

GOVERNMENT OF NAGALAND
DIRECTORATE OF HEALTH & FAMILY WELFARE
NAGALAND: KOHIMA

Syllabus
Of
Pharmaceutical Sciences - *Diploma (D Pharm)*
For
Direct recruitment to the post of
Pharmacist Grade II

Through
Nagaland Public Service Commission (NPSC)

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1.	Paper – I	Pharmaceutical Sciences	1-6
2.	Paper –II	Pharmaceutical Sciences	7-11

Paper-I		% of Marks
1)	Pharmaceutical Chemistry	50
2)	Pharmaceutical Jurisprudence	30
3)	Pharmacology	70
4)	Human Anatomy & Physiology	<u>50</u>
Total		200 Marks

Paper-II		
1)	Medicinal Chemistry	80
2)	Pharmaceutics	70
3)	Pharmacy Practice	<u>50</u>
Total		200 Marks

Paper I

1. PHARMACEUTICAL CHEMISTRY (50 marks)

Impurities in pharmaceutical substances: History of Pharmacopoeia, Sources and types of impurities, principle involved in the limit test for Chloride, Sulphate, Iron, Arsenic, Lead and Heavy metals, modified limit test for Chloride and Sulphate

Acids, Bases and Buffers: Buffer equations and buffer capacity in general, buffers in pharmaceutical systems, preparation, stability, buffered isotonic solutions, measurements of tonicity, calculations and methods of adjusting isotonicity.

Dental products: Dentifrices, role of fluoride in the treatment of dental caries, Desensitizing agents, Calcium carbonate, Sodium fluoride.

Gastrointestinal agents

Antacid: antacids, combinations of antacids, Sodium Bicarbonate, Calcium carbonate, Aluminium hydroxide gel, Magnesium hydroxide mixture

Antimicrobials: Mechanism, classification, Potassium permanganate, Boric acid, Hydrogen peroxide*, Chlorinated lime*, Iodine and its preparations.

Medicinal gases: - Carbon dioxide, Nitrous Oxide & Oxygen.

Heterocyclic compounds:

- Nomenclature and classification
- Synthesis, reactions and medicinal uses of following compounds/derivatives
Pyrrole, Furan, and Thiophene
- Relative aromaticity and reactivity of Pyrrole, Furan and Thiophene.

2. PHARMACEUTICAL JURISPRUDENCE (30 marks)

Drugs and Cosmetics Act, 1940 and its rules 1945:

Objectives, Definitions, Legal definitions of schedules to the Act and Rules
Import of drugs – Classes of drugs and cosmetics prohibited from import, Import under license or permit. Offences and penalties.

Manufacture of drugs: Prohibition of manufacture and sale of certain drugs, Conditions for grant of license and conditions of license for manufacture of drugs, Manufacture of drugs for test, examination and analysis, manufacture of new drug, loan license and repacking license.

Detailed study of Schedule C and C1, G, H, M, N, K, P, T, U, V, X, Y.

Sale of Drugs: Wholesale, Retail sale and restricted license. Offences and penalties.

Drugs prohibited for manufacture and sale in India.

Administration of the Act and Rules: Drugs Technical Advisory Board, Central drugs Laboratory, Drugs Consultative Committee, Government drug analysts, Licensing authorities, controlling authorities, Drugs Inspectors.

Pharmacy Act 1948 & RULES: Objectives, Definitions, Pharmacy Council of India; its constitution and functions, Education Regulations, State and Joint state pharmacy councils; constitution and functions, Registration of Pharmacists, Offences and Penalties, Pharmacy Practice Regulation 2015.

Medicinal and Toilet Preparation Act 1955 : Objectives, Definitions, Licensing, Manufacture In bond and Outside bond, Export of alcoholic preparations, Manufacture of Ayurvedic, Homeopathic, Patent & Proprietary Preparations. Offences and Penalties.

Narcotic Drugs and Psychotropic substances Act 1985 and Rules: Objectives, Definitions, Authorities and Officers, Constitution and Functions of narcotic & Psychotropic Consultative Committee, National Fund for Controlling the Drug Abuse, Prohibition, Control and Regulation, opium poppy cultivation and production of poppy straw, manufacture, sale and export of opium. Offences and Penalties .

Drugs and Magic Remedies Act and its rules:

Objectives, Definitions, Prohibition of certain advertisements, Classes of Exempted advertisements, Offences and Penalties.

Poisons Act 1919:- Introduction, Objective, Definition, possession, possession for sales and sale of any Poison, import of poisons.

National Pharmaceutical Pricing Authority: Drugs Price Control Order (DPCO)-2013. Objectives, Definitions, Sale prices of bulk drugs, Retail price of formulations, Retail price and ceiling price of scheduled formulations, National List of Essential Medicines (NLEM) .

Code of Pharmaceutical ethics Definition, Pharmacist in relation to his job, trade, medical profession and his profession, Pharmacist's oath .

Medical Termination of Pregnancy Act .

3. PHARMACOLOGY (70 marks)

General Pharmacology

- Introduction to Pharmacology- Definition and scope of pharmacology, nature and source of drugs, essential drugs concept and routes of drug administration, Agonists, antagonists (competitive and non competitive), spare receptors, addiction, tolerance, dependence, tachyphylaxis, idiosyncrasy, allergy.
- Pharmacokinetics- Membrane transport, absorption, distribution, metabolism and excretion of drugs .Enzyme induction, enzyme inhibition, kinetics of elimination.
- Pharmacodynamics- Principles and mechanisms of drug action. Receptor theories and classification of receptors, regulation of receptors. drug receptors interactions signal transduction mechanisms, G-protein-coupled receptors, ion channel receptor, transmembrane enzyme linked receptors, transmembrane JAK-STAT binding receptor and receptors that regulate transcription factors, dose response relationship, therapeutic index, combined effects of drugs and factors modifying drug action.
- Adverse drug reactions.
- Drug interactions (pharmacokinetic and pharmacodynamic)

Pharmacology of drugs acting on peripheral nervous system

- Organization and function of ANS.
- Neurohumoral transmission, co-transmission and classification of neurotransmitters.
- Parasympathomimetics, Parasympatholytics, Sympathomimetics, sympatholytics.
- Neuromuscular blocking agents and skeletal muscle relaxants (peripheral).
- Local anesthetic agents.
- Drugs used in myasthenia gravis and glaucoma

Pharmacology of drugs acting on central nervous system

- Neuro humoral transmission in the C.N.S. special emphasis on importance of various neurotransmitters like with GABA, Glutamate, Glycine, serotonin, dopamine.
- General anesthetics and pre-anesthetics.
- Sedatives, hypnotics and centrally acting muscle relaxants.
- Anti-epileptics
- Psychopharmacological agents: Antipsychotics, antidepressants, anti-anxiety agents, anti-manics and hallucinogens.
- CNS stimulants and nootropics.
- Opioid analgesics and antagonists.

Pharmacology of drugs acting on cardio vascular system

- Introduction to hemodynamic and electrophysiology of heart.
- Drugs used in congestive heart failure
- Anti-hypertensive drugs.
- Anti-anginal drugs.
- Anti-arrhythmic drugs.
- Anti-hyperlipidemic drugs.
- Drug used in the therapy of shock.
- Hematinics, coagulants and anticoagulants.
- Fibrinolytics and anti-platelet drugs
- Plasma volume expanders

Pharmacology of drugs acting on urinary system

- Diuretics
- Anti-diuretics.

Autocoids and related drugs

Introduction to autocoids and classification

- Histamine, 5-HT and their antagonists.
- Prostaglandins, Thromboxanes and Leukotrienes.
- Angiotensin, Bradykinin and Substance P.
- Non-steroidal anti-inflammatory agents ,
- Anti-gout drugs
- Antirheumatic drugs .

Pharmacology of drugs acting on endocrine system

- Basic concepts in endocrine pharmacology.

- Anterior Pituitary hormones- analogues and their inhibitors.
- Thyroid hormones- analogues and their inhibitors.
- Hormones regulating plasma calcium level- Parathormone, Calcitonin and Vitamin-D.
- Insulin, Oral Hypoglycemic agents and glucagon.
- ACTH and corticosteroids.
- Androgens and Anabolic steroids.
- Estrogens, progesterone and oral contraceptives.
- Drugs acting on the uterus.

Pharmacology of drugs acting on Respiratory system

- Anti -asthmatic drugs
- Drugs used in the management of COPD
- Expectorants and antitussives
- Nasal decongestants
- Respiratory stimulants

Pharmacology of drugs acting on the Gastrointestinal Tract

- Antiulcer agents.
- Drugs for constipation and diarrhoea.
- Appetite stimulants and suppressants.
- Digestants and carminatives.
- Emetics and anti-emetics.

Chemotherapy

- General principles of chemotherapy.
- Sulfonamides and cotrimoxazole.
- Antibiotics- Penicillins, cephalosporins, chloramphenicol, macrolides, quinolones and fluoroquinolins, tetracycline and aminoglycosides
- 4)Antitubercular agents
- 5)Antileprotic agents
- 6) Antifungal agents
- 7) Antiviral drugs
- 8) Anthelmintics
- 9) Antimalarial drugs
- 10) Antiamoebic agents

Principles of toxicology

- Definition and basic knowledge of acute, subacute and chronic toxicity.
- Definition and basic knowledge of genotoxicity, carcinogenicity, teratogenicity and mutagenicity
- General principles of treatment of poisoning
- Clinical symptoms and management of barbiturates, morphine, organophosphorus compound and lead, mercury and arsenic poisoning.

4. HUMAN ANATOMY & PHYSIOLOGY (50 marks)

Introduction to human body

Definition and scope of anatomy and physiology, levels of structural organization and body systems, basic life processes, homeostasis, basic anatomical terminology.

Structure of Cell: Components and its functions.

Tissues of the human body: Epithelial, Connective, Muscular and Nervous tissues – their sub-types and characteristics.

Osseous system: structure and functions of bones of axial and appendicular skeleton.

Classification, types and movements of joints, disorders of joints.

Haemopoietic system

- Composition and functions of blood
- Process of Hemopoiesis
- Characteristics and functions of RBCs, WBCs and platelets
- Mechanism of Blood Clotting
- Importance of Blood groups.

Lymphatic system

- Lymph and lymphatic system, composition, function and its formation.

Structure and functions of spleen and lymph node.

Cardiovascular system

- Anatomy and Physiology of heart
- Blood vessels and circulation (Pulmonary, coronary and systemic circulation)
- Cardiac cycle and Heart sounds, Basics of ECG
- Blood pressure and its regulation.

Respiratory system

- Anatomy of respiratory organs and their functions.
- Regulation, and Mechanism of respiration.
- Respiratory volumes and capacities – definitions.

Digestive system

- Anatomy and Physiology of the GIT
- Anatomy and functions of accessory glands
- Physiology of digestion and absorption.

Skeletal muscles

- Histology
- Physiology of muscle contraction
- Disorder of skeletal muscles.

Sense organs- Anatomy and physiology of

- Eye
- Ear
- Skin
- Tongue
- Nose

Urinary system

- Anatomy and physiology of urinary system
- Physiology of urine formation
- Renin – angiotensin system
- Clearance tests and micturition.



Endocrine system (Hormones and their functions)

- Pituitary gland
- Adrenal gland
- Thyroid and parathyroid gland
- Pancreas and gonads.

Reproductive system

- Anatomy of male and female reproductive system
- Physiology of menstruation.
- Spermatogenesis and Oogenesis
- Pregnancy and parturition

Paper II

1. MEDICINAL CHEMISTRY (80 marks)

Study of the development of the following classes of drugs, Classification, mechanism of action, uses of drugs, Structure activity relationship and synthesis of drugs.

Sympathomimetic agents: SAR of Sympathomimetic agents. Direct acting: Epinephrine, Phenylephrine*, Dopamine, Methyldopa, Clonidine, Terbutaline, Salbutamol, Oxymetazoline and Xylometazoline.

Alpha adrenergic blockers: Prazosin, Dihydroergotamine, Methysergide.

Beta adrenergic blockers: SAR of beta blockers, Propranolol, Atenolol, Metoprolol, Labetolol, Carvedilol.

Parasympathomimetic agents: SAR of Acetylcholine, Carbachol*, Bethanechol, Methacholine, Pilocarpine, Physostigmine, Neostigmine*, Pyridostigmine.

Drugs acting on Central Nervous System

Sedatives and Hypnotics:

Benzodiazepines: SAR of Benzodiazepines, Chlordiazepoxide, Diazepam, Chlorazepate, Alprazolam.

Barbiturates: SAR of barbiturates, Phenobarbital, Amobarbital, Butobarbital, Pentobarbital.

Antipsychotics

Phenothiazines: SAR of Promazine hydrochloride, Chlorpromazine hydrochloride, Thioridazine hydrochloride, Prochlorperazine maleate, Trifluoperazine hcl.

Narcotic and non-narcotic analgesics

Morphine and related drugs: SAR of Morphine sulphate, Codeine, Fentanyl citrate, Methadone hydrochloride, Propoxyphene hydrochloride, Pentazocine,

Narcotic antagonists: Nalorphine hydrochloride, Levallorphan tartarate, Naloxone hydrochloride.

Anti-inflammatory agents: Aspirin, Mefenamic acid, Indomethacin, Sulindac, Diclofenac, Ketorolac, Ibuprofen, Naproxen, Piroxicam, Phenacetin, Acetaminophen, Antipyrine, Phenylbutazone.

Antihistaminic agents:

H1-antagonists: Diphenhydramine hydrochloride, Doxylamines succinate, Diphenylpyraline hydrochloride, Chlorpheniramine maleate, Triprolidine hydrochloride, Promethazine hydrochloride, Azatidine maleate, Astemizole, Cetirizine.

H2-antagonists: Cimetidine*, Famotidine, Ranitidin.

Gastric Proton pump inhibitors: Omeprazole, Lansoprazole, Rabeprazole, Pantoprazole

Anti-anginal:

Vasodilators: Amyl nitrite, Nitroglycerin, Isosorbide dinitrite*, Dipyridamole.

Calcium channel blockers: Verapamil, Bepridil hydrochloride, Diltiazem hydrochloride, Nifedipine, Amlodipine, Felodipine, Nicardipine, Nimodipine.

Anti-hypertensive Agents: Captopril, Lisinopril, Enalapril, Clonidine hydrochloride, Sodium nitroprusside, Diazoxide, Minoxidil, Reserpine, Hydralazine hydrochloride.

Antidiabetic agents:

Insulin and its preparations, Chlorpropamide, Glipizide, Glimepiride, Metformin, Pioglitazone, Rosiglitazone, Repaglinide, Acarbose, Voglibose.

Antibiotics

Historical background, Nomenclature, Stereochemistry, Structure activity relationship, Chemical degradation classification and important products of the following classes.

β -Lactam antibiotics: Penicillin, Cephalosporins, β -Lactamase inhibitors,

Aminoglycosides: Streptomycin, Neomycin.

Tetracyclines: Tetracycline, Oxytetracycline, Chlortetracycline, Doxycycline

Macrolide: Erythromycin, Clarithromycin, Azithromycin.

Quinolones: SAR of quinolones, Nalidixic Acid, Norfloxacin, Ciprofloxacin, Ofloxacin, Sparfloxacin, Gatiflox.

Antiviral agents:

Amantadine hydrochloride, Idoxuridine trifluoride, Acyclovir, Zidovudine, Zalcitabine, Lamivudine, Ribavirin, Saquinavir, Indinavir.

Antifungal agents:

Antifungal antibiotics: Amphotericin-B, Nystatin, Natamycin, Griseofulvin.

Synthetic Antifungal agents: Clotrimazole, Miconazole, Ketoconazole, Itraconazole, Fluconazole, Tolnaftate.

Anti-protozoal Agents: Metronidazole, Tinidazole, Ornidazole, Diloxanide, Iodoquinol,

Anthelmintics: Diethylcarbamazine citrate, Mebendazole, Albendazole, Niclosamide.

Sulphonamides and Sulfones

Sulfacetamide*, Sulphapyridine, Sulfamethoxazole, Sulphadiazine, Sulfasalazine.

Folate reductase inhibitors: Trimethoprim.

Antimalarials:

Quinolines: SAR, Quinine sulphate, Chloroquine*, Amodiaquine, Primaquine phosphate, Quinacrine hydrochloride, Mefloquine.

Biguanides and dihydro triazines: Cycloguanil pamoate, Proguanil.

Miscellaneous: Pyrimethamine, Artesunate, Artemether, Atovaquone

2. PHARMACEUTICS (70 marks)

- **Historical background and development of profession of pharmacy:** History of profession of Pharmacy in India in relation to pharmacy education, industry and organization, Pharmacy as a career, Pharmacopoeias: Introduction to IP, BP, USP and Extra Pharmacopoeia.
- **Dosage forms:** Introduction to dosage forms, classification and definitions
- **Prescription:** Definition, Parts of prescription, handling of Prescription and Errors in prescription.
- **Posology:** Definition, Factors affecting posology. Paediatric dose calculations based on age, body weight and body surface area.
- **Pharmaceutical calculations:** Weights and measures—Imperial & Metric system, Calculations involving percentage solutions, alligation, proof spirit and isotonic solutions based on freezing point and molecular weight.
- **Powders:** Definition, classification, advantages and disadvantages, Simple & compound powders – official preparations, dusting powders, effervescent, efflorescent and hygroscopic powders, eutectic mixtures. Geometric dilutions.
- **Tablets—coated and uncoated, various modified tablets (sustained release, extended-release, fast dissolving, multi-layered, etc.)**
- **Capsules—hard and soft gelatine capsules.**
- **Liquid dosage forms:** Advantages and disadvantages of liquid dosage forms. Excipients used in formulation of liquid dosage forms. Solubility enhancement techniques
- **Monophasic liquids:** Definitions and preparations of Gargles, Mouthwashes, Throat Paint, Eardrops, Nasal drops, Enemas, Syrups, Elixirs, Liniments and Lotions.
- **Biphasic liquids:**
- **Suspensions:** Definition, advantages and disadvantages, classifications, Preparation of suspensions; Flocculated and Deflocculated suspension & stability problems and methods to overcome.
- **Emulsions:** Definition, classification, emulsifying agent, test for the identification of type of Emulsion, Methods of preparation & stability problems and methods to overcome.
- **Suppositories:** Definition, types, advantages and disadvantages, types of bases, methods of preparations. Displacement value & its calculations, evaluation of suppositories.
- **Pharmaceutical incompatibilities:** Definition, classification, physical, chemical and therapeutic incompatibilities with examples.
- **Semisolid dosage forms:** Definitions, classification, mechanisms and factors influencing dermal penetration of drugs. Preparation of ointments, pastes, creams and gels. Excipients used in semi solid dosage forms. Evaluation of semi solid dosages forms
- **Novel drug delivery systems:** Introduction, Classification with examples, advantages, and challenges.

3. PHARMACY PRACTICE (50 marks)

Hospitals- Definition, Function, Classifications based on various criteria, organization, Management and Health delivery system in India.

Hospital Pharmacy:

- Definition
- Functions and objectives of Hospital Pharmaceutical services.
- Location, Layout, Flow chart of material and men.
- Personnel and facilities requirements including equipments based on individual and basic needs.
- Requirements and abilities required for Hospital pharmacists.

Drug Distribution system in Hospitals:

- Out-patient services
- In-patient services-(a) types of services (b) detailed discussion of unit Dose system, Floor ward stock system, Satellite pharmacy services, Central sterile services, Bed Side Pharmacy.
- P.T.C (Pharmacy Therapeutic Committee), Hospital Formulary System and their organization, functioning, composition.
- Drug Information service and Drug Information Bulletin.
- Application of computer in Pharmacy;-
Drug Information storage and retrieval, Pharmacokinetics, Inventory control, medication monitoring, Electronic prescribing and discharge(EP) system, Barcode medicine identification and automated dispensing of drugs.
Patient monitoring system and Pharma information system.

Clinical Pharmacy.

- Introduction to Clinical Pharmacy Practice-Definition, scope.
- Modern dispensing aspects-Pharmacists and Patient counselling and advice for the use of common drugs, medication history.
- Common daily terminology used in the Practice of Medicine.
- Disease, manifestation and patho-physiology including salient symptoms to understand the disease like Tuberculosis, Hepatitis, Rheumatoid Arthritis, Cardiovascular diseases, Epilepsy, Diabetes, Peptic Ulcer, Hypertension.
- Physiological parameters with their significance.
- **Drug Interactions:**
 - Definition and introduction.
 - Mechanism of Drug Interaction.
 - Drug-drug interaction with reference to analgesics, diuretics, cardiovascular drugs, Gastro-intestinal agents, Vitamins and Hypoglycemic agents.
 - Drug-food interaction.
- **Adverse Drug Reactions:**
 - Definition and Significance.
 - Drug-induced diseases and Teratogenicity.
- **Drugs in Clinical Toxicity:** Introduction, general treatment of poisoning, systematic antidotes. Treatment of insecticide poisoning, heavy metal poison, Narcotic drugs, Barbiturate, Organo-phosphours poisons.

- Drug dependences, Drug abuse, addictive drugs and their treatment, complications.
- Bio-availability of drugs, including factors affecting it.

Preventive medicine: General principles of prevention and control of diseases such as cholera, SARS, Ebola virus, influenza, acute respiratory infections, malaria, chicken guinea, dengue, lymphatic filariasis, pneumonia, hypertension, diabetes mellitus, cancer, drug addiction-drug substance abuse.

National health programs, its objectives, functioning and outcome of the following:

HIV AND AIDS control programme, TB, Integrated disease surveillance program (IDSP), National leprosy control programme, National mental health program, National programme for prevention and control of deafness, Universal immunization programme, National programme for control of blindness, Pulse polio programme.

National health intervention programme for mother and child, National family welfare programme, National tobacco control programme, National Malaria Prevention Program, National programme for the health care for the elderly, Social health programme; role of WHO in Indian national program

Community services in rural, urban and school health: Functions of PHC, Improvement in rural sanitation, national urban health mission, Health promotion and education in school.