. Paraphrasing and Plagiarism. References and Bibliography. Research publication, Impact factor, and Publication ethics.

Recommended Books:

1. Research Methodology; Methods and Techniques. C.R.Kothari. New Age International (P) Limited
2. Fundamentals of Statistics. S.C. Gupta. Himalaya Publishing House
3. Mahajan's Methods in Biostatistics for Medical Students and Research workers.Jaypee Publishers

BP 802T SOCIAL AND PREVENTIVE PHARMACY 45 Hours

Scope: The purpose of this course is to introduce to students a number of health issues and their challenges. This course also introduced a number of national health programmes. The roles of the pharmacist in these contexts are also discussed.

Objectives: After the successful completion of this course, the student shall be able to:

1. Acquire high consciousness/realization of current issues related to health and pharmaceutical problems within the country and worldwide.
2. Have a critical way of thinking based on current health care development.
3. Evaluate alternative ways of solving problems related to health and pharmaceuticalissues

Course content:

Unit I: 10 Hours

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

Unit II: 10 Hours

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

Unit III: 10 Hours

National health programs, its objectives, functioning and outcome of the following: HIV AND AIDS control program, TB, Integrated disease surveillance program (IDSP), National leprosy control program, National mental health program, National program for prevention and control of deafness, Universal immunization program, National program for control of blindness, Pulse polio program.

Unit IV: 08 Hours

National health intervention program for mother and child, National family welfare program, National tobacco control program, National Malaria Prevention Program, National program for the health care for the elderly, Social health program; role of WHO in Indian national program.

Unit V: **07 Hours**

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

ecommended 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, 4thEdition, 2013, ISBN: 9789350901878, JAYPEEPublications
3. Review of Preventive and Social Medicine (Including Biostatistics), JainVivek, 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 BHANOT PUBLISHERS.
6. Community Pharmacy Practice, Ramesh Adepu, BSP publishers, Hyderabad

Recommended Journals:

1. Research in Social and Administrative Pharmacy, Elsevier, Ireland

BP803ET. PHARMACEUTICAL MARKETING (Theory) **45 Hours**

Scope: The pharmaceutical industry not only needs highly qualified researchers, chemist, technical people but also requires skilled managers who can take the industry forward by managing and taking the complex decisions which are imperative for the growth of the industry. Sales & Marketing which grooms the people for taking a challenging role in Sales and Product management. The career in product management starts from having hands on experience in sales and marketing only.

Objectives: The course aim is to provide an understanding of marketing concepts and techniques and the application of the same in the pharmaceutical industry.

Course content:

Unit I **10 Hours**

Marketing: Definition, general concepts, and scope of marketing; Distinction between marketing & selling; Marketing environment; Industry and competitive analysis; Analyzing consumer buying behavior; industrial buying behavior.

Pharmaceutical market: Quantitative and qualitative aspects; size and composition of the market; demographic descriptions and socio-psychological characteristics of the consumer; market segmentation & targeting. Consumer profile; Motivation and prescribing habits of the physician; patients' choice of physician and retail pharmacist. Analyzing the Market; Role of market research.

Unit II **10 Hours**

Product decision: Meaning, 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.

Unit III **07 Hours**

Promotion: Meaning and methods, determinants of promotional mix, promotional budget; An overview of personal selling, advertising, direct mail, journals, sampling, retailing, medical exhibition, public relations, online promotional techniques for OTC Products.

Unit IV **10 Hours**

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.

Unit V **08 Hours**

Pricing: Meaning, importance, objectives, determinants of price; pricing methods and strategies, issues in price management in pharmaceutical industry. An overview of DPCO (Drug Price Control Order) and NPPA (National Pharmaceutical Pricing Authority).

Emerging concepts in marketing: Vertical & Horizontal Marketing; Rural Marketing; Consumerism; Industrial Marketing; Global Marketing.

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, New Delhi.
3. Dhruv Grewal and Michael Levy: Marketing, Tata MC Graw Hill
4. Arun Kumar and N Menakshi: Marketing Management, Vikas Publishing, India
5. Rajan Saxena: Marketing Management; Tata MC Graw-Hill (India Edition)
6. Ramaswamy, U.S & Nanakamari, S: Marketing Managemnt: Global Perspective, Indian Context,Macmilan India, New Delhi.
7. Shanker, Ravi: Service Marketing, Excell Books, New Delhi
8. Subba Rao Changanti, Pharmaceutical Marketing in India (GIFT – Excel series) ExcelPublications.

BP804 ET: PHARMACEUTICAL REGULATORY SCIENCE (Theory) **45 Hours**

Scope: This course is designed to impart the fundamental knowledge on the regulatory requirements for approval of new drugs, drug products in regulated countries like US, EU, Japan, Australia and Canada. It prepares the students to learn in detail on the regulatory requirements, documentation requirements, and registration procedures for marketing the drug products in regulated countries.

Objectives: Upon completion of the subject student shall be able to;

1. Know about the process of drug discovery and development
2. Know the regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals
3. Know the regulatory approval process and their registration in Indian and international markets

Course content:

Unit I **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.

Unit II **10Hours**

Regulatory Approval Process: Approval processes and time lines involved in Investigational New Drug (IND), New Drug Application (NDA), Abbreviated New Drug Application (ANDA) in US. Changes to an approved NDA / ANDA.

Regulatory authorities and agencies: Overview of regulatory authorities of United States, European Union, Australia, Japan, Canada (Organization structure and types of applications only)

Unit III **10 Hours**

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.

Unit IV **08 Hours**

Clinical trials

Developing clinical trial protocols, Institutional Review Board / Independent Ethics committee - formation and working procedures, Informed consent process and procedures, GCP obligations of Investigators, sponsors & Monitors, Managing and Monitoring clinical trials, Pharmacovigilance - safety monitoring in clinical trials

Unit V **07 Hours**

Regulatory Concepts

Basic terminologies, 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, Nirali Prakashan.
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 care Publishers.
3. New Drug Approval Process: Accelerating Global Registrations By Richard A Guarino, MD, 5th edition, Drugs and the Pharmaceutical Sciences, Vol.190.
4. Guidebook for drug regulatory submissions / Sandy Weinberg. By John Wiley & Sons. Inc.
5. FDA Regulatory Affairs: a guide for prescription drugs, medical devices, and biologics /edited by Douglas J. Pisano, David Mantus.
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 By Fay A. Rozovsky and Rodney K. 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 Rick Ng

BP 805T: PHARMACOVIGILANCE (Theory) 45 hours

Scope: This paper will provide an opportunity for the student to learn about development of pharmacovigilance as a science, basic terminologies used in pharmacovigilance, global scenario of Pharmacovigilance, train students on establishing pharmacovigilance programme in an organization, various methods that can be used to generate safety data and signal detection. This paper also develops the skills of classifying drugs, diseases and adverse drugreactions.

Objectives:

1. Why drug safety monitoring is important?
2. History and development of pharmacovigilance.
3. National and international scenario of pharmacovigilance.
4. Dictionaries, coding and terminologies used in pharmacovigilance.
5. Detection of new adverse drug reactions and their assessment.
6. International standards for classification of diseases anddrugs.
7. Adverse drug reaction reporting systems and communication in pharmacovigilance.
8. Methods to generate safety data during pre clinical, clinical and post approval phases of drugs' life cycle.
9. Drug safety evaluation in paediatrics, geriatrics, pregnancy and lactation.
10. Pharmacovigilance Program of India (PvPI).
11. ICH guidelines for ICSR, PSUR, expedited reporting, pharmacovigilance planning.
12. CIOMS requirements for ADR reporting.
13. Writing case narratives of adverse events and their quality.

Course Content

Unit I 10 Hours

Introduction to Pharmacovigilance

History and development of Pharmacovigilance, Importance of safety monitoring of Medicine, WHO international drug monitoring programme, Pharmacovigilance Program of India(PvPI).

Introduction to adverse drug reactions

Definitions and classification of ADRs, Detection and reporting, Methods in Causality assessment, Severity and seriousness assessment, Predictability and preventability assessment, Management of adverse drug reactions.

Basic terminologies used in pharmacovigilance

Terminologies of adverse medication related events, Regulatory terminologies.

Unit II **10 hours**

Drug and disease classification

Anatomical, therapeutic and chemical classification of drugs, International classification of diseases

Daily defined doses, International Non proprietary Names for drugs.

Drug dictionaries and coding in pharmacovigilance

WHO adverse reaction terminologies, MedDRA and Standardised MedDRA queries, WHO drug dictionary, Eudravigilance medicinal product dictionary.

Information resources in pharmacovigilance

Basic drug information resources, Specialised resources for ADRs.

Establishing pharmacovigilance programme

Establishing in a hospital, Establishment & operation of drug safety department in industry, Contract

Unit III **10 Hours**

Vaccine safety surveillance - Vaccine Pharmacovigilance, Vaccination failure, Adverse events following immunization.

Pharmacovigilance methods

Passive surveillance – Spontaneous reports and case series, Stimulated reporting

Active surveillance – Sentinel sites, drug event monitoring and registries

Comparative observational studies – Cross sectional study, case control study and cohort study

Targeted clinical investigations

Communication in pharmacovigilance

Effective communication in Pharmacovigilance, Communication in Drug Safety Crisis management, Communicating with Regulatory Agencies, Business Partners, Healthcare facilities & Media

Unit IV **8 Hours**

Statistical methods for evaluating medication safety data

Safety data generation - Pre clinical phase, Clinical phase, Post approval phase.

ICH Guidelines for Pharmacovigilance

Organization and objectives of ICH, Expedited reporting, Individual case safety reports, Periodic safety update reports, Post approval expedited reporting, Pharmacovigilance planning, Good clinical practice in pharmacovigilance studies.

Unit V **7 hours**

Pharmacogenomics of adverse drug reactions

Drug safety evaluation in special population - Paediatrics, Pregnancy and lactation, Geriatrics

CIOMS - CIOMS Working Groups, CIOMS Form

CDSCO (India) and Pharmacovigilance - D&C Act and Schedule Y, Differences in Indian and global pharmacovigilance requirements.

Recommended Books (Latest edition):

1. Textbook of Pharmacovigilance: S K Gupta, Jaypee Brothers, Medical Publishers.
2. Practical Drug Safety from A to Z By Barton Cobert, Pierre Biron, Jones and Bartlett Publishers.
3. Mann's Pharmacovigilance:Elizabeth B. Andrews, Nicholas, Wiley Publishers.
4. Stephens' Detection of New Adverse Drug Reactions: John Talbot, Patrick Walle, Wiley Publishers.
5. An Introduction to Pharmacovigilance: Patrick Waller,Wiley Publishers.
6. Cobert's Manual of Drug Safety and Pharmacovigilance: Barton Cobert,Jones& Bartlett Publishers.
7. Textbook of Pharmacoepidemiolog edited by Brian L. Strom, Stephen E Kimmel, Sean Hennessy,Wiley Publishers.
8. A Textbook of Clinical Pharmacy Practice -Essential Concepts and Skills:G. Parthasarathi, Karin NyfortHansen,Milap C. Nahata
9. National Formulary of India
10. Text Book of Medicine by Yashpal Munjal
11. Text book of Pharmacovigilance: concept and practice by GP Mohanta and PKManna
12. http://www.whoumc.org/DynPage.aspx?id=105825&mn1=7347&mn2=7259&mn 3=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)

45 Hours

Scope: In this subject the student learns about the various methods and guidelines for evaluation and standardization of herbs and herbal drugs. The subject also provides an opportunity for the student to learn cGMP, GAP and GLP in traditional system of medicines.

Objectives: Upon completion of the subject student shall be able to;

1. know WHO guidelines for quality control of herbal drugs
2. know Quality assurance in herbal drug industry
3. know the regulatory approval process and their registration in Indian and international markets
4. appreciate EU and ICH guidelines for quality control of herbal drugs

Unit I **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.

Unit II **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.

Unit III **10 Hours**

EU and ICH guidelines for quality control of herbal drugs.

Research Guidelines for evaluating the safety and efficacy of herbal medicines

Unit IV **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.

Unit V **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 and Evans
2. Pharmacognosy by Kokate, Purohit and Gokhale
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/Traditional Medicinal Products,
6. Mukherjee, P.W. Quality Control of Herbal Drugs: An Approach to Evaluation of 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 of Herbal 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, 3rd edn. World Health Organization, Geneva, 1981.
10. WHO. Quality Control Methods for Medicinal Plant Materials. World Health Organization, Geneva, 1999.
11. WHO. WHO Global Atlas of Traditional, Complementary and Alternative 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

Scope: This subject is designed to provide detailed knowledge of rational drug design process and various techniques used in rational drug design process.

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

1. Design and discovery of lead molecules
2. The role of drug design in drug discovery process
3. The concept of QSAR and docking
4. Various strategies to develop new drug like molecules.
5. The design of new drug molecules using molecular modelingsoftware

Course Content:

UNIT-I 08 Hours

Introduction to Drug Discovery and Development

A) History of drug discovery and development

B) Rational Drug Discovery- Different stages involved in rational drug discovery process, methods involved in lead discovery and lead optimization. Role of computer applications in lead discovery and lead optimization. Introduction to ligand and structure based drug design.

UNIT-II 10 Hours

Quantitative Structure Activity Relationship (QSAR)

Qualitative versus Quantitative SAR, Types of physicochemical parameters, Lipophilicity effects: Hansch equation,Electronic effects: Hammett equation, Steric effects: Taft equation. QSAR Methods: Hansch analysis and Free Wilson analysis. 3D-QSARapproaches like COMFA and COMSIA.

UNIT-III 5 Hours

Pharmacophore modeling

Concept of pharmacophore, pharmacophore mapping and pharmacophore based screening. Analog based drug design: Bioisosterism-classification and bioisosteric replacement.

UNIT-IV **17Hours**

Molecular Modeling: Introduction to molecular modeling

A) Molecular mechanics- Introduction, force field, potential free energy surface, energy minimization methods, global and local energy minimum conformations. Molecular docking-Rigid, semi-flexible and flexible docking, Docking components: Binding site identification, search algorithms, scoring functions and binding free energy. Case study on the design of HIV protease inhibitors using docking. Introduction to Molecular dynamic simulations.

B) Quantum mechanics-Introduction, Methods-*ab initio* and semi empirical methods, Applications of quantum mechanics in drug design.

c) Introduction to *de novo* drug design and homology modeling of proteins.

UNIT – V **05 Hours**

Informatics methods in drug design

Introduction to bioinformatics, chemoinformatics. ADME databases, chemical, biochemical and pharmaceutical databases.

Recommended Books (Latest Editions)

1. Robert GCK, ed., ―Drug Action at the Molecular Level‖ University Prak Press ,Baltimore.
2. Martin YC., ―Quantitative Drug Design‖ Dekker, New York.
3. Cohen C., -Molecular Modelling in Drug Design‖ Academic Press, New York.
4. Wolf ME., ed -The Basis of Medicinal Chemistry, Burger's Medicinal Chemistry‖ John Wiley & Sons, New York.
5. GoodmanJM., ―Chemical Applications of Molecular modeling‖, Royal Society of Chemistry, Cambridge, UK.
6. Smith HJ., Williams H, eds, ―Introduction to the principles of Drug Design‖ CRC Press,Boston.
7. Patrick Graham, L., An Introduction to Medicinal Chemistry, Oxford University Press.
8. Silverman RB.,―The organic Chemistry of Drug Design and Drug Action‖ Academic Press, New York.
9. Foye WO., ―Principles of Medicinal chemistry‖ Williams&Wilkins, Philadelphia, PA.
10. Koro lkovas A, Burckhalter JH. ―Essentials of Medicinal Chemistry‖ Wiley,New York.

BP808ET: CELL AND MOLECULAR BIOLOGY (Elective subject) **45 Hours**

Scope:

Cell biology is a branch of biology that studies cells– their physiological properties, their structure, the organelles they contain, interactions with their environment, their life cycle, division, death and cell function. This is done both on a microscopic and molecular level.Cell biology research encompasses both the great diversity of single-celled organisms like bacteriaand protozoa, as well as the many specialized cells in multi-cellular organisms such as humans, plants, and sponges. The course content will equip the students with adequate knowledge of the molecular process occurring within the cell and possibly pharmacological interventions into those processes

Objectives: Upon completion of the subject student shall be able to;

1. Summarize cell and molecular biology history.
2. Summarize cellular functioning and composition.
3. Describe the chemical foundations of cell biology.
4. Summarize the DNA properties of cell biology.
5. Describe protein structure and function.
6. Describe cellular membrane structure and function.

7. Describe basic molecular genetic mechanisms.
8. Summarize the Cell Cycle

Course content:

Unit I **10 Hours**

a) Cell and Molecular Biology: Definitions theory and basics and Applications.
b) Cell and Molecular Biology: History and Summation.
c) Theory of the Cell. Properties of cells and cell membrane.
d) Prokaryotic versus Eukaryotic
e) Cellular Reproduction
f) Chemical Foundations – An Introduction and Reactions (Types)

Unit II **10 Hours**

a) DNA and the Flow of Molecular Structure
b) DNA Functioning
c) DNA and RNA
d) Types of RNA
e) Transcription and Translation

Unit III **08 Hours**

a) Proteins
b) Protein Structure
c) Regularities in Protein Pathways
d) Cellular Processes
e) Positive Control and significance of Protein Synthesis

Unit IV **10 Hours**

a) Science of Genetics
b) Transgenics and Genomic Analysis
c) Cell Cycle analysis:
d) Mitosis and Meiosis

Unit V **07 Hours**

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

Recommended Books (latest edition):

1. W.B. Hugo and A.D. Russel: Pharmaceutical Microbiology, Blackwell Scientific 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: Pharmaceutical Microbiology.
5. Rose: Industrial Microbiology.

6. Probisher, Hinsdill et al: Fundamentals of Microbiology, 9th ed. Japan
7. Cooper and Gunn‘s: Tutorial Pharmacy, CBS Publisher and Distribution.
8. Peppler: Microbial Technology.
9. Edward: Fundamentals of Microbiology.
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 Washington D.C.
13. RA Goldshy et. al., : Kuby Immunology.
14. Pelczar, Chan Kreig, Microbiology, Tata McGraw Hill edn.
15. Malcolm Harris, Balliere Tindall and Cox: Pharmaceutical Microbiology.
16. Rose: Industrial Microbiology.
17. Probisher, Hinsdill et al: Fundamentals of Microbiology, 9th ed. Japan
18. Cooper and Gunn‘s: Tutorial Pharmacy, CBS Publisher and Distribution.
19. Peppler: Microbial Technology.
20. Edward: Fundamentals of Microbiology.
21. N.K.Jain: Pharmaceutical Microbiology, Vallabh Prakashan, Delhi
22. Bergeys manual of systematic bacteriology, Williams and Wilkins- A Waverly company
23. B.R. Glick and J.J. Pasternak: Molecular Biotechnology: Principles and Applications of RecombinantDNA: ASM Press Washington D.C.
24. RA Goldshy et. al., : Kuby Immunology.

BP809ET. COSMETIC SCIENCE (Theory) **45 Hours**

Scope: Cosmetic Science is an exciting new applied science that deals with knowledge and understanding of the various disciplines within Cosmetic Science, Cosmetic Formulation Science and the organization and function of the Cosmetic, Toiletry and Perfumery industries. It not only provide knowledge on cosmetics, and related sciences, cosmeceuticals and personal care and hygiene products but also afford multidisciplinary scientific knowledge to gain expertise in the field and to respond the industry challenges effectively.

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

1. Know the cosmetic principles to address the needs of cosmetic industry.
2. Understand formulation science and analytical techniques required to scientifically design and develop cosmetic products.
3. Explain the scientific and technical aspects, high standards of practice and professional ethics within the cosmetic and toiletries industry.

UNIT I **10 Hours**

Definition of cosmetics as per Indian regulations Classification of cosmetic and cosmeceutical products

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**.**

UNIT II **10 Hours**

Principles of formulation and building blocks of skin care products: Face wash, Moisturizing cream, Cold Cream, Vanishing cream their relative skin sensory, advantages and disadvantages. Application of these products in formulation of cosmeceuticals.

Principles of formulation and building blocks of Hair care products: Conditioning shampoo, Hair conditioners, anti-dandruff shampoo. Hair oils. Hair dyes

Principles of formulation and building blocks of oral care products: Tooth paste for bleeding gums, sensitive teeth. Teeth whitening, Mouthwash.

UNIT III **10 Hours**

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

Analysis of cosmetics: BIS specification and analytical methods for shampoo, skin cream and toothpaste**.**

UNIT IV **07 Hours**

Principles of Cosmetic Evaluation: Principles of sebumeter, corneometer. Measurement of TEWL, Skin Color, Hair tensile strength

UNIT V **08 Hours**

Oily and dry skin, causes leading to dry skin, skin moisturisation.

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, George Godwin.
2) Cosmetics – Formulations, Manufacturing and Quality Control, P.P. Sharma, 4th Edition, Vandana Publications Pvt. Ltd., Delhi.
3)

BP 810 ET.EXPERIMENTAL PHARMACOLOGY

(PHARMACOLOGICAL SCREENING METHODS) **45 Hours**

Scope: This subject is designed to impart the basic knowledge of preclinical studies in experimental animals including design, conduct and interpretations of results.

Objectives

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

1. Appreciate the applications of various commonly used laboratory animals.
2. Appreciate and demonstrate the various screening methods used in preclinical research
3. Appreciate and demonstrate the importance of biostatistics and research methodology
4. Design and execute a research hypothesis independently

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 mutant animals. Techniques for collection of blood and common routes of drug administration in laboratory animals, Techniques of blood collection and euthanasia.

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 the study.

b. **Study of screening animal models for** Diuretics, nootropics, anti-Parkinson's, antiasthmatics, **Preclinical screening models:** for CNS activity-analgesic, antipyretic, anti-inflammatory,general anaesthetics, sedative and hypnotics, antipsychotic, antidepressant, antiepileptic, antiparkinsonism, alzheimer's disease

Unit –III **10 Hours**

Preclinical screeningmodels: for ANS activity, sympathomimetics, sympatholytics, parasympathomimetics, parasympatholytics, skeletal muscle relaxants, drugs acting on eye, local anaethetics

Unit –IV **12 Hours**

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.

Unit –V **05 Hours**

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

Recommended Books (latest edition):

1. Fundamentals of experimental Pharmacology-by M.N.Ghosh
2. Hand book of Experimental Pharmacology-S.K.Kulakarni
3. CPCSEA guidelines for laboratory animal facility.
4. Drug discovery and Evaluation by Vogel H.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**

Scope: This subject deals with the application of instrumental methods in qualitative and quantitative analysis of drugs. This subject is designed to impart advanced knowledge on the principles and instrumentation of spectroscopic and chromatographic hyphenated techniques. This also emphasizes on theoretical and practical knowledge on modern analytical instruments that are used for drug testing.

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

1. understand the advanced instruments used and its applications in drug analysis
2. understand the chromatographic separation and analysis of drugs.
3. understand the calibration of various analytical instruments know analysis of drugs using various analytical instruments.

Course Content:

UNIT-I **10 Hours**

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–Electronimpact, chemical ionization, MALDI, FAB, Analyzers-Time of flight and Quadrupole, instrumentation, applications.

UNIT-II **10 Hours**

Thermal Methods of Analysis: Principles, instrumentation and applications of Thermo gravimetric Analysis (TGA), Differential Thermal Analysis (DTA), Differential Scanning Calorimetric (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 **10 Hours**

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 **08 Hours**

Radio immune assay: Importance, various components, Principle, differentmethods, 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.K Sharma
2. Organic spectroscopy by Y.R Sharma
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 William Kemp
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 by Silverstein

Total number of hours

As given under course of study 2.4.3

Branches if any with definition

Not applicable

Teaching learning methods

As given under the syllabus

Content of each subject in each year

As given under the syllabus

Number of hours per subject

As given under the syllabus

Practical training

As given under the course content

Records

The students are expected to perform the number of experiments listed in the respective syllabus. Students are required to maintain practical records for each of the practical subjects and should be certified by the faculty in-charge before registering for end semester examination. It should be produced at the time of practical examination and to be certified by both internal and external examiners.

Dissertation

Not Applicable

Special Training if any

Not Applicable

Project work to be done if any

As given under the syllabus

Any other requirements (CME, Paper publishing etc..)

Not Applicable

Prescribed/ recommended text books for each subject

As given under the syllabus

Reference books

As given under the syllabus

Journals

As given under the course content

Log book

Not Applicable

Program Committee

1. The B. Pharm program shall have a **Program Committee c**onstituted by the **Head of the institution** in consultation with all the Heads of the Deparatments.

2. The composition of the Program Committee shall be as follows:

(i) A **senior teacher** shall be the **Chairperson**

(ii) One teacher from each department handling B. Pharm courses;

(iii) Four student representatives of the program (one from each academic year), nominated by the Head of the institution.

3. Duties of the Program Committee:

i. Periodically reviewing the progress of the classes.

ii. Discussing the problems concerning curriculum, syllabus and the conduct of classes.

(iii) Discussing with the course teachers on the nature and scope of assessment for the course and the same shall be announced to the sutdents 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 examination (Internal assessment) and before the end semester exam.

3. EXAMINATIONS

Eligibility to appear for exams

- A candidate is eligible for registering for the examinations only if he/she secures a minimum of 50% marks in internal assessment in theory and practical separately.
- Partial appearance for the examinations : A candidate is allowed partial appearance for the University examinations, including practical examinations, provided he/ she has 80% attendance in all subjects, in theory and practical separately.

Eligibility for appearance for supplementary examinations: A candidate can register for supplementary examinations if he/she has 80 % attendance in theory and practical separately for that subject/s and has minimum 50% Internal Assessment marks in theory and practical separately in that subject/s.

Schedule of regular/ Supplementary examinations

As given under the course content

Scheme of examination showing maximum marks and minimum marks

As given under the course content

Papers in each year

As given under the course content

Details of theory exams

As given under the course content

Model question paper for each subject

As given under Annexure 5.1.

Question paper pattern

As given under the course content

Internal assessment component

As given under the course content

Details of practical/ clinical practical exams

As given under the course content

Number of examiners (Internal & External) and the qualifications for theory and practical evaluation

One internal and one external exam iner for practical and viva voce exam inations .Post Graduation in the relevant subject with minimum three years teaching experience after acquiring M.Pharm qualification in a PCI recognized institution

Details of Viva

As given under the course content.

4. INTERNSHIP

Not Applicable

5. ANNEXURES

Model question paper for each subject with Question paper pattern

Check lists for monitoring: Log book, Seminar Assessment etc.

To be formulated by the curriculum committee of the concerned institution

Annexure 5. 1

QP CODE: **Reg. No: . .....**

First Semester B. Pharm Degree Examination
HUMAN ANATOMY AND PHYSIOLOGY I
(2017 Scheme)
MODEL QUESTION PAPER

Time: 3 Hours **Max. Marks: 75**

Answer all questions
Draw diagrams wherever necessary

Essays **(2 x 10 = 20)**

1. Describe the anatomy of ear and explain the mechanism of hearing.
2. Explain the conduction system of heart with a neat labelled diagram.

Short notes **(7 x 5 = 35)**

3. Formation and fate of hemoglobin.
4. Explain about spleen.
5. Write about sympathetic nervous system.
6. Difference between arteries and veins.
7. Write about muscular tissue.
8. Classify joints, explain about types of synovial joints.
9. Structure and functions of connective tissue.

Answer briefly **(10 x 2 = 20)**

10. Write the functions of cell.
11. Write the pulmonary circulation.
12. Write about taste buds.
13. Write about nervous tissue.
14. Define polycythemia and sickle cell anaemia.
15. Write the paracrine intracellular signaling.
16. Name the bones of cranium.
17. Define articulation and arthrology.
18. Write the anatomy of spinal nerve.
19. Functions of skin.

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QP CODE: **Reg. No: .....**

First Semester B. Pharm Degree Examination
PHARMACEUTICAL ANALYSIS I
(2017 Scheme)
MODEL QUESTION PAPER

Time: 3 Hours **Max. Marks: 75**

Answer all questions

Draw diagrams wherever necessary

Essays **(2 x 10 = 20)**

1. Discuss Ostwald's theory of acid base indicators taking examples of phenolphthalein and methyl orange indicators as examples. .
2. What is EDTA and mention the EDTA titrations. Describe in brief the type of indicators used in such titrations and explain its working nature.

Short notes **(7 x 5 = 35)**

3. What are redox titrations? Explain any one type.
4. Discuss the phenomena of surface adsorption and occlusion in gravimetry.
5. Explain the preparation and standardization of ceric ammonium sulphate solution
6. Define precipitation titration and explain in detail Mohr's method.
7. Explain in detail about the solvents used in non-aqueous titration.
8. Estimation of sodium benzoate by non-aqueous titration.
9. Limit test for iron.

Answer briefly **(10 x 2 = 20)**

10. Composition and role of barium sulphate reagent.
11. Why acetic anhydride is used in the preparation of percloric acid.
12. Basic requirement for a primary standard.
13. Masking and demasking agent in complexometric titration.
14. What are ligands.
15. Reaction of hydrogen peroxide with potassium permanganate.
16. Define accuracy.
17. Examples for reference electrode and indicator electrodes.
18. Principle in the assay of ammonium chloride.
19. Titrant and indicator used in volhard's method.

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QP CODE: **Reg. No: .....**

First Semester B. Pharm Degree Examination
PHARMACEUTICS I
(2017 Scheme)
MODEL QUESTION PAPER

Time: 3 Hours **Max. Marks: 75**

- Answer all questions
- Draw diagrams wherever necessary

Essays **(2 x 10 = 20)**

1. Give a detailed account of powders.
2. Classify semisolid dosage forms. Explain the mechanism and the factors influencingdermal penetration of drugs.

Short notes **(7 x 5 = 35)**

3. Errors in prescription.
4. Explain pediatric dose calculation based on age, body weight and body surface area
5. Give the advantages and disadvantages of suspension.
6. Solubility enhancement techniques
7. Explain evaluation of suppositories.
8. Compare and contrast ointment and cream.
9. Define gels and explain the preparation of gels.

Answer briefly **(10 x 2 = 20)**

10. Define synergism with example.
11. What is antagonist effect? Give examples.
12. Define isotonic solution.
13. What is geometric dilution?
14. What is displacement value?
15. Define suspension and give examples
16. List out the suppository bases with examples.
17. Define gargles.
18. Define emulsion and give examples.
19. Differentiate between paste andgels.

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QP CODE: **Reg. No: .....**

First Semester B. Pharm Degree Examination
PHARMACEUTICAL INORGANIC CHEMISTRY
(2017 Scheme)
MODEL QUESTION PAPER

Time: 3 Hours **Max. Marks: 75**

- Answer all questions
- Draw diagrams wherever necessary

Essays **(2 x 10 = 20)**

1. Define limit test. Explain the principle, procedure and apparatus involved in the limit test of arsenic and sulphate with neat diagram.
2. Explain the properties of alpha, beta and gamma rays. Explain the various methods employed for the measurement of radio activity.

Short notes **(7 x 5= 35)**

3. Give the principle of limit test for heavy metals.
4. Classify topical agents with examples.
5. Acid neutralizing capacity of antacids.
6. The principle of assay of chlorinated lime.
7. What are saline cathartics? Mention the preparation of magnesium sulphate.
8. Explain the principle of assay of boric acid.
9. Explain about physiological acid-base balance.

Answer briefly **(10 x 2 = 20)**

10. What are the reagents used in limit test for iron
11. The test for alkalinity.
12. The official compounds ofiron
13. Define normality and molarity.
14. What is covalent bond and mention an example.
15. What is an expectorant? Mention examples.
16. Define radio opaque contrast medium. Mention examples.
17. The preparation of sublimed sulphur.
18. Classify inorganic antidotes.
19. What is normal saline solution? How will you prepare it?

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QP CODE: **Reg. No: .....**

First Semester B. Pharm Degree Examination

COMMUNICATION SKILLS

(2017 Scheme)

MODEL QUESTION PAPER

Time: 1.5 Hours **Max. Marks: 35**

Answer all questions

Draw diagrams wherever necessary

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Essays **(1 x 10 = 10 Marks)**

1. Explain written communication. Describe the factors to take into account whendeciding when to use and when not to use written communication..

Short notes **(5 x 5 = 25 Marks)**

2. Describe verbal and nonverbal communication.
3. Explain any five barriers of communication
4. Brief audio visual aids used while delivering a presentation.
5. How can one become an active listener?
6. Explain the communication process.

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QP CODE: **Reg. No: .....**

First Semester B. Pharm Degree Examination

REMEDIAL BIOLOGY
(2017 Scheme)

MODEL QUESTION PAPER

Time: 1.5 Hours **Max. Marks: 35**

- Answer all questions
- Draw diagrams wherever necessary

Essays **(1 x 10 = 10)**

1. Describe the structure and function of heart.

Short notes **(5 x 5 = 25)**

2. Give a short note on different blood products and their uses.
3. What are the different types of venation?
4. Explain the salient features of kingdom Protista.
5. Describe biological nitrogen fixation.
6. Write a note on rennin angiotensin system

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QP CODE: **Reg. No: .....**

First Semester B. Pharm Degree Examination

REMEDIAL MATHEMATICS

MODEL QUESTION PAPER

Time: 1.5 Hours **Max. Marks: 35**

- Answer all questions

Essays **(1 x 10 = 10)**

1. Write an essay on different type of matrices? .

Short notes **(5 x 5 = 25)**

2. Differentiate Y=3tan x+5logx+1/x

3. If A = $\begin{bmatrix} 1 & 4 & 7 \\ 0 & 8 & 9 \\ 2 & 3 & 1 \end{bmatrix}$

Find 5A

4. Use logarithm table solve the $\frac{520.4 \times 8.065}{97.53}$

5. Factorise 3ax-6ay-8by+4bx

6. Find the point of intersection of lines bx + ay = ab and ax + by = ab

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Second Semester B.Pharm Degree Examinations

HUMAN ANATOMY AND PHYSIOLOGY II

(2017 Scheme)

(MODEL QUESTION PAPER)

Time: 3 Hours **Max marks: 75**

- **Answer all questions**
- **Draw diagrams wherever necessary**

Essay **(2x10=20)**

1. Describe the role of adrenal gland in salt, sugar and sex regulation.
2. Explain the anatomy of ovary and explain about various stages of menstrual cycle.

Short notes **(7x5=35)**

3. Structure and functions of liver.
4. Cerebellum
5. Regulation of acid production in stomach
6. Mechanism of respiration
7. Synapse
8. Role of kidneys in acid base balance
9. Lung volume and capacities

Answer briefly **(10x2=20)**

10. Chromosomes
11. Biochemical role of ATP
12. Neat labelled diagram of spinal cord cross section
13. Composition of semen
14. Formation and role of CSF
15. List the anterior pituitary hormones and their functions
16. Structure of sperm
17. Digestion and absorption of proteins
18. Neuroglia
19. Nephrons

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Second Semester B.Pharm Degree Examination

PHARMACEUTICAL ORGANIC CHEMISTRY –I

(2017 Scheme)

(MODEL QUESTION PAPER)

Time: 3 Hours **Max marks: 75**

- **Answer all questions**
- **Draw diagrams wherever necessary**

Essays **(2x 10 = 20)**

1. Discuss the mechanism involved in Perkin's reaction and Cannizaro reaction.

2. Explain nucleophilic aliphatic substitution reactions with suitable examples. Add a note on Walden inversion.

Short notes **(7x5=35)**

3. Define isomerism and elaborate different types with examples
4. Explain SP_2 hybridization
5. Write a note on the stability of conjugated dienes
6. List any three methods for the preparation of carboxylic acids
7. Explain the basicity of amines
8. Discuss the mechanism involved in chlorination of methane
9. Explain E1 mechanism and saytzeff's rule with suitable examples

Answer briefly **(10x2 = 20)**

10. What is hybridization.
11. Why aldehydes are more reactive than ketones in nucleophilic addition reaction
12. The presence of little amount of oxygen retards chlorination of methane. Why?
13. Briefly explain Diel's - Alder reaction
14. Give the chemical structure : (a) Vanillin b. Dimethyl phthalate
15. Write any two uses of: a. Paraldehyde b. Amphetamine
16. Write the structure and uses of Iodoform
17. Write the IUPAC names of the following compounds

    a. CH3 - CH (CH3) - CH2 - COOH b. CH3 - CH= CH -CHO

18. Write structural formulas from names: a. 3 - Hydroxy propanoic acid b. 1,4 - Pentadiene
19. What is Aldol condensation

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Second Semester B.Pharm Degree Examination

BIOCHEMISTRY

(2017 Scheme)

(MODEL QUESTION PAPER)

Time: 3 Hours **Max marks: 75**

- **Answer all questions**
- **Draw diagrams wherever necessary**

Essays **(2x 10 = 20)**

1. Describe the Urea cycle. Add a note on metabolic disorders associated with it.
2. Enumerate the TCA cycle with its energetics

Short Notes **(7 x 5= 35)**

3. IUB classification of enzymes
4. Electron Transport chain
5. Degradation of cholesterol
6. HMP Pathway and its significance
7. Biosynthesis of pyrimidine nucleotides
8. Catabolism of phenylalanine .What are the metabolic disorders.
9. Semiconservative model of DNA replication

Answer Briefly **(10 x 2= 20)**

10. Classification of lipids
11. What are ketone bodies. Mention the conditions causing keto acidosis.
12. Structure and function of tRNA
13. Atherosclerosis.
14. What are essential amino acids? Give examples
15. Genetic code
16. Diabetes Mellitus
17. Transamination
18. Applications of isoenzymes.
19. Albinism

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Second Semester B.Pharm Degree Examination

PATHOPHYSIOLOGY

(2017 Scheme)

(MODEL QUESTION PAPER)

Time: 3 Hours **Max marks: 75**

- **Answer all questions**
- **Draw diagrams wherever necessary**

Essays **(2x 10 = 20)**

1. Discuss the process of acute inflammation in detail.
2. Define hypertension. Give classification. Discuss the pathogenesis of hypertension.

Short Notes **(7 x 5 = 35)**

3. Factors influence wound healing.
4. Etiology of PUD.
5. Pathogenesis of atherosclerosis.
6. Mechanisms of cell injury.
7. Clinical manifestations of Parkinsonism.
8. Pathophysiology of bronchial asthma.
9. Differentiate between benign and malignant tumours.

Answer briefly **(10 x 2 = 20)**

10. Atrophy
11. Clinical features of MI.
12. Megaloblastic anemia.
13. Complications of hypothyroidism
14. Metastasis.
15. Risk factors for gout.
16. Clinical significance of Diabetes mellitus.
17. Causative agent and mode transmission of HIV infection
18. Clinical presentation of depression.
19. Primary prevention of cancer.

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QP CODE: **Reg. No: .....**

Second Semester B. Pharm Degree Examination

COMPUTER APPLICATIONS IN PHARMACY

(2017 Scheme)

MODEL QUESTION PAPER

Time: 2 Hours **Max. Marks: 50**

- Answer all questions
- Draw diagrams wherever necessary

Essays **(2 x 10 = 20 Marks)**

1. Explain the various applications of computer in pharmaceutical field?
2. Explain the process of life cycle in details.

Short Notes **(6 x 5 = 30 Marks)**

3. Explain and differentiate between HTML and XML
4. Electronic prescription and its benefits
5. DBMS
6. Feasibility Analysis
7. How will you convert binary number system into decimal number system and vice versa? Give one example.
8. What is CSS. Explain its advantages?

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QP CODE: **Reg. No: .....**

Second Semester B. Pharm Degree Examination

ENVIRONMENTAL SCIENCES
(2017 Scheme)

MODEL QUESTION PAPER

Time: 2 Hours **Max. Marks: 50**

- Answer all questions
- Draw diagrams wherever necessary

Essays **(2 x 10 = 20)**

1. Define forest Ecosystem. Explain the different components of Ecosysytem.
2. Define environment. Explain the different components of Environment.

Short notes **(6 x 5 = 30)**

3. Write a short note on sustainable water.
4. What are the sources of air pollution?
5. Explain the methods of treatment of sewage.
6. What are the threats associated with land resources.
7. Explain the types of natural resources.
8. Write a short note on renewable energy resources.

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QP Code: **Reg. No.:……**

Third Semester B. Pharm Degree Examination

PHARMACEUTICAL ORGANIC CHEMISTRY II

(2017 Scheme)

(Model Question Paper)

Time: 3 Hours **Max. Marks: 75**

- **Answer all questions**
- **Draw diagrams and structures wherever necessary**

Essays **(2x10=20)**

1. Explain the effect of substituents on orientation of monosubstituted benzene towards electrophilic aromatic substitution
2. Elaborate the method of preparation and chemical properties of anthracene

Short Notes **(7x5=35)**

3. Acidity of phenols
4. Any 5 synthetic uses of aryl diazonium salts
5. Definition, method of assay and significance of saponification value
6. Limitations of Baeyer's strain theory
7. Any three methods of preparation of aromatic amines
8. Chemical reactions of cyclopropane
9. Reactions of phenols due to hydroxyl group

Answer briefly **(10x2=20)**

10. Huckel's rule
11. Friedel-crafts alkylation reaction.
12. Structure and uses of DDT
13. Reichert Meissle Value
14. Why p-nitroaniline is less basic than aniline
15. Reimer Tiemann reaction
16. Define drying oil. Give one example.
17. Give the structure and uses of Resorcinol and Chloramine
18. Significance of Carbylamine reaction
19. Structure and uses of any two naphthalene derivatives

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QP Code: **Reg. No.:……**

Third Semester B. Pharm Degree Examination

PHYSICAL PHARMACEUTICS I

(2017 Scheme)

(Model Question Paper)

Time: 3 Hours **Max. Marks: 75**

- **Answer all questions**
- **Draw diagrams wherever necessary**

Essays **(2 x 10 = 20)**

1. Explain in detail about various derived properties of powders
2. Describe various factors influencing solubility of solids in liquids.

Short notes **(7 x 5 = 35)**

3. State and explain Fick's laws of diffusion.
4. Explain dipole moment and its applications.
5. Explain the kinetics of drug protein binding.
6. Enumerate different methods for determination of particle size. Explain conductivity method in detail.
7. Henderson-Hasselbalch equation and its applications
8. Applications of complexation in pharmacy
9. Explain Nernst distribution Law.

Answer briefly **(10 x 2 = 20)**

10. What are aerosols. Write the importance of propellants in an aerosol.
11. Critical solution temperature.
12. Describe Sorensen's pH scale.
13. What are the applications of bulk density.
14. Explain Henry's law.
15. What is polymorphism. Mention its pharmaceutical importance.
16. Buffer capacity
17. Liquid crystals
18. Dielectric constant and its importance
19. Applications of buffers

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QP Code: **Reg. No.:……**

Third Semester B. Pharm Degree Examination

PHARMACEUTICAL MICROBIOLOGY

(2017 Scheme)

(Model Question Paper)

Time: 3 Hours **Max. Marks: 75**

- **Answer all questions**
- **Draw diagrams wherever necessary**

Essays **(2 x 10 = 20)**

1. Describe the various methods used for the identification of bacteria
2. Explain the different sources and types of microbial contamination in pharmaceutical products.

Short notes **(7 x 5 = 35)**

3. Standardization of antibiotics in brief
4. Sterilization by dry heat
5. Cultivation of viruses
6. Anaerobic methods of cultivation of bacteria
7. Reproduction of fungi
8. Application of cell cultures in Pharmaceutical industry
9. Design of aseptic area

Answer briefly **(10 x 2 = 20)**

10. What are the functions of Pili.
11. Difference between total count and viable count.
12. Name the nutritional requirements of bacteria.
13. What is minimum inhibitory concentration.
14. What is primary cell culture.
15. Name the factors which affect the efficacy of preservatives.
16. What is Lag phase in bacterial growth curve.
17. What is Capsid.
18. What are thermophiles.
19. Principle of Dark field microscopy.

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QP Code: **Reg. No.:……**

Third Semester B. Pharm Degree Examination

PHARMACEUTICAL ENGINEERING

(2017 Scheme)

(Model Question Paper)

Time: 3 Hours **Max. Marks: 75**

- **Answer all questions**
- **Draw diagrams wherever necessary**

Essays **(2x 10 = 20)**

1. Explain the principle, assembly, method and applications of fractional distillation also write in brief on boiling point composition curve.
2. Explain in detail about the various materials used for plant construction.

Short notes **(7 x 5 = 35)**

3. Explain the different laws governing size reduction.
4. Principles, construction, working, uses, merits and demerits of planetary mixer
5. Explain the Fourier's law of heat transfer by conduction
6. Explain the principle, theory & applications of Centrifugal effect
7. Explain the principle, construction, working and uses of Pneumatic conveyor
8. Describe the principle, construction and working and application of fluidized bed dryer.
9. Bernoulli's theorem and its applications

Answer briefly **(10 x 2 = 20)**

10. Mechanism of solid mixing
11. Bond's Theory
12. Raoult's law
13. Reynolds number
14. Factors influencing evaporation
15. Drying rate curve
16. Mechanism of filter aids
17. Kozeny carman equation
18. Azeotropic distillation
19. Principle involved in freeze drying

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QP CODE: **Reg. No:.....**

Fourth Semester B. Pharm Degree Examinations

PHARMACEUTICAL ORGANIC CHEMISTRY- III

(2017 Scheme)

(Model Question Paper)

Time: 3 Hrs **Total Marks: 75**

- Answer all the questions
- Write the reactions wherever necessary

ESSAYS **(2 x 10 = 20 Marks)**

1. Explain racemic modification and resolution of racemic mixture with suitable example. Write a note on elements of symmetry.
2. Discuss the reaction, mechanism and application of Schmidt reaction and Beckmann's rearrangement.

SHORT NOTES **(7 x 5 = 35 Marks)**

3. Explain Diastereomers and meso compounds with example.
4. Write in detail about stereo specific and stereo selective reaction.
5. Explain relative aromaticity of Pyrrole, Furan and Thiophene.
6. Give two methods for the synthesis of Pyridine and Quinoline and mention their medicinal uses.
7. Explain conformational isomerism in Cyclohexane.
8. Explain partial asymmetric synthesis.
9. Describe the electrophilic substitution reactions of Indole and Isoquinoline and their medicinal uses.

ANSWER BRIEFLY **(10 x 2 = 20 Marks)**

10. What is Optical isomerism?
11. Write the chemical structure and uses of Acridineand Thiophene
12. Briefly explain Metal hydride reduction.
13. What is Dakin reaction?
14. Write the synthetic importance of Oppenauer oxidation.
15. Why Pyrrole is more reactive in electrophilic substitution than benzene.
16. What is the difference between d, l and D, L notations?
17. What are condensed ring heterocycles give three examples.
18. Write the reaction for reduction of benzene and its derivatives to non - conjugated dienes.
19. Write any one method of synthesis of Indole.

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QP CODE: **Reg. No:.....**

Fourth Semester B. Pharm Degree Examinations
MEDICINAL CHEMISTRY- I
(2017 Scheme)

(Model Question Paper)

Time: 3 Hours **Max. Marks: 75**

- Answer all questions
- Draw diagrams wherever necessary

Essays **(2 x 10 = 20)**

1. Classify anticonvulsants with one structure from each class. Mention the synthesis of Chlorpromazine.
2. Explain Phase I and Phase II metabolism with examples.

Short notes **(7 x 5 = 35)**

3. Outline the synthesis of Phenylephrine and Ethosuximide.
4. Significance of partition coefficient of drugs in biological action.
5. Explain biosynthesis and catabolism of Acetylcholine.
6. Discuss the SAR of benzodiazepines.
7. Give structure and uses of Dicyclomine and Naproxen
8. Outline the synthesis and mechanism of action of Salbutamol.
9. Explain the SAR of cholinergic drugs.

Answer briefly **(10 x 2 = 20)**

10. Give mechanism of action and use of Pilocarpine.
11. Synthesis of Methohexital.
12. Give the structure and use of Triclofos Sodium.
13. Synthesis of Methadone.
14. Give structure and uses of any one synthetic cholinergic blocking agent.
15. Structure and use of Gabapentin
16. Chemistry and use of Haloperidol
17. Structure of Prochlorperazine.
18. Synthesis of Carbachol.
19. What are narcotic antagonists? Give name and use of anyone.

QP CODE: **Reg. No: .....**

Fourth Semester B. Pharm Degree Examinations

PHYSICAL PHARMACEUTICS - II

(2017 Scheme)

(Model Question Paper)

Time: 3 Hours **Max. Marks: 75**

- Answer all questions
- Draw labelled diagrams wherever necessary

Essays **(2 x 10 = 20)**

1. Classify colloids based on their characteristic features. Explain the different methods for purification of colloids.

2. Explain oxidative and hydrolytic decomposition in pharmaceutical products. Describe the different methods for protection against these decomposition reactions.

Short notes **(7 x 5 = 35)**

3. Write a note on non-Newtonian Liquid.

4. Derive an equation for spreading coefficient. What is its significance?

5. Classify surfactants based on their HLB value. Give two equations for calculation of HLB value.

6. Explain how flocculation can be induced in suspensions with the help of electrolytes.

7. Explain the stability problems in emulsions.

8. Give the construction and working of a falling sphere viscometer.

9. Explain the applications of thixotropy in pharmaceutical formulations.

Answer briefly **(10 x 2 = 20)**

10. Gold number

11. Stokes law

12. Zeta potential

13. Apparent zero order reactions

14. Plug flow

15. Yield value

16. Microemulsions

17. Factors to be considered in the preservation of emulsions.

18. Sedimentation volume.

19. Arrhenius equation.

QP CODE: **Reg. No: .....**

Fourth Semester B. Pharm Degree Examinations
PHARMACOLOGY-I
(2017 Scheme)
(Model Question Paper)

Time: 3 Hours **Max. Marks: 75**

- Answer all questions
- Draw labelled diagrams wherever necessary

Essays **(2 x 10 = 20)**

1. Discuss in detail the different processes involved in the development of a new drug till it is marketed.

2. Classify adrenergic drugs with examples. Discuss the pharmacological actions of adrenaline in detail. Mention its therapeutic uses.

Short notes **(7 x 5 = 35)**

3. . Outline the different types of drug antagonism.
4. Compare and contrast diazepam with Phenobarbitone.
5. Mechanism of action, uses, adverse effects and two examples of SSRIs.
6. Diagnosis and management of Myasthenia gravis.
7. Symptoms and management of methanol poisoning.
8. Pharmacological actions of Atropine.
9. Advantages and disadvantages of oral route of drug administration.

Answer briefly **(10 x 2 = 20)**

10. Name four non-renal routes for drug excretion.
11. Why levodopa is not effective in haloperidol induced Parkinsonism?
12. Give one example each for a microsomal inducer and inhibitor.
13. Define pre-anaesthetic medication.
14. Name any two major effector pathways involved in the functioning of G protein-coupled receptors.
15. Why Pralidoxime is not effective in Neostigmine poisoning?
16. What is meant by the statement –Pethidine is less potent but equally efficacious analgesic as Morphine‖?
17. The rationale for giving Propranolol in acute situations of nervousness.
18. What is Pharmacovigilance?
19. Name two drugs effective in petitmal epilepsy

QP CODE: **Reg. No:**

Fourth Semester B. Pharm Degree Examinations
PHARMACOGNOSY AND PHYTOCHEMISTRY -I
(2017 Scheme)
(Model Question Paper)

Time: 3 Hours **Max. Marks: 75**

- Answer all questions
- Draw labelled diagrams wherever necessary

Essays **(2 x 10 = 20)**

1. Classify natural allergens with suitable examples? Add a note on the preparation and standardization of allergenic extracts.

2. Define plant tissue culture? Discuss in detail about the culture media used in plant tissue culture.

Short notes **(7 x 5 = 35)**

3. Write a note on different types of adulteration in crude drugs.

4. Describe the development and scope of Pharmacognosy.

5. Classify Tannins with suitable examples.

6. Write the biological sources, method of preparation and uses of Gelatin.

7. Write short note on Cotton.

8. What is polyploidy? Write the applications of polyploidy in medicinal plants.

9. With suitable examples write a note on the storage conditions for different crude drugs.

Answer briefly **(10 x 2 = 20)**

10. Name the general tests for identification of alkaloids.

11. Define Pharmacognosy.

12. What is Mutation?

13. Name different types of Artificial Drying methods for crude drugs.

14. What is an explant?

15. What is organized crude drugs?

16. Fiehe‘s test.

17. Biological sources of Agar.

18. Define stomatal number and stomatal index.

19. What are Tannins?

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QP Code: **Reg.No. ……**

Fifth Semester B.Pharm Degree Examinations

MEDICINAL CHEMISTRY II

(2017 scheme)

Model Question Paper

Time: 3 Hrs **Max. Marks: 75**

- **Answer all questions**
- **Draw chemical structures wherever necessary**

Essays **(2 X 10 = 20)**

1. What are antihistaminics? Classify them with examples and outline thesynthesis of diphenhydramine and promethazine.
2. Classify oral hypoglycemic agents with examples. Explain the structure, synthesis and mechanismof action of Tolbutamide.

Short Notes **(7 x 5 = 35)**

3. Explain the chemistry and uses of Thiazide diuretics.
4. Discuss the SAR of local anesthetics.
5. Discuss the inter-relationship between different oestrogens.
6. Structure, mechanism of action and uses of Lovastatin.
7. Outline the synthesis of Methotrexate.
8. Classify antihypertensive agents with specific examples.
9. Write a note on nitrates and give their uses.

Answer Briefly **(10 x 2 = 20)**

10. Give the structure and use of Warfarin.
11. Outline the synthesis of Furosemide.
12. Role of digoxin in CHF.
13. Give the structures of any two antithyroid drugs.
14. What are oral contraceptives?
15. Structure and uses of Nifedipine.
16. Mechanism of action of alkylating agents.
17. Give the structure and uses of any one carbonic anhydrase inhibitor.
18. Outline the synthesis of Benzocaine.
19. Mechanism of action and use of Captopril

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QP Code: **Reg.No. ……**

Fifth Semester B.Pharm Degree Examinations

FORMULATIVE PHARMACY

(2017 scheme)

Model Question Paper

Time: 3 Hrs **Max. Marks: 75**

- **Answer all questions**
- **Draw diagrams wherever necessary**

Essays **(2 X 10 = 20)**

1. Explain the rotary die process for the manufacturing of soft gelatin capsule and discuss thequality control tests for finished soft gelatin capsules.
2. Explain tablet manufacturing by wet granulation process and discuss various problems during tablet manufacturing.

Short Notes **(7 X 5 = 35)**

3. What are the chemical properties studied during preformulation?
4. Explain extrusion spheronization technique.
5. Discuss the various air handling systems in parenteral production facility.
6. Describe the formulation and stabilisation of eye drops.
7. Explain the quality control test for aerosols.
8. What are the factors influencing the choice of pharmaceutical containers?
9. Explain the formulation and manufacturing of vanishing cream.

Answer Briefly **(10 X 2 = 20)**

10. Define base adsorption value
11. What is milliards reaction and how it can be prevented?
12. List out the quality control tests for emulsion.
13. What are enteric film formers? Give two examples.
14. What is LAL test?
15. Give the composition of Rubber closures for pharmaceuticals.
16. Why Friability test is performed on tablets?
17. Classify propellants used in aerosols with examples
18. What is BCS classification of drugs?
19. Mention types of glass used in pharmaceuticals as per I.P.

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QP Code: **Reg.No. ……**

Fifth Semester B.Pharm Degree Examinations

PHARMACOLOGY -II

(2017 scheme)

Model Question Paper

Time: 3 Hrs **Max. Marks: 75**

- **Answer all questions**
- **Draw diagrams wherever necessary**

Essays **(2 X 10 = 20)**

1. Classify antihypertensive drugs. Describe the pharmacological actions, mechanism of action, uses and adverse effects of calcium channel blockers.
2. Classify NSAIDs. Write the mechanism of action, pharmacologicalactions, uses and adverse effects of aspirin.

Short Notes **(7 X 5 = 35)**

3. Define and classify antihistamines. Mention three uses of cetirizine.
4. What are prostaglandin analogues? Discuss with examples their clinical benefits.
5. Write the mechanism of action of a). Spirinolactone b). LMW Heparin
6. Classify antihyperlipidemic drugs. Write the mechanism of action and adverse effects of HMG CoA reductase inhibitors.
7. Define bioassay. Describe the principles and indications of bioassay.
8. Outline the mechanisms of action of different groups of drugs used in hyperthyroidism.
9. Classify oral hypoglycemic agents with examples. Discuss the mechanism of actionof DPP 4 inhibitors.

Answer Briefly **(10 X 2 = 20)**

10. Name the benefits and drawbacks of HRT after menopause.
11. Why Allopurinol is given in chronic gout?
12. What is the mechanism of action of digoxin in CCF?
13. Outline the benefit produced by Streptokinase in acute myocardial infarction.
14. Name two drugs each from clinically used 5-HT receptor agonists and antagonists.
15. After continuous administration, the dose of steroids should be tapered beforestopping. Why?
16. Why Stanozolol is sometimes abused by athletes?
17. Mention two specific uses of Vasopressin analogues.
18. Justify the use of Salbutamol in premature labour.
19. Pharmacological basis of nitroglycerine administration in angina pectoris.

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QP Code: **Reg.No. ……**

Fifth Semester B.Pharm Degree Examinations

PHARMACOGNOSY AND PHYTOCHEMISTRY-II

(2017 scheme)

Model Question Paper

Time: 3 Hrs **Max. Marks: 75**

- **Answer all questions**
- **Draw diagrams wherever necessary**

Essays **(2 X 10 = 20)**

1. Explain the production of aromatic amino acids by Shikimic acid pathway.
2. Give a detailed pharmacognostic study of Senna.

Short Notes **(7 X 5 = 35)**

3. Differentiate between black catechu and pale catechu.
4. Explain the microscopy of Fennel with a neat labelled diagram.
5. Write a brief note on Tracer techniques in the elucidation of biosynthetic pathway ofplants.
6. Write a short note on gel electrophoresis.
7. Write a short note on industrial production and utilization of Artemisinin
8. General method of extraction of Alkaloids.
9. Write a short note on super critical fluid extraction.

Answer Briefly **(10 X 2 = 20)**

10. Name the types of spectroscopic methods used for the identification of compounds fromcrude drugs.
11. Thalleoquin test.
12. Chemical constituents of opium.
13. Biological source and use of Rauwolfia.
14. What is R_f value.
15. Biological source and use of a drug containing oleo gum resin.
16. Biological source and use of a drug containing cardiac glycoside.
17. Enfluerage method in isolation of volatile oil.
18. Write the major constituent present in cinnamon and its chemical structure.
19. Medicinal uses of Guggul.

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QP Code: **Reg.No. ……**

Fifth Semester B.Pharm Degree Examinations

PHARMACEUTICAL JURISPRUDENCE

(2017 scheme)

Model Question Paper

Time: 3 Hrs **Max. Marks: 75**

- **Answer all questions**

Essays **(2 X 10 = 20)**

1. What are the objectives of Pharmacy Act? Explain constitution and functions PCI.
2. Explain in detail about the manufacture of alcoholic preparations in bonded and non-bonded laboratories.

Short Notes **(7 x 5 = 35)**

3. Explain the constitution of DTAB.
4. What are the provisions under Medical Termination of Pregnancy Act?
5. What are the qualification and duties of drugs inspector?
6. Discuss Schedule M of Drug and Cosmetics Act & Rules.
7. Explain the objectives and schedules of Drug price control order.
8. Offences and penalties in Narcotic Drugs and Psychotropic Substances Act.
9. Explain on prohibited and exempted advertisements under Drugs and Magic Remedies Act.

Answer briefly **(10 x 2 = 20)**

10. Differentiate between Misbranded and Spurious drug.
11. Constitution ofInstitutional Animals Ethics Committee.
12. Define code of pharmaceutical ethics.
13. What are the minimum qualifications required for the registration of a pharmacist as per Educational Regulations of Pharmacy Act 1948?
14. Constitution and functions of Drugs Consultative Committee.
15. Define Loan Licence
16. Draw the specimen label for schedule X drug.
17. Define Drug as per Drug and Cosmetic Act.
18. What is schedule P and Schedule Y?
19. Define the term _opium derivatives‘ as per Narcotic Drugs and Psychotropic Substances Act.

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QP CODE: **Reg. No: .....**

Sixth Semester B. Pharm Degree Examination
MEDICINAL CHEMISTRY- III
(2017 Scheme)
MODEL QUESTION PAPER

Time: 3 Hours **Max. Marks: 75**

- Answer all questions
- Draw diagrams wherever necessary

Essays **(2 x 10 = 20)**

1. Classify Sulfonamides and explain the SAR.
2. Explain the various physicochemical parameters commonly used in QSAR based drug design.

Short notes **(7 x 5 = 35)**

3. Outline the synthesis of Dapsone and Acyclovir.
4. Describe solid phase synthesis in combinatorial chemistry.
5. Explain the etiology of malaria.
6. Discuss the SAR of Quinolones.
7. Give structure and uses of Pyrazinamide and Chloramphenicol.
8. Outline the synthesis and mechanism of action of Trimethoprim.
9. Explain the concept of prodrug design.

Answer briefly **(10 x 2 = 20)**

10. Give mechanism of action and use of Sulfamethoxazole.
11. Synthesis of Metronidazole.
12. Give the structure and use of Amantidine hydrochloride.
13. Classify antimalarial drugs.
14. Give structure and uses of any one β-lactamase inhibitor.
15. Give the structure and uses of Miconazole.
16. Discuss the chemistry and uses of Monobactams.
17. Give the structure of Mefloquine and Proguanil.
18. Explain the synthesis of Isoniazid.
19. Briefly explain about macrolide antibiotics.

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QP CODE: **Reg. No: .....**

Sixth Semester B. Pharm Degree Examination
PHARMACOLOGY - III
(2017 Scheme)
MODEL QUESTION PAPER

Time: 3 Hours **Max. Marks: 75**

- Answer all questions
- Draw diagrams wherever necessary

Essays **(2 x 10 = 20)**

1. Classifying anticancer drugs with examples. Explain the pharmacology of alkylating agents.
2. Classify antimalarial drugs. Explain the pharmacology of drugs used for suppressive prophylaxis.

Short notes **(7 x 5 = 35)**

3. Applications of stem cell therapy.
4. Write short notes on urinary antiseptics.
5. MDT of leprosy.
6. Drugs used in the management of COPD
7. Therapeutic applications of co-trimoxazole.
8. RNTCP regimen for MDR-TB.
9. Write notes on Nucleoside reverse transcriptase inhibitors.

Answer briefly **(10 x 2 = 20)**

10. Adverse effects of Tetracycline
11. Therapeutic uses of chloramphenicol
12. Classify anti-ulcer drugs with examples.
13. Define biosimilars.
14. Applications of immunosuppressants.
15. Adverse effects of sulfonamides.
16. What are beta lactamase inhibitors. Give two examples.
17. Write the mechanism of action of ondansetron.
18. Give examples for first line antitubercular drugs.
19. Cinchonism.

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QP CODE: **Reg. No: .....**

Sixth Semester B. Pharm Degree Examination
HERBAL DRUG TECHNOLOGY
(2017 Scheme)
MODEL QUESTION PAPER

Time: 3 Hours **Max. Marks: 75**

- Answer all questions
- Draw diagrams wherever necessary

Essays **(2 x 10 = 20)**

1. Write in detail the preparation and standardization of Arishta.
2. Explain the preparation and evaluation of herbal tablet.

Short notes **(7 x 5 = 35)**

3. Write a short note on processing of herbal raw material.
4. Write a short note on natural pest control agents.
5. Write the basic principle involved in Homeopathy.
6. Write a short note on herb-drug interaction with reference to pepper.
7. Write a note on bleaching agents used in skin care products.
8. Write a note on natural sweeteners used as herbal excipients.
9. WHO guidelines for chemical evaluation of herbal drugs.

Answer briefly **(10 x 2 = 20)**

10. Write any two examples of nutraceuticals used in Irritable Bowel Syndrome.
11. Mention the health benefits of Fenugreek.
12. Mention the side effects and interactions of Ginseng.
13. Define IPR..
14. Schedule Z.
15. List any four institutions involved in research on medicinal and aromatic plants.
16. Mention the biological source of any two fixed oils used in cosmetics.
17. Define herbal medicine.
18. What are the components of schedule T?
19. What is biopiracy?

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QP CODE: **Reg. No: .....**

Sixth Semester B. Pharm Degree Examination
BIOPHARMACEUTICS AND PHARMACOKINETICS
(2017 Scheme)
MODEL QUESTION PAPER

Time: 3 Hours **Max. Marks: 75**

- Answer all questions
- Draw diagrams wherever necessary

Essays **(2 x 10 = 20)**

1. Describe the kinetics of one compartment open model i.v. bolus administration and explain how various kinetic parameters are determined.
2. Explain various physicochemical factors affecting drug absorption.

Short notes **(7 x 5 = 35)**

3. State Michaelis Menton equation and its significance.
4. Explain the influence of various physiological barriers in distribution of drugs.
5. Describe the significances of plasma protein binding.
6. Explain sigma minus method.
7. Discuss the concept of clearance.
8. What is entero-hepatic circulation of drugs? Mention its significances
9. Explain the determination of Absorption rate constant by method of residuals.

Answer briefly **(10 x 2 = 20)**

10. What are the significances of volume of distribution?
11. Explain any one method for determination of AUC.
12. Define bioavailability and bioequivalence.
13. What are the characteristic features of glucuronide conjugation?
14. Define the term Extraction ratio.
15. Give any two reasons for non-linearity with examples.
16. Differentiate passive and active transport mechanisms.
17. How are drugs a classified according to Biopharmaceutical Classification System?
18. What are the various levels of IVIVC?
19. Explain the design of any one official apparatus used for dissolution studies?

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QP CODE: **Reg. No: .....**

Sixth Semester B. Pharm Degree Examination
PHARMACEUTICAL BIOTECHNOLOGY
(2017 Scheme)
MODEL QUESTION PAPER

Time: 3 Hours **Max. Marks: 75**

- Answer all questions
- Draw diagrams wherever necessary

Essays **(2 x 10 = 20)**

1. Explain the various methods adopted for enzyme immobilization.
2. With the help of Fermentor design explain the production of Vitamin B12.

Short notes **(7 x 5 = 35)**

3. Discuss the production of penicillinase.
4. Explain microbial biotransformation and give its application.
5. With the help of a neat diagram explain the function of MHC.
6. Explain the relevance of biosensors in pharmaceutical Industry
7. What is Protein Engineering and give its application in health Care system?
8. Write in detail the application of rDNA Technology
9. Explain the method of preparation of toxoids.

Answer briefly **(10 x 2 = 20)**

10. Define immunity
11. Interferon
12. Mutation
13. Define PCR
14. Western Blotting
15. Antitoxins
16. What is Transformation?
17. Hybridoma Technology
18. Plasmids
19. Plasma Substitute

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QP CODE: **Reg. No: .....**

Sixth Semester B. Pharm Degree Examination
PHARMACEUTICAL QUALITY ASSURANCE
(2017 Scheme)
MODEL QUESTION PAPER

Time: 3 Hours **Max. Marks: 75**

- Answer all questions
- Draw diagrams wherever necessary

Essays **(2 x 10 = 20)**

1. Define quality assurance. Explain the elements and importance of total quality management in pharma industries.
2. Define validation, give its elements and also explain the validation of master formula.

Short notes **(7 x 5 = 35)**

3. Explain in detail the term stress testing.
4. Explain and give importance of risk assessment and control strategies in QbD.
5. Give the details of plant layout and its maintenance in the light of GMP.
6. Difference between QA and QC.
7. What are SOPs and give a specimen for manual tablet punching machine.
8. Define the term documentation; give importance and types of the same.
9. What are internal quality audits and what is their importance.

Answer briefly **(10 x 2 = 20)**

10. How many batches to be consider for a process validation
11. What is cGMP
12. Define warehousing and give the characteristics of good warehousing.
13. Explain the term Recall.
14. Give the advantages of QbD.
15. Difference between quality planning and quality improvement.
16. Give a flow chart of raw material quality assurance.
17. General conditions for stability studies.
18. Give a flow chart of quality audits life cycle.
19. Difference between validation and qualification.

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QP CODE: **Reg. No: .....**

Seventh Semester B. Pharm Degree Examination
INSTRUMENTAL METHODS OF ANALYSIS
(2017 Scheme)
MODEL QUESTION PAPER

Time: 3 Hours **Max. Marks: 75**

- Answer all questions
- Draw diagrams wherever necessary

Essays **(2 x 10 = 20)**

1. Define Beer-Lambert's law. Derive the equation and add a note on it's deviations.
2. Explain the principle and instrumentation of highperformance liquid chromatography.

Short notes **(7 x 5 = 35)**

3. What is fluorescence and explain the factors affecting on it.
4. Explain the instrumentation and interferences of flame photometry.
5. Explain any two thermal detectors of IR spectroscopy.
6. Differentiate nephelometry and turbidimetry.
7. Explain principle, types and development techniques of paper chromatography.
8. Write a note on temperature programming and application of gas chromatography.
9. Explain the principle of gel filtration chromatography. Give its applications.

Answer briefly **(10 x 2 = 20)**

10. Define chromophore and auxochromes.
11. What are the different types of quenching?
12. Types of stretching vibrations of IR spectroscopy.
13. Mention the applications of Atomic absorption spectroscopy.
14. What is Rf value? Write any two significance.
15. What are the derivatization techniques of gas chromatography.
16. Applications of capillary electrophoresis.
17. Differentiate TLC and HPTLC.
18. Difference between adsorption and partition chromatography.
19. Write the radiation sources of IR spectroscopy.

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QP CODE: **Reg. No: .....**

Seventh Semester B. Pharm Degree Examination
INDUSTRIAL PHARMACY
(2017 Scheme)
MODEL QUESTION PAPER

Time: 3 Hours **Max. Marks: 75**

- Answer all questions
- Draw diagrams wherever necessary

Essays **(2 x 10 = 20)**

1. Explain the general considerations of pilot plant scale up techniques for the development of solid dosage forms with relevant documentation.
2. Describe the process of technology transfer from R & D to production.

Short notes **(7 x 5 = 35)**

3. Describe the various preventive and control measures for fire and explosion hazards.
4. Explain the NDA approval process
5. What are the organization structure and responsibilities of CDSCO?
6. Explain in detail about SUPAC guidelines.
7. What are the various TOT agencies in India?
8. Describe the factors influencing the location of the pharmaceutical industry.
9. Explain the steps involved in the drug approval process?

Answer briefly **(10 x 2 = 20)**

10. What are the steps involved in the scale up process?
11. List out the factors affecting technology transfer.
12. List out the responsibilities of State Licensing Authority.
13. What is the content of Investigator‘s Brochure?
14. Differentiate between Process Layout and Product Layout?
15. List out the major utility and service systems used in pharma industry?
16. What is COPP ?
17. Write the importance of risk management principles.
18. List out the five modules of Common Technical Document
19. What are the main contents of IND Application?

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QP CODE: **Reg. No: .....**

Seventh Semester B. Pharm Degree Examination
PHARMACY PRACTICE
(2017 Scheme)
MODEL QUESTION PAPER

Time: 3 Hours **Max. Marks: 75**

- Answer all questions
- Draw diagrams wherever necessary

Essays **(2 x 10 = 20)**

1. Describe in detail various drug dispensing methods to inpatients
2. Explain therapeutic drug monitoring. Mention its indications with examples.

Short notes **(7 x 5 = 35)**

3. Role of PTC in ensuring safe use of drugs in hospitals.
4. Rational use of injections.
5. Clinical management of bronchial asthma
6. Legal requirements for starting a community pharmacy.
7. Role of pharmacist in patient medication adherence.
8. Preparation and revision of hospital formulary.
9. Steps in patient counseling

Answer briefly **(10 x 2 = 20)**

10. Automatic stop order system.
11. Name any four biochemical parameters to assess liver function.
12. Define the term _Reorder level‘.
13. Give anti H.pylori regimen.
14. Write any two examples for Type A adverse drug reaction.
15. What is meant by tertiary hospital?
16. What is the role of Poison Information Centre in hospitals?
17. DOTS programme
18. Pharmacist intervention in patient medication history.
19. Primary Drug Information resources

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QP CODE: **Reg. No: .....**

Seventh Semester B. Pharm Degree Examination

NOVEL DRUG DELIVERY SYSTEMS

(2017 Scheme)

MODEL QUESTION PAPER

Time: 3 Hours **Max. Marks: 75**

- Answer all questions
- Draw diagrams wherever necessary

Essays **(2 x 10 = 20)**

1. Explain the various approaches to formulate gastro-retentive drug delivery systems?
2. Define Transdermal delivery of drugs. Explain the components and formulation approaches of transdermal delivery systems

Short notes **(7 x 5 = 35)**

3. Explain microencapsulation by Wurster process
4. What are implants? Describe the components and working of Alzet Osmotic Pump.
5. Write briefly on the design of ophthalmic inserts.
6. Explain the method of preparation and therapeutic applications of liposomes
7. Discuss the physicochemical characteristics of drug to be considered in the design of CDDS
8. Explain the principles mucoadhesion.
9. What are biodegradable polymers? Explain their applications in pharmaceutical formulations with examples.

Answer briefly **(10 x 2 = 20)**

10. What are the applications of pulmonary delivery of drugs?
11. What is Metered dose inhaler?
12. List out the different methods to enhance the drug permeation through transdermal route.
13. What are applications of microencapsulation of drugs?
14. Give four examples for mucoadessive polymers
15. Define diffusion controlled drug delivery systems?
16. List out the major components and applications of niosomes.
17. What are the applications of monoclonal antibodies in therapeutics?
18. List out the different approaches for targeted delivery of drugs.
19. Mention the merits and demerits of buccal drug delivery system.

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QP CODE: **Reg. No: .....**

Eighth Semester B. Pharm Degree Examination

BIOSTATISTICS AND RESEARCH METHODOLOGY

(2017 Scheme)

MODEL QUESTION PAPER

Time: 3 Hours **Max. Marks: 75**

- Answer all questions
- Draw diagrams wherever necessary

Essays **(2 x 10 = 20)**

1. With suitable examples discuss the different parametric and nonparametric tests used in the testing of hypothesis.
2. What is meant by sampling in epidemiology studies? Discuss its relevance and the different types of sampling techniques in detail.

Short notes **(7 x 5 = 35)**

3. Briefly discuss the different types of epidemiology studies.
4. Outline the format for a research protocol.
5. Discuss the different methods usually adopted for graphical representation of data.
6. Discuss the applications of some commonly used computer software in biostatistical analysis.
7. Write briefly on Publication ethics and Plagiarism.
8. Discuss the importance of research in pharmaceutical Sciences.
9. Write a short note on coding and tabulation of data.

Answer briefly **(10 x 2 = 20)**

10. Explain the meaning of –Research gap.‖
11. Differentiate between primary and secondary data.
12. What is meant by normal distribution of data?
13. With a suitable example describe the term –Confounding‖.
14. What is Type I error in hypothesis testing?
15. Mention the criteria of a good research.
16. What is meant by the term _impact factor in research publication‘?
17. What are drop outs in clinical research?
18. What is the difference between reference and bibliography?
19. Differentiate between methods and methodology in research.

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QP CODE: **Reg. No: .....**

Eighth Semester B. Pharm Degree Examination
SOCIAL AND PREVENTIVE PHARMACY
(2017 Scheme)
MODEL QUESTION PAPER

Time: 3 Hours **Max. Marks: 75**

- Answer all questions
- Draw diagrams wherever necessary

Essays **(2 x 10 = 20)**

1. Discuss Universal Immunization Programme.
2. Discuss in detail the various National Family Welfare Programmes.

Short notes **(7 x 5 = 35)**

3. Balanced diet
4. National Urban Health Mission
5. HIV and AIDS Control Programme
6. Nutritional deficiency disorders
7. Functions of PHC
8. Pulse Polio Programme
9. Prevention and control of malaria.

Answer briefly **(10 x 2 = 20)**

10. What are the deficiency disorders of Vitamin C and Vitamin D?
11. Define the term _Health‘.
12. Define drug abuse.
13. Give measurers for effective control of dengue.
14. What is essential hypertension?
15. What is the impact of urbanisation on health?
16. What are the indicators of health?
17. Concept of prevention of disease.
18. National Leprosy Control Programme.
19. What is the general principle involved in the prevention of Lymphatic Filariasis?

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QP CODE: **Reg. No: .....**

Eighth Semester B. Pharm Degree Examination
PHARMACEUTICAL MARKETING
(2017 Scheme)
MODEL QUESTION PAPER

Time: 3 Hours **Max. Marks: 75**

- Answer all questions
- Draw diagrams wherever necessary

Essays **(2 x 10 = 20)**

1. Explain the various types of channels of distribution in Pharmaceutical marketing.
2. Explain the various concepts in marketing. Add a note on vertical and horizontal marketing.

Short notes **(7 x 5 = 35)**

3. Product folio analysis.
4. Explain quantitative and qualitative aspects of market research.
5. Sales promotion techniques.
6. Duties of professional sales representatives.
7. Product branding.
8. Global marketing of pharmaceuticals.
9. Role of product management team in pharmaceutical industry.

Answer briefly **(10 x 2 = 20)**

10. Define price. Name the pricing strategies employed for pharmaceutical marketing.
11. Online promotional techniques for OTC products.
12. Differentiate between marketing and selling.
13. Define product decision.
14. Mention the factors to be considered while selecting the channels.
15. Evaluation methods adopted for sales representative.
16. Define rural marketing.
17. Functions of NPPA.
18. Define promotional budget.
19. Methods of analysing consumer behaviour.

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QP CODE: **Reg. No: .....**

Eighth Semester B. Pharm Degree Examination
PHARMACEUTICAL REGULATORY SCIENCE
(2017 Scheme)
MODEL QUESTION PAPER

Time: 3 Hours **Max. Marks: 75**

- Answer all questions
- Draw diagrams wherever necessary

Essays **(2 x 10 = 20)**

1. Write in detail the developing of clinical trials protocols and other working procedures for conducting the clinical trials.
2. Explain in detail the Abbreviated New Drug Application (ANDA) regulatory approval process.

Short notes **(7 x 5 = 35)**

3. Write short note on Code of Federal Regulations.
4. Generic drug product development.
5. Stages of drug discovery.
6. Write short note on Drug Master File.
7. Describe briefly about regulatory authorities of Australia.
8. Discuss briefly about Informed consent process and procedures.
9. Describe the CTD and ETCD format and its usefulness in regulatory affairs.

Answer briefly **(10 x 2 = 20)**

10. Define Orange Book. Mention its significance.
11. Mention the functions of the Institutional Review Board.
12. Concept of generics
13. What are the preclinical studies involved in drug development?
14. Name the regulatory authorities of United States, Japan, Canada and European Union.
15. Define Pharmacovigilance
16. ASEAN Common Technical Document (ACTD)
17. What is the content of Purple Book?
18. Time lines involved in Investigational New Drug (IND)
19. Differentiate between Laws and Acts.

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QP CODE: **Reg. No: .....**

Eighth Semester B. Pharm Degree Examination

PHARMACOVIGILANCE

(2017 Scheme)

MODEL QUESTION PAPER

Time: 3 Hours **Max. Marks: 75**

- Answer all questions
- Draw diagrams wherever necessary

Essays **(2 x 10 = 20)**

1. Define and classify Adverse Drug Reactions. Explain the procedure involving In detection and reporting ADR.
2. Explain the genesis and development of Pharmacovigilance in India.

Short notes **(7 x 5 = 35)**

3. Explain the importance of drug safety monitoring.
4. Write briefly about WHO international drug monitoring programme.
5. Explain the different methods of causality assessment.
6. Discuss about the basic drug information resources.
7. Explain the functions of Contract Research Organisations (CROs) in pharmacovigilance.
8. Write the significance of .adverse events following immunization.
9. Explain the objectives of ICH and discuss in detail about its organization.

Answer briefly **(10 x 2 = 20)**

10. Mention the various drug information resources.
11. What is Preclinical phase in drug development?
12. How the safety of drugs can be evaluated in pediatrics?
13. What are the CIOMS requirements for ADR reporting?
14. Difference between Active and Passive surveillance
15. What is Cohort study?
16. Write the pharmacovigilance of vaccines.
17. Define Daily defined doses (DDD).
18. Write a note on CDSCO.
19. What is the role of communication in pharmacovigilance?

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QP CODE: **Reg. No: .....**

Eighth Semester B. Pharm Degree Examination

QUALITY CONTROL AND STANDARDIZATION OF HERBALS

(2017 Scheme)

MODEL QUESTION PAPER

Time: 3 Hours **Max. Marks: 75**

- Answer all questions
- Draw diagrams wherever necessary

Essays **(2 x 10 = 20)**

1. Discuss the WHO guidelines for quality control of herbal drugs.
2. Describe the regulatory requirements of herbal drugs.

Short notes **(7 x 5 = 35)**

3. What is meant by foreign organic matter? How will you determine foreign organic matter?
4. What are the applications of HPTLC in herbal drug standardization?
5. Describe the WHO guidelines on Good Agricultural Practices.
6. Describe briefly on physical evaluation of crude drugs.
7. Define extractive value. Give the procedure for determining alcohol soluble extractive value.
8. What documents are to be produced for new drug application and export registration?
9. Describe stability testing of herbal medicines.

Answer briefly **(10 x 2 = 20)**

10. What is the EU definition of herbal medicinal product?
11. What are the hazardous chemical contaminants present in herbal formulations?
12. What are the specific objectives of herbal drug regulation?
13. Define the term herbal drug standardization.
14. What is meant by cGMP?
15. Define biomarker giving example.
16. Why standardization is essential for a herbal formulation?
17. What is the objective of ICH guidelines?
18. Why safety evaluation is more complex in herbal medicines?
19. Describe any one basic test for detection of steroids in medicinal plant materials.

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QP CODE: **Reg. No: .....**

Eighth Semester B. Pharm Degree Examination
COMPUTER AIDED DRUG DESIGN
(2017 Scheme)
MODEL QUESTION PAPER

Time: 3 Hours **Max. Marks: 75**

- Answer all questions
- Draw diagrams wherever necessary

Essays **(2 x 10 = 20)**

1. Define QSAR. Explain multiparametric approaches to QSAR with special emphasis on Hansch Analysis and Free Wilson Analysis.
2. What is homology modeling? Explain the various steps involved in homology modeling to generate the 3Dstructure of a protein.

Short notes **(7 x 5 = 35)**

3. Explain the various stages of rational drug discovery process.
4. Define and classify bioisosterism with suitable examples.
5. Discuss the role of ADME database in drug discovery process.
6. Explain various energy minimization methods used in molecular modeling.
7. Describe the history of drug discovery and development.
8. Define molecular docking. Explain the different types of molecular docking.
9. Explain the applications of quantum mechanics in drug design.

Answer briefly **(10 x 2 = 20)**

10. What is meant by _structure based drug design‘?
11. Give Hammet Equation. Mention its significance on substituent groups.
12. What is pharmacophore mapping?
13. Write various types of interactions which contribute to molecular mechanics force field?
14. Define 3D-QSAR.
15. What is the concept behind *de novo* drug design?
16. List out the bioinformatics tools used in drug design.
17. Define the term molecular modeling.
18. What is a molecular simulation study? Give its purposes and uses.
19. What is global minimum energy conformation?

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QP CODE: **Reg. No: .....**

Eighth Semester B. Pharm Degree Examination
CELL AND MOLECULAR BIOLOGY
(2017 Scheme)
MODEL QUESTION PAPER

Time: 3 Hours **Max. Marks: 75**

- Answer all questions
- Draw diagrams wherever necessary

Essays **(2 x 10 = 20)**

1. Enumerate the different receptors involved in cell signaling. Explain the signaling pathways.
2. Define and explain semiconservative DNA replication process.

Short notes **(7 x 5 = 35)**

3. Explain different types of RNA and their functions.
4. Describe transcription in prokaryotic cell.
5. Explain the different steps involved in eukaryotic cell replication.
6. Explain the different structures of protein.
7. Differentiate between mitosis and meiosis.
8. Compare and contrast DNA and RNA.
9. Explain genomic analysis.

Answer briefly **(10 x 2 = 20)**

10. Mention the significance of protein synthesis.
11. What are the functions of protein kinase?
12. What are essential aminoacids?
13. Define Translation.
14. What are the functions of DNA?
15. Define nucleosomes.
16. What are the properties of cell membrane?
17. Define transcription.
18. Define primosome.
19. Define chaperones.

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QP CODE: **Reg. No: .....**

Eighth Semester B. Pharm Degree Examination
COSMETIC SCIENCE
(2017 Scheme)
MODEL QUESTION PAPER

Time: 3 Hours **Max. Marks: 75**

- Answer all questions
- Draw diagrams wherever necessary

Essays **(2 x 10 = 20)**

1. Classify shampoo. Describe the ingredients used in the formulation of shampoo.
2. Explain the role of herbs in skin and oral care cosmetic products.

Short notes **(7 x 5 = 35)**

3. Describe the structure of hair and hair growth cycle.
4. Write a note on primary and secondary surfactants with examples.
5. What are the different methods for the analysis of shampoo?
6. Classify sunscreen preparations with examples.
7. Explain the principle involved in the measurement of tensile strength of hair and transepidermal water loss.
8. Explain the formulation and preparation of vanishing cream.
9. Describe the major cosmetic problems associated with skin.

Answer briefly **(10 x 2 = 20)**

10. Define and differentiate cosmetics and cosmeceuticals.
11. What is the mechanism of action of antiperspirants?
12. Define SPF Value.
13. Name two rheology modifiers.
14. What is the application of sebumeter?
15. Define and classify emollients.
16. What is the role of hair conditioners? Give examples.
17. List out the ingredients used in the formulation of dentifrices.
18. What are the common ingredients used in moisturizing cream?
19. What is the working principle of corneometer?

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QP CODE: **Reg. No: .....**

Eighth Semester B. Pharm Degree Examination
EXPERIMENTAL PHARMACOLOGY
(2017 Scheme)
MODEL QUESTION PAPER

Time: 3 Hours **Max. Marks: 75**

- Answer all questions
- Draw diagrams wherever necessary

Essays **(2 x 10 = 20)**

1. Explain the maintenance and breeding of experimental animals as per CPCSEA guidelines.
2. Explain the behavioral paradigms and experimental models (any two models) for screening of drugs affecting learning and memory (anti-Alzheimer activity).

Short notes **(7 x 5 = 35)**

3. Differentiate transgenic and mutant animals.
4. Interpretation of results using Student _*t'* test .
5. Explain MTT assay
6. Give any one experimental model for anti-epileptic agent screening.
7. Principle and procedure for *Tail suspension test* for antidepressant activity.
8. Explain pylorus ligation in rats as an animal model.
9. Chemically induced diabetes in animal model

Answer briefly **(10 x 2 = 20)**

10. Define euthanasia
11. What is Cross over design?
12. Define Null hypothesis
13. What are the uses of rabbit as an experimental animal?
14. Mention the uses of Eddy's hot plate.
15. What are Histograms?
16. When do you use one way ANOVA?
17. Give the uses of metabolic cages in screening of drugs
18. Give the procedure for retro orbital bleeding
19. What are the uses of isolated phrenic nerve diaphragm preparation in experimental pharmacology?

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QP CODE: **Reg. No: .....**

Eighth Semester B. Pharm Degree Examination
ADVANCED INSTRUMENTATION TECHNIQUES
(2017 Scheme)
MODEL QUESTION PAPER

Time: 3 Hours **Max. Marks: 75**

- Answer all questions
- Draw diagrams wherever necessary

Essays **(2 x 10 = 20)**

1. Define mass spectrometry. Explain any four ionization techniques.
2. What are thermal methods of analysis? Explain thermogravimetric analysis and differential scanning calorimetry.

Short notes **(7 x 5 = 35)**

3. Define chemical shift and explain the factors affecting it.
4. Explain various steps of radioimmuno assay.
5. Write a note on GC-MS/MS.
6. Explain the calibration of UV spectrophotometer.
7. Explain powder diffraction technique of X-ray spectroscopy.
8. Write a note on quadrupole mass analyzer.
9. Write briefly on applications of thermal methods of analysis.

Answer briefly **(10 x 2 = 20)**

10. Define calibration and validation.
11. Differentiate H-NMR and C-NMR.
12. Applications of radio immune assay.
13. Fragmentation pattern in mass spectrometry.
14. What is X-ray crystallography?
15. Write the principle of liquid-liquid extraction.
16. List out validation parameters as per ICH guidelines.
17. Write the importance of hyphenated techniques with examples.
18. Define coupling constant and spin-spin coupling.
19. Write the different peaks obtained in mass spectrum.

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KERALA UNIVERSITY OF HEALTH SCIENCES
Thrissur - 680596

SYLLABUS

POST GRADUATE COURSE IN PHARMACY
Master of Pharmacy (M.Pharm.)

PHARMACEUTICAL CHEMISTRY	MPC
KUHS Course Code	277

(2019-20 Academic year onwards)

2019

Course of study for M.Pharm. I & II Semester

MPC	Pharmaceutical Chemistry				
Course Code	**Course**	**Credit Hours**	**Credit Points**	**Hrs./wk**	**Marks**
Semester I					
MPT 101T	Modern Pharmaceutical Analytical Techniques	4	4	4	100
MPC 102T	Advanced Organic Chemistry –I	4	4	4	100
MPC 103T	Advanced Medicinal Chemistry	4	4	4	100
MPC 104T	Chemistry of Natural Products	4	4	4	100
MPC 105P	Pharmaceutical Chemistry Practical – I	12	6	12	150
-	Seminar/Assignment	7	4	7	100
Total		**35**	**26**	**35**	**650**
Semester II					
MPC 201T	Advanced Spectral Analysis	4	4	4	100
MPC 202T	Advanced Organic Chemistry –II	4	4	4	100
MPC 203T	Computer Aided Drug Design	4	4	4	100
MPC 204T	Pharmaceutical Process Chemistry	4	4	4	100
MPC 205P	Pharmaceutical Chemistry Practical II	12	6	12	150
-	Seminar /Assignment	7	4	7	100
Total		**35**	**26**	**35**	**650**

Course of study for M. Pharm. III & IV Semester

Course Code	**Course**	**Credit Hours**	**Credit Points**	**Marks**
Semester III				
MRM 301T	Research Methodology and Biostatistics	4	4	100
-	Journal Club	1	1	25
-	Discussion / Presentation (proposal presentation)	2	2	25
-	Research Work	28	14	350
Total		**35**	**21**	**500**
Semester IV				
-	Journal Club	1	1	25
-	Pre submission Discussion / Presentation	3	3	75
-	Research Work	31	16	400
Total		**35**	**20**	**500**

PHARMACEUTICAL CHEMISTRY (MPC)

MODERN PHARMACEUTICAL ANALYTICAL TECHNIQUES (MPT 101T)

SCOPE

This subject deals with various advanced analytical instrumental techniques for identification, characterization and quantification of drugs. Instruments dealt are NMR, Mass spectrometer, IR, HPLC, GC etc.

OBJECTIVES

Upon completion of the course, student will be able to know about

- Chemicals and excipients
- The analysis of various drugs in single and combination dosage forms
- Theoretical and practical skills for handling of the instruments

THEORY

60 Hrs

1. a. UV-Visible spectroscopy: Introduction, Theory, Laws, Instrumentation **10 Hrs** associated with UV-Visible spectroscopy, Choice of solvents and Solvent effect and Applications of UV-Visible spectroscopy, Difference/ Derivative spectroscopy.

b. IR spectroscopy: Theory, Modes of Molecular vibrations, Sample handling, Instrumentation of Dispersive and Fourier - Transform IR Spectrometer, Factors affecting vibrational frequencies and Applications of IR spectroscopy, Data Interpretation.

c. Spectroflourimetry: Theory of Fluorescence, Factors affecting fluorescence (Characteristics of drugs that can be analysed by flourimetry), Quenchers, Instrumentation and Applications of fluorescence spectrophotometer.

d. Flame emission spectroscopy and Atomic absorption spectroscopy: Principle, Instrumentation, Interferences and Applications.

2. NMR spectroscopy: Principle, Instrumentation, **10 Hrs** Solvent requirement in NMR, Relaxation process, NMR signals in various compounds, Chemical shift, Factors influencing chemical shift, Spin-Spin coupling, Coupling constant, Nuclear magnetic double resonance, Brief outline of principles of FT-NMR and ^{13}C NMR, Applications of NMR spectroscopy.

3. Mass Spectroscopy: Principle, Theory, Instrumentation of Mass Spectroscopy, **9 Hrs** Different types of ionization like electron impact, chemical, field, FAB and MALDI, APCI, ESI, APPI Analyzers of Quadrupole and Time of Flight, Mass fragmentation and its rules, Meta stable ions, Isotopic peaks and Applications of Mass spectroscopy.

4. Chromatography: Principle, apparatus, instrumentation, **9 Hrs** chromatographic parameters, factors affecting resolution, isolation of drug from excipients, data interpretation and applications of the following:

a) Thin Layer chromatography
b) High Performance Thin Layer Chromatography
c) Ion exchange chromatography
d) Column chromatography
e) Gas chromatography
f) High Performance Liquid chromatography
g) Ultra High Performance Liquid chromatography
h) Affinity chromatography
i) Gel Chromatography

5. a. Electrophoresis: Principle, Instrumentation, Working conditions, **9 Hrs**
factors affecting separation and applications of the following:

i) Paper electrophoresis ii) Gel electrophoresis iii) Capillary electrophoresis iv) Zone electrophoresis v) Moving boundary electrophoresis vi) Iso electric focusing

b. X ray Crystallography: Production of X rays, Different X ray methods, Bragg's law, Rotating crystal technique, X ray powder technique, Types of crystals and applications of X-ray diffraction.

6. a. Potentiometry: Principle, working, Ion selective Electrodes and Application of **9 Hrs**
potentiometry.

b.Thermal Techniques: i) Differential scanning calorimetry (DSC): Principle, thermal transitions and Instrumentation (Heat flux and power-compensation and designs), Modulated DSC, Hyper DSC, experimental parameters (sample preparation, experimental conditions, calibration, heating and cooling rates, resolution, source of errors and their influence), advantages, disadvantages and pharmaceutical applications.

ii) Differential Thermal Analysis (DTA): Principle, instrumentation and advantage and disadvantages, pharmaceutical applications, derivative differential thermal analysis (DDTA).

iii) Thermo Gravimetric Analysis (TGA): Principle, instrumentation, factors affecting results, advantage and disadvantages, pharmaceutical applications.

7. Immunological assays: RIA (Radio immuno assay), ELISA, Bioluminescence assays. **4 Hrs**

REFERENCES

1. Spectrometric Identification of Organic compounds - Robert M Silverstein, 6th Edition, John Wiley & Sons, 2004.
2. Principles of Instrumental Analysis - Douglas A Skoog, F. James Holler, Timothy A. Nieman, 5th Edition, Eastern Press, Bangalore, 1998.
3. Instrumental Methods of Analysis - Willards, 7th Edition, CBS publishers.
4. Practical Pharmaceutical Chemistry - Beckett and Stenlake, Vol II, 4th Edition, CBS Publishers, New Delhi, 1997.
5. Organic Spectroscopy - William Kemp, 3rd Edition, ELBS, 1991.
6. Quantitative Analysis of Drugs in Pharmaceutical formulation - P.D. Sethi, 3rd Edition, CBS Publishers, New Delhi, 1997.
7. Pharmaceutical Analysis-Modern Methods-Part B-J.W. Munson, Vol 11, Marcel Dekker Series.
8. Spectroscopy of Organic Compounds, 2nd Edition, P.S. Kalsi, Wiley Eastern Ltd, Delhi.
9. Textbook of Pharmaceutical Analysis, K.A. Connors, 3rd Edition, John Wiley & Sons, 1982.

ADVANCED ORGANIC CHEMISTRY - I (MPC 102T)

Scope

The subject is designed to provide in-depth knowledge about advances in organic chemistry, different techniques of organic synthesis and their applications to process chemistry as well as drug discovery.

Objectives

Upon completion of course, the student shall be to understand

- The principles and applications of reterosynthesis
- The mechanism and applications of various named reactions

• The concept of disconnection to develop synthetic routes for small target molecule.
• The various catalysts used in organic reactions
• The chemistry of heterocyclic compounds

THEORY **60 Hrs**

1. Basic Aspects of Organic Chemistry: **12Hrs**

a) Reactive intermediates: Carbocations, carbanions, free radicals, carbenes and nitrenes. Their method of formation, stability and synthetic applications. b) Types of reaction mechanisms and methods of determining them, Detailed knowledge regarding the reactions, mechanisms and their relative reactivity and orientations.

i) Addition reactions
ii) Nucleophilic uni- and bimolecular reactions (S_N1 and S_N2)
iii) Elimination reactions (E1 & E2; Hoffman & Saytzeff's rule)
iv) Rearrangement reactions.

2. **Study of mechanism and synthetic applications of following named Reactions: 12 Hrs**

Ugi reaction, Brook rearrangement, Ullmann coupling reactions, Dieckmann Reaction,Doebner-Miller Reaction, Sandmeyer Reaction, Mitsunobu reaction, Mannich reaction, Vilsmeyer-Haack Reaction, Sharpless asymmetric epoxidation, Baeyer-Villiger oxidation, Shapiro & Suzuki reaction, Ozonolysis and Michael addition reaction.

3. Synthetic Reagents & Applications: **12 Hrs**

Aluminiumisopropoxide, N-bromosuccinimide, diazomethane, dicyclohexylcarbodiimide, Wilkinson reagent, Witting reagent. Osmium tetroxide, titanium chloride, diazopropane, diethyl azodicarboxylate, Triphenylphosphine, Benzotriazol-1-yloxy tris (dimethylamino) phosphonium hexafluoro-phosphate (BOP).

Protecting groups

a) Role of protection in organic synthesis
b) Protection for the hydroxyl group, including 1,2-and1,3-diols: ethers, esters, carbonates, cyclic acetals & ketals
c) Protection for the Carbonyl Group: Acetals and Ketals
d) Protection for the Carboxyl Group: amides and hydrazides, esters
e) Protection for the Amino Group and Amino acids: carbamates and amides

4. Heterocyclic Chemistry: **12 Hrs**

Organic Name reactions with their respective mechanism and application involved in synthesis of drugs containing five, six membered and fused hetrocyclics such as Debus-Radziszewski imidazole synthesis, Knorr Pyrazole Synthesis, Pinner Pyrimidine Synthesis, Combes Quinoline Synthesis, Bernthsen Acridine Synthesis, Smiles rearrangement and Traube purine synthesis.

Synthesis of a few representative drugs containing these hetrocyclic nucleus such as Ketoconazole, Metronidazole, Miconazole, Celecoxib, Antipyrin, Metamizole sodium, Terconazole, Alprazolam, Triamterene, Sulfamerazine, Trimethoprim, Hydroxychloroquine,

Quinine, Chloroquine, Quinacrine, Amsacrine, Prochlorperazine, Promazine, Chlorpromazine, Theophylline , Mercaptopurine and Thioguanine.

5. Synthon approach and retrosynthesis applications 12 Hrs

i. Basic principles, terminologies and advantages of retrosynthesis; guidelines for dissection of molecules. Functional group interconvertion and addition (FGI and FGA).

ii. C-X disconnections; C-C disconnections – alcohols and carbonyl compounds; 1,2-, 1,3-,1,4-, 1,5-,1,6-difunctionalized compounds

iii. Strategies for synthesis of three, four, five and six-membered ring.

REFERENCES

1. "Advanced Organic chemistry, Reaction, Mechanisms and Structure", J March, John Wiley and Sons, New York.
2. "Mechanism and Structure in Organic Chemistry", ES Gould, Hold Rinchart and Winston, New York.
3. "Organic Chemistry" Clayden, Greeves, Warren and Woihers., Oxford University Press 2001. 4. "Organic Chemistry" Vol I and II. I.L. Finar. ELBS, Pearson Education Lts, Dorling Kindersley 9India) Pvt. Ltd.,.
4. A guide to mechanisms in Organic Chemistry, Peter Skyes (Orient Longman, New Delhi).
5. Reactive Intermediates in Organic Chemistry, Tandom and Gowel, Oxford & IBH Publishers.
6. Combinational Chemistry – Synthesis and applications – Stephen R Wilson & Anthony W Czarnik, Wiley – Blackwell.
7. Carey, Organic Chemistry, 5th Edition (Viva Books Pvt. Ltd.)
8. Organic Synthesis - The Disconnection Approach, S. Warren, Wily India
9. Principles of Organic Synthesis, ROC Norman and JM Coxan, Nelson Thorns.
10. Organic Synthesis - Special Techniques. VK Ahluwalia and R Agarwal, Narosa Publishers.
11. Organic Reaction Mechanisms IV Edtn, VK Ahluwalia and RK Parashar, Narosa Publishers.

ADVANCED MEDICINAL CHEMISTRY (MPC 103T)

Scope

The subject is designed to impart knowledge about recent advances in the field of medicinal chemistry at the molecular level including different techniques for the rational drug design.

Objectives

At completion of this course it is expected that students will be able to understand

- Different stages of drug discovery
- Role of medicinal chemistry in drug research
- Different techniques for drug discovery
- Various strategies to design and develop new drug like molecules for biological targets
- Peptidomimetics

THEORY **60 Hrs**

1. Drug discovery: **12 Hrs**

Stages of drug discovery, lead discovery; identification, validation and diversity of drug targets. Biological drug targets: Receptors, types, binding and activation, theories of drug receptor interaction, drug receptor interactions, agonists vs antagonists, artificial enzymes.

2. Prodrug Design and Analog design: **12 Hrs**

i. Prodrug design: Basic concept, Carrier linked prodrugs / Bioprecursors, Prodrugs of functional group, Prodrugs to improve patient acceptability, Drug solubility, Drug absorption and distribution, site specific drug delivery and sustained drug action. Rationale of prodrug design and practical consideration of prodrug design.

ii. Combating drug resistance: Causes for drug resistance, strategies to combat drug resistance in antibiotics and anticancer therapy, Genetic principles of drug resistance.

iii. Analog Design: Introduction, Classical & Non classical, Bioisosteric replacement strategies, rigid analogs, alteration of chain branching, changes in ring size, ring position isomers, design of stereo isomers and geometric isomers, fragments of a lead molecule, variation in inter atomic distance.

3. **Medicinal chemistry aspects of the following class of drugs:** **12 Hrs**

Systematic study, SAR, Mechanism of action and synthesis of new generation molecules of following class of drugs:

i. Anti-hypertensive drugs, Psychoactive drugs, Anticonvulsant drugs, H1 & H2 receptor antagonist, COX1 & COX2 inhibitors, Adrenergic & Cholinergic agents, Antineoplastic and Antiviral agents.

ii. Stereochemistry and Drug action: Realization that stereo selectivity is a pre-requisite for evolution. Role of chirality in selective and specific therapeutic agents. Case studies, Enantio selectivity in drug adsorption, metabolism, distribution and elimination.

4. Rational Design of Enzyme Inhibitors **12 Hrs**

Enzyme kinetics & Principles of Enzyme inhibitors, Enzyme inhibitors in medicine, Enzyme inhibitors in basic research, rational design of non-covalently and covalently binding enzyme inhibitors.

5. Peptidomimetics **12 Hrs**

Therapeutic values of Peptidomimetics, Design of peptidomimetics by manipulation of the amino acids, Modification of the peptide backbone, Incorporating conformational constraints locally or globally. Chemistry of prostaglandins, leukotrienes and thromboxanes.

REFERENCES

1. Medicinal Chemistry by Burger, Vol I –VI.
2. Wilson and Gisvold's Text book of Organic Medicinal and Pharmaceutical Chemistry, 12th Edition, Lppincott Williams & Wilkins, Woltess Kluwer (India) Pvt.Ltd, New Delhi.
3. Comprehensive Medicinal Chemistry – Corwin and Hansch.
4. Computational and structural approaches to drug design edited by Robert M Stroud and Janet. F Moore
5. Introduction to Quantitative Drug Design by Y.C. Martin.
6. Principles of Medicinal Chemistry by William Foye, 7th Edition, Lippincott Williams & Wilkins, Woltess Kluwer (India) Pvt.Ltd, New Delhi.
7. Drug Design Volumes by Arienes, Academic Press, Elsevier Publishers, Noida, Uttar Pradesh
8. Principles of Drug Design by Smith.
9. The Organic Chemistry of the Drug Design and Drug action by Richard B.Silverman, II Edition, Elsevier Publishers, New Delhi.
10. An Introduction to Medicinal Chemistry, Graham L.Patrick, III Edition, Oxford University Press, USA.
11. Biopharmaceutics and pharmacokinetics, DM.Brahmankar, Sunil B. Jaiswal II Edition, 2014, Vallabh Prakashan, New Delhi.
12. Peptidomimetics in Organic and Medicinal Chemistry by Antonio Guarna and Andrea Trabocchi, First edition, Wiley publishers.

CHEMISTRY OF NATURAL PRODUCTS (MPC 104T)

Scope

The subject is designed to provide detail knowledge about chemistry of medicinal compounds from natural origin and general methods of structural elucidation of such compounds. It also emphasizes on isolation, purification and characterization of medicinal compounds from natural origin.

Objectives

At completion of this course it is expected that students will be able to understand-

- Different types of natural compounds and their chemistry and medicinal importance
- The importance of natural compounds as lead molecules for new drug discovery
- The concept of rDNA technology tool for new drug discovery
- General methods of structural elucidation of compounds of natural origin
- Isolation, purification and characterization of simple chemical constituents from natural source

THEORY **60 Hrs**

1. Study of Natural products as leads for new pharmaceuticals for the following class of drugs

12 Hrs

a) Drugs Affecting the Central Nervous System: Morphine Alkaloids
b) Anticancer Drugs: Paclitaxel and Docetaxel, Etoposide, and Teniposide
c) Cardiovascular Drugs: Lovastatin, Teprotide and Dicoumarol
d) Neuromuscular Blocking Drugs: Curare alkaloids
e) Anti-malarial drugs and Analogues
f) Chemistry of Macrolide antibiotics: (Erythromycin, Azithromycin, Roxithromycin, and Clarithromycin) and β - Lactam antibiotics (Cephalosporins and Carbapenem)

2. a) **Alkaloids** **12 Hrs**

General introduction, Classification, Isolation, Purification, Molecular modification and Biological activity of Alkaloids, General methods of Structural determination of alkaloids, structural elucidation and stereochemistry of ephedrine, morphine, ergot, emetine and reserpine.

b) Flavonoids

Introduction, isolation and purification of flavonoids, General methods of structural determination of flavonoids; Structural elucidation of quercetin.

c) Steroids

General introduction, chemistry of sterols, sapogenin and cardiac glycosides. Stereochemistry and nomenclature of steroids, Chemistry of contraceptive agents, male & female sex hormones (Testosterone, Estradiol, Progesterone), adrenocorticoids (Cortisone), contraceptive agents and steroids (Vit – D).

3. a) **Terpenoids** **12 Hrs**

Classification, isolation, Isoprene rule and General methods of structural elucidation of Terpenoids; Structural elucidation of drugs belonging to mono terpenoids (citral, menthol, camphor), di terpenoids (retinol, Phytol, taxol) and tri terpenoids (Squalene,Ginsenoside) carotinoids (β carotene).

b) **Vitamins**

Chemistry and Physiological significance of Vitamin A, B1, B2, B12, C, E, Folic acid and Niacin.

4. a). **Recombinant DNA technology and drug discovery**

12 Hrs

rDNA technology, hybridoma technology, New pharmaceuticals derived from biotechnology; Oligonucleotide therapy. Gene therapy: Introduction, Clinical application and recent advances in gene therapy, principles of RNA & DNA estimation

b). Active constituent of certain crude drugs used in Indigenous system Diabetic therapy – Gymnema sylvestre, Salacia reticulate, Pterocarpus marsupiam, Swertia chirata, Trigonella foenum graccum; Liver dysfunction – Phyllanthus niruri; Antitumor – Curcuma longa Linn.

5. Structural Characterization of natural compounds
12 Hrs

Structural characterization of natural compounds using IR, ^{1}HNMR, ^{13}CNMR and MS Spectroscopy and of specific drugs e.g., Penicillin, Morphine, Camphor, Vit-D, Quercetin and Digitalis glycosides.

REFERENCES

1. Modern Methods of Plant Analysis, Peech and M.V.Tracey, Springer – Verlag, Berlin, Heidelberg.
2. Phytochemistry Vol. I and II by Miller, Jan Nostrant Rein Hld.
3. Recent advances in Phytochemistry Vol. I to IV – Scikel Runeckles, Springer Science & Business Media.
4. Chemistry of natural products Vol I onwards IWPAC.
5. Natural Product Chemistry Nakanishi Gggolo, University Science Books, California.
6. Natural Product Chemistry "A laboratory guide" – Rapheal Khan.
7. The Alkaloid Chemistry and Physiology by RHF Manske, Academic Press.
8. Introduction to molecular Phytochemistry – CHJ Wells, Chapmannstall.
9. Organic Chemistry of Natural Products Vol I and II by Gurdeep and Chatwall, Himalaya Publishing House.
10. Organic Chemistry of Natural Products Vol I and II by O.P. Agarwal, Krishan Prakashan.
11. Organic Chemistry Vol I and II by I.L. Finar, Pearson education.
12. Elements of Biotechnology by P.K. Gupta, Rastogi Publishers.
13. Pharmaceutical Biotechnology by S.P.Vyas and V.K.Dixit, CBS Publishers.
14. Biotechnology by Purohit and Mathur, Agro-Bios, 13th edition.
15. Phytochemical methods of Harborne, Springer, Netherlands.
16. Burger's Medicinal Chemistry.

PHARMACEUTICAL CHEMISTRY PRACTICAL - I (MPC 105P)

1. Analysis of Pharmacopoeial compounds and their formulations by UV Vis spectrophotometer, RNA & DNA estimation
2. Simultaneous estimation of multi component containing formulations by UV spectrophotometry
3. Experiments based on Column chromatography
4. Experiments based on HPLC
5. Experiments based on Gas Chromatography
6. Estimation of riboflavin/quinine sulphate by fluorimetry
7. Estimation of sodium/potassium by flame photometry

To perform the following reactions of synthetic importance

1. Purification of organic solvents, column chromatography
2. Claisen-schimidt reaction.
3. Benzyllic acid rearrangement.
4. Beckmann rearrangement.
5. Hoffmann rearrangement
6. Mannich reaction
7. Synthesis of medicinally important compounds involving more than one step along with purification and Characterization using TLC, melting point and IR spectroscopy (4 experiments)
8. Estimation of elements and functional groups in organic natural compounds
9. Isolation, characterization like melting point, mixed melting point, molecular weight determination, functional group analysis, co-chromatographic technique for identification of isolated compounds and interpretation of UV and IR data.
10. Some typical degradation reactions to be carried on selected plant constituents

ADVANCED SPECTRAL ANALYSIS (MPC 201T)

Scope

This subject deals with various hyphenated analytical instrumental techniques for identification, characterization and quantification of drugs. Instruments dealt are LC-MS, GC-MS, ATR-IR, DSC etc.

Objectives

At completion of this course it is expected that students will be able to understand-

- Interpretation of the NMR, Mass and IR spectra of various organic compounds
- Theoretical and practical skills of the hyphenated instruments
- Identification of organic compounds

THEORY **60Hrs**

1. UV and IR spectroscopy: **12 Hrs**

Woodward-Fieser rule for 1,3- butadienes, cyclic dienes and α, β-carbonyl compounds and interpretation compounds of enones. ATR-IR, IR Interpretation of organic compounds.

2. NMR spectroscopy: **12 Hrs**

1-D and 2-D NMR, NOESY and COSY, HETCOR, INADEQUATE techniques, Interpretation of organic compounds.

3. Mass Spectroscopy **12 Hrs**

Mass fragmentation and its rules, Fragmentation of important functional groups like alcohols, amines, carbonyl groups and alkanes, Meta stable ions, Mc Lafferty rearrangement, Ring rule, Isotopic peaks, Interpretation of organic compounds.

4. Chromatography: **12 Hrs**

Principle, Instrumentation and Applications of the following:

a) GC-MS b) GC-AAS c) LC-MS d) LC-FTIR e) LC-NMR f) CE- MS g) High Performance Thin Layer chromatography h) Super critical fluid chromatography i) Ion Chromatography j) I-EC (Ion- Exclusion Chromatography) k) Flash chromatography .

5. a). **Thermal methods of analysis** **12 Hrs**

Introduction, principle, instrumentation and application of DSC, DTA and TGA.

b). Raman Spectroscopy

Introduction, Principle, Instrumentation and Applications.

c). Radio immuno assay

Biological standardization, bioassay, ELISA, Radioimmuno assay of digitalis and insulin.

REFERENCES

1. Spectrometric Identification of Organic compounds - Robert M Silverstein, Sixth edition, John Wiley & Sons, 2004.
2. Principles of Instrumental Analysis - Doglas A Skoog, F. James Holler, Timothy A. Nieman, 5th edition, Eastern press, Bangalore, 1998.
3. Instrumental methods of analysis – Willards, 7th edition, CBS publishers.
4. Organic Spectroscopy - William Kemp, 3rd edition, ELBS, 1991.
5. Quantitative analysis of Pharmaceutical formulations by HPTLC - P D Sethi, CBS Publishers, New Delhi.

6. Quantitative Analysis of Drugs in Pharmaceutical formulation - P D Sethi, 3rd Edition, CBS Publishers, New Delhi, 1997.
7. Pharmaceutical Analysis- Modern methods – Part B - J W Munson, Volume 11 Marcel Dekker Series

ADVANCED ORGANIC CHEMISTRY - II (MPC 202T)

Scope

The subject is designed to provide in-depth knowledge about advances in organic chemistry, different techniques of organic synthesis and their applications to process chemistry as well as drug discovery.

Objectives

Upon completion of course, the student shall able to understand

- The principles and applications of Green chemistry
- The concept of peptide chemistry.
- The various catalysts used in organic reactions
- The concept of stereochemistry and asymmetric synthesis.

THEORY **60 Hrs**

1. Green Chemistry: **12 Hrs**

a) Introduction, principles of green chemistry
b) Microwave assisted reactions: Merit and demerits of its use, increased reaction rates, mechanism, superheating effects of microwave, effects of solvents in microwave assisted synthesis, microwave technology in process optimization, its applications in various organic reactions and heterocycles synthesis
c) Ultrasound assisted reactions: Types of sonochemical reactions, homogenous, heterogeneous liquid-liquid and liquid-solid reactions, synthetic applications
d) Continuous flow reactors: Working principle, advantages and synthetic applications.

2. Chemistry of peptides **12 Hrs**

a) Coupling reactions in peptide synthesis
b) Principles of solid phase peptide synthesis, t-BOC and FMOC protocols, various solid supports and linkers: Activation procedures, peptide bond formation, deprotection and cleavage from resin, low and high HF cleavage protocols, formation of free peptides and peptide amides, purification and case studies, site-specific chemical modifications of peptides
c) Segment and sequential strategies for solution phase peptide synthesis with any two case studies
d) Side reactions in peptide synthesis: Deletion peptides, side reactions initiated by proton abstraction, protonation, over- activation and side reactions of individual amino acids.

3. Photochemical Reactions **12 Hrs**

Basic principles of photochemical reactions. Photo-oxidation, photo-addition and photo-fragmentation.

Pericyclic reactions

Mechanism, Types of pericyclic reactions such as cyclo addition, electrocyclic reaction and sigmatrophic rearrangement reactions with examples

4. Catalysis: 12 Hrs

a) Types of catalysis, heterogeneous and homogenous catalysis, advantages and disadvantages

b) Heterogeneous catalysis – preparation, characterization, kinetics, supported catalysts, catalyst deactivation and regeneration, some examples of heterogeneous catalysis used in synthesis of drugs.

c) Homogenous catalysis, hydrogenation, hydroformylation, hydrocyanation, Wilkinson's catalysts, chiral ligands and chiral induction, Ziegler-Natta catalysts, some examples of homogenous catalysis used in synthesis of drugs

d) Transition-metal and Organo-catalysis in organic synthesis: Metal- catalyzed reactions

e) Biocatalysis: Use of enzymes in organic synthesis, immobilized enzymes/cells in organic reaction.

f) Phase transfer catalysis - theory and applications

5. Stereochemistry & Asymmetric Synthesis 12 Hrs

a) Basic concepts in stereochemistry – optical activity, specific rotation, racemates and resolution of racemates, the Cahn, Ingold, Prelog (CIP) sequence rule, meso compounds, pseudo asymmetric centres, axes of symmetry, Fischers D and L notation, cis-trans isomerism, E and Z notation.

b) Methods of asymmetric synthesis using chiral pool, chiral auxiliaries and catalytic asymmetric synthesis, enantiopure separation and Stereoselective synthesis with examples.

REFERENCES

1. "Advanced Organic chemistry, Reaction, mechanisms and structure", J March, John Wiley and sons, New York.
2. "Mechanism and structure in organic chemistry", ES Gould, Hold Rinchart and Winston,NewYork.
3. "Organic Chemistry" Clayden, Greeves, Warren and Woihers., Oxford University Press

2001. 4. “Organic Chemistry” Vol I and II. I.L. Finar. ELBS, Sixth ed., 1995.
4. Carey, Organic chemistry, 5th edition (Viva Books Pvt. Ltd.)
5. Organic synthesis-the disconnection approach, S. Warren, Wily India
6. Principles of organic synthesis, ROCNorman and JMCoxan, Nelson thorns
7. Organic synthesis- Special techniques VK Ahluwalia and R Aggarwal, Narosa Publishers.
8. Organic reaction mechanisms IV edn, VK Ahluwalia and RK Parashar, Narosa Publishers.

COMPUTER AIDED DRUG DESIGN (MPC 203T)

Scope

The subject is designed to impart knowledge on the current state of the art techniques involved in computer assisted drug design.

Objectives

At completion of this course it is expected that students will be able to understand

- Role of CADD in drug discovery
- Different CADD techniques and their applications
- Various strategies to design and develop new drug like molecules.
- Working with molecular modeling softwares to design new drug molecules
- The *in silico* virtual screening protocols

Theory **60 Hrs**

1. Introduction to Computer Aided Drug Design (CADD) **12 Hrs**

History, different techniques and applications.

Quantitative Structure Activity Relationships: Basics History and development of QSAR: Physicochemical parameters and methods to calculate physicochemical parameters: Hammett equation and electronic parameters (sigma), lipophilicity effects and parameters (log P, pi-substituent constant), steric effects (Taft steric and MR parameters) Experimental and theoretical approaches for the determination of these physicochemical parameters.

2. **Quantitative Structure Activity Relationships**: **12 Hrs**

Applications, Hansch analysis, Free Wilson analysis and relationship between them, Advantages and disadvantages. Derivation of 2D-QSAR equations.

3D-QSAR approaches and contour map analysis.

Statistical methods used in QSAR analysis and importance of statistical parameters.

3. Molecular Modeling and Docking **12 Hrs**

a. Molecular and Quantum Mechanics in drug design.
b. Energy Minimization Methods, comparison between global minimum conformation and bioactive conformation
c. Molecular docking and drug receptor interactions: Rigid docking, flexible docking and extra-precision docking. Agents acting on enzymes such as DHFR, HMG-CoA reductase and HIV protease, choline esterase (AchE & BchE)

4. Molecular Properties and Drug Design **12 Hrs**

a) Prediction and analysis of ADMET properties of new molecules and its importance in drug design.
b) *De novo* drug design: Receptor/enzyme-interaction and its analysis, Receptor/enzyme cavity size prediction, prediction of the functional components of cavities, Fragment

based drug design.

c) Homology modeling and generation of 3D-structure of protein.

5. **Pharmacophore Mapping and Virtual Screening** **12 Hrs**

Concept of pharmacophore, pharmacophore mapping, identification of Pharmacophore features and Pharmacophore modeling; Conformational search used in pharmacophore mapping.

In Silico Drug Design and Virtual Screening Techniques. Similarity based methods and Pharmacophore based screening, structure based *in silico* virtual screening protocols.

REFERENCES

1. Computational and structural approaches to drug discovery, Robert M Stroud and Janet. F Moore, RCS Publishers.
2. Introduction to Quantitative Drug Design by Y.C. Martin, CRC Press, Taylor & Francis group.
3. Drug Design by Ariens Volume 1 to 10, Academic Press, 1975, Elsevier Publishers.
4. Principles of Drug Design by Smith and Williams, CRC Press, Taylor & Francis.
5. The Organic Chemistry of the Drug Design and Drug action by Richard B. Silverman, Elsevier Publishers.
6. Medicinal Chemistry by Burger, Wiley Publishing Co.
7. An Introduction to Medicinal Chemistry –Graham L. Patrick, Oxford University Press.
8. Wilson and Gisvold's Text book of Organic Medicinal and Pharmaceutical Chemistry, Lippincott Williams & Wilkins.
9. Comprehensive Medicinal Chemistry – Corwin and Hansch, Pergamon Publishers.
10. Computational and structural approaches to drug design edited by Robert M Stroud and Janet. F Moore

PHARMACEUTICAL PROCESS CHEMISTRY (MPC 204T)

Scope

Process chemistry is often described as scale up reactions, taking them from small quantities created in the research lab to the larger quantities that are needed for further testing and then to even larger quantities required for commercial production. The goal of a process chemist is to develop synthetic routes that are safe, cost-effective, environmentally friendly, and efficient. The subject is designed to impart knowledge on the development and optimization of a synthetic route/s and the pilot plant procedure for the manufacture of Active Pharmaceutical Ingredients (APIs) and new chemical entities (NCEs) for the drug development phase.

Objectives

At completion of this course it is expected that students will be able to understand

- The strategies of scale up process of apis and intermediates

- The various unit operations and various reactions in process chemistry

THEORY **60 Hrs**

1. Process chemistry

Introduction, Synthetic strategy **12 Hrs**

Stages of scale up process: Bench, pilot and large scale process. In-process control and validation of large scale process. Case studies of some scale up process of APIs. Impurities in API, types and their sources including genotoxic impurities

2. Unit operations **12 Hrs**

a) Extraction: Liquid equilibria, extraction with reflux, extraction with agitation, counter current extraction. b) Filtration: Theory of filtration, pressure and vacuum filtration, centrifugal filtration, c) Distillation: azeotropic and steam distillation

d) Evaporation: Types of evaporators, factors affecting evaporation. e) Crystallization: Crystallization from aqueous, non- aqueous solutions factors affecting crystallization, nucleation. Principle and general methods of preparation of polymorphs, hydrates, solvates and amorphous APIs.

3. Unit Processes - I **12 Hrs**

1. Nitration: Nitrating agents, Aromatic nitration, kinetics and mechanism of aromatic nitration, process equipment for technical nitration, mixed acid for nitration,
2. Halogenation: Kinetics of halogenations, types of halogenations, catalytic halogenations. Case study on industrial halogenation process.
3. Oxidation: Introduction, types of oxidative reactions, Liquid phase oxidation with oxidizing agents. Non-metallic oxidizing agents such as H_2O_2, sodium hypochlorite, Oxygen gas and ozonolysis.

4. Unit Processes - II **12 Hrs**

a) Reduction: Catalytic hydrogenation, Heterogeneous and homogeneous catalyst; Hydrogen transfer reactions, Metal hydrides. Case study on industrial reduction process.

b) Fermentation: Aerobic and anaerobic fermentation. Production of

i. Antibiotics; Penicillin and Streptomycin,
ii. Vitamins: B2 and B12
iii. Statins: Lovastatin, Simvastatin

c) Reaction progress kinetic analysis

i. Streamlining reaction steps, route selection,
ii. Characteristics of expedient routes, characteristics of cost- effective routes, reagent selection, families of reagents useful for scale-up.

5. Industrial Safety **12 Hrs**

a) MSDS (Material Safety Data Sheet), hazard labels of chemicals and Personal

Protection Equipment (PPE)

b) Fire hazards, types of fire & fire extinguishers
c) Occupational Health & Safety Assessment Series 1800 (OHSAS-1800) and ISO-14001(Environmental Management System), Effluents and its management.

REFERENCES

1. Process Chemistry in the Pharmaceutical Industry: Challenges in an Ever- Changing Climate-An Overview; K. Gadamasetti, CRC Press.
2. Pharmaceutical Manufacturing Encyclopedia, 3rd edition, Volume 2.
3. Medicinal Chemistry by Burger, 6th edition, Volume 1-8.
4. W.L. McCabe, J.C Smith, Peter Harriott. Unit operations of chemical engineering, 7th edition, McGraw Hill
5. Polymorphism in Pharmaceutical Solids .Dekker Series Volume 95 Ed: H G Brittain (1999)
6. Regina M. Murphy: Introduction to Chemical Processes: Principles, Analysis, Synthesis
7. Peter J. Harrington: Pharmaceutical Process Chemistry for Synthesis: Rethinking the Routes to Scale-Up
8. P.H.Groggins: Unit processes in organic synthesis (MGH)
9. F.A.Henglein: Chemical Technology (Pergamon)
10. M.Gopal: Dryden's Outlines of Chemical Technology, WEP East-West Press
11. Clausen,Mattson: Principle of Industrial Chemistry, Wiley Publishing Co.,
12. Lowenheim & M.K. Moran: Industrial Chemicals
13. S.D. Shukla & G.N. Pandey: A text book of Chemical Technology Vol. II, Vikas Publishing House
14. J.K. Stille: Industrial Organic Chemistry (PH)
15. Shreve: Chemical Process Mc Grawhill, .
16. B.K.Sharma: Industrial Chemistry, Goel Publishing House
17. ICH Guidelines
18. United States Food and Drug Administration official website www.fda.gov

PHARMACEUTICAL CHEMISTRY PRACTICALS – II (MPC 205P)

1. Synthesis of organic compounds by adapting different approaches involving (3 experiments)
    i. Oxidation
    ii. Reduction/hydrogenation
    iii. Nitration
2. Comparative study of synthesis of APIs/intermediates by different synthetic routes (2 experiments)

3. Assignments on regulatory requirements in API (2 experiments)
4. Comparison of absorption spectra by UV and Wood ward – Fieser rule
5. Interpretation of organic compounds by FT-IR
6. Interpretation of organic compounds by NMR
7. Interpretation of organic compounds by MS
8. Determination of purity by DSC in pharmaceuticals
9. Identification of organic compounds using FT-IR, NMR, CNMR and Mass spectra
10. To carry out the preparation of following organic compounds
11. Preparation of 4-chlorobenzhydrylpiperazine. (an intermediate for cetirizine HCl).
12. Preparation of 4-iodotolene from p-toluidine.
13. $NaBH_4$ reduction of vanillin to vanillyl alcohol
14. Preparation of umbelliferone by Pechhman reaction
15. Preparation of triphenyl imidazole
16. To perform the Microwave irradiated reactions of synthetic importance (Any two)
17. Determination of log P, MR, hydrogen bond donors and acceptors of selected drugs using softwares
18. Calculation of ADMET properties of drug molecules and its analysis using softwares Pharmacophore modeling
19. 2D-QSAR based experiments
20. 3D-QSAR based experiments
21. Docking study based experiment
22. Virtual screening based experiment

RESEARCH METHODOLOGY & BIOSTATISTICS (MRM 301T)

UNIT – I

General Research Methodology: Research, objective, requirements, practical difficulties, types of research, scientific methods of research, types of studies, study design.
Review of literature - Sources of information. Searching of library documents and databases online and offline (Pubmed, Biological abstracts, other databases in pharmaceutical sciences). Introduction to internet searching using advanced search tools.

UNIT – II

Collection and analysis of data: Types of data and data collection techniques, processing of data, coding, tabulation and analysis of data.
Biostatistics: Definition, application, sample size, importance of sample size, factors influencing sample size, dropouts, statistical tests of significance, type of significance tests, parametric tests (Student's t-test, ANOVA, Correlation coefficient, regression), non-parametric tests (Wilcoxan rank tests, analysis of variance, correlation, Chi square test), null hypothesis, P values, degree of freedom, interpretation of P values, different software for statistical analysis.

UNIT – III

Medical Research: History, values in medical ethics, strategies to eliminate errors/bias, controls, randomisation, cross over design, placebo, blinding techniques autonomy, beneficence, non-maleficence, double effect, conflicts between autonomy and beneficence/non-maleficence, euthanasia, informed consent, confidentiality, criticisms of orthodox medical ethics, importance of communication, control resolution, guidelines, ethics committees, cultural concerns, truth telling, online business practices, conflicts of interest, vendor relationships, treatment of family members.

UNIT – IV

CPCSEA guidelines for laboratory animal facility: Goals, location of animal facilities to laboratories, anaesthesia, euthanasia, physical facilities, environment, animal husbandry, record keeping, SOPs, personnel and training, transport of lab animals.

UNIT – V

Technical writing, thesis/research report writing, structure of thesis, editing and formatting, reference citations, abstracting, plagiarism and paraphrasing, tools for writing good research report.

UNIT – VI

Research reporting - poster presentation, seminar and conference presentation, publishing in journals, copyright.

REFERENCES:

Atiya Khanum Irfan Ali Khan , Biostatistics for Pharmacy, 2nd Edition , 2007, Ukaaz Publications, Hyderabad

C. George Thomas . Research Methodology and Scientific Writing First edition, 2016, Ane Books Pvt. Ltd.;New Delhi,

C. R Kothari. Research Methodology: Methods and Techniques. New Age International (P) Ltd, Publishers. New Delhi

Mahajan, B.K. Methods in Biostatistics. For Medical Students and Research workers, 7th edition 2008 Jaypee Brothers

Putul Mahanta , Medical Writing: A Guide for Medicos, Educators and Researchers Jaypee Brothers Medical Publishers; First edition (2018)

Ranjan Das . Biomedical Research Methodology :Iincluding Biostatistical Applications. 1st Edn . Jaypee Brothers

Ranjit Kumar, Research Methodology: A Step-by-Step Guide for Beginners, 3rd Edition 2011, Sage Publications India Pvt. Ltd. , New Delhi

Sharma Suresh.Research Methodology and Biostatistics. A Comprehensive Guide for Health Care Professionals. 1st Edn . Elsevier India

Sunder Rao. P.S.S and Richard, J. An introduction to Biostatistics: A manual for students in health sciences. Prentice-Hall of India Pvt.Ltd Publishers

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KERALA UNIVERSITY OF HEALTH SCIENCES
Thrissur - 680596

SYLLABUS

POST GRADUATE COURSE IN PHARMACY
Master of Pharmacy (M.Pharm.)

PHARMACEUTICS	MPH
KUHS Course Code	276

(2019-20 Academic year onwards)

2019

Course of study for M.Pharm. I & II Semester

MPH	PHARMACEUTICS				
Course Code	**Course**	**Credit Hours**	**Credit Points**	**Hrs./wk**	**Marks**
Semester I					
MPT101T	Modern Pharmaceutical Analytical Techniques	4	4	4	100
MPH 102T	Drug Delivery Systems	4	4	4	100
MPH 103T	Modern Pharmaceutics	4	4	4	100
MPH 104T	Regulatory Affairs	4	4	4	100
MPH105P	Pharmaceutics Practical I	12	6	12	150
-	Seminar/Assignment	7	4	7	100
Total		**35**	**26**	**35**	**650**
Semester II					
MPH 201T	Molecular Pharmaceutics (Nano Tech and Targeted DDS)	4	4	4	100
MPH 202T	Advanced Biopharmaceutics &Pharmacokinetics	4	4	4	100
MPH 203T	Computer Aided Drug Development	4	4	4	100
MPH 204T	Cosmetics and Cosmeceuticals	4	4	4	100
MPH205P	Pharmaceutics Practical II	12	6	12	150
-	Seminar /Assignment	7	4	7	100
Total		**35**	**26**	**35**	**650**

Course of study for M. Pharm. III & IV Semester

Course Code	**Course**	**Credit Hours**	**Credit Points**	**Marks**
Semester III				
MRM 301T	Research Methodology and Biostatistics	4	4	100
-	Journal Club	1	1	25
-	Discussion / Presentation(proposal presentation)	2	2	25
-	Research Work	28	14	350
Total		**35**	**21**	**500**
Semester IV				
-	Journal Club	1	1	25
-	Presubmission Discussion / Presentation	3	3	75
-	Research Work	31	16	400
Total		**35**	**20**	**500**

PHARMACEUTICS (MPH)

MODERN PHARMACEUTICAL ANALYTICAL TECHNIQUES (MPT 101T)

SCOPE

This subject deals with various advanced analytical instrumental techniques for identification, characterization and quantification of drugs. Instruments dealt are NMR, Mass spectrometer, IR, HPLC, GC etc.

OBJECTIVES

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

- Chemicals and excipients
- The analysis of various drugs in single and combination dosage forms
- Theoretical and practical skills for handling of the instruments

THEORY **60 Hrs**

1. a. UV-Visible spectroscopy: Introduction, Theory, Laws, Instrumentation 10 Hrs associated with UV-Visible spectroscopy, Choice of solvents and solvent effectand Applications of UV-Visible spectroscopy, Difference/ Derivative spectroscopy.

b. IR spectroscopy: Theory, Modes of Molecular vibrations, Sample handling, Instrumentation of Dispersive and Fourier - Transform IR Spectrometer, Factorsaffecting vibrational frequencies and Applications of IR spectroscopy, Data Interpretation.

c. Spectroflourimetry: Theory of Fluorescence, Factors affecting fluorescence (Characteristics of drugs that can be analysed by flourimetry), Quenchers,Instrumentation and Applications of fluorescence spectrophotometer.

d. Flame emission spectroscopy and Atomic absorption spectroscopy: Principle, Instrumentation, Interferences and Applications.

2. NMR spectroscopy: Principle, Instrumentation, 10 Hrs Solvent requirement in NMR, Relaxation process, NMR signals in various compounds, Chemical shift, Factors influencing chemical shift, Spin-Spin coupling, Coupling constant, Nuclear magnetic double resonance, Briefoutline of principles of FT-NMR and 13C NMR. Applications of NMRspectroscopy.

3. Mass Spectroscopy: Principle, Theory, Instrumentation of Mass Spectroscopy, 9 Hrs Different types of ionization like electron impact, chemical, field, FAB andMALDI, APCI, ESI, APPI Analyzers of Quadrupole and Time of Flight, Massfragmentation and its rules, Meta stable ions, Isotopic peaks and Applications ofMass spectroscopy.

4. Chromatography: Principle, apparatus, instrumentation, chromatographic 9 Hrs parameters, factors affecting resolution, isolation of drug from excipients, datainterpretation and applications of the following:

a) Thin Layer chromatography
b) High Performance Thin Layer Chromatography
c) Ion exchange chromatography
d) Column chromatography
e) Gas chromatography
f) High Performance Liquid chromatography
g) Ultra High Performance Liquid chromatography
h) Affinity chromatography
i) Gel Chromatography

5. a.Electrophoresis: Principle, Instrumentation, Working conditions, factors 9 Hrs affecting separation and applications of the following:

i) Paper electrophoresis ii) Gel electrophoresis iii) Capillary electrophoresis iv)Zone electrophoresis v) Moving boundary electrophoresis vi) Iso electric focusing

b)X ray Crystallography: Production of X rays, Different X ray methods, Bragg'slaw, Rotating crystal technique, X ray powder technique, Types of crystals andapplications of X-ray diffraction.

6. a. Potentiometry: Principle, working, Ion selective Electrodes and Application of potentiometry. 9 Hrs

b. Thermal Techniques: i) Differential scanning calorimetry (DSC): Principle, thermal transitions and Instrumentation (Heat flux and power-compensation and designs), Modulated DSC, Hyper DSC, experimental parameters (sample preparation, experimental conditions, calibration, heating and cooling rates, resolution, source of errors) and their influence, advantage and disadvantages, pharmaceutical applications.

ii)Differential Thermal Analysis (DTA): Principle, instrumentation and advantageand disadvantages, pharmaceutical applications, derivative differential thermalanalysis (DDTA).

iii)Thermo Gravimetric Analysis (TGA): Principle, instrumentation, factors affecting results, advantage and disadvantages, pharmaceutical applications.

7. Immunological assays: RIA (Radio immuno assay), ELISA, Bioluminescence assays. 4 Hrs

REFERENCES

1. Spectrometric Identification of Organic compounds - Robert M Silverstein, 6th Edition, John Wiley& Sons, 2004.
2. Principles of Instrumental Analysis - Douglas A Skoog, F. James Holler, Timothy A. Nieman, 5th Edition, Eastern Press, Bangalore, 1998.
3. Instrumental Methods of Analysis - Willards, 7th Edition, CBS publishers.
4. Practical Pharmaceutical Chemistry - Beckett and Stenlake, Vol II, 4th Edition, CBS Publishers, New Delhi, 1997.
5. Organic Spectroscopy - William Kemp, 3rd Edition, ELBS, 1991.
6. Quantitative Analysis of Drugs in Pharmaceutical formulation - P.D. Sethi, 3rd Edition, CBS Publishers, New Delhi, 1997.
7. Pharmaceutical Analysis-Modern Methods-Part B-J.W. Munson, Vol 11, Marcel Dekker Series.
8. Spectroscopy of Organic Compounds, 2nd Edition, P.S. Kalsi, Wiley Eastern Ltd, Delhi.
9. Textbook of Pharmaceutical Analysis, K.A. Connors, 3rd Edition, John Wiley & Sons, 1982.

DRUG DELIVERY SYSTEMS (MPH 102T)

SCOPE

This course is designed to impart knowledge on the area of advances in novel drug delivery systems.

OBJECTIVES

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

- The various approaches for development of novel drug delivery systems.
- The criteria for selection of drugs and polymers for the development of delivering system
- The formulation and evaluation of Novel drug delivery systems..

THEORY 60 Hrs

1. SustainedRelease(SR)and ControlledRelease(CR)formulations:Introduction&basic concepts, advantages/ disadvantages, factors influencing, Physicochemical&biologicalapproachesforSR/CRformulation,Mechanismof DrugDeliveryfromSR/CRformulation.Polymers:introduction,definition, classification, properties and application Dosage Forms for Personalized Medicine:Introduction,Definition,Pharmacogenetics,CategoriesofPatientsfor Personalized Medicines: Customized drug delivery systems, Bioelectronic Medicines,3Dprintingofpharmaceuticals,Telepharmacy. 10 Hrs
2. Rate Controlled Drug Delivery Systems: Principles &Fundamentals, Types, Activation; Modulated Drug Delivery Systems;Mechanically activated,pH activated, Enzyme activated, and Osmotic activated Drug Delivery Systems FeedbackregulatedDrugDeliverySystems;Principles&Fundamentals. 10 Hrs
3. Gastro-Retentive Drug Delivery Systems: Principle, concepts advantagesand disadvantages,ModulationofGItransittimeapproachestoextendGItransit. Buccal Drug Delivery Systems: Principle of mucoadhesion, advantages and disadvantages,Mechanismofdrugpermeation,Methodsofformulationandits evaluations. 10 Hrs
4. Ocular Drug Delivery Systems: Barriers of drug permeation, Methods to overcome barriers. 06 Hrs
5. TransdermalDrugDeliverySystems:Structureofskinandbarriers, Penetrationenhancers, Transdermal Drug Delivery Systems, Formulation and evaluation. 10 Hrs
6. ProteinandPeptideDelivery:Barriersforproteindelivery.Formulationand Evaluationofdeliverysystemsofproteinsandothermacromolecules. 08 Hrs
7. Vaccine delivery systems: Vaccines, uptake of antigens, single shot vaccines, mucosal and transdermal delivery of vaccines.06 Hrs

REFERENCES

- Y W. Chien, Novel Drug Delivery Systems, 2nd edition, revised and expanded, Marcel Dekker, Inc., New York, 1992.
- Robinson, J. R., Lee V. H. L, Controlled Drug Delivery Systems, Marcel Dekker,Inc., New York, 1992.
- Encyclopedia of controlled delivery, Editor- Edith Mathiowitz, Published by WileyInterscience Publication, John Wiley and Sons, Inc, New York!Chichester/Weinheim
- N.K. Jain, Controlled and Novel Drug Delivery, CBS Publishers & Distributors, New Delhi, First edition 1997 (reprint in 2001).
- S.P.Vyas and R.K.Khar, Controlled Drug Delivery - concepts and advances, VallabhPrakashan, New Delhi, First edition 2002

JOURNALS

- Indian Journal of Pharmaceutical Sciences (IPA)
- Indian drugs (IDMA)
- Journal of controlled release (Elsevier Sciences) desirable
- Drug Development and Industrial Pharmacy (Marcel & Decker) desirable

MODERN PHARMACEUTICS (MPH 103T)

SCOPE

Course designed to impart advanced knowledge and skills required to learn various aspects and concepts at pharmaceutical industries

OBJECTIVES

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

- The elements of preformulation studies.
- The Active Pharmaceutical Ingredients and Generic drug Product development
- Industrial Management and GMP Considerations.
- Optimization Techniques & Pilot Plant Scale Up Techniques
- Stability Testing, sterilization process & packaging of dosage forms.

THEORY 60 HRS

1. PreformationConcepts–DrugExcipientinteractions-differentmethods, Kineticsofstability,Stabilitytesting.Theoriesofdispersionandpharmaceutical Dispersion(EmulsionandSuspension,SMEDDS)preparationandstabilityLarge andsmallvolumeparental–physiologicalandformulationconsideration, Manufacturing andevaluation.

Optimization techniques in Pharmaceutical Formulation:Concept and parameters of optimization, Optimization techniques in pharmaceutical formulationandprocessing.Statisticaldesign,Responsesurfacemethod, Contourdesigns,Factorialdesignsandapplicationinformulation 10Hrs

2. Validation: Introduction to Pharmaceutical Validation, Scope &merits of Validation,ValidationandcalibrationofMasterplan,ICH&WHOguidelinesfor calibration and validation of equipments, Validation of specific dosage form, Typesofvalidation.Governmentregulation,ManufacturingProcessModel,URS, DQ,IQ,OQ&P.Q.offacilities. 10 Hrs

3. cGMP&Industrial Management: Objectives and policies of current good manufacturing practices, layout of buildings, services, equipments and their maintenanceProductionmanagement:Production organization, materialsmanagement, handling and transportation, inventory management and control, production and planning control, Sales forecasting, budget and cost control,industrialandpersonalrelationship.ConceptofTotalQualityManagement. 10 Hrs

4. Compression and compaction: Physics of tablet compression, compression, consolidation,effectoffriction,distributionofforces,compactionprofiles. Solubility. 10 Hrs

5. Study of consolidation parameters; Diffusion parameters,Dissolution parametersandPharmacokineticparameters,Heckelplots,Similarityfactors– f2andf1,HiguchiandPeppasplot,LinearityConceptofsignificance,Standarddeviation , Chi square test, students T-test , ANOVA test. 10 Hrs

REFERENCES

- Theory and Practice of Industrial Pharmacy ByLachmann and Libermann
- Pharmaceutical dosage forms: Tablets Vol. 1-3 by Leon Lachmann.
- Pharmaceutical Dosage forms: Disperse systems, Vol, 1-2; By Leon Lachmann.
- Pharmaceutical Dosage forms: Parenteral medications Vol. 1-2; By Leon Lachmann.

- Modern Pharmaceutics; By Gillbert and S. Banker.
- Remington's Pharmaceutical Sciences.
- Advances in Pharmaceutical Sciences Vol. 1-5; By H.S. Bean &A.H.Beckett.
- Physical Pharmacy; By Alfred martin
- Bentley's Textbook of Pharmaceutics – by Rawlins.
- Good manufacturing practices for Pharmaceuticals: A plan for total quality control, Second edition; By Sidney H. Willig.
- Quality Assurance Guide; By Organization of Pharmaceutical producers of India.
- Drug formulation manual; By D.P.S. Kohli and D.H.Shah. Eastern publishers, New Delhi.
- How to practice GMPs; By P.P.Sharma. Vandhana Publications, Agra.
- Pharmaceutical Process Validation; By Fra. R. Berry and Robert A. Nash.
- Pharmaceutical Preformulations; By J.J. Wells.
- Applied production and operations management; By Evans, Anderson, Sweeney and Williams.
- Encyclopaedia of Pharmaceutical technology, Vol I – III.

REGULATORY AFFAIRS (MPH 104T)

SCOPE

Course designed to impart advanced knowledge and skills required to learn the concept of generic drug and their development, various regulatory filings in different countries, different phases of clinical trials and submitting regulatory documents: filing process of IND, NDA and ANDA

- To know the approval process of
- To know the chemistry, manufacturing controls and their regulatory importance
- To learn the documentation requirements for
- To learn the importance and

OBJECTIVES:

Upon completion of the course, it is expected that the students will be able to understand

- The Concepts of innovator and generic drugs, drug development process
- The Regulatory guidance's and guidelines for filing and approval process
- Preparation of Dossiers and their submission to regulatory agencies in different countries.
- Post approval regulatory requirements for actives and drug products
- Submission of global documents in CTD/ eCTD formats
- Clinical trials requirements for approvals for conducting clinical trials
- Pharmacovigilence and process of monitoring in clinical trials.

THEORY 60 Hrs

1. DocumentationinPharmaceuticalindustry:Masterformularecord,DMF(Drug Master File), distribution records. Generic drugs product development Introduction,Hatch-Waxmanactandamendments,CFR(Code of Federal Regulation),drug product performance, in-vitro, ANDA regulatoryapproval

process,NDAapprovalprocess,BEanddrugproductassessment,in–vivo,scale upprocessapprovalchanges,postmarketingsurveillance,outsourcingBAand BE toCRO. Regulatoryrequirementforproductapproval:API,biologics,novel,therapies obtainingNDA,ANDAforgenericdrugswaysandmeansofUSregistrationfor foreigndrugs 12Hrs

2. CMC,postapprovalregulatoryaffairs.RegulationforcombinationproductsandMedicaldevices.CTDa ndECTDformat,industryandFDAliaison.ICH-Guidelines of ICH-Q, S, E, M. Regulatory requirements of EU, MHRA, TGA and ROW countries. 12 Hrs

3. Non clinical drug development: Global submission of IND, NDA, ANDA. Investigational medicinal products dossier (IMPD) and investigator brochure (IB). 12 Hrs

4. Clinical trials: Developing clinical trial protocols. Institutional review board/ independentethicscommitteeFormulationandworkingproceduresinformed Consentprocessandprocedures.HIPAA-new,requirementtoclinicalstudyprocess, pharmacovigilance safety monitoring in clinical trials 12 Hrs

REFERENCES

- Generic Drug Product Development, Solid Oral Dosage forms, Leon Shargel and IsaderKaufer,Marcel Dekker series, Vol.143
- The Pharmaceutical Regulatory Process, Second Edition Edited by Ira R. Berry and Robert P.Martin, Drugs and the Pharmaceutical Sciences,Vol.185, Informa Health care Publishers.
- New Drug Approval Process: Accelerating Global Registrations By Richard A Guarino, MD,5th edition, Drugs and the Pharmaceutical Sciences,Vol.190.
- Guidebook for drug regulatory submissions / Sandy Weinberg. By John Wiley &Sons.Inc.
- FDA regulatory affairs: a guide for prescription drugs, medical devices, and biologics/edited By Douglas J. Pisano, David Mantus.
- Clinical Trials and Human Research: A Practical Guide to Regulatory Compliance By Fay A.Rozovsky and Rodney K. Adams
- www.ich.org/
- www.fda.gov/
- europa.eu/index_en.htm
- https://www.tga.gov.au/tga-basics

PHARMACEUTICS PRACTICALS - I (MPH 105P)

- Analysis of pharmacopoeial compounds and their formulations by UV Vis spectrophotometer
- Simultaneous estimation of multi component containing formulations by UV spectrophotometry.
- Experiments based on HPLC
- Experiments based on Gas Chromatography
- Estimation of riboflavin/quinine sulphate by fluorimetry
- Estimation of sodium/potassium by flame photometry
- To perform In-vitro dissolution profile of CR/ SR marketed formulation
- Formulation and evaluation of sustained release matrix tablets

- Formulation and evaluation osmotically controlled DDS
- Preparation and evaluation of Floating DDS- hydro dynamically balanced DDS
- Formulation and evaluation of Muco adhesive tablets.
- Formulation and evaluation of transdermal patches.
- To carry out preformulation studies of tablets.
- To study the effect of compressional force on tablets disintegration time.
- To study Micromeritic properties of powders and granulation.
- To study the effect of particle size on dissolution of a tablet.
- To study the effect of binders on dissolution of a tablet.
- To plot Heckal plot, Higuchi and Peppas plot and determine similarity factors.

MOLECULAR PHARMACEUTICS (NANOTECHNOLOGY & TARGETED DRUG DELIVERY SYSTEMS) (MPH 201T)

SCOPE

This course is designed to impart knowledge on the area of advances in novel drug delivery systems.

OBJECTIVES

Upon completion of the course student shall be able to understand

- The various approaches for development of novel drug delivery systems.
- The criteria for selection of drugs and polymers for the development of NTDS
- The formulation and evaluation of novel drug delivery systems.

THEORY 60 Hrs

1. TargetedDrugDeliverySystems:Concepts,Eventsandbiologicalprocessinvolved in drug targeting. Tumor targeting and Brain specific delivery. 12 Hrs
2. Targeting Methods: introduction preparation and evaluation. Nano Particles &Liposomes: Types, preparation and evaluation. 12 Hrs
3. Micro Capsules / Micro Spheres: Types, preparation and evaluation , Monoclonal Antibodies ; preparation and application, preparation and application of Niosomes, Aquasomes, Phytosomes, Electrosomes. 12 Hrs
4. Pulmonary Drug Delivery Systems: Aerosols, propellents, ContainersTypes, preparation and evaluation, Intra Nasal Route Delivery systems; Types, preparation and evaluation. 12 Hrs
5. Nucleicacidbasedtherapeuticdeliverysystem:Genetherapy,introduction(ex- vivo &in-vivo gene therapy). Potential target diseases for gene therapy (inherited disorder and cancer). Gene expression systems (viral and nonviralgenetransfer).Liposomalgenedeliverysystems. Biodistribution and Pharmacokinetics. Knowledge of therapeutic antisense molecules and aptamers as drugs of future. 12 Hrs

REFERENCES

- Y W. Chien, Novel Drug Delivery Systems, 2nd edition, revised and expanded,Marcel Dekker, Inc., New York, 1992.
- S.P.Vyas and R.K.Khar, Controlled Drug Delivery - concepts and advances VallabhPrakashan New Delhi First edition 2002.

• N.K. Jain, Controlled and Novel Drug Delivery, CBS Publishers & Distributors, NewDelhi, First edition 1997 (reprint in 2001).

ADVANCED BIOPHARMACEUTICS & PHARMACOKINETICS (MPH 202T)

SCOPE

This course is designed to impart knowledge and skills necessary for dose calculations, dose adjustments and to apply biopharmaceutics theories in practical problem solving. Basic theoretical discussions of the principles of biopharmaceutics and pharmacokinetics are provided to help the students' to clarify the concepts.

OBJECTIVES

Upon completion of this course it is expected that students will be able understand,

- The basic concepts in biopharmaceutics and pharmacokinetics.
- The use raw data and derive the pharmacokinetic models and parameters the best describe the process of drug absorption, distribution, metabolism and elimination.
- The critical evaluation of biopharmaceutical studies involving drug product equivalency.
- The design and evaluation of dosage regimens of the drugs using pharmacokinetic and biopharmaceutical parameters.
- The potential clinical pharmacokinetic problems and application of basics of pharmacokinetics

THEORY 60 Hrs

1. Drug Absorption from the Gastrointestinal Tract:

Gastrointestinal tract, Mechanism of drug absorption, Factors affecting drug absorption, pH–partition theory of drug absorption. Formulation and physicochemicalfactors:Dissolutionrate,Dissolutionprocess,Noyes–Whitney equation and drug dissolution, Factors affecting the dissolution rate. Gastrointestinalabsorption:roleofthedosageform:Solution(elixir,syrupand solution)asadosageform,Suspensionasadosageform,Capsuleasadosage form,Tabletasadosageform,Dissolutionmethods,Formulationandprocessing factors,Correlationofinvivodatawithinvitrodissolutiondata.Transport model:Permeability-Solubility-Charge State and the pH Partition Hypothesis, PropertiesoftheGastrointestinalTract(GIT),pHMicroclimateIntracellularpH Environment, Tight-JunctionComplex. 12 Hrs

2. Biopharmaceutical considerations in drug product design and In Vitro Drug Product Performance: Introduction, biopharmaceutical factors affecting drugbioavailability,rate-limitingstepsindrugabsorption,physicochemicalnatureofthe drug formulation factors affecting drug product performance,in vitro:dissolutionanddrugreleasetesting, compendia methodsofdissolution, alternative methods of dissolution testing,meeting dissolution requirements,problemsofvariablecontrolindissolutiontestingperformanceof drugproducts.Invitro–

invivocorrelation,dissolutionprofilecomparisons,drug productstability,considerationsinthedesignofadrugproduct.

3. Pharmacokinetics: Basic considerations, pharmacokinetic models, compartment modeling:onecompartmentmodel-IVbolus,IVinfusion,extra-vascular.Multi compartment model:two compartment - model in brief, non-linear pharmacokinetics: cause of non-linearity, Michaelis – Menten equation, estimationofkmaxandvmax.Druginteractions:introduction,theeffectof protein- binding interactions,the effect of tissue-binding interactions,cytochrome p450-based drug interactions,drug interactions linked totransporters. 12 Hrs

4. Drug Product Performance, In Vivo: Bioavailability and Bioequivalence: drug productperformance,purposeofbioavailabilitystudies,relativeandabsolute availability. Methods for assessing bioavailability, bioequivalence studies, design andevaluationofbioequivalencestudies,studydesigns,crossoverstudy designs,evaluationofthedata,bioequivalenceexample,studysubmissionand drug review process. biopharmaceutics classification system, methods. Permeability:In-vitro,in-situandIn-vivomethods. Genericbiologics(biosimilar drug products),clinical significance of bioequivalence studies, special concerns in bioavailabilityandbioequivalencestudies,genericsubstitution. 12 Hrs

5. Application of Pharmacokinetics: Modified-Release Drug Products, Targeted Drug Delivery Systems and Biotechnological Products. Introduction to Pharmacokinetics and pharmacodynamic, drug interactions. Pharmacokinetics and pharmacodynamics of biotechnology drugs. Introduction, Proteins and peptides, Monoclonal antibodies, Oligonucleotides, Vaccines (immunotherapy),Gene therapies. 12 Hrs

REFERENCES

- Biopharmaceutics and Clinical Pharmacokinetics by Milo Gibaldi,4th edition, Philadelphia, Lea and Febiger, 1991
- Biopharmaceutics and Pharmacokinetics, A. Treatise, D .M. Brahmankar and Sunil B. Jaiswal., VallabPrakashan, Pitampura, Delhi
- Applied Biopharmaceutics and Pharmacokinetics by Shargel. Land YuABC, 2nd edition, Connecticut Appleton Century Crofts, 1985
- Textbook of Biopharmaceutics and Pharmacokinetics, Dr.ShobhaRani R. Hiremath, Prism Books
- Pharmacokinetics by Milo Gibaldi and D. Perrier, 2nd edition, Marcel Dekker Inc.,New York, 1982
- Current Concepts in Pharmaceutical Sciences: Biopharmaceutics, Swarbrick. J, LeaandFebiger, Philadelphia, 1970
- Dissolution, Bioavailabilityand Bioequivalence, Abdou.H.M, Mack PublishingCompany, Pennsylvania 1989
- Biopharmaceutics and Clinical Pharmacokinetics, An Introduction, 4th edition,revised and expanded by Robert. E. Notari, Marcel Dekker Inc, New York and Basel,1987.
- Biopharmaceutics and Relevant Pharmacokinetics by John. G Wagner and M.Pemarowski, 1st edition, Drug Intelligence Publications, Hamilton, Illinois, 1971.
- Encyclopedia of Pharmaceutical Technology, Vol 13, James Swarbrick, James. G.Boylan, Marcel Dekker Inc, New York, 1996.
- Basic Pharmacokinetics, 1st edition,Sunil S JambhekarandPhilip J Breen,pharmaceutical press, RPS Publishing,2009.

- Absorption and Drug Development- Solubility, Permeability, and Charge State, Alex Avdeef, John Wiley & Sons, Inc,2003.

COMPUTER AIDED DRUG DEVELOPMENT (MPH 203T)

SCOPE

This course is designed to impart knowledge and skills necessary for computer Applications in pharmaceutical research and development who want to understand the application of computers across the entire drug research and development process. Basic theoretical discussions of the principles of more integrated and coherent use of computerized information (informatics) in the drug development process are provided to help the students to clarify the concepts.

OBJECTIVES

Upon completion of this course it is expected that students will be able to understand,

- History of Computers in Pharmaceutical Research and Development
- Computational Modeling of Drug Disposition
- Computers in Preclinical Development
- Optimization Techniques in Pharmaceutical Formulation
- Computers in Market Analysis
- Computers in Clinical Development
- Artificial Intelligence (AI) and Robotics
- Computational fluid dynamics(CFD)

THEORY 60 Hrs

1. ComputersinPharmaceuticalResearchandDevelopment:AGeneral Overview:HistoryofComputersinPharmaceuticalResearchandDevelopment. StatisticalmodelinginPharmaceuticalresearchanddevelopment:Descriptive versus Mechanistic Modeling, Statistical Parameters, Estimation, Confidence Regions, Nonlinearity at the Optimum, Sensitivity Analysis, OptimalDesign,Population Modeling

- Quality-by-Design In Pharmaceutical Development: Introduction, ICH Q8 guideline, Regulatory and industry views on QbD, Scientifically based QbD - examples ofapplication. 12 Hrs

2. ComputationalModeling Of Drug Disposition: Introduction,Modeling Techniques: Drug Absorption, Solubility, Intestinal Permeation, Drug Distribution,Drug Excretion, Active Transport;P-gp, BCRP, Nucleoside Transporters,hPEPT1, ASBT, OCT, OATP, BBB-Choline Transporter. 12 Hrs

3. Computer-aided formulation development: Concept of optimization, Optimization parameters, Factorial design, Optimization technology &Screening design. Computers in Pharmaceutical Formulation: Development of pharmaceutical emulsions, microemulsion drug carriers Legal Protection of Innovative Uses of Computers in R&D, The Ethics of Computing in Pharmaceutical Research, Computers in Market analysis 12Hrs

4. Computer-aided biopharmaceutical characterization: Gastrointestinal absorption simulation. Introduction, Theoretical background, Model construction,Parametersensitivityanalysis,Virtualtrial,Fedvs.fastedstate,In vitrodissolutionandinvitro-invivocorrelation,Biowaiverconsiderations

- Computer Simulations in Pharmacokinetics and Pharmacodynamics: Introduction,ComputerSimulation:WholeOrganism,IsolatedTissues,Organs, Cell, Proteins andGenes.
- Computers in Clinical Development: Clinical Data Collection and Management, Regulation of ComputerSystems 12 Hrs

5. ArtificialIntelligence(AI),RoboticsandComputationalfluiddynamics:Generaloverview, Pharmaceutical Automation, Pharmaceutical applications, Advantages and Disadvantages. Current Challenges and Future Directions. 12 Hrs

REFERENCES

- Computer Applications in Pharmaceutical Research and Development, Sean Ekins, 2006, John Wiley & Sons.
- Computer-Aided Applications in Pharmaceutical Technology, 1st Edition, JelenaDjuris, Woodhead Publishing
- Encyclopedia of Pharmaceutical Technology, Vol 13, James Swarbrick, James. G.Boylan, Marcel Dekker Inc, New York, 1996.

COSMETICS AND COSMECEUTICALS (MPH 204T)

SCOPE

This course is designed to impart knowledge and skills necessary forthefundamental need for cosmetic and cosmeceutical products.

OBJECTIVES

Upon completion of the course, the students shall be able to understand

- Key ingredients used in cosmetics and cosmeceuticals.
- Key building blocks for various formulations.
- Current technologies in the market
- Various key ingredients and basic science to develop cosmetics and cosmeceuticals
- Scientific knowledge to develop cosmetics and cosmeceuticals with desired Safety, stability, and efficacy.

THEORY 60 Hrs

1. Cosmetics– Regulatory:Definitionofcosmeticproductsasper Indianregulation.Indianregulatoryrequirementsforlabelingofcosmetics Regulatory provisionsrelatingtoimportofcosmetics,Misbrandedandspuriouscosmetics. Regulatory provisions

relating to manufacture of cosmetics – Conditions for obtaininglicense,prohibitionofmanufactureandsaleofcertaincosmetics,loan license,offencesandpenalties. 12 Hrs

2. Cosmetics-Biologicalaspects:Structureofskinrelatingtoproblemslikedry skin,acne,pigmentation,pricklyheat,wrinklesandbodyodor.Structureofhair andhairgrowthcycle.Commonproblemsassociatedwithoralcavity.Cleansing andcareneedsforface,eyelids,lips,hands,feet,nail,scalp,neck,bodyand under-arm. 12 Hrs

3. FormulationBuildingblocks:Buildingblocksfordifferentproductformulations of cosmetics/cosmeceuticals. Surfactants – Classification and application. Emollients, rheological additives:classification and application. Antimicrobial used as preservatives, their merits and demerits. Factors affecting microbial preservativeefficacy.Buildingblocksforformulationofamoisturizingcream,vanishingcream,coldcre am,shampooandtoothpaste.Soapsandsyndetbars. 12 Hrs

Perfumes;Classificationofperfumes.Perfumeingredientslistedasallergensin EU regulation.

Controversial ingredients: Parabens, formaldehyde liberators, dioxane.

4. Designofcosmeceuticalproducts:Sunprotection,sunscreensclassificationand regulatory aspects. Addressing dry skin, acne, sun-protection, pigmentation, prickly heat, wrinkles, body odor, dandruff, dental cavities, bleeding gums, mouthodorandsensitiveteeththroughcosmeceuticalformulations. 12 Hrs

5. HerbalCosmetics:Herbalingredientsusedin Haircare,skincareandoralcare. Review of guidelines for herbal cosmetics by private bodies like cosmos with respecttopreservatives,emollients,foamingagents,emulsifiersandrheologymodifiers. Challenges in formulating herbal cosmetics. 12 Hrs

REFERENCES

- Harry's Cosmeticology. 8th edition.
- Poucher'sperfumecosmeticsandSoaps,10th edition.
- Cosmetics - Formulation, Manufacture and quality control, PP.Sharma,4th edition
- Handbook of cosmetic science and Technology A.O.Barel, M.Paye and H.I. Maibach. 3rd edition
- Cosmetic and Toiletries recent suppliers' catalogue.
- CTFA directory.

PHARMACEUTICS PRACTICALS - II (MPH 205P)

- To study the effect of temperature change , non solvent addition, incompatible polymer addition in microcapsules preparation
- Preparation and evaluation of Alginate beads
- Formulation and evaluation of gelatin /albumin microspheres
- Formulation and evaluation of liposomes/niosomes
- Formulation and evaluation of spherules

- Improvement of dissolution characteristics of slightly soluble drug by Solid dispersion technique.
- Comparison of dissolution of two different marketed products /brands
- Protein binding studies of a highly protein bound drug & poorly protein bound drug
- Bioavailability studies of Paracetamol in animals.
- Pharmacokinetic and IVIVC data analysis by WinnolineR software
- In vitro cell studies for permeability and metabolism
- DoE Using Design Expert® Software
- Formulation data analysis Using Design Expert® Software
- Quality-by-Design in Pharmaceutical Development
- Computer Simulations in Pharmacokinetics and Pharmacodynamics
- Computational Modeling of Drug Disposition
- To develop Clinical Data Collection manual
- To carry out Sensitivity Analysis, and Population Modeling.
- Development and evaluation of Creams
- Development and evaluation of Shampoo and Toothpaste base
- To incorporate herbal and chemical actives to develop products
- To address Dry skin, acne, blemish, Wrinkles, bleeding gums and dandruff

RESEARCH METHODOLOGY & BIOSTATISTICS (MRM 301T)

UNIT – I

General Research Methodology: Research, objective, requirements, practical difficulties, types of research, scientific methods of research, types of studies, study design.

Review of literature - Sources of information. Searching of library documents and databases online and offline (Pubmed, Biological abstracts, other databases in pharmaceutical sciences). Introduction to internet searching using advanced search tools.

UNIT – II

Collection and analysis of data: Types of data and data collection techniques, processing of data, coding, tabulation and analysis of data.

Biostatistics: Definition, application, sample size, importance of sample size, factors influencing sample size, dropouts, statistical tests of significance, type of significance tests, parametric tests (Student's t-test, ANOVA, Correlation coefficient, regression), non-parametric tests (Wilcoxan rank tests, analysis of variance, correlation, Chi square test), null hypothesis, P values, degree of freedom, interpretation of P values, different software for statistical analysis.

UNIT – III

Medical Research: History, values in medical ethics, strategies to eliminate errors/bias, controls, randomisation, cross over design, placebo, blinding techniques autonomy, beneficence, non-maleficence, double effect, conflicts between autonomy and beneficence/non-maleficence, euthanasia, informed consent, confidentiality, criticisms of orthodox medical ethics, importance of communication, control resolution, guidelines, ethics committees, cultural concerns, truth

telling, online business practices, conflicts of interest, vendor relationships, treatment of family members.

UNIT – IV

CPCSEA guidelines for laboratory animal facility: Goals, location of animal facilities to laboratories, anaesthesia, euthanasia, physical facilities, environment, animal husbandry, record keeping, SOPs, personnel and training, transport of lab animals.

UNIT – V

Technical writing, thesis/research report writing, structure of thesis, editing and formatting, reference citations, abstracting, plagiarism and paraphrasing, tools for writing good research report.

UNIT – VI

Research reporting - poster presentation, seminar and conference presentation, publishing in journals, copyright.

REFERENCE BOOKS

AtiyaKhanum Irfan Ali Khan , Biostatistics for Pharmacy, 2nd Edition , 2007, Ukaaz Publications, Hyderabad

C. George Thomas . Research Methodology and Scientific Writing First edition, 2016, Ane Books Pvt. Ltd.;New Delhi,

C. R Kothari. Research Methodology: Methods and Techniques. New Age International (P) Ltd, Publishers. New Delhi

Mahajan, B.K. Methods in Biostatistics. For Medical Students and Research workers, 7th edition 2008 Jaypee Brothers

PutulMahanta , Medical Writing: A Guide for Medicos, Educators and Researchers Jaypee Brothers Medical Publishers; First edition (2018)

RanjanDas . Biomedical Research Methodology :IincludingBiostatistical Applications. 1st Edn .Jaypee Brothers

Ranjit Kumar, Research Methodology: A Step-by-Step Guide for Beginners, 3rd Edition 2011, Sage Publications India Pvt. Ltd. , New Delhi

Sharma Suresh.Research Methodology and Biostatistics. A Comprehensive Guide for Health Care Professionals. 1st Edn . Elsevier India

Sunder Rao. P.S.S and Richard, J. An introduction to Biostatistics: A manual for students in health sciences. Prentice-Hall of India Pvt.Ltd Publishers