



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**

**I/I Year B. Pharmacy**

**T P C**

**Mathematics –I  
(Biology stream students )**

**UNIT I**

**Algebra:**

**Arithmetic Progression-Geometric Progression-** Permutations & combinations-Binomial theorem partial fractions-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.

**SUGGESTED TEXT BOOKS**

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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.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**

**I/I Year B. Pharmacy**

**T P C**

**Biology – I**

**(Maths stream students )**

**UNIT I**

Methods of classification of plants.

**UNIT II**

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

**UNIT III**

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

**UNIT IV**

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

**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. Botany for Degree students Vol I & II by B.P. Pandey

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**

**BIOLOGY LAB**

Description and study of floral characters of the plants representing the families in theory. Histological studies of the leaf, flower, stem and root with description of their sections: Demonstration of muscle contraction experiment: Frog gastrointestinal tract demonstration: Preparation of tissue slides: Observation of permanent slides.

# JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA

I Year I Sem B. Pharmacy

T P C

## ANATOMY AND PHYSIOLOGY & HEALTH EDUCATION - I

### 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

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

### UNIT-III

**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-IV

**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.

### TEXT BOOKS

1. Tortora, G.J and Anagnostokas, Principles of Anatomy and Physiology, N.P Harper & Row Publishers N.Y
2. C.C.Chatterjee, Human Physiology.

### REFERENCES

1. Donald.C Rizzo, Fundamental of Anatomy and Physiology.
- 2 T.S. Ranganathan, A Text book of Human Anatomy.
3. Subrhamanyam and Others, A textbook of Physiology

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# JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA

I Year I Sem B. Pharmacy

T P C

## PHARMACEUTICAL INORGANIC CHEMISTRY - I

### 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 gastrointestinal 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) **Haematinics** – 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

**TEXT BOOKS**

1. A.H.Beckett and J.B.Stenlake, Practical pharmaceutical chemistry, Part-I. The Athtone press, University of London, London.
2. Advanced Inorganic Chemistry by Satya prakash, G.D.Tuli

**REFERENCES**

1. J.H Block, E.Roche, T.O Soine and C.O. Wilson, Inorganic Medical and Pharmaceutical Chemistry Lea & Febiger Philadelphia PA.
2. P. Gundu Rao, Inorganic pharmaceutical chemistry; Vallabh Prakashan, Delhi.
3. L.M. Atherden, Bentley and Driver's Textbook of Pharmaceutical Chemistry Oxford University Press, London.

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**I Year I Sem B. Pharmacy**

**PHARMACEUTICAL INORGANIC CHEMISTRY LAB**

List of experiments:

A) Limit tests for the following as per the procedure given in md

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 (0.1
  - 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 a (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.

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# JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA

I Year I Sem B. Pharmacy

T P C

## 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, electrometric or mesomeric effect, hyperconjugation, concept of resonance; types of organic reagents and reactions.

### UNIT – II

#### A Study of Hydrocarbons:

**Aliphatic/Alicyclic 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.

#### **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.

#### **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.
3. Bruce, Organic chemistry.

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# JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA

I Year I Sem B. Pharmacy

T P C

## 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.

### TEXT BOOKS

1. Patrick J. Sinko, Martin's Physical Pharmacy and Pharmaceutical Sciences Fifth Edition.

### REFERENCES

1. Pharmacopoeia, (I.P., B.P., U.S.P. and European.)
2. Derle D.V., Essentials of Physical Pharmacy
3. C.V.S.Subramanyam, Essentials of Physical Pharmacy, Vallabh Prakashan.
4. B.S Bahl, Arun Bahl and G.D Tuli, Essentials of Physical Chemistry.

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# JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA

I Year I Sem B. Pharmacy

## COMPUTER PROGRAMMING

### UNIT I:

**INTRODUCTION:** Computer systems, Hardware & software concepts.

**PROBLEM SOLVING:** Algorithm / pseudo code, flowchart, program development steps, Computer Languages: machine, symbolic, and high-level languages, Creating and running programs: Writing, editing, compiling, linking, and executing.

**BASICS OF C:** Structure of a C program, identifiers, basic data types and sizes. Constants, variables, arithmetic, relational and logical operators, increment and decrement operators, conditional operator, assignment operators, expressions, type conversions, conditional expressions, precedence and order of evaluation, Sample programs.

### UNIT II:

**BIT-WISE OPERATORS:** logical, shift, rotation, masks.

**SELECTION – MAKING DECISIONS:** Two-way selection: if- else, null else, nested if, examples, Multi-way selection: switch, else-if, examples.

### UNIT III:

**STRINGS:** concepts, c strings.

**ITERATIVE:** Loops - while, do-while and for statements, break, continue, initialization and updating, event and counter controlled loops, Looping applications: Summation, powers, smallest and largest.

### UNIT IV:

**ARRAYS:** Arrays - concepts, declaration, definition, accessing elements, storing elements, Strings and string manipulations, 1-D arrays, 2-D arrays and character arrays, string manipulations, Multidimensional arrays , Array applications: Matrix Operations, checking the symmetricity of a Matrix.

### UNIT V:

**FUNCTIONS-MODULAR PROGRAMMING:** Functions, basics, parameter passing, storage classes- extern, auto, register, static, scope rules, block structure, user defined functions, standard library functions, recursive functions, Recursive solutions for Fibonacci series, Towers of Hanoi, header files, C pre-processor, example c programs. Passing 1-D arrays, 2-D arrays to functions.

## **UNIT VI:**

**POINTERS:** Pointers- concepts, initialization of pointer variables, pointers and function arguments, passing by address –dangling memory, address arithmetic, Character pointers and functions, pointers to pointers, pointers and multidimensional arrays, dynamic memory management functions, command line arguments.

## **UNIT VII:**

**ENUMERATED, STRUCTURE AND UNION TYPES:** Derived types- structures- declaration, definition and initialization of structures, accessing structures, nested structures, arrays of structures, structures and functions, pointers to structures, self referential structures, unions, typedef, bit-fields, program applications

## **UNIT VIII:**

**FILE HANDLING:** Input and output – concept of a file, text files and binary files, Formatted I/o, file I/o operations, example programs.

**Text Books :** ‘ The C – Programming Language’ B.W. Kernighan, Dennis M. Ritchie, PHI

### **Reference :**

1. C Programming : A Problem - Solving Approach, Forouzan, E. V. Prasad, Giliberg, Cengage, 2010.
2. Programming in C, Stephen G. Kochan, 3/e Pearson, 2007

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# AWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA

I Year I Sem B. Pharmacy  
**COMPUTER LAB**

## Objectives:

- To learn/strengthen a programming language like C, To learn problem solving techniques

## Recommended Systems/Software Requirements:

- Intel based desktop PC, ANSI C Compiler with Supporting Editors, IDE's such as Turbo C, Bloodshed C,
- Linux with gcc compiler

## Exercise 1

Solving problems such as temperature conversion, student grading, income tax calculation, etc., which expose students to use basic C operators

## Exercise 2

2's complement of a number is obtained by scanning it from right to left and complementing all the bits after the first appearance of a 1. Thus 2's complement of 11100 is 00100. Write a C program to find the 2's complement of a binary number.

## Exercise 3

- Write a C program to find the sum of individual digits of a positive integer.
- A Fibonacci sequence is defined as follows: the first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence. Write a C program to generate the first n terms of the sequence.
- Write a C program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.
- Write a program which checks a given integer is Fibonacci number or not.

## Exercise 4

- Write a C program to calculate the following Sum:

$$\text{Sum} = 1 - x^2/2! + x^4/4! - x^6/6! + x^8/8! - x^{10}/10!$$

- Write a C program to find the roots of a quadratic equation.

### Exercise 5

a) The total distance travelled by vehicle in 't' seconds is given by distance =  $ut + \frac{1}{2}at^2$  where 'u' and 'a' are the initial velocity (m/sec.) and acceleration ( $m/sec^2$ ). Write C program to find the distance travelled at regular intervals of time given the values of 'u' and 'a'. The program should provide the flexibility to the user to select his own time intervals and repeat the calculations for different values of 'u' and 'a'.

b) Write a C program, which takes two integer operands and one operator from the user, performs the operation and then prints the result. (Consider the operators +, -, \*, /, % and use Switch Statement)

### Exercise 6

- a) Simple programming examples to manipulate strings.
- b) Verifying a string for its palindrome property

### Exercise 7

Write a C program that uses functions to perform the following operations:

- i. To insert a sub-string in to given main string from a given position.
- ii. To delete n Characters from a given position in a given string.
- iii. To replace a character of string either from beginning or ending or at a specified location

### Exercise 8

Write a C program that uses functions to perform the following operations using Structure:

- |                                      |   |
|--------------------------------------|---|
| i) Reading a complex number          | ii) Writing a complex number              |
| iii) Addition of two complex numbers | iv) Multiplication of two complex numbers |

### Exercise 9

- a) Addition of Two Matrices
- b) Calculating transpose of a matrix in-place manner.
- c) Matrix multiplication by checking compatibility

### Exercise 10

a) Write C programs that use both recursive and non-recursive functions for the following

- i) To find the factorial of a given integer.
- ii) To find the GCD (greatest common divisor) of two given integers.
- iii) To solve Towers of Hanoi problem.

**Exercise 11**

- a) Write a C functions to find both the largest and smallest number of an array of integers.
- b) Write a C function that uses functions to perform the following:
  - i) that displays the position/ index in the string S where the string T begins, or -1 if S doesn't contain T.
  - ii) to count the lines, words and characters in a given text.

**Exercise 12**

- a) Write a C function to generate Pascal's triangle.
- b) Write a C function to construct a pyramid of numbers.

**Exercise 13**

Write a C function to read in two numbers, x and n, and then compute the sum of this geometric progression:

$$1+x+x^2+x^3+\dots\dots\dots+x^n$$

Write a C function to read in two numbers, x and n(no. of terms), and then compute sin(x) and cos(x).

**Exercise 14**

- a. Pointer based function to exchange value of two integers using passing by address.
- b. Program which explains the use of dynamic arrays.
- c. Program to enlighten dangling memory problem (Creating a 2-D array dynamically using pointer to pointers approach).

**Exercise 15**

Examples which explores the use of structures, union and other user defined variables

**Exercise 16**

- a) Write a C program which copies one file to another.
- b) Write a C program to reverse the first n characters in a file. (Note: The file name and n are specified on the command line)

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**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**

**I Year II Sem B. Pharmacy**

**T P C**

**(MATHEMATICS – II  
(Biology stream students))**

**UNIT I**

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

**UNIT II**

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

**UNIT III**

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

**UNIT IV**

Introduction to Laplace transforms and their use.

5. Intermediate Second year Mathematics. Printed and published by Telugu Academy, Himayatnagar, Hyderabad
6. Pharmaceutical Arithmetic's by Mohd. Ali CBS publishers and distributor, New Delhi.
7. Higher Engineering Mathematics by Grewal.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**

I Year II Sem B. Pharmacy

T P C

**BIOLOGY - II**  
**( Maths stream students )**

**UNIT I**

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

**UNIT II**

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

**SUGGESTED TEXT BOOKS:**

Intermediate First Year and Second Year Botany / Zoology Text Books printed and published by Telugu Academy, Himayatnagar, Hyderabad.

1. A.C. Dutta, Text Book of Botany
2. Botany for Degree students Vol I & II by B.P. Pandey
3. Intermediate first Year mathematics and

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I Year II Sem B. Pharmacy

T P C

## ANATOMY, PHYSIOLOGY & HEALTH EDUCATION – II

### UNIT-I

**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-II

**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-III

**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 - IV

**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 & Wilson – Anatomy & Physiology in health and illness – Anne Waugh, Allison Grant.

### REFERENCES

1. Donald.C Rizzo, Fundamental of Anatomy and Physiology.
- 2 T.S. Ranganathan, A Text book of Human Anatomy.
3. Subrhamanyam and Others, A textbook of Physiology
4. A treatise on hygiene and public health, B.N.Ghosh, Calcutta scientific publishing company

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**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**

**I Year II Sem B. Pharmacy**

**T P C**

**ANATOMY, PHYSIOLOGY & HEALTH EDUCATION LAB**

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 Hemoglobin 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.

# JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA

I Year II Sem B. Pharmacy

T P C

## PHARMACEUTICAL INORGANIC CHEMISTRY - II

### UNIT- I

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

### UNIT -II

#### *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- III

#### *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-IV

#### 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 parasiticid | : | Sodium antimony gluconate |
| g) | Anti thyroid agents  | : | Potassium perchlorate     |

## **TEXT BOOKS**

1. A.H.Beckett and J.B.Stenlake, Practical pharmaceutical chemistry, Part-I. The Athtone press, University of London, London.
2. 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.
3. J.H Block, E.Roche, T.O Soine and C.O. Wilson, Inorganic Medical and Pharmaceutical Chemistry Lea & Febiger Philadelphia PA.

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**PHARMACEUTICAL ORGANIC CHEMISTRY-II**

**UNIT – I**

**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 Ponderff 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 – II**

**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, Perkins reactions, Reformatsky reaction, Oppenauer oxidation.

**UNIT – III**

***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 – IV**

***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. L. Finar Vol.I. & Vol. II., The Fundamentals Principles of Organic Chemistry, ELBS/Longman.

**REFERENCES**

- 1.. Ball & Ball, Advanced pharmaceutical organic chemistry.
2. Bruce, Organic chemistry.
3. Jerry March, Advanced Organic Chemistry

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**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY**

**KAKINADA**

**I Year II Sem B. Pharmacy**

**PHARMACEUTICAL INORGANIC CHEMISTRY LAB**

Introduction to Equipment & Glassware, Recrystallization method, distillation, ILP and distillation

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 Naphthyl methyl ether from Naphthol
9. Halogenation : Preparation of Iodoform from Oxidation of acetone
10. Extensive Nuclear Substitution : Preparation of Tribromophenol  
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.

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# JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA

I Year II Sem B. Pharmacy

T P C

## PHYSICAL PHARMACY – II

### UNIT I

**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 II

**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 III

**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 IV

**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.

### REFERENCES

1. C.V.S. Subramanyam, Essentials of Physical Pharmacy, Vallabh Prakashan.
2. B.S Bahl, Arun Bahl and G.D Tuli, Essentials of Physical Chemistry.
3. Derle D.V., Essentials of Physical Pharmacy

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**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**

I Year II Sem B. Pharmacy

T P C

**PHYSICAL PHARMACY – II 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.

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# JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA

## I Year II Sem B. Pharmacy ENVIRONMENTAL STUDIES

### UNIT - I

**Multidisciplinary nature of Environmental Studies:** Definition, Scope and Importance – Need for Public Awareness.

### UNIT - II

**Natural Resources :** Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest 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. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

### UNIT - III

**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 - IV

**Biodiversity and its conservation :** Introduction - Definition: genetic, species and ecosystem diversity. - Bio-geographical classification of India - Value of biodiversity: consumptive use, productive use, 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 and Ex-situ conservation of biodiversity.

### UNIT - V

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

- a. Air pollution
- b. Water pollution
- c. Soil pollution
- d. Marine pollution
- e. Noise pollution

f. Thermal pollution

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 - VI**

**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. -Environment Protection Act. -Air (Prevention and Control of Pollution) Act. –Water (Prevention and control of Pollution) Act -Wildlife Protection Act -Forest Conservation Act -Issues involved in enforcement of environmental legislation. -Public awareness.

#### **UNIT - VII**

**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. Page 37 of 79

#### **UNIT - VIII**

**Field work :** Visit to a local area to document environmental assets River /forest grassland/hill/mountain -Visit to a local polluted site Urban/Rural/industrial/ Agricultural Study of common plants, insects, birds. -Study of simple ecosystemspond, river, hill slopes, etc.

#### **Text Books :**

1. An Introduction to Environmental Studies by B. Sudhakara Reddy, T. Sivaji Rao, U. Tataji & K. Purushottam Reddy, Maruti Publications.

#### **Reference:**

1. Text Book of Environmental Studies by Deeshita Dave & P. Udaya Bhaskar, Cengage Learning.
2. Environmental Studies by K.V.S.G. Murali Krishna, VGS Publishers, Vijayawada
3. Text Book of Environmental Sciences and Technology by M. Anji Reddy, BS Publications.

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2010-11

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**  
**Kakinada 533 003**  
**II YEAR (B. PHARMACY)**  
**COURSE STRUCTURE AND SYLLABUS – 2010-11 BATCH**

**II YEAER**

**I Semester**

S.No	Subject	T	C	P	C
1.	Pharmaceutical Engineering	4+1*	4	-	-
2.	Pharmacognosy-1	4+1*	4	3	2
3.	Physical Pharmaceutics	4+1*	4	3	2
4.	Advanced Pharmaceutical Organic Chemistry	4+1*	4	3	2
5.	Health Education & Pathophysiology	4+1*	4	3	2
6.	English Communication Practice			2	1
Total Credits			20		9

**\*Tutorial**



2010-11

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA  
II Year (B. PHARMACY)**

**II Year B. Pharmacy. – I Sem.**

**PHARMACEUTICAL ENGINEERING**

**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**

**Crystalization:** 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, Bentley's Text Book of Pharmaceutics, 8<sup>th</sup> edition, ELBS



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**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA  
II Year (B. PHARMACY)**

**II Year B. Pharmacy. – I Sem.**

**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, cocoa 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.



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**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA  
II Year (B. PHARMACY)**

**II Year B. Pharmacy. – I Sem.**

**PHYSICAL PHARMACEUTICS**

**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 Membrane 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.



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**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA  
II Year (B. PHARMACY)**

**II Year B. Pharmacy. – I Sem.**

**ADVANCED PHARMACEUTICAL ORGANIC CHEMISTRY**

*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



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**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA  
II Year (B. PHARMACY)**

**II Year B. Pharmacy. – I Sem.**

**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, gonnorrhoea, 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 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 Anotamy & Physiology



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**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA  
II Year (B. PHARMACY)**

**II Year B. Pharmacy. – I Sem.**

**PHARMACOGNOSY – I LAB**

1. Collection of natural herbs and preparation of herbarium/laminated photos for five drugs.
2. Macrosopy, microscopy and chemical tests for any five carbohydrates mentioned in theory.
3. Macrosopy, microscopy and chemical tests for any five lipids mentioned in theory. Identification of curde drugs listed in theory.
4. Macrosopy, 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 Pharmocognosy.
2. C.K. Kokate et.al, Practical Pharmocognosy.
3. Iyengar, Practial Pharmocognosy



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**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA  
II Year (B. PHARMACY)**

**II Year B. Pharmacy. – I Sem.**

**PHYSICAL PHARMACEUTICS LAB**

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



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**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA  
II Year (B. PHARMACY)**

**II Year B. Pharmacy. – I Sem.**

**ADVANCED PHARMACEUTICAL ORGANIC CHEMISTRY LAB**

**I. Synthesis of some simple heterocyclic compounds.**

- a. 3, 5-Dimethylpyrazole from Acetylacetone.
- b. 3, 5-Dimethylisooxazole 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



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**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA  
II Year (B. PHARMACY)**

**II Year B. Pharmacy. – I Sem.**

**HEALTH EDUCATION & 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



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**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA  
II Year (B. PHARMACY)**

**II Year –I Sem. (Common to All Branches)**

**ENGLISH COMMUNICATION PRACTICE  
LIFE, LANGUAGE AND CULTURE EXPLORATIONS-I**

**Purpose of the Course:** English for Semesters 3 is designed to provide the learners an opportunity to enhance their language skills through a reading of literary texts which will also help them relate themselves to different cultures vis-à-vis their own. Independent reading is also expected to increase spontaneity in expression among the learners.

**Objectives:** The Course aims at exposing the learners to nuances in culture, inculcating the habit of independent reading which provides the learners an opportunity to develop critical thinking and analytical skills that can be applied to any subject.

**Content of the course:** The literary pieces are carefully chosen from across cultures as samples of contemporary life and issues of global interest. This is meant to encourage students to relate language to personality development. In all, five stories have been selected for English Communication Practice.

**Topics:** Culture and traditions, philosophy, familial relationships, ethics, inter-personal relationships, ability to face disaster and poverty, tolerance.

**Time frame/Hours of instruction:** 2hrs per week (for pre-reading and post reading tasks of the lessons). Total number of hours per semester - 32.

**Time Allocation:** Reading of the text should be done at home. The class hours are meant for discussion, analysis and related activities. Project should be completed in consultation with the teacher.

**Evaluation:** The learner will be assessed on a continuous basis by way of projects and work-sheets given at the end of each story.

Stories selected for English Communication Practice

*Life, Language and Culture:*

**1. The Cop and the Anthem by O. Henry**

**2. The Festival of the Sacred Tooth Relic in Sri Lanka**

(based on the Travelogues of FA Hien Compiled by Ashok Jain Assisted by Dhurjjati Sarma) **3. The Hawk and the Tree** by Mohammad Azam Rahnaward Zaryab

**4. To Be or Not To Be** by Zaheda Hina

**5. Bade Bhai Saab**(My Elder Brother) by Munshi Premchand

**Recommended Book:** Life, Language and Culture Explorations-I, Cengage Learning India Pvt. Ltd., New Delhi.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
KAKINADA

**B. PHARMACY**  
**PROPOSED COURSE STRUCTURE AND SYLLABUS(R10 Batch)**

II YEAR II Semester

S.No	Subject	T	C	P	C
1	Pharmaceutical Unit Operations- II	4+1	4	3	2
2	Pharmaceutical Analysis I	4+1	4	3	2
3	<b>Pharmacognosy – II</b>	4+1	4	3	2
4	Dispensing and Hospital Pharmacy	4+1	4	3	2
5	<b>Biostatistics</b>	4+1	4	-	-
6.	<b>English Communication Practice</b>	-	-	2	1
	Total	25	20	14	9

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
KAKINADA**

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

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

**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  
KAKINADA**

II Year B. Pharmacy II-Semester

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

**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 electrons), conductometry and polarography.

**UNIT - V**

Flourimetry, flame photometry, nephelometry & turbidometry.

**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  
KAKINADA**

II Year B. Pharmacy II-Semester

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**4+1\*   0      4**

**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, Nux-vomica
- 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 pharmaceutical 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.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
KAKINADA**

II Year B. Pharmacy II-Semester

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

**DISPENSING & 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.Sampath, 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  
KAKINADA**

II Year B. Pharmacy II-Semester

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

**BIOSTATISTICS**

**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.

**UNIT-II**

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

**UNIT - III**

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

**UNIT.IV**

**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.V**

**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.

**TEXT BOOKS**

1. Pranab Kumar Benarjee, Introduction to Biostatistics
2. Khan and Khanum, Fundamentals of Biostatistics

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
KAKINADA**

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

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0      3      2**

**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.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
KAKINADA**

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

<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>3</b>	<b>2</b>

**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.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY  
KAKINADA**

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

<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>3</b>	<b>2</b>

**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.

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KAKINADA**

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

**T      P      C  
0      3      2**

**DISPENSING & 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.

w.e.f. 2010-2011 academic year



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA  
KAKINADA-533003, Andhra Pradesh (India)

B.PHARMACY

COURSE STRUCTURE

III YEAR

I SEMESTER

S. No.	Subject	T	P	Credits
1	Pharm. Biochemistry	4	-	4
2	Pharm. Microbiology	4	-	4
3	Chemistry of Natural Drugs	4	-	4
4	Pharm. Technology-I	4	-	4
5	Pharmacology-I	4	-	4
6	Pharm. Biochemistry Lab	-	3	2
7	Pharm. Microbiology Lab	-	3	2
8	Chemistry of Natural Drugs Lab	-	3	2
9	Pharma. Technology-I Lab	-	3	2
10	Pharmacology-1 Lab	-	3	2
	<b>Total</b>			<b>30</b>



## JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA

III Year B. Pharmacy – I Sem.

### 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, Krebs'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 KAKINADA

III Year B.Pharmacy – I Sem.

### 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, archea 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 infectious hepatitis.

## UNIT – VIII

### Application of Microbes in Pharmaceutical Industry

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

### TEXT BOOKS

1. Pelczar and Reid, Text Book of Microbiology
2. Anantha Narayan and Jayram Panikar, Text Book of Microbiology, Orient Longman, Delhi, KAKINADA.
3. N.K. Jain, Pharmaceutical Microbiology
4. Alcamo, Microbiology.
5. R.C. Dubey, A textbook of Microbiology

### REFERENCES

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



## JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA

III Year B.Pharmacy – I Sem.

### 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, Deserpine, 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), LSD, ethysergide.

#### UNIT – III

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

**Citrals:** 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. JB 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 KAKINADA

III Year B.Pharmacy – I Sem.

### 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, racemization, 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.

#### 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.

#### UNIT-VIII

**Suppositories:** Ideal requirements of bases, Different types of bases, manufacturing procedure packing and evaluation.

## TEXT BOOKS

1. L. Lachman, H.A, Lieberman and J.L. Kanig, 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. 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 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 KAKINADA

### III Year B.Pharmacy – I Sem.

#### PHARMACOLOGY – I

##### UNIT I

**General Pharmacology:** Introduction to pharmacology, sources of drugs, dosage forms and routes of administration, mechanism of action, Structural activity and relationship(SAR), factors modifying drug action, tolerance and dependence, Pharmacogenetics Enzyme induction & Inhibition, Absorption, distribution metabolism and excretion of drugs, Principles of drug discovery and development of new drugs.

##### UNIT II

###### **Pharmacology of Autonomic Nervous System:**

Neurohumoral transmission in peripheral nervous system (autonomic and Somatic)  
Parasympathomimetics & parasympatholytics, sympathomimetics & sympatholytics  
Ganglionic-stimulants and blocking agents, Neuromuscular blocking agents.

##### UNIT III

###### **Drugs acting on Central Nervous System:**

Neurohumoral transmission in the C.N.S, General anesthetics, Alcohols and Disulfiram, Sedatives, hypnotics, & anti-anxiety agents.

##### UNIT IV

Analgesics, Antipyretics, Anti-inflammatory and Anti-gout drugs, Narcotic analgesics & antagonists, C.N.S. stimulants, Drug Addiction & Drug Abuse.

##### UNIT V

Pharmacology of Local Anaesthetics & Skeletal muscle relaxants  
Antipsychotics & Lithium, Antidepressants, Pharmacology of Anti-epileptic drugs,  
Pharmacological management of Parkinsonism & other movement disorders

##### UNIT VI

###### **Drugs Acting on the Gastrointestinal Tract**

Antacids, Antisecretory & Anti-ulcer Drugs, Laxatives & antidiarrhoeal drugs, Appetite Stimulants & Suppressants, Emetics & anti-emetics, Carminatives, Demulcents, Protectives, Adsorbents, Astringents, digestants, enzymes & mucolytics.

##### UNIT VII

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

#### TEXT BOOKS

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

## **REFERENCE BOOKS**

1. J.G. Hardman and Lee E. Limbard, Good Mann & Gilman, 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, 4th Ed.
3. J. Crossland, Lewis's Pharmacology, Church living stone.
4. Ruth Woodrow, Essentials of Pharmacology for Health Occupations.



## JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA

III Year B.Pharmacy – I Sem.

### 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.



## JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA

### III Year B.Pharmacy – I Sem.

#### 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 KAKINADA

III Year B.Pharmacy – I Sem.

### CHEMISTRY OF NATURAL DRUGS LAB

1. Preparation of different alkaloid testing reagents like Dragendroff, 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



## **JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**

**III Year B.Pharmacy – I Sem.**

### **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, dentrifices and manicure preparations.



## JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA

### III Year B.Pharmacy – I Sem.

#### Pharmacology-1 Lab

##### Introduction to Experimental Pharmacology

1. Preparation of different solutions for experiments.
2. Drug dilutions, use of molar and w/v solutions in experimental Pharmacology.
3. Common laboratory animals and anesthetics used in animal studies.
4. Commonly used instruments in experimental pharmacology.
5. Some common and standard techniques. Bleeding and intravenous injection, intragastric administration.
6. Experiments in Central Nervous system:  
Recording of spontaneous motor activity, stereotype, analgesia, anticonvulsant activity, anti-inflammatory activity.
7. To study the effect of autonomic drugs on rabbit's eye.
8. To record the concentration response curve (CRC) of acetylcholine using rectus abdominus muscle preparation of frog.
9. To study the effects of physostigmine and d-tubocurarine on the CRC of acetylcholine using frog rectus abdominus muscle preparation.
10. To study the drugs potentiating the activity of acetylcholine.
11. To study the drugs antagonizing action of acetylcholine.
12. To study the effect of drugs on rabbit ileum.
13. 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.