JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

(Established by Govt. of A.P., ACT No.30 of 2008)

ANANTAPUR – 515 002 (A.P) INDIA

Prof.A.ANANDA RAO
M.Tech., Ph.D.
DIRECTOR OF ACADEMIC & PLANNING

Ph & Fax:08554-272432
Mobile: 9000551418
Email:dap@jntua.ac.in

Lr.No.JNTUA/DAPO/A1/I B.Pharm I sem syllabus/2015 **Date:27/06/2015**

Sub:- JNTUA – DAPO – B. Pharm (R15) – 1st year I semester course structure & syllabus-Reg.
Ref:- Note Orders of the Vice-Chancellor, dated:- 27-06-2015.

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Vide ref cited above, I am herewith enclosing approved course structure & syllabi of I B.Pharm I semester of R15 regulations which is applicable for the students admitted from 2015-16 onwards.

S.No.	Code No	Title of the Subject
1	15R00101	Remedial Mathematics
	15R00102 15R00103	Remedial Biology Remedial Biology Lab
2	15R52101	Functional English
3	15R00103	Pharmaceutical Organic Chemistry - I
4	15R00104	Human Anatomy and Physiology - I
5	15R00105	Pharmaceutical Inorganic Chemistry
6	15R00106	Pharmaceutical Organic Chemistry – I Lab
7	15R00107	Human Anatomy and Physiology – I Lab
8	15R00108	Pharmaceutical Inorganic Chemistry Lab

Yours faithfully,

D.A.P

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ANANTHAPURAMU – 515 002 (A.P) INDIA
Course Structure for B.Pharmacy - R15 Regulations

I B.Pharm. - I Semester

S.No	Course code	Subject	Th	Tu	/ Lab	Credits
1.	15R00101	Remedial Mathematics	3	1	-	3
	15R00102	Remedial Biology	2	1	-	2
	15R00103	Remedial Biology Lab	-	-	2	1
2.	15R52101	Functional English	3	1	-	3
3.	15R00104	Pharmaceutical Organic Chemistry - I	3	1	-	3
4.	15R00105	Human Anatomy and Physiology - I	3	1	-	3
5.	15R00106	Pharmaceutical Inorganic Chemistry	3	1	-	3
6.	15R00107	Pharmaceutical Organic Chemistry – I Lab	-	-	4	2
7.	15R00108	Human Anatomy and Physiology – I Lab	-	-	4	2
8.	15R00109	Pharmaceutical Inorganic Chemistry Lab	-	-	4	2
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Subject	**REMEDIAL MATHEMATICS**	***Course Code***	15R00101	***Credits***
Course year	B. Pharmacy I Year	***Semester***	I Semester	3
Theory	3 hrs/week	***Tutorial***	1hr/week	
End exam	70 marks	***Internal***	30 marks	

Objectives: The objective of course is to impart knowledge in basic concepts of Mathematics relevant to pharmacy professionals

UNIT I: Algebra
Arithmetic Progression-Geometric progression, quadratic equations: Equations reducible to quadratics, Logarithms: Logarithm of a real number to an arbitrary base, theorems on logarithms, application of logarithms in pharmaceutical computations and Partial fractions

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 and sub-multiple angles, Sum and Product transformations.

UNIT III: Co-ordinate Geometry
Distance between points, Area of a triangle, Co-ordinates of a point dividing a given line segment in a given ratio, equation to a straight line in different forms, angle between straight lines-point of intersection.

UNIT IV: Differential and Integral calculus
Limit of a function, differentiation, derivatives of trigonometric functions, logarithmic and partial differentiation, maxima and minima (elementary), derivatives of second order.
Integration: Definition of integration, integration by substitution, integration by parts and definite integrals.(Basic problems)

UNIT V: Differential Equations and Laplace Transforms
Differential Equations: Order and degree, formation of a differential, solution of first order differential equations (variable separable method) application of first order and first degree differential equation. Law of natural growth and decay, Newton's law of cooling. Laplace transforms - Definition, elementary functions, properties of linearity and shifting.

Text Books:
1. Intermediate first and second year mathematics text books printed and published by Telugu academy.
2. A textbook of Remedial mathematics by P.Seshagiri Rao.

References:
1. Grewal B. S. Numerical Methods Khanna Publishers.
2. Steve Dobbs & Jane, Miller Advanced Level Mathematics Statistics, Cambridge University Press.
3. Adams Dany Spencer Laboratory Mathematics Carrol & Graphs.
4. Jenny Olive Maths. A Students Survival Guide Cambridge University Press.

Outcomes:
- The student is able to identify the type differential equations and uses the right method to solve the differential equations. Also the able to apply the theory of differential equations to the real world problems
- The student is able to transform functions on time domain to frequency domain using Laplace transforms
- The student will able to understand the methods of differential calculus to optimize single and multivariable functions.

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Subject	**REMEDIAL BIOLOGY**	***Course Code***	15R00102	***Credits***
Course year	B. Pharmacy I Year	***Semester***	I Semester	2
Theory	2 hrs/week	***Tutorial***	1hr/week	
End exam	70 marks	***Internal***	30 marks	

Objectives: This subject is introduced to the pharmacy course in order to make the student aware of the characters of the plants and animals. This subject gives basic foundation to Pharmacognosy

UNIT I
Plant and animal cell: Detailed structure and their functions. Mitosis, meiosis, different types of plant tissues and their functions.

UNIT II
Salient features and classification of plants into major groups-algae, fungi, bryophytes, pteridophytes, gymnosperms and angiosperms. Classification of animal kingdom and salient features of each phyla.

UNIT III
Morphology and histology of root, stem, bark, wood, leaf, flower, inflorescence, fruit and seed. Modifications of root stem and leaf.

UNIT IV
Study of Structure and life history of parasites: Amoeba, Entamoeba, Trypanosoma, Plasmodium, Taenia, Ascaris, Schistosoma, Oxyuris and Ancylostoma.

UNIT V
General structure and life history of insects like Cockroach, Mosquito and Housefly.

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.

References:

1. Concepts of biology, Enger.
2. Text book of Biology by S.B.Gokhale.
3. Outlines of zoology by M.Ekambaranatha Ayyar and T.N.Ananda Krishnan.

Outcomes:

- Describe the structure and functions of animal and plant cell
- Describe the various salient features of animal and plant kingdom
- Student able to identify the morphology of various plant parts
- Student able to identify the structure of the various diseases causing parasite

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Subject	**REMEDIAL BIOLOGY LAB**	***Course Code***	15R00103	***Credits***
Course year	B. Pharmacy	***Semester***	I Semester	1
Practical	2 hrs/week	***Tutorial***	-	
End exam	50 marks	***Internal***	25 marks	

I.EXPERIMENTS:

a) Care and uses of microscope
b) Morphology of plant parts indicated in theory.
c) Preparation, Microscopic Examination of stem, root and leaf of Mono and Dicot leaves.
d) Structure of human parasites and insects mentioned in the theory with the help of specimen

II. Demo/Workshop:

Dissection of cockroach mouth parts, observation of different phases of mitotic division in onion root tips.

III. Seminar/Assignment/Group discussion:

Preparation of herbarium of plant parts indicated in theory and study of salient features for identification.

Reference:

1. Intermediate Botany/Zoology Text manuals printed and published by Telugu academy, himayatnagar, Hyderabad.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
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Subject	**FUNCTIONAL ENGLISH**	***Course Code***	15R52101
Course year	B. Pharm. I year	***Semester***	I
Theory	3 hrs/week	***Tutorial***	1hr/week
End exam	70 marks	***Internal***	30 marks
Credits	3		

Preamble:

English is an international language as well as a living and vibrant one. People have found that knowledge of English is a passport for better career, better pay, and advanced knowledge and for communication with the entire world. As it is a language of opportunities in this global age, English is bound to expand its domain of use everywhere. The syllabus has been designed to enhance communication skills of the students of engineering and pharmacy. The prescribed book serves the purpose of preparing them for everyday communication and to face the global competitions in future.

The text prescribed for detailed study focuses on LSRW skills and vocabulary development. The teachers should encourage the students to use the target language. The classes should be interactive and learner-centered. They should be encouraged to participate in the classroom activities keenly.

In addition to the exercises from the text done in the class, the teacher can bring variety by using authentic materials such as newspaper articles, advertisements, promotional material etc.

Objectives:

- To enable the students to communicate in English for academic and social purpose.
- To enable the students to acquire structure and written expressions required for their profession.
- To develop the listening skills of the students.
- To inculcate the habit of reading and critical thinking skills.
- To enhance the study skills of the students with emphasis on LSRW skills.

UNIT –I

Topics: Paragraph writing, writing letters, role play, reading graphs, prepositions, designing posters, tenses, making recommendations.

Text: ENVIRONMENTAL CONSCIOUSNESS' from *MINDSCAPES*

Climate Change - Green Cover – Pollution

UNIT –II

Topics: Compound nouns, imperatives, writing instructions, interpreting charts and pictures, note making, role play, prefixes, subject-verb agreement.

Text: EMERGING TECHNOLOGIES from *MINDSCAPES*

Solar Thermal Power - Cloud Computing - Nanotechnology

UNIT –III

Topics: Making conversations, homonyms and homophones, SMS and use of emotions, past participle for irregular verbs, group discussion, E - mail communication, antonyms, Preparing projects

Text: GLOBAL ISSUES from *MINDSCAPES*

Child Labour - Food Crisis - Genetic Modification - E-Waste - Assistive Technology

UNIT –IV

Topics: Group discussion, affixes, double consonants, debates, writing a book / film review, predicting and problem-solving-future tense, adverbs

Text: SPACE TREK from *MINDSCAPES*

Hubble Telescope - Chandrayan-2 - Anusat - Living Quarters - Space Tourism

UNIT –V

Topics: Compare and contrast, effective writing, group discussion, writing reports, writing advertisements, tweeting and blogging, types of interviews, framing questions.

Text: MEDIA MATTERS from *MINDSCAPES*

History of Media - Language and Media - Milestone in Media - Manipulation by Media - Entertainment Media - Interviews

Text Books:

1. MINDSCAPES: English for Technologists and Engineers, Orient Blackswan, 2014.

References:

1. A Practical Course in Effective English Speaking Skills by J.K.Gangal, PHI Publishers, New Delhi.2012
2. Technical Communication, Meenakshi Raman, Oxford University Press,2011.
3. Spoken English, R.K. Bansal & JB Harrison, Orient Longman,2013, 4Th edition.
4. Murphy's English Grammar with CD, Murphy, Cambridge University Press,3 Rd edition.
5. An Interactive Grammar of Modern English, Shivendra K. Verma and Hemlatha Nagarajan , Frank Bros & CO,2008.

Outcomes:

- Have improved communication in listening, speaking, reading and writing skills in general.
- Have developed their oral communication and fluency in group discussions and interviews.
- Have improved awareness of English in science and technology context.
- Have achieved familiarity with a variety of technical reports.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
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Subject	**PHARMACEUTICAL ORGANIC CHEMISTRY-I**	***Course Code***	15R00104	***Credits***
Course year	B. Pharmacy I year	***Semester***	I	3
Theory	3 hrs/week	***Tutorial***	1hr/week	
End exam	70 marks	***Internal exam***	30 marks	

Objectives:

- To understand fundamentals of organic chemistry
- To apply the knowledge for the synthesis of various new organic molecules.

UNIT I

Structure and activity of Organic Molecules: Concept on shapes of organic molecules, valency (C, H, O, N, S, P, X, Si), hybridization SP3, SP2, SP, different bonds, bond lengths, bond angles, bond dissociation energies, molecular weight calculations, impact of structure on BP, MP, refractive index, surface tension and solubility.

Electronic effect in organic molecules: Inductive effect, electromeric, mesomeric effect, hyperconjugation, concept of resonance and stability. Types of organic reagents and reactions.

UNIT II

Aliphatic/Alicyclic Hydrocarbons: Nomenclature, isomerism (Chain, Conformational and geometrical) relative stabilities (heat of combustion and hydrogenation) ring stabilities of cyclohexane, Chair-boat conformation, Bayer's strain theory and Sachse- Mohr concept. Free radical substitution reactions (halogenation) of alkanes, selectivity and reactivity of halogens.

UNIT III

Alkenes: Electrophilic addition reactions of alkenes, Markovnikow's rule, anti-Markovnikow's rule, Hkarasch effect, Bayer's oxidation (Cis-hydroxylation, Polymerization)

Alkadienes: Stability of conjugated dienes, 1,2 and **1,4** - addition reactions of conjugated dienes.

UNIT IV

Alkynes: Acidity of 1-alkynes, formation of metal acetylides, stereo specific reduction of alkynes, addition of hydrogen halide, addition of water and keto-enol tautomerism.

Halogen compounds - Aliphatic: Nomenclature, general methods of preparation Characteristic nucleophilic substitution reactions, factors that play role **in** SN 1 and SN2, Walden inversion, elimination reaction and Saytzeff's rule.

UNIT V

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 and Oppenauer oxidation.

Text Books:

1. Advanced pharmaceutical organic chemistry, Bahl & Bahl, S.Chand.
2. Organic chemistry, T.R.Morrison and R.N.Boyd, Pearson Education India , New Delhi.

References:

1. Reactions and Mechanism, Jerry March, 4th edition Wiley Publication.
2. Organic chemistry, Carey, 8th Edition, Mc Graw-Hill.
3. Organic chemistry, Pillai Orient Longman Publisher.

Outcomes:

- Graduates will demonstrate the knowledge of the inter-link of pharmaceutical sciences with pharmaceutical organic chemistry by learning.
- Graduates will understand IUPAC Common system of nomenclature, types of organic reactions, mechanisms, named reaction with mechanism.
- Graduates will expertise their skills for pharmaceutical organic chemistry concepts, tools and atomic models.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
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Subject	**HUMAN ANATOMY AND PHYSIOLOGY - I**	***Course Code***	15R00105	***Credits***
Course year	B. Pharmacy I year	***Semester***	I Semester	3
Theory	3 hrs/week	***Tutorial***	I	
End exam	70 marks	***Internal***	30 marks	

Objectives: This course is designed to impart a fundamental knowledge on the structure and functions of the human body. It also helps in understanding both homeostasis mechanisms and homeostatic imbalances of various body systems

UNIT - I: Cell
Scope of anatomy and physiology, basic terminology used in these subjects. Structure of cell, its components and their functions. Body fluids, homeostasis.
Tissues Elementary tissues of the human body: epithelial, connective, muscular and nervous tissues, their sub types and characteristics and functions.
Urinary system: Various parts, structure & functions of the kidney and urinary tract.
Physiology of urine formation.

UNIT- II:
Haemopoietic system: Composition and functions of blood, blood groups and their significance and mechanism of coagulation of blood. Types of anemia, disorders related to blood components (Definitions only)
Respiratory System*:* Various parts of respiratory tract and their functions. mechanism and regulation of respiration, respiratory volumes and vital capacity. Disorders related to respiratory system (Definitions only)

UNIT-III:
Reproductive Systems: Male and Female reproductive systems and their hormones, physiology of menstruation, coitus and fertilization. Sex differentiation, spermatogenesis & oogeneisis.
Digestive *System:* Gross anatomy of the gastro-intestinal tract, functions of its different parts including those of liver, pancreas and gall bladder. Disorders related to GIT (definitions only)

UNIT - IV:
a) Cardiovascular system: Basic anatomy and physiology of heart and blood vessels, circulation (Systemic, pulmonary, coronary). Understanding of cardiac cycle, heart sounds and electrocardiogram. Blood pressure and its regulation. Disorders related to Cardiovascular system (Definitions only)
b) Lymph and Lymphatic System: Composition, formation and circulation of lymph; Disorders related to lymphatic system (Definitions only)
C) **Study of sense organs:** Structure and detailed functions of eye, ear, nose, tongue, skin

UNIT - V:
a) **Central Nervous System**: Functions of different parts of brain and spinal cord. Structure of blood brain barrier and its importance. Neurochemical transmission in the central nervous system, electroencephalogram, cranial nerves and their functions.
b) **Autonomic Nervous System**: Physiology and functions of autonomic nervous system. Mechanism of neurohumoral transmission in the A.N.S.
c) **Musculoskeletal system:** Structure, composition and functions of skeleton, Joints, classification of joints and types of movements of synovial joints.

Text Books:

1. Principles of Anatomy and Physiology, Tortora, G.J. and Anagnodokas, N.P. Harper & Row Publishers N.Y.
2. Text Book of Human Anatomy, Ross & Willson, M.J. Mycek S.B. Gerther and MMPER.
3. Human Physiology, C.C. Chatterjee. Rosen Educational Publishing 13th Edition.

References:

1. Essential of Human Anatomy & Physiology, Elaine N. Marieb 6th Edition Benjamin Eumming's.
2. Fundamentals of Anatomy & Physiology, Rizzo, Cengage Learning (2009) 3rd Edition.
3. Human Anatomy, Mc. Kinley, Mc. Graw Hill 2009.

Outcomes:

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

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Subject	**PHARMACEUTICAL INORGANIC CHEMISTRY**	***Course Code***	15R00106	Credits
Course year	B. Pharmacy I year	***Semester***	I	3
Theory	3 hrs/week	***Tutorial***	1hr/week	
End exam	70 marks	***Internal exam***	30 marks	

Objectives:

- To understand the knowledge on inorganic compounds those exist as pharmaceutical preparations and pharmaceutical aids.
- To apply the knowledge of volumetric analysis for identification and purity testing for inorganic pharmaceutical compounds specified in IP & BP.

UNIT - I: Basic concepts of Pharmaceutical inorganic chemistry

Introduction to indian pharmacopoeia, concept and content of monograph and definition of various specifications under monograph. Classification of Inorganic Pharmaceuticals based on their applications and therapeutic uses as specified in Indian Pharmacopoeia and British Pharmacopoeia. Sources of impurities in Pharmaceuticals, concept of test for purity, assay, idendification and limit test. Qualitative tests for anion and cations. Limit tests for arsenic, heavy metals, lead, iron, chloride and sulphate.

UNIT - II: Introduction to volumetric analysis

Concept and understanding of titration, titrate, titrant, indicator, primary standard, secondary standard, normality, molarity, molality, concencentrated and dilute acids and bases as per IP. Basic reaction and different titrants used in alkalimetry, acidimetry, oxidation-reduction, non-aqueous, complexometry, argentometry, diazotization titrations. Standardization of sodium hydroxide, perchloric acid, potassium permanganate, silver nitrate, EDTA, sodium nitrite.

Note: Definition, structure, formula, Preparation*, Properties, uses identification test*, principle behind Assays* of the compounds mentioned in Unit III to Unit V (*ONLY FOR SPECIFIED COMPOUNDS)

UNIT- III: Electrolytes, Mineral supplements and Dental products

Electrolytes: Sodium chloride*, compound sodium chloride solution (Ringer's solution), potassiumchloride, ORS, calcium gluconate*, calcium chloride, sodium citrate, haemodialysis fluids.
Mineral Nutrients/Supplements: Ferrous sulphate*, ferrous fumarate, ferrous gluconate, ferricammonium citrate*, iron and dextrose injection.
Dental products:Sodium fluoride*, sodium monofluorophosphate, stannous fluoride, calciumcarbonate, dibasic calcium phosphate* and strontium chloride.

UNIT – IV: Topical agents and Pharmaceutical aids

Topical Agents: Zinc sulphate, calcium hydroxide*, bismuth sub carbonate. zinc oxide*, calamine,zinc stearate, talc, titanium-dioxide, heavy kaolin and light kaolin (only uses), activated dimethicone, hydrogen peroxide solution*, potassium permanganate, silver nitrate (silver protein), iodine (solutions of iodine, povidoneiodine), boric acid*, zinc undecylenate and yellow mercury oxide.
Pharmaceutical aids: Magnesium stearate*, talc, bentonite, colloidal silica. titanium dioxide, ferric oxide.

UNIT – V: Gastro-intestinal agents and other medicinal agents

Acidifiers & Antacids: Dilute hydrochloric acid, sodium acid phosphate, sodium bicarbonate*, aluminium hydroxide gel*, dried aluminium hydroxide gel, magnesium hydroxide mixture,

magnesium trisilicate.
Expectorants: Ammonium chloride* and potassium iodide.
Emetics: Potassium antimony tartarate, copper sulphate*.
Antidotes:sodium thiosulphate*, sodium nitrite, Activated charcoal.
Structure and clinical uses for: Cisplatin, lithium carbonate, barium sulphate, plaster of paris, sodium aurothiomalate, sodium antimony gluconate, potassium perchlorate, sodium tetradecyl sulphate, sodium chloride hypertonic injection.

Text Books:

1. Practical pharmaceutical chemistry, Part-I, A.H.Beckett and J.B.Stenlake, The Athtone press, University of London, London.
2. Inorganic Medical and Pharmaceutical Chemistry, J.H Block, E.Roche, T.O Soine and C.O. Wilson, Lea & Febiger Philadelphia PA. 1974.
3. Pharmaceutical Chemistry-Inorganic, G.R. Chatwal, Himalaya Publishing House, Mubai, India.

References:

1. Inorganic chemistry, Gary L.Miessler and Donald A.Tarr,3/e, Pearson education, New Delhi.
2. Inorganic pharmaceutical chemistry, P. Gundu Rao, Vallabh Prakashan, Delhi.
3. Advanced Inorganic Chemistry, G.D.Tuli, Satya prakash, S.Chand 2006.
4. Modern inorganic chemistry by William L. Jolly Mc Graw-Hill, New Yark 1984
5. Indian Pharmacopoeia 1996, 2007.

Outcomes:

- The graduates will develop the knowledge to find out the purity of pharmaceutical substances.
- They came to know the importance of pharmaceutical inorganic agents in certain diseases.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
ANANTHAPURAMU

Subject	**PHARMACEUTICAL ORGANIC CHEMISTRY-I LAB**	***Course Code***	15R00107	***Credits***
Course year	B. Pharmacy I year	***Semester***	I	2
Practical	4 hrs/week	***Tutorial***	NIL	
End exam	50 marks	***Internal***	25 marks	

I. Experiments:

A. Introduction to Equipment and Glassware, Recrystallization methods, experiments on melting point, boiling point and distillation.

B. Preparation of organic compounds (each involving a specific organic reaction covered in theory- any 10 synthesis)

1. N-Acetylation : Preparation of Acetanilide from Aniline
2. O-Acetylation : Preparation of Aspirin from Salicylic acid
3. Bromination : Preparation of p-Bromoacetanilide from Acetanilide
4. Hydrolysis : Preparation of p-Bromoaniline from p-Bromoacetanilide
5. Nitration : Preparation of m-dinitrobenzene from Nitrobenzene/picric acid from phenol
6. Reduction : Preparation of m-nitro aniline from m-dinitro benzene.
7. Oxidation : Preparation of Benzoic acid from benzyl chloride / benzyl alcohol.
8. Esterification : Preparation of Benzyl benzoate from benzoyl chloride.
9. Condensation : Benzoin from benzaldehyde.
10. □-Halogenation : Preparation of Iodoform from Oxidation of Acetone / Ethanol.

II. Demo / work shop

Laboratory safety exercises, melting point for different crystals of same compound, atomic models emphasizing hybridization.

III. Seminar/assignment/group discussion

Exercise on nomenclature of compounds, Knowledge on CAS, IUPAC, ACS, material safety data and different types of explosive, oxidizable substances.

References:

1. Text Book of Practical Organic Chemistry, Vogel's, 5th Edition Pearson.
2. Laboratory Manual of Organic Chemistry, R.K. Bansal, New Age International 5th Edition 2007.
3. Advanced Practical Organic Chemistry, O.P. Agarwal, 3rd Edition Goel Publication.
4. Practical Organic Chemistry, F.G.Mann & B.C. Saunders, Pearson 4th Edition.

List of Minimum Equipment Required:

1. Triple beam balances
2. Physical balances
3. Melting point apparatus
4. Suction pumps
5. Oven
6. Hot plates
7. Water baths
8. Distillation unit
9. Refrigerator
10. Adequate glassware

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
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Subject	**HUMAN ANATOMY AND PHYSIOLOGY – I LAB**	***Course Code***	15R00108	***Credits***
Course year	B. Pharmacy I year	***Semester***	I	2
Practical	4 hrs/week	***Tutorial***	NIL	
End exam	50 marks	***Internal***	25 marks	

I. EXPERIMENTS:

1. Study of compound microscope
2. Microscopic study of different tissues(Epithelial, Nervous tissues)
3. Microscopic study of different tissues (Muscular, connective tissues)
4. Determination of blood groups
5. Estimation of Haemoglobin in blood.
6. Determination of bleeding time & clotting time.
7. Recording of Blood pressure.
8. Recording of pulse rate
9. Study of ECG
10. Recording of body temperature.

II. DEMO

Study of different systems with the help of charts and models.

1. Study of Cardiovascular system.
2. Study of nervous system.
3. Study of Lymphatic system.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
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Subject	**PHARMACEUTICAL INORGANIC CHEMISTRY LAB**	***Course Code***	15R00109	***Credits***
Course year	B. Pharmacy I year	***Semester***	I	2
Practical	4 hrs/week	***Tutorial***	NIL	
End exam	50 marks	***Internal***	25 marks	

I. Experiments:

1. Limit tests for the following as per the procedure given in Indian Pharmacopoeia
   a) Chlorides &Modifications in limit test for chlorides inpotassiumpermanaganate
   b) Sulphates &Modifications in limit test for sulphates inpotassiumpermanaganate
   c) Iron
   d) Arsenic
2. Balances and Weighing: Calibration of Pipette and Burette.
3. Preparation and standardization of Hydrochloric acid solution (0.1N).
4. Preparation and standardization of Potassium permanganate solution (0.1N).
5. Preparation and purification of Boric acid.
6. Preparation and purification of Potash alum.
7. Assay of sodium bicarbonate and assay of Boric acid (Neutralization).
8. Assay of calcium gluconate (or) any calcium compounds (Complexometry).
9. Assay of copper sulphate (Redox titration).
10. Assay of sodium acetate (Non-aqueous titration).
11. Assay of ferrous sulphate (Oxidation-reduction / Redox titration).

II. Demo/workshop

Labelling, handling, storage of inorganic compounds, safety practices in laboratory, identification of anions and cations.

III. Assignment/Seminar/Group Discussion

a) Radioactive metals in the environment and its importance
b) Importance of inorganic compounds in cancer
c) Different catalysts which are used in various organic preparations and their characteristics
d) Inorganic metals used in biochemical functions and their rule.

References:

1. Practical pharmaceutical chemistry, Part-I, A.H.Beckett and J.B.Stenlake, The Athtone press, University of London, London.
2. Inorganic chemistry, Gary L.Miessler and Donald A.Tarr,3/e, Pearson education, New Delhi
3. Inorganic pharmaceutical chemistry, P. Gundu Rao, Vallabh Prakashan, Delhi.
4. Advanced Inorganic Chemistry, G.D.Tuli, Satya prakash, S.Chand 2006.
5. Modern inorganic chemistry by William L. Jolly Mc Graw-Hill, New Yark 1984
6. Indian Pharmacopoeia 1996, 2007.

List of Minimum Equipment Required:

1. Analytical balances
2. Physical balances
3. Suction pumps
4. Oven
5. Hot plates
6. Water baths
7. Distillation unit
8. Limit test apparatus for arsenic

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Course Structure for B. Pharmacy. - R15 Regulations
B. Pharmacy

I-II Semester

S.No	Course code	Subject	Th	Tu / Drg / Lab	Credits
1.	15R00201	Pharmaceutical Organic Chemistry - II	3	1 - -	3
2.	15R00202	General & Dispensing Pharmacy	2	1 - -	2
3.	15R00203	Pharmaceutical Biochemistry	3	1 - -	3
4.	15R00204	Pharmacognosy – I	2	1 - -	2
5.	15A52201	English for Professional Communication	3	1 - -	3
6.	15R00205	Pharmaceutical Organic Chemistry – II Lab	-	- - 4	2
7.	15R00206	General & Dispensing Pharmacy Lab	-	- - 4	2
8	15R00207	Pharmaceutical Biochemistry Lab		- - 4	2
9	15R00208	Pharmacognosy – I Lab		- - 4	2
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B.Pharmacy. I - II Sem.

T	Tu	C
3	1	3

Subject	**PHARMACEUTICAL ORGANIC CHEMISTRY-II**	***Course Code***	15R00201
Course year	B. Pharmacy I year	***Semester***	II
Theory	3 hrs/week	***Tutorial***	1hr/week
End exam	70 marks	***Internal exam***	30 marks
Credits	3		

Objectives:

1. To understand the reactivity of various functional groups.
2. To understand the recent advances in organic synthesis by knowing safe technologies.

UNIT - I:

Alcohols: Nomenclature, classification, general methods of preparation, physical properties, hydrogen bonding, characteristic nucleophilic substitution reactions (replacement of -OH by -Cl), elimination reactions, and relative reactivities of 1º, 2º and 3º alcohols, Meerwein Pondorff Verley reduction.

Phenols: Nomenclature, general methods of preparation, physical properties, acidity of phenols,stability of phenoxide ion, reactions of phenols, Kolbe-Schmidt reaction, Fries rearrangement, and Reimer-Tiemann Reaction.

Ethers: Nomenclature, Williamson's synthesis, action of hydro iodic acid on ethers (Ziesel'smethod).

UNIT - II:

Aromatic Hydrocarbons:

Kekule Structure of Benzene, Bond Length, Heat Of Hydrogenation, 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.

Aromatic Halogen Compounds:

Nomenclature, Low reactivity of Halobenzenes towards nucleophilic substitution, Arenes, Benzyne ion Concept.

UNIT-III:

Polynuclear Aromatic Hydrocarbons

Nomenclature, Structure and Aromatic Character of Naphthalene, Anthracene and Phenanthrene resonance structures, electron density and reactivity, electrophilic substitution, oxidation and reduction reactions.

UNIT - IV:

Carboxylic acids: Nomenclature, intermolecular association, stability of carboxylate anion, twoimportant methods of preparation, decarboxylation, functional groups reactions and reduction of carboxylic acids.

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

UNIT – V:

Nitro compounds: Nomenclature, acidity of nitro compounds containing□-hydrogens, reductivereactions of aromatic nitro compounds.

Amines: Nomenclature, classification, basicity of amines, relative reactivity, Hinsberg method ofseparation, acylation reactions. Diazotisation and reactions of diazonium salts.

Nitriles and isonitriles: Nomenclature, two methods of synthesis, reactivity and functionalreactions.

TEXT BOOKS

1 *Advanced pharmaceutical organic chemistry, Bahl & Bahl, S.Chand.*

1. *Organic chemistry, T.R.Morrison and R.N.Boyd, Pearson Education India , New Delhi.*

REFERENCES

1 *Organic chemistry, Bruice 6th Edition, Pearson Publisher, 2010.*

2 *Reactions and Mechanism, Jerry March, 4th edition Wiley Publication.*

3 *Organic chemistry, Carey, 8th Edition, Mc Graw-Hill.*

4 *Organic chemistry, Pillai Orient Longman Publisher.*

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

Course outcomes:

1. The graduate can understand nomenclature and chemistry of various functional groups and chemical properties with their mechanisms.

Student can apply green chemical methods for the synthesis of new chemical entities in the view of environment protection.

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B.Pharmacy. I - II Sem. **T 2** **Tu 1** **C 2**

Subject	**GENERAL AND DISPENSING PHARMACY**	***Course Code***	15R00202
Course year	B. Pharmacy I year	***Semester***	II
Theory	2 hrs/week	***Tutorial***	1hr/week
End exam	70 marks	***Internal***	30 marks
Credits	2		

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

UNIT I Origin and History

Development of pharmacy, Evolution of Pharmacy education &Pharma industry in India.Origin anddevelopment of the Pharmacopoeias, History of Ayurveda, salient features of IP, USP and BP.

UNIT II Dispensing Pharmacy

Drug - Definition, Essential characteristics. Dosage form – Definition, Classification, Formulation andpurpose. Principles of dispensing, parts of prescription, handling of prescription, general dispensingprocedures, source of errors in prescription and care required in dispensing procedures includinglabeling of dispensed products.

UNIT III Pharmaceutical calculations

Weights and Measures, introduction to Latin terms, Percentage calculations, alligation method, proofspirit calculations, displacement value and calculations of isotonicity adjustment. Posology-factorsaffecting selection of dose & dosage form and calculations of doses.

UNIT IV Principles involved and procedures adopted in dispensing of the following

classes of preparations:

i) Powders ii) Solutions iii) Mixtures iv)Lotions& liniments v) Suspensions vi) Emulsions and vii) Ointments.

UNIT V Incompatibilities

Introduction, classifications, methods to overcome incompatibility.

TEXT BOOKS

1 Dispensing Pharmacy, Cooper &Gunns CBS, Publ. and Distributors New Delhi – (2008).

2 Dispensing Pharmacy, R.M Metha, 2006 Vallabh Publication, New Delhi.

REFERENCES

1. Text Book of Pharmaceutics, E.A. Rawlins, Bentley''s ELBS publ.

2. Essential dosage calculations -Hospital Pharmacy. Lorria& William, William Hassan.

OUTCOME

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

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B.Pharmacy. I - II Sem.

T	Tu	C
3	1	3

Subject	**PHARMACEUTICAL BIOCHEMISTRY**	***Course Code***	15R00203
Course year	B. Pharmacy I year	***Semester***	II
Theory	3 hrs/week	***Tutorial***	1hr/week
End exam	70 marks	***Internal***	30 marks
Credits	3		

Scope and objectives: This course is designed to impart a fundamental knowledge on the biochemistry. It prepares the students for most basics of life and chemistry of living.

UNIT I:Cell Processes, Bioenergetic and Cellular Reactions
Bio chemical organization of the cell, molecular constitutents of membrane, active & passivetransport process, sodium and potassium pumps, osmoregulation and heamostatis. The concept of freeenergy, determination of change in free energy from equilibrium constant & reduction potential. Production of ATP and its biological significance.Redox reactions, redox potential, the respiratorychain & its role in energy capture & its control.Oxidative phosphorylation & its energetics & E.T.Cmechanism.

UNIT II
Introduction to Bio-Molecules: Structure, classification, cell and biological functions of
carbohydrates, proteins, lipids, nucleic acids (DNA & RNA) vitamins & minerals.
Enzymes & Co-Enzymes: Classification, Structure, mechanism of action, properties, factors
affecting enzymes action, enzyme kinetics and enzyme inhibitions, repressions with reference to drugaction, Isoenzymes, Coenzymes from Vitamins, Nucleotides and non-nucleotides. clinical importanceof enzymes in treatment and diagnosis.

UNIT III : Metabolism of carbohydrates
Metabolic pathway, regulation and significance of the following pathways and cycles: Metabolism ofCarbohydrates: Glycolysis (aerobic and anaerobic), glycogenolysis, gluconeogenesis, Kreb's cycle,HMP &uronic acid pathways, Cori cycle.

UNIT IV : Metabolism of Lipids and Proteins
Lipids : Alpha, Beta, Gama & Omega oxidations of fatty acids, bio-synthesis of fatty acids,
cholesterol, ketogenesis, Utilization of ketone bodies, Regulation and energetics of Lipid metabolism,Metabolic disorders of lipid metabolism.
Proteins: Structure, classification of protein. Classification of aminoacids,

concept of essential andnonessential amino acids and their importance in deamination, Trans-amination, de-carboxylation,Urea cycle. Metabolism of Valine, cystine, cystein, tryptophan, tyrocine, methionine.Biosynthesis ofpurines, pyrimidines, proteins.Metabolic disorders of Carbohydrate and protein.

UNIT V: Clinical Biochemistry

Introduction to clinical biochemistry, Normal values of various biochemical parameters (Blood / orUrine: Glucose, VLDL, LDL etc. total proteins, urea, Minerals, Hormones... etc.) and their abnormalvalues in diagnosis.Liver function test and kidney function test, OGTT.

TEXT BOOKS:

1. A.L.Lehninger, Principles of Biochemistry; CBS Publishers and distributors.
2. Harper, Biochemistry McGraw Hill Medical, 28th Edition.
3. Text Book of Biochemistry by Satyanarayana Oxford University Press.
4. J.L.Jain, Fundamentals of Biochemistry S.Chand

REFERENCE BOOKS:

1. Biochemistry, C.B.Powar&G.R.Chatwal, Himalaya publishing house
2. L.Stryer, Text Book of Bio Chemistry. W.H.Freemann& Co. Ltd. 6th Edition.
3. West, Edward Text Book of Biochemistry; Freeman and company, Sanfransisco.
4. E.E.Conn and PK Stumpf, Outlines of Biochemistry; John Wiley and sons, New York.

OUTCOME

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

a. Understand the chemistry involved in life.
b. Understand biochemical reactions in the human body.
c. Understand the metabolic pathways of various biomolecules.

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B.Pharmacy. I - II Sem.

	T	**Tu**	**C**
	2	**1**	**2**

Subject	**PHARMACOGNOSY-I**	***Course Code***	15R00204
Course year	B. Pharmacy I year	***Semester***	II
Theory	3 hrs/week	***Tutorial***	1 hr/week
End exam	70 marks	***Internal exam***	30 marks
Credits	3		

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

UNIT I

A) Definition, history, development and scope of Pharmacognosy

B) Brief introduction to natural sources of drugs with examples: plants, animals, minerals, marine and microorganisms

UNIT II

A) Classification of drugs of natural origin: Alphabetical, morphological, taxonomical, chemotaxonomic, pharmacological and chemical classification with suitable examples.

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

- Factors influencing cultivation of medicinal plants.
- Plant hormones and their applications.
- Improved methods of cultivation techniques: polyploidy, mutation and hybridization with reference to medicinal plants.
- WHO guidelines on Good Agricultural and Collection Practices (GACP) for medicinal plants

UNIT III

A) Introduction, definition, classification, different chemical tests for the carbohydrates and derived products. Systemic Pharmacognostic study of the following carbohydrates and derived products: Acacia, Tragacanth, Agar, Starch, Guar gum, Pectin, Isabgol and Honey.

UNIT IV

A) Definition, classification and properties of tannins. Study of tannin containing drugs-Gambir, Black catechu, Galls, Myrobalan and Arjuna.
B) Study of source, preparation and identification of fibres used in pharmacy like cotton, silk, wool, nylon and polyester.

UNIT V

Introduction, definition, classification, different physical, chemical properties, extraction methods, chemical tests for the lipids. Systemic Pharmacognostic study of the following lipids: castor oil, cod liver oil, shark liver oil, linseed oil, cocoa butter, kokum butter, bees wax, wool fat, hydnocarpus oil, Rice bran oil and Lard.

TEXT BOOKS:

1. *Kokate C.K., Purohit A.P., Gokhale S. B. Pharmacognosy, Nirali Prakashan, New Delhi.*
2. *Text book of Pharmacognosy by Handa and Kapoor.*
3. *Pharmacognosy by Robert, Tyler.*

REFERENCE BOOKS:

1. *WHO guidelines on good agricultural and collection practices (GACP)- WHO, Geneva*
2. *Cultivation & utilization of medicinal plants by Atal CR and Kapoor BM.*
3. *Text book of Pharmacognosy by Wallis.*
4. *Pharmacognosy by Trease and Evans, latest edition.*
5. *Swain T; Chemical Plant taxonomy, Academic Press London.*

Upon completion of the course student shall be able to:

a. understand the basic principles and improved techniques of cultivation, collection and storage of crude drugs.

b. know the scientific name, geographical distribution, chemical nature and uses of crude drugs;

c. know the significance of carbohydrates, tannins, lipids and fibres in pharmacy.

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B.Pharmacy. I - II Sem.

T	Tu	C
3	1	3

Subject	English for Professional Communication	***Code***	15A52201
Course year	B. Pharm. I year	***Semester***	II
Theory	2 hrs/week	***Tutorial***	1 hr/week
End exam	70 marks	***Internal exam***	30 marks
Credits	2		

1. INTRODUCTION:

English is a global language and has international appeal and application. It is widely used in a variety of contexts and for varied purposes. The students would find it useful both for social and professional development. There is every need to help the students acquire skills useful to them in their career as well as workplace. They need to write a variety of documents and letters now extending into professional domain that cuts across business and research also. The syllabus has been designed to enhance communication skills of the students of engineering and pharmacy. The prescribed book serves the purpose of preparing them for everyday communication and to face the global competitions in future.

The text prescribed for detailed study focuses on LSRW skills and vocabulary development. The teachers should encourage the students to use the target language. The classes should be interactive and learner-centered. They should be encouraged to participate in the classroom activities keenly.

In addition to the exercises from the text done in the class, the teacher can bring variety by using authentic materials such as newspaper articles, advertisements, promotional material etc.

2. OBJECTIVES:

1. To develop confidence in the students to use English in everyday situations.
2. To enable the students to read different discourses so that they appreciate English for science and technologies.
3. To improve familiarity with a variety of technical writings.
4. To enable the students to acquire structure and written expressions required for their profession.
5. To develop the listening skills of the students.

3. SYLLABUS:

UNIT –I

Topics: Group discussion, cause and effect, events and perspectives, debate, if conditional, essay writing.

Text: LESSONS FROM THE PAST from ***MINDSCAPES***

Importance of History - Differing Perspectives - Modern Corporatism - Lessons From The Past

UNIT-II

Topics: Idioms, essay writing, power point presentation, modals, listening and rewriting, preparing summary, debate, group discussion, role play, writing a book review, conversation

Text: 'ENERGY' from ***MINDSCAPES***

Renewable and Non-Renewable Sources - Alternative Sources -Conservation -Nuclear Energy

UNIT-III

Topics: Vocabulary, impromptu speech, creative writing, direct and indirect speech, fixed expressions, developing creative writing skills, accents, presentation skills, making posters, report writing

Text: 'ENGINEERING ETHICS' from ***MINDSCAPES***

Challenger Disaster - Biotechnology - Genetic Engineering - Protection From Natural Calamities

UNIT-IV

Topics: Vocabulary, Conversation, Collocation, Group discussion, Note-making, Clauses, Interpreting charts and tables , Report writing.

Text: 'TRAVEL AND TOURISM' from ***MINDSCAPES***

Advantages and Disadvantages of Travel - Tourism - Atithi Devo Bhava - Tourism in India

UNIT-V

Topics: Vocabulary, phrasal verbs, writing a profile, connectives, discourse markers, problem-solving, telephone skills, application letters, curriculum vitae, interviews (telephone and personal)

Text: 'GETTING JOB-READY' from ***MINDSCAPES***

SWOT Analysis - Companies And Ways Of Powering Growth - Preparing For Interviews

Prescribed Text

MINDSCAPES: English for Technologists and Engineers, Orient Blackswan, 2014.

REFERENCES:

1. **Effective Tech Communication,** Rizvi,Tata McGraw-Hill Education, 2007.
2. **Technical Communication,** Meenakshi Raman, Oxford University Press.
3. **English Conversations Prcatice,** Grant Taylor, Tata Mc GrawHill publications,2013**.**
4. **Practical English Grammar.** Thomson and Martinet, OUP, 2010.

Expected Outcomes:

At the end of the course, students would be expected to:

1. Have acquired ability to participate effectively in group discussions.
2. Have developed ability in writing in various contexts.
3. Have acquired a proper level of competence for employability.

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B.Pharmacy. I - II Sem. **P 4** **C 2**

Subject	**PHARMACEUTICAL ORGANICCHEMISTRY-II LAB**	***Course Code***	15R00205
Course year	B. Pharmacy I year	***Semester***	II
Practical	4 hrs/week	***Tutorial***	NIL
End exam	50 marks	***Internal***	25 marks
Credits	2		

I. Experiments:

A. Preparation of organic compounds (each involving a specific organic reaction covered in theory- any 10 synthesis)

1. Sulphonation : Preparation of Toluene para sulphonic acid from toluene.
2. Bromination : Tribromoaniline from Phenol or Aniline.
3. Addition/Elimination : Preparation of phenyl hydrazone or oxime from Benzaldehyde.
4. Addition : Preparation of 2,3-dibromo-3-phenyl propionic acid from cinnamaldehyde.
5. Dehydration : Preparation of acetonedicarboxylic acid from citric acid
6. Condensation : Preparation of dibenzalaetone from benzaldehyde

B. Identification of the following organic compounds by systematic qualitative analysis including acidic/basic/neutral character, aromatic/aliphatic, saturated/unsaturated, test for special elements and functional group identification tests.

a. Phenols
b. Amides
c. Amines
d. Carboxylic acids
e. Aldehydes and Ketones
f. Alcohols
g. Anilides and nitrocompounds
h. Esters

II. Demo / work shop

Crystallization by using various solvents, atomic models emphasizing organic molecules & TLC for synthesized compounds.

III. Seminar/assignment/group discussion

Exercise on nomenclature of compounds, Knowledge on Protection of groups by green chemical methods, microwave assisted synthesis.

REFERENCES

1. Text Book of Practical Organic Chemistry, Vogel's, 5th Edition Pearson.
2. Laboratory Manual of Organic Chemistry, R.K. Bansal, New Age International 5th Edition 2007.
3. Advanced Practical Organic Chemistry, O.P. Agarwal, 3rd Edition Goel Publication.
4. Practical Organic Chemistry, F.G.Mann & B.C. Saunders, Pearson 4th

Edition.

LIST OF MINIMUM EQUIPMENT REQUIRED

1. Triple beam balances
2. Physical balances
3. Melting point apparatus
4. Suction pumps
5. Oven
6. Hot plates
7. Water baths
8. Distillation unit
9. Refrigerator

Adequate glassware

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B.Pharmacy. I - II Sem. **P 4** **C 2**

Subject	**GENERAL AND DISPENSING PHARMACY LAB**	***Course Code***	15R00206
Course year	B. Pharmacy I year	***Semester***	II
Theory	4hrs/week	***Tutorial***	Nil
End exam	50 marks	***Internal***	25marks
Credits	2		

I. EXPERIMENTS

a) Dispensing of prescriptions falling under the categories: Mixtures, syrups, solutions, emulsions, ointments, powders, lotions, liniments (minimum two prescriptions from each class).

b) Identification of physical, chemical and therapeutic incompatabilities in a prescription, and dispensing ofsuch prescriptions (3 Exercise).

c) Dispensing procedures involving pharmaceutical calculations, and dosage calculations for
paediatric and geriatric patients

II. DEMO/WORKSHOP

Demo on homogenizer and identification test for emulsions.

III. SEMINAR/ASSIGNMENT/GROUP DISCUSSION

a) Current status of Indian pharma industry.

b) Applications of various dosage forms.

REFERENCE:

a) Dispensing Pharmacy, Cooper &Gunns CBS, Publ. and Distributors New Delhi – (2008).

b) Dispensing Pharmacy, R.M Metha, 2006 Vallabh Publication, New Delhi.

LIST OF MINIMUM EQUIPMENT REQUIRED

Adequate number of the following, such that each student gets

1. Mortars and pestles.
2. Analytical balance and weight box.
3. Percolators.
4. Dispensing containers.
5. PH meter.
6. Electronic balance.
7. Adequate quantities of chemicals and glassware.

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B.Pharmacy. I - II Sem. **P 4** **C 2**

Subject	**PHARMACEUTICAL BIOCHEMISTRY LAB**	***Course Code***	15R00207
Course year	B. Pharm I year	***Semester***	II
Theory	3 hrs/week	***Tutorial***	1hr/week
End exam	70 marks	***Internal***	30 marks
Credits	2		

I. EXPERIMENTS:

1. To prepare standard buffers (citrate, phosphate & carbonate) and measure the pH.
2. Separation of amino acids by gel / paper electrophoresis.
3. Identification of carbohydrates
4. Identification of amino acids.
5. Identification of lipids.
6. Estimation of glucose in urine and blood.
7. Estimation of creatinine in urine.
8. Estimation of creatinine in blood.
9. Estimation of cholesterol in blood.
10. Estimation of Urea in Blood
11. Estimation of Serum protein.
12. Estimation of bile pigments in serum.
13. Estimation of alkaline phosphatase, SGOT, SGPT in serum
14. Effect of temperature on the activity of alpha-amylase.

NOTE: Collection of blood samples from human should be carried out by trained pathologist andsubject as per norms from the human subject.

II. WORKSHOP / DEMO

Different diagnostic methods in diagnostic lab, Blood Glucose estimation by Glucometer

III. SEMINAR / ASSIGNMENT/GROUP DISCUSSION

Various diagnostic tests for different diseases, Gene therapy and gene targetting

LIST OF MINIMUM EQUIPMENTS REQUIRED

1. Colorimeter
2. Table top centrifuge
3. Digital balance
4. Physical/chemical balance
5. pH meter
6. Water bath
7. Folin-Wu tubes
8. Autoanalyser
9. Adequate glass wares

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B.Pharmacy. I - II Sem. **P 4** **C 2**

Subject	**PHARMACOGNOSY-I LAB**	***Course Code***	15R00208
Course year	B. Pharmacy I year	***Semester***	II
practical	4 hrs/week	***Tutorial***	NIL
End exam	50 marks	***Internal***	25 marks
Credits	2		

EXPERIMENTS:

1. Collection and preparation of herbarium/laminated photos/ specimens of natural drugs.
2. Study of microscope.
3. Study of various morphological characters of the drugs mentioned in theory under carbohydrates.
4. Study of various morphological characters of the drugs mentioned in theory under lipids.
5. Study of various morphological characters of the drugs mentioned in theory under tannins.
6. Study of various morphological characters of the drugs mentioned in theory under fibres.
7. Chemical tests for Acacia, Tragacanth, Guar gum, Agar and Starch.
8. Chemical tests for Castor oil, Linseed oil, Shark liver oil, Cod liver oil.
9. Chemical tests for Gambir, Black catechu.
10. Chemical test for fibres mentioned in theory.
11. Determination of swelling factor of mucilage containing herbal drug.

Seminar/ Assignment:

Seminar/ Assignment related to theory:

Workshop/Demo

Cultivation of medicinal plants

References

1. Practical Pharmacognosy, C K Kokate, Nirali Prakashan
2. Practical Pharmacognosy, Khandelwal, Nirali Prakashan
3. Practical Pharmacognosy Iyengar, Manipal Press Ltd.
4. Brain KR and Turner TD. The practical Evaluation of Phytopharmaceuticals, Wright-Scientechnics, Bristol.
5. Peach K and Tracey MV, Modern methods of Plant analysis, Narose publishing house, New Delhi.

LIST OF MINIMUM EQUIPMENTS REQUIRED

1. Microscopes with stage
2. Heating mantle

3. Water baths
4. Adequate glass wares

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
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ANANTHAPURAMU – 515 002 (A.P) INDIA

Course Structure for B. Pharmacy. - R15 Regulations
B. Pharmacy

II-I Semester

S.No	Course code	Subject	Th	Tu/Drg/Lab	Credits
1.	15R00301	Pharmaceutical Engineering	3	1 - -	3
2.	15R00302	Physical Pharmacy –I	3	1 - -	3
3.	15R00303	Pharmaceutical Organic Chemistry – III	3	1 - -	3
4.	15R00304	Pharmaceutical Microbiology	3	1 - -	3
5.	15A01101	Environmental Studies	2	1 - -	2
6.	15R00305	Pharmaceutical Engineering Laboratory	-	- - 4	2
7.	15R00306	Physical Pharmacy –I Laboratory	-	- - 4	2
8.	15R00307	Pharmaceutical Organic Chemistry – III Laboratory		- - 4	2
9.	15R00308	Pharmaceutical Microbiology Laboratory	-	- - 4	2
			14	5 16	22

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Subject	**PHARMACEUTICAL ENGINEERING**	***Course Code***	15R00301
Course year	B. Pharmacy II year	***Semester***	I
Theory	3 hrs/week	***Tutorial***	1hr/week
End exam	70 marks	***Internal***	30 marks
Credits	3		

Scope and objectives:
This course is dealing with the various unit operations i.e. drying, evaporation and working principles of different machinery like hammer mill, cyclone separator.

Unit I
Introductory concepts: Unit operation / Unit processes, material and energy balance, equilibriumstate, rate process.
Fluid Flow: Types of flow, Reynold's number, bernoulli's equation, viscosity, concept of boundarylayer, basic equations of fluid flow, valves, flow meters, manometers and principles of measuring
instruments.
Material handling systems
a. Liquid and Gas handling - Study of different types of pumps such as Reciprocating pumps, Turbine pumps and centrifugal pumps, fans, blowers and compressors.
b. Solid handling – Conveyor**.**
Corrosion:
Classification, mechanism of corrosion, factors effecting, prevention and control.

Unit II

Dehumidification and Humidity control
Basic concepts and definition, wet bulb and adiabatic saturation temperature.Psychrometric chart and
measurement of humidity, application of humidity measurement, Equipments for dehumidification
operations.
Refrigeration and air-conditioning: Principles and applications**.**
Evaporation and drying: Basic concept of phase equlibria**.** Definition and theory of evaporation, factorsaffecting evaporation, evaporators-film evaporators.
Moisture content and theory of drying, rate of drying and time of drying calculations, drying curves. Concept of loss on drying and its importance. Classification and types of dryers, dryers used
in pharmaceutical industries- tray dryer, Fluid bed dryer, spray dryer, freeze-dryer, tunnel dryer and
vacuum dryer.

UNIT III

Crystallization:
Miers supersaturation theory, crystals growth, size, shape, geometry. Material and heat balances around Swenson walker crystallizer. Nucleation mechanisms, steady of various types of crystallizers, tanks, agitated batch, single vacuum, circulating magma and krystal crystallizer.

Filtration and Centrifugation: Theory of filtration, Factors affecting filtration, filter aids, filter media, industrial filters including filter press, rotary filter, edge filter, Air filtration. Principles of centrifugation, industrial centrifugal filters and centrifugal sedimenters**.**

UNIT IV

Size Reduction: Definition, theory and objectives of size reduction, factors affecting size reduction,
laws governing energy and power requirements of a mill. A brief study of ball mill, hammer mill, fluid energy mill.
Size Separation: Different techniques of size separation, sieves, sieve shakers, sedimentation tank, cyclone separators, bag fillers.
Mixing: Theory of mixing, solid-solid, solid-liquid and liquid-liquid mixing equipments- double cone,
twin-shell, silverson mixer, colloid mill, sigma blade mixer, planetary mixer, propeller mixer and
turbine mixer. Homogenizer, triple roller mill.

UNIT V

Automated process control systems:
Process variables, temparature, 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. Reactors and fundamentals of reactors design for chemical reactions.

TEXT BOOKS:

1. S.J. Carter, Cooper and Gunn"s Tutorial Pharmacy, 6th ed., CBS publisher, Delhi.
2. CVS Subramanyam, Pharmaceutical Engineering. Vallabh Prakasham New Delhi.
3. K. Samba Murthy, Pharmaceutical Engineering new Age International Publishers Ltd. 1998.
4. L. Lachman, H. Lieberman & J.B.Schwartz. Pharmaceutical dosage forms volume-II, 2nd ed.,
marcel dekker Inc.

REFERENCE BOOKS:

1. *E.A. Rawlin"s, Bentley"s Text Book of Pharmaceutics, 8th ed ELBS.*
2. *Badzer&Banchoro, Introduction to Chemical Engineering. Tata – Mc Graw Hill.*

OUTCOME

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

a. Graduate understands the basic fundamentals of various unit operations required for drug development.

Apply the operating skills of pharmaceutical machinery required to work in the pharmaceutical field viz.drug manufacturing & production.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
ANANTHAPURAMU

Subject	**PHYSICAL PHARMACY – I**	***Course Code***	15R00302
Course year	B. Pharmacy II year	***Semester***	I
Theory	3 hrs/week	***Tutorial***	1hr/week
End exam	70 marks	***Internal***	30 marks
Credits	3		

Scope and objectives:
This course is designed to provide the basis for understanding the chemical and physical phenomena that govern the *in vivo* and *in vitro* actions of pharmaceutical products.

UNIT I
Intermolecular forces and states of matter: Binding forces between molecules, the states of matter, change in the state of matter, latent heat and vapour pressure, sublimation critical point, eutectic mixtures, relative humidity, the liquid state, liquid crystalline state,Glossy state and solid state, amorphous and polymorphism.
Phase rule: Definition and explanation. One component(water system), two compartment system (phenol - water system&TEA (Tri Ethyl Amine) and Water system).

UNIT II
Thermodynamics: The zeroth, first, second and thirdlaw of thermodynamics, Free energy functions and applications.
Physical properties of drug molecules: Dielectric constant induced polarization, dipole moment,
refractive index and molar refraction and optical rotatory dispersion.

UNIT III
Solutions of Non electrolytes: Concentration expressions, ideal and real solutions, colligativeproperties (lowering of vapour pressure, depression in freezing point, elevation of boiling point and
Osmotic pressure), molecular weight determinations.
Solutions of Electrolytes: Properties of solutions of electrolytes. The Arrhenius theory of electrolyte
dissociation. The modern theory of strong electrolytes (Activity co-efficient and ionic strength).

UNIT IV
Ionic equilibria: Modern theories of acids, bases and salts,Sorensen's pH scale, concentration as a function of pH, calculation of pH and acidity constants.
Buffers and isotonic systems: The buffer equation, buffercapacity, buffers in pharmaceutical and biological systems, isotonic solutions, methods of adjusting tonicity and pH(relevant numerical problems).

UNIT V
Kinetics and drug stability: General consideration and concepts**,** half life period ($t_{1/2}$) determination, influence of temperature and Arrhenious theory, light, solvent, catalytic species and other factors. Accelerated stability studies, expiration dating.

TEXT BOOKS:

1. Patrick J. Sinko, Martin's Physical Pharmacy and Pharmaceutical Sciences Fifth Edition.Lippin
Cott Williams and Wilkins.
2. C.V.S.Subramanyam, Essentials of Physical Pharmacy, VallabhPrakashan.
3.Manavalan &Ramaswamy. Physical pharmaceutics. 2nd ed. Vignesh publisher, 2008.

REFERENCE BOOKS:

1. Pharmacopoeia, (I.P., B.P., U.S.P. and European)
2. Martindale, The Extra Pharmacopoeia; latest edition, the Royal Pharmaceutical Society.
3. Lippincott Williams and Wilkins, Remington Pharmaceutical Sciences.
4. L. Lachman, H. Lieberman The Theory And Practice Of Industrial Pharmacy J. L Kaniz Lee &
Febiger Philadelphia, USA.

OUTCOME

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

a. Understand the chemical & physical fundamental aspects of intermolecular forces,
b. Relevant with laws of thermodynamics,
c. Know the importance of solubilization of electrolytes & non-electrolytes,
d. Recognize the significance of pH & tonicity that govern the *In vivo&In vitro* actions of pharmaceutical products.
e. Define reaction kinetics, reaction order, and discuss factors affecting the rate of the reaction, degradation and stabilization of medicinal agents as well as accelerated stability testing.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
ANANTHAPURAMU

Subject	**PHARMACEUTICAL ORGANIC CHEMISTRY – III**	***Course Code***	15R00303
Course year	B. Pharmacy II year	***Semester***	I
Theory	3 hrs/week	***Tutorial***	1 hr/week
End exam	70 marks	***Internal exam***	30 marks
Credits	3		

Objectives:

1. To fulfil the knowledge on basics of hetero cyclic chemistry and stereo chemistry of organic molecules.
2. To understand the knowledge of organic chemistry in relation to natural compounds such as carbohydrates, proteins and lipids etc..
3. To impart the knowledge on fundamentals of named reactions and rearrangements.

UNIT I: Heterocyclic chemistry

Definition, nomenclature, structure, aromaticity, reactivity, synthesis, acidity-basicity and characteristic reactions of the following heterocyclic compounds. Few examples of drugs which contain the cited ring system.

Five membered ring systems: Furan, pyrrole, thiophene, Pyrazole, imidazole, oxazole, isoxazole,thiazole. Six membered ring systems: pyridine, pyrazine, pyrimidine and pyridazine. Fused ring systems: Indole, quinoline, iso-quinoline, acridine, Benzimidazole, phenothiazine, purines.

UNIT II: Stereochemistry of Carbon compounds - Optical rotation, plane polarized light, opticalactivity, chirality, notations (assignment of configuration), relative configuration (Fischer DL configuration), absolute configuration (R & S), sequence rules (with examples), enantiomers, meso compounds, racemic mixture and resolution of racemic mixture.

Concept of E & Z, Cis & Trans, Syn & Anti configurations. Elements of symmetry. Stereo selective & stereo specific reactions. Optical activity of biphenyl compounds.

UNIT III

Carbohydrates: Definition, classification, nomenclature, study of glucose structure, mutarotation,ring structure, oxidation-reduction reactions, osazone formation, epimerization, Lobry De Bruyn – Van Ekenstein reaction, structure of the sucrose, starch and cellulose. non-reducing nature; A brief account on pharmaceutical importance of various carbohydrates. **Glycosides**: Definition, classification, α, β – glycosidic linkages, enzymatic hydrolysis, structure and physiological importance of Anthraquinone glycosides.

UNIT IV

Amino acids and Proteins: Definition, classification, configuration, methods of preparation of aminoacids, physical, chemical properties, Zwitter ionic nature and isoelectric point. peptide synthesis, CTAA and NTAA concept and determination. Structure and chemistry of Insulin, Oxytocin, Heparin. Pharmaceutical importance of polypeptides and proteins.

Lipids (oils and fats): Definition, classification of fatty acids, trans and cis fatty acids, fat analysisincluding Saponification value, acid value, peroxide value and Iodine value etc..), hydrogenation and rancidity of oils and fats. Comparison of fat, oil, wax based on their properties.

UNIT V: Reaction mechanisms and applications in Drug synthesis

Beckmann rearrangement, Birch reduction, Mannich reaction, Michael addition reaction, Wittig reaction, MPV reduction, Oppanauer oxidation, Curtius rearrangement, Schmidt reaction. Neighbouring group effects and reduction by transition metal complexes.

TEXT BOOKS:

1. *Heterocyclic chemistry by Bansal, 5th edition.*
2. *Arun Bahl & S.S Bahl, Advanced Organic Chemistry-S.Chand.*
3. *R Morrison and R. Boyd, organic chemistry, Pub by Printice Hall of India, New Delhi.*
4. *I L Finar, Organic Chemistry, Vol. I. & II, 6th Pearson education*
5. *O.P Agarwal, A Textbook of Organic Chemistry*
6. *Eliel, Stereochemistry of Organic compounds.*
7. *Oraganic reactions,Stereo chemistry&mechanizam by PS Kalsi*

REFERENCE BOOKS:

1. Jerry March, Advanced Organic Chemistry 4th Edition Wiley Publication. 2 Cram & Hammond.Organic Chemistry Mc Graw-Hill.

3. *A.I. Vogal"s, A textbook of practical organic chemistry Mc Graw Hill. 6th Edition.*
4. *Solomons, Organic Chemistry 9th Edition Wiley Publication.*

Course outcomes:

1. Graduate will Understand and apply the nomenclature, basic chemistry, stereochemistry, rearrangement reaction, mechanisms of heterocyclic & other organic compounds.
2. Graduates will able to synthesize basic heterocyclic molecules, analyze, estimate organic compounds and understand the recent methods of organic synthesis.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
ANANTHAPURAMU

Subject	**PHARMACEUTICAL MICROBIOLOGY**	***Course Code***	15R00304
Course year	B. Pharmacy IIyear	***Semester***	I
Theory	3 hrs/week	***Tutorial***	1hr/week
End exam	70 marks	***Internal***	30 marks
Credits	3		

OBJECTIVE :

To know the anatomy, identification, growth factors and sterilization of microorganisms. To know the mode of transmission of diseases and applications of microorganisms in pharmaceutical field.

UNIT I Introduction to Microbiology: Origin, scope and discovery of spontaneous generations
theory, contributions of Antonie Van Leeuwenhoek, Pasteur, Koch and Lister. Diversity of
Microorganisms**:** Prokaryotes versus eukaryotes – eukaryotic and prokaryotic cell structure, threedomains of life (bacteria, archaea and eurkaryotics). Pharmaceutical significance of protozoa, algae,fungi, bacteria and viruses. Characterization and identification of microorganisms.

UNIT II 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
constitutents. Exponential growth and generation time. Bacterial growth in batch and continuousculture (chemostat and turbidostat) synchronous growth.

UNIT III Control of Microorganisms: General Concepts, Inhibition of growth and killing,
sterilization and disinfection, antisepsis and sanitation, mode of action application & limitation ofphysical agents (moist and dry heat, radiation and filtration), chemical agents. Various types ofdisinfectants, 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 IV

Epidimeology of Diseases: Study of etiology, diagnosis, source of infection, mode of transmission,immunization methods, prevention and control of the following diseases. Bacillary dysentry,diphtheria, tuberculosis, leprosy, cholera, typhoid, syphilis, gonorrhoea, tetanus, food poisoning andinfective hepatitis. Diagnostic tests of Malaria, Typhoid, Cholera, TB, Leprosy.

UNIT V Application of Microbes in Pharmaceutical Industry

a. ***Microbiological Assays:*** Principles and Methods involved in Assay of Antibiotics(penicillins,tetracyclines and streptomycins only) Vitamins (cyanocobalamin and riboflavinonly), Amino acids (lysine and glutamic acid only) & 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 Lippincolt Williams & wilkins, 2nd Edition.
2. Anantha Narayan and Jayram Panikar, Text Book of Microbiology, Orient Longman, Delhi, Hyderabad.
3. R.C. Dubey, A textbook of Microbiology S.Chand.

Reference Books:

1. Pharmaceutical microbiology by Kishore Gujar, Himalaya publishing house.
2. Nester, Anderson, Roberts, Pearsall, Microbiology, McGraw-Hill.
3. Hugo.W B, Pharmaceutical Microbiology. PA Publishing Pvt. Ltd.
4. Tortora, Gerard, Text Book of Microbiology. Benjamin Cummings.
5. Prescott and Dunn, " IndustrialMicrobiology" 2nd Ed, Mc Graw hill Book Company Inc.

OUTCOMES :

1. Students can understand the importance of microbiology in industry & pharmacy
2. Students can learn the microbiological significance disease and its treatment.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
ANANTHAPURAMU

Subject	**ENVIRONMENTAL STUDIES**	***Course Code***	15A01101
Course year	B. Pharmacy IIyear	***Semester***	I
Theory	3 hrs/week	***Tutorial***	1hr/week
End exam	70 marks	***Internal***	30 marks
Credits	3		

Objectives:

To make the students to get awareness on environment, to understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day to day activities of human life to save earth from the inventions by the engineers.

UNIT – I

MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES: – Definition, Scope and Importance – Need for Public Awareness.

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:

UNIT – II

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)

BIODIVERSITY AND ITS CONSERVATION : Introduction 0 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-sports 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 – III

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 – IV

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 – V

HUMAN POPULATION AND THE ENVIRONMENT: Population growth, variation among nations. Population explosion – Family Welfare Programmed. – 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.

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, and birds – river, hill slopes, etc..

Text Books:

1. Text Book of Environmental Studies for Undergraduate Cources, Erach Bharucha, Universities Press Pvt Ltd, Hyderabad. 2nd Edition 2013.
2. Environmental Studies by Kaushik, New Age Pubilishers.

References:

1. Environmental Studies by Rajagopalan, Oxford Pubilishers.
2. Comprehensive Environmental studies by J.P.Sharma, Laxmi publications.
3. Introduction to Environmental engineering and science by Gilbert M. Masters and Wendell P. Ela - Printice hall of India Private limited.

Outcomes:

- Students will get the sufficient information that will clarify modern environmental concepts like equitableuse of natural resources, more sustainable life styles etc.
- Students will realize the need to change their approach so as to perceive our own environmental issuescorrectly, using practical approach based on observation and self learning.
- Students become conversant with the fact that there is a need to create a concern for our environment thatwill trigger pro-environmental action; including simple activities we can do in our daily life to protect it.
- By studying environmental sciences, students is exposed to the environment that enables one to find out solution of various environmental problems encountered on and often.
- At the end of the course, it is expected that students will be able to identify and analyze environmental problems as well as the risks associated with these problems and efforts to be taken to protect the environment from getting polluted. This will enable every human being to live in a more sustainable manner.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
ANANTHAPURAMU

Subject	**PHARMACEUTICAL ENGINEERING –LABORATORY**	***Course Code***	15R00305
Course year	B. Pharmacy II year	***Semester***	I
Theory	4 hrs/week	***Tutorial***	NIL
End exam	50 marks	***Internal***	25 marks
Credits	2		

I. EXPERIMENTS:

1. Evaluation of filter media, determination of rate of filtration and study of factors affecting filtration
Including filter aids.
2. Particle size measurement by sieve shaker.
3. Determination of Humidity-using Dry Bulb and Wet Bulb thermometers and Psychometric charts.
4. Determination of overall Heat Transfer Coefficient.
5. Determination of rate of evaporation.
6. Determination of rate of drying, free moisture content and bound moisture content.
7. Experiments to illustrate the influence of various parameters on construction of drying curves.
8. Experiments to illustrate principles of size reduction, Laws governing energy and power requirements of a size reduction (Ball mill).
9. Experiments to illustrate solid-solid mixing, determination of mixing efficiency using different
types of mixers.
10. Analysis of pharmaceutical packaging materials-leaching of contents from packaging materials.

II. DEMO/ WORKSHOP

Determination of type of flow (Reynolds experiment)
Double cone blender, homogenizer, tray dryer.

III. SEMINAR/ASSIGNMENT/GROUP DISCUSSION

Advances in packaging technology.

LIST OF MINIMUM EQUIPMENTS REQUIRED

1. Tray dryer
2. Ball mill
3. Seive shaker with set of sieves as per IP
4. Double cone blender
5. Propeller type mechanical agitator
6. Homogeniser
7. Buchner filtration apparatus
8. Vaccum pump
9. Desiccators'
10. Energy meter
11. Autoclave

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
ANANTHAPURAMU

Subject	**PHYSICAL PHARMACY – I LABORATORY**	***Course Code***	15R00306
Course year	B. Pharmacy II year	***Semester***	I
Theory	4hrs/week	***Tutorial***	NIL
End exam	50 marks	***Internal***	25 marks
Credits	2		

I. EXPERIMENTS:

1. Percent composition – Capillary Flow method.
2. Percent composition –refractometer.
3. Molecular weight – Rast camphor method.
4. Calibration of pH Meter using standard buffers pH Estimation – pH meter.
5. pKa Estimation by Half Neturalization Method.
6. Refractive index of liquids.
7. Phenol water system – CST.
8. Lower consolute temperature – TEA (Tri Ethyl Amine) and Water.
9. Ternary phase diagram.
10. Preparation of phosphate Buffers and their Buffer Capacity Determination.
11. Effect of temperature on first order kinetics and to find the energy of activation.

II. Demo/ Workshop

Demo on polarimeter (To prove that the hydrolysis of sucrose follows first order kinetics).

III. SEMINAR/ASSIGNMENT/GROUP DISCUSSION

Thermodynamics of solutions and polymers, Types of electrodes.

LIST OF MINIMUM EQUIPMENTS REQUIRED

1. Ostwald's viscometer
2. Stalgnometer
3. Polarimeter
4. Abbe's refractometer
5. CST apparatus
6. pH meter
7. Colorimeter
8. Digital balances

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
ANANTHAPURAMU

Subject	**PHARMACEUTICAL ORGANIC CHEMISTRY-III LABORATORY**	***Course Code***	15R00307
Course year	B. Pharmacy II year	***Semester***	I
Theory	4 hrs/week	***Tutorial***	NIL
End exam	50 marks	***Internal***	25 marks
Credits	2		

I. Experiments:

A. Quantitative determination of organic compounds via functional groups

1. Phenolic groups by bromination method.
2. Alcoholic group by acetylation method.
3. Carbonyl group by hydroxylamine hydrochloride-pyridine method.
4. Aldehyde group by sodium sulphite-sulphuric acid procedure.
5. Carboxyl group by acid-base method.
6. Amino group by bromination method.
7. Amino acid formal titration method.

B. Synthesis/preparation involving more than one step (Any five).

8. Synthesis of acetophenone oxime and its conversion to acetamide.
9. Phenothiazine from diphenyl amine
10. Benzimidazole from o-phenylene diamine
11. Knorr quinoline synthesis (4-methyl 2- quinoline) from aceto acetanilide
12. Synthesis of Imidazole -4,5-dicarboxylic acid from tartaric acid
13. Benzilic acid from benzene.
14. Preparation of 2-phenylindole from Phenylhydrazine by Fischer's method.

C. Systematic analysis of organic binary mixtures

D. Analysis of oils & fats

a. Determination of Acid value of fixed oils.
b. Determination of Saponification value of a fixed oils.
c. Determination of Iodine value of a fixed oils.
d. Determination of peroxide value of a fixed oils.

II. Demo/Workshop:

Synthesis of some asymmetric organic molecules, identification of synthesized compounds by TLC, Catalyst and solvent effect in synthesis.

III. Seminar/Assignment/Group discussion:

Principles of green chemistry, solvent free synthesis, sonication as the green chemical method for organic synthesis.

References:

1. *Indian Pharmacopoeia. – 1996.*
2. *A.I. Vogel"s – Practical Organic Chemistry – Prentice Hall.*
3. *Text Book of Practical Organic Chemistry, Vogel"s, 5th Edition Pearson.*
4. *Laboratory Manual of Organic Chemistry, R.K. Bansal, New Age International 5th Edition 2007.*
5. *Advanced Practical Organic Chemistry, O.P. Agarwal, 3rd Edition Goel Publication.*
6. *Practical Organic Chemistry, F.G.Mann & B.C. Saunders, Pearson 4th Edition.*

LIST OFMINIMUM EQUIPMENTS REQUIRED

1. *Triple beam balances*
2. *Physical balances and analytical balances*
3. *Melting point apparatus*
4. *Suction pumps*
5. *Oven*
6. *Hot plates*
7. *Water baths*
8. *Distillation unit*
9. *Refrigerator*
10. *Mechanical stirrer*
11. *Reflex flask with condenser*
12. *Magnetic stirrer with thermostat*
13. *Adequate glassware"s*

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
ANANTHAPURAMU

Subject	**PHARMACEUTICAL MICROBIOLOGY LABORATORY**	***Course Code***	15R00308
Course year	B. PharmacyIIyear	***Semester***	I
Theory	4 hrs/week	***Tutorial***	--
End exam	50 marks	***Internal***	25 marks
Credits	2		

I. EXPERIMENTS:

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 media.
5 Characterization of microbes by staining methods (simple gram's, acid fast and negative
staining and spore 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.(Neubauer's chamber)
8 Isolation of pure cultures by streak plate, spread plate and pour plate.
9 Evaluation of antiseptics and disinfectants by phenol coefficient method(R/w),
10 Sterility test for bulk powders and water for injection (IP).
11 Observation of colony/culture characters
12 Bio chemical reactions:
i) Indole test.
ii) Methyl red test.
iii) Voges proskauer test.
iv) Starch hydrolysis test.
v) Fermentation of carbohydrates and gelatin liquefaction.
13 Anti-microbial assay by cup and plate method and turbidometric method

II. Demonstration/Workshop: Construction of Bacterial growth curve by different methods, Rapid
Diagnostic tests by kits

III. Assignment/Seminar/Group discussion:

Recent trends in Identification, Cultivation, Handling of Microorganisms.
Polymer Chain Reaction
(PCR).

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
(Established by Govt. of A.P., Act. No. 30 of 2008)
ANANTHAPURAMU – 515 002 (A.P) INDIA

Course Structure for B. Pharmacy. - R15 Regulations
B. Pharmacy

II-II Semester

S.No	Course code	Subject	Th	Tu/Drg/Lab	Credits
1.	15R00401	Pharmaceutical Analysis – I	3	1 - -	3
2.	15R00402	Pharmacognosy – II	3	1 - -	3
3.	15R00403	Pharmaceutical Technology – I	3	1 - -	3
4.	15R00404	Physical Pharmacy –II	3	1 - -	3
5.	15R00405	Pathophysiology	2	1 - -	2
6.	15R00406	Pharmaceutical Analysis – I Laboratory	-	- - 4	2
7.	15R00407	Pharmacognosy – II Laboratory	-	- - 4	2
8.	15R00408	Pharmaceutical Technology – I Laboratory		- - 4	2
9.	15R00409	Physical Pharmacy –II Laboratory	-	- - 4	2
10.	15R00410	Comprehensive Online Exams-I	-	- - -	1
			14	5 16	23

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
ANANTHAPURAMU

Subject	**PHARMACEUTICAL ANALYSIS – I**	***Course Code***	15R00401
Course year	B. Pharmacy II year	***Semester***	II
Theory	3 hrs/week	***Tutorial***	1 hr/week
End exam	70 marks	***Internal exam***	30 marks
Credits	3		

COURSEOBJECTIVE

To aquire adequate scientific knowledge regarding basic principles of pharmaceutical analysis.

UNIT I

a) Definition of Analytical chemistry and role of pharmaceutical analysis in pharmaceutical industry.

Significant figures, concept of error, precision, accuracy, rejection of doubtful values with special
reference to volumetric analysis. Calibration of glassware used in volumetric analysis-Burette, pipette and volumetric flask. Methods of expression of concentration(w/w,w/v,v/v).

b) **Theory of Neutralization Titrations**: Acid-base concept, Acidimetry, Alkalimetry, Common ion
effect and solubility product, indicators, Ostwald and quinonoid theories of Indicators

c) **Non-aqueous titration:** Theory, types, solvents used and application in pharmaceutical analysis.

Application of the above methods in the analysis of drugs and formulations as under IP 2007and
2010.

UNIT II

a) General principles, theory and examples of **oxidation-reduction methods,** permanganomerty**,**
ceriometry, iodometry, iodimetry indicators used in these titrations, self indicators.

b) General principles, theory and examples of **Precipitation methods:** Mohr's method, volhard's
method, account of the indicators used in these titrations, Adsorption indicators.

c) **Complexometric titration:** Theory, types and application in pharmaceutical analysis. Indicators
used, Masking and demasking and their applications.

Application of the above methods in the analysis of drugs, as under IP 2007and 2010.

UNIT III

a) Potentiometry: Introduction to EMF, electrochemical cells and half cells, Electrodes, measurement
of potential, pH curve, EMF curve, derivative curve in application to end point determination.

b) Conductometric titrations: Basic concepts, conductivity cell, different types of conductometric
titrations.

c) Polarography: Basic concepts, apparatus and principles, different currents, polarographic maxima,
general polarographic analysis, applications in identification and quantification of metals.

d) Amperometric titrations with one polarized electrode, general procedure, titration curves, applications in pharmaceutical analysis.

UNIT IV

Fluorimetry: Theory, Fluorescence and chemical structure, stokes and anti-stokes, quantum efficiency,factors affecting the intensity of fluorescence, Instrumentation (double beam), Applications inPharmaceutical analysis.

Flame Emission photometry Vs Atomic absorption spectroscopy: Emission spectra, Absorptionspectra, line spectra, principle of absorption / emission of UV light by elements, instrumentation,applications in pharmaceutical analysis. Focus on interference.

Nephelo-turbidimetry: Introduction, principle, instrumentation of Nephelo-turbidimeter,pharmaceutical application as specified in IP, determination chlorides and sulphates.

UNIT V

a) Principle and applications of the following instruments and various grades of reagents a in QC laboratory.

i) Refractometry ii) Polarimetry. iii) LR Grade iv) AR grade v) HPLC grade.

b). Role of moisture content determination in QC of pharmaceuticals (including Karl-Fisher method, LOD, IR balance).

TEXT BOOKS:

1. A.H. Beckett & J.B Stanlake Vol. I & II., Practical Pharmaceutical Chemistry, Athlone Press of the Univ of London

2. B.K. Sharma, Instrumental Chemical Analysis, Goel Publishers.

3. Chatwal & Anand, Instrumental Methods of Analysis. Himalaya Publishing Home, 2009.

REFERENCE BOOKS:

1. A.I Vogel, Quantitative Chemical Analysis, VI edition, Pearson education Delhi.

2. Pharmacopoeia (IP, BP, USP).

3. D. A. Skoog, Principles of Instrumental Analysis, V edition, Thomson Brooks Banglore.

4. Connors, a Textbook of Pharmaceutical Analysis. Wiley India Pvt. Ltd

OUTCOME:

Graduates will conduct analyze and interpret data of experiments in production, Analytical and clinical aspects

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
ANANTHAPURAMU

Subject	**PHARMACOGNOSY-II**	***Course Code***	15R00402
Course year	B. Pharmacy II year	***Semester***	II
Theory	3 hrs/week	***Tutorial***	1 hr/week
End exam	70 marks	***Internal exam***	30 marks
Credits	3		

Objectives: To make the student aware of Secondary metabolites production in plants and its medicinal significance, cosmeceuticals and nutraceuticals importance.

UNIT I

Glycosides

Definition, classification, properties and general tests of glycosides and detailed Pharmacognostic study of the following glycosides containing drugs:

a. **Saponin glycosides**- Glycyrrhiza, Ginseng, Dioscorea, Senega, Sarsaparilla

b. **Cardioactive glycosides**-Digitalis, Squill, Strophanthus, Thevetia

c. **Anthraquinone glycosides**-Aloe, Senna, Rhubarb, Cascara

d. **Bitter Glycosides**- Psoralea, Gentian, Chirata

UNIT II

A) General introduction to cosmeceuticals, role of herbs in cosmetics.
   - Study of the following cosmeceuticals - Amla, Henna, Cyperus, Soap Nut, Aloe Vera, Turmeric, Sandal Wood and Bitter Orange Peel.

B) Definition and study of Neutraceuticals: Garlic, Spirulina, Soya and Royal jelly.

UNIT III

Alkaloids:

Definition, classification, properties and general tests and detailed pharmacognostic study of the following alkaloid containing drugs:

a. **Pyridine-Piperidine alkaloids**- Tobacco, Lobelia

b. **Tropane**- Belladonna, Hyoscyamus, Datura, Coca.

c. **Indole**-Ergot, Rauwolfia, Vinca, Nux Vomica

d. **Imidazole**-Pilocarpus

e. **Steroid**- Kurchi, Veratrum, Aswagandha

UNIT IV

a. **Quinoline-Isoquinoline**-Cinchona, Ipecac, Opium

b**. Alkaloidal amine**- Ephedra, Colchicum

c. **Glycoalkaloid**-Solanum

d**. Purine**-Coffee, Tea, cola

e**. Quinazoline** -Vasaka

UNIT V

A) **Biogenesis:** General techniques of biosynthetic studies and basic metabolic pathways.

- Biogenesisof secondary metabolites of pharmaceutical importance.

B) **Extraction of herbal materials**: Definition of extraction, principle involved in extraction,different types of extraction.

- Factors affecting the process of extraction.

C) Phytochemical Screening: Preparation of extracts, identification and screening of alkaloids, saponins, cardiac glycosides, flavonoids, tannins and anthraquinones in plant extracts.

Text Books:

1. Kokate CK, Purohit A.P. & Gokhale; Pharmacognosy Nirali Prakashan, New Delhi.
2. Text book of Pharmacognosy by Handa and Kapoor.
3. Peach K and Tracey MV, Modern methods of Plant analysis, Narose publishing house, New Delhi.
4. Pharmacognosy by Brady & Tyler.
5. Tutorial Pharmacy by Cooper and Gunn.
6. text book of pharmacognosy and phytochemistry by Vinod D Rangari, Vol I and II.

Reference Books:

1. *Text book of Pharmacognosy by Wallis.*
2. *Herbal drug technology by Pulok Mukharjee*
3. *Pharmacognosy by Trease and Evans*
4. *Biosynthesis of natural products by Manitto P*
5. *Harbone JB, Phytochemical methods, Champman and Hall*

OUTCOME

a. know the scientific name, geographical distribution, chemical nature and uses of crude drugs.

b. know the role of glycosides, alkaloids in treating of various ailments of human beings.

c. know the significance of nutraceuticals and cosmeceuticals in maintaining the health conditions and appearance.

d. know various techniques used in biogenesis of secondary metabolites.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
ANANTHAPURAMU

Subject	**PHARMACEUTICAL TECHNOLOGY – I**	***Course Code***	15R00403
Course year	B. Pharmacy II year	***Semester***	II
Theory	3 hrs/week	***Tutorial***	1hr/week
End exam	70 marks	***Internal***	30 marks
Credits	3		

Scope and objectives:1. This course is designed to understand the aspects of preformulation and formulation of liquid and semi solids
2. To gain the knowledge on stability associated ICH guidelines.
3. To gain basic knowledge on blood products.

UNIT I
Preformulation: Goals, Physicochemical properties like physical form, particle size, shape, density, wetting, dielectric constant, solubility, dissolution, partition coefficient, organoleptic additives, hydrolysis, oxidation-reduction, racemization, polymerization, etc and their effect on formulation, drug-excipient incompatability studies,. Introduction to 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.
Dry syrups: Requirements, formulation, methods of preparation, containers, evaluation.

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

UNIT IV
Pharmaceutical aerosols: Definition, propellants general formulation, manufacturing and packaging
methods, pharmaceutical applications. Quality control tests for aerosols.

UNIT V
Blood Products and Plasma Substitutes: Collection, processing and storage of whole human blood, Concentrated human RBC's, dried human plasma, human fibrinogen, human thrombin, human normal immunoglobulin, human fibrin, foam plasma substitutes, ideal requirements, PVP, Dextran etc. For control of blood pressure as per IP.

Text Books:

1. L. Lachman, H.A, Lieberman and J.L. Kanig, Theory & Practice of industrial pharmacy, Lea &
Febieger, Philadelphia Latest Edn.
2. L. V. Allen Jr., N. G. Popovich, H. C. Ansel. Ansel''s pharmaceutical dosage forms and drug
delivery systems. Lippincott Williams & Wilkins, 2005.
3. M. E. Aulton Pharmaceutics. The science of dosage form design. - 2nd ed. Churchill-Livingstone,
2002
4. B.M.Mithal. a text book of pharmaceutical formulations, 6th ed., vallabh prakashan, 2010.

Reference Books:

1. Banker and Rhodes, Modern pharmaceutics, marcel dekker series.
2. James Swarbrick, Encyclopedia of pharmaceutical technology, 3 rd edi, informa healthcare.

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

a. Acquire sufficient knowledge of preformulation and formulation of liquid and semi solids.
b. Understand the importance of blood products.
c. Describe what the pharmaceutical suspension and emulsion is and what roles they play in pharmaceutical science.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
ANANTHAPURAMU

Subject	**PHYSICAL PHARMACY – II**	***Course Code***	15R00404
Course year	B. Pharmacy II year	***Semester***	II
Theory	3 hrs/week	***Tutorial***	1hr/week
End exam	70 marks	***Internal***	30 marks
Credits	3		

Scope and objectives: This course is designed to understand the physico-chemical fundamental aspects of solubility, distribution, flow of liquids & solids, complexation & interfacial phenomenon, andto gain knowledge on formulation & stability aspects of dispersion systems, drug decomposition & their kinetics.

UNIT I

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

Introduction to phenomena of diffusion: Fick's first law and second law.

Complexation: Classification of complexes, methods of preparation, analysis and applications.

UNIT II

Interfacial Phenomena: Liquid interfaces, spreading coefficient, measurement of surface and interfacial tensions,adsorption at liquid interfaces. Adsorption isotherms only (freundlich's isotherms and Langmuir'sisotherm's).Surface-active agents and HLB classification, solubilization, detergency.Parachor, Adsorption at solid interfaces. Solid gas and solid liquid interfaces, complex films, electrical propertiesof interfaces.

UNIT III

Micromeritics and Powder Rheology: Particle size and size distribution, number and weight distribution, particle number, methods for determining particle volume, methods of determining particle size: optical microscopy and sedimentation, measurement of particle shape, specific surface area: methods for determining surface area, permeability, adsorption, derived properties of powders, porosity, packing arrangement, densities, bulkiness and flow properties.

UNIT IV

Rheology: Newtons law of flow, kinematic viscosity, effect of temperature, Newtonian systems, non-Newtonian systems: pseudoplastic, dilatant, plastic, thixotropy, negative thixotropy Determination of viscosity, capillary, falling ball and rotational viscometers.

UNIT V

Colloids: Introduction, types of colloidal systems, protective colloids, applications of colloids in pharmacy.

Coarse Dispersions:

Suspensions: Types and theories of suspensions, effect of Brownian motion, interfacial properties of suspended particles, settling in suspensions. Sedimentation parameters, wetting of particles, controlled flocculation, flocculation in structured vehicles, rheological considerations.

Emulsions: Theories of emulsification, physical stability of emulsions.

TEXT BOOKS:

1. Patrick J. Sinko, Martin's Physical Pharmacy and Pharmaceutical Sciences 5th Edition.Lippincolt
Williams.
2. CVSSubhramanyam, Physical Pharmaceutics, Vallabhprakashan.
3. Manavalan&Ramaswamy. Physical pharmaceutics. 2nd ed. Vignesh publisher, 2008.

REFERENCE BOOKS:

1. Lippincott Williams and Wilkins, Remington Pharmaceutical Sciences
2. L. Lachman, H. Lieberman The Theory And Practice Of Industrial Pharmacy J. L Kaniz Lee &
Febiger Philadelphia, USA.

OUTCOME

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

a. Acquire sufficient knowledge of surface and interfacial tension and its measurement.
b. Appreciate the role of surface active agents in controlling the solubility and stability of the liquids
c. Understand the different types of flow, thixotropic properties in order to identify and choice the suitable characters for each formulation
d. Describe what the pharmaceutical suspension and emulsion is and what roles they play in pharmaceutical science.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
ANANTHAPURAMU

Subject	**PATHOPHYSIOLOGY**	***Course Code***	15R00405
Course year	B. Pharmacy II year	***Semester***	II
Theory	2 hrs/week	***Tutorial***	1 hr/week
End exam	70 marks	***Internal exam***	30 marks
Credits	2		

Objectives: This course is designed to impart a thorough knowledge of the relevant aspects of pathology of various conditions with reference to its pharmacological applications, and understanding of basic Pathophysiological mechanisms. Hence it will not only help to study the syllabus of pathology, but also to get baseline knowledge of its application in other subject of pharmacy.

UNIT I:
Basic Principles of Cell Injury, Adaptation: Causes of cellular injury,pathogenesis and morphology of cell injury-autolysis, necrosis, apoptosis. Cellular adaptations-atrophy, hypertrophy.
Inflammation: Basic mechanism involved in inflammation and repair, alteration in vascular permeability and blood flow. Acute and chronic inflammation, mediators of inflammation.
UNIT II:
Cancer: Types of cancer, causes of cancer, cell cycle of normal & cancer cell. Apotosis and cell differentiation. Carcinogenesis and molecular mechanism of carcinogenesis. Markers involved in diagnosis of cancer.
UNIT III:
Pathophysiology of common diseases like hypertension, angina, congestive cardiac failure, atherosclerosis, myocardial infraction, diabetes and thyroid.
UNIT IV:
Pathophysiology of common diseases likeepilepsy, psychosis, depression, mania, parkinson's disease, arthritis, gout, osteoporosis and peptic ulcer.
UNIT V:
Pathophysiology of common diseases likeasthma, tuberculosis, AIDS, acute & chronic renal failure and urinary tract infections, hepatitis and obesity.

TEXT BOOKS:
1. Harsh mohan, text book of pathology, latest edition.
2. Joseph Dipiro, Pathophysiology and applied therapeutics.

REFERENCE BOOKS:
1. Robbins, SL & Kumar, Basic Pathology. 8th Edition Elsewier.
2. Mary V. Buras, Pathophysiology: A self Instructional programme. Prentice Hall.
3. Mary Lou Mulvihill, Human Diseases: A Systemic approach. Prentice Hall 6th Edition.

Outcomes:
Upon completion of the subject student shall be able to
a. Describe the etiology and pathogenesis of the selected disease states;
b. Name the signs and symptoms of the diseases; and
c. Mention the complications of the diseases.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
ANANTHAPURAMU

Subject	**PHARMACEUTICAL ANALYSIS – I LABORATORY**	***Course Code***	15R00406
Course year	B. Pharmacy II year	***Semester***	II
Theory	4 hrs/week	***Tutorial***	--
End exam	70 marks	***Internal exam***	30 marks
Credits	2		

I. Experiments:

1 Calibration of analytical glass ware.
2 Assay of Sodium carbonate by acid-base titration.
3 Assay of Ferrous sulfate (redox) ceric ammonium sulfate titration.
4 Assay of Sodium benzoate by non-aqueous titration.
5 Assay of Sodium chloride by precipitation titration.
6 Assay of Calcium gluconate by complexometry.
7 Potentiometric titration : Determination of strength of unknown solution HCl, HCl –Acetic acid mixture) against std. NaOH Solution.
8 Assay of any drug by potentiometry, (eg. Frusemide, metronidazole).
9 Conductometric titration – Determination of strength of unknown solution (HCl, HCl–Acetic Acid mixture) against std. NaOH Solution.
10 Determination of refractive index of any sample by Abbe's refractometer.
11 Determination of sucrose concentration by Polarimetry.
12 Determination of moisture content by Karl-Fishcer reagent.

II. Demo/work shop

1. Demonstration on gel electrophoresis
2. Demonstration on Polarography

III. Seminar/Assignment/Group discussion

1. List out various drugs that can be assayed by acid-base titration, as perI.P.2007.
2. What is the need of determination of moisture content, what is the limit ofmoisture in various natural and synthetic drugs?

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
ANANTHAPURAMU

Subject	**PHARMACOGNOSY-II LABORATORY**	***Course Code***	15R00407
Course year	B. Pharmacy II year	***Semester***	II
Theory	4 hrs/week	***Tutorial***	NIL
End exam	70 marks	***Internal exam***	30 marks
Credits	2		

EXPERIMENTS:

1. Study of various morphological characters of the drugs mentioned in theory under alkaloids
2. Study of various morphological characters of the drugs mentioned in theory under glycosides.
3. Microscopy (Transverse section & powder) of Datura and Vinca leaf
4. Microscopy (Transverse section & powder) of Cinchona and Ephedra
5. Microscopy (Transverse section & powder) of Nux vomica and Rauwolfia
6. Microscopy (Transverse section & powder) of Digitalis and Senna
7. Microscopy (Transverse section & powder) of Squill and Liquorice
8. Preparation and evaluation of any one herbal cosmeceutical preparation
9. Preliminary phytochemical screening of any one plant
10. Determination of crude fibre content for any one nutraceutical listed under theory.

Seminar/ Assignment/Group discussion
Seminar/assignment related to theory.

Workshop/Demo
Extraction of plant material using Soxhlet apparatus

References

1. Practical Pharmacognosy, C K Kokate, Nirali Prakashan
2. Practical Pharmacognosy, Khandelwal, Nirali Prakashan
3. Practical Pharmacognosy Iyengar, Manipal Press Ltd.
4. Peach K and Tracey MV, Modern methods of Plant analysis, Narose publishing house, New Delhi.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
ANANTHAPURAMU

Subject	**PHARMACEUTICAL TECHNOLOGY – I LABORATORY**	***Course Code***	15R00408
Course year	B. Pharmacy II year	***Semester***	II
Theory	4 hrs/week	***Tutorial***	--
End exam	70 marks	***Internal***	30 marks
Credits	2		

I. EXPERIMENTS:

1. Preparation, evaluation and packaging of
a) Solutions: Paracetamol syrup, codeine phosphate linctus
b) Ferrous sulphate syrup
c) Suspensions: Milk of magnesia
d) Emulsions: o/w or w/o type
e) Benzyl benzoate lotion
f) Ointments: Benzoic acid ointment
g) Methyl salicylate ointment
h) Suppositories: Boric acid
i) Eye drops: Gentamycin.
j) Eye ointments: Chloramphenicol.
k) Sodiumchloride eye lotion
l) Cream: Cetrimide
m) Cold cream
n) Zincoxide jelly
o). Preparation of gel

II. DEMO/ WORKSHOP

Drug-excipient incompatibility studies, ointment filling machine.

III. SEMINAR/ASSIGNMENT/GROUP DISCUSSION

1) Excipients and their concentrations in various dosage forms.
2) Seminar on blood products

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
ANANTHAPURAMU

Subject	**PHYSICAL PHARMACY – II LABORATORY**	***Course Code***	15R00409
Course year	B. Pharmacy II year	***Semester***	II
Theory	4 hrs/week	***Tutorial***	NIL
End exam	70 marks	***Internal***	30 marks
Credits	2		

I. EXPERIMENTS:

1. Determination of bulk density, true density and percentage porosity.
2. Effect of particle size and effect of glidant on angle of repose.
3. Study of particle/globule size distribution by optical microscopy
4. Determination of CMC of a surfactant.
5. Determination of partition coefficient
   Iodine between water and carbon tetrachloride
6. Determination of sedimentation volume and degree of flocculation.
7. Effect of addition of Salt/pH/co-solvent on the solubility
8. Surface tension using Stalagmometer.
9. HLB value estimation of surfactants.
10. Viscosity – by Ostwald Viscometer.

II. DEMO/ WORKSHOP

Determination of particle size by AndreasonPippette, Plotting of an adsorption isotherm Brook field viscometer.

III. **SEMINAR/ASSIGNMENT/GROUP DISCUSSION**

Viscoelasticity, solublisation techniques

References

1.Physical Pharmaceutics, By Mohanta, and Guru Prasad B.S. Publications

List Of Minimum Equipments Required

1. Ostwald''s viscometer
2. Stalgnometer
3. Digital pH meter
4. Microscopes
5. Stage and eyepiece micrometer
6. Digital electronic balance
7. Thermometer
8. Andreasonpipetter
9. Adequate glasswares

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

(Established by Govt. of A.P., Act. No. 30 of 2008)

ANANTHAPURAMU – 515 002 (A.P.) INDIA.

Course Structure for B.Pharmacy-R15 Regulations

B.Pharmacy

B.Pharm III-I Semester

S. No.	Course Code	Subject	L	T	P	C
1.	15R00501	Medicinal Chemistry-I	3	1	-	3
2.	15R00502	Pharmacology-I	3	1	-	3
3.	15R00503	Pharmaceutical Technology-II	3	1	-	3
4.	15R00504	Pharmaceutical Biotechnology	3	1	-	3
5.	15R00505	**MOOCS - I** (Application of spectroscopic methods in molecular structure Determination) / **Conventional/ Self study**	3	1	-	3
6.	15R00506	Medicinal Chemistry-I Laboratory	-	-	4	2
7.	15R00507	Pharmacology-I Laboratory	-	-	4	2
8.	15R00508	Pharmaceutical Technology-II Laboratory		-	4	2
9.	15R00509	Pharmaceutical Biotechnology Laboratory	-	-	4	2
10.	15A99501	Audit course –Social Values & Ethics	2	0	2	
		Total:	17	5	18	23

Note: MOOC-I- NPTEL (http://nptel.ac.in) Chemistry & Biochemistry and Biotechnology

B.Pharm III-II Semester

S. No.	Course Code	Subject	L	T	P	C
1.	15R00601	Pharmacology-II	3	1	-	3
2.	15R00602	Pharmaceutical Analysis-II	3	1	-	3
3.	15R00603	Biopharmaceutics & Pharmacokinetics	3	1	-	3
4.	15R00604	Pharmaceutical Jurisprudence	3	1	-	3
5.	15R00605 15R00606 15R00607	**CBCC-I** 1. Pharmacy Administration 2. Clinical Trials 3. Cosmetic Technology	3	1	-	3
6.	15R00608	Pharmacology-II Laboratory	-	-	4	2
7.	15R00609	Pharmaceutical Analysis-II Laboratory	-	-	4	2
8.	15R00610	Biopharmaceutics & Pharmacokinetics Laboratory		-	4	2
9.	15A52602	Advanced English Language Communication Skills (AELCS) Laboratory (Audit Course)	-	-	2	-
10.	15R00611	Comprehensive Online Exam - II	-	-	-	1
		Total:	15	5	16	22

B.Pharm IV-I Semester

S. No.	Course Code	Subject	L	T	P	C
1.	15R00701	Novel Drug Delivery Systems	3	1	-	3
2.	15R00702	Pharmacology -III	3	1	-	3
3.	15R00703	Clinical and Hospital Pharmacy	3	1	-	3
4.	15R00704	Medicinal Chemistry-II	3	1	-	3
5.	15R00705 15R00706 15R00707	**CBCC-II** 1.Chemistry of Natural Products 2. Computer Aided Drug Design 3. Pharmacovigilance.	3	1	-	3
6.	15R00708	Novel Drug Delivery Systems Laboratory	-	-	4	2
7.	15R00709	Clinical and Hospital Pharmacy Laboratory	-	-	4	2
8.	15R00710	Medicinal Chemistry-II Laboratory		-	4	2
		Total:	15	5	12	21

B.Pharm IV-II Semester

S. No.	Course Code	Subject	L	T	P	C
1.	15R00801	**MOOCS -II** (Biostatistics and Design of Experiments) / **Conventional/ Self study**	3	1	-	3
2.	15R00802	**MOOCS - III** (Intellectual Property Rights) / /**Conventional/ Self study**	3	1	-	3
3.	15R00803	Comprehensive viva voice	-	-	4	2
4.	15R00804	Technical Seminar	-	-	4	2
5.	15R00805	Project Work	-	-	24	13
		Total:	06	02	32	23

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

Subject	**MEDICINAL CHEMISTRY – I**	***Code***	**15R00501**
Course year	**B. Pharm III year**	***Semester***	**I**
Theory	**3 hrs/week**	***Tutorial***	**1 hr / week**
End Exam	**70 Marks**	***Internal marks***	**30 Marks**
Credits	**3**		

Scope: This subject will provide an opportunity for the student to learn medicinal chemistry information about the drugs. In this subject student will be able to understand the properties and its biological activity of the drugs.

Objectives: Upon completion of the subject student shall be able to

1. Understand various drugs structure, their properties and biological activities.
2. Correlate and apply the knowledge.
3. Influence of chemical structure on biological activities.

Outcomes:

1. Acquire skill in the structure of drugs and their biological activities.
2. Acquire the knowledge of synthesis of chemical compounds.
3. Assay of some official compounds.

UNIT I

Physico chemical properties of drug molecules in relation to biological activity – Solubility, partition-coefficient, Ionization, hydrogen bonding, Chelation, redox potential and surface activity, Bioisosterism and steric features of drugs, drug distribution and protein binding. Types of receptor and its relation with biological activity.

Enzyme stimulation, Enzyme inhibition. Theories of drug action (Ferguson's, Dale's, perturbation and occupation). Drug metabolism: Introduction to Biotransformation, concept of soft and hard drug, phase I & II (With one drug example). Introduction, basic concepts and clinical importance of Prodrug.

UNIT II

Drugs acting on ANS

Adrenergic and antiadrenergic agents: **Adrenergic agonist**: Chemistry and metabolism of neurotransmitters,Dopamine, Ephedrine*, Isoprenaline*, Oxymetazoline*, Salbutamol, **Adrenergic antagonist:** Classification, Phenoxybenzamine*, Prazosin*, Propranolol, Atenolol, Metaprolol. SAR Sympathomimetics (Catecholamines)

Cholinergic and anti-cholinergic agents: Cholinergic receptor and neuro chemistry and concept of neuromuscular blocking agents. Succinylcholine*, pilocarpine,

Physostigmine,Malathion, Pralidoxime, Nicotine, Dicyclomine*, Biperiden*. SAR-Cholinergic agonists, Anti-cholinergics, Neuro muscular blockers.

UNIT III

Drugs acting on CNS

Depressants and Central dopaminergic signalling agents

Anxiolytics, Sedatives and Hypnotics: Benzodiazepines (Diazepam*, Oxazepam, ,Midozolam, Alprazolam), Barbiturates (Phenobarbital*),Glutethimide*, Meprobamate*, SAR-Benzodiazepines, Barbiturates.

Anti-Psychotics: Phenothiazines (Chlorpromazine*, Thioridazine), thioxanthines (Thiothixene*), Butyrophenones (Haloperidol*, Droperidol), Miscellaneous-Lithium salts, Clozapine and Olanzapine. SAR- Phenothiazines, Butyrophenones.

Anti-convulsants: Phenytoin*, Valproic acid, Carbamazepine*, Ethosuximide. SAR-Hydantoins, Oxazolidinediones, Succinimides.

Anti-parkinsonism: Levodopa*-Carbidopa, Amantidine*, Selegiline, Apomorphine, Ropinirole, Entacapone,Tolcapone.

UNIT IV

Analeptics: Picrotoxin, Doxapram*, Methyl xanthines (Caffeine, Theophylline, Theobromine) Psychomotorstimulant: Dextro amphetamine*, Methamphetamine, Phenfluramine, Sibutramine, Methylphenidate.

Anti-depressants: Types, Phenelzine, Tranylcypromine*, Tricyclic anti-depressants: Imipramine*,Desipramine, Fluoxetine*, Newer agents: Venlafaxine, Buspironeand Bupropion. SAR- Tricyclic antidepressants, MAOIs.

Miscellaneous: Psilocybin, Dimethyltryptamine, Mescaline, Lysergic acid and Tetrahydro cannabinol.

UNIT V

Anaesthetics:

General anaesthetics: Chemical classification, Inhaled and Injectable, Meyer-Overton theory, Halothane*, Propofol, Ketamine, Thiopental sodium*.

Local anaesthetics: Cocaine, Lignocaine*. Adjuvant to localanaesthetics. SAR- Esters and amides.

NOTE: Introduction, definition, chemical classification with structure, nomenclature, synthesis (only for *marked drugs), mechanism of action, SAR including stereo chemical aspects, metabolites (including its ADR)and therapeutic uses of the following classes of drugs from UNIT II to UNIT V.

Text Books:

1. *William O. Foye, Textbook of Medicinal Chemistry, Lea Febiger, Philadelphia.*
2. *JH Block & JM Beale (Eds), Wilson &Giswold''s Text book of organic Medicinal Chemistryand pharmaceutical chemistry, 11th Ed, Lipcolt, Raven, Philadelphia, 2004*

Reference Books:

1. *Hansch, Comprehensive medicinal chemistry, Vol 1 – 6 Elsevier pergmon press, Oxford*
2. *D. Abraham (Ed), Burger Medicinal chemistry ad Drug discovery, Vol. 1 & 2. John Wiley &Sons, New York 2003, 6th Ed.*
3. *M. Atherden, Bentley and Driver''s Textbook of Pharmaceutical Chemistry Ed: I.OxfordUniversity Press, Delhi.*

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

Subject	**PHARMACOLOGY – I**	**Code**	**15R00502**
Course Year	**B.Pharmacy III year**	**Sem**	**I**
Theory	**3hrs/week**	**Tutorial**	**1hr/week**
End exam	**70 Marks**	**Internal exam**	**30Marks**
Credits	**3**		

Scope:
This subject provides an insight to know the class and mode of action of drugs, their unwanted effects and therapeutic actions.

Objectives: Upon completion of the subject student shall be able to

1. Understand various pharmacological aspects like pharmacokinetics, side effects, drug interactions, contraindications and indications of drugs falling under below mentioned chapters.
2. Correlate and apply the knowledge.

Outcomes:

1. Acquire the knowledge in basic mechanism of action of drugs.
2. Therapeutic uses of drugs of the following chapters.

UNIT I

General Pharmacology:

a. Introduction

Definition, historical development and scope of pharmacology. Sources of drugs and routes ofadministration. Principles of discovery and development of new drugs, phases of clinical trials.

b. Pharmacodynamics

Mechanism of action with special emphasis on receptors, drug-receptor interaction theories, factorsmodifying drug action.

c. Pharmacokinetics

Drug absorption, distribution, metabolism and excretion. Factors affecting/modifying Pharmacokinetic parameters.

UNIT II

Pharmacology of Peripheral Nervous System

a. Neurohumoral transmission (autonomic and somatic), cholinergic receptors and adrenergicreceptors.
b. Parasympathomimetics, parasympatholytics ,sympathomimetics and sympatholytics.
c. Ganglionic stimulants and blocking agents.
d. Neuromuscular blocking agents and local anesthetic agents.

UNIT III

Pharmacology of Central Nervous System: I

a. Neurohumoral transmission in the C.N.S with special emphasis on dopamine, GABA and 5-HTneurotransmission.
b. General anesthetics,sleep cycle, sedatives, hypnotics and anti-anxiety agents.
c. CNS stimulants and centrally acting muscle relaxants.
d. Alcohols and disulfiram. Drug addiction, abuse, tolerance and dependence.

UNIT IV

Pharmacology of Central Nervous System: II

a. Pharmacology of drugs used in affective/mood disorders like depression and mania andbehavioral disorders like psychosis.
b. Pharmacology of drugs used in neurodegenerative disorders like Parkinsonism and Alzheimer'sdisease.
c. Pharmacology of drugs used in epilepsy

UNIT V

a. Analgesics, Antipyretics, and Anti-inflammatory drugs.
b. Narcotic analgesics and antagonists.

Text Books:

1. H.P Rang, M. M. dale & J.M. Ritter, Pharmacology, Churchill living stone, 4th Ed.
2. J.G. Hardman and Lee E. Limbard, Good Mann & Gilmann, The Pharmacological basis oftherapeutics, Mc Grawhill, Health Professions Dvn.

Reference Books

1. Bertram. G. Katzung, Basic and clinical pharmacology, 9th Edn; Prentice Hall International
2. Sathoskar, Pharmacology and pharmaco therapeutics Vol. 1 & 2, Publ by PopularPrakashan, Mumbai.
3. Tripathi, Essentials of Medical Pharmacology, Jaypee Brother"s, Latest Edition

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

Subject	PHARMACEUTICAL TECHNOLOGY –II	Code	15R00503
Course Year	B.Pharmacy III year	Sem	I
Theory	3hrs/week	Tutorial	1hr/week
End exam	70 Marks	Internal exam	30Marks
Credits	3		

Scope: This subject will provide an opportunity for the student to learn about the formulation, evaluation and manufacturing of various types of tablets, capsules and also provide insights about aseptic area and parenteral.

Objectives: Upon completion of the subject student shall be able to

1. Understand various formulation aspects of tablets and capsules and also provide knowledge about selection of excipients in the preparation of same.
2. Provide knowledge on packaging materials used in pharmaceutical products.

Outcomes:

1. Acquire skill in preparation of different types of tablets.
2. Demonstrate the handling of equipment for evaluation ofvarious dosage forms.
3. Acquire the knowledge of processing of dosage form on large scale that suit pharma industry.
4.

UNIT I

Tablets: Introduction to different types of tablets, Formulation of tablets, direct compression, Granulation technology on large-scale by various techniques and equipments. Tablet processing problems and their remedy. Types of tablet compression machinery and the equipments employed and evaluation of tablets.

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

UNIT II

Capsules: Advantages and disadvantages of capsule dosage forms, material for production of hardand soft gelatin capsules, sizes of capsules, capsule filling, soft processing problems in capsulemanufacturing, importance of base absorption and minimum/gm factors in soft capsules, qualitycontrol, stability testing and storage of capsule dosage forms.

UNIT III

Microencapsulation: Types of microencapsulation and importance of microencapsulation in Pharmacy, microcapsulation by coacervation phase seperation, multi orifice centrifugal separation. Spray drying, spray congealing, polymerization complex emulsion, air suspension technique, and pancoating techniques, evaluation of microcapsules.

UNIT IV

Parenteral Products

a. Preformulation factors, routes of administration, water for injection, treatment of apyrogenicity, non-aqueous vehicles, isotonicity and methods of its adjustment.

b. Formulation details, containers, closures and their selection.

c. Prefilling treatment, washing and sterilization of containers and closures, preparation of solutionsand suspensions, filling and closing of ampoules, vials, infusion fluids, lyophillization & preparation of sterile powders, equipment for large-scale manufacture and evaluation of parenteralproducts.

d. Aseptic techniques, sources of contamination and methods of prevention. Design of aseptic area,laminar flow benches, Environmental control monitoring.

UNIT V

Packaging of Pharmaceutical products:

Packaging components, types, specifications and methods of evaluation as per I.P. Factors influencingchoice of containers, package testing, legal and other official requirements for containers, packingtesting. Methods of packing of solid, liquid and semi-solid dosage forms, Factors influencing packingmaterial, stability aspects of packaging.

Text Books:

1. L. Lachman, H.A, Lieberman and J.L. Kanig, Theory & Practice of industrial pharmacy, Lea &Febieger, Philadelphia Latest Edn.
2. L. V. Allen Jr., N. G. Popovich, H. C. Ansel. Ansel˝s pharmaceutical dosage forms and drugdelivery systems. Lippincott Williams & Wilkins, 2005.

Reference Books:

1. M. E. Aulton Pharmaceutics. The science of dosage form design. - 2nd ed. Churchill-Livingstone, 2002
2. Lippincott Williams and Wilkins, Remington Pharmaceutical Sciences.
3. E.A.Rawlkins, Bentley˝s Text Book of Pharmaceutics, Elbspubl

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

Subject	PHARMACEUTICAL BIOTECHNOLOGY	Code	15R00504
Course Year	B.Pharmacy III year	Sem	I
Theory	3hrs/week	Tutorial	1hr/week
End exam	70 Marks	Internal exam	30Marks
Credits	3		

Scope: To study the Fermentation, Recombinant and Enzyme Technology
Objective: To know the various technologies types, design, preparation and operation
Outcome: The Student has to know the Application of below mentioned technologies and uses of immunological preparations.

UNIT I

Fermentation Technology: Isolation, Selection, Screening of Industrially important microbes, Strain improvement. Types, design & operation of Bioreactor. Types of fermentations, optimization of fermentation process, Principle and Procedure involving in downstream process and effluent treatment. **Specific Fermentations:** Selection of organism, fermentation & purification of antibiotics (penicillin, streptomycin, tetracycline, and erythromycin), vitamins (riboflavin and cyanocobalamine), lactic acid, alcohol and acetone.

UNIT II

Recombinant DNA Technology: Introduction to r-DNA technology and genetic engineering, steps involved in isolation of enzymes, vectors, recombination and cloning of genes. Production of bio technology derived therapeutic proteins like humulin, humatrop, activase, intron a, monoclonal antibodies by hybridoma technique, recombivax HB (hepatitis b). Stem cells and their applications.

UNIT III

Immunology & Immunological Preparations: Principles of Immunity, Humoral immunity, cell mediated immunity, antigen – antiboby reactions, hypersensitivity and its applications. Active & passive immunizations vaccine preparation, standardization & storage of BCG, cholera, smallpox, polio, typhus, tetanus toxoid, immuno serum & diagnostic agents.

UNIT IV

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

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

UNIT V

Introductory study & applications of bioinformatics, proteomics and genomics, Nanobiotechnology, Gene therapy.

Text Books:

1. Wulf Crueger and Anneliese Crueger, Biotechnology, 2 nd Ed, Publ- Panima publication cooperation, New Delhi.
2. P. F. Stanbury & A. Whitaker, Principles of fermentation technology, Pergamon Press. J. D. Watson, Recombinant DNA technology. 2 nd Edition, W.H. Freemann1992.
3. S.P.Vyas and Dixit, Pharmaceutical Biotechnology, CBS Publishers New Delhi.

Reference Books:

1. Prescott and Dunne, "Industrial Microbiology" MC Graw Hill Book Company.
2. K. Kielsliched "Biotechnology" Vol 6, Verlegchemic, Switzerland.
3. PF Standury& A. Whitaker, "Principles of fermentation Technology" Pergamon Press, Oxford. Wiseman, Handbook of enzyme biotechnology. A. 3rdEdition Elis Horwood.
4. Alexande M Moo-young, Comprehensive Biotechnology, Pergamon Press, New York.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

Subject	(MOOCS-I) APPLICATION OF SPECTROSCOPIC METHODS IN MOLECULAR STRUCTURE DETERMINATION	Code	15R00505
Course Year	B.Pharmacy III year	Sem	I
Theory	3hrs/week	Tutorial	1hr/week
End exam	70 Marks	Internal exam	30 Marks
Credits	3		

Objectives:

1. Introduction, Modern approaches in Bioanalysis and Bioassays.
2. Spectroscopic techniques: UV-Visible spectroscopy, Fluorescence spectroscopy, IR spectroscopy, CD spectroscopy, and Mass spectroscopy.

Out comes:

1. Chemists are molecule makers; whenever a new molecule is synthesized it is essential to determine its structure using spectroscopic techniques.
2. This course is all about practical applications of spectroscopic methods for the determination of organic molecules.

UNIT-I

UV-Vis spectroscopy - Electronic transitions in organic molecules, selection rules, application of Beer Lambert law, qualitative and quantitative analysis by UV-Vis spectroscopy.

UNIT-II

Electrophoresis Techniques

Electrophoresis; Principle, Design of horizontal and vertical gel electrophoresis apparatus, performing electrophoresis techniques, application of electrophoresis in analyzing macromolecules.

UNIT-III

NMR spectroscopy – Nuclear magnetic resonance spectroscopy (NMR), spin ½ nuclei, 1H and 13C-NMR spectroscopy. Chemical shifts, spin-spin coupling, spin-spin splitting pattern recognition for structure elucidation, coupling constants.

UNIT-IV

Mass Spectrometry – various ionization methods – EI, CI, ESI and MALDI methods, fragmentation patterns of simple organic molecules, Use of HRMS. Infra-red spectroscopy – basic concepts, experimental methods, functional group analysis and identification using IR spectroscopy, structural effects on vibrational frequency.

UNIT-V

Introduction & Bioanalytical Spectroscopic techniques

Introduction, Modern approaches in Bioanalysis and Bioassays, Spectroscopic techniques: UV-Visible spectroscopy and IR spectroscopy.

Sources: NPTEL

1. **http://nptel.iitm.ac.in Biotechnology (Bioanalytical Techniques and Bioinformatics)**
2. **http://nptel.ac.in Chemistry and Biochemistry (Application of Spectroscopic methods in molecular structure determination)**

Text Books

1. Spectroscopy, D. L. Pavia, G. M. Lampman, G. S. Kriz, J. R. Vyvyan, Cengage Learning (Indian Edition), 2007.
2. Organic Spectroscopy, William Kemp, 3rd Edition, 1991, Macmillan (Indian Edition).
3. NMR Spectroscopy, H. Gnther, second edition, John Wiley and sons, 1998

References:

1. GA. Manz, N. Pamme and D. Iossifidis, Bioanalytical Chemistry, World Scientific
2. Publishing Company, 2004
3. Baxevanis, B. F. F. Ouellette, Bioinformatics -A practical Guide to the analysis of Genes and Proteins, 2nd Ed, John Wiley and Sons Inc., 2001.
4. T. Lengauer; Bioinformatics - From Genomes to Drugs, Vols 1 & 2, Wiley-VCH, 2002.
5. Live Cell Imaging: A Laboratory Manual R. D. Goldman, J. R. Swedlow and D. L. Spector Cold Spring.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

Subject	**MEDICINAL CHEMISTRY – I LABORATORY**	*Code*	**15R00506**
Course year	**B. Pharm III year**	*Semester*	**I**
Practical	**4hrs/week**	*Tutorial*	**Nil**
End Exam	**70Marks**	*Internal marks*	**30Marks**
Credits	**2**		

Scope: This subject will provide an opportunity for the student on synthesis of various compounds.

Objectives: Upon completion of the subject student shall be able to

a. Synthesis various chemical compounds.
b. Provide knowledge on monograph analysis ofsome chemical compounds.

Outcomes:

1. Acquire skills in synthesis various chemical compounds.
2. Demonstrate of stereo models of some drugs relevant to theory.
3. Acquire skills of extraction of drugs from different dosage forms.

I. EXPERIMENTS

1. Synthesis of Barbituric acid from Diethyl Malonate
2. Synthesis of Phenytion from Benzoin or Benzil
3. Synthesis of Diphenyl quinaoxaline from o-phenylene diamine and benzil
4. Synthesis of phenothiazine from o-phenylene diamine
5. Synthesis of Benzocaine from Para amino benzoic acid
6. Synthesis of Dibromo succinic acid from malic acid
7. Synthesis of Benzoxazine from Anthranilic acid
8. Monograph analysis of Caffeine
9. Monograph analysis of Phenytoin
10. Monograph analysis of Barbituric acid
11. Monograph analysis of Benzocaine
12. Monograph analysis of carbamazine citrate

(Literature, Journal reported lead compounds synthesis relevant to theory can also be Included)

II Demo/Workshop

1. Stereo models of some drugs relevant to theory.
2. Extraction of drugs from different dosage forms

III Seminar/Assignment/Group discussion

Photochemistry as a green synthetic method, novel methods for the separation of optical isomers, highly selective metalation reactions, QSAR, high throughput screening, combinatorial chemistry, In silico drug design.

References:

1. A.I. Vogel, Text Book of Practical Organic Chemistry, 5th Edition. Pearson Prentice Hall.
2. F.G. Mann & B.C. Saunders, Pratical Organic Chemistry, 4th Edition. Pearson Publishers.

LIST OF MINIMUM EQUIPMENTS REQUIRED

1. Water bath
2. Suction pumps
3. Analytical/physical balance
4. Triple beam balance
5. Reflux flask with condenser
6. Hot plates
7. Refrigerator
8. Mechanical and magnetic stirrer with thermostat
9. Distillation unit
10. Oven
11. Adequate glass wares

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

Subject	**PHARMACOLOGY – I LABORATORY**	**Code**	**15R00507**
Course Year	**B.Pharmacy III year**	**Sem**	**I**
Practical	**4hrs/week**	**Tutorial**	**NIL**
End exam	**70 Marks**	**Internal exam**	**30 Marks**
Credits	**2**		

Scope:

- To find out the agents suitable for clinical use.
- Study the toxicity and mechanism of Action and Site of action
- Study the actions of drugs in Preclinical

Objectives:

To know and understand pharmacological investigation techniques applied in the research

Outcomes:

- Knows to administration of drugs to experiments rats by various routes.
- Have insight fundamental difference between agonists and antagonists
- Englighted with basic equipments, anesthetics, lab animals that are to be handled in the pharmacology lab

1.EXPERIMENTAL PART

(To use appropriate softwares for animal experimentation)

1. Introduction to Experimental Pharmacology

- Preparation of different solutions for experiments.
- Drug dilutions, use of molar and % w/v solutions in experimental Pharmacology.
- Common laboratory animals and anaesthetics used in animal studies.
- Commonly used instruments in experimental pharmacology.
- Different routes of administration in animals
- Collection of blood samples from animals

2. Study the effect of autonomic drugs on rabbit's eye
3. Record the concentration response curve (CRC) of acetylcholine using rectus abdominus muscle preparation of frog.
4. Record the CRC of 5-HT on rat fundus preparation.
5. Record the CRC of histamine on guinea pig ileum preparation.

6. To study the inotropic and chronotropic effects of drugs on isolated frog heart.
7. 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.

II. DEMO/ WORK SHOP

Arterial and venous cannulations, organ isolation and its application in research.

III. SEMINAR/ ASSIGNMENT/ GROUP DISCUSSION

1. Isolation, characterization and nomenclature of receptors.
2. Metabolic disorders and their complications
3. Novel targets for the treatment of various disorders

References:

1. Practicals in pharmacology By Dr.R.K.Goyal
2. Handbook of experimental pharmacology By S.K.Kulakarni
3. Experimental pharmacology By M.N.Ghosh
4. EXPO – Experimental pharmacology software.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

Subject	**PHARMACEUTICAL TECHNOLOGY – II LABORATORY**	**Code**	**15R00508**
Course Year	**B.Pharmacy III year**	**Sem**	**I**
Practical	**4hrs/week**	**Tutorial**	**NIL**
End exam	**70 Marks**	**Internal exam**	**30 Marks**
Credits	**2**		

Scope: This subject will provide an opportunity for the student to learn manufacturing of dosage forms such as tablets, capsules and parenteral.

Objectives: Upon completion of the subject student shall be able to

- Manufacture the various types of tablets.
- Evaluate the finished pharmaceutical products.

Outcomes:

1. Acquire skills in manufacture the various types of tablets.
2. Learn how to evaluate the tablets.
3. Acquire skills of manufacturing and evaluation of parental dosage forms.

I. EXPERIMENTS:

1. Manfacturing of tablets:
   a. Ordinary compressed tablets by wet granulation.
   b. Tablets prepared by direct compression
   c. Soluble tablets/dispersible granules
   d. Chewable tablets
   e. Effervescent tablets.

2. Evaluation of tablets (Weight variation, hardness, friability, disintegration and dissolution)
3. Formulation and filling of hard gelatin capsules.
4. Parenteral:
   a. Manufacturing of parenterals (Ampoule sealing (Pull sealing and tip sealing)
   b. Evaluation of parenterals (Clarity test, and leaking test).

II. DEMO/ WORKSHOP

Coating of tablets (sugar/film/enteric)

III. SEMINAR/ASSIGNMENT/GROUP DISCUSSION

1. Advances in granulation technology.
2. Multifunctional excipients.
3. Excipients and their commercial names.

Text Books:

1. L. Lachman, H.A, Lieberman and J.L. Kanig, Theory & Practice of industrial pharmacy, Lea &Febieger, Philadelphia Latest Edn.
2. L. V. Allen Jr., N. G. Popovich, H. C. Ansel. Ansel˝s pharmaceutical dosage forms and drugdelivery systems. Lippincott Williams & Wilkins, 2005.

Reference Books:

1. M. E. Aulton Pharmaceutics. The science of dosage form design. - 2nd ed. Churchill-Livingstone, 2002
2. Lippincott Williams and Wilkins, Remington Pharmaceutical Sciences.
3. E.A.Rawlkins, Bentley˝s Text Book of Pharmaceutics, Elbspubl

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

Subject	**PHARMACEUTICAL BIOTECHNOLOGY LABORATORY**	**Code**	**15R00509**
Course Year	**B.Pharmacy III year**	**Sem**	**I**
Practical	**4hrs/week**	**Tutorial**	**Nil**
End exam	**70 Marks**	**Internal exam**	**30Marks**
Credits	**2**		

I.EXPERIMENTS:

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

II.DEMO/WORKSHOP:

Production of Antibiotics by Fermentation, Development of a Simple Biosensor.

III.ASSIGNEMENT/SEMINAR/GROUP DISCUSSION:

Monoclonal antibodies and Diagnosis, New Drug Targets and Vaccine Development, Stem cells and
their applications.

LIST OF MINIMUM EQUIPMENTS REQUIRED

1. Micropipettes
2. Eppendorf's tubes
3. Ultra centrifuge
4. Dessicators
5. Gel electrophoresis unit
6. Small scale bioreactor
7. Syringes
8. laminar flow bench
9. Autoclave

10. Hot air oven
11. BOD incubator
12. Rotary shaker
13. Anerobic jar
14. Colorimeter
15. Adequate glassware

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B. Pharmacy III-I Sem.

L	T	P	C
2	0	2	0

15A99501 SOCIAL VALUES & ETHICS (AUDIT COURSE)

(Common to all Branches)

UNIT - I

Introduction and Basic Concepts of Society: Family and Society: Concept of family, community, PRIs and other community based organizations and society, growing up in the family – dynamics and impact, Human values, Gender Justice.

Channels of Youth Moments for National Building: NSS & NCC: History, philosophy, aims & objectives; Emblems, flags, mottos, songs, badge etc.; Organizational structure, roles and responsibilities of various NSS functionaries. **Nehru Yuva Kendra (NYK):** Activities – Socio Cultural and Sports.

UNIT – II

Activities of NSS, NCC, NYK:

Citizenship: Basic Features Constitution of India, Fundamental Rights and Fundamental Duties, Human Rights, Consumer awareness and the legal rights of the consumer, RTI.

Youth and Crime: Sociological and psychological Factors influencing youth crime, Peer Mentoring in preventing crimes, Awareness about Anti-Ragging, Cyber Crime and its prevention, Juvenile Justice

Social Harmony and National Integration: Indian history and culture, Role of youth in peace-building and conflict resolution, Role of youth in Nation building.

UNIT – III

Environment Issues: Environment conservation, enrichment and Sustainability, Climate change, Waste management, Natural resource management (Rain water harvesting, energy conservation, waste land development, soil conservations and afforestation).

Health, Hygiene & Sanitation: Definition, needs and scope of health education, Food and Nutrition, Safe drinking water, Sanitation, Swachh Bharat Abhiyan.

Disaster Management: Introduction to Disaster Management, classification of disasters, Role of youth in Disaster Management. Home Nursing, First Aid.

Civil/ Self Defense: Civil defense services, aims and objectives of civil defense, Need for self defense training – Teakwondo, Judo, karate etc.,

UNIT – IV

Gender Sensitization: Understanding Gender – Gender inequality – Role of Family, Society and State; Challenges – Declining Sex Ratio – Sexual Harassment – Domestic

Violence; Gender Equality – Initiatives of Government – Schemes, Law; Initiates of NGOs – Awareness, Movements;

UNIT - V

Physical Education : Games & Sports: Health and Recreation – Biolagical basis of Physical activity – benefiets of exercise – Physical, Psychological, Social; Physiology of Musucular Activity, Respiration, Blood Circulation**.**

Yoga: Basics of Yoga – Yoga Protocol, Postures, Asanas, Pranayama: Introduction of Kriyas, Bandhas and Mudras.

TEXT BOOKS:

1. NSS MANUAL
2. SOCIETY AND ENVIRONMENT: A.S.Chauha, Jain Brothers Publications, 6th Edition,
3. 2006
4. INDIAN SOCIAL PROBLEM: G.R.Madan, Asian Publisher House
5. INDIAN SOCIAL PROBLEM: Ram Ahuja, Rawat Publications
6. HUMAN SOCIETY: Kingsley Davis, Macmillan
7. SOCIETY: Mac Iver D Page, Macmillan
8. SOCIOLOGY – THEMES AND PERSPECTIVES: Michael Honalambos, Oxford University Press
9. CONSTITUTION OF INDIA: D.D.Basu, Lexis Nexis Butterworth Publishers
10. National Youth Policy 2014 (available on www.yas.nic.in)
11. TOWARS A WORLD OF EQUALS: A.Suneetha, Uma Bhrugudanda, Duggirala Vasantha, Rama Melkote, Vasudha Nagraj, Asma Rasheed, Gogu Shyamala, Deepa Streenivas and Susie Tharu
12. LIGHT ON YOGA : B.K.S.Iyengar, Penguin Random House Publishers

www.un.org
www.india.gov.in
www.yas.nic.in
http://www.who.int/countries/ind/en/
http://www.ndma.gov.in
http://ayush.gov.in/event/common-yoga-protocol-2016-0

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

Subject	**PHARMACOLOGY – II**	**Code**	**15R00601**
Course Year	**B.Pharmacy III year**	**Sem**	**II**
Theory	**3hrs/week**	**Tutorial**	**1hr/week**
End exam	**70 Marks**	**Internal exam**	**30Marks**
Credits	**3**		

Scope: This subject will provide an opportunity for the student to learn pharmacological information about the drugs. In this subject drugs acting on cardiovascular system, drugs acting on hematopoietic system, drugs acting on renal system, drugs acting on respiratory system and drugs acting on autacoids will be taught.

Objectives: Upon completion of the subject student shall be able to

a. Understand various pharmacological aspects like mechanism of action, pharmacokinetics, side effects, drug interactions, contraindications and indications of drugs falling under below mentioned chapters.
b. Correlate and apply the knowledge.
c. Handle the animals and carry out the experiments on animals

Outcomes:

1. Acquire the knowledge in basic mechanism of action of drugs.
2. Therapeutic uses of drugs of the following chapters.

UNIT I

Drugs acting on cardiovascular System

a. Pharmacology of drugs used in hypertension and CHF
b. Pharmacology of drugs used in coronary artery diseases (Atherosclerosis, Angina and MI)
c. Pharmacology of drugs used in arrhythmias
d. Shock and treatment of different types of shock

UNIT II Drugs acting on hematopoietic system

a. Coagulants, anticoagulants
b. Fibrinolytics, antifibrinolytics, antiplatelet drugs
c. Hematinics and plasma expanders

UNIT III

a. Drugs acting on urinary system

i) Diuretics and antidiuretics

b. Drugs acting on respiratory system

i) Antiasthmatics

ii) Antitussives, expectorants and respiratoty stimulants

UNIT IV

Autacoids

a. Amine autacoids- Histamine and 5-HT
b. Lipid derived autacoids-Prostaglandins, thromboxanes and leukotrienes.
c. Peptide autacoids- Angiotensin, bradykinin

UNIT V

Hormones and hormone antagonists

a. Insulin,Oral hypoglaceamics agents
b. Thyroid and antithyroid drugs
c. Adrenocortical steroids and their analogues
d. Uterine stimulants and relaxants

Text Books:

1. H.P Rang, M. M. dale & J.M. Ritter, Pharmacology, Churchill living stone, 4th Ed.
2. J.G. Hardman and Lee E. Limbard, Good Mann &Gilmann, The Pharmacological basis of therapeutics, Mc Grawhill, Health Professions Dvn.
3. Illiterated Pharmacology by Lippincotts

References:

1. Tripathi, Essentials of Medical Pharmacology, Jaypee Brother's, Latest Edition
2. Sathoskar, Pharmacology and pharmaco therapeutics Vol. 1 & 2, Publ by Popular Prakashan, Mumbai.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

Subject	PHARMACEUTICAL ANALYSIS- II	Code	15R00602
CourseYear	B.Pharmacy III year	Sem	II
Theory	3hrs/week	Tutorial	1hr/week
End exam	70 Marks	Internal exam	30Marks
Credits	3		

Scope: This subject will provide an opportunity for the student to learn about the spectroscopic and chromatographic techniques.

Objective:

- The course is designed to explore the knowledge in modern analytical instrumental techniques i.e., both spectroscopy and chromatography.
- The course helps to assess the process for identification, determination, quantification and purification of a substance and separation of the components of a solution or mixture.

Outcome:

1. To gain knowledge on basic fundamentals of modern analytical instrumental techniques.
2. Analyze the drug structure, identification, purity determination, and quantification of the drug substance.

UNIT I

a) Study of separations, introduction to chromatography, classifications, types, various stationary and mobile phase in the following techniques and their applications in pharmacy (IP 2010 and 2014).
b) **Column chromatography**: Adsorption and partition theory, concept of theoretical plates, HETP, adsorbents used, preparation, procedure and methods of detection.
c) **Paper Chromatography:** Theory, different techniques employed, filter papers used, qualitative and quantitative detection.
e) **Thin layer chromatography:** Principle, 1D and 2D techniques, preparation of plates, R*f*, Rx, Rm values and detection techniques. Concept of HPTLC.
f) **Ion Pair Chromatography**, Ion suppression and Ion Exchange Chromatography, Introduction to Theory and Principle, Instrumentation. Advantages and limitations. Pharmaceutical and other Applications.
g) **Size exclusion chromatography:** Introduction, principle, instrument. Column packing, Applications.

UNIT-II

Gas Chromatography: Principle, adsorption isotherm and its relation to tailing and fronting, Instrumentation - carrier gas, flow regulators, injectors columns, detectors. Various parameters used in GC analysis. Brief note on GC-MS.

UNIT III

a) Basic Principles (exothermic and endothermic reactions), Instrumentation and applications of the following: Differential Scanning Colorimetry (DSC), DTA, & TGA in analysis of Pharmaceuticals,

b) Quality Assurance

Concept of Quality control and Quality Assurance, ISO 9000, TQM, QC, Vs QA, Concepts of ICH, GMP and GLP, Calibration of UV and IR, Validation of analytical methods as per ICH guidelines.

UNIT IV

HPLC: Principle, Instrumentation- mobile phase, degassing, pumps, injectors, columns, detectors. Normal Phase Vs Reverse Phase HPLC, Isocratic and gradient elution in RP-HPLC. Various parameters in chromatogram of HPLC.

UNIT V

Optical Rotatory dispersion: Principle of optical activity, optical purity, concept of Optical Rotatory dispersion (ORD).

XRD: Production X-ray, types of X-rays, Braggs law, Octant rule, Cotton effect, XRD pattern in identification and comparison of polymorphs with examples.

Radio Immuno Assay & Enzyme Linked Immuno Sorbate Assay: Principle and procedure of RIA, Principle, Types, Procedures of ELISA and application of RIA and ELISA in various diagnosis.

Text books:

1. *Willard HH, Merritt LL, Dean JA and Settle FA. (2001). Instrumental Methods of Analysis, 7thed., CBS Publishers and Distributors, Delhi, ISBN: 9788123909431.*
2. *Douglas A. Skoog, F. James Holler and Stanley R. Crouch. (2006). Principles of Instrumental Analysis, Cengage Learning; 6th edition, ISBN-10: 0495012017*

References:

1. *Settle, Handbook of Instrumental Techniques for Analytical Chemistry. Prentice Hall.*
2. *Robert M Silverstein. Spectrometric Identification of Organic compounds. Sixth edition, John Wiley & Sons, 2004.*
3. *B.K. Sharma, Instrumental Chemical Analysis, Goel Publishers.*

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

Subject	**BIOPHARMACEUTICS AND PHARMACOKINETICS**	**Code**	**15R00603**
Course Year	**B. Pharmacy III year**	**Sem**	**II**
Theory	**3hrs/week**	**Tutorial**	**1hr/week**
End exam	**70 Marks**	**Internal exam**	**30Marks**
Credits	**3**		

Scope: This subject will provide an opportunity for the student to learn about the Biopharmaceutics and pharmacokinetic.

Objective:

- The course is designed to explore the knowledge in ADME.
- The course helps to learn ssignificance of plasma drug concentration measurement.

Outcomes:

1. Graduate will acquire knowledge on the factors influencing absorption, distribution, protein binding and also on pharmacokinetic models.
2. Able to calculate the pharmacokinetic parameters based on plasma level-time data & urine data.
3. Understand the importance of clinical pharmacokinetics and the bioavailability and bio equivalence studies.

UNIT – I

Biopharmaceutics, Pharmacokinetics and Pharmacodynamics. Structure of GI membrane. Routes of drug administration and absorption from different routes.

Drug Absorption. Mechanisms of GI absorption, physico-chemical, biological and dosage form factors influencing absorption.

Drug distribution. Factors affecting drug distribution, physiological barriers of drug diffusion, apparent volume of distribution, drug binding to blood, tissues, protein binding – factors affecting, significance and kinetics of protein binding.

UNIT – II

Drug Metabolism: Pathways of drug metabolism. Phase-I (oxidative, reductive and hydrolytic reactions). Phase II reactions (conjugation) Enzyme induction and inhibition, hepatic clearance, pharmacological activity of metabolites, first pass effect.

Drug excretion. Glomerular filtration, tubular secretion and reabsorption, effect of pH and other drugs. Clearance concept, excretion through bile, feces, lungs and skin in brief.

UNIT – III

Bioavailability and bioequivalence: concept of equivalents, Definitions of various types of equivalents, types of Bioavailability studies, measurement of Bioavailability, plasma level and urinary excretion studies. Bioequivalence study design, IVIVC.

UNIT – IV

Pharmacokinetics. Basic considerations, compartment modeling, one compartment open model - i.v. bolus and extra vascular administration, urinary excretion studies. Apparent volume of distribution, elimination rate constant, biological half life, area under the curve and clearance. Calculation of pharmacokinetic parameters. Method of residuals, Wagner and Nelson method , excretion rate method, sigma minus method. Solving of simple problems

UNIT – V

Nonlinear kinetics. Non compartmental models, reasons for non linearity, concepts of linearity and non linearity , Michaelis- Menten equation and its significance.

Text Books:

1. L. Shargel and ABC Yu, textbook of applied biopharmaceutics & Pharmacokinetics, 4th edn, Appleton – centuary – crofts, Connecticut, 2004.
2. Milo Gibaldi, Biopharmaceutics and clinical pharmacokinetics 4/Edn. Pharma Book
3. Syndicate.Hyderabad.
4. DM Brahmankar and SB Jaiswal, biophamaceutics and pharmacokinetics- a treatise, vallabh prakasham, Delhi.

Reference Books:

1. Ronald & trouser. Clinical pharmacokinetics concepts & applications. 3rd ed, wolterskluwer Pvt Ltd., 2007.
2. Robert E notary, Biopharmaceutics and pharmacokinetics – an introduction, marcel dekker inc., NY
3. Basic pharmacokinetics by Hedaya, CRC press.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

Subject	**PHARMACEUTICAL JURISPRUDENCE**	**Code**	**15R00604**
Course Year	**B.Pharmacy III year**	**Sem**	**II**
Theory	**3hrs/week**	**Tutorial**	**1hr/week**
End exam	**70 Marks**	**Internal exam**	**30Marks**
Credits	**3**		

Scope: This subject will provide an opportunity for the student to review Pharmaceutical Legislations, Pharmaceutical ethics & policy.

Objectives:

- The course is designed to explore the knowledge Pharmaceutical Education.
- The course helps to learn various laws and acts in pharmacy.

Outcomes:

1. Graduate will acquire knowledge on Pharmaceutical Education.
2. Able to understand drugs & pharmaceutical industry.
3. Understand the importance of Pharmacy Acts.

UNIT I

Introduction

a. Pharmaceutical Legislations - A brief review
b. Drugs & Pharmaceutical Industry - A brief review
c. Pharmaceutical Education - A brief review.
d. Pharmaceutical ethics & policy
e. Pharmacy Act 1948

UNIT II

Drugs and Cosmetics Act 1940 and Rules 1945

UNIT III

Narcotic Drugs & Psychotropic Substances Act 1985

UNIT IV

Drugs (Prices Control) Order 1995.
Medicinal & Toilet Preparations (Excise Duties) Act 1955
Drugs and Magic Remedies (Objectionable Advertisements) Act 1954 and Rules 1955.

UNIT V

Study of the salient features of the following.

a.Prevention of Cruelty to animals Act 1960.

b.Medical termination of pregnancy act 1970 and rules 1975

c.Factories Act 1948.

d.WTO, GATT and The Indian Patents Act 1970

Text Books:

1. B.M.Mithal, Text book of Forensic Pharmacy, publ by Vallabh Prakashan
2. Suresh.B, Text book of Forensic Pharmacy
3. C.K.Kokate&S.B.Gokhale, Textbook of Forensic Pharmacy, Pharmabook, Syndicate.
4. N.k.jain. Textbook of Forensic Pharmacy. 7thed, Vallabh prakashan, 2007.

Reference Books:

1. Bare Acts and Rules Publ by Govt of India/state Govt from time to time.
2. Pharmaceutical policy of India
3. Notification from NPPA
4. Vijay Malik, Drugs & Cosmetics act 1940 and Rules, Eastern Law House Co. Delhi, Kolkata.
5. K.Sampath, Pharmaceutical Jurisprudence (Forensic Pharmacy) Jai Publishers.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

Subject	PHARMACY ADMINISTRATION (CBCC-I)	Code	15R00605
Course Year	B.Pharmacy III year	Sem	II
Theory	3hrs/week	Tutorial	1hr/week
End exam	70 Marks	Internal exam	30Marks
Credits	3		

Scope: This subject will provide an opportunity for the student to learn about the Organization of Distribution and Marketing, Principles of drug store and community pharmacy administration.

Objectives:

- To learn Manufacturing Management, work study insurance in pharma industry.
- To gain knowledge on drug store planning and layout.

Outcome:

1. To gain knowledge on basic fundamentals of management and administration in pharma industry.
2. To acquire knowledge on organization of distribution and marketing. (organization =correct spelling)

UNIT – I

Features of Business Organizations & New Economic Environment:

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

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

UNIT – II

Work Study -Basic procedure involved in Method Study and Work Measurement-Statistical Quality Control: *X* chart, R chart, *c* chart, *p* chart, (simple Problems), Acceptance Sampling, Deming's contribution to quality.

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

UNIT - III

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

UNIT – IV

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

UNIT – V

Principles of drug store and community pharmacy administration:

Drug store planning and layout, sales promotion and salesmanship in drug store. Accounting records in drug stores.

Text Books

1. Aryasri and Subbarao, Pharmaceutical Administration, TMH.
2. Smarta, Strategic Pharma Marketing
3. G.Vidya Sagar, Pharmaceutical Industrial Management. PBS/BS Publication 2005.

References

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

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

Subject	CLINICAL TRIALS (CBCC-I)	*Code*	15R00606
Course year	B. Pharmacy III year	*Semester*	II
Theory	3 hrs/week	*Tutorial*	1 hr / week
End Exam	70 Marks	*Internal marks*	30 Marks
Credits	3		

Scope: This subject will provide an opportunity for the student to learn about the Introduction to clinical trials.

Objective:

- To learn Phase I, II and III levels of clinical trials.
- To gain knowledge on statistical approaches for various endpoints.

Outcome:

1. To gain knowledge on clinical trials.
2. To acquire knowledge on Phase I, II, III toxicity studies and dosage calculations.
3. To learn the selection of volunteers for clinical trials.

UNIT –I

Overview of clinical trials

Introduction to clinical trials, Issues in modern clinical trials, Study population.

UNIT –II

Phase I trials:

Up-and-down design, Single patient per cohort design, Titration design.

Phase II trials:

Randomized dose ranging design, Randomized titration design, Two-stage phase II designs, Multistage design, Bayesian design, Randomized phase II design, Multiple outcomes design.

UNIT –III

Phase III trials:

Randomized controlled clinical trials, Uncontrolled trials, Historical controls, Crossover designs, Withdrawal studies, Factorial designs, Group allocation designs, Studies of equivalency.

Randomization methods: Simple randomization**,** Replacement randomization**,** Random permuted blocks**,** Blinded studies.

UNIT –IV

Baseline assessment, subgroup analysis, recruitment, multicenter trials: Use of baseline data, Analysis of baseline comparability, Balance and imbalance, Difficulties of subgroup analysis, Recruitment of study subjects, Multicenter trials

UNIT –V

Statistical approaches for various endpoints: t-test, chisquare test, Fisher's exact test, analysis of variance, regression analysis, longitudinal analysis, nonparametric statistics

Text Books

1. Chow SC, Liu JP. Design and Analysis of Clinical Trials: Concepts and Methodologies. New York, NY: Wiley; 1998.
2. Geller N, Chow SC. Advances in Clinical Trial Biostatistics. New York, NY: Marcel Dekker; 2004.

Reference Books

1. *Interdisciplinary Statistics*. New York, NY: Chapman & Hall; 1997.
2. Jennison C, Turnbull BW. *Group Sequential Methods with Applications to Clinical Trials*. New York, NY: Chapman & Hall; 2000.
3. Machin D, Day S, Green S, Everitt B, George S. *Textbook of Clinical Trials*. New York, NY: Wiley; 2004.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

Subject	**COSMETIC TECHNOLOGY (CBCC-I)**	***Code***	**15R00607**
Course year	**B. Pharmacy III year**	***Semester***	**II**
Theory	**3 hrs/week**	***Tutorial***	**1 hr / week**
End Exam	**70 Marks**	***Internal marks***	**30 Marks**
Credits	**3**		

Scope: This subject will provide an opportunity for the student to learn about Cosmetics, scientific background technology and its future.

Objectives: Upon completion of the subject student shall be able to

a. Understand various formulation aspects of cosmetic preparations.

b. Provide knowledge on excipients & its applications in cosmetics.

Outcomes:

1. Acquire skill in preparation of different types of cosmetics.

2. Demonstrate the handling of equipment for evaluation of various cosmetics.

3. Acquire the knowledge of processing of cosmetic, selection of materials for containers.

UNIT – I

Introduction of Cosmetics: Purposes of Cosmetics meaning of Cosmetics and cosmeceuticals. Classification of Cosmetics Quality characteristics and Quality Assurance Development Process of Cosmetics. Scientific background technology and its future.

UNIT – II

Excipients & its applications in cosmetics.

a. Oily Materials: Introduction, Oils and Fats, Wax, Hydrocarbons, Higher Fatty Acids, Higher Alcohols, Esters, Silicones.

b. Surface Active Agents: Introduction Anionic Surfactant, Cationic, Surfactants, Amphoteric Surfactant, Non-ionic, Surfactant. Other Surfactants.

c. Humectants: Introduction, Choice of Humectants Unusual Humectants, Special Uses of Humectants.

d. Antioxidants: Introduction, General Oxidative theory, Measurement of Oxidation and Assessment of Oxidant efficiency, Choice of Antioxidant.

UNIT – III

Safety of Cosmetics: Basic Concept of Cosmetic Safety, Safety test items & Evaluation method: Skin irritation, sensitization, Testing on Human (Patch test, Usage test)

UNIT – IV

Cosmetics Containers: Introduction, Characteristics required by Cosmetic Containers-Quality Maintenance functional Design, Optimum Packaging.

Types of Cosmetic Containers:- Narrow Mouth bottles, Wide Mouth Bottles (Containers), Tubes, tubular Containers, Powders Containers, Compact containers, Stick containers, pencil containers Applicator containers.

UNIT – V

Material of construction for containers: Types of Material Forming and processing methods. Container design procedure. Material test methods & Specifications. Trends in Container materials

Text Books

1) New Cosmetic Science by Takeo Mitsui
2) Harry's Cosmetology.

Reference Books

1) Cosmetic Science & Technology by Sagarin C.B.
2) Hand book of Cosmetic science & Technology by Marc paye, Andre O. Barel.
3) Cooper & Gunn Dispensing for Pharmaceutical Students.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

Subject	PHARMACOLOGY – II LABORATORY	Code	15R00608
CourseYear	B. Pharmacy III year	Sem	II
Lab	4hrs/week	Tutorial	Nill
End exam	70 Marks	Internal exam	30Marks
Credits	2		

Scope:

a. To find out the drugs that is beneficial in clinics.
b. Study the mechanism of Action and Site of action and their toxicities.
c. Study the actions of drugs existing in Preclinicals

Objectives:

To know and understand pharmacological investigation techniques applied in the research

Outcomes:

1. Acquires ability to apply experimental approaches in characterization of drugs.

2. Able to use the knowledge to screen novel drugs in different animal models.

A. EXPERIMENTAL PART

1. Experiments on Isolated Preparations:
   a. Calculate the PA_2 value of atropine using acetylcholine as an agonist on rat ileum preparation.
   b. Calculate the PA_2 value of chlorpheniramine using histamine as an agonist on guinea pig ileum preparation.
   c. Find out the strength of the given sample (e.g. Acetylcholine, Histamine, 5-HT. Oxytocin etc.) using a suitable isolated muscle preparation by
      i. Interpolation bioassay
      i. Matching or bracketing bioassay
      iii. Three point bioassay
      iii. Four point bioassay

2. Experiments on intact animals like
   a. Study of drug induced catatonia in rats
   b. Study of muscle relaxant activity (rotarod apparatus)
   c. Study of antipsychotic activity (pole climb response apparatus)
   d. Study of antianxiety activity (elevated plus maze)
   e. Study of analgesic activity (analgesiometer)
   f. Study of anti-inflammatory activity (plethysmometer)
   g. Study of antidepressant activity (swim test & tail suspension test)
   h. Study of anticonvulsant activity (electroconvulso meter)

i. Study of spontaneous motor activity and locomotor activity (actophotometer)

B. DEMO/ WORK SHOP

a. Screening of antiulcer activity
b. Invitro antioxidant activity
c. Screening of antihistaminic activity (histamine chamber)

C. SEMINAR/ ASSIGNMENT/ GROUP DISCUSSION

a. BABE studies
b. Invitro-invivo correlation studies
c. Pharmacovigilance
d. Biostatistics and its application

REFERENCES

1. Practicals in pharmacology By Dr.R.K.Goyal
2. Handbook of experimental pharmacology By S.K.Kulakarni
3. Experimental pharmacology By M.N.Ghosh
4. Experimental Pharamcology and Toxicology By Dr.B.M.VrushabendraSwamy and Prof.K.N.Jayaveera, S.Chand& Co.,

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

Subject	PHARMACEUTICAL ANALYSIS-II LABORATORY	Course Code	15R00609
Course Year	B. Pharmacy III Year	Semester	II
Lab	4 Hrs/ Week	Tutorial	NIL
End Exam	70 Marks	Internal Exam	30 marks
Credits	2		

Scope:

This subject will provide an opportunity for the student on handling of modern analytical instruments or equipment.

Objective:

- The course is designed to explore the knowledge in handling of modern analytical instruments or equipment.
- The course helps to understand the instrumental or equipment operational procedures

Outcomes:

- Analyze the drug compound independently by using the instrument.
- Design and deepen their practical skills so as to be capable of performing the analysis in a good manner.
- Compare the results in determination of percent purity of drug performed by self with monographs.

I. Experiments

1. Determination of λ- max of $KMnO_4$
2. Determination of λ- max of any one drug
3. Determination of isobestic point of any 2 drugs.
4. Estimate the unknown concentration of Paracetamol by UV Spectrophotometric method.
5. Estimate the unknown concentration of ciprofloxacin in the ciprofloxacin injection by colorimetric method.
6. Estimate the unknown concentration of Riboflavin by fluorimetric method.
7. Assay of Ibuprofen (any one drug) by UV-spectrophotometric method using calibrative curve method.
8. Assay of Paracetamol (any one drug) by UV-spectrophotometry-A (1%, 1 cm) method.

9. Assay of Pheniramine Maleate by UV-spectrophotometry-A (1%, 1 cm) method.
10. Study of quenching effect of quinine by Fluorimetry.
11. Determination of Na/K ions by Flame photometry.
12. Interpretation of UV Spectra.
13. Interpretation of IR Spectra
14. Interpretation of Mass Spectra
15. Interpretation of NMR Spectra

II. Demo/ Work Shop

1. Demonstration of UV instrumentation of single and double beam spectrophotometer.
2. Demonstration of IR instrumentation including KBr pressed pellet technique, ATR, liquid film technique.

III. Seminar/Assignment/Group Discussion

1. Determination of two drugs simultaneously by using UV spectrophotometer.
2. Reagent mechanisms: Ninhydrin, FC, MBTH, PDAC, PDAB (at least two)

LIST OF MINIMUM INSTRUMENTS/EQUIPMENTS REQUIRED

1. Fluorimeter
2. UV-Spectrophotometer
3. Digital balance
4. IR Spectrometer
5. Digital Colorimeter
6. Flame photometry
7. Hot air oven
8. Adequate glassware

REFERENCES:

1. Monographs: Indian Pharmacopoeia, British Pharmacopoeia, United States of Pharmacopoeia, European Pharmacopoeia, Japanese Pharmacopoeia.
2. AH Beckett & Stenlake, Text book of Practical Pharmaceutical chemistry, Vol. II Continum International Publishing Group, Althone.
3. Martindale: The Complete Drug Reference. 34th and 35th editions.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

Subject	**BIOPHARMACEUTICS AND PHARMACOKINETICS LABORAOTORY**	**Code**	**15R00610**
Course Year	**B. Pharmacy III year**	**Sem**	**II**
Lab	**4hrs/week**	**Tutorial**	**Nil**
End exam	**70 Marks**	**Internal exam**	**30Marks**
Credits	**2**		

Scope: This subject will provide an opportunity for the student to learn about the Biopharmaceutics and pharmacokinetic.

Objective:

- The course is designed to analysis of biological samples for drug content.
- The course helps to estimation of the pharmacokinetic parameters.

Outcomes:

1. Graduate will acquire knowledge on analysis of biological samples for drug content.
2. Able to calculate the pharmacokinetic parameters based on plasma level-time data & urine data.
3. Understand the statistical treatment of pharmaceutical data.

I. EXPERIMENTS

1. Analysis of biological samples for drug content and estimation of the pharmacokinetic parameters.
2. *In vitro* evaluation of tablet/capsule for drug release
3. Drug-protein binding studies.
4. Statistical treatment of pharmaceutical data.
5. Problems related to pharmacokinetics – determination of PK Parameters
6. Problems related to bioavailability and bioequivalence.

II. DEMO/ WORKSHOP

1. Absorption studies – *in vitro*.
2. Experiments designed for the estimation of various pharmacokinetic parameters.

III. SEMINAR/ASSIGNMENT/GROUP DISCUSSION

Chronopharmacokinetics.

Text Books:

1. L. Shargel and ABC Yu, textbook of applied biopharmaceutics & Pharmacokinetics, 4th edn, Appleton – centuary – crofts, Connecticut, 2004.
2. Milo Gibaldi, Biopharmaceutics and clinical pharmacokinetics 4/Edn. Pharma BookSyndicate.Hyderabad.
3. DM Brahmankar and SB Jaiswal, biophamaceutics and pharmacokinetics- a treatise, vallabh prakasham, Delhi.

Reference Books:

1. Ronald & trouser. Clinical pharmacokinetics concepts & applications. 3rd ed, wolterskluwer Pvt Ltd., 2007.
2. Robert E notary, Biopharmaceutics and pharmacokinetics – an introduction, marcel dekker inc., NY
3. Basic pharmacokinetics by Hedaya, CRC press.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B. Pharmacy III-II Sem.	L	T	P	C
	0	0	2	0

15A52602 ADVANCED ENGLISH LANGUAGE COMMUNICATION SKILLS (AELCS) LAB (Audit Course)

1. INTRODUCTION

With increased globalization and rapidly changing industry expectations, employers are looking for the wide cluster of skills to cater to the changing demand. The introduction of the Advanced Communication Skills Lab is considered essential at 3rd year level. At this stage, the students need to prepare themselves for their careers which may require them to listen to, read, speak and write in English both for their professional and interpersonal communication in the globalised context.

The proposed course should be a laboratory course to enable students to use 'good' English and perform the following:

- Gathering ideas and information and to organise ideas relevantly and coherently.
- Engaging in debates.
- Participating in group discussions.
- Facing interviews.
- Writing project/research reports/technical reports.
- Making oral presentations.
- Taking part in social and professional communication.

2. OBJECTIVES:

This Lab focuses on using multi-media instruction for language development to meet the following targets:

- To improve the students' fluency in English, through a well-developed vocabulary and enable them to listen to English spoken at normal conversational speed by educated English speakers and respond appropriately in different socio-cultural and professional contexts.
- Further, they would be required to communicate their ideas relevantly and coherently in writing.
- To prepare all the students for their placements.

3. SYLLABUS:

The following course content to conduct the activities is prescribed for the Advanced English Communication Skills (AECS) Lab:

UNIT-I: COMMUNICATION SKILLS

1. Reading Comprehension
2. Listening comprehension
3. Vocabulary Development
4. Common Errors

UNIT-II: WRITING SKILLS

1. Report writing
2. Resume Preparation
3. E-mail Writing

UNIT-III: PRESENTATION SKILLS

1. Oral presentation
2. Power point presentation
3. Poster presentation

UNIT-IV: GETTING READY FOR JOB

1. Debates
2. Group discussions
3. Job Interviews

UNIT-V: INTERPERSONAL SKILLS

1. Time Management
2. Problem Solving & Decision Making
3. Etiquettes

4. LEARNING OUTCOMES:

- Accomplishment of sound vocabulary and its proper use contextually
- Flair in Writing and felicity in written expression.
- Enhanced job prospects.
- Effective Speaking Abilities
-

5. MINIMUM REQUIREMENT:

The Advanced English Communication Skills (AECS) Laboratory shall have the following infra-structural facilities to accommodate at least 60 students in the lab:

- Spacious room with appropriate acoustics.
- Round Tables with movable chairs
- Audio-visual aids
- LCD Projector
- Public Address system

- P – IV Processor, Hard Disk – 80 GB, RAM–512 MB Minimum, Speed – 2.8 GHZ
- T. V, a digital stereo & Camcorder
- Headphones of High quality

6. SUGGESTED SOFTWARE:

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

1. **Walden Infotech: Advanced English Communication Skills Lab**
2. **K-VAN SOLUTIONS-Advanced English Language Communication Skills lab**
3. **DELTA's key to the Next Generation TOEFL Test: Advanced Skills Practice.**
4. **TOEFL & GRE**(KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)
5. **Train2success.com**

7. BOOKS RECOMMENDED:

1. **Objective English for Competitive Exams**, Hari Mohana Prasad, 4th edition, Tata Mc Graw Hill.
2. **Technical Communication** by Meenakshi Raman & Sangeeta Sharma, O U Press 3rd Edn. 2015.
3. **Essay Writing for Exams, Audrone Raskauskiene, Irena Ragaisience & Ramute Zemaitience,OUP, 2016**
4. **Soft Skills for Everyone**, Butterfield Jeff, Cengage Publications, 2011.
5. **Management Shapers Series** by Universities Press (India) Pvt Ltd., Himayatnagar, Hyderabad 2008.
6. **Campus to Corporate,** Gangadhar Joshi, Sage Publications, 2015
7. **Communicative English,**E Suresh Kumar & P.Sreehari, Orient Blackswan, 2009.
8. **English for Success in Competitive Exams,** Philip Sunil Solomon OUP, 2015

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

Subject	NOVEL DRUG DELIVERYSYSTEMS	*Code*	15R00701
Course year	B. Pharm IV year	*Semester*	I
Theory	3 hrs/week	*Tutorial*	1hr/week
End exam	70 marks	*Internal exam*	30 marks
Credits	3		

Scope: The novel drug delivery systems course provide the knowledge about various novel and targeted systems- formulation, evaluation and applications

Objectives: To learn the novel technologies in drug delivery systems
Outcomes: Student must able to formulate the drug delivery systems for drugs.

UNIT I
Concepts of controlled release, sustained release, extended release, timed release and delayed release.Rationale behind the design of above delivery systems. Factors influencing the design andperformance of sustained and controlled release dosage forms.

UNIT II
Oral Control Drug Delivery Systems: Fundamentals, Dissolution Controlled, Diffusion Controlled,Ion Exchange Resins, Osmotic based systems, pH Independent Systems , altered density systems anduse of polymers in controlled drug delivery.

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

UNIT IV
Transdermal Drug Delivery Systems: Fundamentals, permeation of drugs across the skin, types ofTDDS, Materials employed and Evaluation of TDDS.

UNIT V
Mucoadhesive Delivery Systems: Mechanism of bioadhesion, mucoadhesive materials, formulationand evaluation of Buccal and Nasal drug delivery systems.

Text Books:

1. Robinson JR and Vincent HL lee. Controlled drug delivery fundamentals and applications, 2ed, marcel dekker 2005.
2. YiewChien, Novel drug delivery systems, 2nded, marcel dekker 2003.

Reference Books:

1. N.K. Jain, Advances in Control & Novel drug delivery, CBS Publishers.
2. Lippincott Williams and Wilkins, Remington Pharmaceutical Sciences
3. E.ARawlkins, Bentley˝s Text Book of Pharmaceutics, Elbspubl

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

Subject	**PHARMACOLOGY – III**	**Code**	**15R00702**
Course Year	**B.Pharmacy IVyear**	**Sem**	**I**
Theory	**3hrs/week**	**Tutorial**	**1hr/week**
End exam	**70 Marks**	**Internal exam**	**30Marks**
Credits	**3**		

Scope: This subject will provide an opportunity for the student to learn pharmacological information about the drugs. In this subject drugs acting on gastrointestinal system, chemotherapeutic agents, principles of toxicology and bioassays will be taught.

Objectives: Upon completion of the subject student shall be able to Understand various pharmacological aspects like mechanism of action, pharmacokinetics, sideeffects,druginteractions,contraindications and indications of drugs falling under below mentioned chapters.

Outcomes:

a. Correlate and apply the knowledge.
b. Handle the animals and carry out the experiments on animals
d. Understand the chemotherapy of various diseases

UNIT I.Drugs acting on the gastrointestinal tract

a. Anti-ulcers Drugs
b. Laxatives and anti-diarrhoeal drugs
c. Emetics and anti-emetics
d. Appetite Stimulants and Suppressants

UNIT II. Chemotherapeutic agents and their applications

a. General principles of chemotherapy.
b. Sulphonamides, co-trimoxazole and β-lactam antibiotics
c.Tetracyclines, aminoglycosides, chloramphenicol, macrolides, quinolones, fluoroquinolones and polypeptide antibiotics

UNITIII.

a. Chemotherapy of tuberculosis & leprosy
b. Chemotherapy of malignancy and immunosuppressive agents.

UNIT IV.

a. Chemotherapy of fungal and viral diseases
b. Chemotherapy of protozoal diseases and helminticinfections

UNITV. Principles of toxicology &Principles of bioassays.

a. Definition of poison, general principles of treatment of poisoning
b. Treatment of barbiturate, opiod, organophosphorous and atropine poisoning. Heavy metals and heavy metal antagonisits. LD_{50},ED_{50} and therapeutic index
c. Principles of bioassays and errors in bioassys.
d. Study of bioassay methods for the following drugs
   i. Digitalis ii. d-tubocurarine, iii. Oxytocin iv. Insulin v. HCV

Text Books:

1. H.P Rang, M. M. dale & J.M. Ritter, Pharmacology, Churchill living stone, 4th Ed.
2. J.G. Hardman and Lee E. Limbard, Good Mann &Gilmann, The Pharmacological basis of therapeutics, Mc Grawhill, Health Professions Dvn.
3. Illiterated Pharmacology by Lippincotts

REFERENCES

1. Tripathi, Essentials of Medical Pharmacology, Jaypee Brother's, Latest Edition
2. Sathoskar, Pharmacology and pharmaco therapeutics Vol. 1 & 2, Publ by Popular Prakashan, Mumbai.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

Subject	CLINICAL AND HOSPITAL PHARMACY	Code	15R00703
CourseYear	B.Pharmacy IV year	Sem	I
Theory	3hrs/week	Tutorial	1hr/week
End exam	70 Marks	Internal exam	30Marks
Credits	3		

Scope: To acquire the Knowledge about Clinical Procedures and study of case reports.

Objectives: Patient counseling and Dispensing of Drugs and identification of drug interactions in Prescriptions.

Outcomes: To council the patients about usage of drugs and drug interactions

UNIT I

Introduction to clinical pharmacy:

a. Prospects and perspectives of clinical pharmacy in national and international scenario, scopeof clinical pharmacy
b. Therapeutic Drug Monitoring.
c. Clinical Pharmacokinetics and individualization of Drug Therapy.
d. Concept of Essential Drugs and Rational Drug use.

UNIT II

Introduction to daily activities of Clinical pharmacist

a. Drug therapy monitoring (Medication chart review)
b. Adverse Drug Reactions & Drug Interactions
c. Patient counseling
d. Drug and poison information.
e. Ward round participation.

UNIT III

Clinical laboratory tests and interpretation of test results.

a. Hematological (complete blood picture)
b. Pulmonary function tests
c. Tests associated with cardiac disorders
d. Liver, Renal function tests

UNIT IV

Hospital Management

Organization of a hospital and hospital pharmacy (drug store), responsibilities of a hospital pharmacist, pharmacy and therapeutic committee. Hospital formulary,

purchase and inventory control,role of Pharmacist in community health care and education.

UNIT V

Drug distribution and records

Procedural manual, drug distribution, dispensing to out-patients, in-patients and ambulatory patientdispensingof ancillary and controlled substances. Prescription filling, drug profile.

Text Books:

a. A Textbook of clinical pharmacy practice: Essential concepts and skills. Dr G Parthasarathiet al. Orient Longmannpvt ltd. ISSBN: 8125026
b. Leon shargel, comprenhesive pharmacy review, Latest Edition
c. Health Education and Community Pharmacy, Gupta AK, CBS, Publ. and Distributors New Delhi – (2010).

Reference Books:

1. J.G. Hardman and Lee E. Limbard, Good Mann &Gilmann, The Pharmacological basis oftherapeutics, Mc Grawhill, Health Professions Dvn.
2. Health Education and Community Pharmacy, NK Jain, CBS, Publ. and Distributors New Delhi.
3. *Hospital pharmacy by Hassan.*

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

Subject	**MEDICINAL CHEMISTRY-II**	**Code**	**15R00704**
CourseYear	**B.Pharmacy IV year**	**Sem**	**I**
Theory	**3hrs/week**	**Tutorial**	**1hr/week**
End exam	**70 Marks**	**Internal exam**	**30Marks**
Credits	**3**		

Scope: This subject will provide an opportunity for the student to learn medicinal chemistry information about the drugs. In this subject student will be able to understand the properties and its biological activity of the drugs.

Objectives: Upon completion of the subject student shall be able to

1. Understand various drugs structure, their properties and biological activities.
2. Correlate and apply the knowledge.
3. Influence of chemical structure on biological activities.

Outcomes:

1. Acquire skill in the structure of drugs and their biological activities.
2. Acquire the knowledge of synthesis of chemical compounds.
3. Assay of some official compounds.

UNIT I

Drugs acting on renal system Renin-Angiotensin system inhibitors: Captopril*, Enalapril*, Losartan*.

Diuretics: Acetazolamide, Hydrochlorthiazide*, Furosemide*, Ethacrynic acid*, Spironolactone, Amiloride, Triamterene and Mannitol. SAR- Carbonic anhydrase inhibitors, Thiazides, Loop diuretics.

UNIT II

Drugs acting on CVS

Anti anginal agents & vasodilators: Nitroglycerin*, Isosorbide dinitrate*. Ion channel blockers- Verapamil, Diltiazem, Nifedipine, Amlodipine*.

Antithrombotic agents- Aspirin, Dipyridamole, Clopidogrel*

Antiarrhythmic drugs: Quinidine, Procainamide*, Lidocaine, Mexiletine*, Amiodarone, Sotalol.

Antihypertensive agents: classification, Reserpine, Prazosin, Clonidine, Hydralazine, Sildenafil citrate, Minoxidil, Amrinone,. SAR- beta-blockers.

Antihyperlipidemic agents: Fenofibrate*, Dextrothyroxine, Colestipol, Nicotinic acid, ß-Sitosterol, Probucol, Ezetimibe, Simvastatin, Atorvastatin, Rosuvastatin. SAR-HMG CO-A inhibitors

UNIT III

Drugs acting on Blood, hypoglycemic agents and thyroid.

Anticoagulants: Factors, Warfarin sodium*, Dicumarol

Synthetic hypoglycemic agents: Tolbutamide*, Tolazamide, Glipizide, Glimepiride, Gliclazide, Pioglitazone, Metformin*, Miglitol.

Thyroid and antithyroid drugs: Levothyroxine,Liothyronine, Propylthiouracil.

UNIT IV

Analgesic, antipyretic and anti-inflammatory agents

Opioids:Morphine, Levorphanol, Pentazocine, Meperidine*, Methadone, Tramadol*, Buprenorphine. Opioid antagonist: Naltrexone, Naloxane, Methylnaltrexone.

NSAIDs: A note on prostaglandins and leukotrienes. Aspirin, Indomethacin, Sulindac*, Ketorolac, Ibuprofen, Naproxen, Mefenamic acid, Diclofenac*, Piroxicam, Celecoxib, Paracetamol*.

Management of Gout and Hyperuricemia:, Allopurinol*, Sulfinpyrazole.

Antimigraine drugs: Sumatriptan, SAR – Salicylates, Aryl propionic acids.

UNIT V

Antibiotics β- Lactams: Penicillin G, Ampicillin*, Amoxicillin. β- Lactamase inhibitors: Clavulanate potassium, Sulbactam.

Cephalosporins: Cephalexin*, Cefixime. SAR-Penicillins and Cephalosporin

Aminoglycosides and Tetracyclines: Streptomycin, Gentamicin, Tobramycin, Tetracycline, Doxycycline. SAR- Aminoglycosides and tetracyclines

Macrolides and Lincomycins: Erythromycin, Azithromycin, Clindamycin.

Miscellaneous: Chloramphenicol,

NOTE: Introduction, definition, chemical classification with structure, nomenclature, synthesis (only for * marked drugs), mechanism of action, SAR including stereo chemical aspects, metabolites (including its ADR) and therapeutic uses of the following classes of drugs from UNIT I to UNIT V.

Text Books

1. William O. Foye, Textbook of Medicinal Chemistry, Lea Febiger, Philadelphia.
2. An Introduction to Medicinal Chemistry by Graham. L. Patrick, Oxford University publishers.

3. JH Block & JM Beale (Eds), Wilson &Giswold"s Text book of organic Medicinal Chemistry and pharmaceutical chemistry, 11th Ed, Lipcolt, Raven, Philadelphia, 2004
4. Rama Rao Nadendla, Medicinal Chemistry; Mc Millan Publishers.

Reference Books:

1. Hansch, Comprehensive medicinal chemistry, Vol 1 – 6 Elsevier pergmon press, Oxford
2. Abraham (Ed), Burger Medicinal chemistry and Drug discovery, Vol. 1 & 2. John Wiley & Sons, New York 2003, 6th Ed.
3. M. Atherden, Bentley and Driver"s Textbook of Pharmaceutical Chemistry Ed: I.Oxford University Press, Delhi.
4. Daniel lednicer, Strategies for Organic Drug Synthesis and Design, John Wiley, N. Y. 1998. 5. D. Lednicer, Organic drug synthesis, Vol, 1 – 6, J.Wiley N.Y.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

Subject	CHEMISTRY OF NATURAL PRODUCTS (CBCC-II)	*Code*	15R00705
Courseyear	B. PharmIV year	*Semester*	I
Theory	3 hrs/week	*Tutorial*	1hr/week
End exam	70 marks	*Internal exam*	30 marks
Credits	3		

Scope: To Study the Phytochemical evaluation and Synthesis of natural Products

Objectives: To identify the structure and screening of the natural products

Outcomes: Acquire the skills in determination of structure, mechanism of action and uses of Natural products.

UNIT I

Phytochemical Screening: Preparation of extracts, screening of alkaloids, saponins, cardiac glycosides,flavonoids,tanninsandanthraquinonesinplantextracts.Identificationandestimationof various phytoconstituents.

Planttissueculture: History, types, media requirements, methodology forestablishmentofcell cultures; growthmeasurements, viabilitymeasurementsandapplications. Micropropagation, immobilization, hairy root culture.

Cosmeceuticals:

General introduction to cosmeceuticals, role of herbs in cosmetics. Study of the followingcosmeceuticals-Amla, Henna, Cyperus, SoapNut, AloeVera, Turmeric, SandalWood and Bitter Orange Peel.

Neutraceuticals:Definition, introduction and study ofGarlic, Spirulina, Soya and Royaljelly.

Introduction and importance of trade in herbal medicine, herbal cosmetics and Indian herbal drug industry.

UNIT II

General structural elucidation of natural products

Chemical methods for determination of active hydrogen, methoxy, hydroxyl, N-methyl and degradation (Hoffmann, Edmannetc) techniques for the determination of ring size. Structural elucidation ofEphedrine, Atropine,Morphine, Papaverine.

UNIT III

Alkaloids

Definitionofalkaloids,pseudoalkaloidsandprotoalkaloids.Generalmethodsofextraction,isolation,Propertiesandtestsforalkaloids.

Opiumalkaloids: Structuralfeatures of Morphinemolecule – Peripheralgroups. Modification of structureand effecton analgesic activity– SAR of morphineand morphine-like analgesics.

Narcotic antagonists: Nalorphine, Levallorphan. Anti-tussiveagents: Noscapine, Dextromethorphan.

Smoothmusclerelaxants:Papaverineandrelatedcompoundslikeethaverine,Dioxyline. Structures and usesof thesecompounds.

Tropanealkaloids: Structures of Atropine/hyoscyamine, Hyoscine, Hydrolytic products of these–Tropine and Scopine. Relationship between tropine&pseudotropine. Biological actions and usesof tropanealkaloids.Homatropine.

Rauwolfiaalkaloids: Structures and uses of Reserpine, Rescinnamine, Deserpidine, ajmaline, syrosingapine. Hydrolysisof reserpine andrescinnamine.Mechanismofaction of reserpine.

Ergotalkaloids: Classification,structures,hydrolyticproducts,pharmacologicalactions,therapeutic uses andtoxicity. Synthetic derivatives: Methyl ergonovine(Methyl ergometrine), LSD, Ethysergide.

UNIT IV

Terpenes&Terpenoids:

Introduction to Volatile oils, terpene vs terpenoids, Classification, isoprene, special isoprene and gem- dialkyl rules. Sources and structures, general extraction procedure for Citral, citral-a (Geranial), citral-b (Neral). Alpha-terpeniol, Carvone, Menthol, Menthone, 1,8- Cineole, Camphor. Chemical transformation and interconversion of citral to citronellal, citronellol, geraniol, nerol, geranicacid, p-cymene, alfa-terpeneolandionones.Conversionandinterconversion ofcamphorintocamphoricacid,camphoronicacids, p-cymene, Borneol,isoborneol.

UNIT V

Steroids: Introduction, nomenculature and classification of steroids. Stereochemistry of Cholesterol. Uses of Bile acids, steroidal hormones. Different Sources of steroidal drugs like diosgenin, cholesterol, stigmasterol and ergosterol.

Synthetic oestrogens like diethylstilbosterol, hexosterol,17-alphaethinyloestradiol, Interconversions of Estrone, Estriol,Estradiol.Chemistryofketoandnonketoadrenocorticoids.Anoteonanabolic steroids (Structures and uses).

Cardiac glycosides: Structures of glycosides from Digitalis, Strophanthus, SquillandBufa. Enzymatic andacid hydrolytic reactions of the glycosides. Mechanismofaction, SAR,therapeutic usesand toxicity.

TextBooks:

1. IL Finar, Organicchemistry, Vol. 1 &2, the Englishlanguagebooksociety, London, NewDelhi.
2. O.P. Agarwal, Naturalproductsby. Vol.1 &2, Goelpublications– Meerut.
3. Kokate CK, PurohitA.P. &Gokhale;PharmacognosyNiraliPrakashan, New Delhi.

ReferenceBooks:

1. RTMorrison and R.NBoyd, Organic chemistry, AllynandBacon,inc., boston
2. Me–Wolf,ed., Burger"smedicinalchemistry,J. Wiley&sons, NY.
3. F.G. Mann &B. Saunders,PracticalOrganicchemistryLongmansgreen&Co. Ltd., UK.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

Subject	**COMPUTER AIDED DRUG DESIGN (CBCC- II)**	**Code**	**15R00706**
CourseYear	**B.Pharmacy IV year**	**Sem**	**I**
Theory	**3hrs/week**	**Tutorial**	**1hr/week**
End exam	**70 Marks**	**Internal exam**	**30Marks**
Credits	**3**		

Objectives:

1. CADD course covers the key areas of computational chemistry methods as applied to the modelling of biological processes and to rational drug design, building on students' knowledge of theoretical chemistry.
2. This course also deals with cheminformatics, relations between thermodynamic properties and protein-ligand binding by structure.

Outcomes:

1. Describe the use of lead candidates and database representations
2. Explain the drug development pipeline and understand where computational chemistry fits in chemistry
3. Apply how to use software in structure prediction, ligand design methods, docking programs etc.,

UNITI

Introduction to computer aided drug design: Introduction, types of enzyme inhibition,how drugs are discovered, and the basics of mechanistic drug design, important techniques **UNITII**

Uses of computer graphics in computer aided drug design: Computer graphics displays, Computed molecular models, Molecular modeling systems for drug design, uses of computer-assisted drug design, extending molecular modeling.

UNITIII

Molecular mechanics and molecular dynamics: Potential energy function,Non-bonded energy terms, electrostatic energy, hydrogen bonds, energy minimization, applications of theoretical techniques to drug design.

UNITIV

Computer-Aided Drug Design

EARLY METHODS: Statistical Prediction of Pharmacological Activity, Molecular descriptors based on lipophilicity (Partition coefficient 'logP',substituent hydrophobicity

constant 'π'), polarizability (Molar refractivity, Molar volume), steric (Taft's Steric Factor 'Es', Charton's steric parameter r_v, Verloopparameters), electrostatics (Hammet substitution constant 'σ', ionization 'pKa') and quantum mechanical (Partial atomic charges, dipolemoment, HOMO/LUMO)

NEWER METHODS: Forces Involved with Drug–Receptor Interactions, Optical Isomerism and Biological Activity, conformational analysis, Comparative/Homology modeling, Molecular Docking, Pharmacophore modeling, Quantitative Structure–Activity Relationships, Structural alerts, Database Searching and Mining, Isosterism.

UNITV

Inhibitors of Dihydrofolate Reductase: The enzyme, enzyme – inhibitor interactions, inhibitor design. **Approaches to antiviral drug design:** Rhinovirus as a drug receptor, Designing Antiviral drugs. **Conformational Biological activity relationships for Receptor-selective, conformationally constrained Opoid peptides**: Design of conformationally constrained Delta and μ Opoid Receptor-selective peptides, Problems and prospects for rational design of Receptor-selective peptides.

Text Books:

1. **Computer aided drug design** Methods and Applications by Thomas J.Perun, C.L. Propst; Marcel Dekker, 2010.
2. Wilson and Gisvold's**Text book of Organic Medical and Pharmaceutical Chemistry** by John M. Beale, John H. Block; Lippincott Williams & Wilkins, 12th Edition, 2011.
3. **Molecular Modelling: Principles and Applications** by Andrew R. Leach, Published by Pearson Education EMA, January 2001.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

Subject	**PHARMACOVIGILANCE (CBCC- II)**	**Code**	**15R00707**
CourseYear	**B.Pharmacy IV year**	**Sem**	**I**
Theory	**3hrs/week**	**Tutorial**	**1hr/week**
End exam	**70 Marks**	**Internal exam**	**30Marks**
Credits	**3**		

Scope: To study Adverse effects and monitoring of adverse Drug Reactions
Objectives: To Identify the Adverse drug reactions and surveillance of Reports.
Outcomes: Should have the Knowledge about the terminology of adverse medication related events, roles and responsibilities in Pharmacovigilance.

UNIT –I

Introduction to Pharmacovigilance

- History and development of Pharmacovigilance
- Importance of safety monitoring / Why Pharmacovigilance

National and international scenario

- Pharmacovigilance in India
- Pharmacovigilance global perspective
- WHO international drug monitoring programme

UNIT –II

Basic terminologies used in Pharmacovigilance

- Terminologies of adverse medication related events
- Information resources in Pharmacovigilance

Establishing Pharmacovigilance programme

- Establishing in a hospital
- Establishment & operation of drug safety department in industry
- Establishing a national programme
- SOPs – Types, designing, maintenance and training
- Roles and responsibilities in Pharmacovigilance
- Licence Partners, Contract Research Organisations (CROs) and Market Authorisation Holders (MAH)

UNIT –III

- Pharmacovigilance methods
- Passive surveillance – Spontaneous reports and case series
- Stimulated reporting
- Active surveillance – Sentinel sites, drug event monitoring and registries
- Comparative observational studies – Cross sectional study, case control study and cohort study

UNIT –IV

- Adverse drug reaction reporting
- Introduction to reporting systems
- Spontaneous reporting system
- Reporting to regulatory authorities
- Guidelines for reporting ADRs in biomedical literature

UNIT –V

- Communication in Pharmacovigilance
- Effective communication in Pharmacovigilance
- Communication in Drug Safety Crisis management
- Communicating with Regulatory Agencies, Business Partners, Healthcare facilities &Media, Doctor Letters to Healthcare Professionals

TEXTBOOKS

1. Textbook of Pharmacovigilance by S.K. Gupta, Jaypee brothers.
2. Pharmacovigilance by Ronald D. Mann, Elizabeth B.Andrews, 2nd edition.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

Subject	NOVEL DRUG DELIVERY SYSTEMS LABORATORY	*Code*	15R00708
Course year	B. Pharm IV year	*Semester*	I
Lab	4 hrs/week	*Tutorial*	NIL
End exam	70 marks	*Internal exam*	30 marks
Credits	2		

Scope: This subject will provide an opportunity for the student to learn about preparation and evaluation of Novel Drug Delivery Systems.

Objectives: Upon completion of the subject student shall be able to

a. Understand various Novel Drug delivery systems and their preparations.

b. Provide knowledge on filing of various regulatory agencies.

Outcomes:

1. Acquire skil,l in preparation and evaluation of variousNovel formulations.
2. Acquire the knowledge ofProduct development and filing to various regulatory agencies.

I. EXPERIMENTS:

1. Preparation and evaluation of Matrix Tablets
2. Prepartion and evaluation of Transdermal Drug Delivery Systems.
3. Formulation and evaluation of Mucoadhesive Delivery Systems.
4. Evaluation of Market Sustained Release Formualtions.
5. Preparation and evaluation of microspheres.
6. Assignment on Product development and filing to various regulatory agencies, FDA, TGA.Etc (Ref.: www.fda.gov)

II. Demo/ Workshop

Floating drug delivery system.

III. SEMINAR/ASSIGNMENT/GROUP DISCUSSION

Advances in novel drug delivery.

Text Books:

1. N.K. Jain, Advances in Control & Novel drug delivery, CBS Publishers.
2. NK Jain, Pharmaceutical product development, CBS publishers.
3. L. Lachman, H.A, Lieberman and J.L. Kanig, Theory & Practice of industrial pharmacy by, Lea &Febieger, Philadelphia Latest Edn.

Reference Books:

1. Gilbert S. Banker and Christopher T Rhodes, Modern Pharmaceutics, IVthed, marcel dekker,usa, 2005.
2. Controlled drug delivery systems by Robinson.
3. YiewChien, novel drug delivery systems, 2nded, marcel dekker 2003.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

Subject	CLINICAL AND HOSPITAL PHARMACY LABORATORY	*Code*	15R00709
Course year	B. Pharm IV year	*Semester*	I
Lab	4 hrs/week	*Tutorial*	NIL
End exam	70 marks	*Internal exam*	30 marks
Credits	2		

Scope: This subject will provide an opportunity for the student to learn about various parental preparations.

Objectives: Upon completion of the subject student shall be able to Underst and various Sterilization techniques and parenteral preparations. Provide knowledge on Role of Pharmacist in patient counseling.

Outcomes:

1. Acquire skill in preparation parenteral Preparations.
2. Acquire the knowledge on First Aid treatment and improving patient Compliance.

I. EXPERIMENTS:

1. Preparation of water for injection IP
2. Test for pyrogens on water for injection IP
3. Determination of suitability of NaCl for preparation of transfusion fluid by flame photometer
4. Hydrolytic resistance test on glass used for transfusion fluids
5. Preparation of 5% W/V dextrose IV infusion IP
6. Preparation of 0.9% W/V NaCl IV infusion IP
7. Preparation of Compound NaCl injection (Ringers solution) IP
8. Preparation of NaCl& dextrose injection IP
9. Preparation of sodium bicarbonate intravenous infusion BP
10. Determination of sinking time and water holding capacity of absorbent cotton wool IP
11. Demonstration: Sterilization of surgical instruments, syringes, needles, rubber gloves, hospital fabrics and surgical dressings

II. ASSIGNMENT

1. Assignment 1: Study of role of pharmacist in first aid treatment
2. Assignment 2: Study of role of pharmacist in improving patient compliance

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

Subject	**MEDICINAL CHEMISTRY-II LABORATORY**	**Code**	**15R00710**
Course Year	**B.Pharmacy IV year**	**Sem**	**I**
Lab	**4hrs/week**	**Tutorial**	**NIL**
End exam	**70 Marks**	**Internal exam**	**30 Marks**
Credits	**2**		

Scope: This subject will provide an opportunity for the student on synthesis of various compounds.

Objectives: Upon completion of the subject student shall be able to

c. Synthesis various chemical compounds.

d. Provide knowledge on monograph analysis of some chemical compounds.

Outcomes:

1. Acquire skills in synthesis various chemical compounds.
2. Demonstrate of stereo models of some drugs relevant to theory.
3. Acquire skills of extraction of drugs from different dosage forms.

EXPERIMENTS:

1. Synthesis of Paracetamol from p-amino phenol
2. Synthesis of Cinnamic acid from benzaldehyde
3. Synthesis of Benzotriazole from o-phenylene diamine
4. Synthesis of 1-phenyl-3-methyl-5-pyrazolone from hydrazine hydrate
5. Synthesis of 7-Hydroxy-4-methyl coumarin from resorcinol and ethyl acetoacetate
6. Synthesis of Salicylaldehyde from phenol
7. Identification and test for purity for Aspirin tablet as per IP
8. Identification and test for purity for Acetazolamide tablet as per IP
9. Identification and test for purity for propranolol tablet as per IP
10. Identification and test for purity for Diclofenac sodium tablet as per IP
11. Identification and test for purity for Paracetamol tablet as per IP

II. DEMO/WORKSHOP: Microwave assisted organic synthesis, Purification of synthesized compounds (Column chromatography), Demo on Thin layer chromatography.

III. SEMINAR/ASSIGNMENT/GROUP DISCUSSION Antibiotic discovery in the twenty-first century: Current trends and future perspectives, Current Trends in β-Lactam based β-Lactamase inhibitors and CVS agents.

References:

1. A.I. Vogel, Text Book of Practical Organic Chemistry, 5th Edition. Pearson, Prentice Hall.
2. F.G. Mann & B.C. Saunders, Practical Organic Chemistry, 4th Edition, Pearson Publishers.

LIST OF MINIMUM EQUIPMENTS REQUIRED

1. Water bath
2. Suction pumps
3. Analytical/physical balance
4. Triple beam balance
5. Reflux flask with condenser
6. Hot plates
7. Refrigerator
8. Mechanical and magnetic stirrer with thermostat
9. Distillation unit
10. Oven
11. Adequate glass wares

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

Subject	**MOOCS -II (Biostatistics and Design of Experiments) / Conventional/ Self study**	**Code**	**15R00801**
Course Year	**B.Pharmacy IV year**	**Sem**	**II**
Lab	**3hrs/week**	**Tutorial**	1hr/week
End exam	**70 Marks**	**Internal exam**	**30 Marks**
Credits	**3**		

SCOPE: Biostatistics is the application of statistics to different topics in biology including medicine, pharmacy, public health science, agriculture and fishery. It involves the analysis of data from experiments; its interpretation and drawing conclusion from the results. It involves the application of statistical theory to real-world problems, the practice of designing and conducting biomedical experiments and clinical trials. Design of experiments is planning experimental strategy, screening a large number of parameters and selecting the important ones, determining the minimum number of experiments and deciding on the mode and manner in which experiment have to be conducted. The course encompasses topics such as distribution of data, sample size, tests of significance, data reduction, regression analysis, comparison of performance of drugs in clinical trials, design of experiments, screening and second order designs.

UNIT I

Introduction to Statistics

Various Distributions: Normal Distribution, sample and Population, Z distribution.

UNIT II

Test of Significance, t- test, F test, ANOVA.

UNIT III

2 test/odds ratio, Non-Parametric test, other tests.

UNIT IV

Design of Experiments: Introduction to design of experiments, screening designs – Data Analysis.

UNIT V

Higher order Designs - Data analysis

Regression Analysis – Data reduction

REFERENCES:

1. 'Biostatistics', KS Negi, AITB Publishers, Delhi.
2. 'Fundamentals of Biostatistics',Irfan Ali Khan, Ukaaz Publications
3. 'Biostatistics for Pharmacy', Khan and Khanum, Ukaaz Publications
4. 'Basic statistics and Pharmaceutical applications', J.E, Demuth,Mercel & Dekker.
5. 'Applied statistics' by S.C.Gupta &V.K.Kapoor
6. 'Fundamentals of mathematical statistics' by S.C.Gupta & V.K.Kapoor

NPTEL: http://nptel.ac.in/courses/102106051/

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

Subject	**MOOCS – III (Intellectual Property Rights) / /Conventional/ Self study**	**Code**	**15R00802**
Course Year	**B.Pharmacy IV year**	**Sem**	**II**
Lab	**3hrs/week**	**Tutorial**	**1 hr/week**
End exam	**70 Marks**	**Internal exam**	**30 Marks**
Credits	**3**		

SCOPE: The course is designed to introduce fundamental aspects of Intellectual property Rights to students who are going to play a major role in development and management of innovative projects in industries. The course introduces all aspects of the IPR Acts. It also includes case studies to demonstrate the application of the legal concepts in Science, Engineering, Technology and Creative Design.

UNIT I
OVERVIEW OF INTELLECTUAL PROPERTY
Introduction and the need for intellectual property right (IPR), IPR in India – Genesis and Development, IPR in abroad, Some important examples of IPR

UNIT II
PATENTS AND UTILITY MODELS
PATENTS: Patent document, searching a patent, Drafting of a patent, Filing of a patent Macro-economic impact of the patent system, Patent and kind of inventions protected by a patent, Granting of patent, Rights of a patent Protecting your inventions – extension in patent protection The different layers of the international patent system (national, regional and international options)

UTILITY MODELS: Differences between a utility model and a patent, Trade secrets and know-how agreements.

UNIT III
COPYRIGHTS, TRADEMARKS AND GEOGRAPHICAL INDICATIONS
COPYRIGHTS: Copyright, things covered by copyright, period of copyright, Rights covered by copyrights and protection of copyrights.

RELATED RIGHTS: Related rights, Distinction between related rights and copyright
TRADEMARKS: Trademark –Rights, kind of signs, types and function of trademarks Registration, period, extension and protection of trademark.Well-known marks and their protection, Domain name and its relation to trademarks.

GEOGRAPHICAL INDICATIONS
Geographical indication - its protection, reasons for protection

UNIT IV
INDUSTRIAL DESIGNS AND NEW PLANT VARIETIES
INDUSTRIAL DESIGNS: Protection, kinds of protection, needs for protection
NEW PLANT VARIETIES: New varieties of plants – protection and extension Breeder – Rights and protection

UNIT V
UNFAIR COMPETITION AND ENFORCEMENT OF INTELLECTUAL PROPERTY RIGHTS UNFAIR COMPETITION: Unfair competition, Relationship between unfair competition and intellectual property laws.

ENFORCEMENT OF INTELLECTUAL PROPERTY RIGHTS: Infringement of intellectual property rights, Enforcement Measures and Emerging Issues in Science and technologies.
Overview of Biotechnology and Intellectual Property Rights in Biotechnology Research. Management - Licensing and Enforcing Intellectual Property, Commercializing Biotechnology Invention and Case studies of Biotechnology. Case studies of patents in other areas – Pharmaceutical Research

TEXT BOOKS

1. T. M Murray and M.J. Mehlman, Encyclopedia of Ethical, Legal and Policy issues in Biotechnology, John Wiley & Sons 2000

REFERENCES

1. P.N. Cheremisinoff, R.P. Ouellette and R.M. Bartholomew, Biotechnology Applications and Research, Technomic Publishing Co., Inc. USA, 1985
2. D. Balasubramaniam, C.F.A. Bryce, K. Dharmalingam, J. Green and K. Jayaraman, Concepts in Biotechnology, University Press (Orient Longman Ltd.), 2002
3. Bourgagaize, Jewell and Buiser, Biotechnology: Demystifying the Concepts, Wesley Longman, USA, 2000.
4. AjitParulekar and Sarita D' Souza, Indian Patents Law – Legal & Business Implications; Macmillan India Ltd , 2006.
5. B.L.Wadehra; Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications; Universal law Publishing Pvt. Ltd., India 2000
6. P. Narayanan; Law of Copyright and Industrial Designs; Eastern law House, Delhi , 2010

NPTEL: http://nptel.ac.in/syllabus/syllabus.php?subjectId=110999906