HIMGIRI ZEE UNIVERSITY
[Estd. Under Uttaranchal State Act. No. 17, 2003. Approved by UGC Under Sec. 2(f)]
DEHRADUN

PH.D. ENTRANCE TEST (PET) SYLLABUS

2023-2024

NOTE:

1. There will be two sections of the HZU-PET of 100 Marks.
2. The first section i.e. Research Aptitude, will carry 20% Weightage.
3. The second section i.e. Core Discipline, will carry 60 % Weightage.
4. The 20 % weightage will be for personal interview based on subject knowledge.

Paper-1

RESEARCH APTITUDE

(Common for all Specialization)

Module	Content
Research	Research and Types of research: Meaning of Research- Objectives of Research- Motivation in Research. Research methods vs Methodology. Types of research – Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Research Process. Criteria of good Research. Research Formulation – Defining and formulating the research problem - Selecting the problem - Necessity of defining the problem - Importance of literature review in defining a problem – Literature review – Primary and secondary sources – reviews.
Sampling methods, Errors and fundamental statistics	Finite and infinite population, methods of sampling, Errors, precision and accuracy, Line diagrams, Bar Diagrams, Pie Charts, Histograms, Frequency polygons, Measures of central tendency and dispersal; probability distributions, Confidence interval; Errors; levels of significance; Regression and Correlation; t-test; Analysis of variance;
Logical Reasoning / Aptitude	Types of reasoning, Mathematical Aptitude (Fraction, Time & Distance, Ratio, Proportion and Percentage, Profit and Loss, Interest and Discounting, Averages etc.). Evaluating and distinguishing deductive and inductive reasoning Analogies, Venn diagrams: Simple and multiple;

PH.D. ENTRANCE TEST SYLLABUS

AGRICULTURE

AGRONOMY

Module	Content
Crop Ecology and Geography	Principles of crop ecology; Ecosystem-concept and determinants of crop productivity; Physiological limits of crop yield and variability in relation to ecological optima; Crop adaptation; Climate shift and its ecological implication; Greenhouse effect; Agro-ecological and agro climatic regions of India; Geographical distribution of cereals, legumes, oilseeds, vegetables, fodders and forages, commercial crops, condiments and spices, medicinal and aromatic plants; Adverse climatic factors and crop productivity; Photosynthesis, respiration, net assimilation, solar energy conversion efficiency and relative water content, light intensity, water and CO_2 in relation to photosynthetic rates and efficiency; Physiological stress in crops, detection and indices; Remote sensing: Spectral indices and their application in agriculture.
Weed Management	Scope and principles of weed management; Weed classification, biology, ecology and allelopathy; Weed seed dormancy, Crop weed competition, weed threshold; Herbicides classification, formulations, mode of action, selectivity and resistance; Persistence of herbicides in soils and plants; Application methods and equipment; Cultural, physical, chemical and biological weed control, bio-herbicides: Integrated weed management; Special weeds, parasitic and aquatic weeds and their management in cropped and non-cropped lands; weed control schedules in field crops, vegetables and plantation crops; Role of Genetically Modified (GM) crops in weed management.
Soil Fertility and Fertilizer Use	History of soil fertility and fertilizer use; Concept of essentiality of plant nutrients, their critical concentrations in plants, nutrient interactions, diagnostic techniques with special emphasis on emerging deficiencies of secondary and micro-nutrients; Soil fertility and productivity and their indicators; Fertilizer materials including liquid fertilizers, their composition, mineralization, availability and reaction in soils; Water solubility of phosphate fertilizers; Slow release fertilizers, nitrification inhibitors and their use for crop production; Principles and methods of fertilizer application including fertigation; Integrated nutrient management and bio-fertilizers; Agronomic and physiological efficiency and recovery of applied plant nutrients; Criteria for determining fertilizer schedules for cropping systems - direct, residual and cumulative effects;

Module	Content
Dryland Agronomy	Concept of dryland farming; dryland farming Vs rainfed farming; History, development, significance and constraints of dryland agriculture in India; Climatic classification and delineation of dryland tracts; Characterization of agro-climatic environments of drylands; Rainfall analysis and length of growing season; Types of drought, effect on plant growth, drought resistance, drought avoidance, drought management; Crop Planning including contingency, crop diversification, varieties, cropping systems and mid-season corrections for aberrant weather conditions; Techniques of moisture conservation in-situ to reduce evapotranspiration, runoff and to increase infiltration; Rain water harvesting and recycling concept, techniques and practices; Summer ploughing, seed hardening, pre-monsoon sowing, weed and nutrient management;
Crop Production	Crop production techniques for cereals, millets, pulses /grain legumes, oilseeds, fiber crops, sugarcane, tobacco, fodder and pasture crops including origin, history, distribution, adaptation, climate, soil, season, modern varieties, seed rate, fertilizer requirements, crop geometry, intercultural operations, water requirement, weed control, harvest, quality components, industrial use.
Agricultural Statistics	Frequency distribution, standard error and deviation, correlation and regression analyses, co- efficient of variation; Tests of significancet test, F test and chi-square (x2); Data transformation and missing plot techniques; Design of experiments and their basic principles, completely randomized, randomized block, split plot, strip-plot, factorial and simple confounding designs; Efficiency of designs; Methods of statistical analysis for cropping systems including intercropping; Pooled analysis.
Sustainable Land Use Systems	Tillage - Concept, types, tilth, tools and implements; Modern concepts of tillage and conservation agriculture; Land capability classification, Alternate land use and Agro forestry systems; Types, extent and causes of wasteland; Shifting cultivation; Concept of sustainability; Sustainability parameters and indicators; Agricultural and agro-industrial residues and its recycling.
Soil-Plant-Water Relationship	Importance of water in agriculture; Hydrological cycle; runoff and infiltration, factors affecting infiltration; Soil water relations, water retention by soil, soil moisture characteristics, field capacity, permanent wilting point, plant available water and extractable water; Soil irrigability classifications, Determination of soil water content, computation of soil water depletion, soil water potential and its components; Movement of soil water-saturated and unsaturated water flow; Evapotranspiration (ET), PET, AET and its measurements. Crop co-efficient; Plant water relations: Concept of plant water potential, its components; Methods of moisture estimation in plants.

Module	Content
Irrigation Water Management	History of irrigation in India; Major irrigation projects in India; Water resource development; Crop water requirements; Concepts of irrigation scheduling, Different approaches of irrigation scheduling; Concept of critical stages of crop growth in relation to water supplies; Methods of irrigation viz. surface, subsurface and pressurized irrigation methods, merits and demerits; Measurement of irrigation water, application and distribution efficiencies. Conjunctive use of water; Interaction between irrigation and fertilizers.
Management of Problematic Soils and Crop Production	Problem soils and their distribution in India, acidic, saline, waterlogged and mined- soils; Response of crop to acidity, salinity, excess water and nutrient imbalances; Reclamation of problem soils, role of amendments and drainage; Crop production techniques in problem soils – crops, varieties, cropping system and agronomic practices; Degraded lands and their rehabilitation. Management strategies for flood prone areas; Drainage for improving water logged soils for crop production; Crop production and alternate use of problematic soils and poor quality water for agricultural.
Cropping and Farming Systems and Organic Farming	Cropping system – Definition, principles, classification; Cropping system for different ecosystem; Interaction and indices; Non-monetary inputs and low cost technologies. LEIA, HEIA and LEISA ;Farming systems – type – natural, bio-dynamic, bio-intensive, response, precision, biological and organic farming; organic and bio inputs, Soil health and organic matter and Integrated organic farming systems; IFS – concepts, models for different ecosystem, resource recycling and evaluation.

GENETICS AND PLANT BREEDING

Module	Content
General Genetics and Plant Breeding	Mendelian inheritance. Cell structure and division, Linkage, its detection and estimation. Epistasis. Gene concept, allelism and fine structure of gene. Extra chromosomal inheritance. DNA – structure, function, replication and repair. Genetic code. Gene-enzyme relationship. Replication, Transcription and Translation. Gene regulation in prokaryotes and eukaryotes. Nuclear and cytoplasmic genome organization. Spontaneous and induced mutations and their molecular mechanisms. Crop domestication, evolution of crops and centres of diversity. Emergence of scientific plant breeding. Objectives and accomplishments in plant breeding and the role of National and International institutes. Gametogenesis and fertilization. Modes of sexual and asexual reproduction and its relation to plant breeding methodology. Apomixes, incompatibility and male sterility systems and their use in plant breeding. Epigenetics.
Economics Botany and Plant Breeding Methods	Origin, distribution, classification, description and botany of cereals (wheat, rice, maize, sorghum, pearl millet, small millets); pulses (pigeonpea, chickpea, black gram, green gram, cowpea, soybean, pea, lentil, horse gram, lab-lab, rice bean, lathyrus, lima bean; oilseeds (groundnut, sesamum, castor, rapeseed mustard, sunflower, safflower, niger, linseed); fibre and sugar crops, fodder and green manures; Breeding methods for self-pollinated, cross-pollinated and asexually propagated crops. Combination, recombination and transgressive breeding. Single seed descent. Populations, their improvement methods and maintenance,
Genome Organization and Cytogenetics of Crop Plants	Chromosome number, structure, function and replication. Sex determination & sex linkage. Recombination and crossing over. Molecular and cytological mechanism of crossing over. Karyotype analysis.Chromosomal theory of inheritance. Cell cycle and its regulation. Banding techniques. In situ hybridization. GISH and FISH Special types of chromosomes. Chromosomal interchanges, inversions, duplications and deletions. Polyploids, haploids, aneuploids, their utility and their meiotic behaviour. Wide hybridization and chromosomal manipulations for alien gene transfer. Pre-and post- fertilization barriers in wide hybridization. Genome organization and Cytogenetics of important crop species- wheat, maize, rice, sorghum, Brassica, groundnut, cotton, Vigna, potato and sugarcane.
Quantitative and Biometrical Genetics	Quantitative characters. Multiple factors inheritance. Genetic control of polygenic characters. Genetic advance and types of selection their effects on population mean and variance. Metric characters under natural selection. Repeatability and asymmetry of response. Breeding value. Dominance and interaction deviations. Hardy Weinberg law and changes in gene frequency due tomigration, mutation and selection. Linkage disequilibrium. Genetic load. Polymorphism. Breeding value, heritability. Response to selection, correlated response. Estimates of variance components and covariance among relatives. Mating designs with random and inbred parents. Estimation of gene effects and combining ability. Effects of linkage and epistasis on estimation of genetic parameters. Maternal effects. Genotype-environment interactions, stability of performance and stability analysis. Heterosis and its basis (Genetic, biochemical and physiological).

Module	Content
Genetic Engineering and Biotechnological Tools in Plant Breeding	Somatic hybridization, micropropagation, somaclonal variation, *in vitro* mutagenesis. Antherculture. Cryopreservation. Genetic and molecular markers, generation of molecular markers and their application in genetic analyses and breeding. Molecular markers in genetic diversity analysis and breeding for complex characters. Gene tagging, QTL mapping, MAS, MARS and MABB. Vectors. DNA libraries, DNA fingerprinting, DNA sequencing. Nucleic acid hybridization and immunochemical detection. Chromosome walking, Recombinant DNA technology, Gene cloning strategies. Gene transfer methods.
Plant Breeding for Stress Resistance and Nutritional Quality	Genetic and molecular basis and breeding for resistance to diseases and insect-pests. Breeding for vertical and horizontal resistance to diseases. Genetic and physiological basis of abiotic stress tolerance. Breeding for resistance to heat, frost, flood, drought and soil stresses. Important quality parameters in various crops, their genetic basis and breeding for these traits. Role of molecular markers in stress resistance breeding using biotechnological tools (MAS, MARS and MABB and transgenics). Biofortification.
Plant Genetic Resources and their Regulatory System; Varietal Release and Seed Production	Plant exploration, germplasm introduction, exchange, conservation, evaluation and utilization of plant genetic resources. Types of genetic resources. Centres of diversity of cultivated plants. Genetic erosion and genetic vulnerability. Convention on Biological Diversity and International Treaty on Plant Genetic Resources for Food and Agriculture. Intellectual Property Rights and its different forms for protection of plant genetic resources. Biodiversity Act. Protection of Plant Varieties and Farmers' Rights Act and its features. System of variety release and notification. Types of seeds and seed chain. Maintenance breeding- nucleus and breeder seed production. Seed production and certification.
Statistical Methods and Field Plot Techniques	Frequency distribution. Measures of central tendency, probability theory and its applications in genetics. Probability distribution and tests of significance. Correlation, linear, partial and multiple regression. Genetic divergence. Multivariate analysis. Designs of experiments - basic principles, completely randomized design, randomized block design and split plot design. Complete and incomplete block designs. Augmented design, Grid and honeycomb design. Hill plots, unreplicated evaluation. Data collection and interpretation.

HIMGIRI ZEE UNIVERSITY
[Estd. Under Uttaranchal State Act. No. 17, 2003. Approved by UGC Under Sec. 2(f)]
DEHRADUN

PH.D. ENTRANCE TEST SYLLABUS

COMPUTER SCIENCE AND ENGINEERING

Module	Content
Discrete Structures	Discrete Structures (sets, graphs and trees, algebraic structures, matrix algebra, elementary counting and probability), elementary calculus, linear algebra, 2-3 D geometry.
Programming Aptitude & Algorithm Design	Ability to write and analyse programs in C/C++ to solve simple problems. Use of elementary data structures such as arrays, lists, stacks, queues, trees, graphs. Familiarity with recursion, pointers and file handling. Ability to differentiate procedure & OOP concepts, writing loop invariants and assertions. Analysis of Algorithm, Divide and Conquer, Dynamic Programming, Greedy, Backtracking, P, NP, NP-C, NP-Hard Class Problems
Artificial Intelligence	Knowledge Representation and organization, Search and control Strategies, Matching Techniques, Expert System Architecture
Theory of Computation& Compiler Construction	Finite State Automata (FSM)-deterministic and non-deterministic, Regular Expression, Grammar, Derivation, Ambiguous grammar, Idea on Left-factoring and left-recursion, Push-down automata, Turing Machine, Halting problem of Turing Machine and undecidable Language, Translators, Phases of Compiler: Lexical analysis, Syntax analysis, Intermediate code generation, Code optimization, Run-Time Environment
Database Management Systems & Software Engineering	Relational Query Languages, Transaction Processing Concepts, Process of Normalization Concepts of Indexing and Hashing. System Development Lifecycle Models, Object-Oriented Design, Software Testing, Software Metrics
Computer System Organization, Architecture and Networks	Machine instructions and addressing modes, ALU, Data-path and control unit, Instruction pipelining, Memory hierarchy: cache, main memory and secondary storage; I/O interface. Fundamental communication theory, Data Link Layer protocols, Internetworking, Transport Protocols, Application Layer Protocols

PH.D. ENTRANCE TEST SYLLABUS

EDUCATION

Module	Content
1. Philosophy of Education	Indian Schools of Philosophy, Vedanta, Sankhya, Buddhism; Contributions of Indian Thinkers: J. Krishanamurthi, Vivekananda, Aurobindo, Tagore and Gandhi; Western schools of Philosophy: Idealism, Realism, Naturalism, Pragmatism and Existentialism
2. Sociology of Education	Educational Sociology and Sociology of Education; Theories of Sociology of Education; Education and Social Change, Education and Democracy; Education and Social Mobility; social equity and equality of Educational Opportunities; Education, economic growth and development
3. Growth& Development, Creativity, Intelligence & Personality	Methods of Educational Psychology; Concept of Growth & Development; Individual Differences; Education of Special Children; Creativity, Theories of Intelligence – Two factor, Multi factor, Multiple Intelligence Gardner, Gilford's Model, Hierarchical Theory, Emotional Intelligence; Theories of Personality Development & Assessment of Personality
4. Learning theories & Motivation	Spectrum of Behaviorist theories of Learning; Spectrum of Constructivist theories of learning; Information Processing Model; Vicarious Learning (Bandura); Theories of Motivation : Physiological, Psycho-analytical, Murray's theory, Maslow's theory, Achievement Motivation
5. Tools, Techniques & Methods of Educational Research	Formulation of Research Problem, Types of Sampling, Questionnaire, Interview, Observation, Major Approaches of Research - Descriptive research, Ex-post facto research, Historical research, Experimental research Designs & Qualitative Interpretation. Product Moment Correlation, Rank Difference Correlation, Normal probability Curve, Skewness and Kurtosis; Inferential Statistics - Null Hypothesis, Type I and Type II errors, one and two tailed tests, Standard error, Confidence limits, t-test, F-test-One-way ANOVA, Non-Parametric Tests -Chi–square Tests of Equality and Independence.

PH.D. ENTRANCE TEST SYLLABUS

JOURNALISM AND MASS COMMUNICATION

Module	Content
Theories of Mass Communication	Theories of Mass Communication- Symbolic Convergence Theory, Media Ecology, Semiotics, Hall - Cultural Studies, Hypodermic or Bullet Theory, Selective Exposure and Selective Perception, Paul Lazarsfeld - Two-step Flow Theory, Gerbner - Cultivation Theory, McComb and Shaw - Agenda-setting Theory, Katz - Uses and Gratifications, New Media Theories; Normative Theories of Mass Media, Authoritarian Theory, Free Press Theory, Social Responsibility Theory, Communist Media Theory, Development Communication Theory, Democratic-Participant Media Theory
History and Development of Journalism	History and development of the press, Press freedom, Journalism ethics, Media roles and responsibilities, Media bias, Media framing, Yellow journalism, Journalism: content and design, Newspapers, magazines and tabloids, Television and radio journalism, Journalism in the era of the internet, Online journalism, New media, Alternative media, Community media, Issues and challenges
Film Studies	Cinema as a medium of art, Cinema history: From Hollywood and Europe to India, Film forms: Narrative and Non-narrative, Film and postmodernism, Post structuralism and deconstruction, Impressionism, Expressionism and surrealism, Fiction: realism, symbolic simulation-typology genres of fiction, Cinema and Identities, Representation: Gender, Lesbian and gay, National and Regional Identities, Bollywood Vs others, World Cinema- American, British, Italian, French and Japanese
Communication for Development and Social Change	Issues in development and development support communication: Population, Health, Agriculture, Education, Industrial, Economic, Science and technology, Environment, National integration. Communication through visual artistic forms, dance, music and rituals, songs, stories, paintings, dance, music, tapestries, folklore and rituals that circulate in tribal cultures and rural India, ICT for development, Environmental communication, Science communication, Health communication, Agricultural communication, Educational communication, Women in development (WID), Gender and development (GAD, Current trends in development communication research.
Marketing Communication: Advertising	Target/Geographical market, positioning, Brand strength measurement, message research, Communication effectiveness, Campaign designing and testing, PR and Corporate Communication: Industrial relation and public relations, Customer relations and media relations, Managing corporate crisis: National and international case studies, Event Management: Event planning, Budgeting, Implementation and Evaluation, Study of audience profile, perception and reception of communication.

PH.D. ENTRANCE TEST SYLLABUS

LEGAL STUDIES

Module	Content
M1	Constitutional Law Jurisprudence Public International Law
M2	Family Law Administrative Law Criminal Law
M3	Law of Contract-1 Law of Contract-II Law of Tort
M4	Corporate Law Intellectual Property Law Cyber Law
M5	Environmental Law Human Right law

HIMGIRI ZEE UNIVERSITY
[Estd. Under Uttaranchal State Act. No. 17, 2003. Approved by UGC Under Sec. 2(f)]
DEHRADUN

PH.D. ENTRANCE TEST SYLLABUS

MANAGEMENT

Module	Content
Management	Concept, Nature, Importance; Management levels: their Roles and Skills, Social Responsibility of Managers and Ethics in Managing. Evolution of Management: Early contributions; The Classical School: Scientific Management approach and Administrative Management approach. The Behavioral School: The Hawthorne Experiments. The Management Science School. Modern Approaches: Systems Approach, and Contingency approach. Comparative Management Planning: Nature and Significance of Planning, Types of Planning, Process of Planning, Management by Objective (MBO). Organizing: Nature and Significance: Departmentation, Line and Staff Relationship, Span of Control, Authority and Responsibility, Delegation and Decentralization. Staffing: Concept and Significance, Elements of Staffing, Issues in Managing Human Resources. Directing: Concept and Significance. Theories of Motivation, Leadership: Process and Models of Leadership Development, Contemporary views on Leadership: Transformational-Transactional, Charismatic-Visionary leadership.
Strategic Management	Understanding Strategy, Strategic Management, Strategic Intent: Vision; Mission; Business Definition; Goals and Objectives, Environmental Analysis, core competence, value chain analysis, distinctive competency, competitive advantage, Michael Porter 5 force Model, Corporate Appraisal, Corporate Portfolio Analysis Model, McKinsey's 7s Framework. Corporate and Business Level Strategies, Issues related to Strategy Implementation.
Human Resource Management	Concept, Importance and Functions, Human Resource Planning, Compensation Management, Performance Management, Human Resource Audit, International HRM, Strategic HRM, Leadership Development, Work-life Balance, 360 degree feedback, HR scorecard, Talent Management, Transactional Analysis, Competency Mapping, Quality Circle, Empowerment. Human Resources Management in a changing environment; Corporate objectives and Human Resource Planning; Career and succession planning; job analysis; Methods of manpower search; Attracting, Selecting and

	retaining human resources; Induction and socialization; Manpower training and development; Performance appraisal and potential evaluation; Job evaluation and compensation; Employee welfare; Industrial relations

Organizational Behaviour	Challenges and Opportunities for Organizational Behavior, Personality, Learning, Attitudes, Perception, Values, Team Building, Power and Politics, Organizational Dynamics, Change Management trade unions; Dispute resolution & grievance management, Employee empowerment.
Evolution of management thought	Systems and contingency approach for understanding organizations; Managia1 processes, functions, skills and roles in an organization; Social Responsibility of Business; Understanding and Managing individual behavior; Personality; Perceptions; Attitudes; Learning; Decision-making; Management by Objectives; Understanding and managing group processes-interpersonal and group dynamics; Applications of Emotional Intelligence in organizations. Leadership and influence process; Work Motivation. Understanding arid Managing organizational system—Organizational design and structure, Work stress, Organizational Change and development; Conflict Management; Stress Management.
Marketing Management	Marketing, Marketing Mix, Marketing segmentation, Marketing in a developing economy. Consumer Behavior, Consumerism, Economic, Social and psychological Determinants of Consumer Behavior, Contemporary retailing scene in India and marketing challenges, Services Marketing, Rural Marketing, E-Marketing, Green Marketing, Customer relationship marketing, Viral Marketing, Network Marketing, Managing logistics and supply chain.
Operations Management	Operations management in corporate profitability and competitiveness, Material Management, Purchase Management, Store Management, Safety Management. Quality Improvement: TQM, Six Sigma, JIT Approach, Lean Production System and Kanban System. Supply Chain Management, Supply Chain Strategy and Performance Measures, Linking Supply Chain and Business Performance, Inventory Management, Transportation Management, Supply Chain Management Application Marketplace and Future Trends.

Business Legislation	The Indian Contract Act, 1872 : Essentials of a Valid Contract, Void Agreements Performance of Contracts, Breach of Contract and its Remedies, Quasi-Contracts, The Sale of Goods Act, 1930: Formation of a Contract, Rights of an Unpaid Seller; The Negotiable Instrument Act, 1881 : Nature and Types, Negotiation and Assignment, Holder-in-Due Course, Dishonor and Discharge of a Negotiable Instrument, Arbitration; The Companies Act, 1956 : Nature and types of Companies, Formation, Memorandum and Articles of Association, prospectus Allotment of Shares, Share and Share Capital, Membership, Borrowing Powers, Management and Meetings, Accounts and Audit, Prevention of Oppression and Mismanagement, Winding up.; An Overview of Consumer Protection Act and Cyber Laws).

Financial management	Objectives of financial management; Time value of money, sources of finance, Investment decisions: Importance, Difficulties determining cash flows, methods of capital budgeting Risk analysis : Cost of capital; Concept and importance, Computations of cost of various sources of finance; Weighted Average Cost of Capital; Capital Structure decisions; Theories of capital structure, Factors determining capital structure. Optimum capital structure; Management of working capital - Cash, Receivables and Inventory Management, Internal Financing and Dividend Policy; Financial Modelling.
Business Communication & Ethics	Importance and nature of business communication, Effective communication skills; Process of 3 communication Oral and Non-Verbal communication, Barriers and gateways in communication and Do's and Don't of business writing, Commercial letters; Writing business and academic reports; Public speaking, listening and Negotiations; conducting and attending interview and meetings. Concept of Business Ethics - Values – Concepts, Types and Formation of Values, Ethics and Behavior, Values of Indian Managers; Managerial Excellence through Human Values;

HIMGIRI ZEE UNIVERSITY
[Estd. Under Uttaranchal State Act. No. 17, 2003. Approved by UGC Under Sec. 2(f)]
DEHRADUN

PH.D. ENTRANCE TEST SYLLABUS

PHARMACEUTICAL SCIENCES

PHARMACEUTICS

Module	Content
Biopharmaceutics and Pharmacokinetics	Compartment modelling, physiological models, one compartment open model drug disposition, plasma elimination half-life, two compartment open model drug disposition. Drug Distribution-Apparent volume of distribution (one and two compartment models). Nonlinear Pharmacokinetics.
Basics of Formulations	Dosage form and its types, Powder, solution, suspension, emulsion, identification test for emulsion, theories of emulsification, Suppositories and its bases, Gaseeous dosages forms -Aerosol, propellent withy example.
Bioavailability and Bioequivalence	Measurement of bioavailability, in vitro drug dissolution testing models, Invitro-in Vivo correlation. **Bioequivalence**-General principles, criteria for establishing bioequivalence requirement, criteria for waiver of evidence for bioequivalence requirement and methodology. Pharmacokinetics parameters-logarithmic transformations. Multiple dosage regimens-drugs accumulation, i.e. and oral regiment, loading dosing, scheduling. Diseases-dose adjustment – hepatic disease dose adjustment, renal disease dose adjustment, therapeutic drug monitoring.
Novel Drug Delivery System	Potential application of nanocarriers in Targeted Drug Delivery, oral osmotic pumps, Fundamental of bio adhesion, naturally occurring bio adhesives, mucoadhesive polymers used in oral cavity, Multiple emulsion, colon specific drug delivery system, implant and inserts, Resealed erythrocytes. Organogel, Niosomes.
Industrial Pharmacy and Drug Regulatory Affairs	Preformulation studies, Tablet, Coating of tablets, Liquid orals, Capsules, Pellets, Parenteral Products, cosmetics, Packaging material science. Approval process and timelines involved in IND, NDA, ANDA. Changes to an approved NDA/ANDA. Overview of regulatory authorities of India and US.

PHARMACEUTICAL CHEMISTRY

Module	Content
Molecular modeling	Molecular mechanics quantum mechanism, docking, advanced concepts of molecular modeling.
Structural Elucidation of Drugs	Structural elucidation of natural, synthetic and semisynthetic drugs by using spectroscopic data. [UV, IR, H1NMR, C13 NMR, Mass].
Reactions and their Mechanisms	Generation, Stability, structure and reactivity of free radicals, Carbocations and Carbines. Mechanism of free radical, electrophilic, Nucleophilic (Addition and substitution) reactions, elimination reactions with examples.
Molecular Actions	Concept of receptors and receptor theories. The role of functional groups in drug receptors, interactions with specific reference to opioid, dopaminergic, adrenergic, cholinergic and GABAnergic receptors.
New drug development and lead approach	Identification of lead molecule for natural products. Lead optimization for the new drug development with suitable examples from CVS, CNS and chemotherapeutic agents.
Drug Design	History and development of QSAR, physicochemical parameters. Hansch analysis, free klison analysis.
Instrumental Methods of Analysis	**UV-Visible spectroscopy**: Introduction, Beers law and its limitations, molar extinction coefficient, Woodward's Fiesher rules for calculating absorption maximum, instrumentation and applications. **FTIR Spectroscopy:** Principles-molecular vibrations, vibrational frequency and its influencing factors, sampling techniques, instrumentation and applications of FTIR. **NMR Spectroscopy:** Principle, chemical shifts, shielding and deshielding effects, splitting of signals, computing constants, instrumentations and applications (H- & C-NMR). **Mass-spectroscopy:** Principle, ionization Techniques, Fragmentation pattern, instrumentation and applications. **GLC and HPLC:** Principles, instrumentation with special emphasis on different column and detectors and applications. **HPTLC, Ion-exchange Chromatography and Gel filtration:** Principle, instrumentation and applications. **Potentiometry and conductometry:** Principle, instrumentation and applications. **Polarimetry, fluorimetry and refractometry:** Principle, instrumentation and applications with suitable examples.

PHARMACOGNOSY

Module	Content
Indian Systems of Medicine	Basic principles involved in Ayurveda, Siddha, Unani and Homeopathy. Preparation and standardization of Ayurvedic formulations viz Aristas and Asawas, Ghutika, Churna, Lehya and Bhasma.
Extraction	General methods and Principles of extraction methods, types of extraction and their merits and demerits for crude drugs; selection and purification of solvents for extraction; screening of the plant extracts for chemicals. General methods of isolation of different classes of phytochemical.
Herbal Cosmetics	Sources and description of raw materials of herbal origin used via, fixed oils, waxes, gums colours, perfumes, protective agents, bleaching agents, antioxidants in products such as skincare, hair care and oral hygiene products. Herbal Excipients – Significance of substances of natural origin as excipients – colorants, sweeteners, binders, diluents, viscosity builders, disintegrants, flavors & perfumes.
Screening and evaluation	Screening of plant extracts / phytochemicals for analgesic, anti-inflammatory, anti-diabetic, diuretic, anti-fertility, anti-epileptic, hepatoprotective, immunomodulatory, anticancer cardiovascular and antimicrobial activity.
Patenting and Regulatory requirements of natural products	Definition of the terms: Patent, IPR, Farmers right, Breeder's right, Bioprospecting and Biopiracy. Patenting aspects of Traditional Knowledge and Natural Products. Case study of Curcuma & Neem.
Regulatory Issues.	Regulations in India (ASU DTAB, ASU DCC), Regulation of manufacture of ASU drugs - Schedule Z of Drugs & Cosmetics Act for ASU drugs.
Tissue Culture	Current trends in tissue culture and its applications in pharmaceutical and allied fields. Immobilized cell systems and techniques of immobilization, biotransformation resulting into pharmaceutically important secondary metabolites, using tissue cultures. Micro propagation, Hairy-root cultures and their applications in pharmacy.

PHARMACOLOGY

Module	Content
Basic concept of Pharmacokinetic	Processes involved in transportation of drug across cell membrane. Absorption, distribution, metabolism and excretion of drugs. Basic concepts of clinical pharmacokinetics: i) Bioavailability & bioequivalence ii) volume of distribution iii) half-life iv) clearance.
Pharmacodynamic	Site and mechanisms of drug action, factors modifying drug action. Classification and families of receptors, regulation of receptors, drug receptor interaction theories, dose response curve and therapeutic Index.
Adverse Drug Reactions:	Types and mechanisms
Pharmacology of CNS and ANS acting drugs	Neurohumoral transmission, parasympathomimetics, parasympatholytics, sympathomimetics, sympatholytics, general anesthetics, sedatives, hypnotics and centrally acting muscle relaxants, anti-epileptics, antipsychotics, antidepressants, anti-anxiety agents, anti-manics and hallucinogens.
Chemotherapy	General principles of chemotherapy, sulfonamides and cotrimoxazole, antibiotics (Penicillins, cephalosporins, chloramphenicol, macrolides, quinolones and fluoroquinolins, tetracycline and aminoglycosides), antitubercular agents, antileprotic agents, antifungal agents, antiviral drugs, antimalarial drugs and chemotherapy of malignancy.
Cardiovascular pharmacology	Cardiotonics, antiarrhythmics, antihypertensive, antianginal and antihyperlipidemic agents.
Endocrine Pharmacology	Anterior pituitary hormones, thyroid hormones, hormones regulating plasma calcium level, ACTH and corticosteroids, insulin, oral hypoglycemic agents and glucagon.