

**ACADEMIC REGULATIONS  
COURSE STRUCTURE  
AND  
DETAILED SYLLABUS**

**B.PHARMACY**

*for*

***B.PHARMACY FOUR YEAR DEGREE COURSE***  
(Applicable for the batches admitted from 2007-2008)



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY**  
KUKATPALLY, HYDERABAD - 500 085. (A.P.)



# JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, HYDERABAD

## ACADEMIC REGULATIONS 2007 FOR B.PHARM (REGULAR) DEGREE COURSE

(Effective for the students admitted into I year from the Academic Year 2007-2008)

### 1. Award of B.Pharm Degree

A student will be declared eligible for the award of the B.Pharm Degree if he fulfils the following academic regulations:

1.1 Pursued a course of study for not less than four academic years and not more than eight academic years.

1.2 Registered for all the 224 credits and secured all the 224 credits.

2. Students, who fail to fulfil all the academic requirements for the award of the degree within eight academic years from the year of their admission, shall forfeit their seat in B.Pharm course.

### 3. Credits

	I Year		Semester	
	Periods / Week	Credits	Periods / Week	Credits
Theory	03	06	04	04
	02	04	02	02
	04	08		
Practicals	03	04	03	02
	06	08	06	04
Seminar	—	—	—	02
Project	—	—	—	04

### 4. Distribution and Weightage of Marks

- The performance of a student in each semester / I year shall be evaluated subject wise with a maximum of 100 marks for theory and 75 marks for practical subject. In addition, Seminar and Project Work shall be evaluated for 50 and 100 marks respectively.
- For theory subjects the distribution shall be 20 marks for Internal Evaluation and 80 marks for the End-Examination.
- For theory subjects, during the semester there shall be 4 tests, which include, 2 objective type tests each for a duration of 20 minutes each and 2 subjective type tests each for a duration of 90 minutes each. One objective type test and one subjective test to be conducted in 1 – 4 units and one objective type test and one subjective type test are to be conducted in 5 -

8 units of each semester. The best 3 tests will be considered for awarding 20 sessional marks. For the I year class which shall be on yearly basis, there shall be 6 tests which include, 3 objective type tests and 3 subjective type tests with the same duration and weightage for each test as mentioned above. However, the performance in the best 4 tests will be considered for awarding 20 sessional marks. The distribution of syllabus for the conduct of objective and subjective type tests in the first year shall be as follows<sup>1</sup>:

1 – 2 Units	one Objective type and one Subjective type test.
3 – 5 Units	one Objective type and one Subjective type test.
6 – 8 Units	one Objective type and one Subjective type test.

Each objective test question paper shall contain 20 objective type questions for 20 marks. Each subjective type test question paper shall contain 5 questions out of which any 3 questions need to be answered. The subjective type question paper should also be for 20 marks. Though the test pattern is different, all the tests (objective and subjective type tests) have equal weightage.

- iv. For practical subjects there shall be a continuous evaluation during the semester for 25 sessional marks and 50 end examination marks. Of the 25 marks for internal, 15 marks shall be awarded for day-to-day work and 10 marks to be awarded by conducting an internal laboratory test. The end examination shall be conducted by the teacher concerned and another member of the staff of the same department.
- v. There shall be a seminar presentation in IV year II Semester. For the seminar, the student shall collect the information on a specialized topic and prepare a technical report, showing his understanding over the topic, and submit to the department, which shall be evaluated by the Departmental committee consisting of Head of the department, seminar supervisor and a senior faculty member. The seminar report shall be evaluated for 50 marks. There shall be no external examination for seminar.
- vi. Out of a total of 100 marks for the project work, 20 marks shall be for internal Evaluation and 80 marks for the End Semester Examination. The End Semester Examination (viva-voce) shall be conducted by the committee. The committee consists of an external examiner, head of the department, the supervisor of the project and a senior faculty member of the department. Seminar and project work shall be on the same topic. The evaluation of project work shall be conducted at the end of the IV year. The Internal Evaluation shall be on the basis of two seminars given by each student on the topic of his project.
- vii. Laboratory marks and the sessional marks awarded by the College are not final. They are subject to scrutiny and scaling by the University wherever felt desirable. The sessional and laboratory marks awarded by the College will be referred to a Committee. The Committee will arrive at a scaling factor and the marks will be scaled as per the scaling factor. The recommendations of the Committee are final and binding. The laboratory records and internal test papers shall be preserved in the respective departments as per the University norms and shall be produced to the Committees of the University as and when they ask for.

- viii. There shall be a Comprehensive Viva-Voce in IV year II semester. The Comprehensive Viva-Voce will be conducted by a Committee consisting of (i) Head of the Department (ii) two Senior Faculty members of the Department. The Comprehensive Viva-Voce is aimed to assess the students' understanding in various subjects he / she studied during the B.Pharm course of study. The Comprehensive Viva-Voce is valued for 100 marks by the Committee. There are no internal marks for the Comprehensive viva-voce.

#### 5. Attendance:

- i. A student shall be eligible to appear for University examinations if acquires a minimum of 75% of attendance in aggregate of all the subjects.
- ii. Con-donation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester or I year may be granted by the College Academic Committee.
- iii. A student will not be promoted to the next semester unless he satisfies the attendance requirement of the present semester / I year, as applicable. They may seek re-admission for that semester / I year when offered next.
- iv. Shortage of Attendance below 65% in aggregate shall in NO case be condoned.
- v. Students whose shortage of attendance is not condoned in any semester / I year are not eligible to take their end examination of that class and their registration shall stand cancelled.
- vi. A stipulated fee shall be payable towards condonation of shortage of attendance.

#### 6. Minimum Academic Requirements:

The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in item no. 5.

- i. A student shall be deemed to have satisfied the minimum academic requirements and earned the credits allotted to each theory or practical subject or project if he secures not less than 35% of marks in the end examination and a minimum of 40% of marks in the sum total of the internal evaluation and end examination taken together.
- ii. A student shall be promoted from II to III year only if he fulfils the academic requirement of 42 credits from one regular and one supplementary examinations of I year, and one regular examinations of II year I semester irrespective of whether the candidate takes the examination or not.
- iii. A student shall be promoted from third year to fourth year only if he fulfils the academic requirements of total 70 credits from the following examinations, whether the candidate takes the examinations or not.
  - a. Two regular and two supplementary examinations of I year.
  - b. Two regular and one supplementary examinations of II year I semester.
  - c. One regular and one supplementary examinations of II year II semester.
  - d. One regular examination of III year I semester.



- iv. A student shall register and put up minimum attendance in all 224 credits and earn all the 224 credits. Marks obtained in all the 224 credits shall be considered for the calculation of percentage of marks.
- v. Students who fail to earn 224 credits as indicated in the course structure within eight academic years from the year of their admission shall forfeit their seat in B.Pharm course and their admission shall stand cancelled.

**7. Course pattern:**

- i. The entire course of study is of four academic years. The first year shall be on yearly pattern and the second, third and fourth years on semester pattern.
- ii. A student eligible to appear for the end examination in a subject, but absent at it or has failed in the end examination may appear for that subject at the supplementary examination.

**8. Award of Class:**

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

Class Awarded	% of marks to be secured	From the aggregate marks secured in all the 224 Credits.
First Class with Distinction	70% and above	
First Class	Below 70% but not less than 60%	
Second Class	Below 60% but not less than 50%	
Pass Class	Below 50% but not less than 40%	

(The marks in internal evaluation and end examination shall be shown separately in the marks memorandum)

**9. Minimum Instruction Days:**

The minimum instruction for each semester / I year shall be 95/180 clear instruction days.

10. There shall be no branch transfers after the completion of admission process.
11. There shall be no place transfer within the Constituent Colleges and Units of Jawaharlal Nehru Technological University.

**General:**

12. Where the words "he", "him", "his", occur in the regulations, they include "she", "her", "hers".
13. The academic regulation should be read as a whole for the purpose of any interpretation.
14. In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Vice-Chancellor is final.
15. 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.



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, HYDERABAD**

**Academic Regulations for B. Pharm (Lateral Entry Scheme)**

(Effective for getting admitted into II year from the Academic Year 2008-2009 and onwards)

1. The Students have to acquire 168 credits from II to IV year of B.Pharm program (regular) for the award of the degree.
2. Students, who fail to fulfil the requirement for the award of the degree in 6 consecutive academic years from the year of admission, shall forfeit their seat.
3. The same attendance regulations are to be adopted as that of B.Pharm (Regular).

**4. Promotion Rule:**

A student shall be promoted from third year to fourth year only if he fulfils the academic requirements of 42 credits from the examinations.

- a. Two regular and one supplementary examinations of II year I semester.
- b. One regular and one supplementary examinations of II year II semester.
- c. One regular examination of III year I semester.

**5. Award of Class:**

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

Class Awarded	% of marks to be secured	From the aggregate marks secured in 168 Credits. (i.e. II year to IV year)
First Class with Distinction	70% and above	
First Class	Below 70% but not less than 60%	
Second Class	Below 60% but not less than 50%	
Pass Class	Below 50% but not less than 40%	

(The marks in internal evaluation and end examination shall be shown separately in the marks memorandum)

6. All other regulations as applicable for B.Pharm Four-year degree course (Regular) will hold good for B.Pharm (Lateral Entry Scheme)

**(Footnotes)**

If in any subject, the syllabus is not divided into 8 units. Teacher has to divide into 8 equal units for sake of conducting internal tests.



2007 - 2008

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
HYDERABAD.**

**B.PHARMACY****1 YEAR****COURSE STRUCTURE**

Code	Subject	T	C	P	C
1. R7101	Remedial Mathematics/ Remedial Biology (R7107)	4+1*/2+1*	8/4	0/3 (R7108)	0/4
2. R7102	Physical Pharmacy – I	3+1*	6	3 (R7109)	4
3. R7103	Pharm. Inorganic Chemistry	4+1*	8	3 (R7110)	4
4. R7104	Pharmaceutical Organic Chemistry I	3+1*	6	3 (R7111)	4
5. R7105	Anatomy and Physiology	3+1*	6	3 (R7112)	4
6. R7106	English Language Communication Skills	3+1*	6	-	-
		26/24	40/36	12/15	16/20

II Year

I Semester

**COURSE STRUCTURE**

Code	Subject	T	C	P	C
1. R7201	Pharmaceutical Unit Operations – I	4+1*	4	-	-
2. R7202	Pharmaceutical Organic Chemistry – II	4+1*	4	3 (R7206)	2
3. R7203	Statistical Methods and Computer Applications	4+1*	4	3 (R7207)	2
4. R7204	Physical Pharmacy – II	4+1*	4	3 (R7208)	2
5. R7205	Health Education and Pathophysiology	4+1*	4	3 (R7209)	2
		25	20	12	8

2007 - 2008

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
HYDERABAD.**

**B.PHARMACY**

II Year

II Semester

**COURSE STRUCTURE**

Code	Subject	T	C	P	C
1. R7301	Pharmaceutical Unit Operations- II	4+1*	4	3 (R7306)	2
2. R7302	Pharmaceutical Analysis I	4+1*	4	3 (R7307)	2
3. R7303	Pharmacognosy – I	4+1*	4	3 (R7308)	2
4. R7304	Dispensing and Hospital Pharmacy	4+1*	4	3 (R7309)	2
5. R7305	Environmental Science	4+1*	4	-	-
		25	20	12	8

III Year

I Semester

**COURSE STRUCTURE**

Code	Subject	T	C	P	C
1. R7401	Pharmaceutical Biochemistry	4+1*	4	3 (R7406)	2
2. R7402	Pharmaceutical Microbiology	4+1*	4	3 (R7407)	2
3. R7403	Pharmacognosy – II	4+1*	4	3 (R7408)	2
4. R7404	Pharmaceutical Technology – I	4+1*	4	3 (R7409)	2
5. R7405	Pharmacology – I	4+1*	4	-	-
		25	20	12	8

2007 - 2008  
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
HYDERABAD.

B.PHARMACY

III Year

II Semester

COURSE STRUCTURE

Code	Subject	T	C	P	C
1. R7501	Medicinal Chemistry – I	3+1*	3	3	2
				(R7507)	
2. R7502	Pharmaceutical Technology-II	3+1*	3	3	2
				(R7508)	
3. R7503	Pharmacology II	4+1*	4	3	2
				(R7509)	
4. R7504	Chemistry of Natural Drugs	4+1*	4	3	2
				(R7510)	
5. R7505	Pharmaceutical Jurisprudence	4+1*	4	-	-
6. R7506	Advanced Communication Skills Lab	-	-	3	2
		23	18	15	10

IV Year

I Semester

COURSE STRUCTURE

Code	Subject	T	C	P	C
1. R7601	Pharmaceutical Analysis – II	3+1*	3	3	2
				(R7607)	
2. R7602	Biopharmaceutics and Pharmacokinetics	3+1*	3	3	2
				(R7608)	
3. R7603	Pharmacology III	4+1*	4	3	2
				(R7609)	
4. R7604	Medicinal Chemistry II	4+1*	4	3	2
				(R7610)	
5. R7605	Pharmacy Administration	4+1*	4	-	-
6. R7606	Industrial Training and Seminar	-	-	-	2
		23	18	12	10

2007 - 2008

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
HYDERABAD.

B.PHARMACY

IV Year

II Semester

COURSE STRUCTURE

Code	Subject	T	C	P	C
1. R7701	Novel Drug Delivery Systems and Regulatory Affairs	3+1*	3	3	2
				(R7707)	
2. R7702	Pharmaceutical Biotechnology	3+1*	3	3	2
				(R7708)	
3. R7703	Medicinal Chemistry-III	3+1*	3	3	2
				(R7709)	
4. R7704	Pharmacognosy III	3+1*	3	3	2
				(R7710)	
5. R7705	Clinical Pharmacy and Therapeutics	4+1*	4	-	-
6. R7706	Project work**	-	-	-	2
7. R7711	Comprehensive Viva	-	-	-	2
		21	16	12	12

\*\*Suggested areas for project work.

- 1) Industrial Pharmacy
- 2) Clinical Pharmacy/ Pharmacology
- 3) Pharmacognosy /Medical Chemistry
- 4) Pharmaceutical Analysis / Quality Assurance
- 5) Pharmaceutical Marketing

The candidates have to undergo Industrial Training for One month (200 Hours Minimum) during 3rd year summer vacation

\* – Tutorial

T – Theory periods per week

P – Practical Periods per week

C – Credits

End examinations in theory subjects shall be for a duration of 3 Hours with 5 questions to be answered out of 8 questions.

End examinations in practical subjects shall be for 3 Hours

**(R7101) REMEDIAL MATHEMATICS**

**UNIT I**

**Algebra:**

**Arithmetic Progression Geometric Progression** Permutations & combinations  
Binomial theorem partialfractions Matrices Determinants Application of  
determinants to solve simultaneous equations (Cramer's Rule).

**UNIT II**

**Trigonometry:** Trigonometric ratios and the relations between them Sin (A+B),  
Cos (A+B), Tan (A+B) formulae only. Trigonometric ratios of multiple angles  
Heights and distances (simple 000 problems there on).

**UNIT III**

**Co ordinate Geometry:** Distances between points Area of a triangle, Co  
ordinates of a point dividing a given segment in a given ratio locus equation to a  
straight line in different forms Angle between straight lines point of intersection.

**UNIT IV**

**Differential Calculus:** Continuity and limit: Differentiation, derivability and  
derivative, R.H. derivatives and L.H. derivatives; Differentiation; General theorems  
of derivation.

**UNIT V**

Derivatives of trigonometric functions (excluding inverse trigonometric and  
hyperbolic functions). Logarithmic differentiation. Partial differentiation maxima  
and minima (elementary).

**UNIT VI**

**Integral Calculus:** Integration as on inverse process of differntiation, definite  
integrals, integration by substitution, integration by parts, integration of algebraic  
function of  $E^x$  evolution of area in simple cases.

**UNIT VII**

**Differential equations:** Formation of a differential equation, order and degree,  
solution of first order differential equations.

**UNIT VIII**

Introduction to Laplace transforms and their use.

**TEXT BOOKS**

1. Intermediate first Year mathematics and
2. Intermediate Second year mathematics., printed and published by Telugu  
Academy, Himayatnagar, Hyderabad
3. Pharmaceutical Arithmetic's by Mohd. Ali CBS publishers and distributor,  
New Delhi.
4. Higher Engineering Mathematics by Grewal.

**(R7107) REMEDIAL BIOLOGY**

**UNIT I**

Methods of classification of plants.

**Plant cell:** It's detailed structure, mitosis, meiosis different types of plant tissues  
and their functions.

**UNIT II**

Simple and compound microscopes used in biology; section cutting; staining  
and mounting of sections.

**Morphology and histology** of root, stem, bark, wood, leaf, flower, fruit and seed.  
Modifications of root and stem.

**UNIT III**

**General survey of animal kingdom:** structure and life history of parasites  
illustrated by Amoeba, Entamoeba, Trypanosoma, Plasmodium, Taenia, Ascaris,  
Schistosoma, Oxyuris and Ancylostoma.

**UNIT IV**

General structure and life history of insects like Cockroach, Mosquito, Housefly,  
Mite and Silkworm. Relationship of insects with medicinal crops.

**SUGGESTED TEXT BOOKS**

1. Intermediate First Year and Second Year Botany / Zoology Text Books  
printed and published by Telugu Academy, Himayatnagar, Hyderabad.
2. A.C. Dutta, Text Book of Botany
3. Botnay for Degree students Vol I & II by B.P. Pandey



I Year B. Pharmacy

T	P	C
3+1*	0	6

(R7102) PHYSICAL PHARMACY – I

**UNIT I**

**Intermolecular forces and states of matter:** Binding forces between molecules, the states of matter, the gaseous state, the liquid state, solids and the crystalline state. Phase equilibria and the phase rule.

**UNIT II**

**Thermodynamics:** The first law of thermodynamics. Thermochemistry. The second law of thermodynamics. The third law of thermodynamics, Free energy functions and applications.

**UNIT III**

**Physical properties of Drug Molecules:** Dielectric constant induced polarization, dipole moment, refractive index and molar refraction, optical rotatory dispersion.

**UNIT IV**

**Solutions of Non electrolytes:** Concentration expressions, ideal and real solutions, colligative properties, molecular weight determinations.

**UNIT V**

**Solutions of Electrolytes:** Properties of solutions of electrolytes. The Arrhenius theory of electrolyte dissociation. The modern theory of strong electrolytes and other coefficients for expressing colligative properties.

**UNIT VI**

**Ionic equilibria:** Modern theories of acids, bases and salts, Sorensen's pH scale, specific concentration as a function of pH, calculation of pH, graphical solution to pH problems, acidity constants.

**UNIT VII**

**Buffers and buffered isotonic systems:** The buffer equation, buffer capacity, buffers in pharmaceutical and biological systems, buffered isotonic solutions, methods of adjusting tonicity and pH (relevant numerical problems).

**UNIT VIII**

**Electromotive force and oxidation Reduction systems:** Electrochemical cells. Electrometric determination of pH and redox.

**TEXT BOOKS**

1. Patrick J. Sinko, Martin's Physical Pharmacy and Pharmaceutical Sciences Fifth Edition.
2. C.V.S.Subramanyam, Essentials of Physical Pharmacy, Vallabh Prakashan.
3. B.S Bahl, Arun Bahl and G.D Tuli, Essentials of Physical Chemistry.
4. Derle D.V., Essentials of Physical Pharmacy.

**REFERENCES**

1. Pharmacopoeia, (I.P., B.P., U.S.P. and European.)
2. Martindale, The Extra Pharmacopoeia; latest edition, the Royal Pharmaceutical Society.
3. Lippincott Williams and Wilkins, Remington Pharmaceutical Sciences.
4. Robin. J. Haiwan, Hand Book of Pharmacy & Health Care ED, The Pharma Press UK.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
HYDERABAD**

I Year B. Pharmacy

T      P      C  
4+1\*    0      8

**(R7103) PHARMACEUTICAL INORGANIC CHEMISTRY**

**UNIT- I**

1. Classification of Inorganic Pharmaceuticals based on their applications and therapeutic uses.
2. Sources of impurities, quality control and test for purity.
3. Qualitative tests for anion and cations
4. Limit tests for Arsenic, heavy metals, lead, iron, chloride and sulphate and Pharmacopoeial standards.

**Notes:** Definition, Preparation, Assay principle, Limits tests and Uses for the following classes of compounds from Unit II to Unit VII

**UNIT - II**

1. **Electrolytes:** Sodium, potassium and calcium replenishers.
2. **Sodium and potassium replenishers:** Sodium chloride, compound sodium chloride solution (Ringer solution), potassium chloride, ORS.
3. **Calcium replenishers:** Calcium chloride, calcium gluconate, dibasic calcium phosphate.
4. **Acid base regulators:** Sodium bicarbonate, sodium lactate, sodium citrate/potassium citrate, sodium acetate, and ammonium chloride
5. **Dialysis fluids:** Haemodialysis fluids, intraperitoneal dialysis fluids and gastro-intestinal agents.

**UNIT III**

1. **Acidifiers and Antacids: IP monographs:** Dilute hydrochloric acid, sodium acid phosphate, sodium bicarbonate, sodium citrate, potassium citrate, aluminium hydroxide gel, dried aluminium hydroxide gel, magnesium oxide (Magnesia), magnesium hydroxide mixture, magnesium carbonate, magnesium trisilicate, calcium carbonate.
2. **Adsorbents and related drugs:** Light kaolin, heavy kaolin, and activated charcoal.
3. **Laxatives:** Magnesium sulphate, sodium phosphate.

**UNIT -IV**

- 1) **Mineral Nutrients/Supplements**
  - (a) **Hæmatinics** – Ferrous sulphate, ferrous fumarate, ferrous gluconate, ferric ammonium citrate, iron and dextrose injection.
  - (b) **Halogens:** Iodine, Iodides and fluorides.
- 2) **Pharmaceutical aids:**
  - (a) **Excipients:** Dicalcium phosphate, tricalcium phosphate, magnesium stearate, talc and calcium carbonate (Precipitated chalk).
  - (b) **Suspending agents:** Bentonite, colloidal silica, aluminium stearate.
  - (c) **Colorants:** Titanium oxide, Ferric oxide

**UNIT- V**

- (a) **Expectorants:** Ammonium chloride, potassium iodide.
- (b) **Emetics:** Potassium antimony tartarate, copper sulphate, zinc sulphate.
- (c) **Antidotes:** Sodium thiosulphate, sodium nitrite.

**UNIT -VI****Topical agents:**

- 1) **Astringents:** Zinc sulphate, zinc oxide, calcium hydroxide, copper sulphate, Bismuth sub carbonate.
- 2) **Topical protectants:** Zinc oxide, calamine, zinc stearate, talc, titanium-dioxide, heavy kaolin and light kaolin (only uses).
- 3) **Silicone polymers:** Activated dimethicone.
- 4) **Anti-Infectives:** Hydrogen peroxide solution, potassium permanganate, silver nitrate (silver protein), iodine, (solutions of iodine, povidone iodine), boric acid, zinc undecylenate, mercury compounds (yellow mercuric chloride)

**UNIT- VII****Dental products:**

- 1) **Fluorides:** Sodium fluoride, sodium monofluorophosphate and stannous fluoride.
- 2) **Oral antiseptics and Astringents:** Hydrogen peroxide, sodium peroxide (bp), magnesium peroxide, zinc peroxide and mouth washes.
- 3) **Dentifrices:** Calcium carbonate, dibasic calcium phosphate, calcium phosphate, sodium metaphosphate and strontium chloride.
- 4) **Cements & fillers :** Zinc oxide (only uses).

**UNIT-VIII****Miscellaneous Medicinal Agents**

- |                          |   |                           |
|--------------------------|---|---------------------------|
| a) Antineoplastics       | : | Cisplatin                 |
| b) Antidepressants       | : | Lithium carbonate         |
| c) Diagnostic agents     | : | Barium sulphate           |
| d) Surgical Aids         | : | Plaster of Paris          |
| e) Antirheumatic agents  | : | Sodium aurothiomalate     |
| f) Internal parasiticide | : | Sodium antimony gluconate |
| g) Anti thyroid agents   | : | Potassium perchlorate     |

**TEXT BOOKS**

1. J.H Block, E.Roche, T.O Soine and C.O. Wilson, Inorganic Medical and Pharmaceutical Chemistry Lea & Febiger Philadelphia PA.
2. A.H.Beckett and J.B.Stenlake, Practical pharmaceutical chemistry, Part-1. The Athtome press, University of London, London.
3. P. Gundu Rao, Inorganic pharmaceutical chemistry; Vallabh Prakashan, Delhi.
4. Advanced Inorganic Chemistry by Satya prakash, G.D.Tuli

**REFERENCES**

1. L.M. Atherden, Bentley and Driver's Textbook of Pharmaceutical Chemistry Oxford University Press, London.
2. Indian Pharmacopoeia 1996.

(R7104) PHARMACEUTICAL ORGANIC CHEMISTRY-I

UNIT – I

**Structure and Activity of Organic Molecules:** Shapes of organic molecules, bond lengths, bond angles and bond dissociation energies. Electronic effects in organic molecules: inductive effect, electromeric or mesomeric effect, hyperconjugation, concept of resonance; types of organic reagents and reactions.

UNIT – II

**A Study of Hydrocarbons:**

**Aliphatic/Alcyclic Hydrocarbons:** Nomenclature, isomerism (chain, conformational and geometrical) relative stabilities (heats of combustion and hydrogenation), ring stabilities of cyclohexane, chair-boat conformation, Bayer's strain theory and sachse-mohr theory. Free radical substitution reactions (halogenation) of alkanes, selectivity of halogen.

**Alkenes:** Electrophilic addition reactions of alkenes, Markovnikov's rule, Kharasch effect, Bayer's oxidation (cis-hydroxylation, polymerisation).

**Alkadienes:** Stability & 1,4 addition reactions of conjugated alkadienes.

**Alkynes:** Acidity of 1-alkynes, formation of metal acetylides. Stereo specific reduction of alkynes. Addition of hydrogen halide (HCl) addition of water and keto-enol tautomerism.

UNIT – III

**Aromatic Hydrocarbons:** Kekule's structure of benzene, bond lengths, heats of hydrogenation and stability, molecular orbital picture of benzene, aromaticity, Huckel's rule, nomenclature of benzene derivatives, characteristic reactions of benzene, theory of reactivity and orientation in monosubstituted benzenes, Birch reduction

**Polynuclear aromatic hydrocarbons:** Nomenclature, structure and aromatic character of naphthalene, anthracene, phenanthrene and naphthacene resonance structures, electron density and reactivity. Electrophilic substitution, oxidation and reduction reactions.

UNIT – IV

**Halogen Compounds-Aliphatic:** Nomenclature, general methods of preparation, characteristic nucleophilic substitution reactions, factors that play role in  $SN^1$  and  $SN^2$ , Walden inversion, elimination reaction and Saytzeff's rule.

**Halogen Compounds-Aromatic:** Nomenclature, low reactivity of halo benzenes towards nucleophilic substitution, benzyne concept.

UNIT – V

**Alcohols:** Nomenclature, classification, general methods of preparation, physical properties, hydrogen bonding, characteristic nucleophilic substitution reactions (replacement of -OH by -Cl), elimination reactions, Reimer Tiemann reaction

and relative reactivities of 1°, 2° and 3° alcohols, Meerwein Ponderoff Verley reduction

**Ethers:** Nomenclature, Williamson's synthesis, action of hydro iodide acid on ethers (Ziesel's method).

**Phenols:** Nomenclature, general methods of preparation, physical properties, acidity of phenols, stability of phenoxide ion, reactions of phenols, Kolbe-schmidt reaction stability of conjugated dienes, and Fries rearrangement.

UNIT – VI

**Carbonyl Compounds:** Nomenclature, two important methods of preparation, polarity of carbonyl group, relative reactivities of carbonyl compounds, nucleophilic addition and addition-elimination reactions, oxidation-reduction reactions, aldol condensation, Cannizzaro reaction, benzoin condensation, Perkin's reactions, Reformatsky reaction, Oppenauer oxidation.

UNIT – VII

**Carboxylic acids and their derivatives:**

**Carboxylic acids:** Nomenclature, intermolecular association, stability of carboxylate anion, two important methods of preparation, decarboxylation, functional groups reactions, reduction of carboxylic acids. a note on dicarboxylic acids.

**Acid derivatives:** (acid chlorides, anhydrides, esters and amides). Nomenclature, reactions like hydrolysis, reduction of esters and amides, Hofmann's degradation of amides. Brief account of malonic and acetoacetic esters, their importance in synthesis.

UNIT – VIII

**Nitrogen Compounds:**

**Nitro compounds:** Nomenclature, acidity of nitro compounds containing  $\alpha$ -hydrogens, reductive reactions of aromatic nitro compounds.

**Amines:** Nomenclature, basicity of amines, classification, relative reactivity, hinsberg method of separation, acylation reactions. Diazotisation and reactions of diazonium salts.

**Nitriles and isonitriles:** Nomenclature, two methods of synthesis, reactivity and functional reactions.

TEXT BOOKS

1. T.R.Morrison and R.N.Boyd, Organic chemistry, pentice hall of India private limited, New Delhi.
2. Ball & Ball, Advanced pharmaceutical organic chemistry.
3. Bruce, Organic chemistry.
4. Jerry March, Advanced Organic Chemistry.

REFERENCES

1. Jerry March, Reactions and Mechanism 4<sup>th</sup> ed.
2. I.L. Finar Vol.I. & Vol. II., The Fundamentals Principles of Organic Chemistry, ELBS/Longman.



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
HYDERABAD**

I Year B. Pharmacy

<b>T</b>	<b>P</b>	<b>C</b>
<b>3+1*</b>	<b>0</b>	<b>6</b>

**(R7105) ANATOMY AND PHYSIOLOGY****UNIT-I**

**Scope of anatomy and physiology and basic terminology used in these subjects.** Structure of cell, its components and their function. Elementary tissues of the human body: epithelial, connective, muscular and nervous tissues, their sub-types and characteristics.

**Skeletal system:** Structure, composition and functions of skeleton: classification of joints, types of movements at joints, disorders of joints.

**Skeletal muscles:** Gross anatomy, physiology of muscle contraction, physiological properties of skeletal muscles and their disorders.

**UNIT-II**

**Haemopoietic system:** Composition and functions of blood and its elements, their disorders, blood groups and their significance, mechanism of coagulation, disorders of platelets and coagulation.

**Lymph and Lymphatic System:** Composition, formation and circulation of lymph; disorders of lymph and lymphatic system. Basic physiology and functions of spleen.

**UNIT-III**

**Cardiovascular system:** Basic anatomy of the heart. Physiology of heart, blood vessels and circulation. Basic understanding of cardiac cycle, heart sounds and electrocardiogram. blood pressure and its regulation. Brief outline of cardiovascular disorders like hypertension, hypotension, atherosclerosis, angina, myocardial infarction, congestive heart failure and cardiac arrhythmias.

**UNIT-IV**

**Digestive System:** Gross anatomy of the gastro intestinal tract, functions of its different parts including those of liver, pancreas and gall bladder, various gastrointestinal secretions and their role in the absorption and digestion of food.

**UNIT-V**

**Respiratory System:** Anatomy of respiratory organs. Functions of respiration, mechanism and regulation of respiration, respiratory volumes and vital capacity.

**UNIT-VI**

**Central Nervous System:** Functions of different parts of brain and spinal cord. Neurochemical transmission in the central nervous system; reflex action, electroencephalogram, specialized functions of the brain, cranial nerves and their functions.

**Autonomic Nervous System:** Physiology and functions of autonomic nervous system. Mechanism of neurohumoral transmission in the A.N.S.

**UNIT-VII**

**Urinary System:** Various parts, structures and functions of the kidney and urinary tract. Physiology of urine formation and acid base balance, diseases of the urinary system.

**UNIT - VIII**

**Endocrine System:** Basic anatomy and physiology of pituitary, thyroid, parathyroid, adrenals, pancreas, testes and ovary, their hormones and functions.

**TEXT BOOKS**

1. Tortora, G.J and Anagnodokas, Principles of Anatomy and Physiology, N.P Harper & Row Publishers N.Y
2. Ross & Willson, Text Book of Human Anatomy, M.J.Mycek S.B Gerther and MMFER
3. C.C.Chatterjee, Human Physiology.
4. Donald.C Rizzo, Fundamental of Anatomy and Physiology.
5. T.S. Ranganathan, A Text book of Human Anatomy.
6. Subramanyam and Others, A textbook of Physiology
7. Dr.H.D.Singh, Basic Human Physiology.

**REFERENCES**

1. Elaine N. Marieb, Essential of Human Anatomy & Physiology
2. Guyton, Textbook of Medical Physiology, AC Guyton WB Sannders Company, 1995.
3. K. Sembulingam and Prema Sembulingam, Essentials of Medical Physiology, 3rd Edition, Jaypee Bros., New Delhi.
4. M.N.Gosh, Human Physiology Julia F. Gui, Learning Human Anatomy: A Laboratory Text

I Year B. Pharmacy

T	P	C
3+1*	0	6

(R7106) ENGLISH LANGUAGE COMMUNICATION SKILLS

**UNIT – I**

Humour from **LEARNING ENGLISH: A Communicative Approach**, Orient Longman, 2005

1. The Sounds of English – Vowels and Diphthongs, oral presentations (prepared), Just A Minute (JAM) Sessions.

**UNIT - II**

2. Healths and Medicine from **LEARNING ENGLISH: A Communicative Approach**, Orient Longman, 2005
3. The Sounds of English – Consonants, oral presentations (prepared), Just A Minute sessions).

**UNIT - III**

4. Environment from **LEARNING ENGLISH: A Communicative Approach**, Orient Longman, 2005.
5. Stress in English – Oral presentations (extempore), Just A Minute sessions

**UNIT - IV**

6. Inspiration from **LEARNING ENGLISH: A Communicative Approach**, Orient Longman, 2005.
7. Intonation - Oral presentations (extempore), Just A Minute sessions

**UNIT - V**

8. Human Interest from **LEARNING ENGLISH: A Communicative Approach**, Orient Longman, 2005.
9. Role Play and Situational Dialogues – Informal, Semi- formal and Formal.

**UNIT – VI**

10. Media from **LEARNING ENGLISH: A Communicative Approach**, Orient Longman, 2005.
11. Role Play and Situational Dialogues – Informal, Semi-formal and Formal.

\* Exercises from the lessons not prescribed for detailed study shall also be used for classroom tasks.

**UNIT – VII**

**Exercises on**

Reading and Writing Skills

Reading Comprehension

Situational dialogues

Interview Skills

Group Discussion

Letter writing

2007-2008

e - mail writing and e – mail etiquette

Report writing – Preparing a rough draft, editing and preparing the final report.

**UNIT – VIII**

**Remedial Grammar to be dealt with through practice exercises and activities covering**

Common errors in English, Subject-Verb agreement, Use of Articles and Prepositions,

Tense and aspect

**Vocabulary development covering**

Synonyms & Antonyms, one-word substitutes, prefixes & suffixes, Idioms & phrases, words often confused.

**TEXTBOOKS PRESCRIBED:**

In order to improve the proficiency of the student in the acquisition of the four skills mentioned above, the following texts and course content, divided into **Eight Units**, are prescribed:

**For Detailed study**

- **LEARNING ENGLISH: A Communicative Approach**, Hyderabad: Orient Longman, 2006. (Six Selected Lessons and exercises from all the nine units)

**For Practice in Listening and Speaking skills**

- **A Practical Course in English Pronunciation**, (with two audio cassettes) by J. Sethi, Kamlesh Sadanand and D.V. Jindal, Prentice-Hall of India Pvt. Ltd., New Delhi.

**REFERENCES:**

1. **Strengthen Your English**, Bhaskaran & Horsburgh, Oxford University Press
2. **Basic Communication Skills for Technology**, Andrea J Rutherford, Pearson Education Asia.
3. **Murphy's English Grammar with CD**, Murphy, Cambridge University Press.
4. **English Skills for Technical Students**, WBSCTE with British Council, Orient Longman
5. **Everyday Dialogues in English** by Robert J. Dixon, Prentice-Hall of India Ltd., 2006.
6. **English For Technical Communication**, Vol. 1 & 2, by K. R. Lakshmi Narayanan, Sci tech. Publications.
7. **A Handbook of English for Engineers & Technologists** by Dr. P. Eliah, B. S. Publications.
8. **Spoken English** (CIEFL) in 3 volumes with 6 cassettes, OUP.
9. **English Pronouncing Dictionary** by Daniel Jones, Current Edition with CD.
10. **Spoken English-** R. K. Bansal and J. B. Harrison, Orient Longman 2006 Edn.
11. **A textbook of English Phonetics** for Indian Students by T. Balasubramanian (Macmillan)

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
HYDERABAD**

2007-2008

I Year B. Pharmacy

T      P      C  
0      3      4

**(R7108) REMEDIAL BIOLOGY LAB**

- 1 Care and uses of microscope
- 2 Gross identification of slides of structure and life cycle of plants/animals mentioned in theory.
- 3 Morphology of plant parts indicated in theory.
- 4 Preparation, Microscopic Examination of stem, root and leaf of mono and dicot leaves.
- 5 Structure of human parasites and insects mentioned in the theory with the help of specimens.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
HYDERABAD**

2007-2008

I Year B. Pharmacy

T      P      C  
0      3      4

**(R7109) PHYSICAL PHARMACY – I LAB**

1. Percent composition – Capillary Flow method
2. Percent composition – polarimeter & refractometer
3. Molecular weight – Landsberger method.
4. Molecular weight – Rast camphor method.
5. Calibration of pH Meter
6. pH Estimation – pH meter
7. pH Estimation – colourimetric method.
8. pH Estimation by Half Neutralization Method
9. Refractive index of liquids.
10. Phenol water system – CST
11. Lower consolute temperature – Tea and Water
12. Heat of neutralization
13. Phase diagram - Phenol – Water, Effect of Impurities.
14. Ternary phase diagram.
15. Preparation of Buffers and Buffer Capacity Determination.



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
HYDERABAD**

I Year B. Pharmacy

T	P	C
0	3	4

**(R7110) PHARMACEUTICAL INORGANIC CHEMISTRY LAB****List of experiments:****A) Limit tests for the following as per the procedure given in Indian Pharmacopoeia (1996 – including the latest addenda)**

- 1) Chlorides
- 2) Sulphates
- 3) Heavy metals
- 4) Iron
- 5) Arsenic (demonstration)

- B)**
- 6) Balances and Weighing; Calibration of weights, Pipette and Burette.
  - 7) Preparation and standardization of Hydrochloric acid solution (0.1N).
  - 8) Preparation and standardization of Potassium permanganate solution (0.1N & 0.1M).
  - 9) Preparation of a primary standard solution of 0.1N Potassium hydrogen-phthalate.
  - 10) Preparation and standardization of 0.1N EDTA solution.
  - 11) Preparation and purification of Boric acid.
  - 12) Preparation and purification of Sodium citrate.
  - 13) Preparation and purification of Potash alum.
  - 14) Preparation and purification of Magnesium stearate.
  - 15) Assay of sodium bicarbonate and assay of Boric acid (Neutralization).
  - 16) Assay of Calcium gluconate (or) any calcium compounds (Complexometry).
  - 17) Assay of Copper sulphate (Redox titration).
  - 18) Assay of Sodium acetate (Non-aqueous titration).
  - 19) Assay of Ferrous sulphate (Oxidation-reduction / Redox titration).
  - 20) Exercises related to assay by Gravimetric method.

**REFERENCES**

1. Indian Pharmacopoeia - 1996.
2. Vogel's Qualitative Analysis.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
HYDERABAD**

I Year B. Pharmacy

T	P	C
0	3	4

**(R7111) PHARMACEUTICAL ORGANIC CHEMISTRY-I LAB**

Introduction to Equipment & Glassware, Recrystallization method, details of M.P, B.P and distillation

**I. Preparation of organic compounds (each involving a specific organic reaction covered in theory)**

- |                                    |   |   |
|------------------------------------|---|---|
| 1. N-Acetylation                   | : | Preparation of Acetanilide from Aniline   |
| 2. O-Acetylation                   | : | Preparation of Aspirin from Salicylic acid  |
| 3. Nuclear Bromination             | : | Preparation of p-Bromoacetanilide from Acetanilide                                  |
| 4. Hydrolysis                      | : | Preparation of p-Bromoaniline from p-Bromoacetanilide                               |
| 5. Nuclear Nitration               | : | Preparation of m-Dinitrobenzene from nitrobenzene                                   |
| 6. Oxidation                       | : | Preparation of Benzoic acid from Benzyl chloride                                    |
| 7. Esterification                  | : | Preparation of n-Butylacetate from n-Butylalcohol                                   |
| 8. Etherification                  | : | Preparation of $\beta$ -Naphthyl methyl ether from $\beta$ -Naphthol                |
| 9. $\alpha$ -Halogenation          | : | Preparation of Iodoform from Oxidation of acetone                                   |
| 10. Extensive Nuclear Substitution | : | Preparation of Tribromophenol or Bromination Tribromoaniline from Phenol or Aniline |

**II. Systematic qualitative Analysis (Identification) of Monofunctional Organic Compounds:**

Avoid water-soluble compounds, and compounds containing more than one functional group; at least six individual compounds to be analyzed.

**REFERENCES**

1. Vogel's Text Book of Practical Organic Chemistry, 5<sup>th</sup> Edition.
2. R.K. Bansal, Laboratory Manual of Organic Chemistry.
3. O.P. Agarwal, Advanced Practical Organic Chemistry.
4. F.G.Mann & B.C. Saunders, Practical Organic Chemistry.

**(R7112) ANATOMY AND PHYSIOLOGY LAB  
(21 Experiments)**

1. Study of human skeleton – 2 Experiments
2. Study of different systems with the help of charts and models – 2 Experiments.
3. Microscopic study of different tissues – 3 Experiments.
4. Estimation of Haemoglobin in blood, Determination of bleeding time, clotting time – 3 Experiments.
5. Estimation of R.B.C. count – 2 Experiments.
6. Estimation of W.B.C count – 2 Experiments.
7. Estimation of D.L.C. – 2 Experiments.
8. Recording of body temperature, pulse rate and blood pressure, basic understanding of electrocardiogram PQRST waves and their significance – 3 Experiments.
9. Determination of vital capacity, experiments on spirometry – 2 Experiments.

**REFERENCES**

1. Plummer, Practical Biochemistry
2. Elaine N. Marieb, Human Anatomy & Physiology.
3. A.K. Charterjee, Human Physiology

**(R7201) PHARMACEUTICAL UNIT OPERATIONS- I**

**UNIT-I**

**Stoichiometry:** Unit processes material and energy balance, molecular units, mole fractions, gas laws, mole volume, primary and secondary quantities, equilibrium state, rate process, steady and unsteady states, dimensionless equations, dimensionless formulae, dimensionless groups, different types of graphic representation, mathematical problems

**UNIT –II**

**Fluid Flow:** Types of flow, Reynold's number, viscosity, concept of boundary layer, basic equations of fluid flow, valves, flow meters, manometers and measurement of flow and pressure.

**UNIT-III**

**Material handling systems:**

- a. Liquid handling different types of pumps.
- b. Gas handling various types of fans, blowers and compressors.
- c. Solid handling - conveyors

**UNIT-IV**

**Filtration and Centrifugation:** Theory of filtration, filter aids, filter media, industrial filters including filter press, rotary filter, edge filter, etc. Factors affecting filtration, mathematical problems on filtration, optimum-cleaning cycle in batch filters. Principles of centrifugation, industrial centrifugal filters, centrifugal filters, and centrifugal sedimenters.

**UNIT-V**

**Crystallization:** Characteristics of crystals like; purity, size, shape, geometry, habit, forms, size and factors affecting it. Solubility curves and calculation of yields. Material and heat balances around Swenson Walker Crystallizer. Supersaturation theory and its limitations. Nucleation mechanisms, crystal growth. Study of various types of crystallizers, tanks, agitated batch, single vacuum, circulating magma and crystal crystallizers. Caking of crystals and its prevention. Numerical problems on yields.

**UNIT-VI**

**Dehumidification and Humidity control**

Basic concepts and definition, wet bulb and adiabatic saturation temperature. Psychrometric chart and measurement of humidity, application of humidity measurement in pharmacy, equipments for dehumidification operations.

**Refrigeration and Air Conditioning:**

Principles and applications of refrigeration and air conditioning.

**UNIT-VII**

**Materials of Construction:** General study of composition, corrosion, resistance, properties and applications of the materials of construction with special reference to stainless steel and glass.

**UNIT-VIII**

**Industrial hazards and safety precautions:** Mechanical, Chemical, Electrical, fire and dust hazards. Industrial dermatitis, accident records etc.

**TEXT BOOKS**

1. S.J. Carter, Cooper and Gunn's Tutorial Pharmacy 6<sup>th</sup> ed CBS publisher, Delhi.
2. C.V.S. Subramanayam, Pharmaceutial Unit Operation, Vallabh Prakashan
3. Prof. K. Samba Murthy, Pharmaceutical Engineering.
4. Badzer & Banchemo, Introduction to Chemical Engineering.

**REFERENCES**

1. Perry's Handbook of Chemical Engineering.
2. Unit Operations by Mc Cabe & Smith.
3. Mc Cabe & Smith, Elements of Chemical Engineering.
4. Lippincott Williams and Wilkins: Remington Pharmaceutical Sciences.
5. EA Rawlins, Bently's Text Book of Pharmaceutics, 8<sup>th</sup> edition, ELBS

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
HYDERABAD**

**II Year B. Pharmacy I-Semester**

T	P	C
4+1*	0	4

**(R7202) PHARMACEUTICAL ORGANIC CHEMISTRY - II**

**Note: Definition, nomenclature, structure, aromaticity, reactivity, acidity-basicity and characteristic reactions of the following heterocyclic compounds of Unit I and II**

**UNIT - I**

**Five membered and six membered ring systems with one hetero atom:** Furan, pyrrole, thiophene and pyridine.

**Fused ring systems with one hetero atom indole:** Quinoline, iso-quinoline, and acridine.

**UNIT - II**

**Five membered and six membered ring systems with two heteroatoms:** Pyrazole, imidazole, oxazole, isoxazole, thiazole, pyrazine, pyrimidine and pyridazine.

**Fused ring systems with two heteroatoms:** Benzimidazole and phenothiazine.

**UNIT - III**

**Stereochemistry of Carbon compounds:** Optical rotation, plane polarized light, optical activity, chirality, notations (assignment of configuration), relative configuration (Fischer DL configuration), absolute configuration, sequence rules (with examples), enantiomers, meso compounds, racemic mixture, resolution, and asymmetric synthesis.

**Stereochemistry of alkenes:** Concept of E & Z configurations. Elements of symmetry.

**UNIT - IV**

**Carbohydrates:** Definition, classification, nomenclature, relative configuration of some important monosaccharides, study of glucose structure, mutarotation, ring structure, oxidation-reduction reactions, osazone formation, action of barium hydroxide, epimerization, Lobry De Bruyn - Van Ekenstein reaction, structure of the disaccharide sucrose, glycosidic linkage, non-reducing nature; structural components of starch and cellulose. A brief account on pharmaceutical importance of various carbohydrates.

**UNIT - V**

a) **Amino acids:** Definition, classification, essential amino acids, configuration, three important methods of preparation of amino acids, physical properties. Zwitter ionic nature, isoelectric point, peptide synthesis and important reactions of amino acids.

b) **Polypeptides and proteins:** Definition, classification of proteins, denaturation, isoelectric point, C-terminal and N-terminal concept. Brief account of primary, secondary and tertiary structure. A brief account of the pharmaceutical importance of amino acids, polypeptides and proteins.



**UNIT – VI**

- a. **Glycosides:** Definition and  $\alpha$ ,  $\beta$  – glycosidic linkages, enzymatic hydrolysis, physiological importance.
- b. **Lipids (oils and fats):** Definition, fatty acids, characterization of lipids (Saponification value, acid value and Iodine value), hydrogenation and rancidity of oils and fats.

**UNIT - VII**

- a) **Purine derivatives (xanthine bases):** Chemical structures of uric acid and methylated xanthines (caffeine, theophylline and theobromine) of physiological/ pharmaceutical significance.
- b) Definitions of nucleic Acids, nucleotides, nucleosides, A brief account on structure of DNA & RNA.

**UNIT – VIII**

**A study of the mechanism and application in synthesis of the following named reactions:**

- A. Beckmann rearrangement
- B. Phillips condensation reaction
- C. Mannich reaction
- D. Michael addition reaction
- E. Wittig reaction
- F. Hoffmann rearrangement
- G. Curtius rearrangement
- H. Schmidt reaction

**TEXT BOOKS**

1. R Morrison and R. Boyd, organic chemistry, Pub by Printice Hall of India, New Delhi.
2. I L Finar, Organic Chemistry, Vol. I. & II, 6<sup>th</sup> Pearson education
3. O.P Agarwal, A Textbook of Organic Chemistry
4. Eliel, Stereochemistry of Organic compounds.
5. Arun Bahl & S.S Bahl, Advanced Organic Chemistry

**REFERENCES**

1. Jerry March, Advanced Organic Chemistry 4<sup>th</sup> Ed.
2. Cram & Hammond. Organic Chemistry.
3. A.I. Vogel, A textbook of practical organic chemistry
4. Solomons, Organic Chemistry.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
HYDERABAD**

**II Year B. Pharmacy I-Semester**

T	P	C
4+1*	0	4

**(R7203) STATISTICAL METHODS AND COMPUTER APPLICATIONS  
Section - A: Bio-statistics**

**UNIT-I**

**Data collection and treatment:** Significant digits and rounding of numbers, data collection, random and non-random sampling methods, sample size, data organization, diagrammatic representation of data, bar, pie, 2-D and 3-D diagrams, standard deviation and standard error of means, co-efficient of variation, confidence (fiducial) limits, probability and events.

**Probability and Distributions:** Bayes's theorem, probability theorem, probability distribution, elements of binomial and poison distribution, normal distribution curve and properties, kurtosis and skewness.

**UNIT - II**

**Regression:** Correlation and regression analysis, method of least squares and non-linear regression.

**UNIT.III**

**Statistical inference:** Common parametric and non-parametric tests employed in testing of significance in biological/pharmaceutical experiments and elements of ANOVA (One way and two way).

**UNIT.IV**

**Design of experiments:** Basic concepts of CRD, RBD and Latin square designs. **Sampling and Quality Control:** Concept of random sampling, statistical QC charts. Applications of statistical concepts in pharmaceutical sciences.

**Section - B: Computer Applications**

**UNIT.V**

**Concept:** History of computers, simple model of computer and its working parts of the computer, CPU, memory, input/output devices, computer languages and their hierarchal machine language, assembly language, high level language comparison of high level and low level languages especially C, C++, PASCAL etc.,

**Introduction to microcomputers and concepts of operating systems:** Elements of DOS, UNIX, etc., introduction of computer networks.

**UNIT.VI**

**Database management:** Spread sheets (like MS-EXCEL, ACCESS), concepts and objectives of database and database management system, advantages and disadvantages of the database management system and examples of DBMS packages (like DBASE III).

**Flow chart and algorithm development:** Definition and properties of the algorithm, Flow chart symbols and their uses, Examples of efficient algorithm and flow-chart, conversion of algorithm/flow-chart to high-level languages.

**UNIT.VII**

**Introduction to computer programming:** C language: Constant and string variables, expressions, functions, structures, repetition statements (loops), nested loop, definite and indefinite loop and arrays. Concepts of files. Sequential files and random access files, Simple program writing for bio-statistical methods.

**UNIT.VIII**

**Computer applications** in pharmaceutical and clinical studies. Computer validation – Introduction.

**TEXT BOOKS**

1. Pranab Kumar Benarjee, Introduction to Biostatistics
2. Khan and Khanum, Fundamentals of Biostatistics
3. Yashvanth Kanetkar, Let Us C++, BPB Publications New Delhi.
4. Ron Mansfield, Working In Microsoft Office.
5. Ivan Bayross, SQL, PL/SQL The Programming Language of oracle.

**REFERENCE**

1. Dona E. Knath, The Art Of Computer Programming by Pearson Education (Singapore) Pvt. Ltd Delhi, 110 092.
2. Remez Elmasi, Shankar. B. Navathe, Fundamentals Of Database System, Pearson Education (Singapore) Pvt. Ltd Delhi, 110 092.
3. Collins, Dictionary Of Computers and IT by Ian Sinclair, Harper Collins Publishers Glasgow, UK.
4. Y. Raja Raman, Computer Programming in C.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
HYDERABAD**

**II Year B. Pharmacy I-Semester**

<b>T</b>	<b>P</b>	<b>C</b>
<b>4+1*</b>	<b>0</b>	<b>4</b>

**(R7204) PHYSICAL PHARMACY - II**

**UNIT-I**

**Solubility and Distribution Phenomena:** Solvent-solute interaction, solubility of gases in liquids, liquids in liquids, solids in liquids, distribution of solutes in immiscible solvents.

**Introduction to phenomena of diffusion:** Ficks first law and second law.

**UNIT-II**

**Complexation:** Metal complexes, organic molecular complexes in inclusion complex, and methods of analysis, complexation and drug action.

**UNIT-III**

**Kinetics:** Rates and orders of the reaction. Influence of temperature and other factors on reaction rates. Decomposition and stabilization of medicinal agents, kinetics in the solid state and accelerated stability analysis (relevant numerical problems).

**UNIT-IV**

**Interfacial Phenomena:** Liquid interfaces, measurement of surface and interfacial tensions, adsorption at liquid interfaces. Surface-active agents and systems of hydrophilic lipophilic classification. Adsorption at solid interfaces. Electrical properties of interfaces.

**UNIT-V**

**Micromeritics:** Particle size and size distribution, methods for determining surface area, methods for determining particle size, pore size, particle shape and surface area, derived properties of powders.

**UNIT-VI**

**Rheology:** Newtonian system, non-Newtonian system, thixotropy, measurement and applications in formulations. Determination of viscosity and its applications.

**UNIT - VII**

**Colloids:** Introduction, types of colloidal systems, solubilization, Stability of colloids, optical properties, kinetic properties, electrical properties and Donnan Membran equilibrium.

**UNIT-VIII**

**Coarse Dispersions:** Suspensions, emulsions: suspensions, interfacial properties of suspended particles. Settling in suspensions. Formulation of suspensions: emulsions- theories of emulsification, physical stability of emulsions, preservation of emulsions, rheological properties of emulsions and suspensions.

**TEXT BOOKS**

1. Patrick J. Sinko, Martin's Physical Pharmacy and Pharmaceutical Sciences 5<sup>th</sup> Edition.
2. CVS Subhramanyam, Physical Pharmacy, Vallabh prakashan.
3. L. Lachman, H. Lieberman The Theory And Practice Of Industrial Pharmacy J. L Kaniz Lee & Febiger Philadelphia, USA.

**REFERENCE**

1. Lippincott Williams and Wilkins, Remington Pharmaceutical Sciences
2. M.E. Aulton, Pharmaceutics – The science of dosage form design, 2<sup>nd</sup> edition
3. Derle D.V., Essentials of Physical Pharmacy.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
HYDERABAD**

**II Year B. Pharmacy I-Semester**

T	P	C
4+1*	0	4

**(R7205) HEALTH EDUCATION AND PATHOPHYSIOLOGY****UNIT-I**

**Concepts of health & disease**, disease causing agents and prevention of disease.

Classification of food requirements, balanced diet, nutritional deficiency disorders, their treatment and prevention, specifications for drinking water.

**UNIT-II**

**Demography and family planning:**

Demography cycle, family planning and various contraceptive methods. Medical termination of pregnancy.

**UNIT-III**

**Brief outline of communicable diseases**, their causative agents, modes of transmission and prevention (chicken pox, measles, influenza, diphtheria, whooping cough, tuberculosis, poliomyelitis, hepatitis, cholera, typhoid, food poisoning, helmenthiasis, malaria, filariasis, rabies, trachoma, tetanus, leprosy, syphilis, gonorrhoea, and Aids).

**UNIT-IV**

**First Aid:** Emergency treatment of shock, snakebites, burns, poisoning, fractures and resuscitation methods.

**UNIT-V**

**Reproductive Systems:** Male and Female reproductive systems and their hormones, physiology of menstruation, coitus and fertilization. Sex differentiation, spermatogenesis & oogenesis. Pregnancy its maintenance and parturition.

**UNIT-VI**

**Basic Principles of Cell Injury and Adaptation:** Causes of cellular injury, pathogenesis, morphology of cell injury. Intracellular alterations in lipids, proteins and carbohydrates. Cellular adaptations, atrophy, hypertrophy.

**UNIT-VII**

**Basic Mechanism involved in the process of inflammation and repair:**

Alterations in vascular permeability and blood flow. Migration of WBCs, acute and chronic inflammation, mediators of inflammation, brief outline of the process of repair.

**UNIT-VIII**

**Pathophysiology of common diseases:** Like rheumatoid arthritis, gout, epilepsy, psychosis, depression, mania, hypertension, angina, congestive heart failure, atherosclerosis, myocardial infarction, diabetes, peptic ulcer, asthma, ulcerative colitis, hepatic disorders, acute and chronic renal failure, tuberculosis, urinary tract infections, Sexually transmitted diseases, anemias and common types of neoplasms.

**TEXT BOOKS**

1. Robbins, SL & Kumar, Basic Pathology.
2. Ross & Willson, Text Book of Human Anatomy.
3. Ross & Willson, Principles of anatomy and physiology
4. C.C.Chatterjee, Human Physiology, Pub by Medical allied agency, Delhi, India
5. Mary V. Buras, Pathophysiology: A self Instructional programme.
6. Mary Lou Mulvihill, Human Diseases: A Systemic approach.

**REFERENCE BOOKS**

1. A.C Guyton, Textbook of medicinal physiology by W.B.Prism books Pvt. Ltd., Delhi.
2. Joseph Dipiro, Patho Physiology and applied therapeutics.
3. M.P. Rang, M.N.Dale, J.M Riter Anatomy & Physiology

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
HYDERABAD**

II Year B. Pharmacy I-Semester

T	P	C
0	3	2

**(R7206) PHARMACEUTICAL ORGANIC CHEMISTRY-II LAB****I. Synthesis of some simple heterocyclic compounds.**

- a. 3, 5-Dimethylpyrazole from Acetylacetone.
- b. 3, 5-Dimethylisoxazole from Acetylacetone.
- c. 4, 5-Diphenylimidazole from Benzil.
- d. Benzoxazole from o-Aminophenol.
- e. 2, 5-Dioxopiperazine from Glycine.
- f. Oxazolone from Benzoylglycine.

**II. Molecular rearrangements and named reactions**

- a. Benzimidazole from o-phenylenediamine (Phillip's Reaction).
- b. O-hydroxyacetophenone from phenyl acetate (Fries migration)
- c. Benzanilide from benzophenone oxime (Beckmann's rearrangement)  
(To be avoided from End Examination)
- d. Preparation of 2-phenylindole from Phenylhydrazine by Fischer's method.

**III. Systematic analysis of organic binary mixtures****IV. Analysis of oils & fats**

- a. Determination of Acid value of fixed oils.
- b. Determination of Saponification value of a fixed oil.
- c. Determination of Iodine value of a fixed oil.
- d. Determination of Acetyl value of a fixed oil.

**REFERENCES**

1. Indian Pharmacopoeia. – 1996.
2. A.I. Vogel's – Practical Organic Chemistry.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
HYDERABAD**

**II Year B. Pharmacy I-Semester**

**T P C**  
**0 3 2**

**(R7207) STATISTICAL METHODS AND COMPUTER APPLICATIONS LAB**

- Solving biostatistics problems** related to inference, sampling, graphical representation of data etc., with the help of calculators & software programs like Graph-pad.
- Sample programs in C:** Program to calculate simple and complex arithmetic expressions, program using structures, program using loops and nested loops, program using functions and simple programs using arrays.
- Operating systems** like WINDOWS, UNIX, etc.
- Software packages** like MS-WORD, EXCEL, ACCESS, and POWER POINT.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
HYDERABAD**

**II Year B. Pharmacy I-Semester**

**T P C**  
**0 3 2**

**(R7208) PHYSICAL PHARMACY-II LAB**

- Determination of bulk density, true density and percentage porosity.
- Effect of particle size and effect of glidant on angle of repose.
- Microscopic size analysis.
- Determination of particle size by Andreason Pippette.
- Determination of CMC of a surfactant.
- Adsorption Isotherm.
- Partition coefficient determination.
- Determination of sedimentation volume and degree of flocculation.
- Determination of Order of reaction – First order.
- Determination of Second order reaction rate constant.
- Effect of temperature on solubility of solid in liquid.
- Effect of addition of Salt/pH/cosolvent on the solubility.
- Surface tension using Stalagmometer.
- HLB value estimation of surfactants.
- Viscosity – by Ostwald Viscometer.
- Preparation of Multiple emulsion - Demonstration.
- Preparation of Micro emulsion - Demonstration.
- Determination of Zeta potential - Demonstration.



II Year B. Pharmacy I-Semester

T	P	C
0	3	2

**(R7209) HEALTH EDUCATION AND PATHOPHYSIOLOGY – LAB**  
(14 Experiments)

1. Study of reproductive system with the help of charts and models – 2 Experiments.
2. Various devices used in Family planning like Copper T, Lippes loop, Pills, Diaphragm and Condom.
3. Microscopic studies of abnormal tissue sections – 4 Experiments.
4. Simple experiments involved in the analysis of normal and abnormal urine; collection of specimen, appearance, determination of pH, sugars, proteins, urea and creatinine – 4 Experiments.
5. Physiological experiments on nerve muscle preparations – 4 Experiments.

**REFERENCES**

1. Plummer, Practical Biochemistry
2. Chatterjee, Human Physiology

II Year B. Pharmacy II-Semester

T	P	C
4+1*	0	4

**(R7301) PHARMACEUTICAL UNIT OPERATIONS – II**

**UNIT-I**

**Heat Transfer:** Source of heat, heat transfer, steam and electricity as heating media, determination of requirement of amount of steam/electrical energy, steam pressure, boiler capacity, mathematical problems on heat transfer.

**UNIT-II**

**Evaporation:** Basic concept of phase equilibria, factors affecting the evaporation, evaporators, film evaporators, single effect and multiple effect evaporators.

**UNIT-III**

**Distillation:** Raoult's law, phase diagrams, volatility, simple steam and flash distillations, principles of rectification, Azeotropic and extractive distillation.

**UNIT-IV**

**Drying:** Moisture content and mechanism of drying, rate of drying and time of drying calculations, classification and types of dryers, dryers used in pharmaceutical industries tray dryer, Fluid bed dryer, spray dryer, vacuum oven and freeze-dryer.

**UNIT-V**

**Size Reduction:** Definition, objectives of size reduction, factors affecting size reduction, laws governing energy and power requirements of a mill, types of mills including ball mill, hammer mill, fluid energy mill etc.

**UNIT-VI**

**Mixing:** Theory of mixing, solid solid, solid liquid and liquid liquid mixing equipment, double cone, twin-shell, Silverson mixer, colloid mill, sigma blade mixer, planetary mixer, propeller mixer and turbine mixer.

**UNIT-VIII**

**Automated process control systems:** Process variables, temperature, pressure, flow level and vacuum and their measurements. Elements of automatic process control and introduction to automatic process control systems. Elements of computer aided manufacturing (CAM). Reactors and fundamentals of reactors design for chemical reactions.

## TEXT BOOKS

1. S.J. Carter, Cooper and Gunn's Tutorial Pharmacy, 6<sup>th</sup> ed., CBS publisher, Delhi.
2. CVS Subhramanyam, Pharmaceutical Engineering.
3. K. Samba Murthy, Pharmaceutical Engineering
4. Mc Cabe & Smidth. Unit Operations.

## REFERENCE BOOKS

1. W.I. Macebe and J. C. Smith Macro, Unit Operations To Chemical Engineering, Hill Int. Book Co., London.
2. L. Lachman, H. Lieberman & J. L Kaniz, The Theory And Practice Of Industrial Pharmacy, Lee & Febiger Philadelphia, USA
3. Badzer & Banchoro, Introduction to Chemical Engineering.
4. Perry's Handbook of Chemical Engineering
5. M.E. Aulton, Pharmaceutics- The science of dosage form design, 2<sup>nd</sup> ed.
6. E.A. Rawlin's, Bentley's Text Book of Pharmaceutics, 8<sup>th</sup> ed ELBS.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
HYDERABAD

## II Year B. Pharmacy II-Semester

T	P	C
4+1*	0	4

## (R7302) PHARMACEUTICAL ANALYSIS – I

## UNIT –I

Computation of analytical results, significant figures, concept of error, precision, accuracy, standard deviation, rejection of doubtful values with special reference to volumetric analysis.

Calibration of analytical equipment used in volumetric analysis.

## UNIT-II

- (a) **Theory of Neutralization Titration:** Acidimetry, Alkalimetry, Acid-base concept, Common ion effect and Solubility product, pH, Buffers and indicators.
- (b) General Principles and theory of oxidation-reduction methods, and precipitation methods. An account of the indicators used in these titrations.

**Application of the above methods in the analysis of drugs, as under IP 1996 including the latest addendum.**

## UNIT-III

- a) **Complexometric titration:** Theory, types and application in pharmaceutical analysis. Masking and demasking and their applications.
  - a) **Non-aqueous Titration:** Theory, types, solvents used and application in pharmaceutical analysis.
  - b) **Karl-Fisher method** of estimation of water and other methods of moisture determination.

**Note: Principle, instrumentation and applications of instruments mentioned in UNIT IV to UNIT VI**

## UNIT - IV

Potentiometry, pH metry (including specific ion electrodes), conductometry and polarography.

## UNIT - V

Fluorimetry, flame photometry, nephelometry & turbidimetry.

## UNIT – VI

Refractometry, polarimetry and spectropolarimetry.

## TEXT BOOKS

1. Kasture & Wadodkar, Text Book of Pharmaceutical analysis Vol.I & II.
2. A. Day Under Wood, Text Book of Quantative Analysis
3. Connors, A Textbook of Pharmaceutical Analysis.
4. B.K. Sarma, Instrumental Chemical Analysis, Goel Publishers.
5. Chatwal & Anand, Instrumental Methods of Analysis.

## REFERENCE

1. A.H. Beckett & J.B Stanlake Vol.I&II., Practical Pharmaceutical Chemistry, Athlone Press of the Univ of London
2. A.I Vogel, Quantitative Chemical Analysis, ELBS ed.
3. L.M. Atherden, Bentley and Driver's Textbook of Pharmaceutical Chemistry., Oxford University Press, Delhi.
4. Pharmacopoeia (IP, BP, USP).
5. Y.Anjaneyulu, K.Chandrasekhar, Valli Manickam, A Textbook of Analytical Chemistry.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
HYDERABAD

## II Year B. Pharmacy II-Semester

T	P	C
4+1*	0	4

## (R7303) PHARMACOGNOSY – I

## UNIT-I

Definition, history, scope and development of Pharmacognosy.

## UNIT-II

**Brief introduction to natural sources of drugs with examples:** Plant Source, Animal Source, Mineral Source, Marine Source and microorganisms.

## UNIT-III

**Classification of crude drugs:** Alphabetical, morphological, taxonomical and chemical classification with suitable examples.

## UNIT-IV

Cultivation, collection, processing, drying and storage of medicinal plants.

- Factors influencing cultivation of medicinal plants.
- Plant hormones and their applications.
- Definitions and examples for polyploidy, mutation and hybridization with reference to medicinal plants.

## UNIT-V

**Good Agriculture Practices:** Strategies of obtaining improved cultivations of medicinal plants

## UNIT-VI

**Systematic pharmacognostic study of the following carbohydrates and derived products:** Acacia, tragacanth, agar, starch, guar gum, pectin, isabgol and honey.

## UNIT-VII

**Systematic Pharmacognostic study of the following Lipids:** Castor oil, cod liver oil, shark liver oil, linseed oil, coca butter, kokum butter, bees wax, wool fat, hyndocarpus oil, spremaceti, lard and olive oil.

## UNIT-VIII

**Systematic Pharmacognostic study of the following volatile oils:** Mentha, coriander, cinnamon, lemon oil, nutumug, eucalyptus, ginger, cardmom, tulsi, lemon grass, caraway, cumin, dill, clove, fennel and black pepper

## TEXT BOOKS

1. Kokate C.K, Purohit AP & Gokhale Pharmacognosy S.B (Nirali)
2. Trease and Evans Pharmacognosy, Latest Edition.
3. Tyler, Brady & Robert, Pharmacognosy.
4. T.E.Wallis, Textbook of Pharmacognosy, Pub by CBS Publishers and distributors, New Delhi.

## REFERENCES:

1. Atal C.R & Kapur B.M, Cultivation & Utilization of Medicinal Plants.
2. Ayurvedic Pharmacopoeia of India, Pub by Govt. of India.
3. A.A. Farooqi & B.S. Sree Ramu, Cultivation of Medicinal and Aromatic Crops, University Press, Hyderabad.
4. CSIR Publications, Wealth of India.
5. Handa and Kapoor, Text Book of Pharmacognosy.
6. Gokhale, Pharmacognosy.
7. Ali, Pharmacognosy.
8. Heinrich, Fundamentals of Pharmacognosy and Phytotherapy.
9. B.P. Pandey, Economic Botany.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
HYDERABAD

## II Year B. Pharmacy II-Semester

T	P	C
4+1*	0	4

## (R7304) DISPENSING AND HOSPITAL PHARMACY

## UNIT-I

**Dispensing Pharmacy:** Principles of dispensing, form of prescription, handling of prescription, source of errors for prescription, care required in dispensing procedures including labeling of dispensed products. Weights and Measures, introduction to Latin terms, Percentage calculations, alligation method, proof spirit calculations, displacement value and calculations of isotonicity adjustment. General dispensing procedure- posology-calculations of doses.

## UNIT-II

**Principles involved and procedures adopted in dispensing of the following classes of preparations.**

(i) Mixtures ii) solutions iii) emulsions iv) powders v) lotions & liniments vi) ointments

**Definition of the following preparations like** creams, capsules, pastes, jellies, suppositories, ophthalmics, lozenges, pills, inhalations, paints, sprays, tablet triturates etc.

## UNIT-III

**Incompatibilities:** Physical, chemical and therapeutic incompatibilities – methods of over coming and handling of incompatible prescriptions.

## UNIT-IV

**Extraction and galenical products:** Principle and method of extraction preparation of infusion, tinctures, dry, soft liquid extracts.

## UNIT-V

**Hospital Pharmacy:** Organization and structure, organization of a hospital and hospital pharmacy, responsibilities of a hospital pharmacist, pharmacy and therapeutic committee, Budget preparation and implementation hospital formulary, organization of drug store, purchase and inventory control, patient counseling, role of pharmacist in community health care and education.

## UNIT-VI

**The pharmacy procedural manual, drug distribution, dispensing to out-patients, in-patients and ambulatory patient-dispensing of ancillary and controlled substances, drug information center.**

## UNIT-VIII

**Records and Reports:** Prescription filling, drug profile, patient medication profile, cases on drug interaction and adverse reactions, idiosyncratic cases etc.

**TEXT BOOKS:**

1. Cooper & Gunns Dispensing Pharmacy, CBS, Publ. and Distributors New Delhi.
2. Gupta AK, Health Education and Community Pharmacy, CBS, Publ. and Distributors New Delhi.
3. JS Quadry, Hospital Pharmacy.
4. K.Samphat, Hospital & Clinical Pharmacy, Vikas Publications.
5. Lorria & William, Essential dosage calculations.

**REFERENCES:**

1. Lippincott Williams and Wilkins, Remington Pharmaceutical Sciences.
2. William Hassan, Hospital Pharmacy.
3. R.M Metha, Dispensing Pharmacy.
4. E.A. Rawlkins, Bentley's Text Book of Pharmaceutics, Elbs publ.
5. Hoover, Dispensing of Medication.
6. NK Jain, Health Education and Community Pharmacy by, CBS, Publ. and Distributors New Delhi.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
HYDERABAD**
**II Year B. Pharmacy II-Semester**

T	P	C
4+1*	0	4

**(R7305) ENVIRONMENTAL SCIENCE****UNIT-I:****The Multidisciplinary nature of environmental studies:**

Definition, scope and importance.

**UNIT-II:****Natural Resources:**

- Forest resources:** Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.
- Water resources:** Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
- Mineral resources:** Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
- Food resources:** World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies
- Energy resources:** Growing energy needs, renewable and non-renewable energy sources use of alternate energy sources, case studies.
- Land resources:** Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

**UNIT-III:**

**Conservation of natural resources:** Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

**UNIT-IV:**

**Ecosystems:** Concept of an ecosystem. Structure and function of an ecosystem. Producers, consumers and decomposers. Energy flow in the ecosystem. Ecological succession. Food chains, food webs and ecological pyramids.  
**Introduction, types, characteristic features, structure and function of the following ecosystem:**

- a) Forest ecosystem b) Grassland ecosystem, c) Desert ecosystem, d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

**UNIT-V:**

**Biodiversity and its conservation:** Introduction, definition: genetic species and ecosystem diversity.

**Biogeographically, classification of India. Value of biodiversity:** consumptive use, productive use, and social, ethical, aesthetic and option values; biodiversity at global, national and local levels. India as a mega-diversity nation. Hot spots of



biodiversity. **Threats to biodiversity:** Habitat loss, poaching of wildlife, man-wildlife conflicts. Endangered and endemic species of India.

**Conservation of biodiversity:** In-situ conservation of biodiversity.

#### UNIT-VI :

**Environmental Pollution: Definition, causes, effects and control measures of:**

(a) Air pollution, (b) Water pollution, (c) Soil pollution, (d) Marine pollution, (e) Noise pollution, (f) Thermal pollution and (g) Nuclear hazards.

**Solid waste Management:** Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies.

**Disaster management:** Floods, earthquake, cyclone and landslides.

#### UNIT-VII:

**Social Issues and the Environment:** From unsustainable to sustainable development. Urban problems related to energy. Water conservation, rain water harvesting, watershed management Resettlement and rehabilitation of people; its problems and concerns.

**Case studies. Environmental ethics:** Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear Accidents and holocaust.

**Case studies: Wasteland reclamation.** Consumerism and waste products.

#### Unit VIII:

**Environment protection Act.** The air (prevention and control of pollution) act 1981. The Water (prevention and control of pollution) act 1974. The wildlife protection Act 1972. The Forest conservation Act 1980. Issues involved in enforcement of environmental legislation. Public awareness.

#### Human population and the Environment

Population growth, variation among nations. Population explosion – Family welfare programme. Environment and human health, human rights. Value education. HIV / AIDS, women and child welfare, role of information technology in environment and human health. **Case studies.**

#### TEXT BOOKS

1. M. Anji Reddy, Text Book of Environmental Sciences & Technology, BS Publications
2. Connar, Basic Concepts of Environmental Chemistry, Lewis Publications.
3. D.K Asthana and Meera, Text book of Environmental studies.
4. Y. Anjaneyulu, Introduction to Environmental Science, B.S. Publication, Hyderabad
5. C. Manohar Chary, P Jayram Reddy, Principles of Environmental Studies, Pharma book syndicate.

#### REFERENCES:

1. William P. Cunningham & Mary Ann Cunningham, Principles of Environmental Science - Inquiry & Applications.
2. W. P. Cooper & et al, Environmental Encyclopedia, Jaico Publishing House, Mumbai.
3. K. C. Agarwal, Environmental Biology, Nidi Publishers Ltd, Bikaner.
4. Environmental Protection and laws, Himalaya Publ House, New Delhi.
5. R. Rajagopalan, Environmental Studies, Oxford University Press.

II Year B. Pharmacy II-Semester

T      P      C  
0      3      2

**(R7306) PHARMACEUTICAL UNIT OPERATIONS II LAB**

1. Measurement of flow of fluids and their pressure, determination of reynold's number and calculation of frictional losses.
2. Evaluation of filter media, determination of rate filtration and study of factors affecting filtration including filter aids.
3. Experiments to demonstrate applications of centrifugation.
4. Determination of Humidity use of Dry Bulb and Wet Bulb thermometers and Psychometric charts.
5. Determination of overall Heat Transfer Coefficient.
6. Determination of rate of evaporation.
7. Experiments based on steam. Extractive and Azeotropic distillations.
8. Determination of rate of drying, free moisture content and bound moisture content.
9. Experiments to illustrate the influence of various parameters on the time of drying.
10. Experiments to illustrate principles of size reduction, Laws governing energy and power requirements of a size reduction.
11. Experiments to illustrate solid solid mixing, determination of mixing efficiency using different types of mixers.

II Year B. Pharmacy II-Semester

T      P      C  
0      3      2

**(R7307) PHARMACEUTICAL ANALYSIS - I LAB**

1. Assay of Pharmaceutical compounds based on chemical methods such as acid base, oxidation-reduction, non-aqueous, complexometric titration methods.
2. Conductometric determination of equivalent point of titration of HCl with NaOH.
3. Potentiometric determination of pH of a solution.
4. Potentiometric titration of an Acid.
5. Potentiometric determination of strength of unknown solution and HCL with NaOH.
6. Nephelometric determination of sulfate.
7. Fluorimetric estimation of quinine.
8. Polarographic determination of amount of Nitrobenzene in solutions.
9. Flame photometric determination of Sodium.
10. Flame photometric determination of Potassium.
11. Determination of refractive index of liquids by Abbe refractometer.

II Year B. Pharmacy II-Semester

T      P      C  
0      3      2

**(R7308) PHARMACOGNOSY – I    LAB**

1. Collection of natural herbs and preparation of herbarium/laminated photos for five drugs.
2. Macroscopy, microscopy and chemical tests for any five carbohydrates mentioned in theory.
3. Macroscopy, microscopy and chemical tests for any five lipids mentioned in theory. Identification of crude drugs listed in theory.
4. Macroscopy, microscopy and chemical tests for any five volatile oils mentioned in theory.
5. Cultivation of medicinal plants: Maintenance of one plant in Medicinal garden.

**REFERENCES**

1. Kandhelwal, Practical Pharmacognosy.
2. C.K. Kokate et.al, Practical Pharmacognosy.
3. Iyengar, Practical Pharmacognosy.

II Year B. Pharmacy II-Semester

T      P      C  
0      3      2

**(R7309) DISPENSING AND HOSPITAL PHARMACY LAB**

1. Dispensing of prescriptions falling under the categories; Mixtures, solutions, emulsions, creams, ointments, powders, pastes, lotions, liniments, inhalations, paints. etc.
2. Identification of various types of incompatibilities in a prescription, correlation thereof and dispensing of such prescriptions.
3. Dispensing procedures involving pharmaceutical calculations, pricing of prescriptions and dosage calculations for paediatric and geriatric patients.
4. Dispensing of prescriptions involving adjustment of tonicity.
5. Categorization and storage of pharmaceutical products based on legal requirements of labelling and storage.
6. Project report on visit to the community pharmacy for Counseling on the rational use of drugs and aspects of health care.
7. Preparation of Pharmacopoeial extracts and galenical products utilizing various methods of extraction.

III Year B. Pharmacy I-Semester

T	P	C
4+1*	0	4

(R7401) PHARMACEUTICAL BIOCHEMISTRY

UNIT - I

Bio chemical organization of the cell, molecular constituents of membrane, active & passive transport process, sodium and potassium pumps, osmoregulation and homeostasis.

UNIT - II

**Bio-energetics & Redox Reactions:** The concept of free energy, laws of thermodynamics. Determination of change in free energy from equilibrium constant & reduction potential. Production of ATP and its biological significance. Redox reactions, redox potential, the respiratory chain & its role in energy capture & its control. Oxidative phosphorylation & its energetics & E.T.S mechanism of actions.

UNIT - III

**Enzymes & Co-Enzymes:** Classification, Structure, mechanism of action, properties, factors affecting enzymes action. Activators & de activators of enzymes, enzyme kinetics & enzyme inhibitions, repressions with reference to drug action.

UNIT - IV

**Introduction to Bio-Molecules:** Structure, classification, cell and biological functions of carbohydrates, proteins, lipids, nucleic acids (DNA & RNA) vitamins & minerals.

UNIT - V

**Metabolism of Carbohydrates:** Glycolysis, glycogenolysis, gluconeogenesis, Kreb's cycle, HMP & uronic acid pathways, anaerobic respiration in muscle.

UNIT - VI

**Metabolism of Proteins:** *Amino acid structure & classifications, de amination, Trans-amination, de-carboxylation, Urea cycle, Metabolism & examples:* Valine, cystine, cysteine, tryptophan, tyrosine, methionine.

UNIT - VII

**Metabolism of Lipids:**

**Oxidations :** Alpha, Beta, Gamma & Omega oxidations of fatty acids, bio-synthesis of fatty acids, cholesterol, ketogenesis.

UNIT - VIII

Introduction to xenobiotic metabolism, detoxification, conjugation, prostaglandins & related products (Eicosanoids).

TEXT BOOKS:

1. Harper, Biochemistry
2. A.L.Lehninger, Principles of Biochemistry.
3. J.L.Jain, Fundamentals of Biochemistry
4. Satyanarayana, Text Book of Biochemistry
5. Rama Rao, Text Book of Bio Chemistry.
6. Conn, Outlines of biochemistry

REFERENCES

1. L.Stryer, Text Book of Bio Chemistry.
2. E.E Conn & P.K. Stumpf, Outlines of Biochemistry by, Publ, John Wiley & sons, New York.
3. B.Harrow and A. Mazur, Text Book of Biochemistry, WB Saunders Co., Philadelphia.
4. Boyer Rodney, Modern experimental Bio Chemistry.
5. West, Edward Text Book of Biochemistry.
6. Conn, Outlines of Biochemistry.
7. Plummer, Practical Bio Chemistry.
8. Denniston, Topping & Caret; General, Organic, and Biochemistry, McGraw-Hill.



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
HYDERABAD**

III Year B. Pharmacy I-Semester

T	P	C
4+1*	0	4

**(R7402) PHARMACEUTICAL MICROBIOLOGY****UNIT - I**

**Introduction to Microbiology:** Origin, scope and discovery of spontaneous generations theory, contributions of Antony Von Lewvonhock, Pasteur, Koch and Lister.

**UNIT - II**

**Diversity of Microorganisms:** Prokaryotes versus eukaryotes – eukaryotic and prokaryotic cell structure, three domains of life (bacteria, archaea and eukaryotes). Pharmaceutical significance of protozoa, algae, fungi, bacteria and viruses. Characterisation and identification of microorganisms.

**UNIT - III**

**Nutrition and Growth of Microbes:** Nutritional requirements, Types of Nutrient media and growth conditions and Nutritional types based on energy source. Isolation, cultivation (aerobic & anaerobic) and preservation of microorganisms, physiology of growth, bacterial growth curve, methods for determining bacterial numbers, mass and cell constituents. Exponential growth and generation time. Bacterial growth in batch and continuous culture (chemostat and turbidostat) synchronous growth.

**UNIT - IV**

**Microorganisms and their Environment: Effects and microbial adaptations to environmental conditions** – Temperature, oxygen desiccation, extreme cold ionic effect, electricity, osmotic pressure, radiant energy, hydrostatic pressure, mechanical impact, vibration.

**UNIT - V**

**Control of Microorganisms:** General Concepts, Inhibition of growth and killing, sterilization and disinfection, antiseptics and sanitation, mode of action application & limitation of physical agents (moist and dry heat, radiation and filtration), chemical agents. Various types of disinfectants, factors affecting sterilization and disinfection, evaluation of antimicrobial activity. Chemotherapeutic agents, mode of action and applications, drug resistance. Official methods of sterility testing of pharmaceuticals and biosafety measures.

**UNIT - VI**

**Bacterial Genetics:** Genetic recombination in bacteria, DNA replication, transcription and translation. Gene regulation (lac operon and tryptophan operon). Mutagenesis, chemical and physical mutagens.

**UNIT - VII**

**Epidemiology of Diseases:** Study of etiology, diagnosis, source of infection, mode of transmission, immunization methods, prevention and control of the following diseases. Bacillary dysentery, diphtheria, tuberculosis, leprosy, cholera, typhoid, syphilis, gonorrhoea, tetanus, food poisoning and infection hepatitis.

**UNIT - VIII****Application of Microbes in Pharmaceutical Industry**

- Microbiological Assays:** Principles and Methods involved in Assay of Antibiotics, Vitamins, Amino acids & Bio-Sensors in Analysis.
- Microbial Source & applications of various pharmaceuticals** like Antibiotics, vitamins, amino acids, solvents, enzymes & genetic engineered products etc.

**TEXT BOOKS**

- Pelczar and Reid, Text Book of Microbiology
- Anantha Narayan and Jayram Panikar, Text Book of Microbiology, Orient Longman, Delhi, Hyderabad.
- N.K. Jain, Pharmaceutical Microbiology
- Alcamo, Microbiology.
- R.C. Dubey, A textbook of Microbiology

**REFERENCES**

- Heritage, J Introductory Microbiology.
- Nester, Anderson, Roberts, Pearsall, Microbiology, McGraw-Hill.
- Hugo, W B Pharmaceutical Microbiology.
- Tortora, Gerard Text Book of Microbiology.
- E.A Rawlins, Betley's Text Book of Pharmaceutics, 8<sup>th</sup> ed
- Garg, F C Experimental Microbiology
- Gaud, R.S Practical Microbiology



III Year B. Pharmacy I-Semester

T	P	C
4+1*	0	4

(R7403) PHARMACOGNOSY – II

UNIT I

*Definition, general test and detailed pharmacognostic study of the following glycoside containing drugs.*

- |                             |   |   |
|-----------------------------|---|---|
| a. Saponin Glycosides       | : | Glycyrrhiza, Ginseng, Discorea, Sarasaparilla & Senega. |
| b. Cardioactive Glycosides  | : | Digitalis, Squill, Strophanthus, Thevetia.              |
| c. Anthraquinone Glycosides | : | Aloe, Senna, Rhubarb & Cascara.                         |
| d. Bitter Glycosides        | : | Psoralea, Gentian, Chirata.                             |

UNIT II

*Definition, general test and detailed pharmacognostic study of the following Alkaloid containing drugs.*

- |                                      |   |  |
|--------------------------------------|---|--|
| a. Pyridine – Piperidine derivatives | : | Tobacco & Lobelia.                                 |
| b. Tropane                           | : | Belladonna, Hyoscyamus, Datura, Coca & Aswagandha. |
| c. Quinoline & Isoquinoline          | : | Cinchona, Ipecac, Opium.                           |
| d. Indole                            | : | Ergot, Rauwolfia, Vinca, Nuxvomica                 |
| e. Imidazole                         | : | Pilocarpus   |
| f. Steroid                           | : | Kurchi   |
| a. Alkaloidal amine                  | : | Ephedra & Colchicum.                               |
| b. Glycoalkaloid                     | : | Solanum  |
| c. Purine                            | : | Coffee, Tea.                                       |

UNIT III

**Study of Tannins & Tannin containing drugs:** Gambir, Black catechu, Myroblan & Arjuna.

UNIT IV

**Defination & study of drugs contining resin & resin combinations:** Benzoin, Asafoetida, Balsam of Tolu, Podophyllum.

UNIT-V

**Biological sources, preparations, identification tests and uses of the following enzymes:** Diastase, Papain, Pepsin, Trypsin, Pancreatin.

UNIT-VI

General techniques of biosynthetic studies and basic metabolic pathways. Brief introduction to biogenesis of secondary metabolites of pharmaceuitcal importance.

UNIT – VII

Natural dyes and their applications in pharmacy.

TEXT BOOKS

1. Kokate C.K , Purohit AP & Gokhale, The Pharmacognosy S.B (Nirali)
2. Trease and Evans, Pharmacognosy, Latest Edition.
3. Tyler, Brady & Robert, Pharmacognosy.
4. Khare C.P, Indian Medicinal plants – An Illustrated dictionary

REFERENCES

1. Atal C.R & Kapur B.M, Cultivation & Utilization of Medicinal Plants.
2. Wallis, Textbook of pharmacognosy, Pub by CBS Publishers and distributors, New Delhi.
3. Ayurvedic Pharmacopoeia of India, Pub by Govt. Of India
4. Herbal Drug Industry Eastern Publishers., New Delhi.
5. J.B.Harbone, Phytochemical Methods: A guide to modern techniques of Plant analysis.

III Year B. Pharmacy I-Semester

T	P	C
4+1*	0	4

(R7404) PHARMACEUTICAL TECHNOLOGY – I

UNIT-I

**Preformulation:** Physicochemical properties like physical form, particle size, shape, density, wetting, dielectric constant, solubility, dissolution, organoleptic additives, hydrolysis, oxidation-reduction, recemization, polymerization etc and their effect on formulation, stability and bioavailability study of prodrugs in solving problems related to stability bio availability in formulations. Stability testing of finished products as per ICH guidelines.

UNIT-II

**Liquid dosage forms:** Introduction, types of additives used in formulations, vehicles, stabilizers, preservatives, suspending agents, emulsifying agents, solubilizers, colors, flavours and others, manufacturing packaging and evaluation of clear liquids, suspensions and emulsions official in pharmacopoeia.

UNIT-III

**Semisolid dosage forms:** Definitions, types, mechanisms of drug penetration, factors influencing penetration, semisolid bases and their selection. General formulation of semi solids, clear gels manufacturing procedure, evaluation and packaging. Suppositories: Ideal requirements bases, manufacturing procedure, packaging and evaluation.

UNIT-IV

**Pharmaceutical aerosols:** Definition, propellants general formulation, manufacturing and packaging methods, pharmaceutical applications.

UNIT-V

**Ophthalmic Preparations:** Requirements, formulation, methods of preparation, containers, evaluation.

UNIT-VI

**Cosmeticology and Cosmetic Preparations –I:** Fundamentals of cosmetic science, structures and functions of skin and hair. Formulation, preparation and packaging of cosmetics for skin, hair.

UNIT-VII

**Cosmeticology and Cosmetic Preparations –II:** Formulation, preparation & packaging of dentrifices like tooth powders, pastes, gels etc., and manicure preparations like nail polish, lipsticks, eye lashes, baby care products etc.

TEXT BOOKS

1. L. Lachman, H.A. Lieberman and J.L. Kang, Theory & Practice of industrial pharmacy, Lea & Febieger, Philadelphia Latest Edn.
2. CVS. Subramanyam, Pharmaceutical production and management, Vallabh Prakashan, New Delhi 2005.

REFERENCES

1. Shobha Rani, Text of Industrial Pharmacy, Hiremath Orient Longman
2. Sagarin & MS Balsam, Cosmetics Sciences & Technology Vol.1, 2 & 3
3. Lippincott Williams and Wilkins, Remington Pharmaceutical Sciences.
4. E.A.Rawlins, Bentley's Text Book of Pharmaceutics, Elbs publ
5. HC Ansel Introduction to Pharmaceutical Dosage forms
6. S.H. Willing, M.M.Tucherman and W.S. Hitchens IV, Good Manufacturing Practices for Pharmaceuticals: A Plan for Total Quality Control, Marcel Dekker, Inc., New York 1998.
7. Gilbert S. Banker and Christopher T Rhodes, Modern Pharmaceutics, IVth ed, Marcel Dekker, USA, 2005.
8. Yiew Chien, novel drug delivery systems, Marcel Dekker 2003.
9. Robert. A. Nash, Pharmaceutical Process Validation, 3<sup>rd</sup> Ed Marcel Dekker, 2003.
10. Good Manufacturing Practices – Schedule M Read With The Drugs And Cosmetic Rules 1945.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
HYDERABAD**

**III Year B. Pharmacy I-Semester**

<b>T</b>	<b>P</b>	<b>C</b>
<b>4+1*</b>	<b>0</b>	<b>4</b>

**(R7405) PHARMACOLOGY – I**

**UNIT I**

**General Pharmacology:** Introduction to pharmacology, sources of drugs, dosage forms and routes of administration, mechanism of action, combined effect of drugs, factors modifying drug action, tolerance and dependence, pharmacogenetics. Absorption, distribution and excretion of drugs, principles of discovery and development of new drugs.

**UNIT II**

**Pharmacology of Peripheral Nervous System:**

- Neurohumoral transmission (autonomic and Somatic)
- Parasympathomimetics, parasympatholytics, sympathomimetics & sympatholytics

**UNIT III**

**Adrenergic Receptor and neuron blocking agents, Ganglionic-stimulants and blocking agents.**

- Neuromuscular blocking agents
- Local anesthetic agents.

**UNIT IV**

**Pharmacology of Central Nervous System: I**

- Neurohumoral transmission in the C.N.S.
- General anesthetics.
- Alcohols and disulfiram.

**UNIT V**

Pharmacology of Sedatives, hypnotics, anti anxiety agents and centrally acting muscle relaxants.

**UNIT VI**

Psychopharmacological agents (antipsychotics) Antidepressants, anti- maniacs and hallucinogens)

**UNIT VII**

Pharmacology of Anti epileptic drugs, Anti Parkinsonian Drugs

**UNIT VIII**

Analgesics, Antipyretics, Anti inflammatory and Anti gout drugs.

- Narcotic analgesics and antagonists.
- C.N.S. stimulants
- Drug Addiction and Drug Abuse.

**TEXT BOOKS**

- Sathoskar, Pharmacology and pharmaco therapeutics Vol. 1 & 2, Publ by Popular Prakashan, Mumbai.
- Bertram. G. Katzung, Basic and clinical pharmacology, 9th Edn
- Tripathi, Text book of Pharmacology
- Rang & Dale, Text book of Pharmacology.

**REFERENCE BOOKS**

- J.G. Hardman and Lee E. Limbard, Good Mann & Gilmann, The Pharmacological basis of therapeutics, Mc Graw hill, Health Professions Dvn.
- H.P Rang, M. M. dale & J.M. Ritter, Pharmacology, Churchill living stone, 4<sup>th</sup> Ed.
- J. Crossland, Lewis's Pharmacology, Church living stone.
- Ruth Woodrow, Essentials of Pharmacology for Health Occupations by.

III Year B. Pharmacy I-Semester

T 0 P 3 C 2

(R7406) PHARMACEUTICAL BIOCHEMISTRY LAB

Experiments:

1. To prepare standard buffers (citrate, phosphate & carbonate) and measure the pH.
2. Titration curve for amino acids.
3. Separation of amino acids by two dimensional paper chromatography & gel electrophoresis.
4. The separation of lipids by T.L.C.
5. Identification of carbohydrates
6. Identification of amino acid.
7. Identification of lipids.
8. Estimation of glucose in urine.
9. Estimation of creatinine in urine.
10. Estimation of urea in blood.
11. Estimation of creatinine in blood.
12. Estimation of Serum protein.
13. Estimation of bile pigments in serum.
14. Estimation of alkaline phosphatase in serum
15. Effect of temperature on the activity of alpha-amylase.

III Year B. Pharmacy I-Semester

T 0 P 3 C 2

(R7407) PHARMACEUTICAL MICROBIOLOGY LAB

1. Introduction to equipment and glassware used in microbiology laboratory.
2. Preparation of various culture media.
3. Sterilization techniques and their validations.
4. Aseptic transfer of culture into different types of medias.
5. Characterisation of microbes by staining methods (simple gram's, acid fast and negative staining) and motility testing by hanging drop method.
6. Enumeration of bacteria by pour plate/spread plate technique.
7. Enumeration of bacteria by direct microscopic count.
8. Isolation of pure cultures by streak plate, spread plate, pour plate.
9. Evaluation of antiseptics and disinfectants, sterility of pharmaceutical products as per ip requirements.
10. Observation of colony characteristics.
11. bio chemical reactions:
  - i) Indole test.
  - ii) Methyl red test.
  - iii) Voges proskauer test.
  - iv) Starch hydrolysis test.
  - v) Fermentation of carbohydrates.
12. Morphology of molds, yeasts.
13. Preseravation of microorganisms (slant and stab cultures)

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
HYDERABAD**

III Year B. Pharmacy I-Semester

T	P	C
0	3	2

**(R7408) PHARMACOGNOSY II LAB**

1. Microscopy and macroscopy of any four glycoside containing crude drugs and study of their powder characters given in theory.
2. Microscopy and macroscopy of any four alkaloids containing crude drugs and study of their powder characters given in theory.
3. Microscopy and macroscopy of any three tanin containing crude drugs and study of their powder characters given in theory.
4. Microscopy and macroscopy of any three resin containing crude drugs and study of their powder characters given in theory.
5. Identification test for any two enzymes given in theory.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
HYDERABAD**

III Year B. Pharmacy I-Semester

T	P	C
0	3	2

**(R7409) PHARMACEUTICAL TECHNOLOGY - I LAB**

1. Preparation, evaluation and packaging of solutions, suspensions and emulsions, ointments. Suppositories, aerosols, eye drops, eye ointments etc.
2. Formulation of various types of cosmetics for skin, hair, dentifrices and manicure preparations.



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
HYDERABAD**

**III Year B. Pharmacy II-Semester**

**T P C**  
**3+1\* 0 3**

**(R7501) MEDICINAL CHEMISTRY – I**

**UNIT – I**

**Basic considerations of Drug activity:** Physico chemical properties of drug molecules in relation to biological activity – Solubility, lipophilicity, partition-coefficient, Ionization, hydrogen bonding, Chelation, redox potential and surface activity. Bioisosterism and steric features of drugs, drug distribution and protein binding: Introduction to Pro and soft drug approach in drug design.

**UNIT – II**

**Mechanisms of Drug action:** Introduction, Enzyme stimulation, Enzyme inhibition, Sulfonamides and Membrane – active drugs

**Drug metabolism and inactivation:** Introduction, Biotransformations, Metabolic reactions, and Conjugation reactions and factors affecting drug metabolism.

*Note: Introduction, definition, nomenclature, chemical classification, structure, synthesis, general mechanism, mode of action, SAR including physicochemical and stereo chemical aspects, metabolism and therapeutic uses of the drugs from each category shall be studied for the following units. An outline of synthetic procedure of only the drugs, which are official as per Indian Pharmacopoeia and British Pharmacopoeia and mentioned in each category.*

**UNIT – III**

**Drugs acting on CNS: A brief study of the chemistry of neurotransmitters.**

Hypnotics and Anxiolytics – Phenobarbital, diazepam, alprazolam, glutethimide  
Anti-psychotics – Chlorpromazine, haloperidol, clozapine, oxyphenazine  
Anti-epileptics – Phenytoin, valproic acid, carbamazepine, ethosuximide, meprobamate  
Anti-depressants – Imipramine, fluoxetine, doxepine, sertraline.

**UNIT - IV**

**Local anesthetic and General anesthetic agents:** Benzocaine, procaine, bupivacaine and lidocaine, halothane, thiopental sodium and ketamine.

**UNIT – V**

**Drugs affecting adrenergic mechanism :** Introduction to adrenergic receptors, catabolism

**Indirect acting sympathomimetics :** Amphetamine, ephedrine, salbutamol, pseudoephedrine, dobutamine, dopamine.

**UNIT – VI**

**Drugs affecting cholinergic mechanism:**

Introduction to cholinergic system

**Cholinergics** - Carbachol, bethanichol  
**Anticholinesterase** - Neostigmine, pyridostigmine  
**Antidotes for ach inhibitors** - PAM (pralidoxime)  
**Cholinergic blockers** - Propantheline, dicycloamine.  
**Neuromuscular blockers** - Galamine, succinyl choline.

**UNIT – VII**

**Anti-adrenergics:**

**α-blockers** - Phenoxylbenzamine, prazosine, tolazoline  
**β – blockers** - Propranolol, atenolol, labetalol.

**UNIT – VIII**

**Anti-cholinergics:** Atropine, ipratropium bromide, dicyclomine, bipyridine, propantheline

**TEXT BOOKS**

1. William O. Foye, Textbook of Medicinal Chemistry, Lea Febiger, Philadelphia
2. JH Block & JM Beale (Eds), Wilson & Giswold's Text book of organic Medicinal Chemistry and pharmaceutical chemistry, 11<sup>th</sup> Ed, Lipcott, Raven, Philadelphia, 2004.
3. S. N. Pandeya, Textbook of medicinal chemistry, SG Publ. Varanasi, 2003.
4. Rama Rao Nadendla, Medicinal Chemistry

**REFERENCES**

1. D. Abraham (Ed), Burger Medicinal chemistry and Drug discovery, Vol. 1 & 2, John Wiley & Sons, New York 2003, 6<sup>th</sup> Ed.
2. Lippincott Williams and Wilkins, Remington Pharmaceutical Sciences; 20<sup>th</sup> Edition.
3. M. Atherden, Bentley and Driver's Textbook of Pharmaceutical Chemistry, Ed: I. Oxford University Press, Delhi.
4. B.N. Lads, MG.Mandel and F.I. way, Fundamentals of drug metabolism & disposition, William & welking co, Baltimore USA.
5. C. Hansch, Comprehensive medicinal chemistry, Vol 1 – 6 Elsevier pergon press, Oxford
6. Daniel lednicer, Strategies for Organic Drug Synthesis and Design, John Wiley, N. Y. 1998.
7. D. Lednicer, Organic drug synthesis, Vol, 1 – 6, J.Wiley N.Y.
8. Kadam, Textbook of Medicinal Chemistry Vol. 1 & 2.
9. T Nogrady, Medicinal Chemistry – A Biochemical Approach. Oxford University Press, New York, Oxford
10. SS Dhara, A textbook of Pharmaceutical Chemistry.

III Year B. Pharmacy II-Semester

T	P	C
3+1*	0	3

(R7502) PHARMACEUTICAL TECHNOLOGY - II

**UNIT-I**

**Capsules:** Advantage and disadvantages of capsule dosage forms, material for production of hard and soft gelatin capsules, sizes of capsules, capsule filling, soft processing problems in capsule manufacturing, importance of base absorption and minimum/gm factors in soft capsules, quality control, stability testing and storage of capsule dosage forms.

**UNIT-II**

**Microencapsulation:** Types of microencapsulation and importance of microencapsulation in pharmacy, microencapsulation by coacervation phase separator, multi orifice centrifugal separation. Spray drying, spray congealing, polymerization complex emulsion, air suspension technique, and pan coating techniques, evaluation of microcapsules.

**UNIT-III**

**Tablets:** Formulation of different types of tablets, granulation technology on large-scale by various techniques, types of tablet compression machinery and the equipments employed evaluation of tablets.

**UNIT-IV**

**Coating of Tablets:** Types of coating, coating materials and their selection, formulation of coating solution, equipment for coating, coating processes, evaluation of coated tablets.

**UNIT-V**

**Parenteral Products**

- a. Preformulation factors, routes of administration, water for injection, treatment apyrogenicity, non-aqueous vehicles, isotonicity and methods of its adjustment.
- b. Formulation details, container and closures and selection.
- c. Prefilling treatment, washing and sterilization of containers and closures, preparation of solution and suspensions, filling and closing of ampules, vials, infusion fluids, lyophilization & preparation of sterile powders, equipment for large-scale manufacture and evaluation of parenteral products.
- d. Aseptic techniques, sources of contamination and method of prevention. Design of aseptic area, laminar flow benches, services and maintenance.

**UNIT-VI**

**Packaging of Pharmaceutical products:** Packaging components, types, specifications and methods of evaluation, stability aspects of packaging. Packaging equipments, factors influencing choice of containers, legal and other official requirements for containers, package testing.

**TEXT BOOKS**

1. L. Lachman, H.A. Lieberman and J.L. Kanig, Theory & Practice of industrial pharmacy, Lea & Febieger, Philadelphia Latest Edn
2. HC Ansel introduction to Pharmaceutical Dosage forms
3. Pharmaceutical Dosage forms Tablet by Lieberman, Lachman
4. CVS. Subramanyam, Pharmaceutical production and management, Vallabh Prakashan, New Delhi 2005.

**REFERENCES**

1. Sagarin & MS Balsam, Cosmetics Sciences & Technology, Vol. 1, 2 & 3
2. Lippincott Williams and Wilkins, Remington Pharmaceutical Sciences
3. E.A. Rawlkins Bentley's Text Book of Pharmaceutics, Elbs publ
4. S.H. Willing, M.M Tucherman and W.S. Hitchings IV, Good Manufacturing Practices for Pharmaceuticals: A Plan for Total Quality Control, 2<sup>nd</sup> ed, Marcel Dekker, Inc., New York 1998.
5. Gilbert S. Banker and Christopher T Rhodes, Modern Pharmaceutics, IVth ed., marcel dekker, usa, 2005.
6. Yiew chien, novel drug delivery systems, 2<sup>nd</sup> ed, marcel dekker 2003.
7. Robert. A. Nash, Pharmaceutical Process Validation, 3<sup>rd</sup> Ed Marcel Dekker, 2003.
8. Good Manufacturing Practices – Schedule M. Read With The Drugs And Cosmetic Rules 1945

M.E. Aulton, Pharmaceutics- The science of Dosage form Design 2<sup>nd</sup> ed.

# JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

## III Year B. Pharmacy II-Semester

T P C  
4+1\* 0 4

### (R7503) PHARMACOLOGY – II

#### UNIT-I

Pharmacology of Cardiovascular System - Hypertension & congestive heart failure

- Digitalis and cardiac glycosides
- Antihypertensive drugs.
- Drugs used in the therapy of shock.

#### UNIT-II

Pharmacology of Drugs used in coronary artery disease

#### UNIT-III Pharmacology of drugs used arrhythmias

#### UNIT-IV

Drugs acting on hematopoietic system

- Anti-coagulants, Anti-platelets & Thrombolytics.
- Hematinics.

#### UNIT-V

Drugs acting on urinary system

- Fluid and electrolyte balance
- Diuretics

#### UNIT-VI

Autacoids-I

Histamine, 5 HT and their antagonists.

#### UNIT-VII

Autacoids -II

- Prostaglandins, thromboxanes and leukotrienes
- Pentagastrin, cholecystokinin, angiotensin, Bradykinin and substance P

#### UNIT-VIII

Drugs Acting on the Respiratory System

- Anti asthmatic drugs including bronchodilators.
- Anti tussives and expectorants.
- Respiratory stimulants.

## TEXT BOOKS

- Rang & Dale, Textbook of Pharmacology.
- Sathoskar, Pharmacology and pharmaco therapeutics Vol. 1 & 2, Publ by Popular Prakashan, Mumbai
- Bertram. G. Katzung, Basic and clinical pharmacology, 9th Edn, Mc Graw hill
- Tripathi, Textbook of Pharmacology, JAYPEE
- Leilani Grajeda, Understanding Pharmacology: A physiological Approach
- F.S.K Barar, Essentials of Pharamcotherapeutics.

## REFERENCES

- J.G. Hardman and Lee E. Limbard, Good Mann & Gilmann: The Pharmacological basis of therapeutics, Mc Graw hill, Health Professions Dvn.
- H.P Rang, M. M. dale & J.M. Ritter, Pharmacology, : Churchill Living stone, 4<sup>th</sup> Ed.
- J. Crossland, Lewis 's Pharmacology, Church living stone.

(R7504) CHEMISTRY OF NATURAL DRUGS

UNIT – I

**Alkaloids:** Definition of alkaloids, pseudoalkaloids and protoalkaloids. General methods of extraction and isolation. Properties of alkaloids. Tests for alkaloids.

**Opium alkaloids:** Structural features of Morphine molecule – Peripheral groups. Modification of structure and effect on analgesic activity – SAR of morphine and morphine-like analgesics. **Narcotic antagonists:** Nalorphine, Levallorphan. Anti-tussive agents: Noscapine, Dextromethorphan. Smooth muscle relaxants: Papaverine and related compounds like ethaverine, Dioxylone. Structures and uses of these compounds.

**Tropane alkaloids:** Structures of Atropine/hyoscyamine, Hyoscine, Hydrolytic products of these – Tropine and Scopine. Relationship between tropine & pseudotropine. Biological actions and uses of tropane alkaloids. Homatropine.

UNIT – II

**Rauwolfia alkaloids:** Structures and uses of Reserpine, Rescinnamine, Deserpidine, ajmaline, syrosingapine. Hydrolysis of reserpine and rescinnamine. Mechanism of action of reserpine.

**Ergot alkaloids:** Classification, structures, hydrolytic products, pharmacological actions, therapeutic uses and toxicity. Synthetic derivatives: Methylergonovine (Methylergometrine), L S D, ethysergide.

UNIT – III

**Terpenoids:** Volatile oils: Definition of terpenoids, Classification, isoprene, special isoprene and gem-dialkyl rules.

**Citral:** Sources and structures, isomerism in citral, citral-a (Geranial), citral-b (Neral). Reduction of citral to citronellal, citronellol, geraniol and nerol. Oxidation of citral to geranic acid. Cyclodehydration of citral to p-cymene. Conversion of citrals – a and b into alfa-terpeneol and ionones.

**Alfa – Terpeniol:** Sources and structure. Conversion into p-cymene, 1,8 – terpin, terpinolene, dipentene, dipentene dihydrochloride. Preparation of alfa-terpeneol from limonene/dipentene, 1,8-Terpin and pinene.

UNIT – IV

**Carvone:** Sources and structure. Conversion into Carvacrol. Reduction of Carvone with different reagents. Synthesis from Limonene/Dipentene and alfa – Terpeneol.

**Menthol and menthone:** Sources, structures and uses. Oxidation of menthol to menthone. Conversion of menthol into thymol.

**1,8-cineole:** Sources and structure. Preparation from Cis-terpin. Mention of 1,4-cineole.

**Camphor:** Source, properties, commercial method of preparation from  $\alpha$ -pinene and uses. Oxidation to camphoric acid and camphoronic acids, conversion into p-cymene. Reduction of camphor to Borneol & isoborneol. Source, structures, uses of isoborneol. Oxidation of borneols to camphor.

UNIT – V

**Steroids:** Introduction: Brief history of development of steroid industry. Sources of steroidal drugs – diosgenin, cholesterol, stigmasterol and ergosterol – their structures. Marker's synthesis of progesterone. Nomenclature of steroids, stereochemistry and numbering the ring system. Colour reactions of steroids. Selenium distillation of steroids.

UNIT – VI

**Steroidal Anti-Inflammatory drugs:** Classification, structures, SAR, uses & toxicity.

**Cardiac glycosides:** structures of glycosides from Digitalis, Strophanthus, Squill and Bufo. Enzymatic and acid hydrolytic reactions of the glycosides. Mechanism of action, SAR, therapeutic uses and toxicity.

**Bile acids:** Names, structures and functions.

UNIT – VII

**Hormones: Sex Hormones:** Male and female sex hormones.

**Estrogens – estradiol, estrone, estriol.** Structures and their interconversion. Structures of synthetic estrogens. Therapeutic uses and side effects.

**Progesterone and selected progestins – structures, uses and side-effects.**

**Preparation of progesterone from diosgenin.** A note on Steroid contraceptive agents and regimens.

**Androgens – Testosterone and derivatives.** Structure and biological activities & uses.

**Hormones of Thyroid:** Thyroxine and triiodothyronine – structure and functions.

UNIT – VIII

**Adrenal Cortex Hormones:**

**Mineralocorticoids:** Aldosterone, Deoxycorticosterone,

Fludrocortisone – structures, biological activity and uses. Aldosterone antagonist Spiranolactone.

**Glucocorticoids:** Cortisone & Hydrocortisone – Structure, biological actions, uses.

**Hormones of Pancreas:**

**Insulin – introduction, structural features – some sequence differences in insulins of some species like humans, pork, beef.** Metabolic effects of insulin. A note on insulin preparations. **Glucagon – Structure and Physiological role.**



**NOTE:**

1. **Structure elucidation of compounds is not included in the syllabus.**
2. **Structural features like the basic nucleus; presence of substituent groups will be discussed.**
3. **Simple reactions like hydrolysis, selenium dehydrogenation, oxidation, reduction etc., will be taught wherever applicable.**

**TEXT BOOKS**

1. O.P. Agarwal, Natural products by. Vol.1 & 2, Goel publications – Meerut.
2. J.B Harborne, Phyto Chemical methods.
3. I L Finar, Organic chemistry, Vol. 1 & 2, the English language book society, London, New Delhi.

**REFERENCES**

1. RT Morrison and R.N BOYD, Organic chemistry, Allyn and Bacon, inc., boston
2. Me – Wolf, ed., Burger's medicinal chemistry, J. Wiley & sons, NY.
3. F.G. Mann & B. Saunders, Practical Organic chemistry Longmans green & Co. Ltd., UK.
4. RM. Acheson, an introduction to the chemistry of heterocyclic compounds, Interscience NY.
5. Duquesn & others, Practical pharmacognocny, CBS Publ.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
HYDERABAD**

III Year B. Pharmacy II-Semester

T	P	C
4+1*	0	4

**(R7505) PHARMACEUTICAL JURISPRUDENCE****UNIT-I****Introduction**

- |    |                                 |                 |
|----|---------------------------------|-----------------|
| a. | Pharmaceutical Legislations     | A brief review  |
| b. | Drugs & Pharmaceutical Industry | A brief review  |
| c. | Pharmaceutical Education        | A brief review. |
| d. | Pharmaceutical ethics & policy  |                 |

**An elaborate study of the following****UNIT-II**

Pharmacy Act 1948

**UNIT-III**

Drugs and Cosmetics Act 1940 and Rules 1945

**UNIT-IV**

Medicinal &amp; Toilet Preparations (Excise Duties) Act 1955

**UNIT-V**

Narcotic Drugs &amp; Psychotropic Substances Act 1985 &amp; A.P. N. D. P.S Rules 1986

**UNIT-VI**

Drugs (Prices Control) Order 1995.

**UNIT-VII**

Drugs and Magic Remedies (Objectionable Advertisements) Act 1954 and Rules 1955.

**UNIT-VIII**

A study of the salient features of the following.

- Prevention of Cruelty to animals Act 1960.
- AP State Shops & Establishments Act 1988 & Rules 1990.
- Factories Act 1948.
- WTO, GATT and The Indian Patents Act 1970
- Pharmaceutical Policy 2002.

**Note: The teaching of all the above Acts should cover the latest amendments.**



**TEXT BOOKS**

1. B.M.Mithal, Text book of Forensic Pharmacy, publ by Vallabh Prakashan
2. Prof. Suresh Kumar J.N, Text book of Forensic Pharmacy by. Frontline Publications
3. C.K.Kokate & S.B.Gokhale, Textbook of Forensic Pharmacy

**REFERENCE BOOK**

1. Bare Acts and Rules Publ by Govt of India/state Govt from time to time.
2. AIR – reported judgments of Supreme Court of India and other High Courts
3. Pharmaceutical policy of India
4. Notification from NPPA
5. Vijay Malik, Drugs & Cosmetics act 1940 and Rules, Eastern Law House Co. Delhi, Kolkata.
6. K.Sampath, Pharmaceutical Jurisprudence (Forensic Pharmacy)

**III Year B. Pharmacy II-Semester**

T	P	C
0	3	2

**(R7506) ADVANCED ENGLISH LANGUAGE COMMUNICATION SKILLS LAB****1. Introduction**

The introduction of the English Language Lab is considered essential at 3<sup>rd</sup> year level. At this stage the students need to prepare themselves for their careers which may require them to listen to, read, speak and write in English both for their professional and interpersonal communication in the globalised context.

The proposed course should be an integrated theory and lab course to enable students to use 'good' English and perform the following:

Gather ideas and information, to organise ideas relevantly and coherently.

Engage in debates.

Participate in group discussions.

Face interviews.

Write project/research reports/technical reports.

Make oral presentations.

Write formal letters.

Transfer information from non-verbal to verbal texts and vice versa.

To take part in social and professional communication.

**2. Objectives:**

This Lab focuses on using computer-aided multimedia instruction for language development to meet the following targets:

To improve the students' fluency in English, through a well-developed vocabulary and enable them to listen to English spoken at normal conversational speed by educated English speakers and respond appropriately in different socio-cultural and professional contexts.

Further, they would be required to communicate their ideas relevantly and coherently in writing.

**3. Syllabus:**

The following course content is prescribed for the Advanced Communication Skills Lab:

**UNIT – I**

**Fundamentals of interpersonal communication** – starting a conversation – responding appropriately and relevantly – using the right body language – role play in different situations.

**UNIT – II**

**Vocabulary building** – synonyms and antonyms, word roots, one-word substitutes, prefixes and suffixes, study of word origin, analogy, idioms and phrases.

**UNIT – III**

**Group Discussion** – dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and coherence.

**UNIT – IV**

**Interview Skills** – concept and process, pre-interview planning, opening strategies, answering strategies, interview through tele and video-conferencing.

**UNIT – V**

**e-Mail** – content, formats – formal/informal. Structure, etiquette, structure and presentation.

**UNIT – VI**

**Resume' writing** – structure and presentation, planning, defining the career objective, projecting ones strengths and skill-sets, summary, formats and styles, letter-writing.

**UNIT – VII**

**Reading comprehension** – reading for facts, guessing meanings from context, scanning, skimming, inferring meaning, critical reading.

**UNIT – VIII**

**Technical Report writing** – Types of formats and styles, subject matter – organization, clarity, coherence and style, planning, data-collection, tools, analysis.

**4. Minimum Requirement**

Computer aided multimedia language lab with 60 systems with LAN facility with speakers, head phones and a teacher console to accommodate 60 students.

**5. Suggested Software**

The software consisting of the prescribed topics elaborated above should be procured and used.

**6. Books Recommended:**

1. Effective Technical Communication, M. Ashraf Rizvi, Tata Mc. Graw-Hill Publishing Company Ltd.
2. A course in English communication by Madhavi Apte, Prentice-Hall of India, 2007.
3. Communication Skills by Leena Sen, Prentice-Hall of India, 2005.
4. Academic Writing- A Practical guide for students by Stephen Bailey, Rontledge Falmer, London & New York, 2004.
5. Body Language- Your Success Mantra by Dr. Shalini Verma, S. Chand, 2006.
6. Books on TOEFL/GRE/GMAT/CAT by Barron's/cup
7. IELTS series with CDs by Cambridge University Press.
8. Technical Report Writing Today by Daniel G. Riordan & Steven E. Pauley, Biztantra Publishers, 2005.

9. Basic Communication Skills for Technology by Andra J. Rutherford, 2<sup>nd</sup> Edition, Pearson Education, 2007.
10. Communication Skills for Engineers by Sunita Mishra & C. Muralikrishna, Pearson Education, 2007.
11. Objective English by Edgar Thorpe & Showick Thorpe, 2<sup>nd</sup> edition, Pearson Education, 2007.
12. Objective IELTS by Michal Black & Wendy Sharp, Cambridge University Press.
13. Objective IELTS by Michal Black & Annette Capel, Cambridge University Press.
14. Cambridge Preparation for the TOEFL Test by Jolene Gear & Robert Gear, 4<sup>th</sup> Edition.
15. Technical Communication by Meenakshi Raman & Sangeeta Sharma, Oxford University Press.

**TEXT BOOKS**

1. Strengthen Your English, Bhaskaran & Horsburgh, Oxford University Press
2. English for Technical Communication, K R Lakshminarayana, SCITECH
3. Strategies for Engineering Communication, Susan Stevenson & Steve Whitmore (John Wiley and sons).
4. English for Engineers: With CD, Sirish Chaudhary, Vikas Publishing House Pvt. Ltd. With CD.
5. Basic Communication Skills for Technology, Andrea J Rutherford, Pearson Education Asia.
6. Murphy's English Grammar with CD, Murphy, Cambridge University Press
7. English Skills for Technical Students by Orient Longman
8. English for Professional Students, by S S Prabhakara Rao.
9. The Oxford Guide to Writing and Speaking, John Seely, Oxford.
10. Grammar Games, Renvolucir Mario, Cambridge University Press.
11. Everyday Dialogues in English by Robert J. Dixon, Prentice-Hall of India Ltd., 2006.
12. English Technical Communication, Vol. 1 & 2, by K. R. Lakshmi Narayanan, Sci tech. Publications.
13. Spoken English (CIEFL) in 3 volumes with 6 cassettes, OUP English Pronouncing Dictionary Daniel Jones Current Edition with CD.
14. Spoken English- R. K. Bansal, J. B. Marrison and Orient Longman 2006 Edn.
15. A Practical course in English Pronunciation, (with two Audio cassettes) by J. Sethi, Kamlesh Sadanand & D.V. Jindal, Prentice-Hall of India Pvt. Ltd., New Delhi.
16. Pronunciation Practice Activities: A resource book for teaching English pronunciation by Martin Hewings, Cambridge University Press, 2004.
17. English Pronunciation in use by Mark Hancock (with 4 CD)- Cambridge University Press, 2005.
18. A text book of English Phonetics for Indian Students by T. Balasubramanian (Macmillan)
19. English Skills for Technical Students, WBSCTE with British Council, OL

20. Effective Technical Communication, M. Ashraf Rizvi, Tata Mc. Graw-Hill Publishing Company Ltd.
21. Professional Presentations- A Video based course by Malcolm Goodale, Cambridge University Press, 2005.
22. A course in English communication by Madhavi Apte, Prentice-Hall of India, 2007.
23. Communication Skills by Leena Sen, Prentice-Hall of India, 2005.
24. Academic Writing- A Practical guide for students by Stephen Bailey, Rontledge Falmer, London & New York, 2004.
25. Body Language- Your Success Mantra by Dr. Shalini Verma, S. Chand, 2006.
26. Books on TOEFL/GRE/GMAT/CAT by Barron's/cup.
27. IELTS series with CDs by Cambridge University Press.
28. Anderson, Technical Communication-Thompson publications
29. Delta's Key to the Next Generation TOEFL Test, Nancy Gallagher.
30. Technical Report Writing Today by Daniel G. Riordan & Steven E. Pauley, Biztantra Publishers, 2005.
31. Basic Communication Skills for Technology by Andra J. Rutherford, 2<sup>nd</sup> Edition, Pearson Education, 2007.
32. Communication Skills for Engineers by Sunita Mishra & C. Muralikrishna, Pearson Education, 2007.
33. Objective English by Edgar Thorpe & Showick Thorpe, 2<sup>nd</sup> edition, Pearson Education, 2007.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
HYDERABAD**

III Year B. Pharmacy II-Semester

T	P	C
0	3	2

**(R7507) MEDICINAL CHEMISTRY – I LAB**

- I. **Synthesis of some medicinal compounds and their analogues.**
    - i. Barbituric acid from Diethyl Malonate.
    - ii. Phenytion from Benzoin or Benzil.
    - iii. Paracetamol from *para*- nitro phenol or *para*- aminophenol.
    - iv. 1,4- di hydro pyridine from ethyl aceto acetate.
    - v. Quinazolinone from anthranilic acid via benzoxazinone.
    - vi. Sulfanilamide from acetanilide
    - vii. Isoniazid from  $\gamma$ -picoline.
    - viii. Antipyrine from ethyl aceto acetate.
    - ix. Benzocaine from *para*- nitro benzoic acid.
  - II. **Qualitative estimation of some functional groups.**
    - i. Halogens (Strepheno's method).
    - ii. Hydroxyl groups (acetylation method)
    - iii. Methoxyl groups (Zeissel's method)
    - iv. Carboxyl groups (silver salt method).
- **Not to be given in End Examinations**

**REFERENCES:**

1. A.I. Vogel, Text Book of Practical Organic Chemistry, 5<sup>th</sup> Edition.
2. R.K. Bansal, Laboratory Manual of Organic Chemistry.
3. F.G. Mann & B.C. Saunders, Pratical Organic Chemistry, 4<sup>th</sup> Edition.

III Year B. Pharmacy II-Semester

T	P	C
0	3	2

**(R7508) PHARMACEUTICAL TECHNOLOGY – II LAB**

1. Experiments to illustrate preparation, stabilization, physical, chemical and biological evaluation of pharmaceutical products like capsules, tablets, parenterals, microcapsules etc.
2. Evaluation of materials used in pharmaceutical packaging.

III Year B. Pharmacy II-Semester

T	P	C
0	3	2

**(R7509) PHARMACOLOGY – II LAB**

1. **Introduction to Experimental Pharmacology**  
Preparation of different solutions for experiments.  
Drug dilutions, use of molar and w/v solutions in experimental Pharmacology.  
Common laboratory animals and anesthetics used in animal studies.  
Commonly used instruments in experimental pharmacology.  
Some common and standard techniques.  
Bleeding and intravenous injection, intragastric administration.
2. **Experiments on intact preparations:**  
Study of different routes of administration of drugs in mice/rats.
3. **Experiments in Central Nervous system:**  
Recording of spontaneous motor activity, stereotype, analgesia, anticonvulsant activity, anti inflammatory activity,
4. **To study the effect of autonomic drugs on rabbit's eye**
5. To study the effects of various agonists and antagonists and their characterisation using isolated preparations like frog's rectus abdominus muscle and isolated ileum preparation of rat & guinea pig.

**Experiments on Isolated Preparations:**

- i.
  - a. To record the concentration response curve (CRC) of acetylcholine using rectus abdominus muscle preparation of frog.
  - b. To study the effects of physostigmine and d tubocurarine on the crc of acetylcholine using frog rectus abdominus muscle preparation of frog.
  - c. To record the CRC of 5 HT on rat fundus preparation.
  - d. To record the CRC of histamine on guineapig ileum preparation.
- ii.
  - a. To study the inotropic and chronotropic effects of drugs on isolated frog heart.
  - b. To study the effects of drugs on normal and hypodynamic frog heart.
6. Experiments pertaining to analgesia, anti-convulsant activity, anti-inflammatory activity (**Only demonstration**).

III Year B. Pharmacy II-Semester	T	P	C
	0	3	2

**(R7510) CHEMISTRY OF NATURAL DRUGS LAB**

1. Preparation of different alkaloid testing reagents like Dragendorff, Mayer, Wagner's, etc. and testing some alkaloids and plant extracts using these reagents.
2. Identification of alkaloids by specific colour tests.
3. Tests for steroids, steroidal glycosides and cardiac glycosides. Liberman-Burchard test, Salkowski reaction, Kedde reaction, etc.
4. Tests for flavanoids and their glycosides. Shinoda Test (Mg /Hcl test), FeCl<sub>3</sub> test.
5. TLC end examination of alkaloids, steroids, steroidal glycosides and cardiac glycosides.
6. Identification of natural products.
7. Extraction of caffeine from tea leaves.
8. Extraction of lactose from milk.
9. Extraction of nicotine from tobacco.
10. Extraction of piperine from black pepper.
11. Extraction of lycopene from tomatoes.
12. Extraction of beta - carotene from carrots.
13. Volatile oil production by steam distillation (**Demonstration only**)

**TEXT BOOKS**

1. Indian Pharmacopoeia – 1996.
2. Weagners, Phyto Chemical Methods of Drug Analysis.
3. C.K. Kokate, Practical Pharmacognosy

IV Year B. Pharmacy I-Semester	T	P	C
	3+1*	0	3

**(R7601) PHARMACEUTICAL ANALYSIS - II**

**UNIT – I**

**Visible, UV & IR Spectrophotometry:** Principle, Electron Transition, Beer-Lamberts Law & Deviations, Chromophores, Instrumentation – Construction of Single Beam and Double Beam Spectrophotometers, Applications.

**UNIT - II**

**NMR and Mass Spectrometry:** Basic Principle, Instrumentation and Applications.

**UNIT - III**

**Basic Principles and applications** of differential thermal analysis (DTA) and differential scanning calorimetry (DSC).

**Basic Principles and applications** of atomic absorption spectroscopy and XRD.

**UNIT – IV**

Optical rotatory dispersion (ORD) and Circular dichroism: General Principle and Applications.

Radio Immuno Assay & Enzyme Linked Immuno Sorbate Assay.

**NOTE: Introduction to chromatographic techniques**

**Principle, Instrumentation and applications of the instruments in UNIT V to UNIT VII**

**UNIT - V**

Paper, TLC and column chromatography.

**UNIT - VI**

Gas Chromatography.

**UNIT - VII**

HPLC and HPTLC.

**UNIT – VIII**

**Electrophoresis:** Scope, Different types Electrophoresis and applications.

**TEXT BOOKS**

1. R.M. Silvesterin and G.C. Bassler. Spectrometric Identification of Organic Compounds.
2. AH Beckett & Stenlake, Text book of Practical Pharmaceutical chemistry, Vol.I&II
3. AI Vogel, Quantitative Chemical Analysis.
4. Hobart. H. Willard and others, Instrumental methods of analysis, CBS publ and Distributors New Delhi.



5. Robert D. Brown, Introduction to Instrumental Analysis.
6. Skoog, Principles of Instrumental Analysis.
7. B.K.Sharma, Instrumental and Chemical Analysis, Goel Publ House, Hyderabad.

#### REFERENCES:

1. Settle, Handbook of Instrumental Techniques for Analytical Chemistry.
2. Y.Anjaneyulu & Maraiah, Quality Assurance & Quality Management in Pharmaceutical Industry.
3. P.D. Sethi, Quantitative analysis of Drugs and Pharmaceuticals.
4. K. A. Connors, A Textbook of pharmaceutical analysis, Wiley Interscienc, NY.
5. A.M. Knevel & F.E. Digengl, Jenkin's quantitative pharmaceutical chemistry, Mc Graw Hill Book Co., NY.
6. Pharmacopoeia (IP, BP, USP, PhI, Eu. PhI).

#### JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B. Pharmacy I-Semester

T	P	C
3+1*	0	3

#### (R7602) BIOPHARMACEUTICS AND PHARMACOKINETICS

##### UNIT-I

Introduction to Biopharmaceutics and Pharmacokinetics and their role in formulation development and clinical setting

##### UNIT-II

**Biopharmaceutics:** Passage of drugs across biological barrier (passive diffusion, active transport, facilitated diffusion and pinocytosis) factors influencing absorption – physiochemical, physiological and pharmaceutical.

##### UNIT-III

Drug distribution in the body, Factors influencing distribution.

##### UNIT-IV

Plasma protein binding, binding sites, factors influencing protein binding

##### UNIT-V

##### Pharmacokinetics

Significance of plasma drug concentration measurement.

**Compartment model:** Definition and scope.

Pharmacokinetics of drug absorption – Zero order and first order absorption rate constant using Wagner Nelson and Loo-riegelman method.

Volume of distribution and distribution coefficient.

**Comparative kinetics :** One compartment and two compartment models. Determination of Pharmacokinetic parameters from plasma and urine data after drug administration by oral parenteral and other routes.

Curve fitting (Method of Residuals) Regression procedures.

Clearance concept, Mechanism of Renal clearance, clearance ratio, determination of renal clearance.

Non-linear pharmacokinetics with special reference to one compartment model after I.V.Drug administration, Michales Mente Equation, detection of non-linearity (Saturation mechanism).

##### UNIT-VI

##### Clinical pharmacokinetics

Definition and scope

Dosage adjustment in patients with and without renal and hepatic failure.

Pharmacokinetic drug interactions and its significance in combination therapy.

**UNIT-VII****Bioavailability and bioequivalence.**

Measures of bioavailability, C-max, T-max and Area Under the Curve (AUC)

Design of single dose bioequivalence study and relevant statistics. Overview of regulatory requirements for conduction of bio-equivalence studies.

**UNIT-VIII**

Bio availability and bio equivalence including evaluation testing protocols.

- In vitro dissolution studies for solid dosage forms methods, interpretation of dissolution data in vitro, in vivo correlations.
- Bioavailability testing protocol and procedures.
- In vivo methods of evaluation – statistical treatment.

**TEXT BOOKS**

- Venkateshulu, Fundamentals of Biopharmaceutics and Pharmacokinetics, Pharma Book Syndicate.
- Milo Gibaldi, Biopharmaceutics and clinical pharmacokinetics 4/Edn. Pharma Book Syndicate. Hyderabad
- DM Brahmkar and SB Jaiswal, biopharmaceutics and pharmacokinetics- a treatise, vallabh prakasham, Delhi,
- P.L. Madan, Biopharmaceutics and Pharmacokinetics, Jaypee Bros.

**REFERENCES**

- Remington's pharmaceutical sciences, Mac Pub. Co., Easton Pennsylvania.
- Modern pharmaceutics by banker Marcel Dekker Inc., NY
- L. Iachman, H.A. Lieberman, J.L. Kanig, the theory and practice of industrial pharmacy, Varghese publ house, Mumbai.
- AR. Gennerio Remington: the science and practice of pharmacy, vol 1 & 2 Lippincott Williams & wilkins, Philadelphia, 2004.
- Robert E notary, Biopharmaceutics and pharmacokinetics – an introduction, arcel dekker inc., NY
- L. Shargel and ABC Yu, textbook of applied biopharmaceutics & pharmacokinetics, 4<sup>th</sup> edn, Appleton – century – crofts, Connecticut, 2004.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
HYDERABAD**

**IV Year B. Pharmacy I-Semester**

T	P	C
4+1*	0	4

**(R7603) PHARMACOLOGY – III****UNIT-I****Drugs Acting on the Gastrointestinal Tract**

- Antacids, Antisecretory and Anti ulcer Drugs
- Laxatives and antidiarrhoeal drugs.
- Appetite Stimulants and Suppressants
- Emetics and anti emetics
- Miscellaneous; Carminatives, demulcents, protectives, adsorbents, astringents, digestants, enzymes and mucolytics.

**UNIT-II****Chemotherapeutic agents and their applications:**

- General principles of chemotherapy.
- Sulphonamides and co trimoxazole.
- Antibiotics: Penicillins, cephalosporins, betalactams,

**UNIT-III**

**Chemotherapeutic agents and their applications:** Tetracyclines aminoglycosides, chloramphenicol, erythromycin, quinolones and miscellaneous antibiotics.

**UNIT-IV**

Chemotherapy of tuberculosis & leprosy.

**UNIT-V**

Chemotherapy of fungal diseases, viral diseases, urinary tract infections and sexually transmitted diseases.

**UNIT-VI**

Chemotherapy of malignancy and immunosuppressive Agents.

**UNIT-VII**

**Principles of Toxicology:** Definition of poison, general principles of treatment of poisoning with particular reference to barbiturates opioids, organophosphorous and atropine poisoning. Heavy metals and heavy metals antagonists.

**UNIT-VIII**

Principles of bioassays. Errors in bioassays. Study of bioassay methods for the following drugs

- Digitalis,
- D – tubocarine,
- Oxytocine,
- HCG.

## TEXT BOOKS

1. Sathoskar, Pharmacology and pharmaco therapeutics, Vol. 1 & 2, Publ by Popular Prakashan, Mumbai.
2. Bertram. G. Katzung, Basic and clinical pharmacology
3. Tripathi, Textbook of Pharmacology.
4. Rang & Dale, Textbook of Pharmacology.

## REFERENCE BOOKS

1. J.G. Hardman and Lee E. Limbard, Good Mann & Gilmann: The Pharmacological basis of therapeutics, Mc Graw hill, Health Professions Dvn.
2. H.P Rang, M. M. dale & J.M. Ritter, Pharmacology, Churchill Living stone, 4<sup>th</sup> Ed.
3. J. Crossland, Lewis 's Pharmacology, Church living stone.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
HYDERABAD

## IV Year B. Pharmacy I-Semester

T	P	C
4+1*	0	4

## (R7604) MEDICINAL CHEMISTRY – II

## UNIT – I

**Antibiotics:** Brief historical background, definition, requirements for a substance to be considered as an antibiotic and classification of antibiotics.

**Penicillins:** Historical background and biological sources. Structures of different penicillins.

**Nomenclature:** Numbering and naming according to the CA and USP systems, as derivatives of penam, penicillanic acid and as penicillins (trivial system).

**Reactions:** Hydrolysis of penicillin by cold and hot dilute mineral acid, alkali, enzymatic hydrolysis with Pencillinase, amidase and methanolysis followed by aqueous mercuric chloride.

**Classification:** Oral and parenteral, based on spectrum of activity and resistance to  $\beta$ -lactamase, as natural, biosynthetic and semi-synthetic.

General method of synthesis of pencillins from 6-APA, SAR, mechanism of action, therapeutic uses, toxicity. A note on  $\beta$ -lactamase inhibitors.

## UNIT – II

**Cephalosporins:** Historical background and biological sources. Structures of some important Cephalosporins and Cephamecins. Acid hydrolysis of Cephalosporin C. Comparison of 6-APA and 7-ACA, penam and cepham.

**Classification:** Generations of cephalosporins Oral and parenteral, SAR and Advantages over penicillins.

## UNIT – III

**Tetracyclins:** Biological sources, structures of the important tetracyclines, important structural units and the three acidity constants in the tetracycline molecule, Amphoteric nature, epimerisation, chelation with metals, mechanism of action, spectrum of activity, SAR and toxicity.

## UNIT – IV

**Aminoglycosides:** Structure of streptomycin, acid hydrolysis, mechanism of action, therapeutic uses and toxicity. Dihydrostreptomycin and its importance. A mention of other aminoglycoside antibiotics.

A brief account of chloramphenicol, macrolide and polypeptide antibiotics and Rifampicin (Structures not included).

## UNIT – V

**Vitamins: Introduction and Classification.**

**Fat-soluble vitamins:** Vitamins A– Structure, Physiological role and uses, Tretinoin (Retinoic acid), Isotretinoin.

**UNIT – VI**

**Fat-soluble vitamins:** Vit D – Structures – Physiological role and uses, preparation of ergocalciferol from ergosterol, and cholecalciferol from 7-dehydrocholesterol.

**UNIT – VII**

**Fat-soluble vitamins:** Vit E – Structures of  $\alpha$ ,  $\beta$  and  $\gamma$  - tocopherols – Physiological role and uses.

**Fat-soluble vitamins:** Vitamin Ks – Vit K<sub>1</sub>, K<sub>2</sub>, K<sub>3</sub> and K<sub>4</sub> – Structures – Physiological role and uses.

**UNIT – VIII**

**Water soluble vitamins:** Structures, physiological role and uses of Vit B<sub>1</sub>, B<sub>2</sub>, B<sub>6</sub>, B<sub>12</sub>, Nicotinic acid and amide, Cyanocobalamine, folic acid and Ascorbic acid.

Some important reactions of water soluble vitamins like: The oxidation of thiamine to thiochrome, the oxidation of nicotine to nicotinic acid, the amidation of nicotinic acid to nicotinamide, the degradation of riboflavine to lumiflavine and lumichrome, the reduction of folic acid to dihydro and tetrahydro folic acids in the biological system, the oxidation of Ascorbic acid to dehydroascorbic acid.

**NOTE:**

1. Structure elucidation of compounds is **not** included in the syllabus.
2. Structural features like the basic nucleus, presence of substituent groups will be discussed.
3. Simple reactions like hydrolysis, selenium dehydrogenation, oxidation, reduction etc., will be taught wherever applicable.

**TEXT BOOKS**

1. William O. Foye, Textbook of Medicinal Chemistry, Lea & Febiger, Philadelphia.
2. JH Block & JM Beale, Wilson & Giswold's Text book of organic Medicinal Chemistry and pharmaceutical chemistry by (Eds), 11<sup>th</sup> Ed, Lipincott, Raven, Philadelphia, 2004.
3. S. N. Pandeya, Textbook of medicinal chemistry, SG Publ. Varanasi, 2003.
4. Sri Ram, Medicinal Chemistry.
5. Rama Rao Nadendia, Medicinal Chemistry.

**REFERENCES**

1. D. Abraham (Ed), Burger Medicinal chemistry and Drug discovery, Vol. 1 & 2. John Wiley & Sons, New York 2003.
2. Lippincott Williams and Wilkins: Remington Pharmaceutical Sciences
3. L. M. Atherden, Bentley and Driver's Textbook of Pharmaceutical Chemistry. Oxford University Press, Delhi.
4. B.N. Lads, MG.Mandel and F.I. way, Fundamentals of drug metabolism & disposition, William & welking co, Baltimore USA.

5. C. Hansch, Comprehensive medicinal chemistry, Vol 1 – 6 Elsevier pergmon press, oxford 1991.
6. Daniel lednicer, Strategies For Organic Drug Synthesis And Design, John Wiley, N. Y. 1998.
7. D. Lednicer, Organic drug synthesis, Vol, 1 – 6, J.Wiley N.Y.
8. Kadam, Textbook of Medicinal Chemistry Vol. 1 & 2.
9. O.P.Agarwal, Text book of natural products by Vol. 1 & 2

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
HYDERABAD**

**IV Year B. Pharmacy I-Semester**

<b>T</b>	<b>P</b>	<b>C</b>
<b>4+1*</b>	<b>0</b>	<b>4</b>

**(R7605) PHARMACY ADMINISTRATION**

**UNIT – I**

**Features of Business Organisations & New Economic Environment:**

Characteristic features of Business, Features and evaluation of Sole Proprietorship, Partnership, Joint Stock Company, Public Enterprises and their types, Changing Business Environment in Post-Liberalisation scenario.

**UNIT – II**

**Manufacturing Management:** Goals of Production Management and Organisation – Production, Planning and Control – Plant location -Principles and Types of Plant Layout-Methods of production (Job, batch and Mass Production), New Product Development.

**UNIT – III**

**Work Study** -Basic procedure involved in Method Study and Work Measurement-

Statistical Quality Control:  $\bar{X}$  chart, R chart, c chart, p chart, (simple Problems), Acceptance Sampling, Deming's contribution to quality.

**UNIT – IV**

**Organisation of Distribution and Marketing:** Functions of Marketing, Marketing Mix, Marketing Strategies based on Product Life Cycle., Channels of distribution – Factors influencing channels of distribution, sales organization and sales promotion.

**UNIT - V**

**Pharma Industry:** Growth of Pharma Industry in India – current status and its role in building national economy and national health – Structure of Pharma Industry in India – PSUs in Pharma Industry –Progress in the manufacture of basic drugs, synthetic and drugs of vegetable origin. Export and import of drugs and pharmaceuticals – Export and import Trade.

**UNIT – VI**

**Insurance and Pharma:** Various types of insurance including marine and health insurance.

**UNIT – VII**

Pharmaceutical associations and societies, statutory councils governing the profession. General Principles of medical detailing.

**UNIT – VIII**

**Principles of drug store and community pharmacy administration:** Drug store planning and layout, sales promotion and salesmanship in drug store. Accounting records in drug stores.

**TEXT BOOK**

1. Aryasri and Subbarao, Pharmaceutical Administration, TMH.
2. Smarta, Strategic Pharma Marketing
3. G.Vidya Sagar, Pharmaceutical Industrial Management.

**REFERENCES**

1. Subbarao Chaganti, Pharmaceutal Marketing in India – Concepts and Strategy Cases, Pharma Book Syndicate.
2. O.P.Khanna, Industrial Management, Dhanpatrai, New Delhi.



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
HYDERABAD**

IV Year B. Pharmacy I-Semester

T	P	C
0	0	2

**(R7606) INDUSTRIAL TRAINING AND SEMINAR**

- Industrial Pharmacy
- Clinical Pharmacy/Pharmacology
- Pharmacognosy/Med. Chem.
- Pharmaceutical Analysis/Quality assurance
- Pharmaceutical Marketing

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
HYDERABAD**

IV Year B. Pharmacy I-Semester

T	P	C
0	3	2

**(R7607) PHARMACEUTICAL ANALYSIS – II LAB**

**Experiments**

- Interpretation of IR Spectra.
- Determination of  $\lambda$ - max of a drug.
- Determination of concentration of glycerine by Abbe's refractometer.
- Assay of ibuprofen - UV-spectro photometry.
- Assay of paracetamol - UV-spectro photometry.
- Assay of riboflavin - Colorimetric method.
- Assay of rifampicin - Colorimetric method.
- Ascending paper chromatography.
- Radial paper chromatography.
- Two dimension chromatography
- Thin layer chromatography.
- Column chromatography (**Demonstration Only**).
- Paper electrophoresis of amino acids.
- Gel electrophoresis (**Demonstration Only**).
- HPLC (**Demonstration Only**).

IV Year B. Pharmacy I-Semester

T	P	C
0	3	2

(R7608) BIOPHARMACEUTICS AND PHARMACOKINETICS LAB

1. Experiments designed for the estimation of various pharmacokinetic parameters with given data
2. Analysis of biological specifications for drug content and estimation of the pharmacokinetic parameters.
3. In vitro evaluation of different dosage forms for drug release
4. Absorption studies – *in vitro* and *in vivo*.
5. Statistical treatment of pharmaceutical data.

IV Year B. Pharmacy I-Semester

T	P	C
0	3	2

(R7609) PHARMACOLOGY – III LAB

1. Experiments on Isolated Preparations:
  - a. To calculate the  $PA_2$  value of atropine using acetylcholine as an agonist on rat ileum preparation.
  - b. To calculate the  $PA_2$  value of mepyramine or chlorampheniramine using histamine as agonist on guinea pig ileum.
  - c. To find out the strength of the given sample on (e.g. Acetylcholine, Histamine, 5 HT, Oxytocin etc.) Using a suitable isolated muscle preparation by
    - i. Matching Assay
    - ii. Two point Assay
    - iii. Three point Assay
2. Pharmacology of the Gastrointestinal Tract. To study the anti secretory and anti ulcer activity using pylorus ligated rats.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
HYDERABAD**

IV Year B. Pharmacy I-Semester

T	P	C
0	3	2

## (R7610) MEDICINAL CHEMISTRY – II LAB

**Estimations of the following.**

1. Ascorbic acid.
2. Vitamin B1.
3. Penicillin.
4. Alkaloid (by gravimetry).
5. Phosphoric acid by volumetric method
6. Lactic acid by volumetric method
7. Salicylic acid by volumetric method
8. Ibuprofen by volumetric method
9. Aspirin by volumetric method

**REFERENCES**

1. Indian Pharmacopoeia.. – 1996, 4<sup>th</sup> Edition.
2. P.D.Sethi – Quantitative Analysis of Drugs and Pharmaceuticals.
3. B.G.Nagavi Lab Hand Book of Instrumental Drug Analysis.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
HYDERABAD**

IV Year B. Pharmacy II-Semester

T	P	C
3+1*	0	3

## (R7701) NOVEL DRUG DELIVERY SYSTEMS AND REGULATORY AFFAIRS

**UNIT-I**

**Oral Control Drug Delivery Systems:** Fundamentals, Dissolution Controlled, Diffusion Controlled, Ion Exchange Resins, Osmotic based systems, pH Independent Systems and altered density systems.

**UNIT – II**

**Transdermal Drug Delivery Systems:** Fundamentals, types of TDDS, Materials Employed and Evaluation of TDDS.

**UNIT - III**

**Mucoadhesive Delivery Systems:** Mechanism of bioadhesion, mucoadhesive materials, formulation and evaluation of mucoadhesive-based systems.

**UNIT – IV**

**Targeted Drug Delivery Systems:** Fundamentals and applications, formulation and evaluation of liposomes, resealed erythrocytes and nano particles.

**UNIT-V**

**Introduction Drug Regulatory Agencies:** Indian CDSCO, US FDA, Canadian HPFBI, and Australian TGA

Introduction to NDA & ANDA Submissions of USFDA

**UNIT-VI**

Introduction to quality assurance activities related to warehouse control, manufacturing control, packaging control and quality control.

**UNIT-VII**

**Introduction to Good Manufacturing Practices:** Schedule – M (India), CFR 21 Part 210 and 211 of US FDA.

**UNIT-VII**

**Introduction to Validations:** Process validation (prospective, retrospective & concurrent), analytical method validation (accuracy, precision, specificity, linearity, range, robustness etc.), cleaning validation (sampling procedure and acceptance criteria)

## TEXT BOOKS

1. N.K. Jain, Control Drug Delivery Systems by
2. Y. Anjaneyulu & Maraiah, Quality Assurance & Quality Management in Pharmaceutical Industry.
3. L. Lachman, H.A. Lieberman and J.L. Kanig, Theory & Practice of industrial pharmacy by, Lea & Febieger, Philadelphia Latest Edn.
4. Shobhan Rani Hiremath Text Book of Industrial Pharmacy.

## REFERENCES

1. Leon Shargel Isadore Kanfer, Generic Drug Product Development, Solid Oral Dosage Forms, Marcel Dekker.
2. Sagarian & MS Balsam, Cosmetics Sciences & Technology. Vol. 1, 2 & 3
3. Lippincott Williams and Wilkins, Remington Pharmaceutical Sciences
4. E.A Rawlkins, Bentley's Text Book of Pharmaceutics, Elbs publ
5. HC Ansel, Introduction to Pharmaceutical Dosage forms
6. S.H. Willing, M.M Tucherman and W.S. Hitchings IV, Good Manufacturing Practices for Pharmaceuticals: A Plan for Total Quality Control, Marcel Dekker, Inc., New York
7. Gilbert S. Banker and Christopher T Rhodes, Modern Pharmaceutics, IVth ed, marcel dekker, usa, 2005.
8. Yiew Chien, novel drug delivery systems, 2<sup>nd</sup> ed, marcel dekker 2003.
9. Robert. A. Nash, Pharmaceutical Process Validation, 3<sup>rd</sup> Ed Marcel Dekker, 2003.
10. Good Manufacturing Practices – Schedule M Read with The Drugs And Cosmetic Rules 1945.
11. M.E. Aulton, Pharmaceutics- The science of Dosage form Design 2<sup>nd</sup> ed.
12. Aukunuru Jithan, Oral Drug Delivery Technology.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
HYDERABAD

## IV Year B. Pharmacy II-Semester

T	P	C
3+1*	0	3

## (R7702) PHARMACEUTICAL BIOTECHNOLOGY

## UNIT - I

**Fermentation Technology:** Isolation, Selection, Screening of Industrial important microbes, Strain improvement. Types, design & operation of Bioreactor. Types of fermentations, optimization of fermentation process. Principle and Procedure involving in downstream process and effluent treatment.

## UNIT - II

**Specific Fermentations:** Selection of organism, fermentation & purification of various antibiotics, vitamins, aminoacids, organic acids, solvents like penicillin, streptomycin, tetracyclin, erythromycin, riboflavin, cyanocobalamin, glutamic acid, lysin, citric acid, lactic acid, alcohol, acetone etc.

## UNIT - III

**Microbial Transformations:** Types, Methods of bioconversions & Application in Pharma Industry, Steroidal transformation.

## UNIT - IV

**Recombinant DNA Technology:** Introduction to r-dna technology and genetic engineering, steps involved, isolation of enzymes, vectors, recombination and cloning of ggenes.

Production of bio technology derived therapeutic proteins like humulin, humatrop, activase, intron a, monoclonal antibodies by hybridoma technique, recombivax HB(hepatitis b).

## UNIT - V

**Immunology & Immunological Preparations:** Principles of Immunity, Humoral immunity, cell mediated immunity, antigen – antibody reactions, hypersensitivity and its applications.

Active & passive immunizations vaccine preparation, standardization & storage of BCG, cholera, smallpox, polio, typhus, tetanus toxoids, immuno serum & diagnostic agents.

## UNIT - VI

**Enzyme Technology:** Techniques of immobilization of enzymes, factors affecting enzyme kinetics, advantages of immobilization over isolated enzymes.

Study of enzymes such as hyaluronidase, penicillinase, streptokinase, streptodornase, amylase, protease etc. immobilization of bacteria & plant cells.

## UNIT - VII

Introduction, role, collection, process & storage of blood products, plasma substitutes and sutures & ligatures like whole human blood, human normal ig, dextran, catgut etc.

**UNIT – VIII**

Introductory study & applications of bioinformatics, proteomics and genomics.

**TEXT BOOKS**

1. Wulf Crueger and Anneliese Crueger, Biotechnology, 2<sup>nd</sup> Ed, Publ- Panima publication co-operation, New Delhi.
2. P. F. Stanbury & A. Whitaker, Principles of fermentation technology, Pergamon Press
3. B.P. Nagori & Roshan Issari, Foundations in Pharmaceutical Biotechnology
4. Sambamurthy. K, Text Book of Pharmaceutical Biotechnology.
5. S. S. Kori, Pharmaceutical biotechnology.

**REFERENCES**

1. Prescott and Dunne, "Industrial Microbiology" MC Caraw Hill Bool Company
2. Peppler "Microbial Technology" Vol. 1 & 2.
3. K. Kielslich "Biotechnology" Vol 6, Verlegchemic, Switzerland.
4. PF Standury & A. Whitaker, "Principles of fermentation Technology" Pergamon Press, Oxford
5. OP Ward "Fermentation Technology, Principles, Processes products" Open University press, Milton Keynes, UK.
6. A. M. Campbelli, Monoclonal antibody technology.
7. A. Wiseman, Handbook of enzyme biotechnology.
8. J. D. Watson, Recombinant DNA technology.
9. Smith and Hood, Molecular biology and biotechnology.
10. E.A. Rawlins, Bentley's, A text book of pharmaceutics, 8<sup>th</sup> Ed, 1982 Bailler Tindall & Co.
11. Alexander N. Glazer & Hiroshi Nikaido, Microbial biotechnology, W. H. Freeman Co.
12. Ahwood.T.K, Introduction to Bio Informatics.
13. Cassida, Industrial microbiology.
14. H.K. Das, Textbook of Biochemistry.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
HYDERABAD**

**IV Year B. Pharmacy II-Semester**

T	P	C
3+1*	0	3

**(R7703) MEDICINAL CHEMISTRY – III****Note:**

*A study of the following classes of drugs including introduction, classification with examples of structures, mechanism of action, SAR and metabolism. Synthesis of compounds specified against each class is to be studied for the following UNITS*

**UNIT – I****Drugs acting on Cardio-vascular diseases:****General account of cardiovascular diseases**

**Antihypertensives** – Methyldopa, amlodipine, enalapril, losartan.

**UNIT – II**

**Anti-arrhythmics** – Procainamide

**Diuretics** – **Acetazolamide, hydrochlorthiazide, furosemide**

**Anticoagulants, Anti-anginals and Coronary vasodilators** – Isosorbide dinitrate, verapamil, diltiazem

**UNIT – III**

**Antihyperlipidemics** (Hypocholesteremic drugs)- Clofibrate. A brief account on statins

**General account on pancreatic and thyroid hormonal malfunctions.**

**Antidiabetics** – Phenformin, Glipizide including a brief account on PPARinhibitors, Meglitinide analogues,

**α-Glucosidase inhibitors** – Acarbose, Miglitol

**Drugs affecting Thyroid Function:** Methimazole, Propylthiouracil, Insulin preparations

**UNIT – IV****Analgesics and NSAIDS (Non-steroidal anti-inflammatory agents):**

- i. Introduction and types of pain and inflammation
- ii. Classification and systematic development of analgesics of morphine, mild analgesics and strong analgesics: Meperidine and Methadone
- iii. NSAIDS – Aspirin, paracetamol, oxyphenbutazone, ibuprofen, indomethacin, diclofenac and meloxicam
- iv. A brief account on Cox-2 inhibitors and Nimsulide.



**UNIT – V****Chemotherapeutic Agents:**

Sulpha drugs	-	Sulphadiazine, Suphasalazine, Trimethoprim, Sulphamethoxazole, Sulphameter
Anti viral Drugs	-	Acyclovir, Zidovudine
Antifungal Agents	-	Fluconazole and Itraconazole.

**UNIT – VI**

Anti tubercular agents	:	Isonicotinic acid hydrazide and ethambutol,
Anti leprotic agents	:	Dapsone, clofazimine
Antiamoebics	:	Metronidazole, diloxanide furoate

**UNIT - VII**

Anthelmintics	:	Diethylcarbamazine citrate, pyrantel pamoate, mebendazole, albendazole
Antimalarial drugs	:	Chloroquine, primaquine and pyrimethamine, norflaxacin and ciprofloxacin

**UNIT – VIII**

Anticancer Drugs	:	Chlorambucil, busulphan, procarbazine, carmustine, 5-fluorouracil, 5-mercaptopurine, methotrexate, vinca alkaloids – vinblastin, vincristine
------------------	---	--

**TEXT BOOKS**

1. William O. Foye, Textbook of Medicinal Chemistry by, Lea Febiger, Philadelphia.
2. JH Block & JM Beale, Wilson & Giswold's Textbook of organic Medicinal Chemistry and pharmaceutical chemistry by (Eds), 11<sup>th</sup> Ed, Lipcott, Raven, Philadelphia, 2004.
3. S. N. Pandeya, Textbook of medicinal chemistry, SG Publ. Varanasi, 2003.
4. Rama Rao Nadendla, Medicinal Chemistry.

**REFERENCES**

1. D. Abraham (Ed), Burger Medicinal chemistry and Drug discovery, Vol. 1 & 2. John Wiley & Sons, New York 2003, 6<sup>th</sup> Ed.
2. Lippincott Williams and Wilkins: Remington Pharmaceutical Sciences
3. L. M. Atherden, Bentley and Driver's Textbook of Pharmaceutical Chemistry. Oxford University Press, Delhi.
4. B.N. Lads, MG. Mandel and F.I. way, Fundamentals of drug metabolism & disposition, William & Welking Co, Baltimore USA.
5. C. Hansch, Comprehensive medicinal chemistry, Vol 1 – 6 Elsevier Pergamon Press, Oxford
6. Daniel Lednicher, Strategies For Organic Drug Synthesis And Design, John Wiley, N. Y. 1998.
7. D. Lednicher, Organic drug synthesis, Vol, 1 – 6, J. Wiley N.Y.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
HYDERABAD**

IV Year B. Pharmacy II-Semester

<b>T</b>	<b>P</b>	<b>C</b>
<b>3+1*</b>	<b>0</b>	<b>3</b>

(R7704) PHARMACOGNOSY – III

**UNIT – I****Evaluation of crude drugs.**

Adulteration of crude drugs and their detection by

- (i) Organoleptic (ii) Microscopic (iii) Physical (iv) Chemical and Biological methods of evaluation

**UNIT - II**

**Phytochemical Screening:** Identification & isolation of plant constituents, identification and estimation of various functional groups in phytoconstituents.

**UNIT – III**

Introduction, classification and study of different chromatographic methods and their applications in evaluation of crude drugs.

**UNIT – IV**

**Plant Tissue Culture:** History, types, media requirements, methodology for establishment of cultures, growth measurements and applications.

**UNIT – V**

**Study of traditional drugs:** Common and vernacular names, sources, chemical constituents and uses of kantakari, malkanguni, shatavari, sankhapushphi, tylophora, bilva, kaliyeeri, rasna, apamarga, gokhru, gudhuchi, bach, amla, methi, guggul, kalimusli, punarnava, chitrak and brahmi.

**UNIT – VI****Herbal Formulations**

- a. General introduction to alternative systems of medicine like Ayurveda, Siddha, Unani and Homoeopathy.
- b. Methods of preparation of formulations in Ayurveda like churnas, lehyas, tailas, bhasmas, asavas and arishta.

**UNIT – VII****Herbal Formulations**

- a. **General introduction to cosmetics role of herbs in cosmetics:** Study of the following drugs. Amla, henna, cyperus, soap nut, aloe vera, turmeric, sandal wood, bitter orange peel
- b. **Definition and study of Nutraceuticals:** Garlic, spirulina, soya and royal jelly.

**UNIT – VIII**

Introduction and importance of herbal medicine, herbal cosmetics and herbal drug industry.

**TEXT BOOKS**

1. J.B.Harbone, Phytochemical Methods: A guide to modern techniques of Plant analysis by
2. Kokate C.K, Purohit AP & Gokhale S.B, The Pharmacognosy (Nirali)
3. Trease and Evans, Pharmacognosy, Latest Edition.
4. T.E. Wallis, Text Book of Pharmacognosy.

**REFERENCES**

1. Atal C.R & Kapur B.M Cultivation & Utilization of Medicinal Plants.
2. Ayurvedic Pharmacopoeia of India, Pub by Govt. of India.
3. Pharmacognosy and Phytotherapy Research: Chapter contributed by Subhash C. Mandal & S.Mohana Lakshmi in the book Biodiversity and Environmental Biotechnology by P.Dwiveit atal, Scientific Publisher, Jodhpur.
4. Handa & Kapoor, Text book of Pharmacognosy.
5. S.S. Agarwal & M. Paridhavi, Herbal Drug Technology, University Press, Hyderabad.
6. Timir Baran JHa & Biswajit Gosh, Plant Tissue Culture, University Press, Hyderabad.
7. P. Dwiveti, Tissue Culture and Plant Science, Scientific Publisher, Jodhpur.
8. M. K. Razdan, An Introduction To Plant Tissue Culture, Oxford & IBH Publishing Co., New Delhi

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
HYDERABAD**
**IV Year B. Pharmacy II-Semester**

T	P	C
4+1*	0	4

**(R7705) CLINICAL PHARMACY AND THERAPEUTICS****UNIT - I**

Introduction to Clinical Pharmacy

**UNIT - II****Basic concepts of Pharmacotherapy**

- a. Clinical Pharmacokinetics and individualization of Drug Therapy.
- b. Special precautions in drugs usage during infancy and in the elderly (Pediatrics & Geriatrics).
- c. Special precautions in drugs usage during pregnancy & lactation.
- d. Adverse Drug Reactions
- e. The Basics of Drug Interactions
- f. Interpretation of Clinical laboratory Tests.

**UNIT - III****Important Disorders of Organ Systems and their Management:**

- a. **Cardiovascular Disorders:** Hypertension, congestive heart failure, angina, acute myocardial infarction, cardiac arrhythmias
- b. **CNS Disorders:** Epilepsy, parkinsonism, schizophrenia depression

**UNIT - IV**

- a. **Respiratory Disease:** Asthma.
- b. **Gastrointestinal Disorders:** Peptic Ulcer Disease, Ulcerative Colitis, Hepatitis, and Cirrhosis.

**UNIT - V**

- a. **Endocrine Disorders:** Diabetes mellitus and Thyroid Disorders.
- b. **Infectious Diseases:** Tuberculosis, Urinary Tract Infefction, Enteric Infections,

**UNIT - VI****Upper Respiratory Infections.**

- a. **Hematopoietic Disorders:** Anemias.
- b. **Joint and Connective Tissue Disorders:** rheumatic diseases, gout and Hyperuricemia.
- c. **Neoplastic Diseases:** Acute leukaemias, Hodgkin's disease

**UNIT - VII**

Therapeutic Drug Monitoring

**UNIT - VIII**

Concept of Essential Drugs and Rational Drug use.

**TEXT BOOKS**

1. Katzung, B.G. Basic and Clinical Pharmacology, Prentice hall, International.
2. Laurence, DR and Bennet PN. Clinical Pharmacology, Scientific book agency
3. Dr. D.R Krishna, V. Klotz, Clinical pharmacokinetics, Publ Springer Verlag
4. M Rowland and T N Tozer, "Clinical Pharmacokinetics" 2nd ed Lea & Febiger, NY.

**REFERENCES**

1. Lippincott Williams and Wilkins: Remington Pharmaceutical Sciences, 20<sup>th</sup> Edition.
2. Hamsten, Drug interaction, Kven Stockley.
3. J.K. Mehra, Drug interaction, Basic Business Publ, Bombay.
4. Grahame smith and Aronson, Clinical pharmacology and drug therapy
5. Richard A Helms, Text Book of Therapeutics Drug and Disease Management Hardbound.
5. Herfindal E T and Hirschman JL, Williams and Wilkins, Clinical Pharmacy and therapeutics
6. Applied Therapeutics, The clinical uses of Drugs applied therapeutics INC
7. Dr. A.R. Paradker, Hospital and Clinical Pharmacy, Nirali Prakashan.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
HYDERABAD**
**IV Year B. Pharmacy II-Semester**

T	P	C
0	0	2

**(R7706) PROJECT WORK**

\* \*Suggested areas for project work.

- 1) Industrial Pharmacy
- 2) Clinical Pharmacy/ Pharmacology
- 3) Pharmacognosy /Medical Chemistry
- 4) Pharmaceutical Analysis / Quality Assurance
- 5) Pharmaceutical Marketing

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
HYDERABAD**

IV Year B. Pharmacy II-Semester

T	P	C
0	3	2

**(R7707) NOVEL DRUG DELIVERY SYSTEMS AND REGULATORY AFFAIRS  
LAB**

1. Preparation and Evaluation of Matrix Tablets
2. Formulation and Evaluation of Film Coated Tablets.
3. Formulation and Evaluation of Enteric Coated Tablets.
4. Preparation and Evaluation of Transdermal Drug Delivery Systems.
5. Formulation and Evaluation of Mucoadhesive Delivery Systems.
6. Evaluation of Market SR Formulations.
7. Preparation and Evaluation of Alginate Beads.
8. Analytical Method Validation.
9. Assignment on Product development and filing to various regulatory agencies , FDA,MCC, EMEA,TGA.Etc (Ref.: [www.fda.gov](http://www.fda.gov))

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
HYDERABAD**

IV Year B. Pharmacy II-Semester

T	P	C
0	3	2

**(R7708) PHARMACEUTICAL BIOTECHNOLOGY LAB**

1. Isolation of antibiotic producing microorganism from soil.
2. Enzyme immobilization by Ca-alginate method.
3. Determination of minimum inhibitory concentration of the given antibiotic. Antibiotic assay by cup plate method.
4. Collection, Processing, Storage and fractionation of blood.
5. Standardization of Cultures.
6. Microbiological assay of Antibiotics / Vitamins.
7. Production of alcohol by fermentation techniques.
8. Comparison of efficacy of immobilized cells.
9. Sterility testing of Pharmaceutical products.
10. Isolation of mutants by gradient plate technique.
11. Preparation of bacterial vaccine.
12. Preparation of blood products / Human normal immunoglobulin injection.
13. Extraction of DNA.
14. Separation techniques: Various types of Gel Electro Phoresis, Centrifugation.



IV Year B. Pharmacy II-Semester

T	P	C
0	3	2

**(R7709) MEDICINAL CHEMISTRY – III LAB**

**Assay of some drugs from their formulations:**

1. Sulpha methoxazole (anti bacterial)
2. Glibenclamide (hypoglycemic agent)
3. Metronidazole (antiprotozoal)
4. Ibuprofen (analgesic, antiinflammatory)
5. Furosemide (diuretic)
6. Isoniazid (anti tubercular)
7. Aspirin (analgesic, antipyretic, antiinflammatory and antithrombotic)
8. Phenytoin (anticonvulsant)
9. Phenobarbitol (sedative and hypnotic)
10. Diethylcarbamizine (antihelmintic)
11. Salbutamol (antiasthmatic)
12. Phenyl butazone (anti inflammatory)
13. compound benzoic acid (anti fungal)

**REFERENCES**

1. I.P. – 1996.
2. P.D.Sethi – Quantative Analysis of Drugs and Pharmaceuticals.
3. B.P. - 2004.

IV Year B. Pharmacy II-Semester

T	P	C
0	3	2

**(R7710) PHARMACOGNOSY – III LAB**

1. Determination of Leaf Constants (6 Experiments).
2. Laboratory experiment on isolation, separation, purification of various groups of chemical constituents (2 Experiments).
3. Experiments on paper and thin layer chromatographic evaluations of herbal drug constituents (8 Experiments).



IV Year B. Pharmacy II -Semester

T	P	C
0	0	2

## (R7711) COMPREHENSIVE VIVA

## BOOKS RECOMMENDED FOR REFERENCE:

## PHARMACEUTICS

Cooper and Gunns "Tutorial Pharmacy" ed. S.J Carter, 6th edition, CBS Publisher, Delhi,

A N Martin, Arthur Cammarata, James Swarbrick, "Physical Pharmacy", 3rd edition, K M Varghese & Co., Bombay,

E Shotton and K Ridgway, "Physical Pharmaceutics" Oxford University Press, London,

"Remington's Pharmaceutical Sciences", ed. A R Gennaro, 18th ed, Mack Publishing Co., P.A.,

Leon Lachmen, H A Lieberman and J L Kanig, "The Theory and Practice of Industrial Pharmacy, 3rd ed. Lea & Febiger Philadelphia.

H C Ansel "Introduction to Pharmaceutical Dosage Forms", 3rd (Indian ed) K M Varghese & Co. Bombay .

Cooper and Gunn's "Dispensing for Pharmaceutical Students" ed S J Carter, 12th ed., CBS Publishers, Delhi.

"Sprowl's American Pharmacy" ed L W Dittert, 7th ed J & B Lippincott Co., Philadelphia

"Bentley's Textbook of Pharmaceutics" ed EA Rawlines, 8th ed ELBS Bacilliere Tindall.

"Dispensing of Medication", ed J E Hoover, 8th ed Mack Publishing Co., Easton PA.

William E Hassan, "Hospital Pharmacy", 5th ed Lea & Febiger, Philadelphia.

"Modern Pharmaceutics" ed G S Banker and C T Rhodes, 2nd ed Marcel Dekker Inc., NY.

"Pharmaceutical Dosage, Forms and Drug Delivery Systems", 5th ed Lea and Febiger, Philadelphia .

S.Turco and R.E.King, "Sterile Dosage Forms" 3rd ed Lea and Febiger, Philadelphia.

H M Chitton and R L Witcofski, "Nuclear Pharmacy", Lea and Febiger, Philadelphia.

K A Connores, G L Amiden and V J Stella, "Chemical Stability of Pharmaceuticals", 2nd ed John Wiley & Sons NY 1986.

"Pharmaceutics The Science of Dosage Form Design", ed M E Aulton, ELBS/Churchill Livingstone

J T Carstensen, "Drug Stability", Marcel Dekker Inc NY

"Cosmetic Science and Technology" ed Sagarian and M S Balsam, Vol 1 3, 2nd ed John Wiley & Sons, NY

J S Jellinek, "Formulation and Function of Cosmetics", John Wiley & Sons, NY.

S G Thomsen, "Modern Cosmetics" Universal Publishing Corporation, Bombay.

- "Advance in Pharmaceutical Sciences", ed H S Hean, A H Beckett, and J E Carless, Vol 1 4 Academic Press, London.
- W L Macbe and J C Smith, "Unit Operation of Chemical Engineering" 4th ed McGraw Hill International Book Co., London.
- C G Brown et al, "Unit Operations" (Indian ed) Asia Publishing House, Bombay.
- W L Badger and J T Banchemo, "Introduction to Chemical Engineering" McGraw Hill International Book Co., London.
- B T Loftus and Robert Nash, "Pharmaceutical Process Validation", Marcel Dekker Inc. NY.
- M L Schroff, "Professional Pharmacy", Five Star Enterprises, Calcutta
- "Dispensing of Medication", Ed, E W Martin, 7th ed Mack Publishing Co., Eastern PA.
- M J Stocklose, "Pharmaceutical Calculation", 6th ed Lea & Febiger, Philadelphia.
- Joel L Zatz, "Pharmaceutical Calculations" John Wiley & Sons, NY.
- J G Wagner, "Fundamentals of Clinical Pharmacokinetics", Drug Intelligence Publications, Hamilton.
- R L Juliano, "Drug Delivery System", Oxford University Press, Oxford.
- R E Notari, "Biopharmaceutics and Pharmacokinetics an Introduction" 2nd ed Marcel Dekker Inc NY.
- M Rowland and T N Tozer, "Clinical Pharmacokinetics" 2nd ed Lea & Febiger, NY.
- M Gibaldi & D Perrier, "Pharmacokinetics", 2nd ed Marcel Dekker Inc NY
- J G Wagner, "Pharmacokinetics for the Pharmaceutical Scientist", Technomic Publishing A G Basel, Switzerland .
- "Milo Gibaldi, "Biopharmaceutics & Clinical Pharmacokinetics" 3rd ed. Lea & Febiger, Philadelphia .
- "Pharmaceutical Dosage Forms Tablets, Vols. 1 3 ed H A Lieberman, L Lachman & J B Schwartz, 2nd ed K E Avis, L Lachman and H A Lieberman, Macel Dekker Inc. NY.
- Pharmaceutical Dosage Forms; Disperse Systems", Vols. 1&2 ed H A Liberman, N M Rieger and G S Banker, Marcel Dekker Inc. NY.
- J R Robinson & Vincent Lee, "Controlled Drug Delivery Fundamentals & Applications" 2nd ed Marcel Dekker Inc..
- M C Winter, "Basic Clinical Pharmacokinetics", Applied Therapeutics, Inc San Francisco
- "Pharmacokinetics" eds A Pecile and A Rescigno, Plenum Press, NY.
- S H Willing, IV, "Good Manufacturing Practices for Pharmaceuticals" 2nd ed Marcel Dekker Inc NY .
- "Hard Capsules", ed K Ridgway. The Pharmaceutical Press, London.

- "Textbook of Hospital Pharmacy", ed M C Allwood and J T Fell, Blackwell Scientific Publications, Oxford .
- A Owunwonne, "Handbook of Radiopharmaceuticals", Narosa Publishing House, New Delhi.
- Peter G Welling and Francis L S Tse. "Pharmacokinetics", 2nd ed Marcel Dekker Inc NY.
- H K Bharati, "Drugs and Pharmacy Laws in India", Sadhana Mandir, Indore .
- Sanford Bolton, "Pharmaceutical Statistics" 2nd ed Marcel Dekker Inc NY .
- "Chemical Engineers" Handbook ed R H Parry & C H Chilton, 5th ed McGraw Kogakusha Ltd .
- J C KacChenney "Packaging of Cosmetics and Toiletries, Newness Butterworth, London.
- W A Ritschel, "Handbook of Basic Pharmacokinetics", Drug Intelligence Publications, Hamilton .
- Pharmacopoeias of India, published by the Controller of Publications, Delhi, 1st ed. 1966 3rd ed .
- British Pharmacopoeias, Her Majesty's Stationery office, University Press, Cambridge.
- The United States Pharmacopoeias, 22nd revision. The United States Pharmacopoeial Convention, Mack Pub Co. Easton, PA.
- The British Pharmaceutical Codex, 12th ed. The Pharmaceutical Press, London.
- Martindale: The Extra Pharmacopoeias, ed J E F Reynolds, 28th ed. The Pharmaceutical Press, London .
- British National Formulary, No.15 Pub jointly by British Medical Association and Royal Pharmaceutical Society of Great Britain .
- The Merck Index 9th ed, Merck & Co., Inc NJ.
- R Y Stanier, Ingraham, "General Microbiology" 5th ed, Wheelis and Painter.
- Rugu and Russel, "Pharmaceutical Microbiology; Blackwell Scientific Publication, Oxford.
- A J Salle, "Fundamental Principles of Bacteriology",
- Bergy's Manual of Determinative Bacteriology.
- G Sykes, "Disinfection and sterilization, II ed.
- Davis, Dulbertro, Eisen "Microbiology".
- Benjamin Lewis, Gene V "Microbiology"
- Prescott and Dunn, "Industrial Microbiology" , 2nd ed McGraw Hill Book Company Inc.
- Peppler, "Microbial Technology", Vol I & II
- Suichi Aiba Humphrey and Millis, "Biochemical Engineering", University of Tokyo
- K Kielslich Ed "Biotechnology" Vol 6a, Verlag Chemie, Switzerland.

P F Standury & A Whitaker, "Principles of Fermentation Technology" Pergamon Press, Oxford, 1987.

O P Ward "Fermentation Technology, Principles, Processes & Products" Open University Press, Milton Keynes, UK 1989.

G Reeves, "Lecture Notes on Immunology", Blackwell Scientific Publications, Oxford 1987.

L M Prescott, G P Jarley, D A Klein, "Microbiology", 2nd Ed., Wmc Borown Publishers, Oxford 1993.

T D Brock, M T Madigen "Biology of Micro organism" 5th aed Prentice Hall, New Jersey USA 1988.

Biopharmaceutics and clinical pharmacokinetics 4/Edn.- Milo Gibaldi.-Pharma Book Syndicate.Hyderabad.

Pharmaceutical Industrial Management – SAGAR - Pharma Book Syndicate.

Biopharmaceutics and Pharmacokinetics – Venkateshulu - Pharma Book Syndicate.

#### BOOKS RECOMMENDED (PHARMACOGNOSY)

Atal, C Kssssss and Kapur, B M, Cultivation and utilization of Medicinal plants, RRL, Jammu

Barz, W, Reinhard, E and Zenk, M H, Plant Tissue Culture and its Biotechnological Application, Springer, Berlin.

Brain, K R and Turner, T D-The Practical Evaluation of Phytopharmaceuticals, Wright Sciencetchnics, Bristol.

Bullock, J D. The Biosynthesis of Natural Products, McGraw & Hill.

Chadha, K L and Gupta, R, "Advance in Horticulture, Medicinal and Aromatic Plants Vol XI Malhotra Publishing, New Delhi.

Chopra, R N, Nayar S L and Chopra, I C Glossary of Indian Medicinal Plants, CSIR, New Delhi.

Clarke, ECG, Isolation and Identification of Drugs, The Pharmaceutical Press, London.

De Mayo, P The Chemistry of Natural Products, 2 3, Interscience, New York.

Export Potential of Selected Medicinal Plants, prepared by a Basic Chemicals, Pharmaceuticals and Cosmetic Export Promotion Council, Bombay, and other reports.

Fahn, A, Plant Anatomy, 3rd Ed., Pergamon Press, Oxford.

Faulkner, D J and Fenical, W H, Marine Natural Products a Chemistry (NATCO Conference Series 4). Plenum Press, New York.

Gamborg, G.L and Wetter. L R. Plant Tissue Culture Methods, National Research Council of Canada, Saskatchewan.

Gibbs, R Darneley, Chemotaxonomy of Flowering Plants, 4 volumes McGill University Press.

Guenther, E. The Essential Oils 4D Van Nostrand Co Inc New York.

Harborne, JB, Biochemistry of Phenolic Compounds Academic Press. New York.

Barborne JB, Phytochemical Methods, Champan, and Hall, International Edition, London.

Henry TA, The Plant Alkaloids, 5th Ed, EcGrwd Hill, New York.

Kokate C K. Practical Pharmacognosy, Vallabh Prakashan, Delhi.

Kokate C K, Purohit A P and Gokhale S B. The Pharmacognosy (Degree) Nirali Prakashan, Pune

Manitto P. The Biosynthesis of Natural Products, Ellis ahorwood, Chichester.

Manske RHF. The Alkaloids Academic Press, New York.

Martindale, The Extra Pharmacopoea, Pharmaceutical Society of Great Britain, London

Medicinal Plants of India, 1.Indian Council of Medical Research New Delhi.

Medicinal Plants of India, Zafar, R.,C.B.S.Publisher, New Delhi

Miller, L.P.,Phytochemistry, 1 3 Van Nostrand Reinhold Co.,

Nadkarni, A K, Indian Materia Medica, 1 2, Popular Prakashan Pvt.Ltd.,Bombay

Official methods of analysis, Association of official analytical chemists publications, Washington.

Peach, K and Tracey M V., Modern methods of plant analysis, 1 4, Narose Publishing house, New Delhi

Pharmacopoea of India, Govt.of India, Ministry of Health.7

Pridham, J B, and Swain, T., Biosynthesis pathways in higher plants, Academic press, New York.

Pridham, J.B.,Terpenoids in plants, Academic press, New York

Reinetrt, J and Bajaj Y P S, Applied and fundamental aspects of plant cell, Tissue and organ culture, Berlin.

Robinson, T., The Biochemistry of alkaloids, Springer Verlag, New York.

Rosenthaler, L., The chemical investigations of plants, G.Bell and sons Limited, London

Ross, M S F and Brain K R., An Introduction to Phytopharmacy, pitman medical, Kent

Schellard, E J., Practical plant chemistry for pharmacy students, pitman medical London.

Scheuer, P.J., Marine natural products, Academic press, London

Sinnott, E W., Dunn L C., and Dobzhansky, T., Principles of Genetics, Tata McGraw Hill Publishing Co., Limited, New Delhi

Staba, E J., Plant tissue culture as a source of Biomedicinals, CRC Press, Florida.

Stahl, E., Thin Layer Chromatography A Laboratory handbook, Springer verlag, Berlin

Street, H E., Tissue Culture and plant science, Academic press, London

- Stumpf, P K and Conn, E E., The Biochemistry of Plants ; A Comprehensive treatise, 1 8, Academic press.
- Swain, T., Chemical plant Taxonomy, Academic press, London
- Swain, T., Comparative Phytochemistry, Academic press, London
- The Merck Index, Merck and Company, Rahway, New Jersey, USA
- The National Formulary, United States Pharmacopoeial convention Inc., Rockville, Meddison, USA
- The Wealth of India, Raw Materials (all Volumes) Council of Scientific and Industrial Research, New Delhi
- Trease, G E and Evans, W C, Pharmacognosy, 12th Ed., Bailliers Tindall, Easbourne UK
- Tyler, V C., Brady, L R and Roberts, J E Pharmacognosy, Lea and Febiger, Philadelphia
- United States Pharmacopoeia, United States Pharmacopoeial Convention Inc., Rockville Meddison
- Wallis, T E, Analytical microscopy, J&A Churchill limited, London.
- Wallis, T.E Textbook of Pharmacognosy, J&A Churchill Limited London

#### **BOOKS RECOMMENDED ON PHYSIOLOGY AND ANATOMY**

- Guyton, Textbook of Medical Physiology, AC Guyton WB Sannders Company, 1995
- Human Physiology C.C. Chatterjee
- Medical Allied Agency, Calcutta 1991
- Human Physiology, Subhash Shalya
- CBS Publishers & Distributors, 1994
- Samson Wright's Applied Physiology, Keele, C.A., Neil, E. and Joels, N. Oxford University Press
- Review of Medical Physiology, Ganong, W.F., Prentice Hall International
- Principles of Anatomy and Physiology Tortora, G.J. and Anagnodokos, N.P., Harper & Row Publishers N.Y.
- Human Physiology, Vander, A.J., Sherman, J.H and Luciano, D.S. Tata McGraw Hill Publishing Co., New Delhi/
- Best and Taylor's Physiological Basis of Medical Practice.
- William & Wilkins, Baltimore
- Illustrated Physiology, McNaught, A.B. and Callander, R., Churchill Livingstone.
- B.D.Chaurasia's Human Anatomy, Regional & Applied, Part I, II & III, CBS Publishers and Distributors, New Delhi.
- Textbook of Practical Physiology, Ranade, V.G., Pune Vidyarthi Griha Prakashan, Pune.
- Atlas of Normal Histology, Difore Marionon S.H. Lea and Febiger, Philadelphia
- Basic Pathology, Robbins, S.L. and Kumar, V., W.B. Sanders Company

- Davidson's Principles and Practice of Medicine, ELBS/Churchill Living Stone.
- Goodman and Gilman's The Pharmacological basis of Therapeutics Editors : A Goodman Gilman, T.W. Rall, A.S.Nies, P.Taylor, pergamon Press,
- Modern Pharmacology, C.R.Craig and R.E.Stitzel, Little brown and Company
- Modern Pharmacology, C.R.Craig and R.E. Stitzel, Little brown and Company
- Paul, L., Principles of Pharmacology, Chapman and Hall,
- T.C.Theoharides, Pharmacology, Little Brown and Co.,
- M.P.Rang, M.N.Dale, J M Riter., Pharmacology, 3<sup>rd</sup> edition, Churchill Livingstone
- M.J Mycek, S.B Gerther and M M perper, Pharmacology: Lipponcott's illustrated Reviews, J B Lipponcott company
- Crossland, J and Thomson, J H., Essentials of pharmacology, Harper and Row
- Katzung, B.G., Basic and clinical pharmacology, prentice hall, International.
- Laurence, D R and Bennet P N., Clinical Pharmacology, Scientific book agency, calcutta.
- Berar F S K., Text book of pharmacology, Interprint, New Delhi.
- P S R K Harnath, Synopsis of Pharmacology, Bombay.
- Clinical Pharmacy and therapeutics, Herfindal E T, and Hirschman J L., Williams and Wilkins.
- Applied Therapeutics : The clinical use of Durgs, Applied therapeutics INC.,
- Pharmacotherapy: A pathophysiological approach, dipiro, J L Elsevier.
- BOOKS RECOMMENDED (PHARMACEUTICAL ANALYSIS, PHARMACEUTICAL CHEMISTRY BIOCHEMISTRY)**
- J Bassett, R C Denny, G H Jeffery, J Mendham, Vogel's Text book of quantitative Inorganic analysis, ELBS/Longman, London.
- L M Atherden, Benteley and Driver's Text book of Pharmaceutical Chemistry, oxford university Press , London
- L M Kothoff and V A Stenger, Volumetric analysis, Vol.II Titration methods, Interscience Publishers, INC., new York
- Pharmacopoea of India, Government of India, Ministry of Health
- L G Chatten, A Text book of Pharmaceutical Chemistry, Voll and II, Marcel Dekker, New York.
- A H Beckett and J B Stenlake, Practical Pharmaceutical Chemistry Vol. I and II. The athlone press of the university of London.
- A M Knevel and FE Digani, Jenkin's Quantitative Pharmaceutical Chemistry, McGraw Hill Book Co., New York.
- J H Block, F Roche, I O Soine and C O Wilson, Inorganic Medicinal and Pharmaceutical Chemistry, Lea and Febiger, Philadelphia, P A.
- L A Disheher, Modern Inorganic Pharmaceutical Chemistry
- W S Brey, Physical Chemistry and its biological applications Academic Press.
- K J Laidler, Physical Chemistry with Biological applications, Benjamin



- V R Williams and H S Williams, basic Physical Chemistry for the life sciences, W H Freeman
- S R Pali and S K D E Prabartak, practical Physical Chemistry, Haltone Limited, Calcutta.
- D P Shoemaker, C W Garland, Experiments in Physical Chemistry, McGraw Hill Book Co., New York.
- J A Ritchener, Findley's physical chemistry, (Ed) Green & Co., London
- A N Acheson, An Introduction to the chemistry of heterocyclic compounds, Interscience Publication, New Delhi.
- P Sykes, A guidebook to mechanism in organic chemistry, Orient Longman, New Delhi.
- J D Roberts and M C Caserio, Basic principles of Organic Chemistry, W A Benjamin, Inc., New York.
- I L Finar, Organic Chemistry, Vol. I., The Fundamentals of Principles, ELBS/Longman
- F C Mann, and B C Saunders, practical organic chemistry. The English language book society and long man group limited, London.
- A I Vogel, A text book of practical organic chemistry. The English language society and longman group limited, London.
- E L Eliel, Stereochemistry of carbon compounds, Mc Graw Hill book company, Inc., New York
- B.S Furniss, A J Hannaford, P W G Smith and A R Tatehell vogel's Text boook of practical organic chemistry. The ELBS/Longman, London
- D T Plumer., An Introduction to practical biochemistry, Tata McGraw Hill, New Delhi
- J Jayaraman, laboratory manual in Biochemistry, Willey Estern Limited, New Delhi
- D W Martin, P A Mys and V M Redwell, Harpers Review of Biochemistry, lange Medical Publications.
- E E Conn and P K Stumpf, Outlines of biochemistry, John Willey and sons, New York.
- A L Lehninger, Biochemistry, Worth Publisher, Inc.,
- A L Lehninger, Principles of Biochemistry, CBS Publishers and Distributors
- L Stryer, Biochemistry, W H Freeman and Company, Sanfransisco
- B Harrow and A Mazur, Text Book of Biochemistry, W B Saunders Co., Philadelphia.
- C Hanch, Comprehenisve medicinal chemistry, Vol. IV, quantitative Drug Design, Pergamon Press. Oxford
- V.C. Martin, quanititative Drug Design – Critical Introduction (Medicinal Research Monographah, Vol. 8 Marcel Dekker, Inc. New York
- Exploring QSAR : Vol. I Fundamentals and applications in chemistry and biology and C Hanch, A Leo and D Hockman ACS Book Catalog.

- P C Jurs, Computer software application in chemistry, John Wiley & Sons, New York.
- M E Wolff, Ed. Burger's Medicinal Chemistry, John Wiley & New York
- J N Delagado and W A R Remers, Eds., Wilson and Gisworld's Text book of Organic Medicinal and pharmaceutical chemistry, J Lipponcott Co., Philadelphia
- W C Foye, principles of Medicinal Chemistry, Lea & Febiger, Philadelphia 1955
- T Nogrady, Medicinal Chemistry – A Biochemical Approach. Oxford University Press, New York, Oxford
- .N.Ladu, H G Mandel and E L Way., Fundamentals of Drug Metabolism and Disposition, William and Welkins Co., 428 E, Preston street, Baltimore
- J E F Reynolds, Martindale, The Extra Pharmacopoea, The pharmaceutical press, London
- J E F REYNOLDS, Martindale, The Extra Pharmacopoea, The Pharmaceutical Press London
- Analytical Chemistry – Y. ANJANEYULU - Pharma Book Syndicate.Hyderabad.
- T Nogrady, Medicinal Chemistry – A Biochemical Approach.- Pharma Book Syndicate. Hyderabad.
- OTHER BOOKS RECOMMENDED**
- Popst and Perrum "Computer Aided Drug Design". Academic Press, New York.
- Computer Programming in pascal – V Ragaraman, Prentice – hall of India New Delhi, 1983.
- Computers and Commonsense – N Hunt and J Shelley, prentics – Hall of India, New Delhi, 1981.
- PASCAL USER MANNUAL AND Report – K Jensen and N Wirth., Narosa Pub. House, New Delhi, 1983.
- Systematic programming in Introduction – N Wirth, Prentice Hall Englewood cliff's New Jersey, 1973.
- Programming in Pascal – P Grogona, Adeison Wesley, Reading, M.A., 1980.
- Text Book of Drug design and discovery 3/Edn.- LARSEN.- Pharma Book Syndicate.
- Name Reaction: LI - Pharma Book Syndicate. Hyderabad.
- Organic Reaction Mechanisms – GALLEG0- Pharma Book Syndicate.Hyderabad
- Text book of Forensic Pharmacy – KOKATE - Pharma Book Syndicate.Hyderabad.
- The art of writing Reason. Organic REAC.MECH – GROSS MAN - Pharma Book Syndicate.Hyderabad.



2007-2008

Hand Book of Instrumental Techniques for Analytical Chemistry – SETTLE -  
Pharma Book Syndicate. Hyderabad.

Quality Assurance and Quality Management in Pharma Industry –Y.  
ANJANEYULU, R. MARRAYA, - Pharma Book Syndicate.

What Everyone should know about PATENTS.- SUBBA RAM - Pharma Book  
Syndicate

Elementary Bioinformatics – KHAN - Pharma Book Syndicate.

Analytical Chemistry – Y. ANJANEYULU - Pharma Book Syndicate. Hyderabad.

Phytochemical Methods by HARBONE, Published by Chapman & Hall

\*\*\*\*\*