ANDHRA UNIVERSITY

COLLEGE OF PHARMACEUTICAL SCIENCES
VISAKHAPATNAM – 530 003.

From
Prof. D.G. Sankar
Principal

Telephone: 0891-2844922
email: principalpcau@gmail.com

No. AUCOPS/Sup/Pre-Ph.D. Exams/2018

Date: 26-09-2018

N O T I F I C A T I O N

Sub: Pre-Ph.D. Examination October, 2018.
Ref: Proceeding of the V.C. No.T.Section/Pre-Ph.D. Exam/ 2018, dated. 31-01-2018.

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With reference to Proceedings of the Vice-Chancellor, it is proposed to conduct Pre-Ph.D. Examinations on **26th & 27th October, 2018** for eligible Research Scholars, pursuing Ph.D., you are requested to submit the duly filled examination application forms. The applications should reach this office on or before **08-10-2018**.

Enclosers: Examination application form, syllabus and Model question papers.

PRINCIPAL

To
The Dean of Examinations, A.U.
The Dean Academic Affairs, A.U.
The Controller of Examiations, A.U.
The Secretary to Hon'ble Vice-Chancellor, A.U.
P.A. to Registrar, A.U.
All the Faculty members of A.U. College of Pharmaceutical Sciences, A.U.
OOF

Hall Ticket No. | |

(Office Use)

ANDHRA UNIVERSITY
COLLEGE OF PHARMACEUTICAL SCIENCES
VISAKHAPATNAM – 530 003

FORM OF APPLICATION FOR Pre- Ph.D. EXAMINATION OCTOBER, 2018

Affix recent passport size photo graph

1. Name of the College :
2. Name of the College / Recognized Research Centre:
3. Name of the Candidate (in full) (in Capitals)
4. Contact Telephone Number:
5. Course :
6. Date and month of Admission and VC Proceedings No. :
7. Name of the Research Guide:
8. Topic of Research :
9. Particular of qualifying examination (already passed)

Name of the degree	University	Month and Year of Passing	Percentage of Marks

10. Previous appearance of the Examination, if any:

Month & Year of appearing	Paper appeared	Hall Ticket No.	Papers Completed

(The candidates are requested to write the exact title of each paper according to the approved syllabus)

11. Title of Examination papers
    PAPER – I :
    PAPER- II :

Declaration by the candidate

I declare that the particulars given above are true and also I will abide by the rules and regulations of the Andhra University.

Station:
Date : Signature of the Candidate

Certify that the particulars furnished above by the candidate are correct. This is to certify that the candidate he/she attended/not attended course work and is eligible/ not appear for the M.Phil/Pre. Ph.D. Exams

RESEARCH GUIDE PRINCIPAL

Note: Enclose Xerox Copies of 1. Proceedings of the Vice-Chancellor for Ph.D. and Joining Report
2. Fee receipt at the time of joining Ph.D.

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ORIGINAL

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VISAKHAPATNAM – 530 003

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Name of the Candidate :

Identification of Marks : 1.

2.

Name of the College / Organisation:

Date and month of admission :

Specialization : Subject:

(The candidates are requested to write the exact title of each paper according to the approved syllabus)

Titles of Papers appearing : Paper – I
Paper – II

Signature of the candidate PRINCIPAL

1. The candidate will not be permitted into the examination without hall ticket.
2. This hall ticket should be retained carefully till the results is finalized

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Hall Ticket No. | |

DUPLICATE

ANDHRA UNIVERSITY
COLLEGE OF PHARMACEUTICAL SCIENCES
VISAKHAPATNAM – 530 003

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2.

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Date and month of admission :

Specialization : Subject:

(The candidates are requested to write the exact title of each paper according to the approved syllabus)

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SYLLABUS

1.RESEARCH METHODOLOGY SPECIALIZATION PhD SYLLABUS

Unit I: Introduction

Meaning and objectives of research, motivation and dedication in research, criteria of good research, ethics in research, plagiarism, scientific integrity, selecting a topic, importance of planning, planning experimentation, field work and accessing advanced facilities. Ethics concerning studies on animals and human volunteers, ICMR and CDSCO guidelines on ethics in research.

Unit II: Types of Research

Descriptive studies: Case report; *Analytical studies*: Ecology study, cross-sectional study, case-control study, cohort study; *Experimental studies:* Interventional trial studies: Randomized Control Studies, Uncontrolled trial studies; Qualitative study design: Case study, observations, in-depth interview; Pharmacokinetic studies and pharmacodynamic studies, Bioequivalence studies.

Unit III: Literature review

Journals: Standard journals in Pharmaceutical Sciences, Impact factor, Citations, web based journals, writing a research paper, popular websites for scientific literature, choosing a journal for sending research publications, styles of writing references. Search Engines like Google Scholar and Science Direct.

Patents: Importance of patenting, Steps in patenting process, accessing patent literature.

Unit IV: Modern Analytical techniques

Instrumentation and applications of the following techniques for research in pharmaceutical sciences

Chromatography: HPLC, GC, LCMS

Spectrophotometry: UV, IR, NMR, MASS, Flourescence

X-ray Diffraction, DSC and thermo gravimetry

SEM and TEM

Unit V: Designing Research

Sampling and Randomization, Size of sample, Bias, Single Blind Design, Double blind design, Open Design, Completely Randomised Design, Randomised Block Design and Latin Square Design.

Unit VI: **Optimisation**

Optimization through Full Factorial design, Fractional Factorial Design, Simple Lattice, Response surface methodology – Box Benhen Design, Central Composite Design, Evolutionary operations procedure.

Unit VII: **Testing of hypothesis**

Theory, calculation and applications of t-test, z-test, Chi square test, one way ANOVA, two way ANOVA and three way ANOVA, Duncan's test and Tukey's test.

Unit VIII: Preparation of Thesis

Structure of thesis, background of the work, importance of language, grammar, scientific and systematic way of presentation, statistical analysis, use of graphical representation, proper preparation of graphs and tables, discussion, comparison with previous work, interpretation of *in vitro* and *in vivo* results, summary and conclusion.

Unit V: Designing Research

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Optimization through Full Factorial design, Fractional Factorial Design, Simple Lattice, Response surface methodology – Box Benhen Design, Central Composite Design, Evolutionary operations procedure.

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2.PHARMACEUTICAL ANALYSIS AND QA SPECIALIZATION Ph.D SYLLABUS

UNIT -I

UV-VISIBLE & DERIVATIVE SPECTROSCOPY

Brief review of electromagnetic spectrum, UV-Visible range, Energy wavelength colour relationships. Interaction of electro - magnetic radiation (UV-Vis) and matter and its effects, Chromophores and their interaction with EMR, Woodward-Fischer rule, Absorption spectra of organic compounds and complexes illustrating the phenomenon and its utilization in qualitative and quantitative studies of drugs, Beer-Lambert's law, Shifts and their interpretation (including solvent effects). Principles, Instrumentation- including sources, monochromators, detectors, preparation of calibration curves and pharmaceutical applications including assay of official compounds and formulations used in the structure determination, Multicomponent analysis, Derivative spectroscopy. Source of errors and their corrections and validation of spectrophotometric methods.Pharmaceutical Applications

INFRARED SPECTROSCOPY

Nature of Infra-red radiation, Molecular or infra-red spectra, origin of infra red spectra, vibrational energies of diatomic molecules, Interaction of IR radiation with organic molecules and effects on bonds, Brief outline of classical IR instrumentation and interpretation of spectra, including sample preparation for spectroscopy, qualitative interpretation of IR Spectra, influence of substituent's, ring size, hydrogen bonding, vibrational coupling and field effect on frequency, quantitative methods, FT-IR and applications. Recent advances in IR Spectroscopy (FT-NIR), Interpretation of IR spectra- Characteristic group frequencies of organic molecules.Pharmaceutical Applications.

UNIT- II

H ^{1} NMR AND C 13 NMR SPECTROSCOPY

Nuclear spin and magnetic moment, nuclear magnetic- resonance-origin of NMR spectra, theory of NMR spectroscopy, Nuclear resonance: saturation-relaxation process in NMR, Flipping – origin of signal, factors effecting -chemical shift and spin spin splitting. Double resonance-spin spin decoupling and nuclear overhauser effect (NOE). One dimensional and two dimensional NMR spectroscopy- comparisons between one dimensional and two dimensional NMR, C13 NMR-natural abundance of C13, resolution and multiplicity FT mode, RF mode, uses of proton coupled, decoupled and off resonance decoupling techniques, deuterium substitution, chemical

equivalence in peak assignment, chemical shift. Effect of 4 substitution on chemical shifts, position of alkanes, alkenes, alkynes and benzene spin coupling and c13 -H 1 coupling – other techniques and pharmaceutical Applications.

UNIT III

MASS SPECTROSCOPY

Basic principles and instrumentation (components and their significance).Ionization techniques (FAB, MALDI, SELDI, APCI, APPI, ESI and DART).Mass analyzers [Quadrupole, Ion Trap, FT-ICR, TOF and tandem mass (MS-MS)].High resolution mass spectroscopy. Concepts of interpretation of mass spectra: Mass spectrum, molecular ion, metastable ions, fragmentation patterns α fission, β fission. Mac Lafferty rearrangement, Retro Diels Alder rearrangement. Pharmaceutical applications.

Hyphenated techniques of Mass Spectroscopy Hyphenated techniques-GC-MS/MS, LC-MS/MS- including recent advances in MS, fast atom bombardment mass spectroscopy; Pharmaceutical Applications.

UNIT IV

HIGH PERFORMANCE LIQUID CHROMATOGRAPHY AND DERIVATIVE METHODS

Theoretical principles involved in HPLC, discussion of typical equipment including pumps, columns, injection systems, detectors, packing materials and solvent systems, pharmaceutical applications, advantages and disadvantages. Precolumn and post column derivatization, detection methods, reagents for coloured and UV absorbing derivatives, reagents for UV/Visible detection, fluorimetric detection, fluorescent derivatives, electrochemical 5 derivatives, chiral derivatization reagents. Introduction to UPLC and pharmaceutical applications.

UNIT V

GAS CHROMATOGRAPHY

Basic principles, instrumentation, columns, detectors, Van Deemter equation, Kovats retention index and HETP and temperature programming, qualitative and quantitative applications in Pharmacy, combination of GLC with other methods, advantages and disadvantages.Derivatization techniques – acylation, silylation, alkylation and esterification. Introduction to head space GC and pharmaceutical applications.

Super critical fluid chromatography Introduction, theory, important properties of supercritical fluids, fluid extraction solvents, Categorization of SFC, instrumentation and pharmaceutical applications.

UNIT VI

ANALYTICAL METHOD VALIDATION

a. Recommendation of ICH guideline- Definition of accuracy, precision, linearity, LOD,

LOQ, range, robustness, ruggedness, specificity, system suitability test.

b. USP requirement of analytical validation- different category of assays.

c. Stability indicating methods.

d. Bio analytical method validation .

UNIT VII

INSTRUMENTS CALIBRATION

a. Analytical balance calibration.

b. Calibration of weight box.

c. Calibration of UV-spectrophotometer.

d. Calibration of IR spectrophotometer.

e. Calibration of HPLC system.

f. Calibration of Gas Chromatography instrument.

g. Performance check of HPLC/GC column.

h. Out of Calibration.

UNIT VIII

ANALYSIS OF DRUGS IN DOSAGE FORMS

A detailed study of principles and procedure involved in various physicochemical methods of analysis including instrumental methods, (biological and microbiological methods to be completely excluded) of pharmaceutical preparations and dosage forms include in the Indian

pharmacopoeia containing the following class of drugs.

a) Anti Malarial drugs b) Anti Neoplastic Drugs

c) Antibiotics d) Anti viral drugs

UNIT -IX ANALYSIS OF DRUGS IN DOSAGE FORMS

A detailed study of principles and procedure involved in various physicochemical methods of analysis including instrumental methods, (biological and microbiological methods to be completely excluded) of pharmaceutical preparations and dosage forms include in the Indian pharmacopoeia containing the following class of drugs**.**

a) Steroidal Harmones b) Vitamins

c) Anti tubercular drugs d) Sulfonamides

UNIT X

ANALYSIS OF DRUGS IN DOSAGE FORMS

A detailed study of principles and procedure involved in various physicochemical methods of analysis including instrumental methods, (biological and microbiological methods to be completely excluded) of pharmaceutical preparations and dosage forms include in the Indian pharmacopoeia containing the following class of drugs.

a) Adrenergic drugs b) Diuretics

c) Anti hypertensive drugs

UNIT -XI

ANALYSIS OF DRUGS IN DOSAGE FORMS

A detailed study of principles and procedure involved in various physicochemical methods of analysis including instrumental methods, (biological and microbiological methods to be completely excluded) of pharmaceutical preparations and dosage forms include in the Indian pharmacopoeia containing the following class of drugs.

a) Drugs acting on CNS (Local anesthetics, Sedatives and hypnotics, Anti depressants, Anti psychotics)

b) Analgesics and Anti Pyretics.

UNIT XII

REAGENTS AND FUNCTIONAL GROUP BASED ANALYSIS OF ACTIVE PHARMACEUTICALINGREDIENTS (API)

Principles and procedures involved in quantitative determination of the following functional groups a) Hydroxy b) Aldehyde c) Ketone d) Amine

e) Methoxyl f) Ester g) Carboxyl

Analytical principles, procedures and applications involved in the use of the following reagents.

a) MBTH (3-methyl-2-benzothiazoline hydrazone).

b) Folin – Ciocalteu (FC) reagent.

c) 2,6- Dichloroquinone chlorimide.

d) 2,3,5- Triphenyl tetrazolium salt.

e) 1,2- naptho quininone -4- sulfonate.

f) Bratton-Marshall reagent.

g) p-Dimethyl amino cinnamaldehyde (PDAC) reagent.

UNIT XIII

Stability Testing

Solidstatedrugstability,acceleratedstabilitystudies,physicaldegradationofpharmaceuticalproducts, prolongingtheshelflife,effectofpackagingmaterialsondosageformonstability,ICHguidelines-ICHbasicprinciples,stabilitytestingofnewdrugsubstanceandformulations,photostabilitytesting,Containers.WHOstabilityguidelines.ForcedDegradation.

ImpurityProfiling

Sourcesofimpuritiesandtheireffectondrugstabilityandtherapeuticaction.Determinationofimpurities inbulkdrugs:Isolation,characterization,andanalyticalmethodsFormulationrelatedimpurities:Isolation,characterization,andanalyticalmethods.ICHandWHOguidelinesforimpurityandrelatedsubstances in the drugs.

3.PHARMACEUTICAL BIOTECHNOLOGY SPECIALIZATION Ph.D SYLLABUS

Unit I

Separation of proteins by 2D electrophoresis, Purification of proteins – salting out, precipitation by organic solvents, dialysis, ion-exchange, size exclusion and affinity chromatography methods. Capillary electrophoresis and its applications.

Unit II

Identification of proteins by MALDI-TOF MS, Applications of proteomics – Drug discovery, disease diagnosis, identification and characterization of novel proteins.

Unit III

Bioinformatics: Types of biological data, biological data bases, Nucleic acid and protein sequence data bases. Data base and search engines in proteomics. Protein modeling, Protein & DNA microarrays.

Unit IV

Specific DNA techniques- DNA sequencing, Genome sequencing, DNA hybridization and PCR technology. Theory of lyophilization and its application to biological systems, protein recovery.

Unit V

Nucleic acid technologies – Oligonucleotides, Antisense technology, Aptamer technology, and Ribozymes. Advances in screening – High-throughput screening

Unit VI

Modern vaccine technologies – Genetically improved live vaccines, Genetically improved subunit vaccines, synthetic peptide-based vaccines and Nucleic acid vaccines,

Unit VII

Development of Human monoclonal antibodies as therapeutcis – Human antibodies derived through Phage-display, Human antibodies from Genetically Engineered Mice and Antibody derivatives.

Unit VIII

Isolation, detection and characterization of viruses. Animal cell cultures, Cell line based evaluation of anticancer agents.

4.PHARMACOLOGY SPECIALIZATION Ph.D SYLLABUS

UNIT- I: Basic principles of Pharmacology

Mechanisms of drug action, Types of Receptor proteins and their molecular structure, Targets for G-Protein coupled receptors, Protein phosphorylation and Kinase cascade mechanisms, Cellular aspects- Excitation, Contraction and Secretion.

UNIT –II: ADME of drugs

Transfer of drugs through biological membranes. Plasma protein binding of drugs. Microsomal & Non-microsomal biotransformation of drugs. Excretion of drugs by various routes.

UNIT –III: Endogenous Mediators

1. Histamine 2. Prostaglandins 3. Leucotrienes

4. Kinins 5. Opioids 6. Nitric oxide

UNIT –IV:

Common laboratory animals in pharmacological research. Anaesthetics used in laboratory animals, Some standard techniques used in handling laboratory animals. Regulation for the care and use of laboratory animals. Acute, Sub-acute, and Chronic toxicity studies.

UNIT –V:

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

UNIT –VI:

Stem Cell: Basic concepts and their therapeutic applications in medicine.

Free radicals - their role in biological system, endogenous anti-oxidant system.

RAS

UNIT –VII: Screening methods and biological assay

Simple, Blind and Programmed screening. Organization for Screening of Pharmacological activity and Evaluation of new substances.

Methods used in the bioassays and development of new bioassay methods.

UNIT –VIII: Pharmacology of Receptors

1. Excitatory amino acid receptors 2. Purinoreceptors

3. Cannabinoid receptors 4. Adrenergic receptors

5. Cholinergic receptors 6. Dopaminergic receptors

7. Serotonergic receptors

5.PHARMACEUTICAL TECHNOLOGY SPECIALIZATION Ph.D SYLLABUS

UNIT – I Bioavailability and Bioequivalence: Definition, objectives, considerations in *in-vivo* bioavailability study design, objectives for bioequivalence studies, types of bioequivalence studies, measurement of bioavailability, correlation of *in-vitro* dissolution & *in-vivo* bioavailability (IVIVC), methods for enhancement of bioavailability. Biopharmaceutical factors influencing the dosage form design.

UNIT – II Dissolution: BCS classification system, theories of drug dissolution, study of various approaches to enhance dissolution of poorly water soluble drugs, i*n-vitro* drug dissolution testing models for different dosage forms based on USP, modeling and comparison of dissolution profiles using model independent and model dependent approaches.

UNIT – III Topical drug delivery: Advantages and limitations, basic components and approaches used in development of transdermal drug delivery and evaluation of transdermal drug delivery. **Ocular drug delivery:** Characteristics, formulation approaches, ophthalmic inserts.

UNIT – IV Tablets: Types of tablets, advantages, disadvantages, components, granulation techniques, processing problems during granulation and evaluation of tablets. **Tablet coating:** sugar coating, film coating and aqueous film coating, problems during processing of tablets and evaluation of tablets.

UNIT – V Drug stability: Pre-formulation studies as per ICH guidelines**,** stability testing protocol, methods of accelerated stability testing in dosage forms, freeze-thaw methods, centrifugal methods, temperature and humidity control, stability studies as per ICH, WHO guidelines, classification of solvents as per ICH guidelines**,** drug excipient compatibility and incompatibility studies using DSC, XRD and IR.

UNIT–VI Vesicular systems: Classification, preparation methods, characterization and therapeutic applications of nanoparticles, neosomes, self emulsifying drug delivery systems (SEDDS), self micro emulsifying drug delivery systems(SMEDDS) and liposomes. **Drug targeting:** Concepts of targeting, passive targeting, active targeting, first, second and third order targeting, targeting to a tumor.

UNIT – VII Mucoadhesion: Definition, mucoadhesion**,** advantages, disadvantages, methods of preparation and evaluation techniques of buccal and sub lingual drug delivery systems. **Gastro retentitive drug delivery systems**: Drug suitability, approaches and evaluation.

UNIT – VIII Controlled and sustained drug delivery systems: Concepts of design sustained release dosage forms, calculation of loading and maintenance doses based on zero order and first order release. **Polymer Science:** Types of polymers, properties of polymers, polymer solution and polymers in solid state, applications of polymers in pharmaceutical formulations.

6.PHARMACEUTICAL CHEMISTRY SPECIALIZATION Ph.D SYLLABUS

Unit 1

Nucleophilic substitution reactions- S_N1, S_N2 including their mechanisms, Elimination reactions- E1 and E2 including their mechanisms.

Unit 2

Named reactions:

Michael addition, Mannich reaction, Bayer Villager oxidation, Oppenaeur oxidation and their applications in organic synthesis.

Unit 3

Reagents and their applications:

Lithium aluminium tetrahydride, Sodiumborohydride, N Bromosuccinamide and Diazomethane

Unit 4

General methods of Isolation of alkaloids, Identification tests and general methods used in their structural determination.

Unit 5

Cardiac glycosides: Isolation, Methods of hydrolysis and structural features.

Marine natural products with therapeutic potential.

Unit 6

Pro drugs and soft drugs:

Objectives of pro drug design and strategies of design of pro drugs

Unit 7

Types of receptors, Binding forces, theories of drug action.

Unit 8

Anti viral and Anti HIV drugs, Anti hypertensive drugs, Antipsychotics and Antidepressants.

1. **Introductory Pharmacognosy**

   Historical development, modern concept and scope of Pharmacognosy. Significance of Pharmacognosy in various systems of medicine practiced in India viz: Ayurveda, Unani, Homeopathic and Siddha.

2. **Classification of crude drugs**

   Based on alphabetical, morphological, pharmacological, chemical, taxonomical and chemotaxonomic methods: organized and unorganized drugs: official and unofficial drugs.

3. **Sources of crude drugs**

   Plants, animals and minerals: marine products: plant tissue culture.

4. **Factors influencing quality of crude drugs exogenous factors:** temperature, rainfall, daylight, altitude and soil. Endogenous factors: Mutation, polyploidy, & hybridization in medicinal plants. Production factors including collection, drying, storage and transport methods. Study of morphological and histological characters of crude drugs, Ergastic cell inclusions, anatomical structures of both monocot and dicot stems, leaves and roots: barks, fruits and seeds.

5. **Techniques in microscopy** Details of mountants, clearing agents, chemomicroscopic (microchemical) reagents.

6. **Introduction to phytoconstituents** Definition, classification, chemical tests and pharmaceutical importance of: carbohydrates and their derivatives, fats and proteins, alkaloids, glycosides, flavonoids, steroids, saponins, tannins, resins, lipids and volatile oils.

7. **Principles of plant classification** Diagnostic features and medicinal significance of important plants with special reference to: Algae: Rhodophyceae (Agar, Alginic acid, Diatoms). Fungi: Ergot, Yeast and penicillium. Gymnosperm: Pinaceae (Turpentine, Colophony), Gnetaceae (Ephedra). Angiosperm: Apocynaceae, Asteraceae, Lamiaceae, Rubiaceae, Rutaceae, Solanaceae, Scrophulariaceae, Leguminosae, Papaveraceae, Acanthaceae and Apiaceae. Pteridophytes: Male fern.

8. **Pharmaceutical aids** Biological sources, chemical constituents, adulterants and uses of: Starches, acacia gum, tragacanth, sterculia, guar gum, pectin, arachis oil, castor oil, sesame oil, cotton seed oil, olive oil, cotton, silk, wool, regenerated fibers, asbestos, kaolin, prepared chalk, kieselghur.

9. **Animal products** Biological sources, chemical constituents, adulterants and uses of: Shellac, cochineal, cantherides, woolfat, lard, beeswax, honey, musk, lanolin, gelatin.

10. **Plant products** Introduction to plant bitters, sweeteners, nutraceuticals, cosmeceuticals and photosensitizing agents.

11. **Toxic drugs** Study of allergens, hallucinogens, narcotics, toxic mushrooms

12. **Enzymes** Biological sources, preparation, characters and uses of: diastase, papain bromalain, ficin, yeast, pancreatin, urokinase, pepsin, trypsin, pencillinase, hyaluronidase and stryptokinase.

13. **Natural pesticides and insecticides** Introduction to herbicides, fungicides, fumigants and rodenticides tobacco, pyrethrum, & neem.

14. **Adulteration and evaluation of crude drugs** Different methods of adulteration: Evaluation of drugs by organoleptic, microscopic, physical, chemical and biological methods. Deterioration of herbal drugs by insects.

15. **Quantitative microscopy** Definition and determination of stomatal index, stomatal number, palisade ratio, vein islet number, vein termination number, lycopodium spore method. Micrometers and measurement of microscopic characters.

16. **Biogenetic pathways** Formation of primary and secondary metabolites. Study of Calvin cycle, TCA cycle, Shikimic acid pathway, Embden-Mayerhoff pathway, acetate hypothesis, isoprenoid pathway. Biosynthesis of carbohydrates, lipids and volatile oils.

17. **Carbohydrates & lipids** Biological sources, salient morphological features, chemical constituents, and uses of: Plantago, bael, chalmooogra oil, neem oil, shark liver oil, cod liver oil, guggul lipids.

18. **Tannins** Biological sources, morphology, chemical constituents, chemical test and uses of: Pale catechu, black catechu, nutgalls, Terminalia belerica, Terminalia chebula, Terminalia arjuna.

19. **Volatile oils** Biological sources, morphology, chemical constituents, adulterants and uses of: Black pepper, turpentine, mentha, coriander,

cardamom, cinnamon, cassia, lemon peel, orange peel, lemon grass, citronella, cumin, caraway, dill, spearmint, clove, anise, star anise, fennel, nutmeg, eucalyptus, chenopodium, ajowan, sandal wood.

20. **Resinous drugs** Classification, formation, sources, chemical constituents, identification test, adulterants and uses of: benzoin, peru balsam, tolu balsam, colophony, myrrh, asafoetida, jalap, colocynth, ginger, turmeric, capsicum, cannabis, podophyllum.

21. **Glycosides** Nature and classification. Biological sources, morphology, chemical constituents, adulterants and uses of: Digitalis, strophanthus, squill, thevetia, oleander, cascara, aloe, rhubarb, senna, quassia, dioscorea, quillaia, glycyrrhiza, ginseng, gentian, wild cherry, withania, bitter almond. Biosynthesis of cardiac and anthraquinone glycosides.

22. **Alkaloids** Nature, classification, biological sources, morphology, chemical constituents, adulterants and uses of: Areca nut, belladonna, hyoscymous, stramonium, duboisea, coca, coffee, tea, cinchona, opium, ipecac, nux vomica, ergot, rauwolfia, vinca, kurchi, ephedra, colchicum, vasaca, pilocarpus, aconite, Solanum xanthocarpum. Biosynthesis of tropane, cinchona and opium alkaloids.

23. **Herbarium** Preparation of herbarium sheets and their importance in authentication of plants.

24. **Extraction and Isolation Techniques** General methods used for the extraction, isolation and identification of alkaloids, lipids, glycosides, flavonoids, saponins, volatile oils and resins. Application of column, paper and thin layer chromatographic techniques, for the isolation of phytopharmaceuticals.

25. **Phytopharmaceuticals** Isolation, identification and estimation of: caffeine, eugenol, digoxin, piperine, tannic acid, diosgenin, hesperidine, berberine, calcium sennosides, rutin, glycyrrhizin, menthol, ephedrine, quinine, andrographolides and guggul lipids.

26. **Quality control and Standardization of herbal drugs** Quality control of herbal drugs as per WHO, AYUSH and Pharmacopoeial guidelinesExtractive values, ash values, chromatographic techniques (TLC, HPTLC and HPLC) for determination of chromatographic markers. Determination of heavy metals, insecticides, pesticides and microbial load in herbal preparations.

27. **Herbal formulations** Principals involved in Ayurveda, Sidha, Unani, Chinese and Homeopathic systems of medicines. Preparation of Ayurvedic formulations like aristas, asava, ghutika, tailia, churna, avaleha, ghrita and bhasmas: Unani formulations like majooms, Safoofs. Determination of alcohol contents in arishtas & asavas.

28. **Worldwide trade of crude drugs and volatile oils** Study of drugs having high commercial value and their regulations pertaining to trade.

29. **Plant Biotechnology** History and scope of plant tissue culture, growth media, plant growth regulators: callus and suspension culture, Biotransformation, immobilization, hairy root culture. Transgenic plants and their applications, plant tissue culture as source of secondary metabolites.

30. **Herbal cosmetics** Importance of herbals as shampoos (soapnut), conditioners and hair darkeners, (amla, henna, hibiscus, tea), skin care (aloe, turmeric, lemon peel, vetiver).

31. **Traditional herbal drugs** Common names, sources, morphology, active constituents and uses (traditional, folklore), pharmacological and clinical uses of: punarnava (Boerhaviadiffusa), shankhpushpi (Convolvulus microphylla), lehsun (Allium sativum), guggul (Commiphora mukul), kalmegh (Andrographis peniculata), tulsi (Ocimum sanctum), valerian (Valerian officinalis), artemisia (Artemisia annua), chirata (Swertia chirata), ashoka (Saraca indica).

32. **Plants based industries and research institutes in India** Knowledge about the herbal products being manufactured by premier herbal industries and thrust area of the institutes involved in plant research.

33. **Patents** Indian and International patent laws, proposed amendments as applicable to herbal/natural products and processes: Intellectual Property Rights with special reference to phytoconstituents.

MODEL QUESTION PAPERS

Subject: RESEARCH METHODOLOGY

Time : 3 hours Max. Marks: 100

Answer any FIVE Questions. All questions carry equal marks.

1. Discuss on the importance of ethics and planning in research in pharmaceutical sciences.
2. Explain how cohort studies, case studies and randomized control studies are carried out.
3. Write notes on any four important journals in the field of pharmaceutical sciences and discuss the criteria based on which you would choose a journal for sending your work.
4. Explain the principles and applications of High Performance Liquid Chromatography, Scanning Electron Microscopy, and X Ray Diffraction in pharmaceutical research.
5. Explain the theory, applications and analysis of Completely Randomised Design and Latin Square Design.
6. Explain full factorial design and Box Benhen design.
7. Explain about Chi square test and t test.
8. Explain how presentation of results and discussion of results is to be carried out.

Subject: PHARMACEUTICAL ANALYSIS & QUALITY ASSURANCE

Time : 3 hours Max marks: 100

Answer any **Five** Questions

1. Write principle, instrumentation and applications of UV Visible spectroscopy and IR spectroscopy.

2. What is the principle involved in NMR spectroscopy. How can you Interpret the NMR spectra explain with example.

3. Explain in detail
   a. Various Ionization techniques involved in Mass Spectroscopy
   b. LC- MS

4. Write principle, instrumentation and applications of HPLC add a note on various detection techniques.

5. Give a detailed explanation on
   a. Super critical fluid chromatography
   b. Various derivatization techniques available in Gas chromatography.

6. Write about
   a. Analytical method validation
   b. Stability indicating methods
   c. Calibration of HPLC

7. Write the principle and procedure for the determination of
   a. Antiviral drugs b. Sulfonamides

8. Write the principle and procedure for the determination of
   a. Drugs containing Hydroxy group
   b. Principle involved in usage of Folin – Ciocalteu(FC)reagent.

Subject: PHARMACEUTICAL BIOTECHNOLOGY

Time: 3 hrs **Max. Marks: 100**

Answer any FIVE questions from the following
All questions carry equal marks.

1. Describe in detail about the purification of proteins obtained from microbiological source. Add note on stability of protein.

2. Write about the following:

   a) Proteomics and its applications
   b) b) Identification of proteins by MALDI TOF-MS

3. Write notes on the following

   a) Protein sequence data bases
   b) DNA micro arrays

4. Write in detail about the following.

   a) DNA sequencing
   b) Ribozymes

5. Write the in detail about the working principle and applications of capillary electrophoresis. Add note on freeze drying.

6. Describe in detail about genetically improved subunit vaccines and nucleic acid vaccines

7. Discuss about the production of human antibodies derived through phage-display and write a note on high throughput screening.

8. Write in detail about the cell line based evaluation of anticancer agents.

Subject: PHARMACEUTICAL TECHNOLOGY

Time: 3 hours **Max. Marks: 100**

Answer any five questions

All questions carry equal marks

1. a) What are the objectives of bioequivalence studies? Explain the models used in bioavailability studies. 12

   b) Write about the methods for improving bioavailability. 8

2. a) Write about model independent and model dependent methods for interpretation of dissolution data. 14

   b) Write about the theories of dissolution. 6

3. a) Write about the ingredients used in transdermal preparation. 12

   b) Explain the evaluation methods for ophthalmic inserts. 8

4. a) Write about different types of coating techniques highlighting their relative merits. 12

   b) Write the in process quality control tests for tablets with their limits of acceptance. 8

5. a) Explain the methods for studying drug-excipient compatibility. 10

   b) What is stress testing and how it is carried out on drug product? 10

6. a) Write about different types of drug targeting. 10

   b) Write about the significance of liposomes and their methods of preparation. 10

7. a) Write about the theories of mucoadhesion. 10

   b) Mention the qualities of drugs suitable for designing gastroretentive drug delivery systems. Discuss about the techniques for preparation of effervescent gastric systems. 10

8. a) Explain the approaches for calculation of loading and maintenance dose with zero order release pattern. 10

   b) Write about the hydrophilic polymers suitable for controlled drug delivery with suitable examples. 10

Subject: PHARMACEUTICAL CHEMISTRY

Time: 3 hours **(Max Marks: 100)**

Answer any five questions- All questions carry equal marks:

1) What do you understand by the terms S_N1 and S_N2? Explain with suitable examples the mechanistic features of these reactions. 20M

2) Discuss the mechanism and applications of :

   a) Mannich reaction. b) Oppenaeur oxidation 2x10=20M

3) Give an account of the applications of Lithium aluminium tetrahydride in organic synthesis. 20M

4) What are alkaloids? Discuss the general methods of their structural determination. 20M

5) What are soft drugs? Discuss with examples their advantages and disadvantages. 20M

6) What are Anti depressants? Classify them with examples, Discuss the mode of action and SAR of tricyclic anti depressants. Outline the synthesis of imipramine. 20M

7) What do you know of:

   a) Marine natural products b) Types of receptors. 2x10M

8) Write short notes on

   a) Prodrugs b) Antihypertensive agents 2x10M

Subject: PHARMACOGNOSY

Time: 3 hours Marks:100

Answer any Five Questions.

1. A) Biosynthesis of Shikmic acid pathway.
   B) Biosynthesis of Lysergic acid.

2.a) Briefly explain the Pharmacognostic studies of a crude drug.
   b) Write about the Indian and aromatic plants with suitable examples.

3.a) Briefly explain the quality control of herbal drugs.
   b)Stas Otto Method.

4. a) Discribe the life cycle of Ergot
   b) Explain any two herbal formulations with suitable examples.

5. a) What are transgenic plants. Briefly explain their applications.
   b) Discribe any two unaniformulations with suitable examples.

6. a)Briefly explain the isolation, identification, and estimation of diosgenin.
   b) Write about the intellectual property rights for Phytopharmaceuticals.

7. Explain the significance of Pharmacognosy in various systems of medicine

8. a) Explain the deterioration of herbal drugs by insects.
   b) Explain briefly about streptokinase

Subject: PHARMACOLOGY

Time : 3 Hrs Max.Marks : 100

Answer any FIVE questions

All questions carry equal marks

1.Write about the following.

a) What are GPCRs ? Discuss in detail about signal transduction pathways of GPCRs.

b) Discuss about the mechanism of contraction of skeletal muscle.

2.Discuss in detail about the following.

a) Biological factors affecting drug absorption.

b) Phase I metabolic reactions.

3. Describe the following.

a) Biosynthesis and functions of serotonin.

b) Physiological and pathological functions of prostaglandins.

4. Discuss about the following.

a) CPCSEA guidelines

b) Acute toxicity studies

5.Write about the role of the following in drug discovery.

a) High throughput screening

b) In vitro testing of drugs

6.Discuss about the following.

a) Types of stem cells and their applications.

b) Production of free radicals.

7.Write about the following.

a) Programmed screening.

b) Different bioassay methods.

8.Discuss about the following.

a) Glutamate receptors.

b) Adrenergic receptors.