

Motherhood University
RAT Research Methodology Syllabus
(Part-A)

RAT Research Methodology Syllabus (Part-A)

Unit-I: Research Aptitude

- Research: Meaning, types, and characteristics, positivism and post-positivistic approach to research
- Methods of research: Experimental, descriptive, historical, qualitative and quantitative methods
- Steps of research
- Thesis and article writing: Format and styles of referencing
- Research ethics
- Ethics in research
- National and International regulations/ laws/ ethics related to research on Human, Animals and Environments

Literature review: Importance of literature review, methods and sources of literature review, review the literature selected, formulating the research problem based on extensive literature survey, developing the hypothesis, preparing the research design, development of a theoretical and conceptual framework, writing up the synopsis of the proposed Ph.D. program.

Unit-II: Data Interpretation

- Sources, acquisition and classification of data
- Quantitative and qualitative data
- Graphical representation (bar-chart, histograms, pie-chart, table-chart and line-chart) and mapping of data
- Data interpretation
- Data and governance

Unit-III: Information and Communication Technology (ICT)

- ICT: General abbreviations and terminology
- Basics of the Internet, Intranet, E-mail, Audio and Video-conferencing
- Use of word processing, spread sheet and database software. Plotting of graphs. Internet and its application: E-mail, WWW, Web browsing, acquiring technical skills, drawing inferences from data.
- Digital initiatives in higher education
- ICT and Governance

Unit-IV: Research ethics, IPR and Scientific Communication

Ethics-ethical issues, ethical committees (human and animal); prewriting considerations, thesis writing, formats of report writing, preparing posters for scientific presentation, preparing and delivering of oral presentation. Scholarly publishing-IMRAD concept and design of research paper, citation and acknowledgment, plagiarism, reproducibility and accountability, general consideration of IPR for patent drafting and submission.

Babita Singh

Jain Anand

W. M. Singh

Unit-V: People, Development and Environment

- Development and environment: Millennium development and Sustainable development goals
- Human and environment interaction: Anthropogenic activities and their impacts on the environment
- Environmental issues: Local, regional and global; air pollution, water-pollution, soil pollution, noise pollution, waste (solid, liquid, biomedical, hazardous, electronic), climate change and its socio-economic and political dimensions
- Impacts of pollutants on human health
- Natural and energy resources: Solar, Wind, Soil, Hydro, Geothermal, Biomass, Nuclear and Forests
- Natural hazards and disasters: Mitigation strategies
- Environmental Protection Act (1986), National Action Plan on Climate Change, International agreements/efforts -Montreal Protocol, Rio Summit, Convention on Biodiversity, Kyoto Protocol, Paris Agreement, International Solar Alliance

Unit-VI: Communication

- Communication: Meaning, types, and characteristics of communication
- Effective communication: Verbal and non-verbal, inter-cultural and group communications, classroom communication
- Barriers to effective communication
- Mass media and society

Unit-VII: Teaching Aptitude

- Teaching: Concept, objectives, levels of teaching (memory, understanding and reflective), characteristics and basic requirements
- Learner's characteristics: Characteristics of adolescent and adult learners (academic, social, emotional and cognitive), individual differences
- Factors affecting teaching related to: Teacher, Learner, Support material, Instructional facilities, Learning environment and Institution
- Methods of teaching in higher learning institutions: Teacher-centred vs learner-centred methods; offline vs online methods (Swayam, Swayamprabha, MOOCs, etc.).
- Teaching support system: Traditional, modern and ICT based
- Evaluation systems: Elements and types of evaluation, evaluation in Choice Based Credit Systems in higher education, computer-based testing, innovations in evaluation systems

Me
Baljit Singh

Tarika

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**MOTHERHOOD
UNIVERSITY, Roorkee**

ENLIGHTENING WORLD

**Doctor of Philosophy(Ph.D.)
Entrance Exam Syllabus**

FACULTY OF AGRICULTURE

Roorkee-

**Dehradun Road, Village Karoundi Post B
hagwanpur, Tehsil Roorkee District Hari
dwar, Uttarakhand**

Soil Science

Unit 1: Pedology Concept of land, soil and soil science. Composition of earth crust and its relationship with soils; Rocks, minerals and other soil forming materials; Weathering of rocks and minerals; Factors of soil formation; Pedogenic processes and their relationships with soil properties; Soil development; Pedon, polypedon, soil profile, horizons and their nomenclature. Soil Taxonomy - epipedons, diagnostic subsurface horizons and other diagnostic characteristics, soil moisture and temperature regimes, categories of the system and their criteria; Interpretation of soil survey data for land capability and crop suitability classifications, Macro-morphological study of soils. Application and use of global positioning system for soil survey. Soil survey- types, techniques. Soil series- characterization and procedure for establishing soil series, benchmark soils and soil correlations. Study of base maps: cadastral maps, toposheets, aerial photographs and satellite imageries. Use of geographical information system for preparing thematic maps.

Unit 2: Soil Physics Soil physical constraints affecting crop production. Soil texture – textural classes. Soil structure – classification, soil aggregation and significance, soil consistency, soil crusting, bulk density and particle density of soils and porosity, their significance and manipulation. Soil water- retention and potentials. Soil moisture constants. Movement of soil water - infiltration, percolation, permeability, drainage and methods of determination of soil moisture. Darcy's law. Thermal properties of soils, soil temperature, Soil air- composition, gaseous exchange, influence of soil temperature and air on plant growth. Soil erosion by water- types, effects, mechanics. Rain erosivity and soil erodibility. Runoff - methods of measurement, factors and management, runoff farming. Soil conservation measures. Characterization and evaluation of soil and land quality indicators; Causes of land degradation; Management of soil physical properties for prevention/restoration of land degradation; Identification, monitoring and management of waste lands; Land use-land cover mapping and land use planning using conventional and remote sensing techniques; Concept of watershed – its characterization and management.

Unit 3: Soil Chemistry Chemical composition of soil; Soil colloids - structure, composition, constitution of clay minerals, amorphous clays and other non-crystalline silicate minerals, oxide and hydroxide minerals; Charge development on clays and organic matter; pH-charge relations; Buffer capacity of soils. Elements of equilibrium thermodynamics, chemical equilibria, electrochemistry and chemical kinetics. Inorganic and organic colloids- surface charge characteristics, diffuse double layer theories, zeta potential stability, coagulation/flocculation, peptization, electrometric and sorption properties of soil colloid. Soil organic matter fractionation, clay-organic interactions. Cation exchange- theories, adsorption isotherms, Donnan-membrane equilibrium concept, clay-membrane electrodes and ionic activity measurement, thermodynamics, anion and ligand exchange- inner sphere and outer-sphere surface complex formation, fixation of oxyanions, hysteresis in sorption-desorption of oxy-anions and anions. Nitrogen, potassium, phosphate and ammonium fixation in soils and management aspects. Chemistry of acid, salt-affected and submerged soils and management aspects.

Unit 4: Soil Fertility Essential elements in plant nutrition; Nutrient cycles in soil; Transformation and transport of nutrients (Macro and micro nutrients) in soil; Manures and fertilizers; Fate and reactions of fertilizers in soils; Chemistry of production of different


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fertilizers; Slow-release fertilizers and nitrification retarders; Quality control of fertilizers. Soil fertility evaluation – soil testing, plant and tissue tests and biological methods; Common soil test methods for fertilizer recommendation; Soil test-crop response correlations; Integrated nutrient management; Use of isotopic tracers in soil research; Nature, properties and development of acid, acid sulphate, saline and alkali and their management; Lime and gypsum requirements of soils; Irrigation water quality - EC, SAR, RSC and specifications. Fertility status of major soil groups of India. Pollution: types, causes, methods of measurement, standards and management. Heavy metal toxicity and soil pollution; Chemical and bio-remediation of contaminated soils; Soil factors in emission of greenhouse gases; Carbon sequestration in mitigating greenhouse effect; Radio-active contamination of soil.

Unit 5: Soil Microbiology Soil biota, soil microbial ecology, types of organisms. Soil microbial biomass, microbial interactions, unculturable soil biota. Microbiology and biochemistry of root soil interface. Phyllosphere. Soil enzymes, origin, activities and importance. Soil characteristics influencing growth and activity of microflora. Microbial transformations of N, P, K, S, Fe and Zn in soil. Biochemical composition and biodegradation of soil organic matter and crop residues. Humus formation. Cycles of important organic nutrients. Biodegradation of pesticides, organic wastes and their use for production of biogas and manures. Biofertilizers – definition, classification, specifications, method of production and role in crop production. Methods of soil analysis - particle size distribution, bulk and particle density, moisture constants, Modern methods of soil, plant and fertilizer analysis; Flame photometry and inductively coupled plasma optical emission spectroscopy; Spectrophotometry - visible, ultra-violet and infrared; Atomic absorption spectrophotometry; Potentiometry and conductimetry; X-ray diffractometry; Mass spectrometry.

Unit 6: Statistics Experimental designs for pot culture and field experiments; Statistical measures of central tendency and dispersion; Correlation and regression; Tests of significance - t and F tests; Computer use in soil research.

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AGRONOMY

Unit 1 : Crop Ecology and Geography Principles of crop ecology; Ecosystem concept and determinants of productivity of ecosystem; 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 CO₂ in relation to photosynthetic rates and efficiency; Physiological stress in crops; Remote sensing: Spectral indices and their application in agriculture, crop water stress indices and crop stress detection.

Unit 2 : Weed Management Scope and principles of weed management; Weeds' classification, biology, ecology and allelopathy; 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; Biological weed control, bioherbicides: 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 GM crops in weed management.

Unit 3 : 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, drought syndrome, effect on plant growth, drought resistance, drought avoidance, drought management; Crop Planning including contingency, crop diversification, varieties, cropping systems, conservation cropping and mid-season corrections for aberrant weather conditions; Techniques of moisture conservation insitu to reduce evapotranspiration, runoff and to increase infiltration; Rain water harvesting and recycling concept, techniques and practices; Timelines and precision key factors for timely sowing, precision in seeding, weed control; Fertilizer placement, top dressing and foliar application, aqua-fertigation; Concept and importance of

Unit 4 :Crop Production Crop production techniques for cereals, millets, legumes, oilseeds, fiber crops, sugarcane, tobacco, fodder and pasture crops including origin, history, distribution, adaptation, climate, soil, season, modern varieties, fertilizer requirements, intercultural operations, water requirement, weed control, quality components, industrial use, economics and post-harvest technology. Concept of sustainability; Sustainability parameters and indicators; Conservation agriculture; Alternate land use systems; Types, extent and causes of wasteland; Shifting cultivation; Agro forestry systems; Agricultural and agro-industrial residues and its recycling, safe disposal; Allelopathy and biomass production.

Unit 5 : Irrigation Water Management Management of irrigation water; History of irrigation in India; Major irrigation projects in India; Water resources development; Crop water requirements; Concepts of irrigation scheduling, Different approaches of irrigation scheduling; Soil water depletion plant indices and climatic parameters; Concept of critical stages of crop growth in relation to water supplies; Crop modeling, crop coefficients, water production functions; Methods of irrigation viz. surface methods, overhead methods, drip

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irrigation and air conditioning irrigation, merits and demerits of various methods, design and evaluation of irrigation methods; Measurement of irrigation water, application and distribution efficiencies; Management of water resources (rain, canal and ground water) for agricultural production; Agronomic considerations in tiledesign and operation of irrigation projects, characteristics of irrigation and family systems affecting irrigation management; Irrigation legislation; Water quality, conjunctive use of water, irrigation strategies under different situation of water availability, optimum crop plans and cropping patterns in canal command areas; Socio-economic aspects of on-farm water management; Irrigation water distribution, Irrigation efficiencies; Design of irrigation canals, design of irrigation structures; Interaction between irrigation and fertilizers.

Unit 6 : **Agricultural Statistics** Frequency distribution, standard error and deviation, correlation and regression analyses, co-efficient of variation; Tests of significance-t, F and chi-square (X^2); 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.

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Genetics & Plant Breeding

Unit 1: 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.

Unit 2: Economics Botany and Plant Breeding Methods Origin, distribution, classification, description and botany of cereals (wheat, rice, maize, sorghum, pearl millet, minor millets); pulses (pigeon pea, chickpea, black gram, green gram, cowpea, soyabean, pea, lentil, horse gram, lab-lab, rice bean, winged bean, lathyrus, Lima bean; oilseeds (groundnuts, sesamum, castor, rapeseed mustard, sunflower, Niger, linseed); fibers and sugar crops, fodder and green manures; Breeding methods for self-pollinated, cross-pollinated and clonally propagated crops. Component, recombinational and transgressive breeding. Single seed descent. Populations, their improvement methods and maintenance, Hybrid breeding and genetic basis of heterosis. Ideotype breeding. Mutation breeding.

Unit 3: Genome organization and Cytogenetics of Crop Plants Chromosome structure, function and replication. Recombination and crossing over. Karyotype analysis. Banding techniques. In situ hybridization. Special types of chromosomes. Chromosomal interchanges, inversions, duplications and deletions. Polyploids, haploids, aneuploids and their utility. 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, Brassica, cotton, Vigna, potato and sugarcane. Principles and procedures of genome analysis. Cytogenetic techniques for gene location and gene transfer, Construction and use of molecular marker-based chromosome maps. Comparative mapping and genome analysis.

Unit 4: Quantitative and Biometrical Genetics Quantitative characters. Multiple factors inheritance. Genetic control of polygenic characters. Genetic advance and types of selection and correlated response. Hardy Weinberg law. 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. Genotypeenvironment interactions and stability of performance. Heterosis and its basis. Mating system and mating design- diallel, line X tester, NC-I, NC-II and NC-III designs, approaches to estimate and exploit component of self- and cross-pollinated crops. Genotype X environment interaction and stability analysis.

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Unit 5: Genetic Engineering and Biotechnological Tools in Plant Breeding Somatic hybridization, micropropagation, somachonal variation in vitro mutagenesis. Artificial synthesis of gene. Genetic and molecular markers, generations 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 and marker aided selection. Genome projects and utilization of sequence formation. Vectors. DNA libraries, DNA fingerprinting, DNA sequencing. Nuclei acid hybridization and immunochemical detection. Chromosome walking, Recombinant DNA technology, Gene cloning strategies. Genetic transformation and transgenics. Antisense RNA, RNAi and micro-RNA techniques in crop improvement.

Unit 6: 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. Design 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.

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FRUIT SCIENCE

Unit 1. **TROPICAL AND DRY LAND FRUIT PRODUCTION** Commercial varieties of regional, national and international importance, Eco physiological requirements, recent trends in propagation, rootstock influence, planting systems, cropping systems, root zone and canopy management, nutrient management, water management, fertigation, role of bioregulators, abiotic factors limiting fruit production, physiology of flowering, pollination fruit set and development, honeybees in cross pollination, physiological disorders- causes and remedies, quality improvement by management practices; maturity indices, harvesting, grading, packing, storage and ripening techniques; industrial and export potential, Agri. Export Zones(AEZ) and industrial supports. Crops: Mango and Banana, Citrus and Papaya, Guava, Sapota and Jackfruit, Pineapple, Annonas and Avocado, Aonla, Pomegranate and Ber, minor fruits of tropics.

Unit 2. **SUBTROPICAL AND TEMPERATE FRUIT PRODUCTION** Commercial varieties of regional, national and international importance, eco physiological requirements, recent trends in propagation, rootstock influence, planting systems, cropping systems, root zone and canopy management, nutrient management, water management, fertigation, bioregulation, abiotic factors limiting fruit production, physiology of flowering, fruit set and development, abiotic factors limiting production, physiological disorders-causes and remedies, quality improvement by management practices; maturity indices, harvesting, grading, packing, precooling, storage, transportation and ripening techniques; industrial and export potential, Agri Export Zones(AEZ) and industrial support. Crops: Apple, pear, quince, grapes, Plums, peach, apricot, cherries, Litchi, loquat, persimmon, kiwifruit, strawberry, Nuts- walnut, almond, pistachio, pecan, hazelnut, Minor fruits mangosteen, carambola, bael, wood apple, fig, jamun, rambutan, pomegranate.

Unit 3. **CANOPY MANAGEMENT IN FRUIT CROPS** Canopy management - importance and advantages; factors affecting canopy development; Canopy types and structures with special emphasis on geometry of planting, canopy manipulation for optimum utilization of light. Light interception and distribution in different types of tree canopies; Spacing and utilization of land area - Canopy classification; Canopy management through rootstock and scion; Canopy management through plant growth inhibitors, training and pruning and management practices; Canopy development and management in relation to growth, flowering, 30 fruiting and fruit quality in temperate fruits, grapes, passion fruits, mango, sapota, guava, citrus and ber.

Unit 4. **BREEDING OF FRUIT CROPS** Origin and distribution, taxonomical status – species and cultivars, cytogenetics, genetic resources, blossom biology, breeding systems, breeding objectives, ideotypes, approaches for crop improvement – introduction, selection, hybridization, mutation breeding, polyploid breeding, rootstock breeding, improvement of quality traits, resistance breeding for biotic and abiotic stresses, biotechnological interventions, achievements and future thrust in the following selected fruit crops. Crops: Mango, banana and pineapple, Citrus, grapes, guava and sapota, Jackfruit, papaya, custard apple, aonla, avocado and ber, Mangosteen, litchi, jamun, phalsa, mulberry, raspberry, kokam and nuts, Apple, pear, plums, peach, apricot, cherries and strawberry.

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Unit 5. **POST HARVEST TECHNOLOGY** Maturity indices, harvesting practices for specific market requirements, influence of pre-harvest practices, enzymatic and textural changes, respiration, transpiration; Physiology and biochemistry of fruit ripening, ethylene evolution and ethylene management, factors leading to post-harvest loss, pre-cooling; Treatments prior to shipment, viz., chlorination, waxing, chemicals, biocontrol agents and natural plant products. Methods of storage- ventilated, refrigerated, MAS, CA storage, physical injuries and disorders; Packing methods and transport, principles and methods of preservation, food processing, canning, fruit juices, beverages, pickles, jam, jellies, candies; Dried and dehydrated products, nutritionally enriched products, fermented fruit beverages, packaging technology, processing waste management, food safety standards.

Unit 6. **PROTECTED FRUIT CULTURE** Greenhouse – World scenario, Indian situation: present and future, Different agroclimatic zones in India, Environmental factors and their effects on plant growth; Basics of greenhouse design, different types of structures – glasshouse, shade net, poly tunnels - Design and development of low cost greenhouse structures; Interaction of light, temperature, humidity, CO₂, water on crop regulation - Greenhouse heating, cooling, ventilation and shading; Types of ventilation- Forced cooling techniques - Glazing materials - Micro irrigation and Fertigation; Automated greenhouses, microcontrollers, waste water recycling, Management of pest and diseases – IPM.

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ENLIGHTENING WORLD

Syllabus

For

Sociology

Ph.D Entrance Exam

[W.e.f. Academic Session 2022-23 onwards]



**Roorkee-Dehradun Road, Village Karoundi,
Post Bhagwanpur, Tehsil-Roorkee
Pin -247661
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Faculty of Arts, Humanities and Social Sciences, Motherhood University, Roorkee

Sociology

Unit 1: Basic Concepts:

- 1.1 Definition, Sociological perspective
- 1.2 Social Structure
- 1.3 Status and Role
- 1.4 Social Group
- 1.5 Community
- 1.6 Social Institution
- 1.7 Association
- 1.8 Values norms and rules
- 1.9 Culture
- 1.10 Socialization.

Unit II: (A) Classical Sociological Thinkers

- 2.1 August Comte
- 2.2 Emile Durkheim
- 2.3 Max Weber
- 2.4 Karl Marx.

(B) Modern Sociological Thinkers

- 2.1 Talcott Parsons
- 2.2 R. Radcliffe Brown
- 2.3 Robert Merton
- 2.4 Anthony Giddens
- 2.5 Harold Garfinkel
- 2.6 Erving Goffman

Unit III: Indian Thinkers

- 3.1 M.K. Gandhi
- 3.2 Ambedkar
- 3.3 S. Ghurje.
- 3.4 M. Srinivas
- 3.5 Irawati Krve.

Unit IV Social Research Method

- 4.1 Meaning and Nature
- 4.2 Quantitative method
- 4.3 Qualitative method
- 4.4 Techniques
- 4.5 Sampling
- 4.6 Questionnaire and schedule
- 4.7 Statistical Analysis.
- 4.8 Observation, interview and case study.

Unit V: Family, kinship and marriage

- 5.1 Meaning of Family, Types and Characteristics
- 5.2 Gender, sexuality and reproduction.
- 5.3 Family laws
- 5.4 Domestic violence and crime against women
- 5.5 Marriage: Forms and Marriage, Dowry, Divorce and Widow remarriage
- 5.6 Kinship: Terminology, Types of kinship


Professor

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Unit VI : Social Stratification

- 6.1 Social difference, hierarchy, equality and inequality
- 6.2 Caste and class
- 6.3 Gender, sexuality
- 6.4 Race, Tribe and Ethnicity.

Unit VII: Process of Social change in India

- 7.1 Process of cultural change,
- 7.2 Modernization
- 7.3 Sanskritisation
- 7.4 Process of structural change
- 7.5 Colonialism
- 7.6 Industrialization
- 7.7 Globalization
- 7.8 Social Reform movements and laws

Unit VIII: Economy and society


- 8.1 Models of Economic Development
- 8.2 Labour and market
- 8.3 Changing nature of labor relations
- 8.4 Gender and labor process
- 8.5 Business and family
- 8.6 Digital economy, E-commerce
- 8.7 Tourisms
- 8.8 Consumption.


Unit IX: Sociology of Environment

- 9.1 Environment and its concepts
- 9.2 Importance of environmental sociology
- 9.3 Environment and society
- 9.4 Sociological degradation and migration
- 9.5 Water and social exclusion
- 9.6 Environmental Pollution, public health and disability
- 9.7 Climate change
- 9.8 Environmental Movements in India
- 9.9 Environmental legislation

Unit X: Contemporary Issues of Indian society

- 10.1 Groups communities and cultural diversity in India
- 10.2 Inequalities, caste, class, gender
- 10.3 Women and family: Dowry, Domestic violence, divorce,
- 10.4 Problems of aged and intergenerational mobility,
- 10.5 Deviance and crime: changing forms of crime and criminals.


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MOTHERHOOD UNIVERSITY, Roorkee

Department of Economics
Faculty of Arts, Humanities and social Sciences
PhD Entrance Examination (RAT) Syllabus

Unit-1: Micro Economics

- * Theory of Consumer Behavior
- * Theory of Production and Costs
- * Decision making under uncertainty Attitude towards Risk
- * Game Theory – Non Cooperative games
- * Market Structures, competitive and non-competitive equilibria and their efficiency properties
- * Factor Pricing
- * General Equilibrium Analysis
- * Efficiency Criteria: Pareto-Optimality, Kaldor – Hicks and Wealth Maximization
- * Welfare Economics: Fundamental Theorems, Social Welfare Function
- * Asymmetric Information: Adverse Selection and Moral Hazard

Unit- 2: Macro Economics

- * National Income: Concepts and Measurement
- * Determination of output and employment: Classical & Keynesian Approach
- * Consumption Function
- * Investment Function
- * Multiplier and Accelerator
- * Demand for Money
- * Supply of Money
- * IS – LM Model Approach
- * Inflation and Phillips Curve Analysis
- * Business Cycles
- * Monetary and Fiscal Policy
- * Rational Expectation Hypothesis and its critique

Unit- 3: Statistics and Econometrics

- * Probability Theory: Concepts of probability, Distributions, Moments, Central Limit theorem
- * Descriptive Statistics – Measures of Central tendency & dispersions, Correlation, Index Numbers
- * Sampling methods & Sampling Distribution
- * Statistical Inferences, Hypothesis testing
- * Linear Regression Models and their properties – BLUE
- * Identification Problem
- * Simultaneous Equation Models – recursive and non-recursive
- * Discrete choice models
- * Time Series Analysis

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Unit- 4: Mathematical Economics

- * Sets, functions and continuity, sequence, series
- * Differential Calculus and its Applications
- * Linear Algebra – Matrices, Vector Spaces
- * Static Optimization Problems and their applications
- * Input-Output Model, Linear Programming
- * Difference and Differential equations with applications

Unit-5 International Economics

- * International Trade: Basic concepts and analytical tools
- * Theories of International Trade
- * International Trade under imperfect competition
- * Balance of Payments: Composition, Equilibrium and Disequilibrium and Adjustment Mechanisms
- * Exchange Rate: Concepts and Theories
- * Foreign Exchange Market and Arbitrage
- * Gains from Trade, Terms of Trade, Trade Multiplier

- * Tariff and Non-Tariff barriers to trade; Dumping
- * GATT, WTO and Regional Trade Blocks; Trade Policy Issues
- * IMF & World Bank

Unit-6: Public Economics

- * Market Failure and Remedial Measures: Asymmetric Information, Public Goods, Externality
- * Regulation of Market – Collusion and Consumers' Welfare
- * Public Revenue: Tax & Non-Tax Revenue, Direct & Indirect Taxes, Progressive and non-Progressive Taxation, Incidence and Effects of Taxation
- * Public expenditure
- * Public Debt and its management
- * Public Budget and Budget Multiplier
- * Fiscal Policy and its implications

Unit-7 Money and Banking

- * Components of Money Supply
- * Central Bank
- * Commercial Banking
- * Instruments and Working of Monetary Policy
- * Non-banking Financial Institutions
- * Capital Market and its Regulation

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Unit-8: Growth and Development Economics

- * Economic Growth and Economic Development
- * Theories of Economic Development: Adam Smith, Ricardo, Marx, Schumpeter, Rostow, Balanced & Unbalanced growth, Big Push approach.
- * Models of Economic Growth: Harrod-Domar, Solow, Robinson, Kaldor
- * Technical progress – Disembodied & embodied; endogenous growth
- * Indicators of Economic Development: PQLI, HDI, SDGs
- * Poverty and Inequalities – Concepts and Measurement
- * Social Sector Development: Health, Education, Gender


Unit-9: Environmental Economics and Demography

- * Environment as a Public Good
- * Market Failure
- * Coase Theorem
- * Cost-Benefit Analysis and Compensation Criteria
- * Valuation of Environmental Goods
- * Theories of Population
- * Concepts and Measures: Fertility, Morbidity, Mortality
- * Age Structure, Demographic Dividend
- * Life Table
- * Migration

Unit-10: Indian Economy

- * Economic Growth in India: Pattern and Structure
- * Agriculture: Pattern & Structure of Growth, Major Challenges, Policy Responses
- * Industry: Pattern & Structure of Growth, Major Challenges, Policy Responses
- * Services: Pattern & Structure of Growth, Major Challenges, Policy Responses
- * Rural Development – Issues, Challenges & Policy Responses
- * Urban Development – Issues, Challenges and Policy Responses.
- * Foreign Trade: Structure and Direction, BOP, Flow of Foreign Capital, Trade Policies
- * Infrastructure Development: Physical and Social; Public-Private Partnerships
- * Reforms in Land, Labor and Capital Markets
- * Centre-State Financial Relations and Finance Commissions of India; FRBM
- * Poverty, Inequality & Unemployment .


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Faculty of Arts, Humanities and Social Sciences


Dr. (Prof) Alka Rani
Dean
Faculty of Arts
Humanities & Social Sciences
Faculty of Arts, Humanities and Social Sciences
Roorkee, Distt. Haridwar

Motherhood University
Roorkee:Haridwar
Enlightening the World

PhD-English Syllabus



Kamal Bhattacharya
Prof (Dr.) Kamal Bhattacharya
Prof of English FAHSS

Dr. Alka Rani
Dr. Alka Rani
Dean FAHSS
Humanities & Social Sciences
Motherhood University
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Roorkee-Dehradun Road
Village Karoundi Post-Bhagwanpur
Tehsil-Roorkee, District - Haridwar
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LITERARY CRITICISM AND LITERARY THEORY

Unit I:

- a) Historical Survey from Plato to contemporary trends
- b) Schools and Approaches
- c) Relation between Literary Theory and Literary Criticism

Unit II: Formalism, Structuralism, Post Structuralist Poetics and Linguistics

- a) Roman Jakobson: *Linguistics and Poetics*
- b) Gerald Genette: *Structuralism and Literary Criticism*
- c) Paul de Man: *The Resistance to Theory*

Unit III: Deconstruction, Psychoanalysis, Ideology and Cultural History

Essays for detailed study:

- a) Jacques Derrida: *Structure, sign and Play in the Discourse of the Human Sciences*
- b) Bakhtin: *Discourse in the Novel*
- c) Julia Kristeva: *The Ethics of Language*

Unit IV: Reader Response, Feminism, Culturalism and Post Colonialism

Essays for detailed study:

- a) Michel Foucault: *What is an Author?*
- b) Edward Said: *Crisis (in Orientalism)*
- c) Mitchell: *Feminity, Narrative and Psychoanalysis*

Unit V: Practical Criticism

- a) Excerpts from Drama
- b) Excerpts from Poetry To be selected by the Teacher
- c) Excerpts from Fiction

Suggested Readings:

Barry, P. (2002) *Beginning Theory*


Wagh, P. (ed) *Literary Theory and Criticism: An Oxford Guide*


Richter, D. (ed) (1998) *The Critical Tradition: Classical Trends and contemporary Trends*

Lexington (1954) *The Verbal Icon*,

Sebeok, T (ed) (1960) *Style in Language*,

David L (1972) *Twentieth Century Literary Criticism: A Reader*


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ENGLISH LANGUAGE TEACHING

Unit I: Major Trends in English Language Teaching

- a) Approaches in English Language Teaching
- b) Methods of Teaching English
- c) Techniques of Teaching English

Unit II: English Language Teaching in India

- a) History of English Language Teaching in India
- b) English as Second Language (ESL)
- c) English for Specific Purpose
- d) The Problems of Teaching English

Unit III: Testing & Evaluation

- a) Types of Tests
- b) Tools of Evaluation
- c) Remedial Teaching

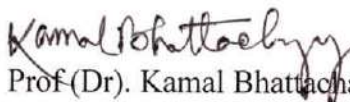
Unit IV: Structure of English

- a) Phonetics & Phonology of English
- b) Syntax of English
- c) Semantics of English

Unit V: History of English Language

Suggested Reading:

- Abbott, G. & Wingard, P. (eds.) (1992) *Teaching of English as an International Language. A Practical Guide*. Surrey: Nelson.
- Celce-Murcia, M. M. (ed.) (1991) *Teaching English as a Second or Foreign Language*. Rowley, MA: Newbury House.
- Crystal, David. (1987) *The Cambridge Encyclopedia of Language*. Cambridge, England: Cambridge University Press
- David Nunan. (1998) *Language Teaching Methodology*. NJ: Prentice Hall
- Desmond M. Allison. (1999) *Language Testing and Evaluation: An Introductory Course*. Singapore: World Scientific Publishing Company
- Doff, Adrian. (1988) *Teach English – A Training Course for Teachers*. Cambridge, England: Cambridge University Press
- Laurel J. Brinton. (2000) *The Structure of Modern English: A Linguistic Introduction*. Amsterdam: John Benjamins Publishing Company
- Raghubir Sahai Gupta, Kapil Kapoor. (1991) *English in India, Issues and Problems*. New Delhi: Academic Foundation
- Richards J. and Rodgers T. (2002) *Approaches and Methods in Language Teaching*. Cambridge: CUP
- Thirumala, M.S. (2002) *An Introduction to TESOL*, Mysore: Central Institute of Indian Language.


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FICTION

Unit I: Fiction Theory – Narratology, Narrative Techniques, Narrative types, Narrative Structure, Narrative discourse, Resources Research and Elements

Unit II: Hardy: *Mayor of Casterbridge* / Dickens: *Great Expectations* **Unit III:**

Virginia Woolf: *Mrs. Dalloway* / Lawrence: *The Rainbow* **Unit IV:** Kafka: *Trial* / Camus: *The Stranger*

Unit V: Margaret Atwood: *The Edible Woman* / Arundhati Roy: *The God of Small Things*

Suggested Readings:

Lukas, George. *The Theory of the Novel*

Forster, E.M. *The Theory of the Novel*. (Ed: Philip Stevick)

Gulbert, Sandra and Susan Gubar. *No Man's Land: The Place of the Women Writer in Twentieth Century*

Brooks, Cleanth and Warren, R.P. *Understanding Fiction*

Mayden, White. *The Content of the Form: Narrative Discourse and Historical Representation* Cohn, Dorrit.

Transparent Minds: Narrative Modes for Presenting Consciousness in Fiction Booth, Wayne. *The Rhetoric of Fiction*

Gerard Genette. *Narrative Discourse*

Wimmers, Inge Crosman. *Poetics of Reading: Approaches to the Novel*

Poetry (Optional)

Unit I: 1. John Donne: 'Canonization', 'Valediction', 'Sun Rising', 'Good Morrow'

2. John Milton: *Paradise Lost* – Book – I

Unit II: John Dryden: *Absalom and Achitophel*

Alexander Pope: *Rape of the Lock*.

Unit III: 1) Wordsworth: *Tintern Abbey*; *Ode to Intimations of Immortality*

2) Coleridge: *Ancient Mariner*

3) Keats: *Odes*

4) Shelley: *Nightingale*, *Autumn*, *Psyche Odes* – *West wind Greenroom*

Unit IV: Mathew Arnold: *Dover Beach*

Browning: *Last Duchess* Tennyson: *Ulysses*,

In Memoriam **Unit V:** 1) T. S. Eliot

2) W. B. Yeats:

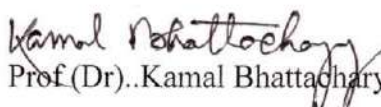
Easter 1916, *Lapis Lazuli*, *Second Coming*, *September – 1913*, *An Irish American*


Overseas His Death, *To Ireland in Coming Times*, *A Meditation in Time of War*

3) Faiz Ahmed Faiz:

'A Few Days More', 'Speak', 'Poetry's Theme', 'If Inks Pen', 'Freedom's Dawn',

'Two Loves', 'To Some Foreign Students', 'Bury Me Under Your Pavements', 'Not Enough'


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DRAMA

Unit I: Nature, Origin and Development of Drama – A Historical Survey

Unit II: Greek and Roman Drama – Medieval Drama–Renaissance Drama – Elizabethan Drama- Jacobean Drama- Caroline Drama – Restoration Drama – Sentimental Comedy – Drama of Ideas

– Theatre of the Absurd

Unit III: Tragedy – Definition and Features, Aristotelian Tragedy, Medieval Tragedy, Senecan

Tragedy, Revenge Tragedy.

Unit IV: Shakespearean Tragedy, Heroic Tragedy, Domestic Tragedy, The Tragi-Comedy

Unit V: Comedy – Definition and Features, Romantic Comedy, Satiric Comedy, Comedy of Manners, Comedy of Humours, Sentimental Comedy, Roman Comedy, Comedy of Errors, High Comedy, Low Comedy

Suggested

Reading:

Shakespeare:

Hamlet

Ibsen:

A Doll's House

Shaw: *Apple*

Cart

Tennessee Williams

The Glass Menagerie

Miller:

Death of a Salesman Hans

Berry:


A Raisin in the Sun

Chekov: *The Proposal: A Jest in One Act*

Pinter: *The Caretaker*

Brenton: *The Romans in Britain*

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Faculty of Commerce & Business Studies

RAT Commerce Syllabus (Part-B)



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RAT Commerce Syllabus (Part-B)

Unit 1: Business Environment and International Business

- Concepts and elements of business environment: Economic environment- Economic systems, Economic policies (Monetary and fiscal policies); Political environment- Role of government in business; Legal environment- Consumer Protection Act, FEMA; Socio-cultural factors and their influence on business; Corporate Social Responsibility (CSR)
- Scope and importance of international business; Globalization and its drivers; Modes of entry into international business
- Theories of international trade; Foreign direct investment (FDI); India's FDI policy; Balance of payments (BOP): Importance and components of BOP; ASEAN, SAARC, IMF, World Bank, World Trade Organisation (WTO): Functions and objectives of WTO.

Unit 2: Accounting and Auditing

- Basic accounting principles; concepts and postulates
- Partnership Accounts: Admission, Retirement, Death.
- Corporate Accounting: Issue, forfeiture and reissue of shares.
- Cost and Management Accounting: Marginal costing and Break-even analysis; Standard costing; Budgetary control.
- Financial Statements Analysis: Ratio analysis; Funds flow Analysis; Cash flow analysis
- Human Resources Accounting; Inflation Accounting; Environmental Accounting
- Indian Accounting Standards and IFRS
- Auditing: Independent financial audit; Vouching; Verification and valuation of assets and liabilities; Audit of financial statements and audit report; Cost audit
- Recent Trends in Auditing: Management audit; Energy audit; Environment audit.

Unit 3: Business Economics

- Meaning and scope of business economics
- Objectives of business firms
- Demand analysis: Law of demand; Elasticity of demand and its measurement; Relationship between AR and MR
- Consumer behavior: Utility analysis; Indifference curve analysis
- Law of Variable Proportions: Law of Returns to Scale
- Theory of cost: Short-run and long-run cost curves
- Price determination under different market forms: Perfect competition; Monopolistic competition; Oligopoly- Price leadership model; Monopoly; Price discrimination
- Pricing strategies: Price skimming; Price penetration; Peak load pricing.

Unit 4: Business Finance

- Scope and sources of finance; Lease financing
- Cost of capital and time value of money
- Capital structure
- Capital budgeting decisions.
- Working capital management; Dividend decision: Theories and policies
- Risk and return analysis; Asset securitization
- International monetary system
- Foreign exchange market; International financial markets.

Unit 5: Business Statistics

- Measures of central tendency; Measures of dispersion; Measures of skewness; Correlation and regression of two variables
- Probability: Approaches to probability; Probability distributions: Binomial, poisson and normal distributions
- Research: Concept and types; Research designs
- Data: Collection and classification of data
- Sampling and estimation: Concepts; Methods of sampling - probability and non- probability methods.
- Hypothesis testing: z-test; t-test.

Unit 6: Business Management and Human Resource Management

- Principles and functions of management; Organization structure: Formal and informal organizations; Span of control
- Responsibility and authority: Delegation of authority and decentralization
- Motivation and leadership: Concept and theories
- Corporate governance and business ethics
- Human resource management: Concept, role and functions of HRM; Human resource planning; Recruitment and selection; Training and development; Succession planning
- Compensation management: Job evaluation; Incentives and fringe benefits
- Performance appraisal including 360-degree performance appraisal; Workers' participation in management.


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Unit 7: Banking and Financial Institutions

- Overview of Indian financial system.
- Types of banks: Commercial banks; Regional Rural Banks (RRBs); Foreign banks; Cooperative banks; Reserve Bank of India: Functions.
- Banking sector reforms in India: Basel norms; Risk management; NPA management
- Financial markets: Money market; Capital market; Government securities market
- Financial Institutions: Development Finance Institutions (DFIs); Non-Banking Financial Companies (NBFCs); Mutual Funds; Pension Funds
- Financial Regulators in India.
- Digitisation of banking and other financial services: Internet banking; mobile banking; Digital payments systems; Insurance: Types of insurance- Life and Non-life insurance; Re-insurance.

Unit 8: Marketing Management

- Marketing: Concept and approaches; Marketing channels; Marketing mix; Strategic marketing planning; Market segmentation, targeting and positioning
- Product decisions: Concept; Product line; Product mix decisions; Product life cycle; New product development
- Pricing decisions: Factors affecting price determination; Pricing policies and strategies.
- Promotion decisions: Role of promotion in marketing; Promotion methods - Advertising; Personal selling; Publicity; Sales promotion tools and techniques; Promotion mix
- Distribution decisions: Channels of distribution; Channel management
- Consumer Behaviour; Consumer buying process; factors influencing consumer buying decisions
- Service marketing; Trends in marketing; Social marketing; Online marketing; Logistics management.

Unit 9: Legal Aspects of Business

- Indian Contract Act, 1872: Elements of a valid contract; Capacity of parties; Free consent; Discharge of a contract; Breach of contract and remedies against breach; Quasi contracts;
- Special contracts: Contracts of indemnity and guarantee; contracts of bailment and pledge; Contracts of agency
- Sale of Goods Act, 1930: Sale and agreement to sell; Doctrine of Caveat Emptor; Rights of unpaid seller and rights of buyer
- Negotiable Instruments Act, 1881: Types of negotiable instruments; Negotiation and assignment; Dishonour and discharge of negotiable instruments

- The Companies Act, 2013: Nature and kinds of companies; Company formation; Management, meetings and winding up of a joint stock company
- The Competition Act, 2002: Objectives and main provisions
- The Information Technology Act, 2000: Objectives and main provisions; Cyber-crimes and penalties.
- The RTI Act, 2005: Objectives and main provisions
- Intellectual Property Rights (IPRs): Patents, trademarks and copyrights; Emerging issues in intellectual property
- Goods and Services Tax (GST): Objectives and main provisions; Benefits of GST; Implementation mechanism; Working of dual GST

Unit 10: Income-tax and Corporate Tax Planning

- Income-tax: Basic concepts; Residential status and tax incidence; Exempted incomes; Agricultural income; Computation of taxable income under various heads; Deductions from Gross total income; Assessment of Individuals; Clubbing of incomes.
- Corporate Tax Planning: Concepts and significance of corporate tax planning; Tax avoidance versus tax evasion; Deduction and collection of tax at source; Advance payment of tax; E-filing of income-tax returns.


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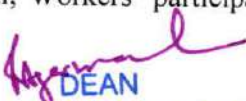
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SUBJECT- EDUCATION

As per prescribed by Departmental Committee for Development of syllabus (Education) for Ph.D. Research Entrance Examination, Faculty of Education, Motherhood University, Roorkee (Uttarakhand).

Unit I: Curriculum Studies

Concept, meaning, domains, types and bases of Determinant of Curriculum, Curriculum Evaluation, Need and Criteria for curriculum renewal in terms of its Philosophy and Transaction, Curriculum Development in India, Role of NCERT, SCERT, NEP 2020 in Curriculum Development, Research and Innovations in Curriculum, Curriculum for Distance Mode.

Unit II: Educational Management, Administration and Leadership

Meaning, nature, definition and scope of Management, Administration and Leadership, Processes in Educational Organization, Structure, Communication, Decision Making, Management by objectives, Educational Institutions as Organization, Personal Administration, Functions and Importance of Personal Administration, Agencies involved in administration and planning of different levels of Education - Primary Education to Higher Education Level via- Central Advisory Board, University Grant Commission, NCERT, AICTE and NCTE. Leadership – Concept, Meaning and Nature, the Principal as a Leader. Theories of Leadership and their styles & Measurement of Leadership Styles.

Unit III: Inclusive Education

Concept of Impairment, Disability and Handicap, Need and Importance of Special Education and Adjustment of Special Children, Nature, Need and Importance of Inclusive Education, Planning and Management of Inclusive Classrooms, legal and policy perspective of inclusion: Constitutional provisions of Education in national policy on disability 2006, disability inclusion Act 2014 and Indian disability Act 2016 with reference of NEP 2020, Rehabilitation council of India, national institute of different disabilities, Special needs and inclusion, Special needs in terms of learning experience in context of disabilities and their learning styles, school awareness and readiness for addressing learning difficulties, Support system for inclusion, Assistive and adaptive technology in inclusive setup, use of ICT, Equipment and other technology for different disabilities, Pedagogical strategies to respond to individual needs of learners in classroom, peer tutoring, cooperative learning strategies and school learning.

Unit IV: Philosophical Perspective of Education

Philosophy, Philosophy of Education, meaning and functions of educational philosophy, Branches of Philosophy like Metaphysics, Epistemology, Axiology, Aesthetics and logic, Indian School of Philosophy- Sankhya, Vendanta (Advait and Vishishtadvait), Contribution to Education thoughts and practice made by Great Thinkers, Western Schools of thought and their Contributions to education with special reference to Information, Knowledge and Wisdom,

Unit V: Sociological Perspective of Education

Sociology of education – Concept and Nature, Approaches to Sociology of Education, Committees and Commissions Contribution to Teacher Education, Relationship between Politics and Education, Socialization and Education. Education and social change, modernization, democracy, secularism and globalisation, their needs and relationship with education, unity and diversity in Indian Society, Culture and Civilizations, Education and Democracy, constitutional provisions for education – Nationalism, National Integration and international understanding, Human Right and Value Education.

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Unit VI: Advance Psychological Perspective of Education

Meaning and definition of Psychology, concept and scope of educational psychology Relevance and relationship between psychology and education, methods of educational psychology, Major schools of psychology like Behaviourism, Gestalt, Psycho – Analysis, Humanism and Constructivism. Development - Concept, stages, factors and areas of development. Intelligence- Nature, concept, process, identification and major theories. Creativity - Meaning, concept and factors fostering creativity. Personality - Concept, development, structure and dynamics of personality Learning - Concept, types, principles, behaviourist's perspective. Approaches to Intelligence from Unitary to Multiple, Growth and Development, Principles and Theories of Learning, classical and operant conditioning, The Piagetian and Bruner's theory, social cognitive perspective of Albert Bandura theory.

Unit VII: Pedagogy, Andragogy and Assessment

Assessment in Pedagogy of Education, Pedagogy, Pedagogical Analysis, Unseen Reading Comprehension. Assessment and measurement, appraisal of existing assessment and evaluation system, characteristics of good test, teacher made test, steps of preparing standardized test, concept and measurement of intelligence test, attitude test, aptitude test and interest inventory.

Unit VIII: Methodology of Educational Research in Education

Meaning and scope of Educational Research, Qualitative Research Designs, Quantitative Research Designs, Types of Measurement Scale, Variables, Sources of data, qualitative, quantitative and mixed research and its characteristics. Research problem, objective of the study, Research Process and it's elements, Writing a Research Paper, Variables- meaning and types. Hypotheses in research, Concept of sampling and other concept related to sampling, Tools of Data Collections, Research Tools like Questionnaire, observation, interviews, scales and tests etc., Concept and uses of statistics, graphical presentation of data. Techniques of Correlation- Spearman & Karl Pearson Method, Linear regression, prediction, Chi-square test, Z-test, T-test and ANOVA, Validity and delimitations of research findings, Ethics in educational research, identification of Publication, misconduct, complains and appeals, Guidelines of the Committee on Publication Ethics(COPE), Scientific misconduct, Falsification, Fabrication and Plagiarism.

Unit IX: Teacher Education

Concept, Need, importance and Objective of Profession and Professionalism. Concept, Need, Purpose and Scope of Pre- Service and In-Service Teacher Education, Current Problems of Teacher Education, Meaning, Nature and Scope of Teacher Education, Teacher Education for adult and Non formal Education, Professional growth of Teacher Orientation.

UNIT X: Educational Technology

Meaning and Scope of Educational Technology: System approach to Education and its Characteristics Components of Educational Technology- Software and Hardware. Stages of Teaching- Pre-active, Interactive and Post active, Teaching as different levels- Memory, Understanding and Reflective levels of organizing teaching and learning, Programmed Instruction- Origin, Principles and Characteristics, Communication Process, Principles, Modes and Barriers to Communication, Designing Instructional System: Formulation of Instructional Objectives, Application of Educational Technology in Distance Education: Distance and Open Learning System, Student Support Services, Evaluation Strategies in Distance Education, Counselling in Distance Education, New Trends in Educational Technology like a New Pedagogy, E-Learning Style and Network Learning, Web 2.0 with Wikipedia, Virtual Laboratories and Massive Open Online Courses(MOOCs).

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MOTHERHOOD UNIVERSITY, Roorkee

ENLIGHTENING WORLD

Recognized by the UGC with the right to award degrees
 UVS 22(1) of the UGC Act 1956 and established under
 Uttarakhand Govt. Act No. 95 of 2015

SUBJECT: LAW

As per prescribed by Departmental Committee, for development of syllabus (Subject- Law) for Research Entrance Test (Ph.D. Programme), Faculty of Legal Studies, Motherhood University, Roorkee, Haridwar, Uttarakhand according UGC rules/ Regulation.

UNIT - I: JURISPRUDENCE

Nature and sources of law, Schools of jurisprudence, Law and morality, Concept of rights and duties, Legal personality, Concepts of property, ownership and possession, Concept of liability, Law, poverty and development, Global justice, Modernism and post-modernism

UNIT - II: CONSTITUTIONAL AND ADMINISTRATIVE LAW

Preamble, fundamental rights and duties, directive principles of state policy, Union and State executive and their interrelationship, Union and State legislature and distribution of legislative powers, Judiciary, Emergency provisions, Temporary, transitional and special provisions in respect of certain states, Election Commission of India, Nature, scope and importance of administrative law, Principle of natural justice, Judicial review of administrative actions - Grounds.

UNIT - III: PUBLIC INTERNATIONAL LAW AND IHL

International law - Definition, nature and basis, Sources of International law, Recognition of states and governments, Nationality, immigrants, refugees and internally displaced persons (IDPs), Extradition and asylum, United Nations and its organs, Settlement of international disputes, World Trade Organization (WTO), International humanitarian law (IHL) - Conventions and protocols, Implementation of IHL - Challenges

UNIT - IV: LAW OF CRIMES

General principles of criminal liability - *Actus reus* and *mens rea*, individual and group liability and constructive liability, Stages of crime and inchoate crimes - Abetment, criminal conspiracy and attempt, General exceptions, Offences against human body, Offences against state and terrorism, Offences against property, Offences against women and children, Drug trafficking and counterfeiting, Offences against public tranquility, Theories and kinds of punishments, compensation to the victims of crime

UNIT - V: LAW OF TORTS AND CONSUMER PROTECTION

Nature and definition of tort, General principles of tortious liability, General defenses, Specific torts - Negligence, nuisance, trespass and defamation, Remoteness of damages, Strict and absolute liability, Tortious liability of the State, The Consumer Protection Act 1986 - Definitions, consumer rights and redressal mechanism, The Motor Vehicles Act, 1988 - No fault liability, third party insurance and claims tribunal, The Competition Act, 2002 - Prohibition of certain agreements, abuse of dominant position and regulation of combinations

Attested Copy

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 17/09/2022
 Faculty of Legal Studies
 Motherhood University, Roorkee

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 16.09.2022
 Faculty of Legal Studies
 Motherhood University, Roorkee

UNIT – VI: COMMERCIAL LAW

Essential elements of contract and e-contract, Breach of contract, frustration of contract, void and voidable agreements, Standard form of contract and quasi-contract, Specific contracts - Bailment, pledge, indemnity, guarantee and agency, Sale of Goods Act, 1930, Partnership and limited liability partnership, Negotiable Instruments Act, 1881, Company law – Incorporation of a company, prospectus, shares and debentures, Company law – Directors and meetings, Corporate social responsibility

UNIT-VII: FAMILY LAW

Sources and schools, Marriage and dissolution of marriage, Matrimonial remedies - Divorce and theories of divorce, Changing dimensions of institution of marriage – *Live-in* relationship, Recognition of foreign decrees in India on marriage and divorce, Maintenance, dower and *stridhan*, Adoption, guardianship and acknowledgement, Succession and inheritance, Will, gift and *wakf*, Uniform Civil Code

UNIT –VIII: ENVIRONMENT AND HUMAN RIGHTS LAW

Meaning and concept of 'environment' and 'environmental pollution', International environmental law and UN Conferences, Constitutional and legal framework for protection of environment in India, Environmental Impact Assessment and control of hazardous waste in India, National Green Tribunal, Concept and development of human rights, Universalism and cultural relativism, International Bill of Rights, Group rights – Women, children, persons with disabilities, elderly persons, minorities and weaker sections, Protection and enforcement of human rights in India – National Human Rights Commission, National Commission for Minorities, National Commission for Women, National Commission for Scheduled Castes, National Commission for Schedule Tribes and National Commission for Backward Classes

UNIT – IX: INTELLECTUAL PROPERTY RIGHTS AND INFORMATION TECHNOLOGY LAW

Concept and meaning of intellectual property, Theories of intellectual property, International conventions pertaining to intellectual properties, Copyright and neighboring rights – Subject matters, limitations and exceptions, infringement and remedies, Law of patent – Patentability, procedure for grant of patent, limitations and exceptions, infringement and remedies, Law of trademark – Registration of trademarks, kinds of trademarks, infringement and passing off, remedies, Protection of Geographical Indications, Bio-diversity and Traditional Knowledge, Information technology law- digital signature and electronic signature, electronic governance, electronic records and duties of subscribers, Cyber crimes, penalties and adjudication

UNIT – X: COMPARATIVE PUBLIC LAW AND SYSTEMS OF GOVERNANCE

Comparative Law – Relevance, methodology, problems and concerns in Comparison, Forms of governments – Presidential and parliamentary, unitary and federal, Models of federalism – USA, Canada and India, Rule of Law – 'Formal' and 'substantive' versions, Separation of powers – India, UK, USA and France, Independence of judiciary, judicial activism and accountability – India, UK and USA, Systems of constitutional review – India, USA, Switzerland and France, Amendment of the Constitution – India, USA and South Africa, *Ombudsman* – Sweden, UK and India, Open Government and Right to Information - USA, UK and India

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Part II: Pharmaceutical Science (50 Marks)**UNIT I Pharmaceutics**

1. **Introduction to Pharmacokinetics:** Pharmacokinetics models, 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). Protein binding of drugs-Implications of drug protein binding in pharmacokinetics and therapy.
2. **Dosage form Evaluation-Bioavailability:** Rate and extent of bioavailability, assessing bioavailability, multiple dosing bioavailability, in vitro bioavailability studies (dissolution), 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.v. and oral regimen, loading dosing, scheduling. Diseases-dose adjustment – hepatic disease dose adjustment, renal disease dose adjustment, therapeutic drug monitoring. Non-compartment model pharmacokinetics-statistical moment theory, pharmacokinetics parameters.
3. **Concept & Models for NDDS:** Classification of rate controlled drug delivery system (DDS), rate programmed release, activation modulated & feedback regulated DDS. Fundamentals of rate controlled drug delivery-Introduction, mechanistic analysis of controlled release drug delivery, effect of system parameters in controlled drug delivery, evaluation of controlled release drug delivery systems.
4. **Target Oriented Drug Delivery Systems:** Rationale for targeted drug delivery, biological processes and events involved in drug targeting, pharmacokinetics and pharmacodynamics considerations, targeted drug delivery systems, targeting in the gastrointestinal tracts and other mucosal surfaces.
5. **Biotechnology:**
 - a) Proteins and nucleic acids and their structure and features, genetic Engineering, enzymes and vectors in genetic engineering, concepts of cloning, cDNA and genomic libraries, cloning for production of biopharmaceuticals, screening and detection methods for clones. Recombinant DNA products and their applications, immune System- Innate and acquired immunity, monoclonal antibodies and immunological techniques.
 - b) Basic techniques of mammalian cell culture in vitro; disaggregation of tissue and primary culture, maintenance of cell culture; cell separation, and applications of mammalian cell culture. Different areas and applications of plant tissue culture. Nutritional components of tissue culture media. Totipotency, Transgenic Plants and animals and their applications, Bioinformatics overview and applications.

Recommended Books:

1. Biopharmaceutics and Pharmacokinetics-A Treatise by D. M. Brahmkar and Suril B. Jaiswal.
2. Pharmaceutics, The Science & Dosage Form Design by M. E. Aulton.
3. Pharmaceutical Dosage Form and Drug Delivery System by H.C. Ansel
4. Bentley's Text Book of Pharmaceutics by E.A. Rawlins
5. Molecular Biotechnology: Principles and Applications of Recombinant DNA by B.R. Glick and J.J. Pasternak

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UNIT II Pharmaceutical Chemistry

- 1. Structural Elucidation:** Structural elucidation of natural, synthetic and semisynthetic drugs by using spectroscopic data. [UV, IR, ¹H NMR, ¹³C NMR, Mass].
- 2. Reaction Mechanisms:** Generation, Stability, structure and reactivity of free radicals, Carbocations and Carbenes. Mechanism of free radical, electrophilic, Nucleophilic (Addition and substitution) reactions, elimination reactions with examples.
- 3. 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.
- 4. Molecular modeling:**
 - a. Molecular mechanics quantum mechanism, docking, advanced concepts of molecular modeling.
 - b. 1. Design and application of prodrugs, structure based drug design, combinational chemistry
2. Assays and screening combinational libraries introduction to high throughputs screening (HTS)
- 5. Instrumental Methods of Analysis:**
 - 1. UV-Visible spectroscopy:** Introduction, Beers law and its limitations, molar extinction coefficient, Woodward's Fiesher rules for calculating absorption maximum, instrumentation and applications.
 - 2. FTIR Spectroscopy:** Principles-molecular vibrations, vibrational frequency and its influencing factors, sampling techniques, instrumentation and applications of FTIR.
 - 3. NMR Spectroscopy:** Principle, chemical shifts, shielding and deshielding effects, splitting of signals, computing constants, instrumentations and applications (¹H- & ¹³C-NMR).
 - 4. Massspectroscopy:** Principle, ionization Techniques, Fragmentation pattern, instrumentation and applications.
 - 5. GLC and HPLC:** Principles, instrumentation with special emphasis on different column and detectors and applications.

Recommended Books:

1. Organic Chemistry by Clayden, Greeves, Warren and Wothers.
2. Reactive Intermediates in Organic Chemistry by Tandon and Gowel.
3. Organic Synthesis - Special Techniques by V. K. Ahluwalia and R. Agarwal.
4. Spectrometric Identification of Organic compounds by Robert M Silverstein
5. Principles of Instrumental Analysis by Douglas A Skoog, F. James Holler and Timothy A. Nieman.
6. Spectroscopy by Gary M. Lampman and Donald L. Pavia.

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UNIT III Pharmacognosy

- 1. Basic concepts:** 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.
- 2. Screening** of plant extracts / phytochemicals.
- 3. Evaluation** of phytochemicals for analgesic, anti-inflammatory, anti-diabetic, diuretic, anti-fertility, anti-epileptic, hepatoprotective, immunomodulatory, anticancer cardiovascular and antimicrobial activity.
- 4. Herbal formulations:** Types of herbal formulations preparation of standardized extracts suitable for incorporation into solid dosage form like tablets, capsules etc. Recent trends in poly-herbal medicines. Herbal cosmetics and herbal teas. Manufacture, packaging and approach to quality control of herbal formulations. GMP for herbal drug formulations.
- 5. Plant 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.

Recommended Books:


1. Instrumental methods of Chemical analysis by B. K. Sharma.
2. Text book of Pharmacognosy by Trease and Evans.
3. A text book of Herbal cosmetics by Vinla Devi.
4. Quality control of herbal drugs and approach to evaluation of botanicals by Puroak Mukherjee.
5. Pharmacognosy and Phytochemistry (Vol I & II) by V. D. Rangari.

UNIT IV Pharmacology

- 1. Pharmacokinetics:** 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.
- 2. Receptor Pharmacology:** 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.
- 3. Adverse drug reactions and drug Interactions:** Types and mechanisms
- 4. 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, anti-hypertensives, anti-anxiety agents, anti-manics and hallucinogens.
- 5. 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.

Recommended Books:

1. Pharmacology by H. P. Rang and M. M. Dale.
2. Basic and Clinical Pharmacology by B. G. Katzung.
3. Essentials of Medical Pharmacology by K. D. Tripathi.
4. Principles of Pharmacology by H. L. Sharma and K. K. Sharma.


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Syllabus of Ph.D. Entrance Examination for Botany

Unit 1

Molecules and their Interaction Relevant to Biology

Structure of atoms, molecules and chemical bonds:

Composition, structure and function of biomolecules (carbohydrates, lipids, proteins, nucleic acids and vitamins). Stabilizing interactions (Van der Waals, electrostatic, hydrogen bonding, hydrophobic interaction, etc.). Principles of biophysical chemistry (pH, buffer, reaction kinetics, thermodynamics, colligative properties). Bioenergetics, glycolysis, oxidative phosphorylation, coupled reaction, group transfer, biological energy transducers. Principles of catalysis, Conformation of proteins (Ramachandran plot, secondary structure, domains, motif and folds). Conformation of nucleic acids (helix (A, B, Z), t-RNA, micro-RNA). Stability of proteins and nucleic acids. Metabolism of carbohydrates, lipids, amino acids nucleotides and vitamins.

Origin of cells and unicellular evolution :

Origin of basic biological molecules; Abiotic synthesis of organic monomers and polymers; Concept of Oparin and Haldane; Experiment of Miller (1953); The first cell; Evolution of prokaryotes; Origin of eukaryotic cells; Evolution of unicellular eukaryotes; Anaerobic metabolism, photosynthesis and aerobic metabolism.

Unit 2

Diversity of Viruses, Mycoplasma, Bacteria and Fungi:

Prokaryotic and eukaryotic cellular organization.

Viruses:

General characteristics, nomenclature and classification, structure, transmission and replication, viral diseases.

Mycoplasma:

General characteristics, ultrastructure and reproduction.

Bacteria:

Distribution in soil, air and water, Diversity in structure, organization and reproduction. Role in organic matter decomposition, Production of methane and Xenobiotics.

Fungi:

Distribution, Structure and reproduction. Fungi as saprophytes, parasites, predators, symbionts, biopesticides, biofertilizer, pollution indicators and Food.

Unit 3

Diversity of Algae, Bryophytes, Pteridophytes and Gymnosperms:

Algae:

Thallus organization, cell structure and reproduction in Cyanophyceae, Chlorophyceae, Phaeophyceae, Rhodophyceae, Bacillariophyceae and Economic importance.

Bryophytes:

Morphology and reproduction- Marchantiales, Jungermanniales, Anthocerotales, Polytrichales and Economic importance.

Pteridophytes :

Morphology and reproduction of Psilotales, Lycopodiales, Selaginellales, Equisetales, Osmundales, Filicales and Marseliales. Stellar Evolution, Heterosporry and Seed habit.

Gymnosperms :

Morphology, anatomy and reproduction in Cycas, Pinus, Gnetum and Economic importance.

Unit 4**Plant Anatomy and Plant Physiology:****Apical meristem (Shoot and Root):**

Structural organisation, Tunica-carpus theory, Quiescent centre concept and Pro meristem concept.

Plant cell wall:

Ultra structure and organization

Leaf Anatomy:

Stomatal-types and distribution, dorsiventral and isobilateral.

Stem and Root Anatomy :

Primary and secondary structure of monocot and dicot.

Xylem:

Tracheids and Vessels. Heart and sapwood.

Phloem :

Ultra structure and function.

Anomalous growth:

Bignonia and *Aristolochiasp.*

Morphogenesis and organogenesis in plants:

Organization of shoot and root apical meristem; shoot and root development; leaf development and phyllotaxy; transition to flowering, floral meristems and floral development in Arabidopsis and Antirrhinum. Programmed cell death, aging and senescence

Water relations and Mineral Nutrition:

Water potential, Passive & Active transport, Membrane transport proteins & Ion transport in roots

Enzymes:

Enzymes structure and properties, classification, enzyme regulation, kinetics and mechanism of action, Isoenzymes mechanism of enzyme catalysis and Allosteric mechanism.

Photosynthesis:

Light harvesting complexes; Photosynthetic apparatus and pigments, Photooxidation of Water, mechanism of electron & proton transport, Photophosphorylation. C₃, C₄ and CAM pathways of carbon assimilation.

Respiration:

Glycolysis, TCA Cycle, ETS and PP pathway, energy budget.

Nitrogen Metabolism:

Biological nitrogen fixation, Nitrate and ammonium assimilation; amino acid biosynthesis.

Secondary metabolites:

Biosynthesis of terpenes, phenols and nitrogenous compounds and their roles.

Plant Growth regulators:

Plant hormones & types, Biosynthesis, storage, breakdown and transport; physiological effects and mechanisms of action. Physiological effects of auxins, Cytokinins and gibberellins.

Sensory photobiology :

Structure, function and mechanisms of action of phytochromes, cryptochromes and phototropins; stomatal movement; photoperiodism and biological clocks.

Seed:

Dormancy and germination.

Unit 5**Cytology, Genetics and Molecular Biology:**

Ultra structure of plant Cell and its organelles. Cell division and cell cycle (Mitosis and meiosis, their regulation, steps in cell cycle, regulation and control of cell cycle).

Chromosomes:

Ultra structure, centomere, kinetochore complex, centomere proteins (CENPs), sister chromatid cohesion, telomeres and their role in chromosome segregation, chromosomal packaging, gene function and human health.

Structural variations in chromosomes:

Deletion, duplication, inversions and translocations.

Mendelism :

multiple alleles and linkage.

Population genetics:

Hardy-Weinberg concept and its application, Allele frequency, genotype frequency, amino acid variation, Molecular drive, genetic variability in populations and factors responsible for variation

Gene:

Organization of genes and chromosomes (Operon, unique and repetitive DNA, interrupted genes, gene families, structure of chromatin and chromosomes, heterochromatin, euchromatin, transposons). Split genes, gene regulation in prokaryotes and eukaryotes.

Molecular methods for genome analysis:

Physical mapping of genome, Restriction enzyme fingerprinting. Marker sequences, sequencing tag sites (STS) and sequence tag connectors, expressed sequence tags (ESTs), simple sequence length polymorphism and single nucleotide polymorphism, PCR, RAPD, AFLP, ISSR; functional and structural genomics.

Unit 6**Plant Morphogenesis and Biotechnology:**

Cellular basis of growth and the concept of relative growth.

Symmetry:

Radial, bilateral and dorsiventral symmetry Experimental Studies on shoot apex, root apex and differentiated organs.

Organogenesis in plants:

Differentiation of plant body, organization of shoot & root apical meristem.

Polarity:

Contemporary understandings at different levels of organization - *Fucus* egg, *Equisetum* spores, *Saprolegnia* and *Acetabularia*.

Flower:

Morphogenetic concept of flower development (the initial, steady state, stimulus and transition to flowering), genetic analysis of floral development (*Arabidopsis*) and flower regulatory genes.

Plant Biotechnology :

Applications, requirements of Tissue culture, production of haploids, Protoplast culture, somatic hybrids and cybrids. Single cell culture and secondary metabolite production, Industrial applications of secondary products, hairy root cultures. Germplasm storage and Cryopreservation. Transgenic plants and its application.

Scope of Biotechnology

DNA replication, repair and recombination:

Unit of replication, enzymes involved, replication origin and replication fork, fidelity of replication, extra chromosomal replicons, DNA damage and repair mechanisms, homologous and site-specific recombination.

RNA synthesis and processing :

Transcription factors and machinery, formation of initiation complex, transcription activator and repressor, RNA polymerases, capping, elongation, and termination, processing, RNA editing, splicing, and polyadenylation, structure and function of different types of RNA, RNA transport.

Protein synthesis and processing :

Ribosome, formation of initiation complex, initiation factors and their regulation, elongation and elongation factors, termination, genetic code, aminoacylation of tRNA, tRNA-identity, aminoacyl tRNA synthetase, and translational proof-reading, translational inhibitors, Post- translational modification of proteins.

Enzymes used in genetic engineering:

Restriction Endonucleases , Ligases, Polymerases, Kinases and Phosphatases, DNA Methylases.

Use of vectors in cloning:

Plasmids, Phages, Cosmids, ssDNA vectors, BAC, YAC, MACs. Expression Vectors, Vectors for cloning PCR products, Binary and Shuttle Vectors. Improved *Agrobacterium* based Vectors and Virus based vectors for plants.

Methods of DNA delivery:

PEG mediated DNA uptake, electroporation, Biolistic transfer, Microinjection, organelle transformation, Mechanism of integration of foreign DNA into plant genomes.

Genomic and cDNA libraries:

Construction, size, full length cDNA cloning, RT-PCR, RACE.

Nucleic acid hybridization:

Southern, Northern and Western blotting techniques

Unit 7

Environmental Biology, Evolution and Phytogeography : Principles: Interdependence, Biomagnification and Thermodynamics.

Ecosystems:

Concept, Components and types – aquatic and terrestrial, functions, dynamics, energy flow in the ecosystem, trophic levels, food web, food chains.

Ecological factors:

Climatic, edaphic, physiographic and biotic factors.

Ecological Succession:

Types; mechanisms; changes involved in succession; concept of climax.

Population Ecology:

Growth and characteristics of population, Natality, Mortality, Ecological niche and plant interactions.

Bio-geochemical cycles: N, P, C, O and S cycles in nature.

Plant Communities:

Methods of studying vegetation - Quadrat, Line and belt methods, General account on Forests of

Techniques of propagation:

Cuttings, Layering, grafting and budding.

Propagation methods:

Propagation methods of succulents, cacti and house plants, A general account of Hydroponics.

Plant Embryology:**Microsporogenesis :**

Pollen wall morphogenesis, walls structure and functions, male gametophyte formation. Tetrad and post tetrad phases, origin, structure and differential behavior of generative and vegetative cells, formation of spores and ultra structure of 3- celled pollen grain.

Megasporogenesis:

Organization of female gametophyte (polygonum type), embryosachauatoria (a general account).

Fertilization:

Structure of stigma and style, pollen germination *in vivo*, pollen tube entry into the stigma, entry of pollen tube into female gametophyte, double fertilization.

Endosperm and Embryo :

Development, embryo-endosperm relationship. Embryogenesis in *Capsella* (Dicot) and *Grass* (Monocot).

Plant Taxonomy :**Species concept:**

Taxonomic hierarchy, species, genus, family and other categories, principles used in assessing relationship, delimitations of taxa and attribution of ranks.

Nomenclature:

International Code of Botanical Nomenclature (ICBN) and International Code of Nomenclature of Cultivated Plants (ICNCP).

Study of Malvaceae, Umbelliferae, and Asteraceae, Lamiaceae, Rubiaceae and Liliaceae.

Methods in Plant Science and Biosystematics :**Microscopy:**

Principles, Aberrations, different kinds of lens systems, Magnification, Resolution, Contrast, illumination. Dark field, Phase contrast, Polarized, electron microscope- TEM, SEM

Stains and staining schedules,

Principles and mechanisms of histochemical staining.

Principle, types and applications:

Spectroscopy, chromatography & Electrophoresis - Infrared Spectroscopy Visible and ultra violet spectrophotometry, Paper chromatography, Thin layer chromatography (TLC), Column chromatography, Adsorption, Gas chromatography, GLC and HPLC. Gel Electrophoresis, Disk Electrophoresis, SDS-PAGE and Immuno electrophoresis.

Syllabus of Ph.D. Entrance Examination for Chemistry

Unit 1

Atomic Structure: Bohr's theory and its limitation, Heisenberg Uncertainty principle, Madelung Constant, atomic orbitals and their variations for 1s, 2s, 2p, 3s, 3p and 3d orbitals (only graphical representation). Quantum numbers and their significance. Stability of half-filled and full-filled orbitals. Electronic configuration, Hund's rule, Pauli exclusion principle. Aufbau principle. Chemical periodicity. Chemical bonding in homo- and heteronuclear molecules, including shapes of molecules (VSEPR Theory), MO Theory. Concepts of acids and bases, Hard-Soft acid base concept, Non-aqueous solvents.

Unit 2

Main group elements and their compounds: Allotropy, synthesis, structure and bonding, industrial importance of the compounds. Transition elements and coordination compounds: structure, bonding theories, spectral and magnetic properties, reaction mechanisms. Inner transition elements: spectral and magnetic properties, redox chemistry, analytical applications. Organometallic compounds: synthesis, bonding and structure, and reactivity. Organometallics in homogeneous catalysis. Ring, Cages and metal clusters. Analytical chemistry- separation, spectroscopic, electro- and thermoanalytical methods. Bioinorganic chemistry: photosystems, porphyrins, metalloenzymes, oxygen transport, electron-transfer reactions; nitrogen fixation.

Unit 3

IUPAC nomenclature of organic molecules including regio- and stereoisomers. Principles of stereochemistry: Configurational and conformational isomerism in acyclic and cyclic compounds; stereogenicity, stereoselectivity, enantioselectivity, diastereoselectivity and asymmetric induction. Aromaticity: Benzenoid and non-benzenoid compounds – generation and reactions. Organic reactive intermediates: Generation, stability and reactivity of carbocations, carbanions, free radicals, carbenes, benzyne and nitrenes. Organic reaction mechanisms involving addition, elimination and substitution reactions with electrophilic, nucleophilic or radical species. Common named reactions and rearrangements – applications in organic synthesis. Functional group interconversion including oxidations and reductions; common catalysts and reagents. Chemo, regio and stereoselective transformations.

Unit 4

Pericyclic reactions – electrocycloaddition, cycloaddition, sigmatropic rearrangements and other related concerted reactions. Principles and applications of photochemical reactions in organic chemistry. Synthesis and reactivity of common heterocyclic compounds. Chemistry of natural products: Carbohydrates, proteins and peptides, fatty acids, nucleic acids, terpenes, steroids and alkaloids. Biogenesis of terpenoids and alkaloids. Structure determination of organic compounds by IR, UV-Vis, ^1H & ^{13}C NMR and Mass spectroscopic techniques.

Unit 5

Basic principles of quantum mechanics: Postulates; operator algebra; exactly- solvable systems: particle-in-a-box, harmonic oscillator and the hydrogen atom, including shapes of atomic orbitals; orbital and spin angular momenta; tunneling. Approximate methods of quantum mechanics: Variational principle; perturbation theory up to second order in energy; applications. Atomic structure and spectroscopy; term symbols; many-electron systems and antisymmetry principle. Chemical applications of group theory; symmetry elements; point groups; character tables; selection rules. Molecular spectroscopy: Rotational and vibrational spectra of diatomic molecules;

Syllabus of Ph.D. Entrance Examination for Zoology

Unit 1

Molecules and their interaction relevant to biology Composition, structure and function of biomolecules (carbohydrates, lipids, proteins, nucleic acids and vitamins). Principles of catalysis, enzymes and enzyme kinetics, enzyme regulation, mechanism of enzyme catalysis, isozymes. Conformation of proteins (Ramachandran plot, secondary structure, domains, motif and folds). Conformation of nucleic acids (helix (A, B, Z), t-RNA, micro-RNA). Stability of proteins and nucleic acids. Metabolism of carbohydrates, lipids, amino acids nucleotides and vitamins.

Unit 2

Membrane structure and function Structure of model membrane, lipid bilayer and membrane protein diffusion, osmosis, ion channels, active transport, membrane pumps, mechanism of sorting and regulation of intracellular transport, electrical properties of membranes.

Structural organization and function of intracellular organelles Cell wall, nucleus, mitochondria, Golgi bodies, lysosomes, endoplasmic reticulum, peroxisomes, plastids, vacuoles, chloroplast, structure & function of cytoskeleton and its role in motility.

Organization of genes and chromosomes Operon, unique and repetitive DNA, interrupted genes, gene families, structure of chromatin and chromosomes, heterochromatin, euchromatin, transposons.

Cell division and cell cycle Mitosis and meiosis, their regulation, steps in cell cycle, regulation and control of cell cycle.

Cell signaling Hormones and their receptors, cell surface receptor, signaling through G-protein coupled receptors, signal transduction pathways, second messengers, regulation of signaling pathways, bacterial and plant two-component systems, light signaling in plants, bacterial chemotaxis and quorum sensing.

Cellular communication Regulation of hematopoiesis, general principles of cell communication, cell adhesion and roles of different adhesion molecules, gap junctions, extracellular matrix, integrins, neurotransmission and its regulation.

Cancer Genetic rearrangements in progenitor cells, oncogenes, tumor suppressor genes, cancer and the cell cycle, virus-induced cancer, metastasis, interaction of cancer cells with normal cells, apoptosis, therapeutic interventions of uncontrolled cell growth.

Unit 3

DNA replication, repair and recombination Unit of replication, enzymes involved, replication origin and replication fork, fidelity of replication, extrachromosomal replicons, DNA damage and repair mechanisms, homologous and site-specific recombination.

RNA synthesis and processing Transcription factors and machinery, formation of initiation complex, transcription activator and repressor, RNA polymerases, capping, elongation, and termination, RNA processing, RNA editing, splicing, and polyadenylation, structure and function of different types of RNA, RNA transport).

Protein synthesis and processing Ribosome, formation of initiation complex, initiation factors and their regulation, elongation and elongation factors, termination, genetic code, aminoacylation of tRNA, tRNA-identity, aminoacyl tRNA synthetase, and translational proof-reading, translational inhibitors, Post-translational modification of proteins.

Control of gene expression at transcription and translation level Regulating the expression of phages, viruses, prokaryotic and eukaryotic genes, role of chromatin in gene expression and gene silencing.

Unit 4

Basic concepts of development Potency, commitment, specification, induction, competence, determination and differentiation; morphogenetic gradients; cell fate and cell lineages; stem cells; genomic equivalence and the cytoplasmic determinants; imprinting; mutants and transgenics in analysis of development.

Gametogenesis, fertilization and early development Production of gametes, cell surface molecules in sperm-egg recognition in animals; embryo sac development and double fertilization in plants; zygote formation, cleavage, blastula formation, embryonic fields, gastrulation and formation of germ layers in animals; embryogenesis, establishment of symmetry in plants; seed formation and germination.

Morphogenesis and organogenesis in animals Cell aggregation and differentiation in *Dictyostelium*; axes and pattern formation in *Drosophila*, amphibia and chick; organogenesis – vulva formation in *Caenorhabditis elegans*, eye lens induction, limb development and regeneration in vertebrates; differentiation of neurons, post embryonic development- larval formation, metamorphosis; environmental regulation of normal development; sex determination.

Unit 5

Blood and circulation Blood corpuscles, haemopoiesis and formed elements, plasma function, blood volume, blood volume regulation, blood groups, haemoglobin, immunity, haemostasis.

Cardiovascular System Comparative anatomy of heart structure, myogenic heart, specialized tissue, ECG – its principle and significance, cardiac cycle, heart as a pump, blood pressure, neural and chemical regulation of all above.

Respiratory system Comparison of respiration in different species, anatomical considerations, transport of gases, exchange of gases, waste elimination, neural and chemical regulation of respiration.

Nervous system Neurons, action potential, gross neuroanatomy of the brain and spinal cord, central and peripheral nervous system, neural control of muscle tone and posture.

Sense organs Vision, hearing and tactile response.

Excretory system Comparative physiology of excretion, kidney, urine formation, urine concentration, waste elimination, micturition, regulation of water balance, blood volume, blood pressure, electrolyte balance, acid-base balance.

Thermoregulation - Comfort zone, body temperature – physical, chemical, neural regulation, acclimatization.

Digestive system - Digestion, absorption, energy balance, BMR.

Endocrinology and reproduction - Endocrine glands, basic mechanism of hormone action, hormones and diseases; reproductive processes, gametogenesis, ovulation, neuroendocrine regulation.

Unit 6

Mendelian principles Dominance, segregation, independent assortment.

Concept of gene Allele, multiple alleles, pseudoallele, complementation tests

Extensions of Mendelian principles Codominance, incomplete dominance, gene interactions, pleiotropy, genomic imprinting, penetrance and expressivity, phenocopy, linkage and crossing over, sex linkage, sex limited and sex influenced characters.

Gene mapping methods: Linkage maps, tetrad analysis, mapping with molecular markers, mapping by using somatic cell hybrids, development of mapping population in plants.

Extra chromosomal inheritance: Inheritance of Mitochondrial and chloroplast genes, maternal inheritance.

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Syllabus of Ph.D. Entrance Examination for Mathematics

Unit 1

Analysis: Elementary set theory, finite, countable and uncountable sets, Real numbers system as a complete ordered field, Archimedean property, supremum, infimum. Sequences and series, convergence, limsup, liminf. Bolzano Weierstrass theorem, Heine Borel theorem. Continuity, uniform continuity, differentiability, mean value theorem. Sequences and series of functions, uniform convergence. Riemann sums and Riemann integral, Improper Integrals.

Monotonic functions, types of discontinuity, functions of bounded variation, Lebesgue measure, Lebesgue integral. Functions of several variables, directional derivative, partial derivative, derivative as a linear transformation.

Metric spaces: compactness, connectedness. Normed Linear Spaces. Spaces of Continuous functions as examples.

Linear Algebra: Vector spaces, subspaces, linear dependence, basis, dimension, algebra of linear transformations. Algebra of matrices, rank and determinant of matrices, linear equations. Eigen values and eigenvectors, Cayley-Hamilton theorem.

Matrix representation of linear transformations. Change of basis, canonical forms, diagonal forms, triangular forms, Jordan forms. Inner product spaces, orthonormal basis.

Quadratic forms, reduction and classification of quadratic forms

Unit 2

Complex Analysis: Algebra of complex numbers, the complex plane, polynomials, Power series, transcendental functions such as exponential, trigonometric and hyperbolic functions. Analytic functions, Cauchy-Riemann equations.

Contour integral, Cauchy's theorem, Cauchy's integral formula, Liouville's theorem, Maximum modulus principle, Schwarz lemma, Open mapping theorem. Taylor series, Laurent series, calculus of residues. Conformal mappings, Mobius transformations.

Algebra: Permutations, combinations, pigeon-hole principle, inclusion-exclusion principle, derangements. Groups, subgroups, normal subgroups, quotient groups, homomorphisms, cyclic groups, permutation groups, Cayley's theorem, class equations, Sylow theorems.

Rings, ideals, prime and maximal ideals, quotient rings, unique factorization domain, principal ideal domain, Euclidean domain. Polynomial rings and irreducibility criteria. Fields, finite fields, field extensions

Unit 3

Ordinary Differential Equations (ODEs):

Existence and Uniqueness of solutions of initial value problems for first order ordinary differential equations, singular solutions of first order ODEs, system of first order ODEs.

General theory of homogenous and non-homogeneous linear ODEs, variation of parameters, Sturm-Liouville boundary value problem, Green's function.

Unit 9

Emergence of evolutionary thoughts Lamarck; Darwin—concepts of variation, adaptation, struggle, fitness and natural selection; Mendelism; Spontaneity of mutations; The evolutionary synthesis.

Origin of cells and unicellular evolution Origin of basic biological molecules; Abiotic synthesis of organic monomers and polymers; Concept of Oparin and Haldane; Experiment of Miller.

Evolution of prokaryotes; Origin of eukaryotic cells; Evolution of unicellular eukaryotes; Anaerobic metabolism, photosynthesis and aerobic metabolism.

Paleontology and Evolutionary History The evolutionary time scale; Eras, periods and epoch; Major events in the evolutionary time scale; Origins of unicellular and multi cellular organisms; Major groups of plants and animals; Stages in primate evolution including Homo.

Molecular Evolution Concepts of neutral evolution, molecular divergence and molecular clocks; Molecular tools in phylogeny, classification and identification; Protein and nucleotide sequence analysis; origin of new genes and proteins; Gene duplication and divergence.

The Mechanisms Population genetics – Populations, Gene pool, Gene frequency; Hardy-Weinberg Law; concepts and rate of change in gene frequency through natural selection, migration and random genetic drift; Adaptive radiation; Isolating mechanisms; Speciation; Allopatricity and Sympatricity; Convergent evolution; Sexual selection; Co-evolution.

Brain, Behavior and Evolution Approaches and methods in study of behavior; Proximate and ultimate causation; Altruism and evolution—Group selection, Kin selection, Reciprocal altruism; Neural basis of learning, memory, cognition, sleep and arousal; Biological clocks; Development of behavior; Social communication; Social dominance; Use of space and territoriality; Mating systems, Parental investment and Reproductive success; Parental care; Aggressive behavior; Habitat selection and optimality in foraging; Migration, orientation and navigation; Domestication and behavioral changes.

Unit 10

Molecular Biology and Recombinant DNA methods Isolation and purification of RNA, DNA (genomic and plasmid) and proteins, different separation methods. Analysis of RNA, DNA and proteins by one and two dimensional gelelectrophoresis, Isoelectric focusing gels. Molecular cloning of DNA or RNA fragments in bacterial and eukaryotic systems. Expression of recombinant proteins using bacterial, animal and plant vectors. Isolation of specific nucleic acid sequences. Generation of genomic and cDNA libraries in plasmid, phage, cosmid, BAC and YAC vectors. In vitro mutagenesis and deletion techniques, gene knock out in bacterial and eukaryotic organisms. Protein sequencing methods, detection of post translation modification of proteins. DNA sequencing methods, strategies for genome sequencing. Methods for analysis of gene expression at RNA and protein level, large scale expression, such as micro array based techniques. Isolation, separation and analysis of carbohydrate and lipid molecules. RFLP, RAPD and AFLP techniques

Histochemical and Immunotechniques Antibody generation, Detection of molecules using ELISA, RIA, western blot, immunoprecipitation, flow cytometry and immunofluorescence microscopy, detection of molecules in living cells, in situ localization by techniques such as FISH and GISH.

Biophysical Method Molecular analysis using UV/visible, fluorescence, circular dichroism, NMR and ESR spectroscopy. Molecular structure determination using X-ray diffraction and NMR, Molecular analysis using light scattering, different types of mass spectrometry and surface plasma resonance methods.

Microscopic techniques Visualization of cells and subcellular components by light microscopy, resolving powers of different microscopes, microscopy of living cells, scanning and transmission microscopes, different fixation and staining techniques for EM, freeze-etch and freeze-fracture methods for EM, image processing methods in microscopy.

Tests of hypotheses: most powerful and uniformly most powerful tests, Likelihood ratio tests. Analysis of discrete data and chi-square test of goodness of fit. Large sample tests.

Simple nonparametric tests for one and two sample problems, rank correlation and test for independence. Elementary Bayesian inference.

Gauss-Markov models, estimability of parameters, Best linear unbiased estimators, tests for linear hypotheses and confidence intervals. Analysis of variance and covariance. Fixed, random and mixed effects models. Simple and multiple linear regression. Elementary regression diagnostics. Logistic regression.

Multivariate normal distribution, Wishart distribution and their properties. Distribution of quadratic forms. Inference for parameters, partial and multiple correlation coefficients and related tests. Data reduction techniques: Principle component analysis, Discriminant analysis, Cluster analysis, Canonical correlation.

Simple random sampling, stratified sampling and systematic sampling. Probability proportional to size sampling. Ratio and regression methods.

Linear programming problem. Simplex methods, duality. Elementary queuing and inventory models. Steady-state solutions of Markovian queuing models: M/M/1, M/M/1 with limited waiting space, M/M/C, M/M/C with limited waiting space, M/G/1.

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MOTHERHOOD UNIVERSITY, Roorkee

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Annexure 2 (g) 5

PART - B

FACULTY OF SCIENCE DEPARTMENT OF MICROBIOLOGY Ph.D. ENTRANCE EXAM SYLLABUS OF MICROBIOLOGY

CONTENTS	
UNITS	UNITS NAME
UNIT - I	Microbiological Techniques
UNIT - II	Advanced Techniques in Microbiology: I
UNIT - III	Bacterial response to antimicrobials
UNIT - IV	Extreme Environments
UNIT - V	Microbial growth and Fermentation kinetics
UNIT - VI	Study of Important Human Pathogens
UNIT - VII	Microorganisms in foods and their study
UNIT - VIII	Prebiotics, Probiotics and Functional foods
UNIT - IX	Food Safety Management
UNIT - X	Industrial Microbiology

Unit I: Microbiological Techniques

Aseptic techniques: (Physical and chemical methods of Sterilization and Disinfection), Isolation and pure culture Techniques, Staining (Simple staining, Gram's staining, Capsule, Spore and Acid fast staining), Sample selection, sample collection and sample transport, Preservation Techniques, Antibiotic susceptibility techniques: disc diffusion and Minimum Inhibitory Concentration. Brief overview of Biosafety.

Unit II: Advanced Techniques in Microbiology

Polymerase Chain Reaction (PCR), Denaturing Gradient Gel Electrophoresis (DGGE), Restriction Fragment Length Polymorphism (RFLP), Amplified Ribosomal DNA and Restriction Analysis (ARDRA), PFGE, Phenotypic Identification of bacteria and fungi including automated method by Biolog and other methods.

Unit III: Bacterial response to antimicrobials

Effects of various phytochemicals and antibiotics on microorganisms. Methods of phytochemical extraction. Cellular defense strategy of microorganisms against phytochemicals, cellular oxyradicals and antioxidative strategies in bacteria.

Unit IV: Extreme Environments

Extremophiles: Introduction, Diversity, Habitat, Physiology and applications of Acidophilic, Alkaliphilic, Thermophilic, Psychrophilic, Barophilic, Halophilic microorganism and Microorganism resistant to radiations.

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Unit V: Microbial growth and Fermentation kinetics

Batch kinetics – single substrate, dual substrates – sequential utilization, multiple substrates – simultaneous utilization, substrate inhibition, product synthesis (primary and secondary metabolite), toxic inhibition, death constant. Fed-batch kinetics – fixed volume, variable volume and cyclic fed-batch, applications and examples of fed-batch systems. Continuous cultivation system – applications and examples of continuous cultivation system; comparison between various cultivation systems.

Unit VI: Study of Important Human Pathogens

Infection and disease process in humans. Pathogenesis, clinical features and Laboratory diagnosis of important bacterial, viral, fungal, and parasitic diseases. Important molecular methods of identification and typing of pathogenic microorganisms. Vaccines.

Unit VII: Microorganisms in foods and their study

Factors affecting growth and survival of microorganisms in foods; Classification, physiology and Genotypic identification of microorganisms associated with the foods: Lactic acid bacteria, Bifidobacteria, Propionibacteria, Bacillus, yeasts and molds; techniques to study un-culturable microorganisms in foods.

Unit VIII: Prebiotics, Probiotics and Functional foods

Brief overview of gut microbiome: Prebiotic and Probiotic; Prebiotics – criteria of prebiotics, effects of prebiotics on metabolism and or absorption of nutrients; prebiotics in infant formulas; Probiotics: Criteria for probiotics, Development of Probiotics for animal and human use; Functional foods- health claims and benefits, Development of functional foods.

Unit IX: Food Safety Management

Indicators of food safety, Microbiological quality and microbiological criteria, sampling plans; quality control using microbiological criteria, control at source; Good Manufacturing Practices; Rapid detection of pathogenic bacteria and viruses in the foods by various methods.

Unit X: Industrial Microbiology

An introduction to the fermentation process; Screening of industrial microbes – Detection and assay of fermentation products. Classification of fermentation types. Metabolic engineering. Strain selection and improvement, mutation - protoplast fusion, and recombinant DNA technique for strain development. Preservation methods of cultures.

Submitted by

[Signature]

21/9/22
Dr. Harshdeep Shetty
Asst. Professor, FOS

Partial Differential Equations (PDEs):

Lagrange and Charpit methods for solving first order PDEs, Cauchy problem for first order PDEs. Classification of second order PDEs, General solution of higher order PDEs with constant coefficients, Method of separation of variables for Laplace, Heat and Wave equations.

Numerical Analysis :

Numerical solutions of algebraic equations, Method of iteration and Newton-Raphson method, Rate of convergence, Solution of systems of linear algebraic equations using Gauss elimination and Gauss-Seidel methods, Finite differences, Lagrange, Hermite and spline interpolation, Numerical differentiation and integration, Numerical solutions of ODEs using Picard, Euler, modified Euler and Runge-Kutta methods.

Calculus of Variations:

Variation of a functional, Euler-Lagrange equation, Necessary and sufficient conditions for extrema. Variational methods for boundary value problems in ordinary and partial differential equations.

Linear Integral Equations:

Linear integral equation of the first and second kind of Fredholm and Volterra type, Solutions with separable kernels. Characteristic numbers and eigenfunctions, resolvent kernel.

Mechanics:

Generalized coordinates, Lagrange's equations, Hamilton's canonical equations, Hamilton's principle and principle of least action, Two-dimensional motion of rigid bodies, Euler's dynamical equations for the motion of a rigid body about an axis, theory of small oscillations

Unit 4

Statistics

Sample space, discrete probability, independent events, Bayes theorem. Random variables and distribution functions (univariate and multivariate); expectation and moments. Independent random variables, marginal and conditional distributions. Characteristic functions. Probability inequalities (Tchebyshef, Markov, Jensen). Modes of convergence, weak and strong laws of large numbers, Central Limit theorems (i.i.d. case). Markov chains with finite and countable state space, classification of states, limiting behaviour of n-step transition probabilities, stationary distribution. Standard discrete and continuous univariate distributions. Sampling distributions. Standard errors and asymptotic distributions, distribution of order statistics and range.

Microbial genetics Methods of genetic transfers – transformation, conjugation, transduction and sex-duction, mapping genes by interrupted mating, fine structure analysis of genes.

Human genetics Pedigree analysis, lod score for linkage testing, karyotypes, genetic disorders.

Quantitative genetics Polygenic inheritance, heritability and its measurements, QTL mapping.

Mutation Types, causes and detection, mutant types – lethal, conditional, biochemical, loss of function, gain of function, germinal verses somatic mutants, insertional mutagenesis.

Structural and numerical alterations of chromosomes Deletion, duplication, inversion, translocation, ploidy and their genetic implications.

Recombination Homologous and non-homologous recombination including transposition.

Unit 7

Principles & methods of taxonomy Concepts of species and hierarchical taxa, biological nomenclature, classical & quantitative methods of taxonomy of plants, animals and microorganisms.

Levels of structural organization Unicellular, colonial and multicellular forms. Levels of organization of tissues, organs & systems. Comparative anatomy, adaptive radiation, adaptive modifications.

Outline classification of plants, animals & microorganisms Important criteria used for classification in each taxon. Classification of plants, animals and microorganisms. Evolutionary relationships among taxa.

Natural history of Indian subcontinent Major habitat types of the subcontinent, geographic origins and migrations of species. Common Indian mammals, birds. Seasonality and phenology of the subcontinent.

Organisms of health & agricultural importance Common parasites and pathogens of humans, domestic animals and crops.

Organisms of conservation concern Rare, endangered species. Conservation strategies.

Unit 8

The Environment Physical environment; biotic environment; biotic and abiotic interactions.

Habitat and Niche Concept of habitat and niche; niche width and overlap; fundamental and realized niche; resource partitioning; character displacement.

Population Ecology Characteristics of a population; population growth curves; population regulation; life history strategies (r and K selection); concept of metapopulation – demes and dispersal, interdemec extinctions, age structured populations.

Species Interactions Types of interactions, interspecific competition, herbivory, carnivory, pollination, symbiosis.

Community Ecology Nature of communities; community structure and attributes; levels of species diversity and its measurement; edges and ecotones.

Ecological Succession Types; mechanisms; changes involved in succession; concept of climax.

Ecosystem Ecology Ecosystem structure; ecosystem function; energy flow and mineral cycling (C,N,P); primary production and decomposition; structure and function of some Indian ecosystems: terrestrial (forest, grassland) and aquatic (fresh water, marine, eustarine).

Biogeography Major terrestrial biomes; theory of island biogeography; biogeographical zones of India.

Applied Ecology Environmental pollution; global environmental change; biodiversity: status, monitoring and documentation; major drivers of biodiversity change; biodiversity management approaches.

Conservation Biology Principles of conservation, major approaches to management, Indian case studies on conservation/management strategy (Project Tiger, Biosphere reserves).

electronic spectra; IR and Raman activities – selection rules; basic principles of magnetic resonance.

Unit 6

Chemical thermodynamics: Laws, state and path functions and their applications; thermodynamic description of various types of processes; Maxwell's relations; spontaneity and equilibria; Kirchoff equations; phase equilibria and phase rule; Colloids and surfaces: Stability and properties of colloids; isotherms and surface area; Solid state: Crystal structures; Bragg's law and applications; band structure of solids. Polymer chemistry: Molar masses; kinetics of polymerization. Data analysis: Mean and standard deviation; absolute and relative errors; linear regression; covariance and correlation coefficient Electrochemistry: Nernst equation, redox systems, electrochemical cells; Debye-Huckel theory; electrolytic conductance – Kohlrausch's law and its applications; ionic equilibria; Chemical kinetics: Empirical rate laws and temperature dependence; complex reactions; steady state approximation; determination of reaction mechanisms; collision and transition state theories of rate constants; unimolecular reactions; enzyme kinetics; salt effects; photochemical reactions.

 HOD
Faculty of Sciences
Motherhood University, India



Dr. Subis Kr Maiti

Karnataka. Biomes of the world; Mangroves in India.

Sources, Nature and Impact of - Air, Water, Soil Pollution, Radioactive Pollution, Noise Pollution and Heavy Metal Pollution.

Plant indicators of Pollution:

Bioindicators, Biomonitoring and Bioremediation.

Global Environmental Problems:

Ozone depletion, Global warming, Climatic change [Rio de Janeiro earth summit].

Organisms of conservation concern:

Rare, endangered species. Conservation strategies.

Organisms of health & agricultural importance:

Common parasites and pathogens of humans, domestic animals and crops.

Biogeography:

Major terrestrial biomes; theory of island biogeography; biogeographical zones of India.

Conservation Biology:

Principles of conservation, major approaches to management, Indian case studies on conservation/management strategy (Project Tiger, Biosphere reserves).

Environmental Education:

Bio-diversity Hot spots, Management of natural resources, Remote Sensing in Ecological Science.

Unit 8

Plant breeding and Propagation :

Reproduction:

Modes of reproduction, Mechanism of pollination control in crop plants (self incompatibility and male sterility).

Hybridization:

Conventional breeding methods, Hybridization methods in self and cross pollinated crop plants, Backcross method and its importance in crop plants. Plant Genetic resources and its importance, Sources of Germplasm utilization and conservation. Role of Global and National Organizations for crop Improvement.

Heterosis:

Genetic basis of Heterosis, Homozygous and Heterozygous balance.

Resistance Breeding:

Breeding for resistance to Abiotic stresses – drought resistance, breeding methods and genetics of drought resistance. Breeding for resistance to biotic stresses – diseases resistance, disease development and escape, breeding methods, genetics of disease resistance

Distant Hybridization:

Barriers, techniques in crop improvement.

Quality Seeds:

Classes, production, development of seed industry, Indian seed act, Plant protection Act.

Basic concepts and principles of plant propagation:

Propagating structures, Green house, Shade house, Net house, Mist propagation unit, containers for growing plants, media for propagation, treatment of soil and soil mixtures, fertilizers and sanitation. Plant nurseries.

Seed propagation:

Selection, testing, storage, germination, dormancy, testing and certification.

Vegetative Propagation:

Advantage, limitations and management.

Clones:

Source, production, viability & maintenance and genetic variability.