DEPARTMENT OF PHARMACEUTICAL SCIENCES
GURU JAMBHESHWAR UNIVERSITY OF SCIENCE AND TECHNOLOGY, HISAR
Syllabus for Entrance Examination for admission to

PhD in Pharmaceutical Sciences

Note: The Syllabus consists of five sections (A-E). The examiner will set 40 questions from Section-A (25 multiple choice questions from Part I and 15 questions from Part II) and 15 multiple choice questions each from section B to E.

Sr. No.		Questions
1	**Section A: Research Methodology and Analytical Techniques**	**25**
	Part I	
	General Research Methodology: Research objective, requirements. practical difficulties, review of literature, study design, types of studies. strategies to eliminate errors/bias, controls, randomization, crossover design, placebo, blinding techniques. **Biostatistics:** Definition, application, sample size, importance of sample size, factors influencing sample size, dropouts, statistical tests of significance. **Pre-Clinical and Clinical Research:** Definition, importance, types and practices, phases of clinical trials, ethics in pre-Clinical studies. Research ethics, informed consent, confidentiality, guidelines, ethics committees. **CPCSEA guidelines for laboratory animal facility:** Goals, veterinary care, quarantine, surveillance, diagnosis, treatment and control of disease, personal hygiene, location of animal facilities to laboratories, anaesthesia, euthanasia. physical facilities, environment, animal husbandry, record keeping. SOPS. personnel and training, transport of lab animals.	
	Part II	**15**
	UV-Visible Spectroscopy: Theory, Beer-Lambert's Law, Instrumentation of UV-Visible Spectrophotometer, choice of solvents and solvent effect. Woodward- Fieser rules for 1,3-Butadienes, cyclic dienes and a, B unsaturated carbonyl compounds **IR Spectroscopy:** Theory, modes of molecular vibrations, instrumentation of IR spectrometers, factors affecting vibrational frequency, Interpretation of IR spectrum of organic compounds.	

	NMR spectroscopy: Theory of NMR spectroscopy, role of quantum numbers in NMR, instrumentation, relaxation process in NMR, solvent requirement in NMR, chemical shift, factors influencing chemical shift, spin- spin coupling and coupling constant, interpretation of NMR spectrum of simple organic compounds. **Mass Spectrometry:** Principle, theory and instrumentation of mass spectrometry, resolution of mass spectrometers, ionization techniques and mass analysers used in mass spectrometry, mass fragmentation and its rules, isotopic peaks. **Chromatography:** Principle, apparatus, instrumentation, chromatographic a) Paper chromatography b) Thin Layer chromatography c) Ion exchange chromatography d) Column chromatography e) Gas chromatography f) High Performance Liquid chromatography g) Affinity chromatography **Electrophoresis:** Principle, Instrumentation, Working conditions, actors affecting separation and applications of the following: a) Paper electrophoresis b) Gel electrophoresis c) Capillary electrophoresis d) Zone electrophoresis e) Moving boundary electrophoresis) Iso-electric focusing. **Thermal Methods of Analysis:** Introduction, principle, instrumentation, sources of errors and application of DSC, DTA and TGA.	
2	**Section B: Pharmaceutics**	**15**
	Introduction to dosage form: Definition of the drug. New drug and dosage form. The desirable properties of a dosage form, the need of dosage form. Ideas about the available type of dosage forms and new drug delivery system. **Dosage Form Necessities and Additives:** Antioxidants, preservatives, colouring agents, flavouring agents and diluting agents, emulsifying agents, suspending agents, ointment bases, solvents, and others. **Powders:** Advantages and limitations as dosage form, manufacturing procedure and equipment, special care and problems in manufacturing powders, powders of IP, effervescent granules and salts. **Capsules:** Hard gelatin capsules, shell formulation and manufacturing, capsule sizes, storage, filing, cleaning process general formulation contents and evaluation. Soft gelatin capsules, shell formulation, formulation contents, filing, sealing and storage. Microencapsulation, advantages, encapsulation	

	materials, methods of microencapsulation, I.P. formulations **Tablets:** Types, ideal requirement, classification, granulation methods, general formulation, compression machines, different types of tooling's, difficulties in tableting, evaluation, sugar coating, compression coating, fil1m coating, problems in tablet coatings and their troubleshooting aspects. IP formulations. **Parenterals- product requiring sterile packaging:** Definition, types advantages and limitations, general formulation, vehicles, production procedure, production facilities, controls, tests, selected IP injections, sterile powders, implants, emulsions, suspensions. **Suspensions and Emulsions:** Formulation, preparation and evaluation **Suppositories:** Ideal requirements, bases, manufacturing procedure, evaluation methods, IP products. **Semisolids:** Definitions, bases, general formulation, manufacturing procedure, evaluation methods, IP products. **Liquids (solutions, syrups, elixirs, spirits, aromatic water, liquid for external uses):** Definition, types, general formulation, manufacturing procedure, evaluation methods, IP products. **Pharmaceutical Aerosols:** Definition, propellants, general formulation, manufacturing and packaging methods, pharmaceutical applications. Impacts of propellants on the environment. **Ophthalmic preparations:** Requirement, formulation, methods of preparation, containers, evaluation, IP products. **Preformulations:** Importance, objectives, physical properties and chemical properties characterization such as solubility, particle size, flow characterization, hydrolysis, Oxidation, racemization etc. **Stability of formulated products:** Requirements, drug regulatory aspects. pharmaceutical products stability, shelf life, overages, containers, closures. Reaction rate and order, acid-base catalysis, destabilization and accelerated stability testing. **Novel Drug delivery system:** Transdermal drug delivery system. controlled drug delivery system, nanoparticles, targeted drug delivery System **Introduction to Drugs and Cosmetics Act 1940, Rules 1945, including New Drug applications.**	

	Introduction to Intellectual Property Rights and Indian Patent Act 1970.	
3	**Section C: Pharmaceutical Chemistry**	**15**
	Importance of fundamentals of organic chemistry in pharmaceutical sciences: Structure and Properties: Atomic structure, atomic orbitals. Molecular orbital theory, wave equation, Molecular orbitals, Bonding and Anti-bonding orbitals, Covalent bond, Hybrid orbitals, Intramolecular forces, Bond dissociation energy, Polarity of bonds, Polarity of molecules, Structure and physical properties, Intermolecular forces, Acids and bases. Nomenclature, isomerism. Bioisosterism, Drug-receptor interactions including transduction mechanisms; Drug metabolism and Concept of Prodrugs; **Principles of Drug Design (Theoretical Aspects):** Traditional analog and mechanism-based approaches, QSAR approaches, Applications of quantum mechanics, Computer Aided Drug Designing (CADD) and molecular modelling. General Anesthetics, Hypnotics and Sedatives, Anticonvulsants, Anti Parkinsonian drugs, Psychopharmacological agents (Neuroleptics, Anti depressants, Anxiolytics), Opioid analgesics, Anti-tussives, CNS stimulants: Chemotherapeutic Agents used in bacterial, fungal, viral, protozoal, parasitic infections, Antibiotics: B-Lactam, macrolides, tetracyclines, aminoglycosides, polypeptide antibiotics, fluoroquinolones, Anti-metabolites (Including sulfonamides); Anti-neoplastic agents; Anti-viral agents (including anti-HIV); Steroidal nomenclature (UPAC) and stereochemistry, Androgens and anabolic agents, Estrogens and Progestational agents, Oral contraceptives, Adrenocorticoids; Adrenocorticoids; Anti-hypertensives, Anti-arrythmic agents, anti-anginal agents, Cardiotonics agents, Precipitation techniques, The colloidal state, Supersaturation, Co precipitation, Postprecipitation, Digestion, washing of the precipitate. Filtration, Filter papers and crucibles, Ignition.	
4	**Section D: Pharmacology**	**15**
	Pharmacokinetics: The dynamics of drug absorption, distribution, biotransformation and elimination. Significance of Protein binding. Pharmacodynamics: Mechanism of drug action and	

	the relationship between drug concentration and effect. Receptors, structural and functional families of receptors. **Neurotransmission:** General aspects and steps involved in neurotransmission. Neurohumoral transmission in autonomic nervous system (study about neurotransmitters - Noradrenaline and Acetylcholine). Neurohumoral transmission in central nervous system (study about neurotransmitters - histamine, serotonin, dopamine, GABA, and glutamate). **Drug Screening:** General principles of preclinical screening. Principles and applications of cell viability assays. **Toxicokinetics.**	
5	**Section E: Pharmacognosy**	**15**
	Quality control of Drugs of Natural Origin: Adulteration of drugs of natural origin. Evaluation by organoleptic, microscopic, physical, chemical and biological methods and properties. Quantitative microscopy of crude drugs including lycopodium spore method, leaf constants, micromeres and camera lucida. **Extraction and Phytochemical Studies:** Recent advances in extractions with emphasis on selection of method and choice of solvent for extraction, successive and exhaustive extraction and other methods of extraction including ultrasonic, microwave assisted & supercritical fluid extraction, method of fractionation. Detection and analysis of different classes of phytoconstituents by HPTLC, HPLC and Flash column chromatography. **Traditional System of Medicine & evaluation using animal models:** Different dosage forms of Indigenous System of Medicine. Screening of plant extracts/ phytochemicals for anti-diabetic, hepatoprotective, analgesic. anti-inflammatory, diuretic, anti-epileptic, anticancer, cardiovascular and antimicrobial activity through in vitro and in vivo models. **Pharmacognosy of selected drugs:** Senna, liquorice, digitalis, opium, cinchona, ergot, coriander, cumin, clove, fennel, arjuna, catechu, turmeric. tragacanth and ashwagandha **Herbal Drugs Development** Herbal sources f food supplements, Bioavailability enhancers, plant bitters & sweeteners, Herbal Cosmetics: Identification, collection and chemical nature of the natural products used in: Hair care,	

	dandruff, dyeing, Skin care, anti-wrinkles & anti-aging, leucoderma, Scabies, Anticancer Herbal drugs, Standardization of Herbal Drugs: Quantitative Pharmacognosy, Modern Instrumental Techniques, Biological response measurements.	