LAMRIN TECH SKILLS UNIVERSITY
Ph.D. ENTRANCE TEST

SYLLABUS
(LTSU PET-2024)

The **LTSU-PET** (Lamrin Tech Skills University Ph.D. EntranceTest) for Ph.D. in Pharmacy consists of two parts:

• Part I: Research Methodology (35 marks) and

• Part II: Core Subjects (Related to Pharmacy 35 marks)

Total Marks for Ph.D. Entrance Test: 70 Marks

50% marks are required to qualifying the LTSU-PET

SYLLABUS

Part I: Research Methodology (35 Marks)

1. **Basics of Research:** Definition, characteristics, types, need of research. Identification of the problem, assessing the status of the problem, formulating the objectives, preparing design (experimental or otherwise), and actual investigation.
2. **Literature Review:** Importance of literature review, methods, and sources of literature review, review the literature selected, formulating the research problem based on extensive literature survey,developing the hypothesis, preparing the research design, development of a theoretical and conceptual framework, writing up the synopsis of the proposed Ph.D. program.
3. **Writing a Research Proposal:** Research grant funding agencies, preparation of study protocols, preparing for application to funding agencies (Preamble, problem, objectives, hypothesis to be tested, design of study, measurement procedures, analysis of data, organization of report, displaying data tables, graphs, and charts).
4. **Data Collection and Computer applications:** Methods of primary and secondary data collection, selection of appropriate method of data collection. Use of word processing, spreadsheet, and database software. Plotting of graphs. Internet and its application: E-mail, WWW, Web browsing, acquiring technical skills, drawing inferences from data.
5. **Research Ethics, IPR and Scientific Communication:** Ethics-ethical issues, ethical committees (human and animal); prewriting considerations, thesis writing, formats of report writing, preparing posters for scientific presentation, preparing, and delivering of oral presentation. Scholarly publishing-IMRADconcept and design of research paper, citation andacknowledgement, plagiarism, reproducibility and accountability, general consideration of IPR for patent drafting and submission.

6. **Introduction to Statistics:** Introduction to hypothesis, procedure for hypothesis testing, sample size, statistical tests of significance, mean, mode, median, parametric tests (students "t" test, ANOVA, correlation coefficient, regression), non–parametric tests (Wilcoxon rank tests, analysis of variance, correlation, chi-square test), null hypothesis, P-values, degree of freedom, interpretation of P-values.
7. **Communication Skills:** Meaning and importance of communication, objectives of communication, need for communication, types of communication, written and verbal communication language as a tool for communication, forms of technical communication.

Part II: Core Subject Paper Pharmacy (35 Marks)

A. **PHARMACEUTICALCHEMISTRY**

1. **General Principles:**Physicochemical properties in relation to drug action; metabolic transformation ofdrugsand itsroleindevelopmentof newdrugmolecules;metabolicantagonism.

   Stereo-chemicalaspectsofdrugreceptorinteractionsandmechanismofdruginteraction. Isosterism and bio-isosterism as guides to structural variations; Concepts ofconformationalanalysisanditsrole indesignanddevelopmentof newdrugmolecules.

   Principle of drug design: Analogue synthesis versus rational design; discovery ofleadcompounds,Pharmacophoricidentification,Prodrugsandsoftdrug.

2. **QSARandintroductiontomolecularmodeling.**

   Followingnamereactionsandtheirapplicationinthesynthesisofsomemedicinalagents.

   - Claisen-Schmidtreaction.
   - Perkinsreaction
   - FriedalCraftReaction
   - Aldolcondensation
   - Mannichreactions.
   - Beckmann'srearrangement.
   - Wagner-Meerweinrearrangement
   - Wittig Reaction
   - Oppenauroxidation.
   - (Meervein-pondroff-verley)M.P.V.Reduction

3. **Naturalproducts**:Leadsfornewpharmaceuticalsobtainedfromterrestrialandmicrobial sources will be discussed in the light of various degradative and syntheticapproaches. Important members representing the following classes of natural productsshallbediscussed.

   - Alkaloids:Generalintroductionandclassification,isolationandpurificationmethods,generalmeth ods employed for determining the structure of alkaloids, constitution of morphine,reserpineandquinine.
   - Steroids:General introduction, stereochemistry, nomenclature and structure elucidation of sterols(cholesterol),sapogenin (diosgenin)and cardiacglycosides.

- AminoAcids,PeptidesandNucleicacids:Generalintroduction,synthesisofpeptidesandaminoacids .Endgroupanalysis,structuralfeaturesofInsulin,vasopressin and oxytocin.
- Antibiotics:Classificationofantibiotics,structuraldetailsofpenicillinsandtetracyclines,polypeptide antibiotics.
- Flavonoids: Detailedchemicalaccountofrutinandquercetin.
- Triterpenoids:Ageneralchemicaltreatmentandstructuralelucidationofterpenoids
- Coumarins: General methods of isolation and structural determination of Xanthotoxinandpsoralene.

4. **CardiovascularAgents:**Anti-hypertensiveagents,antiarrhythmicagents,antihyperlipidemicagents,antianginal agents.

5. **Psychopharmacologicalagents:**

   AntipsychoticAgents:Introduction,Biochemicalbasisofmentaldisorders,Developmentofantipsychoticagents:Phenothiazines,Butyrophenones:Atypicalantipsychoticagents.

   AntidepressantDrugs:Introduction,Developmentoftricyclicantidepressants,Monoamineoxidaseinhibitors;Selectiveserotonin-reuptakeinhibitors;Atypicalantidepressants,Lithiumsalts.AntianxietyAgents: Introduction, medicinal Chemistry of benzodiazepines; SAR of benzodiazepinederivatives, medicinal chemistry of non-benzodiazepine; serotonin-reuptake inhibitors, development of meprobamate and analogues; atypical anxiolytic agents.

6. **Chemotherapy:**AntiviralagentsincludingthedevelopmentinchemotherapyofAIDS.
   - Drugsforneoplasticdiseases.
   - Drugaffectingimmuneresponses.
   - Radioprotectivedrugs.
   - Analgesics and anti-inflammatory agents, Prostaglandins, Nonsteroidaldrugs,Steroidaldrugs,Endorphins.
   - Diureticagents
   - ChemistryofcellmembraneSignaltransductionandG.Proteins.

B. **PHARMACOLOGY**

1. **Basic Principles in Drug Therapy:** Drug-receptor interaction, Cellular TransductionMechanisms, Adverse Drug Reactions, Drug therapy in elderly, Drug Therapy duringpregnancyandlactation,Genetherapy, ChiralPharmacology.
2. **Drugs acting on the Autonomic Nervous System and Central Nervous System:**Neurotransmitter in ANS and CNS, Muscarinic Receptor (Agonists and Antagonists),Cholinesterase Inhibitors, Agents acting at the skeletal muscle and autonomic ganglia,SympathomimeticDrugs andAdrenergic receptorantagonists.

   Drugs in the treatment of Anxiety, Depression, Psychosis, Mania, Epilepsy andParkinsonism,Opioidanalgesicsandantagonists,Drugaddictionanddrugabuse.
3. **DrugseffectingCardiovascularfunctionandDigestiveSystem:**

   Diuretics,Congestiveheartfailureanditstreatment,Pharmacotherapyofhypertension,Drugsused inthetreatmentofcoronaryarterydiseases,Arrhythmiaanditsmanagement,Drugsusedinthetreat mentofHyper lipo-proteinemias,Anticoagulant,thrombolyticandantiplateletdrugs. Pharmacotherapyofpepticulcer,ulcerativecolitis,IrritableBowelSyndrome,Diarrhea,Constipat ion, Emetics&antiemetics.
4. **Therapy of Infectious diseases and Endocrinology:** General Principles, Antibacterial drug (Sulphonamides,Penicillins, Cephalosporins, Tetracyclines, Chloramphenicol, Aminoglycosides, Quinolones), Drugs used in the chemotherapy of Protozoal infections, Leprosy, Tuberculosis, Fungal infections, Viral infections, Drugs used in the Chemotherapy of Neoplastic diseases and Immunomodulators. Hormones of anterior and posterior pituitary gland. Insulin, oral hypoglycemic agents, Adrenocorticotropic hormones, Antithyroid drugs, Androgens and Anabolics. Agents affecting Calcification and bone turnover.
5. **Screening methods in Pharmacology and Toxicology:** Basic principles, methods ofbioassay and important bioassay of drugs, PharmacologicalScreening Techniques toevaluate drugs belongingtofollowingcategories:

- Analgesics,anti-inflammatoryagentsandlocalanaesthetics.
- Anti-hypertensives,antianginals,diureticandsalureticactivity.
- Antiulcerdrugs,antidiabetics,hepatoprotective,nephroprotectiveandanti-obesity activity.
- Effectsonbehaviorandmusclecoordination,antiepileptics,anti-Parkinsonism,drug effectsonlearningandmemory.
- Anticanceractivity(InvitroandInvivo)
- Evaluationofantioxidants(InvitroandInvivo) DrugToxicity,

SafetyEvaluationofnew drugs.RegulationsforLaboratory animalcareand ethical requirements.

C. **PHARMACEUTICS**

1. **PreformulationStudies:**Timingandgoalsofpreformulation,preformulation methodology, solid state properties, partition coefficient, solubility, dissolution ofdrugsubstance& dosage,crystal formandstability, compatibilitytests.

   Kinetic principles and stability testing: Order of reaction, influence of pH,temperature, Acid-base catalysis, effect of ionic strength on degradation, dosageforms,influenceofpackagingcomponentondosageformstability.

   Optimizationtechniquesinpharmaceutics,formulationandprocessing:Optimizationpar ameters,statistical designand otherapplication.

2. **Documentation**:Relevanceandimportanceofdocumentation,statuaryrequirementandproce durefordocumentation,criticalexaminationofdocumentation.

   Validation: Regulatory basis, validation of sterile products, solid dosage forms,processvalidationandnon-sterileanalytical methodvalidation.

   Quality control: Process control, control of validation, control of manufacturingprocess, statistical quality control, control charts, sampling plans, automated andprocesscontrol,dosageformcontrol,testingprogramandmethod,productidentificationsys tems,adulteration,misbranding,recordmaintenance,bioavailability,bioequivalence,manufa cture'sreliability,manufacturer/druginformationprofile.

3. **Preparationofmastermanufacturingdetails:**Materialhandling,blending,granulation,slugg ingcompression,coatingofliquidforms,contractmanufacturing.

   Productionandplanningmanagement:Spaceallocation,environmentalfactors,materialma nagement, salesforecasting, cost control.

   Drug and regulatory methods: Definitions, federal food, drug and cosmetic act,KafaurverHarre'samendment,newdrugapplication,drugefficacystudy,implementationr eview,OTCdrugreview,druglisting,drugamendments,patents,copyright,trademarks,drugre calls,productliability,andclinicaltrial.

4. **Good manufacturing practices**: GMP in manufacturing, packaging and holdingofdrugs,controlofcomponents,containersandclosures,productionandprocess control, packaging and labeling control, inspection for compliance withGMPpotablewaterstandards,Premises:design,construction,maintenance,equipment,w arehousing. ISO9000certification.

   Polymersandtheirapplications:Nomenclature,polymerclassification,physico-

chemicalproperties,chemistry,blendofpolymerandpropertiesofblends, evaluation of polymers and their characterization, mechanism of drugrelease from polymers, applications of polymers in controlled release of activeagentsand inotherformulations.

Packagingandmaterialsciences:Packagingdesignandspecifications,packagingvalidationtrials,materialofconstruction,componentproductvalidation,regulatoryrequirements,qualitycontroltestingstandards,GMPrequirementanditsdeficiencies,inprocesscontrolduringcomponentmanufacturedocumentation,sterilizationofpackagingcomponents,packaging andfillingequipment,pharmaceuticalpackagingincludingsterileworkingarea,customercomplaints.

D. PHARMACOGNOSY&PHYTOCHEMISTRY

1. **AdvancesinPharmacognosy: GeneticsinPharmacognosy:**Mendal's laws of hereditary and their application to Pharmacognosy, Chemical races,Selections, Hybridization, Polyploidy, mutation, plant growth hormones, their applicationandeffect on plant growth and its constituents.

   Chemotaxonomicsignificanceinmedicinalplants: History of Chemotaxonomic developments, chemotaxonomy of higher and lower plantsand distribution of certain chemotaxonomical group of constituents in plant kingdom likealkaloids, glycosides and terpenoids, semantides, amino acid sequencing, DNA fingerprinting.

   ComparativePhytochemistry: RelationshipbetweenPhytochemistry&Taxonomy.Comparative Phytochemistry ofalkaloids,flavonoidsand C-glycosides.

2. **PlantTissueCulture:PlantTissueCulturetechniquesanditsapplicationinrelationtoPhytopharmaceuticals:**Introduction,techniquesofinitiationandmaintenanceofvarioustypesofcultures.Immobilized cell techniques, Biotransformation studies including recent developments inproduction of biological active constituents in static, suspension and hairy root cultures,Bioreactors for production of biologically active constituents and other applications ofplanttissue culturetechniques.

3. **Phytochemistry& Biogenesis:** General methods of phytochemical & biological screening, isolation and purification ofplantconstituents.

   Natural sources, extraction, purification, isolation and characterization of the followingPhytopharmaceuticals:

   - Alkaloids: Morphine,Quinine
   - Glycosides:Sennosides,Glycyrrhizine,Asiaticosides,Diosgenin,Solarodine,Rutin
   - Industrially importantvolatileoils:Naturaloccurrence,theirchemistry,ontogenicvariationandtrade.
   - Methodsofinvestigationofbiogeneticpathways.
   - Biogenetic pathways for the production of phytopharmaceuticals, such as Alkylamine(Ephedra), Pyridine, Piperidine (Lobelia), Tropane (Belladonna), Quinoline (Cinchona),Isoquinoline(Opium),Diterpene(Cannabinoids),Indole(Ergot),Cardiacglycos

ides,Coumarinsand Flavones.

4. **Cultivation&Standardizationofmedicinalplants:** Preparation of herbarium specifications, use of flora and keys of plant identification,Microtomyandadvancedhistologicaltechniquesasappliedtopharmacognosticalspecimen, pharmacognostical drawings and macro and micro photography. Quantitativemicroscopyas appliedto drugevaluationandpollen grainanalysis.

   Agrotechnology of medicinal plants: Ecotypic, Phenotypic and Genotypic Variabilityaffecting phytopharmaceuticals. Prospects and economics and medicinal and aromaticplantsinIndia.CultivationmethodsdevelopedinIndiaforthefollowingplantsofcommercial significance.Glycyrrhiza,Ipecac,Mentha,Poppy,PsylliumandSenna.Tropanealkaloid and steroidcontainingplants.

   Standardization and quality procedures for the assay of plant products includingbotanical,physicochemical,pharmacologicalandtoxicological parameters.

5. **Applicationofchromatographictechniquesandspectroscopictechniques:** Applicationofchromatographictechniquessuchascolumn,paper,TLC,HPTLC,GLC,HPLCandDCCC intheisolationandpurificationofphytopharmaceuticals.

   Applicationsofspectroscopictechniqueslike UV, IR, NMR, ^{1}HNMR, ^{13}CNMR and Massspectroscopyforstructuralelucidationofphytopharmaceuticals.