# Jawaharlal Nehru Technological University Hyderabad

## M. Pharmacy (Pharmaceutical Chemistry)

### R19 Course Structure and Syllabus

Effective from Academic Year 2019-20 Admitted Batch

### I Year I Semester

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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### I Year II Semester

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## II YEAR I SEMESTER

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**Total Credits: 6 0 12 12**

## II YEAR II - SEMESTER

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**Total Credits: 0 0 40 20**

*For Dissertation Work Review - I, Please refer 7.8 in R19 Academic Regulations.*

**Audit Courses I & II:**

1. English for Research Paper Writing
2. Disaster Management
3. Sanskrit for Technological Learning
4. Value Education
5. Constitution of India
6. Pedagogy Studies
7. Stress Management by Yoga
8. Personality Development through Life Enlightenment Skills
Course Objectives: The course structure is designed to give the knowledge of organic chemistry at an advanced level and mainly aimed at the stereochemistry and different organic named reactions including preparations of reactive intermediates.

Course Outcome: The student would be in position to design a stereoselective synthesis of new chemical entities (NCE) for the treatment of different diseases in new drug discovery Program.

UNIT I
b. Chirality due to helical shape, cis / trans, E – Z isomerism resulting from double bonds, monocyclic compounds, fused ring system. Racemic modifications and methods for resolution of racemic mixtures. Asymmetric synthesis and stereo – selective synthesis.

UNIT II
b. Concepts of aromaticity and antiaromaticity, nonbenzenoid aromatic compounds.

UNIT III
Mechanisms of organic reactions: Free radical, Electrophilic, Nucleophilic reactions of aliphatic and aromatic compounds

UNIT IV

UNIT V
Electrocyclic, pericyclic and sigmatropic reactions: Introduction, terminology and mechanism, with suitable examples.

RECOMMENDED BOOKS:
5. I. L. Finar, Organic Chemistry, ELBS
Course Objectives: The course contents are mainly aimed to have advanced knowledge of rational drug design including QSAR and molecular modeling and also aimed at the identification of lead molecule from natural sources for the development of new drugs.

Course Outcome: The student would be in a position to have detailed knowledge of computer aided drug design which is useful to involve in new drug discovery Program by the utilization of natural leads and also with the help of structure-based drug design.

UNIT I

UNIT II

UNIT III
a. Computer aided drug design (CADD):
   Virtual screening: concept, drug likeness screening, focused screening libraries for lead identification, pharmacophore screening, structure based virtual screening and applications.
   Molecular modeling: Molecular mechanics, quantum mechanics, modeling ligands for known receptors and unknown receptors.

UNIT IV
Natural Products as Leads for New Drugs: Introduction/History, approaches to discovery and development of natural products as potential new drugs, selection and optimization of lead compounds for further developments from CNS, anticancer antibiotics and cardiovascular drugs.

UNIT V

RECOMMENDED BOOKS:
2. Korolkovas Essentials of Medicinal Chemistry
3. Purcell Strategies of Drug Design
4. Corwin, Hansen Comprehensive Medicinal Chemistry
5. William O Foye Medicinal Chemistry
7. Stenlake, Foundation of Molecular Pharmacology- Pharma Med Press, volume I &II
CHEMISTRY OF NATURAL PRODUCTS (Professional Elective – I)

**Course Objective:** The contents of Unit I mainly aimed to identify lead molecules from the natural sources. The contents of Unit II & III are mainly designed to have the knowledge of alkaloids and steroids especially structural elucidation of few important compounds. The contents of Unit IV and V are to offer an understanding of utilization of natural products for the preparation of new molecules for the treatment of different diseases like cancer, malaria etc.

**Course Outcome:** The student would be in a position to explore the natural lead compounds for the treatment of different diseases like cancer, malaria, diabetes etc.

**UNIT I**

**Natural products as leads for new drugs:** Introduction/history, approaches to discovery and development of natural products as potential new drugs selection and optimization of lead compounds for further development with suitable examples from antibiotics, CNS, and cardiovascular agents.

**UNIT II**

**Alkaloids:** Introduction and general methods of structure elucidation.
From opium: morphine-structure elucidation, development of morphine analogues and morphine antagonists.
From Rauwolfia: Reserpine-structure elucidation, structural modifications and uses.
From vinca rosea: vincristine and vinblastine - structural modification, semisynthetic derivatives and uses.

**UNIT III**

**Steroids:** Introduction, nomenclature, stereochemistry of steroids. Source and structure elucidation of cholesterol and diosgenin.
Structures, structure modifications and therapeutic uses of steroidal anti-inflammatory agents and antifertility agents.

**UNIT IV**

**Polypeptides and proteins:** introduction and general methods of separation, general methods of degradation and end group analysis, general methods of synthesis of peptides. Primary, secondary, tertiary and quaternary structure of proteins; chemistry of insulin.

**UNIT V**

**Compounds of medicinal Interest:** Structure, structural modifications, mechanism of action and therapeutic uses of a) taxanes b) camptothecin c) artemisinin e) ginkgolides and f) gymnemic acids.

**RECOMMENDED BOOKS:**
6. Ataur Rahman. Chemistry of natural products
Course Objective: The course is designed to impart the knowledge in the field of Pharmaceutical Analysis. The various modern analytical techniques like UV-Visible, IR, NMR, Mass, GC, HPLC, different chromatographic methods and other important topics are taught to enable the students to understand and apply the principles involved in the determination of different bulk drugs and their formulation. In addition to the theoretical aspects, the basic practical knowledge relevant to the analysis is also imparted.

Course Outcome: The appreciable knowledge will be gained by the students in the Modern Analytical Techniques and can apply the theories in the Analysis of various bulk drugs and their formulations. The students will also be in a position to apply their knowledge in developing the new methods for the determination and validate the procedures.

UNIT I
Introduction to chromatography and classification of chromatographic methods based on the mechanism of separation
a. Column Chromatography: Adsorption and partition, theory, preparation, procedure and methods of detection
b. Thin Layer Chromatography: Theory, preparation, procedures, detection of compounds
c. Paper Chromatography: Theory, different techniques employed, filter papers used, qualitative and quantitative detection
d. Counter – current extraction, solid phase extraction techniques, gel filtration

UNIT II
b. HPLC: Basic Parameters, Principles and instrumentation, solvents and columns used, Operational Modes, detection and applications
c. HPTLC: Theory and principle, instrumentation, elution techniques and pharmaceutical applications

UNIT III
a. UV-Visible spectroscopy: Introduction, electromagnetic spectrum, absorbance laws and limitations, instrumentation-design and working principle, chromophore concept, auxochromes, Wood-Fisher rules for calculating absorption maximum, applications of UV-Visible spectroscopy
b. IR spectroscopy: Basic principles - Molecular vibrations, vibrational frequency, factors influencing vibrational frequencies, sampling techniques, instrumentation, interpretation of spectra, FT-IR, theory and applications

UNIT IV
Mass spectroscopy: Theory, ionization techniques: electron impact ionization, chemical ionization, field ionization, fast atom bombardment, plasma desorption, fragmentation process: types of fission, resolution, GC/MS, interpretation of spectra and applications for identification and structure determination.

UNIT V
NMR: Theory, instrumentation, chemical shift, shielding and deshielding effects, splitting of signals, spin-spin coupling, proton exchange reactions, coupling constant(J), nuclear overhauser effect (NOE), $^{13}$CNMR spectra and its applications, 2D-NMR, COSY and applications in pharmacy.
REFERENCES:
1. Instrumental Methods of Chemical Analysis by B.K Sharma
2. Organic spectroscopy by Y.R Sharma
3. A Text book of Pharmaceutical Analysis by Kerrenth A. Connors
4. Vogel’s Text book of Quantitative Chemical Analysis by A.I. Vogel
5. Practical Pharmaceutical Chemistry by A.H. Beckett and J.B. Stenlake
6. Organic Chemistry by I. L. Finar
7. Organic spectroscopy by William Kemp
8. Quantitative Analysis of Drugs by D. C. Garrett
9. Quantitative Analysis of Drugs in Pharmaceutical Formulations by P. D. Sethi
10. Spectrophotometric identification of Organic Compounds by Silverstein
11. HPTLC by P.D. Seth
12. Indian Pharmacopoeia 2007
13. High Performance thin layer chromatography for the analysis of medicinal plants by Eike Reich, Anne Schibli
DRUG REGULATORY AFFAIRS (Professional Elective – I)

**Course Objective:** The topics which are present in the Drug regulatory affairs are very much useful which increases the knowledge regarding the regulatory aspects in the pharmaceutical industries.

**Course Outcome:**
- Students will come to know the different competent regulatory authorities globally.
- Students be aware of technical aspects pertaining to the marketing authorization application (MAA)
- The regulatory guidelines and directions framed by the regulatory authorities will be helpful to place the drug products in market for marketing approvals.

**UNIT I**
Drug Regulatory Aspects (India)
1. Indian drug regulatory authorities, Central and State regulatory bodies (FDA)
2. Drugs and Cosmmetics Act and Rules with latest Amendments (Selective)
3. Special emphasis – Schedule M and Y
4. New drugs – Importation, Registration, development, Clinical Trials, BE NOC & BE studies
5. Various Licences – Test Lic., Import lic., for testing of drugs and API’s, Manufacturing Contract and Loan licence manufacturing.

**UNIT II**
Good Manufacturing Practices (GMP)
1. Indian GMP certification, WHO GMP certification.
2. ICH guidelines for stability testing and other relevant ones (Q1-Q10)
3. Export permissions and manufacturing for semi-regulated countries
4. Understanding of the plant layouts with special emphasis on the environment & safety (HVAC, Water Systems, Stores Management, Effluent etc.)
5. Quality Assurance and Qulaity Control – Basic understanding for in-built quality.

**UNIT III**
A detailed study of regulatory aspects that affect drug product design, manufacture and distribution in a developed country such as USA and in a developing country such as Brazil, Hatch Waxmann Act; Bolar Provisions and other FDA Regulations. Regulatory aspects of pharmaceutical and bulk drug manufacture, regulatory drug analysis.

**UNIT IV**
Documentation related to manufacturing, cleaning methods, retention samples and records, quality control, batch release documents, distribution records, complaints and recalls. Quality, safety and legislation for cosmetic products and herbal products.

**UNIT V**
Governing Regulatory Bodies across the globe.
Country Authority Submission
- U.S Food & Drug Administration USDMF
- Canada Therapeutic Product Directorate DMF
- Europe
  1) European Medicines Agency (EMEA/ National Authorities) EDMF
  2) European Directorate for Quality of Medicines CEP/COS & Health Care Products.
3) MHRA – Medicines and Health Care Products Regulatory Agency

d. Product Filing
e. Responding Regulatory Deficiencies
f. Final Approval Procedure

Preparation, review and submission of Drug Master Files to Regulatory Authorities as per their specific requirements.

TEXT AND REFERENCE BOOKS:

1. Original laws published by Govt. of India.
3. Laws of Drugs in India by Hussain.
5. Pharmaceutical Regulatory Affairs - Selected Topics, CVS Subramanyam and J Thimmasetty, Vallabh Prakashan Delhi - 2013
Course Objective: The topics are framed to enhance the student’s knowledge in the various areas of molecular modelling, molecular docking, pharmacophore concepts, drug design techniques with detail concepts of all the mentioned areas.

Course Outcome: This enables the students to get a broad idea on the drug discovery mechanisms, its related terms and concepts of designing of drugs.

UNIT - I

UNIT - II
Pharmacophore concept: Pharmacophore mapping, methods of conformational search used in pharmacophore mapping. Comparison between the popular pharmacophore methods like Catalyst/HipHop, DiscoTech, GASP with practical examples, 3D QSAR Techniques.

UNIT - III
Design of drugs for the following biological targets Agent acting on enzymes: DHFR, HIV-protease HMG-CoA Reductase, Phosphodiesterase, ACE, Transpeptidase, β-lactamase. Agents acting on receptors: PPAR, protein kinases. Agents acting on Nucleic acids: Topoisomerase, DNA and RNA polymerase, HIV-Reverse transcriptase

UNIT - IV
Molecular docking: Rigid docking, flexible docking, manual docking. Advantages and disadvantages of Flex-X, Flex-S, Autodock and Dock softwares, with successful examples. Molecular dynamics: Dynamics of drugs, biomolecules, drug-receptor complexes, Monte Carlo simulations and Molecular dynamics in performing conformational search and docking. Estimation of free energy from dynamical methods.

UNIT - V
De Novo drug design techniques: Receptor/enzyme cavity size prediction. Predicting the functional components of cavities, designing drugs fitting into cavity. Active site analysis structure – based drug design. Informatics methods in drug design: Informatics methods in drug design: Brief introduction to bioinformatics, chemoinformatics.

REFERENCES:
5. Molecular Modelling, by A. R. Leach
7. Practical Applications of computer aided drug design, by P.S. Charifson
8. Molecular modeling in Drug Design, by C. Cohen
9. Chemical Applications of Molecular modeling, by J. Goodman
10. Pharmacophore perception, by O.F. Guner
Course Objective: This course is designed to impart knowledge on analysis of food constituents and finished food products. The course includes application of instrumental analysis in the determination of pesticides in variety of food products.

Course Outcome: At completion of this course student shall be able to understand various analytical techniques in the determination of

- Food constituents
- Food additives
- Finished food products
- Pesticides in food
- Pharmaceuticals (API & Dosage forms)
- And also student shall have the knowledge on food regulations and legislations

UNIT - I
a. **Carbohydrates:** Classification and properties of food carbohydrates, General methods of analysis of food carbohydrates,
b. **Proteins:** Chemistry and classification of amino acids and proteins, Physico-Chemical properties of protein and their structure, general methods of analysis of proteins and amino acids

UNIT - II
a. **Lipids:** Classification, general methods of analysis, refining of fats and oils; hydrogenation of vegetable oils, Determination of adulteration in fats and oils.
b. **Vitamins:** Classification of vitamins, methods of analysis of vitamins, Principles of microbial assay of vitamins of B-series

UNIT - III
**Probiotics:** Definition, history, importance, mode of action, identification advantages and disadvantages of probiotics. Applications of Probiotics

UNIT - IV
Definition, classification and principles and procedures involved in the quantitative determination of drugs from each category of both API and dosage forms (IP) of the following

- Analgesics & Antipyretics
- Antihypertensives
- Antihistamines
- Alkaloids
- Antibiotics
- Diuretics

UNIT - V
a. **General Analytical methods** for milk, milk constituents and milk products like ice cream, milk powder, butter, margarine, cheese including adulterants and contaminants of milk.
b. **Analysis of fermentation products** like wine, spirits, beer and vinegar.
   - Pesticides in food
   - And also student shall have knowledge in food regulations and legislations

TEXT BOOKS:
4. Analysis of Food constituents – Multon, Wiley VCH.
5. Dr. William Horwitz, Official methods of analysis of AOAC International

REFERENCE BOOKS:
1. Remington’s Pharmaceutical Sciences by Alfonso and Gennaro
4. Indian Pharmacopoeia 2012
Course Objective: The students will acquire the knowledge about the various aspects of X-Ray diffraction methods, all types of IR methods, particle sizing methods, also DSC, DTA, TGA etc

Course Outcome: By the completion of topics the students will come out with the thorough knowledge of various spectral aspects of X-Ray, IR, SEM, ORD etc which help them in further projects works and also industrial opportunities.

UNIT - I
X-Ray diffraction methods: Origin of X-rays, basic aspects of crystals, X-ray crystallography, miller indices, rotating crystal techniques, single crystal diffraction, power diffraction, structural elucidation and applications.

UNIT - II
a) FT-NIR: Principle (overtones, combinations, fermi resonance, interferences etc.), instrumentation (dispersion spectrometer and FT-NIR), advantage and disadvantage, qualitative and quantitative applications, including PAT and non-destructive analysis.
b) ATR: Principle (total internal reflection, evanescent wave, etc.), instrumentation (ATR crystal, IR beam), advantages and disadvantages, pharmaceutical applications.

UNIT - III
ELECTROMETRIC TECHNIQUES: Principle, instrumentation and applications of Potentiometer, Amperometer, Conductometer and Polarography.

UNIT - IV
a) Spectrofluorimetry: Theory of Fluorescence, Factors affecting fluorescence (Characteristics of drugs that can be analysed by flourimetry), Quenchers, Instrumentation and Applications of fluorescence spectrophotometer.
b) Flame emission spectroscopy and Atomic absorption spectroscopy: Principle, Instrumentation, Interferences and applications.

UNIT - V
FT-Raman: Principle (absorption, diffraction, scattering and emission of wave, molecular interaction), instrumentation (Dispersive Raman, FT-Raman), advantage and disadvantage, pharmaceutical applications including detection of counterfeit

REFERENCES:
1. Instrumental Methods of Chemical Analysis by B.K Sharma
2. Organic spectroscopy by Y.R Sharma
3. A Text book of Pharmaceutical Analysis by Kerrenth A. Connors
4. Vogel’s Text book of Quantitative Chemical Analysis by A.I. Vogel
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9. Quantitative Analysis of Drugs in Pharmaceutical Formulations by P. D. Sethi
10. Spectrophotometric identification of Organic Compounds by Silverstein
11. HPTLC by P.D. Seth
12. Spectroscopy by Donald L Pavia, Gary M Lampman, George S Kriz, James A Vyvyan
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.Pharm I Year I Sem (Pharmaceutical Chemistry)

RESEARCH METHODOLOGY AND IPR

Course Objectives:
- To understand the research problem
- To know the literature studies, plagiarism and ethics
- To get the knowledge about technical writing
- To analyze the nature of intellectual property rights and new developments
- To know the patent rights

Course Outcomes: At the end of this course, students will be able to
- Understand research problem formulation.
- Analyze research related information
- Follow research ethics
- Understand that today’s world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
- Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
- Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

UNIT - I
Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

UNIT - II
Effective literature studies approaches, analysis, Plagiarism, Research ethics

UNIT - III
Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

UNIT - IV

UNIT-V:
TEXT BOOKS:
2. Wayne Goddard and Stuart Melville, “Research Methodology: An Introduction”

REFERENCES:
List of Experiments: (Minimum of 10 experiments shall be conducted)

1. Synthesis and characterization of the following drugs:
   a. Benzanilide by Beckmann rearrangement
   b. 4-Benzylidene-2-methylloxazol-5-one (or) azalactone
   c. N-(m-Nitrobenzyl) aniline from m-nitrobenzaldehyde
   d. 2, 3-Diphenyl quinoxaline
   e. 1H-Indole-3-carboxaldehyde
   f. 3, 4-Dihydropyrimidin-2(1H)-one from benzaldehyde, ethyl acetoacetate and urea in presence of CaCl$_2$ (catalyst).
   g. Schiff base by microwave irradiation
   h. Cinnamic acid by Perkin reaction
   i. β-Dimethylaminopropiophenone hydrochloride (Mannich base)
   j. 2-Phenyl indole
   k. Dimedone (5,5-dimethyl cyclohexane-1,3-dione)
   l. 3-Bromo cyclohexene from cyclohexene using NBS.
   m. p-Amino benzyl alcohol from p-amino benzaldehyde using sodium borohydride.
   n. Cyclohexane-2,5-dicarboxylic acid from benzoic acid (hydrogenation).

2. Any other relevant experiments based on theory.

REFERENCES:
List of Experiments:

1. Synthesis of any two drugs from the following classes of drugs (Minimum two from each class)
   a. Analgesics, NSAIDS and antipyretics
   b. CNS and CVS drugs

2. QSAR Studies by using softwares
   a. CoMFA – 3D QSAR method, 
   b. CODESSA, 
   c. descriptor software (all are free online softwares) minimum of 3 experiments 

3. Docking studies of drugs by using free online softwares like
   a. AutoDock, 
   b. BLAST, 
   c. GPCR pred, 
   d. FASTA, 
   e. ATPIINT, 
   f. Maestro, 
   g. ESLPRED2 (Minimum of 5 experiments)
Course Objective: The content of Unit I and II are mainly aimed at utilization of different synthetic reagents used in the preparation of intermediates and final compounds and also aimed at the principles of green chemistry. Unit III and IV contents are mainly aimed at scale of processes for the preparation of new pharmaceutical agents and also to design different synthetic strategies. Unit V is mainly aimed to utilize the knowledge of chemical library for drug design.

Course Outcome: The student would be in a position to have advanced knowledge of different synthetic reagents and reaction processes, synthetic routes by involving green chemistry principles. The student would also have techniques to utilize the chemical library of combinatorial chemistry.

UNIT - I
Synthetic Reagents & Applications: Lead Tetra Acetate (LTA), N-Bromosuccinimide (NBS), Osmium Tetroxide, Lithium Aluminum Hydride (LAH) and Sodium Borohydride, Dicyclohexylcarbodimide (DCC) and 2,3-dichloro-5,6-dicyano-1,4-benzoquinone (DDQ).
A brief account on Green Chemistry: Principles and applications

UNIT - II
Catalysis:
   a. Types of catalysis, heterogeneous and homogenous catalysis, advantages and disadvantages
   b. Heterogeneous catalysis – preparation, characterization, kinetics, supported catalysts, catalyst deactivation and regeneration, some examples of heterogeneous catalysis used in synthesis of drugs.
   c. Homogenous catalysis, hydrogenation, hydroformylation, hydrocyanation, Wilkinson catalysts, chiral ligands and chiral induction, Ziegler-Natta catalysts, some examples of homogenous catalysis used in synthesis of drugs
   d. Transition-metal and Organo-catalysis in organic synthesis: Metal-catalyzed reactions
   f. Phase transfer catalysis -theory and applications

UNIT - III
Molecular Rearrangements & their applications:
   2. Carbon to Nitrogen Migration: Hoffmann rearrangement, Curtius rearrangement and Lossen rearrangement, Beckman rearrangement.

UNIT - IV
Chemistry of peptides
   a. Coupling reactions in peptide synthesis
   b. Principles of solid phase peptide synthesis, t-BOC and FMOC protocols, various solid supports and linkers: Activation procedures, peptide bond formation, deprotection and cleavage from resin, low and high HF cleavage protocols, formation of free peptides and peptide amides, purification and case studies, site-specific chemical modifications of peptides
c. Segment and sequential strategies for solution phase peptide synthesis with any two case studies
d. Side reactions in peptide synthesis: Deletion peptides, side reactions initiated by proton abstraction, protonation, overactivation and side reactions of individual amino acids.

UNIT - V

Combinatorial Chemistry: Introduction, solid phase techniques, parallel synthesis, mixed combinatorial chemistry, diconvulution techniques, tagging, photolithography, limitations of combinatorial chemistry, planning and designing of combinatorial synthesis.

RECOMMENDED BOOKS:
4. T.W. Greene and PGM Warts, Protecting Groups – John Willey
5. Michael B. Smith, Organic Synthesis
Course Objective: The course contents of Unit I and Unit II are mainly aimed at enzyme inhibitors for the treatment of different CNS and CVS diseases. Unit III contents are aimed to have advanced knowledge of the developments of antipsychotic agents. The remaining contents are aimed to design prodrugs, peptidomimetic agents and recombinant DNA products.

Course Outcome: The student would be in a position to involve in the development of different enzyme inhibitors, prodrugs and also equipped with different biotechnological techniques of recombinant DNA products.

UNIT - I
Enzyme Inhibitors I: A detailed study of the following types of enzyme inhibitors, related drugs and their pharmaceutical significance:
   a) Prostaglandin Synthetase (Cyclooxygenase & Lipoxygenase Inhibitors)
   b) Phosphodiesterase (PDE) Inhibitors
   c) Carbonic Anhydrase Inhibitors.
   d) B- Secretase.

UNIT - II
Enzyme Inhibitors II:
   a) Angiotensin Converting Enzyme (ACE) Inhibitors
   b) Acetyl Cholinesterase (Ach E) Inhibitors.
   c) HMG-CoA inhibitors
   d) Protease inhibitors

UNIT - III
Antipsychotic Agents: Role of Dopamine, Serotonin, Glutamate and their receptors. SAR and Pharmacokinetics of Ticyclic Neuroleptics, Butyrophenones and Benzamides. A brief account of non – benzodiazepine agonist.

UNIT - IV
Peptidmimetic agents & Prodrugs
   a) Physiological role of peptids, Endogenous peptide transmitters & function, cyclosporin and oxytocin
   b) Prodrugs belong to esters, Lactones, amides, hydrazides and azo compounds. Targettedprodrug, bioprecurror of prodrugs

UNIT - V
Biotechnologically produced drugs: Biotechnology of Recombinant DNA, Process of Recombinant proteins, Immunogencity of biotechnologically produced drugs.
Recombinant drug products: Hormones, cytokinins, interferons, Interleukins, enzymes, vaccines and monoclonal antibody drugs.

RECOMMENDED BOOKS:
2. Korolkovas Essentials of Medicinal Chemistry
3. William O Foye Medicinal Chemistry
4. Lednicer, Organic Chemistry of Drug Synthesis
6. Purcell Strategies of Drug Design
7. Corwin, Hansen Comprehensive Medicinal Chemistry
Course Objectives: The goal of a process chemist is to develop synthetic routes that are safe, cost-effective, environmentally friendly, and efficient. The subject is designed to impart knowledge on the development and optimization of a synthetic route/s and the pilot plant procedure for the manufacture of Active Pharmaceutical Ingredients (APIs) and new chemical entities (NCEs) for the drug development phase.

Course Outcome: At completion of this course it is expected that students will be able to understand
- The strategies of scale up process of APIs and intermediates
- The various unit operations and various reactions in process chemistry

UNIT - I
Process chemistry; Introduction, Synthetic strategy Stages of scale up process: Bench, pilot and large-scale process. In-process control and validation of large-scale process. Case studies of some scale up process of APIs. Impurities in API, types and their sources including genotoxic impurities

UNIT - II
Unit operations
a) Extraction: Liquid equilibria, extraction with reflux, extraction with agitation, counter current extraction.
b) Filtration: Theory of filtration, pressure and vacuum filtration, centrifugal filtration,
c) Distillation: azeotropic and steam distillation
d) Evaporation: Types of evaporators, factors affecting evaporation.
e) Crystallization: Crystallization from aqueous, nonaqueous solutions factors affecting crystallization, nucleation. Principle and general methods of Preparation of polymorphs, hydrates, solvates and amorphous APIs.

UNIT - III
Unit Processes - I
a) Nitration: Nitrating agents, Aromatic nitration, kinetics and mechanism of aromatic nitration, process equipment for technical nitration, mixed acid for nitration,
b) Halogenation: Kinetics of halogenations, types of halogenations, catalytic halogenations. Case study on industrial halogenation process.
c) Oxidation: Introduction, types of oxidative reactions, Liquid phase oxidation with oxidizing agents. Nonmetallic Oxidizing agents such as H2O2, sodium hypochlorite, Oxygen gas, ozonolysis.

UNIT - IV
Unit Processes - II
a) Reduction: Catalytic hydrogenation, Heterogeneous and homogeneous catalyst; Hydrogen transfer reactions, Metal hydrides. Case study on industrial reduction process.
b) Fermentation: Aerobic and anaerobic fermentation.
Production of
   i. Antibiotics; Penicillin and Streptomycin,
   ii. Vitamins: B2 and B12
   iii. Statins: Lovastatin, Simvastatin
c) Reaction progress kinetic analysis
   i. Streamlining reaction steps, route selection,
ii. Characteristics of expedient routes, characteristics of cost-effective routes, reagent selection, families of reagents useful for scale-up.

UNIT - V
Industrial Safety
a) MSDS (Material Safety Data Sheet), hazard labels of chemicals and Personal Protection Equipment (PPE)
b) Fire hazards, types of fire & fire extinguishers
c) Occupational Health & Safety Assessment Series 1800(OHSAS-1800) and ISO-14001(Environmental Management System), Effluents and its management

REFERENCES:
8. P.H. Groggins: Unit processes in organic synthesis (MGH)
9. F.A. Henglein: Chemical Technology (Pergamon)
10. M. Gopal: Dryden’s Outlines of Chemical Technology, WEP East-West Press
12. Lowenheim & M.K. Moran: Industrial Chemicals
17. ICH Guidelines
18. United States Food and Drug Administration official website www.fda.gov
Course Objective: This course deals with the various aspects of quality control and quality assurance aspects of pharmaceutical industries. It covers the important aspects like cGMP, QC tests, documentation, quality certifications, GLP and regulatory affairs.

Course Outcome: Upon completion of this course the student should be able to
- Understand the cGMP aspects in a pharmaceutical industry
- To appreciate the importance of documentation
- To understand the scope of quality certifications applicable to pharmaceutical industries
- To understand the responsibilities of QA & QC departments.

UNIT – I
Introduction: Concept and evolution and scopes of Quality Control and Quality Assurance, Good Laboratory Practice, GMP, Overview of ICH Guidelines - QSEM, with special emphasis on Qseries guidelines. Good Laboratory Practices: Scope of GLP, Definitions, Quality assurance unit, protocol for conduct of non-clinical testing, control on animal house, report preparation and documentation. CPCSEA guidelines.

UNIT - II
cGMP guidelines according to schedule M, USFDA (inclusive of CDER and CBER) Pharmaceutical Inspection Convention (PIC), WHO and EMEA covering: Organization and personnel responsibilities, training, hygiene and personal records, drug industry location, design, construction and plant lay out, maintenance, sanitation, environmental control, utilities and maintenance of sterile areas, control of contamination and Good Warehousing Practice.

UNIT - III
Analysis of raw materials, finished products, packaging materials, in process quality control (IPQC), Developing specification (ICH Q6 and Q3), purchase specifications and maintenance of stores for raw materials. In process quality control and finished products quality control for following dosage forms in Pharma industry according to Indian, US and British pharmacopoeias: tablets, capsules, ointments, suppositories, creams, parenterals, ophthalmic and surgical products (How to refer pharmacopoeias).

UNIT - IV

UNIT - V
Manufacturing operations and controls: Sanitation of manufacturing premises, mix-ups and cross contamination, processing of intermediates and bulk products, packaging operations, IPQC, release of finished product, process deviations, charge-in of components, time limitations on production, drug product inspection, expiry date calculation, calculation of yields, production record review, change control, sterile products, aseptic process control, packaging, reprocessing, salvaging, handling of
waste and scrap disposal. Introduction, scope and importance of intellectual property rights. Concept of trade mark, copyright and patents.

**REFERENCE BOOKS:**

7. ICH guidelines
8. ISO 9000 and total quality management
14. Packaging of Pharmaceuticals.
15. Schedule M and Schedule N.
CLINICAL RESEARCH AND PHARMACOVIGILANCE (Professional Elective - III)

Course Objectives: This subject will provide a value addition and current requirement for the students in clinical research and pharmacovigilance. It will teach the students on conceptualizing, designing, conducting, managing and reporting of clinical trials. This subject also focuses on global scenario of pharmacovigilance in different methods that can be used to generate safety data. It will teach the students in developing drug safety data in pre-clinical, clinical phases of drug development and post market surveillance.

Course Outcomes: Upon completion of the course, the student shall be able to;

- explain the regulatory requirements for conducting clinical trial
- Demonstrate the types of clinical trial designs
- Explain the responsibilities of key players involved in clinical trials
- Execute safety monitoring, reporting and close-out activities
- Explain the principles of Pharmacovigilance
- Detect new adverse drug reactions and their assessment
- Perform the adverse drug reaction reporting systems and communication in pharmacovigilance

UNIT - I

Regulatory Perspectives of Clinical Trials:

UNIT - II

Clinical Trials: Types and Design:
Experimental Study- RCT and Non RCT, Observation Study: Cohort, Case Control, Cross sectional Clinical Trial Study Team Roles and responsibilities of Clinical Trial Personnel: Investigator, Study Coordinator, Sponsor, Contract Research Organization and its management.

UNIT - III

Clinical Trial Documentation:

UNIT - IV

Basic aspects, terminologies and establishment of pharmacovigilance:
History and progress of pharmacovigilance, Significance of safety monitoring, Pharmacovigilance in India and international aspects, WHO international drug monitoring Program, WHO and Regulatory terminologies of ADR, evaluation of medication safety, establishing pharmacovigilance centres in Hospitals, Industry and National Programs related to pharmacovigilance. Roles and responsibilities in Pharmacovigilance.
UNIT - V
Methods, ADR reporting and tools used in pharmacovigilance:

REFERENCES:
SCREENING METHODS IN PHARMACOLOGY (Professional Elective - IV)

Course Objective: The students are going to study about various techniques for screening of drugs for various pharmacological activities and guidelines for handling animals and human and animal ethics for screening of drugs.

Course Outcome: The expected outcomes are students will know how to handle animals and know about various techniques for screening of drugs for different pharmacological activities, guidelines and regulations for screening new drug molecules on animals.

UNIT - I
Care Handling and breeding techniques of laboratory animals, Regulations for laboratory animals, CPCSEA guidelines, alternatives to animal studies, Good laboratory Practices.

UNIT - II
Bioassays: Basic principles of Biological standardization: Methods used in the bio-assay of Rabbits Vaccine, Oxytocin, Tetanus Antitoxin and Diphtheria Vaccine. Test for pyrogens.

UNIT - III
Toxicity tests: OECD guidelines, determination of LD50, acute, sub-acute and chronic toxicity studies.

UNIT - IV
Organization of screening for the Pharmacological activity of new substances with emphasis on the evaluation of cardiac and anti-diabetic activities.

UNIT - V
Organization of screening for the Pharmacological activity of new substances with emphasis on the evaluation of psychopharmacological, anti-inflammatory and analgesic activities.

TEXT BOOKS:

REFERENCE BOOKS:
1. ICH of technical requirements for registration of pharmaceuticals for human use, ICH harmonized tripartite guidelines - Guidelines for good clinical practice, E6, May 1996.
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.Pharm I Year II Sem (Pharmaceutical Chemistry)

ADVANCED INSTRUMENTAL ANALYSIS (Professional Elective – IV)

Course Objectives: This subject deals with various hyphenated analytical instrumental techniques for identification, characterization and quantification of drugs. Instruments dealt are LC-MS, GC-MS, and hyphenated techniques.

Course Outcome: By the completion of topics the students will come out with the thorough knowledge of various spectral aspects of X-Ray, IR, SEM, ORD etc which help them in further projects works and also industrial opportunities

UNIT - I
X-Ray diffraction methods: Origin of X-rays, basic aspects of crystals, X-ray crystallography, miller indices, rotating crystal techniques, single crystal diffraction, powder diffraction, structural elucidation and applications.

UNIT - II
a. Biochromatography: Size exclusion chromatography, ion exchange chromatography, ion pair chromatography, affinity chromatography general principles, stationary phases and mobile phases.

UNIT - III
Capillary Electrophoresis: Overview of CE in pharmaceutical analysis, basic configuration, CE characteristics, principles of CE, methods and modes of CE. General considerations and method development in CE,

UNIT - IV
a. DSC: Principle, thermal transitions, instrumentation (Heat flux and power- compensation designs), Modulated DSC, Hyper DSC, experimental parameters (sample preparation, experimental conditions, calibration, heating and cooling rates, resolution, Sources of errors) and their influence, advantages and disadvantages, pharmaceutical applications.
b. DTA: Principle, instrumentation, advantage and disadvantage, pharmaceutical application, derivative differential thermal analysis (DDTA).
c. TGA: Principle, instrumentation, factors affecting results, advantages and disadvantages, pharmaceutical application.

UNIT - V
b. Optical Rotatory Dispersion (ORD), Circular Dichroism, Cotton effect, Octane rule and applications.

REFERENCES:
1. Instrumental Methods of Chemical Analysis by B.K Sharma
2. Organic spectroscopy by Y.R Sharma
3. A Text book of Pharmaceutical Analysis by Kerrenth A. Connors
4. Vogel's Text book of Quantitative Chemical Analysis by A.I. Vogel
5. Practical Pharmaceutical Chemistry by A.H. Beckett and J.B. Stenlake
6. Organic Chemistry by I. L. Finar
7. Organic spectroscopy by William Kemp
8. Quantitative Analysis of Drugs by D. C. Garrett
9. Quantitative Analysis of Drugs in Pharmaceutical Formulations by P. D. Sethi
10. Spectrophotometric identification of Organic Compounds by Silverstein
11. HPTLC by P.D. Seth
Course Objectives: Helps the students in getting exposed to methods of extraction, preparation and purification of herbal extracts. To acquire knowledge on the preparation and standardization of herbal preparation. They will expose to various research institutions of natural products.

Course Outcomes: Helps the students to understand the organization and research of natural products in herbal drugs industries

UNIT - I
Equipment for preparing herbal extracts: Process and equipments- Name of the equipment and its uses with merits and demerits in each of the following unit operations in the extraction process.
1. Size reduction
2. Filtration
3. Evaporation/Distillation
4. Drying of extracts
5. Solvent recovery

UNIT - II
Definition, classification of natural excipients: Sources, Chemical nature, Description parameters Pharmaceutical uses and storage conditions of following Natural excipients
Binding agents, disintegrating agents, diluents, emulsifying agents:
Acacia, Tragacanth, Alginates, CMC, Gelatin, Pectin, Lactose, Starches, Talc,
Ointment bases, suppository bases and Hardening agents: Beeswax, Cocoa butter, Lanolin, Hard paraffin

UNIT - III
Methods of preparation and Evaluation of Herbal Tablets, Capsules, Ointments and other dosage forms. Study of any three formulations under each category with respect to their formulas and claims for various herbs used in them

UNIT - IV
b. Food Laws and Regulations, FDA, FPO, MPO, BIS, AGMARK.

UNIT - V
a) Natural colorants: Biological Source, coloring principles, chemical nature and usage of the following Annatto, Cochineal, Caramel, Henna, Indigo, Madder, Saffron, Turmeric
b) Natural sweeteners:
   1) Definition of nutritive and non-nutritive sweeteners, qualities of an ideal sweetener and sweetness potency.
   2) Biological source, chemical nature, extraction details and usage of the following: Steviosides, Glycyrrhizin, Rebaudioside

REFERENCE BOOKS:
1. Textbook of Pharmacognosy by G.E. Trease, W.C. Evans, ELBS
2. Textbook of HPTLC by P.D. Seth.
3. Herbal Perfumes and cosmetics by Panda
4. Pharmacognosy by V.E Tyler, LR Brandy and JE Robbers (KM Varghese & co., Mumbai)
5. Natural Excipients by R. S Gaud, Surana.
6. Herbal Drug industry by RD Chowdary
7. Herbal Drug Technology by SS Agarwal
8. Pharmacognosy and Phytochemistry by VD Rangari.
9. Indian Pharmacopoeia
10. Dietetics by Sri Lakshmi
List of Experiments:
1. Analysis of Pharmacopoeial compounds and their formulations by UV Vis spectrophotometer, RNA & DNA estimation
2. Simultaneous estimation of multi component containing formulations by UV spectrophotometry
3. Experiments based on Column chromatography
4. Experiments based on HPLC
5. Experiments based on Gas Chromatography
6. Estimation of riboflavin/quinine sulphate by fluorimetry
7. Estimation of sodium/potassium by flame photometry
8. To perform the following reactions of synthetic importance Purification of organic solvents, column chromatography
   a. Claisen-schmidt reaction.
   b. Benzylic acid rearrangement.
   c. Beckmann rearrangement.
   d. Hoffmann rearrangement.
   e. Mannich reaction
9. Synthesis of medicinally important compounds involving more than one step along with purification and Characterization using TLC, melting point and IR spectroscopy (4 experiments)
10. Estimation of elements and functional groups in organic natural compounds Isolation, characterization like melting point, mixed melting point, molecular weight determination, functional group analysis, co-chromatographic technique for identification of isolated compounds and interpretation of UV and IR data.
11. Some typical degradation reactions to be carried on selected plant constituents
List of Experiments: (Minimum of 10 experiments shall be conducted)
1. Synthesis and characterization of the following drugs:
   a. Phenacetin
   b. Antipyrin
   c. Benzocaine
   d. Uramil
   e. Tolbutamide
   f. Phenothiazine
   g. Isoniazid
   h. Sulphasalazine
   i. aspirin from salicylic acid
   j. paracetamol from p-aminophenol

2. Determination of partition coefficient of any medicinal compound by shake flask method.
3. Any other relevant experiments based on theory.

REFERENCES:
BIOSTATISTICS (Professional Elective - V)

Course Objective: The student shall know the introduction, scope of biostatistics and Research work, calculation and present of the data.

Course Outcome: The student will be known the Biostatistics arrangement, presentation and formation of tables and charts. They also know the correlation and regression & application of different methods, analysis of data.

UNIT - I

UNIT - II
Measures of central tendency: computation of means, median and mode from grouped and ungrouped data.
Measure of dispersion: computation of variance, standard deviation, standard error and their coefficients.

UNIT - III
Measures of Correlation and Regression
Probability rules: Binomial, Poison and Normal distribution.

UNIT - IV
Experimental designing, planning of an experiment, replication and randomization.
Analysis of Variance (ANOVA): 1-way, 2- Way

UNIT - V
Hypothesis testing: Student ‘t’ test, Chi square test,
Non- Parametric Tests: Sign Test, Sign Rank Test, Wilcoxon Sign Rank Test

REFERENCE BOOKS:
1. Statistics for business and economics 3rd edition by Vikas books publications
2. Biostatistics & Computer applications by GN Rao and NK Tiwari
Course Objectives: The student shall learn about Industrial area design, Current good manufacturing practices. They also learn about packaging components, polymers and metals used in packaging. They also understand about the storage conditions of different formulations and their stability evaluations.

Course Outcome: At the end of the semester student will get an idea about Industrial area design and packaging of different formulations and its stability conditions.

UNIT - I
Production Area Design: Selection of plant location, Design of plant for bulk drugs and formulations (Solids, Semisolids, Injectables, Nutraceuticals etc), General utilities such as purified water, portable water, water for injection, Air handling units-Relative humidity and Temperature control, Material and personnel movement. Warehouse handling-API, Excipients, packaging materials and solvents.

UNIT - II

UNIT - III
Pharmaceutical packaging and Design: Introduction, Packaging system, Components of packaging, Symbols used on packages and labels. Package development and Design research. Packaging materials- Polymers and Plasters, Glass, Metal and Blister and strip packaging.

UNIT - IV

UNIT - V

REFERENCES:
1. Leon Lachman; Lieberman Herbert A.; Kanig, Joseph L. The theory and Practice of Industrial Pharmacy.
2. Gilbert Banker and Christopher Rhodes. Modern Pharmaceutics.
3. Aulton’s Pharmaceutics: The design and Manufacture of Medicine
Course Objective: This course is designed to impart knowledge and skills necessary to train the students to be on scale up, technology transfer process and industrial safety issues.

Course Outcome: On completion of this course it is expected that students will be able to:
- Manage the scale up process in pharmaceutical industry.
- Assist in technology transfer.
- To establish safety guidelines, which prevent industrial hazards

UNIT - I
Pilot plant design: Basic requirements for design, facility, equipment selection, for tablets, capsules, liquid orals, parenteral and semisolid preparations.
Scale up: Importance, Technology transfer from R & D to pilot plant to plant scale, process scale up for tablets, capsules, liquid orals, semisolids, parenteral, NDDS products – stress on formula, equipments, product uniformity, stability, raw materials, physical layout, input, in-process and finished product specifications, problems encountered during transfer of technology

UNIT - II
Validation: General concepts, types, procedures & protocols, documentation, VMF. Analytical method validation, cleaning validation and vendor qualification.

UNIT - III

UNIT - IV
Process validation: Importance, validation of mixing, granulation, drying, compression, tablet coating, liquid filling and sealing, sterilization, water process systems, environmental control.

UNIT - V

REFERENCES:
1. Pharmaceutical process validation, JR Berry, Nash, Vol 57, Marcel Dekker, NY.
3. Pharmaceutical project management, T. Kennedy, Vol 86, Marcel Dekker, NY.
5. Tablet machine instruments in pharmaceuticals, PR Watt, John Wiloy.
6. Pharmaceutical dosage forms, Tablets, Vol 1, 2, 3 by Lachman, Lieberman, Marcel Dekker, NY.
7. Pharmaceutical dosage forms, Parenteral medications, Vol 1, 2 by K.E. Avis, Marcel Dekker, NY.
8. Dispersed system Vol 1, 2, 3 by Lachman, Lieberman, Marcel Dekker, NY.
ENGLISH FOR RESEARCH PAPER WRITING (Audit Course - I & II)

Prerequisite: None

Course objectives: Students will be able to:
- Understand how to improve your writing skills and level of readability
- Learn about what to write in each section
- Understand the skills needed when writing a Title Ensure the good quality of paper at very first-time submission

UNIT-I:
Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

UNIT-II:

UNIT-III:
Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

UNIT-IV:
key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature,

UNIT-V:
skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions. useful phrases, how to ensure paper is as good as it could possibly be the first-time submission

TEXT BOOKS/ REFERENCES:
Prerequisite: None

Course Objectives: Students will be able to
- learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- critically understand the strengths and weaknesses of disaster management approaches,
- planning and programming in different countries, particularly their home country or the countries they work in

UNIT-I:
Introduction:
Disaster: Definition, Factors and Significance; Difference Between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

Disaster Prone Areas in India:
Study of Seismic Zones; Areas Prone to Floods and Droughts, Landslides and Avalanches; Areas Prone to Cyclonic and Coastal Hazards with Special Reference to Tsunami; Post-Disaster Diseases and Epidemics

UNIT-II:
Repercussions of Disasters and Hazards:

UNIT-III:
Disaster Preparedness and Management:
Preparedness: Monitoring of Phenomena Triggering A Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological and Other Agencies, Media Reports: Governmental and Community Preparedness.

UNIT-IV:
Risk Assessment Disaster Risk:

UNIT-V:
Disaster Mitigation:
Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs of Disaster Mitigation in India.
TEXT BOOKS/ REFERENCES:
2. Sahni, Pardeep Et. Al. (Eds.),” Disaster Mitigation Experiences and Reflections”, Prentice Hall of India, New Delhi.
SANSKRIT FOR TECHNICAL KNOWLEDGE (Audit Course - I & II)

Prerequisite: None

Course Objectives:

- To get a working knowledge in illustrious Sanskrit, the scientific language in the world
- Learning of Sanskrit to improve brain functioning
- Learning of Sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power
- The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature

Course Outcomes: Students will be able to

- Understanding basic Sanskrit language
- Ancient Sanskrit literature about science & technology can be understood
- Being a logical language will help to develop logic in students

UNIT-I:
Alphabets in Sanskrit,

UNIT-II:
Past/Present/Future Tense, Simple Sentences

UNIT-III:
Order, Introduction of roots,

UNIT-IV:
Technical information about Sanskrit Literature

UNIT-V:
Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics

TEXT BOOKS/ REFERENCES:
1. “Abhyaspustakam” – Dr. Vishwas, Samskrita-Bharti Publication, New Delhi
2. “Teach Yourself Sanskrit” Prathama Deeksha-Vempati Kutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication
Prerequisite: None

Course Objectives: Students will be able to
- Understand value of education and self-development
- Imbibe good values in students
- Let the should know about the importance of character

Course outcomes: Students will be able to
- Knowledge of self-development
- Learn the importance of Human values
- Developing the overall personality

UNIT-I:

UNIT-II:

UNIT-III:
Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline, Punctuality, Love and Kindness.

UNIT-IV:

UNIT-V:

TEXT BOOKS/ REFERENCES:
Prerequisite: None

Course Objectives: Students will be able to:
- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals’ constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

Course Outcomes: Students will be able to:
- Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
- Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
- Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
- Discuss the passage of the Hindu Code Bill of 1956.

UNIT-I:

UNIT-II:

UNIT-III:
Organs of Governance: Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualification, Powers and Functions.

UNIT-IV:

UNIT-V:
TEXT BOOKS/ REFERENCES:
1. The Constitution of India, 1950 (Bare Act), Government Publication.
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.Pharm (Pharmaceutical Chemistry)

PEDAGOGY STUDIES (Audit Course - I & II)

Prerequisite: None

Course Objectives: Students will be able to:
- Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers.
- Identify critical evidence gaps to guide the development.

Course Outcomes: Students will be able to understand:
- What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?
- What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?
- How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

UNIT-I:

UNIT-II:
Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. Curriculum, Teacher education.

UNIT-III:
Evidence on the effectiveness of pedagogical practices, Methodology for the indepth stage: quality assessment of included studies. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? Theory of change. Strength and nature of the body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teachers' attitudes and beliefs and Pedagogic strategies.

UNIT-IV:
Professional development: alignment with classroom practices and follow-up support, Peer support, Support from the head teacher and the community. Curriculum and assessment, Barriers to learning: limited resources and large class sizes.

UNIT-V:
Research gaps and future directions: Research design, Contexts, Pedagogy, Teacher education, Curriculum and assessment, Dissemination and research impact.

TEXT BOOKS/ REFERENCES:
Prerequisite: None

Course Objectives:
- To achieve overall health of body and mind
- To overcome stress

Course Outcomes: Students will be able to:
- Develop healthy mind in a healthy body thus improving social health also
- Improve efficiency

UNIT-I:
Definitions of Eight parts of yog. (Ashtanga)

UNIT-II:
Yam and Niyam.

UNIT-III:
Do’s and Don’t’s in life.
i) Ahinsa, satya, astheya, bramhacharya and aparigraha
ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

UNIT-IV:
Asan and Pranayam

UNIT-V:
i) Various yog poses and their benefits for mind & body
ii) Regularization of breathing techniques and its effects-Types of pranayam

TEXT BOOKS/ REFERENCES:
1. “Yogic Asanas for Group Tarining-Part-I”: Janardan Swami Yogabhyasi Mandal, Nagpur
2. “Rajayoga or conquering the Internal Nature” by Swami Vivekananda, Advaita Ashrama
   (Publication Department), Kolkata
PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS
(Audit Course - I & II)

Prerequisite: None

Course Objectives:
- To learn to achieve the highest goal happily
- To become a person with stable mind, pleasing personality and determination
- To awaken wisdom in students

Course Outcomes: Students will be able to
- Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life
- The person who has studied Geeta will lead the nation and mankind to peace and prosperity
- Study of Neetishatakam will help in developing versatile personality of students

UNIT-I:
Neetisatakam-Holistic development of personality
- Verses- 19,20,21,22 (wisdom)
- Verses- 29,31,32 (pride & heroism)
- Verses- 26,28,63,65 (virtue)

UNIT-II:
Neetisatakam-Holistic development of personality
- Verses- 52,53,59 (don’ts)
- Verses- 71,73,75,78 (do’s)

UNIT-III:
Approach to day to day work and duties.
- Shrimad Bhagwad Geeta: Chapter 2-Verses 41, 47,48,
- Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23, 35,
- Chapter 18-Verses 45, 46, 48.

UNIT-IV:
Statements of basic knowledge.
- Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68
- Chapter 12 -Verses 13, 14, 15, 16,17, 18
- Personality of Role model. Shrimad Bhagwad Geeta:

UNIT-V:
- Chapter2-Verses 17, Chapter 3-Verses 36,37,42,
- Chapter 4-Verses 18, 38,39
- Chapter18 – Verses 37,38,63

TEXT BOOKS/ REFERENCES:
1. “Srimad Bhagavad Gita” by Swami Swarupananda Advaita Ashram (Publication Department), Kolkata.
2. Bhartrihari’s Three Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.