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ACADEMIC REGULATIONS
COURSE STRUCTURE
AND
DETAILED SYLLABUS

For
M.PHARMACY
PHARMACOLOGY

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JAWAHARLAL NEHRU TECHNOLOGY UNIVERSITY KAKINADA

KAKINADA - 533 003, Andhra Pradesh, India

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RLD

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ACADEMIC REGULATIONS R13 FOR M. Pharmacy (REGULAR) DEGREE COURSE

Applicable for the students of M. Pharmacy (Regular) Course from the Academic Year 2013-14 onwards

The M. Pharmacy Degree of Jawaharlal Nehru Technological University Kakinada shall be conferred on candidates who are admitted to the program and who fulfil all the requirements for the award of the Degree.

1.0 ELIGIBILITY FOR ADMISSIONS

Admission to the above program shall be made subject to eligibility, qualification and specialization as prescribed by the University from time to time.

Admissions shall be made on the basis of merit/rank obtained by the candidates at the qualifying Entrance Test conducted by the University or on the basis of any other order of merit as approved by the University, subject to reservations as laid down by the Govt. from time to time.

2.0 AWARD OF M. Pharmacy DEGREE

2.1 A student shall be declared eligible for the award of the M. Pharmacy Degree, if he pursues a course of study in not less than two and not more than four academic years.

2.2 The minimum instruction days in each semester are 90.

3.0 A. COURSES OF STUDY

The following specializations are offered at present for the M. Pharmacy course of study.

S.No	Specializations
1	Industrial Pharmacy
2	Pharmaceutical Analysis
3	Pharmaceutical Analysis & Q A
4	Pharmaceutical Analysis & QC
5	Pharmaceutical Chemistry
6	Pharmaceutical Management & Regulatory Affairs
7	Pharmaceutical Technology
8	Pharmaceutics
9	Pharmacognosy
10	Pharmacology
11	Pharmacology & Toxicology
12	Pharmacy Practices
13	Quality Assurance & Regulatory Affairs

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and any other course as approved by AICTE/ PCI University from time to time.

4.0 ATTENDANCE

4.1 A student shall be eligible to write University examinations if he acquires a minimum of 75% of attendance in aggregate of all the subjects.

4.2 Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester shall be granted by the College Academic Committee.

4.3 Shortage of Attendance below 65% in aggregate shall not be condoned.

4.4 Students whose shortage of attendance is not condoned in any semester are not eligible to write their end semester examination of that class.

4.5 A prescribed fee shall be payable towards condonation of shortage of attendance.

4.6 A student shall not be promoted to the next semester unless he satisfies the attendance requirement of the present semester, as applicable. They may seek readmission into that semester when offered next. If any candidate fulfills the attendance requirement in the present semester, he shall not be eligible for readmission into the same class.

5.0 EVALUATION

The performance of the candidate in each semester shall be evaluated subject-wise, with a maximum of 100 marks for theory and 100 marks for practicals, on the basis of Internal Evaluation and End Semester Examination.

5.1 For the theory subjects 60 marks shall be awarded based on the performance in the End Semester Examination and 40 marks shall be awarded based on the Internal Evaluation. The internal evaluation shall be made based on the **average** of the marks secured in the two Mid Term-Examinations conducted-one in the middle of the Semester and the other immediately after the completion of instruction. Each mid term examination shall be conducted for a total duration of 120 minutes with 4 questions

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(without choice) each question for 10 marks. End semester examination is conducted for 60 marks for 5 questions to be answered out of 8 questions.

5.2 For practical subjects, 60 marks shall be awarded based on the performance in the End Semester Examinations and 40 marks shall be awarded based on the day-to-day performance as Internal Marks.

5.3 There shall be two seminar presentations during III semester and IV semester. For seminar, a student under the supervision of a faculty member, shall collect the literature on a topic and critically review the literature and submit it to the department in a report form and shall make an oral presentation before the Project Review Committee consisting of Head of the Department, Supervisor and two other senior faculty members of the department. For each Seminar there will be only internal evaluation of 50 marks. A candidate has to secure a minimum of 50% of marks to be declared successful.

5.4 A candidate shall be deemed to have secured the minimum academic requirement in a subject if he secures a minimum of 40% of marks in the End semester Examination and a minimum aggregate of 50% of the total marks in the End Semester Examination and Internal Evaluation taken together.

5.5 In case the candidate does not secure the minimum academic requirement in any subject (as specified in 5.4) he has to reappear for the End semester Examination in that subject. A candidate shall be given one chance to re-register for each subject provided the internal marks secured by a candidate are less than 50% and has failed in the end examination. In such a case, the candidate must re-register for the subject(s) and secure the required minimum attendance. The candidate's attendance in the re-registered subject(s) shall be calculated separately to decide upon his eligibility for writing the end examination in those subject(s). In the event of the student taking another chance, his internal marks and end examination marks obtained in the previous attempt stand cancelled. For re-registration the candidates have to apply to the

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University through the college by paying the requisite fees and get approval from the University before the start of the semester in which re-registration is required.

5.6 In case the candidate secures less than the required attendance in any re registered subject (s), he shall not be permitted to write the End Examination in that subject. He shall again re-register the subject when next offered.

5.7 Laboratory examination for M. Pharmacy. courses must be conducted with two Examiners, one of them being the Laboratory Class Teacher or teacher of the respective college and the second examiner shall be appointed by the university from the panel of examiners submitted by the respective college.

6.0 EVALUATION OF PROJECT/DISSERTATION WORK

Every candidate shall be required to submit a thesis or dissertation on a topic approved by the Project Review Committee.

6.1 A Project Review Committee (PRC) shall be constituted with Head of the Department and two other senior faculty members.

6.2 Registration of Project Work: A candidate is permitted to register for the project work after satisfying the attendance requirement of all the subjects, both theory and practical.

6.3 After satisfying 6.2, a candidate has to submit, in consultation with his project supervisor, the title, objective and plan of action of his project work for approval. The student can initiate the Project work, only after obtaining the approval from the Project Review Committee (PRC).

6.4 If a candidate wishes to change his supervisor or topic of the project, he can do so with the approval of the Project Review Committee (PRC). However, the Project Review Committee (PRC) shall examine whether or not the change of topic/supervisor leads to a major change of his initial plans of project proposal. If yes, his date of registration for the project work starts from the date of change of Supervisor or topic as the case may be.

6.5 A candidate shall submit his status report in two stages at least with a gap of 3 months between them.

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6.6 The work on the project shall be initiated at the beginning of the II year and the duration of the project is two semesters. A candidate is permitted to submit Project Thesis only after successful completion of theory and practical course with the approval of PRC not earlier than 40 weeks from the date of registration of the project work. The candidate has to pass all the theory and practical subjects before submission of the Thesis.

6.7 Three copies of the Project Thesis certified by the supervisor shall be submitted to the College/School/Institute.

6.8 The thesis shall be adjudicated by one examiner selected by the University. For this, the Principal of the College shall submit a panel of 5 examiners, eminent in that field, with the help of the guide concerned and head of the department.

6.9 If the report of the examiner is not favourable, the candidate shall revise and resubmit the Thesis, in the time frame as decided by the PRC. If the report of the examiner is unfavorable again, the thesis shall be summarily rejected. The candidate has to re-register for the project and complete the project within the stipulated time after taking the approval from the University.

6.10 If the report of the examiner is favourable, Viva-Voce examination shall be conducted by a board consisting of the Supervisor, Head of the Department and the examiner who adjudicated the Thesis. The Board shall jointly report the candidate's work as one of the following:

A. Excellent
B. Good
C. Satisfactory
D. Unsatisfactory

The Head of the Department shall coordinate and make arrangements for the conduct of Viva-Voce examination.

6.11 If the report of the Viva-Voce is unsatisfactory, the candidate shall retake the Viva-Voce examination only after three months. If he fails to get a satisfactory report at the second Viva-Voce examination, the candidate has to re-register for the project and complete the project within the stipulated time after taking the approval from the University.

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7.0 AWARD OF DEGREE AND CLASS

After a student has satisfied the requirements prescribed for the completion of the program and is eligible for the award of M. Pharmacy. Degree he shall be placed in one of the following four classes:

Class Awarded	% of marks to be secured
First Class with Distinction	70% and above (Without any Supplementary Appearance)
First Class	Below 70% but not less than 60%
	70% and above (With any Supplementary Appearance)
Second Class	Below 60% but not less than 50%

The marks in internal evaluation and end examination shall be shown separately in the memorandum of marks.

8.0 WITHHOLDING OF RESULTS

If the student has not paid the dues, if any, to the university or if any case of indiscipline is pending against him, the result of the student will be withheld. His degree will be withheld in such cases.

9.0 TRANSITORY REGULATIONS (for R09)

9.1 Discontinued or detained candidates are eligible for re-admission into same or equivalent subjects at a time as and when offered.

9.2 The candidate who fails in any subject will be given two chances to pass the same subject; otherwise, he has to identify an equivalent subject as per R13 academic regulations.

10. GENERAL

10.1 Wherever the words "he", "him", "his", occur in the regulations, they include "she", "her", "hers".

10.2 The academic regulation should be read as a whole for the purpose of any interpretation.

10.3 In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Vice-Chancellor is final.

10.4 The University may change or amend the academic regulations or syllabi at any time and the changes or amendments made shall be applicable to all the students with effect from the dates notified by the University.

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MALPRACTICES RULES

DISCIPLINARY ACTION FOR / IMPROPER CONDUCT IN EXAMINATIONS

	Nature of Malpractices/ Improper conduct	Punishment
	If the candidate:	
1. (a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project

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	(theory or practical) in which the candidate is appearing.	work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The Hall Ticket of the candidate is to be cancelled and sent to the University.
3.	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
4.	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and

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	the examination.	shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.
6.	Refuses to obey the orders of the Chief Superintendent/ Assistant – Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.

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	outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	
7.	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining

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		examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat.
9.	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them.
10.	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year.
11.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/ year examinations.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the University for further action to award suitable punishment.	

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Malpractices identified by squad or special invigilators

1. Punishments to the candidates as per the above guidelines.
2. Punishment for institutions : (if the squad reports that the college is also involved in encouraging malpractices)
   - (i) A show cause notice shall be issued to the college.
   - (ii) Impose a suitable fine on the college.
   - (iii) Shifting the examination centre from the college to another college for a specific period of not less than one year.

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KAKINADA-533003, Andhra Pradesh (India)
For Constituent Colleges and Affiliated Colleges of JNTUK

Ragging

Prohibition of ragging in educational institutions Act 26 of 1997

Salient Features

- ⇨ Ragging within or outside any educational institution is prohibited.
- ⇨ Ragging means doing an act which causes or is likely to cause Insult or Annoyance of Fear or Apprehension or Threat or Intimidation or outrage of modesty or Injury to a student

	Imprisonment upto		Fine Upto
Teasing, Embarrassing and Humiliation	6 Months	+	Rs. 1,000/-
Assaulting or Using Criminal force or Criminal intimidation	1 Year	+	Rs. 2,000/-
Wrongfully restraining or confining or causing hurt	2 Years	+	Rs. 5,000/-
Causing grievous hurt, kidnapping or Abducts or rape or committing unnatural offence	5 Years	+	Rs.10,000/-
Causing death or abetting suicide	10 Months	+	Rs. 50,000/-

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KAKINADA-533003, Andhra Pradesh (India)
For Constituent Colleges and Affiliated Colleges of JNTUK

Ragging

ABSOLUTELY NO TO RAGGING

1. Ragging is prohibited as per Act 26 of A.P. Legislative Assembly, 1997.
2. Ragging entails heavy fines and/or imprisonment.
3. Ragging invokes suspension and dismissal from the College.
4. Outsiders are prohibited from entering the College and Hostel without permission.
5. Girl students must be in their hostel rooms by 7.00 p.m.
6. All the students must carry their Identity Card and show them when demanded
7. The Principal and the Wardens may visit the Hostels and inspect the rooms any time.

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SYLLABUS for M.PHARMACY
PHARMACOLOGY

I SEMESTER

Paper 101 - Modern Analytical Techniques
Paper 102 - Research Methodologies
Paper 103 - Systemic Pharmacology
Paper 104 - Pharmacokinetics and Drug Metabolism
Paper 105 - Systemic Pharmacology – LAB
Paper 106 - Pharmacokinetics and Drug Metabolism – LAB
Paper 107 - Seminar

II SEMESTER

Paper 201 - Advanced Pharmacology
Paper 202 - Pathophysiology and Pharmacotherapeutics
Paper 203 - Bioassays & Pharmacological Screening Methods
Paper 204 - Drug Regulatory Affairs
Paper 205 - Pathophysiology and Pharmacotherapeutics - LAB
Paper 206 - Bioassays & Pharmacological Screening Methods - LAB
Paper 207 - Seminar

III SEMESTER

Paper 301 - Seminar-I
Paper 302 - Project Work – I

IV SEMESTER

Paper 401 - Seminar-II
Paper 402 - Project Work – II
Paper 403 - Comprehensive Viva Voce

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SCHEME OF INSTRUCTIONS AND EVALUATION
PHARMACOLOGY

I SEMESTER

Paper No.	Title of the Paper	Evaluation / Marks				Total	Credits
		Theory		Practical			
		Mid Examination	University End Examination	Mid Examination	University End Examination		
Paper - 101	Modern Analytical Techniques	40	60			100	3
Paper - 102	Research Methodo -logies	40	60			100	3
Paper - 103	Systemic Pharmaco - logy	40	60			100	3
Paper - 104	Pharmaco kinetics and drug Metabolism	40	60			100	3
Paper - 105	Systemic Phramaco logy- Lab			40	60	100	2
Paper - 106	Pharmaco kinetics and drug Metabolism-Lab			40	60	100	2
Paper - 107	Seminar					100	2
	Total					700	18

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II SEMESTER

Paper No.	Title of the Paper	Evaluation / Marks				Total	Credits
		Theory		Practical			
		Mid Examination	University End Examination	Mid Examination	University End Examination		
Paper - 201	Advanced Pharmacology	40	60			100	3
Paper - 202	Pathophysiology Pharmacotherapeutics	40	60			100	3
Paper - 203	Bioassays and Phamacological Screening Methods	40	60			100	3
Paper - 204	Drgu Regultory Affairs	40	60			100	3
Paper - 205	Pathophysiology Pharmacotherapeutics - Lab			40	60	100	2
Paper - 206	Bioassays and Pharmacological Screening Methods - Lab			40	60	100	2
Paper - 207	Seminar					100	2
	Total					700	18

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III SEMESTER

Paper No.		Marks	Credits
Paper - 301	Seminar – I	50	2
Paper - 302	Project work – I	100	14
	Total	150	16

IV SEMESTER

Paper No.		Marks	Credits
Paper - 401	Seminar – II	50	2
Paper – 402	Project work – II	100	14
Paper - 403	Comprehensive Viva Voce	100	4
	Total	250	20
Grand Total (Four Semesters)		1800	72

***** Credits for III & IV Seminar (Research & Seminar) = 40**

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M.PHARM (PHARMACOLOGY)

I – I	L	P	Credits
	-	-	3

MODERN ANALYTICAL TECHNIQUES
(Paper Common for all Specializations)

Principles, instrumentation and applications of the following Instruments and Chromatographic Techniques

UNIT-I

i. UV- Visible spectrophotometry
ii. Infrared spectroscopy
iii. Spectrofluorimetry

UNIT-II

i. NMR spectroscopy
ii. Electron Spin Resonance spectroscopy
iii. Atomic Emission spectroscopy

UNIT-III

i. HPLC
ii. HPTLC
iii. Exclusion chromatography
iv. Super critical fluid chromatography

UNIT-IV

i. Mass Spectroscopy including LCMS & GCMS
ii. GLC

UNIT-V

i. Plasma Emission spectroscopy
ii. X-Ray diffractometry
iii. Optical Rotatory Dispersion
iv. Vapour phase chromatography
v. Affinity chromatography
vi. Ion-exchange chromatography

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TEXT BOOKS

1. Practical Pharmaceutical Chemistry Vol. 1 &II by Beckett & Stenlake.
2. Instrumental Methods of Analysis by Scoog and West.
3. Instrumental Methods of Analysis by B.K.Sharma
4. Vogel's text book of Quantitative Chemical Analysis.
5. Instrumental methods of Analysis by Willard & Merrit.
6. A text book of Pharmaceutical Analysis by K. A. Conners.

REFERENCE BOOKS

1. I.P.
2. B.P.
3. U.S.P.
4. Remington's Pharmaceutical Sciences.
5. Spectroscopy by Silverstein

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I – I	L	P	Credits
	-	-	3

RESEARCH METHODOLOGIES
(Paper common for all Specializations)

UNIT - I

Statistical Methods:

Chance Variation – Probability Distribution - Normal Distribution – Sampling Distribution.

Error and its significance - Measures of Error - Control of Error in Experimental Investigations – Problem Solving.

UNIT - II

Correlation and Regression, Multiple Regression - Problem Solving

UNIT - III

Tests of Significance: Principles, t-test, z-test, F-ratio test, Chi-square test. Non-parametric tests - their applications in pharmacy research with examples – Problem Solving

UNIT - IV

Design of Experiments

Criteria of a good design with examples.

Principles - Randomization, replication and local control.

Study of CRD, RBD, LSD and factorial designs - their applications in Pharmacy research with examples – Problem Solving

UNIT - V

Analysis of Variance (ANOVA) – one way, two way and three way – principles and applications in pharmacy research - Problem Solving.

Optimization Techniques: Optimization Techniques based on Factorial Experiments - Problem Solving.

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Recommended Books:

1. Fundamentals of Biostatistics by Khan & Khanum, Ukaaz Publications, Hyderabad.
2. Theory & Practice of Industrial Pharmacy by Leon Lachman and Others.
3. Reming Remington's Practice of Pharmaceutical sciences, (Latest Edition).
4. Principles of Biostatistics by Marcello Pagnano, Published by Brooks/ Cole, (Saurabh Printers Pvt. Ltd).
5. Introduction to Biostatistics – A text book of biometry By Pranab Kumar Banerjee

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I – I	L	P	Credits
	-	-	3

SYSTEMIC PHARMACOLOGY

UNIT – I

Basic principles of pharmacology, Mechanisms of drug action, Receptor proteins, Types and their molecular structure, Targets for G-Protein coupled receptors, protein phosphorylation and kinase cascade mechanisms, cellular aspects-excitation, contraction and secretion.

Pharmacology of Autonomic Nervous System

- Introduction and Physiology of autonomic nervous system, synthesis, release and metabolism of ANS neurotransmitters.
- Muscarinic receptor agonists and antagonists.
- Anticholinergic agonists and antagonists.
- Agents acting at neuromuscular junction and autonomic ganglia.
- Neuromuscular blockers.

UNIT – II

Drugs acting on Central Nervous System:

- Neurotransmitters and neurotransmission in central nervous system.
- Anti epileptics.
- Anti psychotics.
- Antidepressants.
- CNS stimulants.
- Hypnotics and sedatives.
- Opioid analgesics.
- Drug addiction and drug abuse.
- Analgesic, Antipyretic and Anti-inflammatory agents**.**
- Drugs acting on Parkinson's disease.

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UNIT – III

Drugs acting on cardiovascular and renal systems:

- Cardiotonics.
- Anti – arrhythmics.
- Anti – hypertensives.
- Anti – anginal drugs.
- Anti – hyperlipidemics.
- Diuretics.

Drugs acting on the blood and blood – forming organs

- Hematopoietic agents : growth factors, minerals and vitamins.
- Blood coagulation and anti – coagulants, thrombolytics and anti – platelet drugs.

UNIT – IV

Pharmacology of Chemotherapeutic and Anti-microbial agents

- General considerations of antimicrobial therapy.
- Sulfonamides, Trimethoprim, Quinolones, other related agents.
- Penicillins, Cephalosporins and other beta lactum anti-bacterial agents.
- Anti-fungal agents.
- Anti-viral agents.
- Chemotherapy of Tuberculosis, Leprosy and Malaria.
- Chemotherapy of Protozoal infections.
- Antineoplastic agents, Immunosuppressants and Immunostimulants.

UNIT – V

Hormones and their antagonists

- Pituitary hormones and their hypothalamic releasing factors.
- Thyroid and anti- thyroid drugs.
- Endocrine pancreas; Pharmacotherapy of Diabetes Mellitus.
- Estrogens and progestins.
- Androgens.

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RECOMMENDED BOOKS:

1. Pharmacology and Pharmacotherapeutics by R. S. Satoskar, S. D.Bhandarkar and S.S. Ainapure.
2. The Pharmacological basis of therapeutics by Joel G. Hardman, Lee E. Limbird and Alfred Goodman Gilman.
3. Pharmacology by H.P. Rang, M.M. Dale, J.M. Ritter & P.K. Moore.
4. Basic and Clinical Pharmacology by Bertram G. Katzung.
5. Pharmacology (Lippincott's) by Mary J. Mycer, Richard A. Harvey and Pamela C. Champe.
6. Essentials of Medical Pharmacology by K.D. Tripathi.

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I – I	L	P	Credits
	-	-	3

PHARMACOKINETICS AND DRUG METABOLISM

UNIT – I

Absorption

- Factors affecting drug absorption
- Gastrointestinal, percutaneous and rectal absorption
- Absorption kinetics, Wagner Nelson & Loo Riegelman methods
- Invitro methods of drug absorption (PAMPA and $CACO_2$ models)
- Role of P- glycoprotein in drug absorption

UNIT – II

Distribution

- Plasma protein binding , factors affecting plasma protein binding
- Tissue binding, kinetics of protein binding
- Transfer of drugs through biological membranes (Blood Brain Barrier, Placental Barrier)

UNIT – III

Metabolism

- Microsomal & Non microsomal biotransformations of drugs(Liver,Kidney and kinetics)
- Physiological, Pathological factors affecting drug metabolism
- Genetic factors influencing drug metabolism
- First pass effect
- Human Cytochrome P450 enzyme ,Substrates,inducers and inhibitors of CYP 450 enzymes
- In Vitro methods of drug metabolism(Liver microsomes,Liver S9 fraction&Hepatocytes)

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UNIT – IV

Excretion

- Excretion of drugs by various routes
- Factors affecting excretion of drugs
- Enterohepatic recirculation
- Significance of elimination rate constant and elimination half life

UNIT – V

Clinical Pharmacokinetics

- Basic concepts of clinical pharmacokinetics
- Therapeutic drug monitoring
- Population pharmacokinetics
- Drug interactions and their clinical significance
- Prediction of drug interactions
- Pharmacokinetic and pharmacodynamic modelling(PK/PD modelling)

RECOMMENDED BOOKS:

1. Biopharmaceutics and pharmacokinetics - An Introduction by Robert E, Notari
2. Drug metabolism by Bernard Testa and Peter Jenner.
3. Selected chapters from Principles of drug action by Gold Stein, Aranow and Kalman.
4. Drug interaction by D. G. Grahme – Smith.
5. Remington's Pharmaceutical Sciences
6. The Pharmacological basis of therapeutics by Joel G. Hardman, Lee E. Limbird and
   Alfred Goodman Gilman

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SYSTEMIC PHARMACOLOGY – LAB

(Practicals based on theory)

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PHARMACOKINETICS AND DRUG METABOLISM – LAB

(Practicals based on theory)

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ADVANCED PHARMACOLOGY

UNIT – I

Molecular Pharmacology

Pharmacology of receptors: Classification, cellular signaling systems, pharmacology of agonists and antagonists of the following receptors

i. Excitatory amino acid receptors
ii. Purinoreceptors
iii. GABA and Glycine receptors
iv. Neurosteroid receptors
v. Cannabinoid receptors
vi. Melatonin receptors
vii. Adrenergic receptors
viii. Cholinergic receptors
ix. Dopaminergic receptors
x. Serotonergic receptors.

Signalling Mechanisms: Physiological function, Pharmacological implications and therapeutic potential of the following target sites:

i. Phosphoinositide 3 – kinase (PI3K)
ii. MAP Kinase
iii. Caspases
iv. Peroxisome propliferator activator receptors (PPAR) – á, and ã
v. Protein kinases
vi. Phospho diesterases

UNIT – II

Neuropeptides

A study of the mechanisms involved in the formation, release, possible physiological role, pharmacological actions, agonists, antagonists and therapeutic potential of

i. Calcitonin gene related peptides
ii. Neuropeptide Y
iii. Substance P
iv. Cholecystokinin

UNIT – III

Endogenous Mediators

i. Histamine
v. Nitric Oxide

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ii. Prostaglandins
iii. Leukotrienes
iv. Opioid peptides
vi. Kinins
vii. 5-HT

UNIT – IV

Transporter Proteins

i. Classification and biology of ATP binding cassette (ABC) transporter superfamily.
ii. Multidrug resistance (MDR) proteins.

UNIT – V

i. Principles of clinical pharmacology and designs for testing of drugs in humans. Clinical trials – Phases I, II, III, IV.
ii. Stem cells – Basic concepts and therapeutic applications in medicine.
iii. Free radicals, their biological role, endogenous anti-oxidant systems (PI3K)and their role in tissue protection.

RECOMMENDED BOOKS:

1. The Pharmacological basis of therapeutics by Joel G. Hardman, Lee E. Limbird and Alfred Goodman Gilman.
2. Pharmacology by H.P. Rang, M.M. Dale, J.M. Ritter & P.K. Moore
3. Basic and Clinical Pharmacology by Bertram G. Katzung.
4. Text book of Pharmacology by W. C. Bowman, M. J. Rand.

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PATHOPHYSIOLOGY AND PHARMACOTHERAPEUTICS

Pathophysiology and Pharmacotherapeutics of following Diseases

UNIT – I

1. Clinical Pharmacy Process
2. Practical pharmacokinetics
3. Drug Interactions
4. Adverse Drug Reactions
5. Laboratory data
6. Pharmacoeconomics
7. Neonates
8. Paediatrics
9. Geriatrics

UNIT-II

1. Peptic Ulcer Diseases
2. Liver diseases
3. Acute Renal failure
4. Hypertension
5. Coronary heart diseases
6. Chronic heart failure
7. Cardiac arrhythmias
8. Thrombosis
9. Dyslipidemia

UNIT – III:

1. Insomnia and anxiety
2. Schizophrenia
3. Parkinson's disease
4. Urinary tract infections
5. Respiratory tract infections and asthma
6. Gastro intestinal infections

UNIT – IV:

1. Tuberculosis
2. HIV infection
3. Thyroid and parathyroid disorders
4. Diabetes cycle disorders

UNIT – V:

1. Anaemia
2. Leukemia
3. Lymphomas
4. Solid tumors
5. Rheumatoid arthritis and Osteoarthritis.

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RECOMMENDED BOOKS :

1. Clinical Pharmacy and Therapeutics by Roger Walker, Cate Whittlesea.
2. Pharmacotherapy – a Pathophysiologic Approach by Joseph T. Dipiro, Robert L. Talbert, Gary C. Yee, Gary R. Matzke, Barbara G. Wells, L. Michael Posey.
3. Clinical Pharmacy by Dr.H.P.Tipnis.
4. Clinical Pharmacy Practice by G Parthasarathi, Karin Nyfort-Hansen.
5. Clinical Pharmacy and Therapeutics by K.Ravishankar, Kiranmayi
6. Hospital and clinical Pharmacy by N.Narayan, S.Balasubramanian.

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BIOASSAYS & PHARMACOLOGICAL SCREENING METHODS

UNIT – I

Principles of Experimental Pharmacology and Drug Discovery:

Common laboratory animals in Pharmacological research, Limitations of animal tests, Alternatives to animal use, Anaesthetics used in laboratory animals, some standard techniques used in handling laboratory animals, Euthanasia of experimental animals. Regulation for the care and use of laboratory animals.

Strategies and approaches employed in drug discovery. Basic concepts of Combinatorial chemistry, High throughput screening, Cell lines and their applications in drug discovery. Transgenic animal models in the development of new drugs.

UNIT – II

Principles of Biological standardization: Statistical treatment of modern problems in the biological evaluation of drugs. Methods used in the bio-assays for antibiotics and microbiological assays. Bioassay for Diphtheria antitoxin; Tetanus; Cholera vaccine; Posterior Pituitary extract; Adrenaline; Heparin; Digitalis; d-Tubocurarine; Vitamins. Test for pyrogens.

Bioassay methods for autocoids – Development of new bio-assay methods. Assays using special designs for experiments to eliminate known source of variation. Toxicity tests, Determination of LD_{50}, Acute, Sub acute, and Chronic toxicity studies – Tests for freedom from undue toxicity of drugs.

UNIT - III

Basic Principles of Screening and types – Simple, Blind and Programmed Screening. Need for isolated tissues in pharmacological evaluation of drugs. Organization of screening for the Pharmacological activity and evaluation of new substances in CVS:

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1. Diuretics
2. Antihypertensives
3. Antianginal agents
4. Anti arrhythmic agents and agents used in sudden cardiac failure
5. Drugs used in cardiomyopathies
6. Drugs used in hyperlipidemia and atherosclerosis
7. Anti infarct agents

UNIT - IV

Organization of screening for the Pharmacological activity and evaluation of new substances in CNS:

1. Anti-epileptics
2. Anti-anxiety agents and Drugs used in mood and sleep disorders
3. Antipsychotics
4. Drugs affecting memory
5. Drugs used in Alzheimer's disease
6. Local Anesthetics
7. Skeletal muscle relaxants and Neuromuscular blockers

UNIT - V

Organization of screening for the Pharmacological activity and evaluation of new substances

1. Anti-diabetic agents
2. Analgesics and Drugs used in arthritis and neuropathic pain
3. Anti-Inflammatory agents
4. Anti-asthmatic agents
5. Anti-ulcer agents
6. Hepatoprotective agents

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RECOMMENDED BOOKS:

1. H.G.Vogel (ed),Drug Discovery and Evaluation- Pharmacological Assays,2nd Edition, Springer verlag,Berlin,Germany,2002.
2. M.N.Gosh, Fundamentals of Experimental pharmacology,2nd Edition, Scientific Book Agency,Culcutta,India,1985.
3. D.R.Laurence and A.L.Bacharach (Eds), Evaluation of Drug Activities: Pharmacometrics, Volume I and II, Academic press,London,U.K,1964.
4. Biological Standardization by J.H.Burn, D.J.Finney and L.G. Goodwin.
5. Pharmacopoeias: IP,BP,USP
6. Screening methods in pharmacology by Robert A.Turner. VolumeI and II
7. Methods in Pharmacology by Swarbrick.

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DRUG REGULATORY AFFAIRS: (Paper Common for all Specializations)

UNIT - I

Formulation development: Regulatory requirements involved in the preformulation studies, solid, liquid and semi-solid dosage forms, controlled release preparations, injections and ocular preparations as per the European community, United States and Indian regulatory authorities.

UNIT - II

Manufacturing: Regulatory requirements as per European community, United States and Indian regulatory authorities for manufacturing information, manufacturing formula, process, validation of manufacturing process, equipment, documentation, inspection requirement of regulatory guidelines for active ingredients, data requirement for new drug, International aspects of Excipients, approval as per guidelines of all the territories. Regulatory guidelines for packaging materials, test and evaluation of packaging materials, biological test, elastometer test, microbiological test and evaluation of closures.

UNIT - III

Stability testing: Scientific and technical background to the design of stability testing regulatory requirements as per European community, United States and Indian regulatory authorities for testing of new active substances, bulk active drug substances, dosage form in their final packaging. Extension of shelf-life after authorization of drug international harmonization and current guidelines. Regulatory affairs in respect of residual solvents as per the ICH guidelines, analytical method validation, pharmacokinetic and toxicokinetic validation.

Biopharmaceutics: Different testing parameters and standards as per regulatory requirements of European community, United States and Indian regulatory authorities with respect to factors related to formulation, dosage form, manufacturing process, stability and storage.

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UNIT - IV

Preclinical aspects of Biopharmaceutics: Current guidelines and developments as per regulatory requirements of European community, United States and Indian regulatory authorities in respect of clinical bioavailability , study design, presentation documentation and statistical analysis.

Clinical pharmacology and Pharmacodynamics: Regulatory guidelines as per European community, United States and Indian regulatory authorities on clinical study design, documentation, presentation and interpretation. Clinical trials: Definition, phase I, phase II, phase III and phase IV studies, design documentation, presentation and interpretation, statistical analysis of clinical data and factorial design.

UNIT - V

Intellectual property rights and patents: Introduction, purpose, international scenario and Indian scenario, guidelines as per European community, United States and Indian regulatory authorities, documentation, presentation and application, procedure for obtaining and writing a patent and patenting rules and regulations.

RECOMMENDED BOOKS:

1. Quality Assurance Guide by Organization of Pharmaceutical producers of India.
2. Drug formulation manual by D.P.S. Kohli and D.H.Shah. Eastern publishers, New Delhi.
3. How to practice GMPs by P.P.Sharma. Vandhana Publications, Agra.
4. Pharmaceutical Process Validation by Fra. R. Berry and Robert A. Nash.
5. Pharmaceutical Preformulations by J.J. Wells.
6. Applied production and operations management by Evans, Anderson, Sweeney and Williams.
7. Basic Principles of Clinical Research and Methodology by Gupta.
8. Biopharmaceutics and Clinical Pharmacokinetics-An introduction; 4th edition, Revised and expanded by Robert. E. Notari, Marcel Dekker Inc, New York and Basel, 1987

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PATHOPHYSIOLOGY AND PHARMACOTHERAPEUTICS LAB

(Practicals based on theory)

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