



TEERTHANKER MAHAVEER UNIVERSITY

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Delhi Road, Moradabad (U.P.)

SYLLABUS FOR RESEARCH APTITUDE TEST IN PHARMACEUTICAL SCIENCES

The syllabus for Research Aptitude Test (RAT) in Pharmaceutical Sciences is divided in two parts viz. Part A and Part B as described below:

PART – A

Part A of the RAT shall be designed to assess the research skills/aptitude of the candidate consisting of questions from the following areas:

- 1. Research Methodology:** meaning, characteristics, and ethical issues in research; types of research; research methods.
- 2. Logical Reasoning:** arguments, deductive and inductive research; logical and Venn diagram; inferences; analogies.
- 3. Data Interpretation:** interpretation of data; mapping and analysis of data, tools for data analysis; quantitative and qualitative research.
- 4. General Awareness about Basic Science:** basic science up to the level of SSC.
- 5. Mathematical Reasoning:** number series, letter series, codes; relationships, classification.

PART – B

Part-B of RAT is designed to assess the subject specific knowledge of the candidate and is further divided into two Sections viz. Section-I & Section-II. Section-I is common for all the candidates. From Section-II, a candidate is required to *select One Elective* paper out of the four elective papers viz. Pharmaceutics, Pharmaceutical Chemistry, Pharmacognosy, and Pharmacology.

SECTION – I

UNIT -I

Pre-formulation studies: Study of physical properties of drug and organoleptic properties, their effect on formulation, stability and bioavailability.

Pharmaceutical Aerosols: Definition, propellants, general formulation, manufacturing and packaging methods, pharmaceutical applications.

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.

Micro-encapsulation: Types of microcapsule, importance of microencapsulation in pharmacy, microencapsulation by phase separation, co-acervation, multi orifice, spray

drying, spray congealing, polymerisation, complex, formulation, emulsion, air suspension technique, coating pan and other techniques, evaluation of micro capsules.

Tablets: Formulation of different types of tablets, granulation technology on large-scale by various techniques, physics of tablets making, different types of tablet compression machinery and the equipments employed, evaluation of tablets, evaluation of coated tablet; stability kinetics and quality assurance; approaches to sustained and controlled release dosage forms.

Parenteral Products: Pre-formulation factors, routes of administration, water for injection, pyrogenicity, nonaqueous vehicles. Formulation details, containers and closures and their selection. Prefilling treatment, washing of containers and closures, preparation of solution and suspensions, filling and sealing of ampoules, vial, infusion fluids, lyophilization and preparation of sterile powders, equipment for large scale manufacture and evaluation of parenteral products.

UNIT-II

Methods of investigation of biosynthetic pathways, tracer techniques and autoradiography; isolation, characterization and purification with a special reference to their importance in herbal industries of following phytopharmaceuticals containing drugs, alkaloids- ephedrine, hyoscyamine, quinine, morphine, ergometrine, reserpine, vincristine, glycosides, digitoxin, scillaren, glycyrrhizin; steroids- sitosterols, hecogenin, diosgenin, coumarin, umbelliferone, antibiotics: penicillin, griseofulvin, tetracycline; distribution, isolation, purification and characterization of bioactive chemical constituents- steroids: diosgenin, hecogenin, guggulosterone and withanolides, alkaloids: morphine, ergometrine, quinine, reserpine, strychnine, vincristine, piperine, berberine, vasicine, glycosides: digitoxin, sennosides, bacosides, volatile oils: lemongrass oil, camphor, menthol, eugenol, antibiotics: penicillin, streptomycin, tetracycline, vitamins: cyanocobalamin

UNIT-III

Principles of Medicinal Chemistry: Physicochemical aspects (optical, geometric and bioisosterism) of drug molecules and biological action, drug-receptor interaction including transduction mechanism, concept of prodrug, mode of action, uses, structure activity relationship and synthetic of the following classes of drugs:

(i). drugs acting at synaptic and neuro-effector junction sites- cholinergic, anticholinergic and anticholinesterases: neostigmine, physostigmine, methacholine, pilocarpine, atropine, adrenergic drugs-ephedrine, isoproterenol, amphetamine, salbutamol, terbutaline, adrenaline, (ii). drugs acting on the central nervous system: general anaesthetics- thiopental, ketamine, methohexital; opioid analgesics- pethidine, methadone, pentazocine; anticonvulsants- phenytoin, carbamazepine, ethosuximide, valproic acid; CNS stimulants- caffeine, nikethamide, (iii). psychopharmacological agents: neuroleptics- meprobamate, chlordiazepoxide, diazepam; antidepressants- imipramine, amitriptyline; antispasmodic and antiulcer drugs- dicyclomine, ranitidine, omeprazole.

UNIT-IV

General Pharmacology: Introduction to pharmacology, sources of drugs, dosage forms and routes of administration, mechanism of action, concept of receptors.

Pharmacology of ANS: Parasympathomimetic, parasympatholytics, sympathomimetics, adrenergic receptor and neuron blocking agents.

Pharmacology of CNS: General anaesthetics, alcohols and disulfiram, sedatives hypnotics, anti-anxiety agents & centrally acting muscle relaxants. psychopharmacological agents

(antipsychotics), antidepressants, antiepileptic drugs, antiparkinsonism drugs, narcotic analgesics & antagonists, drug addiction and drug abuse.

Pharmacology of CVS: Cardiac glycosides, antihypertensive drugs, antianginal drugs, antiarrhythmics, antihyperlipidemics, therapy of shock.

Drug Acting on Hemopoietic System: Haematinics, vit. k and anticoagulants, fibrinolytics and antiplatelet drugs, plasma volume expanders.

SECTION- II (ELECTIVES / OPTIONALS)

ELECTIVE-I (PHARMACEUTICS)

Biopharmaceutics: Passage of drugs across biological barrier (passive diffusion, active transport, facilitated diffusion and pinocytosis); factors influencing absorption– physicochemical, physiological and pharmaceutical; drug distribution in the body, plasma protein binding.

Pharmacokinetics: Significance of plasma drug concentration measurement, compartment model and non-compartment model, definition and scope; pharmacokinetics of drug absorption– zero order and first order absorption rate constant using Wagner–Nelson, Loo-Reigelman method; volume of distribution and distribution coefficient; compartment kinetics– one compartment and preliminary information of multicompartment models; determination of pharmacokinetic parameters from plasma and urine data after drug administration by intravascular and oral route; clinical pharmacokinetics- definition and scope; dosage adjustment in patients with and without renal and hepatic failure; pharmacokinetic drug interactions and their significance in combination therapy.

Bioavailability and Bioequivalence: Measures of bioavailability, C-max, and area under the curve (AUC), review of regulatory requirements for conduction of bioequivalent studies, fast release- introduction, formulation and evaluation; transdermal drugs delivery system- factors influencing transdermal delivery, formulation and evaluation including iontophoresis and ionophoresis; target oriented drug delivery systems- prodrugs, liposome, niosome, nanoparticles microspheres and microparticles; lipoproteins activated carbons, cellular carriers, antibodies, DNA, and low molecular weight proteins; hormones, dextran and polysaccharides, synthetic polymers, nanoparticles, microparticles fabrication techniques (latest advances); nutraceuticals- introduction and scope.

ELECTIVE-II (PHARMACEUTICAL CHEMISTRY)

Principles of Drug Design: Traditional analogs, introduction to QSAR and mechanism based approaches, computer-aided drug design and molecular modeling; mode of action, uses, structure activity relationship of the following classes of drugs:

(i). cardiovascular agents: antianginal and vasodilators, antiarrhythmics, antihypertensives, anticoagulants, antihyperlipidemics and cardiotonics– nifedipine, procainamide, propranolol, methyldopa, captopril, clofibrate, warfarin, phenidione; (ii). antineoplastics- chlorambucil, 5-fluorouracil, methotrexate; (iii). analgesics and antipyretics- aspirin, mefenamic acid, ibuprofen, diclofenac; (iv). antibacterials- sulphamethoxazole, sulphadiazine, sulphacetamide, nalidixic acid; (v). diuretics- acetazolamide, chlorthiazide; frusemide, spironolactone.

Steroids and related drugs: Introduction, classification, nomenclature and stereochemistry: androgens and anabolic steroids– testosterone, stanozolol. estrogens and progestational

agents– progesterone, estradiol; adrenocorticoids– prednisolone, dexamethasone, betamethasone.

Antibiotics: Penicillins, semi-synthetic, penicillins, streptomycin, tetracyclines, cephalosporins, chloramphenicol, fluoroquinolones; classification, mechanism of action, SAR, synthetic approach and recent advances of fourth generation cephalosporins and fluoroquinolones antibacterials; classification, mechanism of action, SAR, synthetic approach and recent advances of sex hormones and corticosteroids, prostaglandins, interferon and gene therapy; anti- HIV agents, ACE inhibitors and statins.

ELECTIVE-III (PHARMACOGNOSY)

Role of natural products in new drug development, plant derived drugs, novel drug templates; bioactive compounds from micro-organism with reference to antibiotics, anti-protozoals and marine natural products; structural elucidation insights for natural products by combination of classical, synthetic, degradative and spectral methods with reference to quercetin, tropanes and morphinan type alkaloids, quinine, digitoxigenin, camphor and caffeine, steroids, testosterone, progesterone, cortisone and antibiotic (beta- lactum).

Pharmacological screening of herbal drugs- introduction and evaluation of herbal drugs for antidiabetic, hepatoprotective, diuretic, anti-diarrhoeal, antiulcer, wound healing, cardiovascular, anti-inflammatory, analgesic, antipyretic, antifertility, anti-oxidant, anti-viral & cyto-toxic properties.

Biomedicinals from plant tissue culture- Introduction, profile of plant tissue culture, bioproduction of commandable secondary metabolites, Hi-Tech products from plant sources with reference to Genistein, Comptophein, Rhein & Taxanes, Recombinant DNA technology.

ELECTIVE-IV (PHARMACOLOGY)

Drugs Acting on Respiratory System: Anti-asthmatic drugs, anti-tussives and expectorants, respiratory stimulants.

NSAIDS & Anti-Gout Drugs, Diuretics Autocoids: Histamine, 5HT and their antagonists, prostaglandins, thromboxans, leukotrienes, angiotensin and bradykinin.

Drugs Acting on GIT: Antacids and antiulcer drugs, laxatives and anti-diarrhoeal agents, emetics and antiemetics.

Pharmacology of Endocrine System: Hypothalamic and pituitary hormones, thyroid hormones and thyroid drugs, parathyroid, calcitonin and vitamin D, insulin, oral hypoglycaemic agents and glucagon; ACTH and cortico steroids, androgens and anabolic steroids, estrogens, progesterone and oral contraceptives, drugs acting on uterus.

Chemotherapy: General principles of chemotherapy, sulphonamides, cotrimoxazole, quinolines, antibiotics– penicillins, cephalosporins, chloramphenicol, tetracyclines, macrolides. chemotherapy of parasitic infections, tuberculosis, leprosy, malaria, fungal infections, viral diseases, introduction to immuno modulators and chemotherapy of cancer.