Gandaki University
गण्डकी विश्वविद्यालय

Syllabus for Written Examination

(For Special Internal Competition)

Post: **Assistant Professor/Lecturer**
Subject: **Pharmacology**

1. **The knowledge of the related subject matters which are generally included in the concerned bachelor and master level courses (60%)**

   (a) **Basics of Pharmacology and Therapeutics** - General principles of pharmacology, including drug nomenclature, sources, classification, and drug action mechanisms. Pharmacokinetics (absorption, distribution, metabolism, and excretion of drugs). Pharmacodynamics (drug-receptor interactions, agonists, antagonists, dose-response relationships). Therapeutic Index (TI), bioavailability, bioequivalence, and drug interactions. Drug development process, including preclinical and clinical trials.

   (b) **Neurotransmission** Autonomic Nervous System (ANS): Mechanisms of adrenergic, cholinergic, and dopaminergic transmission. Central Nervous System (CNS): Role of neurotransmitters in neurological disorders and drug action. Non-Adrenergic Non-Cholinergic Transmission (NANC): Involvement in gastrointestinal, respiratory, and cardiovascular functions. Receptor Pharmacology: Signal transduction pathways and second messengers.

   (c) **Systemic Pharmacology** - Cardiovascular Pharmacology: Drugs acting on the heart, blood vessels, and kidneys, including antihypertensives, antiarrhythmics, diuretics, and anticoagulants. Respiratory Pharmacology: Mechanism of bronchodilators, antihistamines, and anti-inflammatory agents. Gastrointestinal Pharmacology: Acid-peptic disorder drugs, antiemetics, prokinetics, and laxatives. Endocrine Pharmacology: Hormone replacement therapies, insulin, oral hypoglycemic agents, and thyroid medications. Renal Pharmacology: Diuretics, renal protective agents, and drugs for renal failure management.

   (d) **Chemotherapy** - Antimicrobial Agents: Mechanisms of action, resistance, and spectrum of activity of antibiotics, antivirals, antifungals, and antiparasitic drugs. Cancer Chemotherapy: Cytotoxic agents, targeted therapy, monoclonal antibodies, and immunotherapy. Antiviral Pharmacology: Treatment of viral infections, including HIV, Hepatitis, Influenza, and COVID-19. Antimicrobial Resistance (AMR): Strategies to combat resistance and role of antimicrobial stewardship.

   (e) **Immunopharmacology, Autocoids, and GIT Pharmacology** - Immunomodulators and Immunosuppressants: Role in autoimmune diseases, organ transplantation, and cancer therapy. Autacoids: Histamines, serotonin, prostaglandins, leukotrienes, and bradykinins, including their physiological roles and therapeutic applications. Gastrointestinal Pharmacology: Drugs affecting gastric acid secretion, gut motility, and absorption.

   (f) **Experimental Pharmacology** - Animal models in drug discovery and testing: Rodents, zebrafish, primates, and alternatives. In vivo and in vitro methods for drug evaluation (efficacy, safety, and toxicity testing). Good Laboratory Practices (GLP): Ethical considerations, handling of experimental animals, and regulatory guidelines. Preclinical and clinical trials: Design, methodology, and significance in pharmacology research.

(g) **Molecular Pharmacology** - Role of molecular pharmacology in drug discovery and target identification. Genomics, proteomics, and metabolomics in drug development. Biomarkers in disease detection and personalized medicine. Techniques in molecular pharmacology: PCR, ELISA, Western blot, flow cytometry, and microarrays.

(h) **Toxicology and Regulatory Affairs** - General principles of toxicology: Dose-response relationship, toxicokinetics, and risk assessment. Organ-specific toxicity: Hepatotoxicity, nephrotoxicity, neurotoxicity, cardiotoxicity, and reproductive toxicity. Regulatory frameworks in drug safety: FDA, EMA, ICH, CDSCO, and WHO guidelines. Ethical and legal considerations in pharmacological research: Good Clinical Practices (GCP), informed consent, and adverse event reporting.

2. **Basic Knowledge of the recent trends in Pharmaceutics (15%)**

(a) **Advances in Drug Discovery and Screening Models** – AI-driven drug design, in silico modeling, high-throughput screening, organoids, organ-on-a-chip technology, CRISPR-based gene editing, and innovative screening models for various diseases.

(b) **Pharmacovigilance and Drug Safety** – AI in adverse drug reaction (ADR) detection, post-marketing surveillance, global pharmacovigilance databases (VigiBase, FAERS, EudraVigilance), and evolving regulatory guidelines for drug safety.

(c) **Innovations in Disease Treatment and Precision Medicine** – Targeted therapies (monoclonal antibodies, CAR-T cell therapy), new antidiabetic drugs (GLP-1 receptor agonists, SGLT2 inhibitors), AI-driven personalized medicine, and advances in neurodegenerative disease treatment.

(d) **Pharmacogenomics and Gene Therapy** – Genetic polymorphisms in drug metabolism, pharmacogenetic biomarkers, CRISPR-based gene editing, RNA therapeutics (siRNA, mRNA vaccines), and regulatory challenges in gene therapy.

(e) **Toxicokinetics and Alternative Toxicity Testing** – Microdosing, PBPK modeling, AI-based toxicity prediction, alternatives to animal testing (3D cell cultures, organoids, humanized models), and safety concerns of nanomedicines.

(f) **Research Advances in Pharmacology** – Omics technologies (genomics, proteomics, metabolomics), neuropharmacology (psychedelic drugs for mental health), cannabinoids in therapy, AI and big data in drug discovery, and regulatory challenges in novel treatments.

3. **National and Global Trends and Issues Regarding Pharmacology Education (10%)**

(a) Curriculum Reforms and Multidisciplinary Integration – Incorporation of AI, nanotechnology, bioinformatics, and precision medicine; shift towards competency-based education; integration with biomedical sciences, toxicology, and clinical pharmacology.

(b) Digitalization and Globalization in Pharmacology Education – Use of MOOCs, virtual labs, AR/VR-based pharmacology simulations, AI-driven drug modeling, and remote clinical trial training; joint degree programs and global accreditation standardization.

(c) Emerging Research and Industry-Academia Collaboration – Advancements in pharmacogenomics, biopharmaceuticals, gene therapy, neuropharmacology, immunopharmacology, clinical trials, and drug safety monitoring; emphasis on green pharmacology and regulatory pharmacovigilance.

(d) Policy Reforms and Government Initiatives – Research grants, innovation funding, national accreditation policies, regulatory framework alignment, and scholarship programs to support pharmacology education and research.

(e) Challenges in Higher Education and Skill Development – Limited access to state-of-the-art pharmacology labs, ethical concerns in human and animal studies, clinical training gaps, funding shortages, and pharmacovigilance training.

(f) Future of Pharmacology Education – Role of big data in pharmacological research, telepharmacology, personalized medicine, AI-assisted drug safety monitoring, sustainable pharmacological practices, and lifelong competency-based learning programs.

4. **Teaching and Research Methodology (10%)**

   (a) Teaching Skills & Strategies – Effective communication, student-centered learning, classroom management, and use of technology in higher education in Pharmacology.

   (b) Common research methods – Conceptualizing a Research Topic, Identifying research gaps, formulating hypotheses, data collection, aligning with current trends, and exploring multidisciplinary research areas.

   (c) Curriculum Review & Lesson Planning – Designing industry-relevant curricula, structuring lesson/work plans, integrating theory with practical learning, and incorporating emerging technologies.

   (d) Academic Planning & Reference Material Development – Preparing quality reference materials, using open educational resources (OER), and structuring academic calendars effectively.

   (e) Culturally Responsive Teaching – Promoting diversity and inclusion, adapting to different learning styles, and module based teaching & evaluation.

   (f) Research Paper & Proposal Writing – Structuring research papers, writing proposals, maintaining academic integrity, and selecting high-impact journals.

   (g) Assessment & Evaluation Methods – Implementing effective assessment techniques, feedback mechanisms, and ensuring student engagement through innovative teaching practices.

5. **Governance, Policies, and Legal Framework of Gandaki University (5%)**
   Overview of Gandaki University's establishment, vision, academic structure, governance bodies, strategic plans, key acts, laws, and bylaws, and Nepal's higher education policies.